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Using Nursing Simulation to Improve Early Recognition of Emergent Situations

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This is to certify that the doctoral study by

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2017

Abstract

Improvement of Early Recognition of Emergent Situations Through Nursing Simulation

by

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MSN, Walden University, 2009

BSN, Rivier University, 2005

Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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Abstract

Nurses' ability to recognize and respond to postoperative patients who require emergent medical care and need immediate assistance during a code blue in the first 10 minutes is essential to improve patient outcomes. This is particularly important for the project site, a 44-bed inpatient surgical specialty hospital located in the Northeast, providing care for patients with head and neck cancer, as the hospital does not have an internal code blue response team. An adjacent facility responds to all code blue emergencies and takes approximately 10 minutes for the team to respond. The purpose of this DNP project was to develop an evidence based, theory supported educational effort using a rapid response in-situ simulation program with 2 simulation scenarios specific to the patient population. As a first step in the DNP project, 2 simulation scenarios were developed and then evaluated by a panel of 4 expert nurse educators using a modified National League of Nursing/Jeffries Simulation Design Scale. The qualitative evaluation the expert nurse educators provided strengthened the simulation design for each simulation scenario. The revised simulation scenarios, respiratory distress/pulseless electrical activity, and the postoperative patient with unstable hemodynamics, as part of the education rapid response in-situ simulation program, have the potential to improve the nurse's ability to recognize early warning signs of respiratory distress and hemodynamic instability from postoperative complications. The simulation program has the potential for positive social change by empowering the nurses to provide quality patient care and improve patient outcomes during a code blue event.

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Dedication

This project is dedicated to my daughter, Andrea. Without her encouragement and support, this project would not have been possible. Andrea, throughout this project you were there for me during those times I never thought this project would be completed. I am so proud of your accomplishments and achieving your goal of becoming a Family Nurse Practitioner, all while working and raising a family. Andrea, I dedicate this project to you.

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Section 1: Overview of the Evidence Based Project

Introduction

Failure to recognize and rescue hospitalized patients in distress in the hospital setting is a patient safety concern and a contemporary patient safety indicator (Agency for Healthcare Research and Quality [AHRQ], 2011). Silber, Williams, Krakauer, and Schwartz (1992) first introduced failure to rescue as a hospital quality metric and described it as complications not related to a hospital admission leading to death in surgical patients. Factors associated with the inability of a nurse to recognize the clinical change in a patient's condition is contributed to lack of knowledge and skills (Schubert, 2012). Strategies to increase nurse knowledge and skill in hospitals are a priority to improve performance and decrease failure to rescue events. Simulation training is one strategy used in the hospital setting to address nurse knowledge and skill in failure to rescue events (Buckley & Gordon, 2012; Schubert, 2012).

Qualified nurses caring for head and neck cancer (HNCA) surgical patients on the adult inpatient unit have the knowledge and skill to care for the surgical aspect of the patient; however, they must also have the knowledge and skill to recognize the sequela as a result of patient comorbidities. HNCA patients present with comorbidities such as alcohol consumption, smoking, and cardiovascular and respiratory pathologies that contribute to postoperative complications. Postoperative complications include acute myocardial infarction, pulmonary failure, and hemorrhage (Mulvey, Pronovost, & Gourin, 2015; Ribeiro, Kowalski, & Latorre, 2003).

Failure to rescue patients with postoperative complications has resulted in cardiac arrest. The project facility does not have a team of specific providers to begin immediate resuscitative efforts, also known as a code blue team. Instead, an adjacent facility responds to all code blue calls, which adds a time element. This is problematic; a response from the other facility requires 10 minutes. Nurses are responsible for recognizing and initiating cardiopulmonary resuscitation (CPR), which includes beginning chest compressions within 1 minute and activating the code blue team (American Heart Association [AHA], 2010). Patient survival depends on the nurse's ability to identify and initiate a code blue response (Hussman, 2012).

In the best case, approximately 25% of hospitalized adults will survive cardiac arrest to discharge with about 33% suffering significant permanent neurological impairment (Go et al., 2013). It is estimated that only 10% of patients survive cardiac arrest in hospitals and requires timely response from nurses and medical providers in order to prevent death (Huseman, 2012). Inconsistent application of evidence-based resuscitation practices is a principal contributory factor (Go et al., 2013). Basic Life Support (BLS) and Advanced Cardiac Life Support (ACLS) skill is measured every 2 years. Without ongoing training during the time between skills measurement, the resuscitation skills can be a challenge (White, 2006).

The Institute of Medicine (IOM, 2004) and the Robert Wood Johnson Initiative (2009) recommended ongoing nurse education and training in the hospital to improve patient safety and supported simulation training as one method (National Research Council, 2011). Simulation is a technique used to recreate a real experience for nurses.

Incorporating high-fidelity simulation, the use of computerized manikins to emulate physiological responses similar to a human to improve code blue recognition and response is a valuable tool in identifying and correcting critical code blue responses (Aebersold & Tschannen, 2013; Benner et al., 2010; Jeffries, 2012).

Educational in-situ simulation provides the opportunity for this organization to increase nursing knowledge and skills to improve patient outcomes. Failure to rescue and respond in code blue emergencies in the healthcare setting is well studied. Providing the adult inpatient nurses with the education resources and simulation experience empowers them to provide quality patient care.

Problem Statement

The site for this project is a 44-bed inpatient surgical specialty hospital located in a rural town in the Northeastern United States. The clinical staff care for people with disorders of the eye, ear, nose, throat, and adjacent regions of the head and neck for adult patients. Specifically, the specialty hospital provides surgical and medical care for HNCA patients. Surgery includes laryngectomy, neck dissection, hemiglossectomy, and neck and face reconstruction. The average monthly patient surgical census is 450 and 10% of the patients present with medical comorbidities such as alcohol consumption, smoking, cardiovascular and respiratory pathologies, and postoperative contributions to complications (Mulvey, Pronovost, & Gourin, 2015; Ribeiro, Kowalski, & Latorre, 2003).

The adult inpatient nurse's ability to recognize early warning signs of respiratory distress and hemodynamic instability from postoperative complications related to

pulmonary failure and hemorrhage was identified as a root cause for those patients who progressed to a code blue emergency. During the root cause analysis, patient vital signs, specifically blood pressure (BP), heart rate (HR), respiratory rate (RR), and oxygen saturation were identified as early signs of deterioration which contributed to the patient's progression to a code blue. Nurses must accurately assess patient vital signs to recognize acute changes that affect the physiological status of the patient (Elliot & Coventry, 2012). For example, changes in BP trends and HR such as lower BP and increased HR can indicate a change in the patient's hemodynamic status (Fetzer, 2006).

Root Cause Analysis

The root cause analysis identified patients who progressed to a code blue emergency; recognition for initiating the code blue call, call for the resuscitation code cart, and initiation of chest compressions were delayed. An adjacent hospital responds to all code blue emergencies at the clinical site, which adds a time element. This is problematic as response from the other facility requires 10 minutes. A nurse must provide rapid response in identifying patients in cardiac arrest and have the knowledge to initiate the code response team and intervene until the code team arrives (Huseman, 2012).

The PICO(T) format is a framework that will be used for constructing the DNP proposal. The PICO(T) takes into account the population of interest and problem (P), intervention (I), comparison of the intervention or group (C), outcome (O), and time (T) (Melnyk, Finout-Overholt, Stillwell, & Williamson, 2010). This format provides the framework to ask the clinical question and yield a streamlined literature search. The

PICO(T) framework also provides a guide for implementation, evaluation, and dissemination of EBP (Melnyk et al., 2011).

Purpose Statement and Project Objectives

The purpose of this project was to synthesize the evidence-based literature and identify a theoretical framework to support the development of a rapid response education in-situ simulation program. The educational component of the simulation program focused on improving the nurse's ability to recognize a patient in hemodynamic and respiratory distress in a 44-bed adult inpatient surgical unit. In addition, the simulation program would provide nurse's, as the first responders, the knowledge and skill to respond appropriately in a code blue emergency.

Specifically, the simulation scenario design educational component focused on teaching nurses to recognize the subtle but significant changes in patient hemodynamic and respiratory status, as well as the vital signs (blood pressure and heart rate, respiratory rate, and oxygen saturation). As a first step, the purpose of this project was to have two simulation scenarios reviewed and critiqued by an expert panel of four nurse educators experienced in simulation.

Project Objectives

- Increase nurse knowledge about the signs and symptoms of a patient in hemodynamic and respiratory distress.
- Improve the identification of hemodynamically unstable patients prior to the initiation of a code blue event.

- Decrease the time of first response to a code blue emergency; initiating the code blue call, call for the code cart, and initiation of chest compressions.

Project Question

How will the development of a rapid response education in-situ simulation program increase nurse knowledge of the signs and symptoms of a patient in distress and nurse response in a code blue emergency?

Theoretical Foundation

Kolb's Theory of Experimental Learning

Kolb's theory of experimental learning, (TEL) was the educational approach selected for the project. The TEL focuses on adult learning through engaging in concrete experiences and working with concepts applicable to the practice setting (Kolb, 1984). The TEL provides the theoretical perspective to support behavior changes with enhanced or altered thinking in the clinical setting (Kolb & Kolb, 2005).

Jeffries Framework for Simulation Design

The National League of Nursing (NLN)/Jeffries framework for simulation design, or Jeffries framework, was the conceptual framework used to guide the design for the rapid response education in-situ simulation component of the project. The Jeffries framework consists of five conceptual components to guide the development, implementation, and evaluation of this project. The five components are the facilitator (DNP student), participants (nurses), identifying educational needs, simulation design, and learning outcomes. Similar to the TEL, the Jeffries framework support strategies

grounded in concepts of experiential learning and growth, cognitive skill, and sociocultural dialogue (Jeffries & Rogers, 2012).

Significance of the Project

The 2010 AHA guidelines for CPR begin within 1 minute of cardiac arrest with minimal interruptions, and defibrillation within minutes for ventricular tachycardia without a pulse or ventricular fibrillation (Field et al., 2010). Epinephrine, the most frequently administered drug for cardiac arrest, should be administered within the first 5 minutes of pulselessness (Huseman, 2012). However, without continued training and the prolonged time between formal training, effective cardiac resuscitation becomes a challenge in most health care settings (White, 2006). The current requirement for BLS and ACLS cognitive and skills testing is once every 2 years and is not sufficient to sustain competence in recognition and response to emergent medical situations. Development of a rapid response education in-situ simulation program has the potential to increase nursing knowledge to improve patient safety.

Implications for Social Change

Simulation programs in nursing practice have been known to increase knowledge, confidence, and skill levels at all levels of nursing practice (Aebersold & Tschannen, 2013). Through this program, nurses could potentially have a direct impact on patient outcomes through enhanced assessment skills, response time to emergent situations, and improved critical thinking. A rapid response education in-situ simulation program could significantly empower the nurse to provide high quality safe patient care.

Definitions of Terms

The following definitions will guide this project.

Briefing: This is a purposeful and planned communication about the simulation objectives, how the manikin simulates human physiology and its limitations, and the errors discovered during the simulation to serve as opportunities for improved patient care and are often due to systems not the person (Miller, Riley, Davis, & Hansen, 2008).

Code Blue: An emergency situation announced in a hospital when a patient is in cardiopulmonary arrest, requiring a team of providers to respond and assist in resuscitative efforts.

Debriefing: Debriefing is a purposeful communication considered to be the cornerstone of experiential simulated learning. The debriefing session is intended to narrow the gap between what the nurse experienced and what the nurse learned during the simulation (Miller et al., 2008).

High-Fidelity Simulation: This type of simulation incorporates computerized manikins to emulate physiological responses similar to a human. For example, breathing sounds with chest rising and falling, hemodynamic changes, and vocal sounds are utilized (Jeffries, 2012).

*In-Situ Simulation***:** This is the type of simulation that transpires in the clinical environment versus within a simulation lab. In-situ simulation allows for experiential learning in a familiar clinical work environment (Patterson, Blike, & Nadkarni, 2008).

Rapid Response: Identifying and responding to a medically deteriorating patient **(**Subbe & Welch, 2013).

Assumptions and Limitations

Assumptions

- Assumptions are often unrecognized, are embedded in behavior and thinking and can be considered universal truths as opposed to scientifically vetted research (Grove, Burns, & Gray, 2013). The in-situ simulation program includes the following assumptions:
    - The in-situ simulation program scenarios should be practical to the clinical environment and increase nursing knowledge and skills for the recognition and response to a code blue event.
    - The in-situ simulation program should be a positive process for participants.
- The in-situ simulation program should provide opportunities for the clinical site to improve nurse response in a code blue.

Limitations

Limitations are found in all studies and can lack generalizability of the findings (Grove et al., 2013). The limitations of the in-situ simulation program include the following:

- The in-situ simulation program scenarios cannot be generalized throughout the clinical site.
- The evaluation plan in this project may not be generalized to other settings.

Summary

Section 1 provided an overview of the purpose and significance of the DNP project. The adult inpatient unit nurses' ability to recognize and respond to the

deterioration of a HNC surgical patient's medical condition and respond during a code blue in the first 10 minutes is essential. The facility's code blue response team is an adjacent facility and takes approximately 10 minutes to respond. Development of a repaid response education in-situ simulation program could have a significant impact on increasing nursing knowledge and response during a cardiac event. An in-situ simulation program has the potential to increase patient safety and quality of care and improve patient outcomes.

Section 2: Review of Literature and Theoretical Framework

Section 2 included a review of the general and specific literature and the theoretical and conceptual framework that supports the development and design of the project. The literature review included in-situ simulations in a health care setting with a focus on nursing knowledge and skill in failure to rescue, rapid response, and early recognition and response to a code blue event. The conclusion of the review expanded on Kolb's theory of experiential learning and the NLN Jeffries simulation framework.

Introduction

The purpose of this project was to develop a rapid response education in-situ simulation program with two simulation scenarios to improve nurses' ability to recognize and respond to the deterioration of a HNC surgical patient's medical condition and respond during a code blue in the first 10 minutes. In this section, general literature was explored to support the development of a rapid response education in-situ simulation program to address failure to rescue patients experiencing postoperative complications. The specific literature explored simulation in nursing practice and simulation program development. The theoretical and conceptual framework to guide the development of the program was also reviewed in the context of adult learning and program development.

Scholarly Literature Search Strategies

The literature search was conducted using these online databases: CINAHL Plus, Medline, OVID Nursing, and PubMed, and Google Search. The Boolean search strings and/or were also used to expand the literature search. The following terms were used to guide the literature search: *In-situ simulation*, *simulation program development*, *cardiac*

arrest, *patient safety*, *nursing education*, *quality improvement*, and *adult learning theory*. The literature search retrieved 50 articles and 21 articles were selected for review of which 15 relevant articles were selected for the literature synthesis. Articles published between 1999 and 2015 were considered for review of the general literature, specific literature, and the theoretical and conceptual framework (see Appendix A).

General Literature

Failure to recognize and rescue patients in distress is not a new concept for healthcare organizations. Failure to rescue events in hospitals is a major patient safety concern (AHRQ, 2011). In 2007, death occurred in 105.7 per 1,000 admissions of patients 18-74 years of age due to failure to recognize deterioration in patients' conditions (AHRQ, 2011). Nurses play a key role in recognizing deterioration in patients at the bedside and are identified as a key quality measure by the IOM (2001).

Odell, Victor, and Oliver (2009) found the nurse's role in detecting and responding to a patient's deteriorating condition was complex and influenced by the level of nurse experience and education. The authors identified key nursing skills and assessment, nurses' timely measurement of vital signs, and appropriate and timely response to changes as contributing factors to patient outcomes. Providing education programs where nurses can practice critical competencies for low volume but high risk situations in a non-threating environment was identified as an important strategy to improve nurse confidence in performing, resulting in improved patient outcomes. Similarly, Subbe and Welch (2013) identified nurse delayed response and failure to

recognize patients with deteriorating vital signs on a medical surgical ward resulted in transfer to a higher level of care or cardiac arrest.

Specific Literature: Simulation in Nursing Practice

Simulation is well described in the military and aviation industries, and over the last 20 years, has been incorporated into health sciences education and training in different health care environments (Benner et al., 2010). Resulting from the IOM and Robert Wood Johnson recommendation to embrace simulation for ongoing knowledge and skill development, many organizations have included simulation in nursing training programs. According to Gaba (2004) "simulation is a technique—not a technology—to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner" (p. 3).

Simulation in nursing practice has been used in different patient care settings. Nagle, McHale, Alexander, and French (2009) in a large academic hospital in Boston, Massachusetts developed a simulation program to complement the classroom setting for professional development. The authors developed five high-fidelity simulation programs focused on specific work environments and skills: Critical care, acute care, obstetrics, and pediatrics. Nagle et al. (2009) concluded simulation as a teaching methodology for nurses was useful for all levels of nursing practice, as well as effective for skill training and higher-level skills related to communication, critical thinking, and teamwork. However, Nagle et al. (2009) determined a further study was needed to quantify the impact on learner performance, patient outcomes, and patient safety. In a similar study Pilcher et al. (2012) developed simulation based learning in the neonatal intensive care

unit (NICU) environment to improve nursing knowledge and skills and support new graduate programs and annual competencies. Pilcher et al. (2012) summarized the potential future of simulation-based education for orienting NICU nurses as a training tool to improve communication in transport teams and perinatal outreach programs. Similarly, Roots, Thomas, Jaye, and Birns (2011) identified nurses working on a hyperacute stroke unit required special training for early assessment and treatment of acute stroke patients. Roots et al. (2011) developed a simulation education training program the yielded an increase in nursing recognition and intervention in stroke patients. Although Roots et al. (2011) small sample size of 6 nurses in the study showed no meaningful statistical data using a Likert scale, the authors reported the pre-course and post-course qualitative open-ended questions showed self-reported increases in leadership, communication skills, and managing hyperacute stroke clinical situations Whereas, Goldsworthy (2012) over a five year study in partnership with nine hospitals in Canada, developed a high-fidelity simulation critical care graduate certificate training program for critical care nurses. Feedback from nurses using a pre/post knowledge test for each learning experience yielded self-reported increased confidence, active learning, and engagement. Although the feedback yielded positive responses from nurse participants in the critical care graduate simulation program, there were challenges related to financial investment due the cost of high-fidelity simulation labs.

As a quality initiative to improve nurse confidence and performance in responding to a code blue, over two years, Herbers and Heaser (2016) implemented an in-situ mock code simulation in a 36-bed medical and vascular surgical unit and a 33-bed

thoracic surgical unit. The authors reported a 12% increase in nurse response time in calling for help, a 52% reduction in time elapsed for initiating chest compression improved, and a 37% improvement in defibrillation. Overall, the in-situ mock codes improved nurse response times and perceived confidence level in responding to emergent situations. Whereas, Barbeito et al. (2015) in a quality improvement initiative monitored the cardiac arrest response process in a veteran medical center in North Carolina. The research study was conducted over a three-year period and included 72 unannounced high-fidelity in-situ simulations throughout different clinical areas within the facility. More than 300 providers participated in the simulation scenarios, including 100 nurses, 87 medical residents, 21 respiratory therapists, and 10 nurse manager. Barbeito et al. (2015) detected environmental, teamwork, culture, and policy defects throughout the medical center during the simulations. Actions were taken using the Systems Engineering Initiative for Patient Safety (SEIPS) model to mitigate the environmental, teamwork, culture, and policy defects on an ongoing basis throughout the study. Barbeito et al. (2015) determined the impact of the high-fidelity in-situ simulation program on team performance during real codes and patient outcomes were beyond the scope of this study

Buykx et al. (2012) over three years implemented the Feedback Incorporating Review and Simulation Techniques to Act on Clinical Trends (FIRST2ACT) educational model to improve nurses emergency management skills for medically deteriorating patient. Included in the study were final year undergraduate nursing students, undergraduate and post-graduate midwifery students in a simulation lab and nurses working in a rural hospital medical unit. Buykx et al. (2012) reported final year

undergraduate nursing students (*n*=51) clinical skills improved by 60% and clinical awareness improved by 59%. Under and post graduate midwifery nursing students (*n*=35) clinical skills improved by 54% and clinical awareness improved by 54%. Nurses in medical unit (*n*=35) clinical skills improved by 50% and clinical awareness improved by 50%. Overall, the simulation program in all three groups improved nurse knowledge and clinical practice in emergency situations. In a similar study, Buckley and Gordon (2010) immersed 50 graduate students in a combined classroom and high-fidelity simulation workshop to determine if simulation training for medical-surgical nurses improved the nurses' ability to recognize and respond to patients' deteriorating medical condition. Three months following the simulation-based training, 38 of the 50 participants completed a follow-up survey related to their ability to respond to clinical emergencies. Overall, 79% of the participants reported it was important to recognize and respond to patients in actual clinical emergencies.

Development of a Simulation Program

Simulation programs require institutional financial resources and human resources, and the cost of high-fidelity manikins may require philanthropic funding (Aggarwal et al., 2010). Developing a simulation program can be done at the unit level or program level. In-situ simulation programs target a specific patient population and learning needs and may be used as a starting point for future institutional program development (Aebersold & Tschannen, 2013).

In-situ simulation placed nurses in the middle of complex patient care scenarios within in their own clinical environment without the risk of harm to self or to real

patients. In-situ high-fidelity simulation programs recreate stressful patient events in a safe environment (Kneebone, 2006). An in-situ simulation program supports experiential learning for the nurses.

In-situ simulation programs consist of three components: briefing, simulation, and debriefing. Briefing before the simulation provides the nurses with the purpose and objectives of the simulation training. Clear communication is provided by the facilitator that the simulation experience is educational and is in a safe environment to promote learning for the participants (Jeffries, 2012). The facilitator discusses the assumption that everyone participating in the simulation is intelligent and wants to learn. Review of how the manikin works, for example lung sounds, bowel sounds, and blood pressure. Participants are encouraged to suspend disbelieve as the manikin is not human and does have limitations (Miller et al., 2008). In-situ simulation consists of scenarios that are relevant to the clinical environment, should be realistic and relevant to the participants and support learning without intent to trick participants. Debriefing serves two important functions and is considered the cornerstone of experiential learning. Debriefing allows for self-discovery, enables participants to voice safety concerns, discuss how they performed, and uncovers systems issues (Miller et al., 2008).

Theoretical Framework

Kolb's Theory of Experiential Learning

David Kolb (1984) developed the Theory of Experiential Learning (TEL) where "learning is the process whereby knowledge is created through the transformation of experience" (p. 38). TEL is a model consisting of four learning stages: concrete

experience (Do); reflective observation (Observe); abstract conceptualization (Think); and active experimentation (Plan). The stages may be started in any order; however, one stage must follow the other in the sequence (Kolb & Kolb, 2005).

The first stage, concrete experience, applies to the participant's experience in the in-situ simulation. The second stage, reflective observation, is applicable in the debriefing session of what the participants experienced during the simulation. The third stage, abstract conceptualization, is where the participants conceptualize what was observed. The fourth stage, active experimentation, is where the participants incorporate their learning experience in the future (Kolb & Kolb, 2005).

Poore, Cullen, and Schaar (2014) operationalized Kolb's TEL for a simulation-based interprofessional education for new graduate nurses. The author's postulated the simulation-based experiential learning for new nurses' is fundamental in preparing nurses for interproffessional communication. Kolb's TEL theoretical foundation supports experiential learning and individual learning and has been widely used in different simulation-based programs (Kolb & Kolb, 2005).

National League of Nursing (NLN) Jeffries Simulation Framework

The NLN/Jeffries Simulation Framework, or the Jeffries Framework, was initially advanced with a theoretical foundation and informed by empirical simulation literature from multiple disciplines, including nursing, medicine, and non-health care disciplines (Jeffries & Rogers, 2012). Simulation was recognized to be similar and adaptable across industries, in terms of design and instructional development strategies (Jeffries & Rogers, 2012).

The Jeffries Framework consists of five conceptual components. The five components include: facilitator (DNP student); participants (nurses); identified educational needs; simulation design; and learning outcomes. The Jeffries Framework provides simulation learning strategies grounded in the concepts of experiential learning and growth, cognitive skill development, and socio-cultural dialogue (Jeffries & Rogers, 2012) (see Appendix C).

Simulation design characteristics should incorporate the following elements: Objectives, fidelity, problem solving, participant support, and reflective thinking strategies such as debriefing (Jeffries & Rogers, 2012).

- Objectives: The objectives of the simulation are the tools that guide learning of the participants and are essential when using simulation.
- Fidelity: Fidelity refers to the extent the simulation mimics the real clinical environment.
- Problem Solving: Problem solving is related to the complexity of the simulation scenario and should be based on the level of learner needs.
- Participant Support: The facilitator in creating the simulation needs to determine when to provide support or cues to the participant to give enough information for the learner to continue with the simulation, but not interfere with independent learning.
- Reflective Thinking: Reflective thinking (debriefing) is the cornerstone of experiential learning in simulation and must be provided in a supportive

environment by the facilitator. The session needs to be guided by the learning objectives of the simulation.

The Jeffries Framework provides the components for the development, implementation, and evaluation of simulation programs**.**

Summary

Education in-situ simulation programs have shown to improve nursing knowledge and skills and empower nurses to provide quality patient care in a variety of clinical settings. The DNP project, development of a rapid response in-situ simulation program, would support the adult inpatient nurses ablity to recognize and respond to patients with deteriorating medical care needs and reponse during a code blue in the first ten minutes. The development, implementation, and evaluation of simulation programs are essential for successful learning outcomes (Jeffries & Rogers, 2012). Incorporating Kolb's thoery of experencial learning and the NLN Jeffries simulation framework in the development of the simulation program would provide the necessary elements for program success.

Section 3: Project Design and Methodology

The purpose of the DNP project was to develop a rapid response education in-situ simulation program, including two simulation scenarios developed by this DNP student specifically for the HNC surgical specialty. The scenarios were developed using the NLN simulation design template (see Appendix D) and reviewed and critiqued by an expert panel of four nurse educators experienced in simulation. The scenarios were evaluated using a modified 20-question simulation design evaluation survey developed by NLN/Jeffries (see Appendix E). This section outlines the scenario design, program design, data collection, data instrument, and data analysis. Further discussed in this section is IRB approval and the evaluation plan for the project.

Scenario Design

Evidence-based simulation scenarios require preparation and knowledge of realistic patient care needs (Dowie & Phillips, 2011). Although previously written simulation scenario designs were reviewed, they did not fit all aspects of the intended scenario design for this study. The scenario design characteristics described in Jeffries Framework were used to define the simulation purpose and intended outcomes of the simulation. The two scenarios were developed based on the clinical site as a specialty hospital that provides care for disorders that affect the eye, ear, nose, throat, and adjacent regions of the head and neck. The participants were required to have specific psychomotor skills attend cognitive activities prior to participation in each scenario. Psychomotor skills included performing a head-to-toe assessment, taking blood pressures, and identifying adult dysrhythmia. Specific cognitive activities included

attending an intermediate medical unit course (IMCU). The first scenario was designed for the nurse to identify and respond to a surgical patient with increased respiratory rate and identify a decrease in oxygen saturation leading to pulseless electrical activity (PEA) arrest (Appendix F). The second scenario was designed for the nurse to identify and respond to a surgical patient with an increased heart rate and decrease in blood pressure leading to atrial fibrillation.

Program Design

The setting for the rapid response education in-situ simulation scenario is a 44 bed adult surgical HNC inpatient unit utilizing a high-fidelity manikin. Specifically, the intermediate medical care unit nurses would participate in the two scenarios developed as a result of the DNP project. The nurses participating in the simulation would have fulfilled the psychomotor and cognitive training required to provide care in the intermediate care unit. The training would be provided by the unit nurse educator. All equipment, including the adult code cart, would be available for use. The simulation setting would incorporate all standard equipment found in a patient room. It is anticipated the simulation program would take 2 hours to complete. Each simulation would consist of a 20-minute scenario participation and 45 minutes of debriefing. Integrated into the simulation program would be the NLN/Jeffries simulation framework five conceptual components.

Population and Sampling

The population for this study was a panel of four expert nurse educators experienced in simulation. Two panel members hold Masters in Nursing, are certified in

Nurse Professional Development (NPD) through the American Nurse Credentialing Center (ANCC) and are experienced in academia and hospital simulation design. Two panel members have a Bachelor of Science in Nursing (BSN) degree and are certified by the Center for Medical Simulation in operating room team training and simulation design. All panel members have extensive experience in simulation scenario development for academia, inpatient populations, and operating room training.

Data Collection and Instrument

Institutional Review Board (IRB) approval was obtained from the project site prior to requesting evaluation of the simulation scenario design. The cover letter information sheet and oral consent form (see Appendix H) were provided to the content experts prior to participating in the simulation scenario evaluation. A modified 20-question simulation design evaluation survey developed by NLN/Jeffries (see Appendix E) was used for the evaluation of the respiratory and hemodynamic simulation scenario design. The NLN/Jeffries simulation evaluation design tool was evaluated by nine nurse experts for content validity. Cronbach's alpha was the instrument of measurement for internal consistency and reliability for each item question. The coefficient alpha was 0.94.

The four content expert nurse educators completed the survey using a five point Likert scale as the instrument for the simulation design followed by a 20-question open-ended survey. The simulation design evaluation survey took place in two different sessions in a roundtable format. The Likert scale was measured using strongly agree

(SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD) as the scale of measurement.

Data Analysis

The first part of the survey used a five-point Likert Scale to evaluate the five components of the simulation design: objectives/information (I clearly understood the purpose and objectives of the simulation and the cues were appropriate and geared to promote my understanding), participant support (my need for help was recognized, and I was supported in the learning process), problem solving/complexity (I was encouraged to explore all possibilities during the simulation, and the simulation provided me the opportunity to improve my recognition of the signs and symptoms of a patient in distress and acting on a code blue) fidelity (the scenario was relevant to my practice and a real life situation), and guided reflection/debriefing (feedback provided was constructive). The second part of the survey allowed the nurse experts to provide qualitative feedback for improvement of the simulation design elements.

Project Evaluation Plan

The purpose of the DNP project was to develop an in-situ rapid response education simulation program with two simulation scenarios based on the clinical site, a specialty hospital that provides care for head and neck adult surgical patients. Prior to implementing the simulation as a teaching strategy, an evaluation plan was considered to ensure the simulation scenario design was effective and met the simulation objectives. There were several simulation evaluation tools available in the literature for performance, learning, and simulation design. The four evaluation instruments were: The Sweeny-

Clark simulation performance evaluation tool, the clinical simulation evaluation tool, the Lasater clinical judgment rubric, and the Creighton simulation evaluation instrument (Adamson, Kardong-Edgren, & Willhaus (2013). The four evaluation instruments were reviewed and it was determined the evaluation tools did not meet the evaluation methodology for simulation scenario design evaluation. The NLN/Jeffries Simulation Design Scale (SDS) was reviewed and chosen as the appropriate evaluation tool for the DNP project.

Summary

The purpose of the evidence-based project was to develop a rapid response education in-situ simulation program. The initial step in developing the simulation program was to evaluate the simulation scenario design elements using the NLN/Jeffries simulation design evaluation tool prior to implementation in the adult medical surgical unit. The two simulation scenarios evaluated would be incorporated and evaluated in the future by the adult nurses at the unit level.

Section 4 will review the project findings and implications. The doctoral project strengths and the limitations will be discussed. Recommendation for future projects will also be discussed.

Section 4: Findings and Recommendations

Introduction

The purpose of this project was to develop a rapid response education in-situ simulation program with two simulation scenarios specific to the patient for the facility patient population. The facility for the project was a specialty hospital that cares for patients with HNC. The project was developed based on an identified gap in nursing knowledge of the early signs of deterioration of patient vital signs, specifically BP, HR, RR, and oxygen saturation, which for some patients progressed to a code blue emergency. For those patients who progressed to a code blue emergency, the nurses did not announce a code blue emergency, ask for the emergency code cart, and chest compressions were not initiated. An adjacent hospital responds to all code blue emergencies at the clinical site which adds a time element. This is problematic as a response from the other facility requires 10 minutes.

Two simulation scenarios were evaluated by four content expert nurse educators in simulation using the modified NLN/Jeffries SDS tool. Section 4 includes the findings of the evaluation survey based on the expert nurse educator feedback. The outcomes from the findings will be discussed related to how they may impact future research and social change.

Summary of Findings

The two simulation scenarios developed for the simulation program were evaluated by the four content expert nurse educators in simulation during two roundtable sessions. The nurse educators evaluated and critiqued the initial respiratory distress and

unstable hemodynamic scenario using the modified 20-question NLN/Jeffries SDS. A formative evaluation of the open-ended questions during the first roundtable discussion was used to revise the simulation scenario design for the second roundtable evaluation. The NLN/Jeffries SDS five-point Likert Scale evaluation tool was used to compare the first and revised final simulation scenarios. The two-tailed *t* test was used for quantitative data results.

Formative Evaluation

A formative evaluation of the four nurse educator's qualitative responses during the first roundtable evaluation of the Jeffries and Rogers simulation design characteristics was used to assess the strengths and limitations of the simulation design characteristics. The review and critique informed the necessary revisions needed for the final simulation scenarios (Ketter, Moroney, & Martin, 2013). The analysis of the data collected for the revised and final respiratory distress/PEA (see Appendix I) and unstable hemodynamic (see Appendix J) simulation scenarios were discussed.

Respiratory Distress/PEA Simulation Design Qualitative Analysis

There were common themes identified for the design element that informed the changes for the final respiratory distress/PEA scenario. Specific changes were recommended for simulation flow and content to reflect general learning objectives. Fidelity (realism) themes were described by Participant 1 (P1) as "very population specific", and Participant 3 (P3) "and this is realistic and can happen with these patients, mucus plug." For the psychomotor skills section of the simulation design Participant 4 (P4) recommended "psychomotor skills on page 2 of simulation scenario-include

demonstrations/return demonstration during IMCU orientation." All participants during the roundtable discussion recommended nurses must complete the IMCU orientation process as part of the cognitive activity prior to participating in the simulation scenario.

Unstable Hemodynamic Simulation Design Qualitative Analysis

There were common themes identified for the design element, objectives and information, and fidelity that informed the changes for the final unstable hemodynamic simulation scenario. Specific changes were recommended for simulation flow and content to reflect general learning objectives. The following were specific recommendations by participants for the scenario progression timeline that were incorporated into the final simulation scenario. P3 wrote *"*0-5min add under manikin/actions: NSR to HR, crackles at bases". P1 wrote under expected interventions: "listen to lung sounds, hears crackles, IV fluid at 125ml/hr." P3 wrote under "cue ankle edema change +3 to 3+, 0-10min add under manikin actions: add with frequent premature atrial contractions (PAC's) to HR 100, increased crackles". P2 wrote under expected interventions: "change 12 lead to 5 lead, 10-15min under manikin/actions: add rapid AF to HR 150". P1 wrote under expected interventions: "add recognize rapid afib*"*.

NLN/Jeffries SDS Five-Point Likert Scale Two-Tailed *t*-Test Data Analysis

Use of a *t* statistic requires a large sample population greater than 100 to yield accurate results of a study (Polit, 2010). A two-tailed *t*-test was the statistical analysis tool used to evaluate the quantitative data of the survey tool. Due to the small sample size, the NLN/Jeffries twenty-question SDS five–point Likert Scale data analysis using a

two-tailed *t*-test did not reveal any significant difference between the first survey and second survey.

Implications

Practice

Simulation programs designed for ongoing nurse education and training in the hospital have the potential to empower nurses to provide evidence-based care and improve patient safety (NRC, 2011). Evidence-based simulation programs that are developed to replicate different patient care settings and all levels of nursing skill would have the potential for healthcare organizations to improve patient outcomes. The simulation programs are vital for improving nursing practice (Jeffries, 2012).

Social Change

The potential implication for positive social change is the direct impact simulation could have on improved nursing knowledge and skill. Recognizing the gaps in nursing knowledge and providing the means of improvement through simulation is often necessary for social change in nursing (Aebersold & Tschannen, 2013). Through the simulation program, nurses could potentially have a direct impact on patient outcomes through enhanced assessment skills, response time to emergent situations, and improved critical thinking.

Strength of the Project

The project provided an opportunity to develop two simulation scenarios as part of a rapid response education in-situ simulation program specific to the project facilities patient population. The adult inpatient nurse's ability to recognize early warning signs of

respiratory distress and hemodynamic instability from postoperative complications related to pulmonary failure and hemorrhage was identified as a root cause for those patients who progressed to a code blue emergency. Simulation scenario design evaluation is recommended as part of the pre-implementation phase of simulation programs (Jeffries, 2012). The simulation scenario design elements were evaluated by a panel of four content expert nurse educators in simulation using a modified validated NLN/Jeffries SDS tool. The revised and final simulation scenarios met the recommended design elements for future program implementation.

Limitations of the Project

There were several limitations of the project. First there was a small sample size of four nurse experts. In a quantitative study the sample size should be large enough to describe the variables (Grove, Burns, & Gray, 2013). The sample size for the *t*-test did not reflect the effects of the study. The second limitation was the NLN/Jefferies SDS evaluation tool in the context that it was modified to gather data from a panel of four nurse educators that did not participate in the simulation itself. The NLN/Jeffries SDS evaluation tool was originally intended for nursing students participating in a simulation. The third limitation was the information obtained from the qualitative simulation design questions. The open-ended questions for the scenario design elements; support and feedback/guided reflection, were only applicable for evaluation for scenario design when participating in the simulation.

Recommendations for Future Research

Future research is recommended using a larger sample size of the adult nurses at the project facility caring for patients in the IMCU to further evaluate the respiratory distress/PEA and unstable hemodynamic simulation scenarios (Grove et al., 2013). Using the original validated NLN/Jeffries SDS evaluation tool would be integral to positive learning outcomes in the simulation (Jeffries, 2012). In the future, implementing an education rapid response in-situ simulation program with validated simulation scenarios could provide research data to reflect the simulation program objectives; increase nurse knowledge about the signs and symptoms of a patient in hemodynamic and respiratory distress, improve the identification of hemodynamically unstable patients prior to the initiation of a code blue event, and decrease the time of "first response" to a code blue emergency; initiating the code blue call, call for the code cart and initiation of chest compressions.

Summary and Conclusions

The purpose of the DNP project was to develop an education rapid response in-situ simulation program. The first step and the objective of the project was to evaluate two simulation scenarios that represented a gap in nursing knowledge specific to the facilities patient population. It is believed with increased knowledge and skill though simulation nurses would be empowered to provide safe patient care and could directly improve patient outcomes.

The simulation scenarios were enhanced and modified after receiving the thorough critique from the content expert nurse educators. The nurse educator comments

and recommendations further strengthened the simulation design characteristics for each scenario. The simulation scenarios could be used for future orientation for the adult nurses in the IMCU.

Section 5: Scholarly Product

In this final section, Section 5, the plan for project dissemination will be discussed. An analysis-of-self as a scholar will also be explored. In conclusion, a summary of the project will be described.

Project Dissemination Plan

The dissemination of the DNP project outcomes serves two purposes: reporting the results to project stakeholders, the academic community, and other professionals in similar settings (Zaccanini & White, 2011). It is important to share the results of the DNP project with others as it is most likely that other facilities share the same problem. There are several venues available for the dissemination of DNP projects. They include publication in peer-reviewed journals, poster presentations at national conferences, and PowerPoint presentations of the findings to project stakeholders.

The intended dissemination plan of this DNP project would be to present the findings of the DNP project to the project stakeholders. The project stakeholders include a panel of nurse experts who participated in the study and the hospital nurse leadership. Upon completion of the DNP project, a PowerPoint presentation will be shared at a future nurse leadership meeting held once a month.

The future dissemination plan would be to present the DNP project findings as a poster presentation at the Society of Otorhinolaryngology and Head-Neck Nurses (SOHN) spring conference in the fall of 2018. The SOHN is the governing body for nurses who care for patients with HNC. The SOHN is a professional organization that provides opportunities for professional interaction, education, and growth for frontline

nurses, leaders, and educators who care for adult and pediatric otolaryngology head and neck patients. Presenting the DNP project findings at the SOHN 2018 fall conference could help other facilities that may have similar problems.

Analysis of Self

The American Association of Colleges of Nursing (AACN, 2006) stated that "DNP graduates generate evidence through their practice to guide improvements in practice and outcomes of care" (p. 12). Completing my project has been a long journey with the ultimate achievement of acquiring my DNP. I believe this journey has given me the foundation for the necessary skills, knowledge, and competencies to meet my professional goals of becoming a change agent for local and international healthcare needs in the practice and academia settings.

My professional and academic goals incorporate social change as the ultimate outcome plan. The DNP project experience has not only reinforced the need for me to strive to be a forward thinking leader of change through evidence-based practice change and action, but has also aligned my vision and mission as a nurse leader of the future. My vision and mission as a DNP prepared nurse is to inspire and lead nurses of the future through scholarly inquiry and become the nurse who leads social change for all societies.

The completion of the DNP project was not without challenges. There were many competing priorities throughout the process, such as work and life commitments. However, I learned through perseverance goals can be achieved. I would like to end with a quote from Joel Barker as cited in Grossman and Valiga (2005) "Vision without action

is merely a dream. Action without vision passes time. Vision and action can change the world" (p.85).

Summary

The purpose of this DNP project was to develop an education rapid response in-situ simulation program. As a first step of the DNP project, two simulation scenarios specific to the hospitals' surgical specialty were evaluated and critiqued by a panel of four expert nurse educators in simulation. The project facility does not have a designated internal code blue response team. An adjacent hospital responds to all code blue emergencies at the clinical site. The typical response time for the code team to arrive is approximately 10 minutes. The adult inpatient unit nurses' ability to recognize and respond to deterioration of HNC surgical patients and respond to patients with emergent medical care needs during a code blue was essential for improving patient outcomes (Shubert, 2012). The simulation program could have a significant impact on increasing nursing knowledge and response time for those patients experiencing medical deterioration and nursing skill during a cardiac event. The DNP project could have the potential to increase patient safety, increase quality of care, and improve patient outcomes.

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Appendix A: Literature Review Matrix

Author/ Date	Methodology	Analysis & Results	Conclusions	Implications for Future research	Implications For practice
Aebersold, M., & Tschannen, D. (2013).	Literature Review Level IV	Lack of empirical evidence of simulation on patient outcomes.	Although there is lack of empirical evidence that simulation improves patient outcomes, simulation improves nursing competency.	Empirical research for improved patient outcomes related to in-situ simulation programs.	Simulation has demonstrated effectiveness in improving nurse competency and training.
Barbeito, A., Bonifacio, A., Holtschneider, M., Segall, N., Schroeder, R., & Mark, J. (2015).	Prospective Quality Improvement Level V	72 in-situ simulated unannounced cardiac arrest simulations conducted over a 2-year period found environmental, human-machine interface, culture, and policy safety related problems.	Using the Systems Engineering Initiative for Patient Safety (SEIPS) model to understand the hospital's emergency response system was used to improve the emergency response system.	Ongoing prospective research for improved patient outcomes through simulation.	Improved hospital emergency response systems.
Buckley, T. & Gordon, C. (2010).	Qualitative Non-experimental Study Level III	Retrospective 38 registered nurses participated in the survey post high fidelity simulation training. Of 164 reported patient emergencies participating nurses reported the ability to recognize and respond to patient emergencies as an increased skill.	Skills practiced in the simulation were highly relevant to the nurse's practice.	Non-technical skills (human factors) should be considered for future simulation and research.	Improved nursing skills.
Buykx, P., Cooper, S., Kinsman, L., Endacott, R.,	Expert Opinion	Pre and posttest simulation (FIRST ACT) participation survey self-rated	The FIRST ACT educational and simulation	Can be adapted to meet different groups of	FIRST ACT model provides education

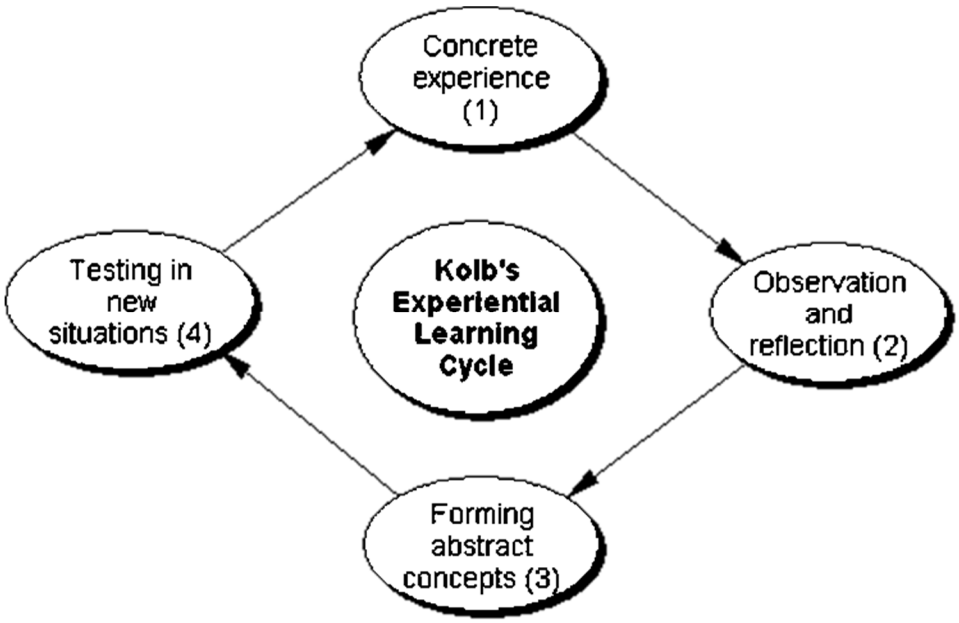
Scholes, J., McConnell-Henry, T., & Cant, R. (2012).	Quality Improvement Level V.	satisfaction and confidence levels. Average satisfaction score using 5 point scale for all 3 studies were 4.4-5 with self-rated knowledge levels *(p<0.001)*.	model provides a high fidelity opportunity to practice emergency management skills.	participants training needs.	opportunity to improve nurse recognition and response to medical emergencies.
Gaba, D. M. (2004).	Expert Opinion Level V	Utilizing the 11 dimensions of simulation applications in healthcare as a technique not a technology is applicable in all healthcare settings.	The future of simulation education if integrated successfully into healthcare by 2025 has the potential become a key driver in a culture of safety.	Assessing the impact or benefit of simulation training in different dimensions. Establishing benchmarks for criteria in competency assessment.	Simulation training applied in different healthcare settings long-term has the potential empower healthcare provider to improve patient safety.
Goldsworthy, S. (2012).	Non-experimental Study Level III	5-year study of a critical care simulation program pre and post-test of participants using summative and formative evaluation.	Development of a critical simulation program in the critical care unit setting provides key elements for learning. Lessons learned: scenario design should be as realistic as possible, avoid role confusion	Further research is needed in applying summative and formative evaluation in simulation education programs.	Simulation in the critical care setting empowers nurses in providing competent safe care.
Herbers, M.D., & Heaser, J. A. (2016).	Non-experimental Study Level III	Over a 2-year period 124 nurses participated in an in-situ mock code simulation. Utilizing an observational evaluation tool based on the American Heart Association (AHA) revealed a 12% improvement in assessing and calling for help the	Results indicated a significant improvement in response time, better than the recommended AHA response time. Confidence levels also improved past mock code simulations.	Future research correlating in-situ mock code simulations to improved patient outcomes is needed.	Increased knowledge, skills, and confidence of nurses participating in in-situ mock code simulations.

		second year, initiating compression improved by 52%, initial time for defibrillation improved by 37%. RN confidence levels improved from 82% to 100% for initiating chest compressions.			
Huseman, K. F. (2012).	Single-sample quasi-experimental Descriptive Design Level II	A two-tailed *t* test revealed statistically significant differences in response times for start of compressions *t*= 2.8717, *p* =.0079 and first dose of epinephrine *t* =4.6602, *p*= .1008 post training. No significant difference in time of administration of defibrillation.	Significant improvement post training in initiation of chest compressions and first dose of epinephrine, however data analysis post training versus maintenance period were not consistently maintained.	Future research correlating in-situ mock code simulations to improved patient outcomes is needed.	In-situ mock code simulation improve nurse competency in responding and acting in a code blue emergency.
Miller, K. K., Riley, W., Davis, S., & Hansen, H. E. (2008).	Expert Opinion Level V	Pilot study of 35 obstetric and neonatal emergency simulations in 6 hospitals with 700 multidisciplinary participants. Video observations by the authors revealed individual verses team training characteristics and the need for interdisciplinary team training.	Successful team training requires 4 separate components of in-situ simulation training: briefing, the simulation, debriefing, and follow-up.	Future research correlating in-situ simulations and team training and improved patient outcomes.	Interdisciplinary team training for improved knowledge, skill, and communication.
Nagle, B., McHale, J., Alexander, G., & French, B. (2009).	Expert Opinion Level V	High-fidelity simulation was developed for novice to expert nursing staff in an academic hospital.	Simulation education and training is a successful methodology for nurses at all	Additional research is needed to study the impact of simulation as a	Simulation is a methodology for nurse education and training.

			levels of experience.	methodology on participant performance, patient safety, and clinical outcomes.	
Odell, M., Victor, C., & Oliver, D. (2009).	Literature Review Level IV	14 studies met the inclusion criteria, primary research, all research designs, and qualitative and quantitative studies.	Managing and detecting deteriorating patient conditions is complex and influenced by many factors.	Further research is needed to find solutions such as tracking systems to monitor deterioration in patients.	Development of simulation and education programs to increase nurse knowledge and skills to recognize and respond to deteriorating patients.
Patterson, M. D., Blike, G. T., & Nadkarni, V. M. (2008)	Expert Opinion Level IV	Three successful implemented pilot in-situ simulations programs were reviewed. Qualitative data included feedback form participants and patients on the value and concerns related to simulation practice were reviewed.	In-situ simulation has the potential of improve patient safety by identifying gaps in knowledge, improving communication, teamwork, and skills.	Implementation of in-situ simulation program outcomes.	Simulation programs empower healthcare provider to provide safe quality care to patients.
Pilcher, J., Goodall, H. Jensen, C., Huwe, V., Jewell, C., Reynolds, R., & Karlsen, K. A. (2012).	Expert Opinion Level V	Review of simulation history and application of simulation in-based activities to promote learning in a neonatal unit.	Simulation can be used in orientation of new nurses and outreach programs.	Expand simulation programs to promote education.	Increased nurse knowledge and expertise.
Roots, A., Thomas, L., Jaye, P., & Birns, J. (2011).	Expert Opinion Level V	Qualitative open ended and quantitative liker scale pre and acute stroke simulation training questioner. Sample size was small to demonstrate meaningful statistical trend.	Six of the seven participants post-course self-reported improvement in leadership, communication skills, and confidence in managing acute stroke patients.	A larger pilot study is needed to validate statistical significance.	Simulation and education have the potential improve nurse communication and confidence in the acute stroke setting.

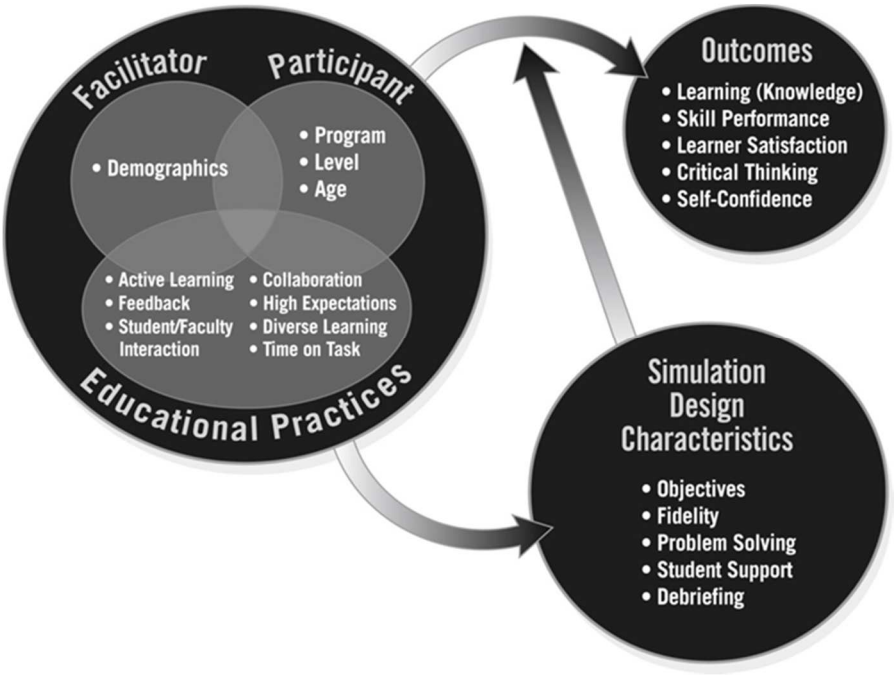
Schubert, C. R. (2012).	Non-experimental Study Level III	Pretest, posttest, and 2-week posttest results of simulated failure to rescue events using independent *t* test to measure changes in knowledge and critical thinking found a significant change in knowledge between groups pre and posttest with an average increase of 0.73 points (*t*=3.16, *df*=110, *p*=.002, 95% confidence interval=0.27, 1.19). A nonparametric Mann-Whitney U test was utilized.	Nurses knowledge of failure to rescue events increased by 11%. Critical thinking skills significantly improved.	Future research correlating in-situ simulations and team training and improved patient outcomes	Simulation learning is a valuable tool to improve nurse knowledge and skill.

Appendix B: Kolb's Cycle of Experiential Learning



Kolb, D. A. (1984). Experiential learning: *Experience as the source of learning and development*. Prentice-Hall, Inc., Englewood Cliffs, N.J.

Appendix C: Jeffries Simulation Framework



Jeffries, P. R., & Rogers, K. J. (2012). *Theoretical framework for simulation design. In P. R. Jeffries (Ed.), Simulation in nursing education. From conceptualization to evaluation* (2nd ed.) New York: National League for Nursing.

Appendix D: NLN Simulation Template

NLN National League for Nursing

Simulation Design Template

Date:	**File Name:**
Discipline:	**Student Level:**
Expected Simulation Run Time:	**Guided Reflection Time:**
Location:	**Location for Reflection:**

Admission Date: | **Today's Date:**

Brief Description of Client

Name:

Gender: **Age**: **Race**: **Weight**: **Height**:

Religion:

Major Support: **Support Phone:**

Allergies: **Immunizations:**

Primary Care Provider/Team:

Past Medical History:

History of Present Illness:

Social History:

Primary Medical Diagnosis:

Surgeries/Procedures & Dates:

Nursing Diagnoses:

NLN
National League for Nursing

Psychomotor Skills Required Prior to Simulation:

Cognitive Activities Required Prior to Simulation:
[i.e. independent reading (R), video review (V), computer simulations (CS), lecture (L)]

Simulation Learning Objectives

General Objectives:

Simulation Scenario Objectives:

References, Evidence-Based Practice Guidelines, Protocols, or Algorithms Used for This Scenario:

NLN
National League for Nursing

Fidelity (choose all that apply to this simulation)

Setting/Environment:
- ☐ ER
- ☐ Med-Surg
- ☐ Peds
- ☐ ICU
- ☐ OR / PACU
- ☐ Women's Center
- ☐ Behavioral Health
- ☐ Home Health
- ☐ Pre-Hospital
- ☐ Other:

Simulator Manikin/s Needed:

Props:

Equipment Attached to Manikin:
- ☐ IV tubing with primary line fluids running at ☐ mL/hr
- ☐ Secondary IV line running at mL/hr
- ☐ IV pump
- ☐ Foley catheter ☐mL output
- ☐ PCA pump running
- ☐ IVPB with running at ☐ mL/hr
- ☐ 02 ☐
- ☐ Monitor attached
- ☐ ID band
- ☐ Other:

Equipment Available in Room:
- ☐ Bedpan/Urinal
- ☐ Foley kit
- ☐ Straight Catheter Kit
- ☐ Incentive Spirometer
- ☐ Fluids
- ☐ IV start kit
- ☐ IV tubing
- ☐ IVPB Tubing
- ☐ IV Pump
- ☐ Feeding Pump
- ☐ Pressure Bag
- ☐ 02 delivery device (type)
- ☐ Crash cart with airway devices and

Medications and Fluids: (see chart)
- ☐ IV Fluids
- ☐ Oral Meds
- ☐ IVPB
- ☐ IV Push
- ☐ IM or SC

Diagnostics Available: (see chart)
- ☐ Labs
- ☐ X-rays (Images)
- ☐ 12-Lead EKG
- ☐ Other:

Documentation Forms:
- ☐ Provider Orders
- ☐ Admit Orders
- ☐ Flow sheet
- ☐ Medication Administration Record
- ☐ Graphic Record
- ☐ Shift Assessment
- ☐ Triage Forms
- ☐ Code Record
- ☐ Anesthesia / PACU Record
- ☐ Standing (Protocol) Orders
- ☐ Transfer Orders
- ☐ Other:

Recommended Mode for Simulation:
(i.e. manual, programmed, etc.)

Student Information Needed Prior to Scenario:
- ☐ Has been oriented to simulator
- ☐ Understands guidelines /expectations for scenario
- ☐ Has accomplished all pre-simulation requirements
- ☐ All participants understand their assigned roles
- ☐ Has been given time frame expectations
- ☐ Other:

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emergency medications
☐ Defibrillator/Pacer
☐ Suction
☐ Other:

Roles/Guidelines for Roles:	**Important Information Related to Roles:**
☐ Primary Nurse	
☐ Secondary Nurse	
☐ Clinical Instructor	
☐ Family Member #1	
☐ Family Member #2	
☐ Observer/s	
☐ Recorder	
☐ Physician/Advanced Practice Nurse	
☐ Respiratory Therapy	
☐ Anesthesia	
☐ Pharmacy	
☐ Lab	
☐ Imaging	
☐ Social Services	
☐ Clergy	
☐ Unlicensed Assistive Personnel	
☐ Code Team	
☐ Other:	

NLN
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Report Students Will Receive Before Simulation

Time:

Significant Lab Values: refer to chart

Provider Orders: refer to chart

Home Medications: refer to chart

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Scenario Progression Outline

Timing (approx.)	Manikin/SP Actions	Expected Interventions	May Use the Following Cues
0-5 min			**Role member providing cue:** Cue:
5-10 min			**Role member providing cue:** Cue:
10-15 min			**Role member providing cue:** Cue:
15-20 min			**Role member providing cue:** Cue:

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Debriefing/Guided Reflection Questions for This Simulation

(Remember to identify important concepts or curricular threads that are specific to your program)

1. How did you feel throughout the simulation experience?
2. Describe the objectives you were able to achieve.
3. Which ones were you unable to achieve (if any)?
4. Did you have the knowledge and skills to meet objectives?
5. Were you satisfied with your ability to work through the simulation?
6. To Observer: Could the nurses have handled any aspects of the simulation differently?
7. If you were able to do this again, how could you have handled the situation differently?
8. What did the group do well?
9. What did the team feel was the primary nursing diagnosis?
10. How were physical and mental health aspects interrelated in this case?
11. What were the key assessments and interventions?
12. Is there anything else you would like to discuss?

Complexity – Simple to Complex

Suggestions for Changing the Complexity of This Scenario to Adapt to Different Levels of Learners

Appendix E: NLN/Jeffries Simulation Design Scale Survey Template

Simulation Design Scale (modified)

In order to measure if the best simulation design elements were implemented in the presented simulation scenario, please complete the survey below as you perceive it. There are no right or wrong answers, only your perceived amount of agreement or disagreement. Please use the following code to answer the questions.

Use the following rating system when assessing the simulation design elements:

1 - Strongly Disagree with the statement
2 - Disagree with the statement
3 - Undecided - you neither agree or disagree with the statement
4 - Agree with the statement
5 - Strongly Agree with the statement
NA - Not Applicable; the statement does not pertain to the simulation activity performed.

Rate each item based upon how important that item is **to you as a nurse educator.**

1 - Not Important
2 - Somewhat Important
3 - Neutral
4 - Important
5 - Very Important

Item	1	2	3	4	5	NA	1	2	3	4	5
Objectives and Information											
1. There was enough information provided at the beginning of the simulation to provide direction and encouragement.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
2. I clearly understood the purpose and objectives of the simulation.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
3. The simulation provided information in a clear matter for me to problem-solve the situation.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
4. There was enough information provided to me during the simulation.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
5. The cues were appropriate and geared to promote my understanding.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
Support											
6. Support was offered in a timely manner.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
7.My need for help was recognized.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
8. I felt supported by the facilitator's assistance during the simulation.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
9. I was supported in the learning process.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5

Modified January, 2017

Simulation Design Scale (modified)

Use the following rating system when assessing the simulation design elements:

1 - Strongly Disagree with the statement
2 - Disagree with the statement
3 - Undecided - you neither agree or disagree with the statement
4 - Agree with the statement
5 - Strongly Agree with the statement
NA - Not Applicable; the statement does not pertain to the simulation activity performed.

Rate each item based upon how important that item is **to you as a nurse educator.**

1 - Not Important
2 - Somewhat Important
3 - Neutral
4 - Important
5 - Very Important

Item	1	2	3	4	5	NA	1	2	3	4	5
Problem Solving											
10. Independent problem-solving was facilitated.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
11. I was encouraged to explore all possibilities of the simulation.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
12. The simulation was designed for my specific level of knowledge and skills.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
13. The simulation allowed me the opportunity to prioritize nursing assessments and care.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
14. The simulation provided me an opportunity to goal set for my patient.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
Feedback/Guided Reflection											
15. Feedback provided was constructive.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
16. Feedback was provided in a timely manner.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
17. The simulation allowed me to analyze my own behavior and actions.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
18. There was an opportunity after the simulation to obtain guidance/feedback from the facilitator in order to build knowledge to another level.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
Fidelity (Realism)											
19. The scenario resembled a real-life situation.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5
20. Real life factors, situations, and variables were built into the simulation scenario.	○1	○2	○3	○4	○5	○NA	○1	○2	○3	○4	○5

Simulation Design Scale (modified)

Use the following section to provide written assessment of the simulation design element for strengths, weaknesses, and suggested additions/eliminations.

Objectives and Information

1. There was enough information provided at the beginning of the simulation to provide direction and encouragement.

2. I clearly understood the purpose and objectives of the simulation.

3. The simulation provided enough information in a clear matter for me to problem-solve the situation.

4. There was enough information provided to me during the simulation.

5. The cues were appropriate and geared to promote my understanding.

Support

6. Support was offered in a timely manner.

7. My need for help was recognized.

Simulation Design Scale (modified)

Support

8. I felt supported by the facilitator's assistance during the simulation.

9. I was supported in the learning process.

Problem Solving

10. Independent problem-solving was facilitated.

11. I was encouraged to explore all possibilities of the simulation.

12. The simulation was designed for my specific level of knowledge and skills.

13. The simulation allowed me the opportunity to prioritize nursing assessments and care.

14. The simulation provided me an opportunity to goal set for my patient.

Feedback/Guided Reflection

15. Feedback provided was constructive.

Simulation Design Scale (modified)

16. Feedback was provided in a timely manner.

17. The simulation allowed me to analyze my own behavior and actions.

18. There was an opportunity after the simulation to obtain guidance/feedback from the facilitator in order to build knowledge to another level.

Fidelity (Realism)

19. The scenario resembled a real-life situation.

20. Real life factors, situations, and variables were built into the simulation scenario.

Appendix F: Respiratory Distress Simulation/ PEA Arrest

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Respiratory Distress Simulation/ PEA Arrest

Date: **Guided Reflection Time: 40 minutes**
Discipline: Nursing
Expected Simulation Run Time: 20minutes
Location: Adult Inpatient Unit

Brief Description of Client

Name: Ralph Deon

Gender: M **Age**: 70 **Weight**: 90Kg **Height**: 6ft.

Allergies: NKDA

Surgical Team: Attending: Dr. Lin, Resident: Dr. Kozen

Past Medical History:
CAD

Social History:
2 pack a day smoker for 50 years
ETOH

Primary Medical Diagnosis:
Laryngeal CA

Surgeries/Procedures & Dates:

Total Laryngectomy /Current Date____POD1

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Psychomotor Skills Required Prior to Simulation:

Adult IMCU competency completed including care of the Laryngectomy patient.
Return demonstrations required during IMCU orientation.

Cognitive Activities Required Prior to Simulation:

[i.e. independent reading (R), video review (V), computer simulations (CS), lecture (L)]

IMCU course completed

Simulation Learning Objectives

General Objectives:

1. Identify increased respiratory rate, effort/distress.
2. Identify a decrease in oxygen saturation

Simulation Scenario Objectives:

1. Demonstrate suction of Laryngectomy tube
2. Recognize respiratory failure
3. Call out for help
4. Recognize Pulseless Electrical Activity
5. Call a code blue
6. Start Chest Compression
7. Call for the code cart

References, Evidence-Based Practice Guidelines, Protocols, or Algorithms Used for This Scenario:

AHA Algorithm/ACLS

IMCU Protocol

Rhythm recognition

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Fidelity (choose all that apply to this simulation)

Setting/Environment:
- ☐ ER
- ☒ Med-Surg
- ☐ Peds
- ☐ ICU
- ☐ OR / PACU
- ☐ Women's Center
- ☐ Behavioral Health
- ☐ Home Health
- ☐ Pre-Hospital
- ☐ Other:

Simulator Manikin/s Needed:
Sim Man Essential

Props:

Equipment Attached to Manikin:
- ☒ IV tubing with primary line fluids running at ☒ mL/hr 125
- ☐ Secondary IV line running at mL/hr
- ☒ IV pump
- ☐ Foley catheter ☐mL output
- ☐ PCA pump running
- ☐ IVPB with running at ☐ mL/hr
- ☒ 02 35% humidified
- ☒ Monitor attached
- ☒ ID band
- ☐ Other:

Equipment Available in Room:
- ☐ Bedpan/Urinal
- ☐ Foley kit
- ☐ Straight Catheter Kit
- ☐ Incentive Spirometer
- ☐ Fluids
- ☐ IV start kit
- ☐ IV tubing
- ☐ IVPB Tubing
- ☒ IV Pump
- ☐ Feeding Pump
- ☐ Pressure Bag

Medications and Fluids: (see chart)
- ☒ IV Fluids
- ☐ Oral Meds
- ☐ IVPB
- ☐ IV Push
- ☐ IM or SC

Diagnostics Available: (see chart)
- ☒ Labs
- ☐ X-rays (Images)
- ☐ 12-Lead EKG
- ☐ Other:

Documentation Forms:
Electronic Documentation System

Recommended Mode for Simulation:
Manual

Nurse Information Needed Prior to Scenario:
- ☒ Has been oriented to simulator
- ☒ Understands guidelines /expectations for scenario
- ☐ Has accomplished all pre-simulation requirements
- ☐ All participants understand their assigned roles
- ☐ Has been given time frame expectations
- ☐ Other:

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☐ 02 delivery device (type) ☐ Crash cart with airway devices and emergency medications ☐ Defibrillator/Pacer ☒ Suction ☒ Other: Standard room equipment	
Roles/Guidelines for Roles:	**Important Information Related to Roles:**
☒ Primary Nurse ☒ Secondary Nurse (charge RN) ☐ Clinical Instructor ☐ Family Member #1 ☐ Family Member #2 ☐ Observer/s ☒ Recorder ☐ Physician/Advanced Practice Nurse ☐ Respiratory Therapy ☐ Anesthesia ☐ Pharmacy ☐ Lab ☐ Imaging ☐ Social Services ☐ Clergy ☐ Unlicensed Assistive Personnel ☐ Code Team ☐ Other:	

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Report Nurses Will Receive Before Simulation

Time:

Mr. Deon is a 70 old male who had surgery for a total laryngectomy post op day one. He has a laryngectomy tube (Lary tube) in place. O2 sats have been greater than 92% on 35% humidified oxygen via trach mask. Lary tube suctioned every 2 hrs due to increased secretions. RR 24 unlabored, HR 90 regular.

Significant Lab Values: refer to chart

Provider Orders: refer to chart

Home Medications: refer to chart

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Scenario Progression Outline

Timing (approx.)	Manikin/SP Actions	Expected Interventions	May Use the Following Cues
0-5 min	Upright positon RR 24 O2 Saturation 90-92% on 35% humidified oxygen HR 90 Increased secretions via Laryngectomy tube Upper airway rhonchi	Suction Lary Tube Listen to lung sounds Ask patient to cough	**Role member providing cue:** Cue: **rhonchi upper airway sounds, patient able to cough and clear secretions**
5-10 min	RR 30 O2 Saturation drifts 88% HR 100	Suction Lary Tube Increase Humidified O2 to 50%	**Role member providing cue:** Cue:
10-15 min	**RR 44** **O2 Saturation 85%** **HR 120**	Call for assistance/press nurse emergency button Suction Lary Tube Remove tube Ambu assist 100% O2	**Role member providing cue:** Cue: **Nurse will meet resistance when trying to suction**
15-20 min	**RR 0** **O2 Saturation 0** **HR 40 (no pulse)**	**Identify PEA** **Call a code blue** **Call for the code cart**	**Role member providing cue:** Cue: Patient unresponsive

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Debriefing/Guided Reflection Questions for This Simulation

(Remember to identify important concepts or curricular threads that are specific to your program)

1. How did you feel throughout the simulation experience?
2. Describe the objectives you were able to achieve.
3. Which ones were you unable to achieve (if any)?
4. Did you have the knowledge and skills to meet objectives?
5. Were you satisfied with your ability to work through the simulation?
6. To Observer: Could the nurses have handled any aspects of the simulation differently?
7. If you were able to do this again, how could you have handled the situation differently?
8. What did the group do well?
9. What did the team feel was the primary nursing diagnosis?
10. How were physical and mental health aspects interrelated in this case?
11. What were the key assessments and interventions?
12. Is there anything else you would like to discuss?

Complexity – Simple to Complex

Suggestions for Changing the Complexity of This Scenario to Adapt to Different Levels of Learners

Appendix G: Unstable Hemodynamic Simulation

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Unstable Hemodynamic Simulation

Date: **Guided Reflection Time: 40 minutes**
Discipline: Nursing
Expected Simulation Run Time: 20minutes
Location: Adult Inpatient Unit

Brief Description of Client

Name: Helen Hebert

Gender: F **Age**: 62 **Weight**: 65kg **Height**: 5ft4

Allergies: Sulfur

Surgical Team: Attending: Dr. Emerick, Surgical Resident: Dr. Strong

Past Medical History:
Type II DM
Renal disease
HTN

Social History:
ETOH drinks 6 beers a day
Denies smoking

Primary Medical Diagnosis:
Squamous cell cancer oral cavity

Surgeries/Procedures & Dates:
Hemiglossectomy

/Current Date___POD1_____

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Psychomotor Skills Required Prior to Simulation:

IMCU orientation return demonstration
Adult Dysrhythmia course completed

Cognitive Activities Required Prior to Simulation:

[i.e. independent reading (R), video review (V), computer simulations (CS), lecture (L)]

IMCU Nurse
IMCU course completed

Simulation Learning Objectives

General Objectives:

1. Identify increased heart rate
2. Identify a decrease in blood pressure

Simulation Scenario Objectives:

1. Identify Atrial Fibrillation
2. Call for support (STAT)
3. Call for code cart

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References, Evidence-Based Practice Guidelines, Protocols, or Algorithms Used for This Scenario:

AHA algorithm (Tachy arrhythmia)

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Fidelity (choose all that apply to this simulation)

Setting/Environment:
- ☐ ER
- ☒ Med-Surg
- ☐ Peds
- ☐ ICU
- ☐ OR / PACU
- ☐ Women's Center
- ☐ Behavioral Health
- ☐ Home Health
- ☐ Pre-Hospital
- ☒ Other: IMCU

Simulator Manikin/s Needed:
Sim Man Essential

Props:

Equipment Attached to Manikin:
- ☒ IV tubing with primary line fluids running at ☒ mL/hr 125
- ☐ Secondary IV line running at mL/hr
- ☒ IV pump
- ☐ Foley catheter ☐ mL output
- ☐ PCA pump running
- ☐ IVPB with running at ☐ mL/hr
- ☐ 02 ☐
- ☒ Monitor attached
- ☒ ID band
- ☐ Other:

Equipment Available in Room:
- ☐ Bedpan/Urinal
- ☐ Foley kit
- ☐ Straight Catheter Kit
- ☐ Incentive Spirometer
- ☐ Fluids
- ☐ IV start kit
- ☐ IV tubing
- ☐ IVPB Tubing

Medications and Fluids: (see chart)
- ☒ IV Fluids
- ☐ Oral Meds
- ☐ IVPB
- ☐ IV Push
- ☐ IM or SC

Diagnostics Available: (see chart)
- ☒ Labs (glucose, BUN/Creatinine
- ☐ X-rays (Images)
- ☐ 12-Lead EKG
- ☐ Other:

Documentation Forms:
Electronic Documentation System

Recommended Mode for Simulation:
Manual

Nurse Information Needed Prior to Scenario:
- ☒ Has been oriented to simulator
- ☒ Understands guidelines /expectations for scenario
- ☐ Has accomplished all pre-simulation requirements
- ☒ All participants understand their assigned roles
- ☐ Has been given time frame expectations
- ☐ Other:

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for **Nursing**

☒ IV Pump ☐ Feeding Pump ☐ Pressure Bag ☒ 02 delivery device (type) Nasal Cannula ☐ Crash cart with airway devices and emergency medications ☐ Defibrillator/Pacer ☐ Suction ☒ Other: Standard room equipment	
Roles/Guidelines for Roles:	**Important Information Related to Roles:**
☒ Primary Nurse ☒ Secondary Nurse (charge nurse) ☐ Clinical Instructor ☐ Family Member #1 ☐ Family Member #2 ☐ Observer/s ☒ Recorder ☐ Physician/Advanced Practice Nurse ☐ Respiratory Therapy ☐ Anesthesia ☐ Pharmacy ☐ Lab ☐ Imaging ☐ Social Services ☐ Clergy ☐ Unlicensed Assistive Personnel ☐ Code Team ☐ Other:	

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Report Nurses Will Receive Before Simulation

Time:

Helen Hebert is a 62yr old post op day 1 status post hemiiglossectomy. Patient received 5 liters LR intraop and current IV fluid is D5LR @ 125ml/hr running in her RAC. As of this report Ms. Hebert I/O is positive 3 liters in 24 hours. Her urine output is 20cc/hr in 24 hours. She has +2 pitting edema in her ankles. Lungs noted to have mild crackles at bilateral bases. MD is aware.

Significant Lab Values:	refer to chart
Provider Orders:	refer to chart
Home Medications:	Lisinopril 20mg oral daily Metformin 500 mg 3 times a day PO with meals

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Scenario Progression Outline

Timing (approx.)	Manikin/SP Actions	Expected Interventions	May Use the Following Cues
0-5 min	RR 24 O2 Saturation 98% RA HR 70 NSR BP 130/80	Head to Toe shift assessment	**Role member providing cue:** Cue: **ankle edema +3** **Lung sounds: noted on auscultation crackles bilateral bases**
5-10 min	RR 30 O2 Saturation drifts 88% RA HR 100 Frequent PAC's BP 100/60	Cardiac monitor apply 5 lead Auscultate lung sounds Apply oxygen 4L NC Q5 min BP monitoring	**Role member providing cue:** Cue: Bilateral **Crackles noted on auscultation bilaterally mid lung fields.**
10-15 min	**RR 44** **O2 Saturation 88%** **HR 150 Rapid Atrial Fibrillation** **BP 90/60**	Call for Stat response Recognize Rapid Atrial Fibrillation Hemodynamicaly unstable	**Role member providing cue:** Cue:
15-20 min	**RR 44** **O2 Saturation 88%** **HR 150** **BP 90/60**	**Call for code cart** **MD arrives**	**Role member providing cue:** Cue:

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Debriefing/Guided Reflection Questions for This Simulation

(Remember to identify important concepts or curricular threads that are specific to your program)

1. How did you feel throughout the simulation experience?
2. Describe the objectives you were able to achieve.
3. Which ones were you unable to achieve (if any)?
4. Did you have the knowledge and skills to meet objectives?
5. Were you satisfied with your ability to work through the simulation?
6. To Observer: Could the nurses have handled any aspects of the simulation differently?
7. If you were able to do this again, how could you have handled the situation differently?
8. What did the group do well?
9. What did the team feel was the primary nursing diagnosis?
10. How were physical and mental health aspects interrelated in this case?
11. What were the key assessments and interventions?
12. Is there anything else you would like to discuss?

Complexity – Simple to Complex

Suggestions for Changing the Complexity of This Scenario to Adapt to Different Levels of Learners

Appendix H: IRB

Massachusetts Eye and Ear

Human Studies Committee
HSC@meei.harvard.edu

PROTOCOL APPROVAL

DATE:	February 7, 2017
TO:	Carlene Blais, MSN, RN
FROM:	HUMAN STUDIES COMMMITTEE
TITLE:	[984236-3] Improving code blue recognition and response with an evidence-based in-situ simulation program.
PROTOCOL #:	16-137H
SPONSOR:	N/A
SUBMISSION TYPE:	Response/Follow-Up
SUBMISSION DATE:	February 7, 2017
ACTION:	APPROVED/ACTIVATION PENDING
RISK LEVEL:	Minimal Risk
REVIEW TYPE:	Expedited Review
EFFECTIVE DATE:	February 7, 2017
EXPIRATION DATE:	February 6, 2018
IND/IDE #:	N/A
ClinicalTrials.gov:	N/A

EXPEDITED REVIEW CATEGORY: 7

Dear Ms. Blais, MSN, RN,

Thank you for your submission of Response/Follow-Up materials for this research study.

This protocol has been reviewed and approved by the HSC. During the review of this protocol, the HSC specifically considered (i) the minimization of risks to subjects (ii) the risks and anticipated benefits, if any, to subjects; (iii) the equitable selection of subjects; (iv) the procedures for obtaining and documenting informed consent; (v) the monitoring of data related to subject safety; and (vi) subject privacy and

confidentiality of data in accordance with 45 CFR 46.111 and 21 CFR 56.111, criteria for IRB approval of research.

Notes, Determinations, Findings:

Waiver of Documentation/Authorization: A waiver of documentation of consent and a waiver of authorization has been approved in accordance with the Common Rule and Privacy Rule regulations for the entire study.

TERMS OF APPROVAL

As Principal Investigator you are responsible for the following:

1. Submission in writing of any changes to this project (e.g., personnel, protocol, recruitment materials, consent form, etc.) to the HSC for review and approval prior to initiation of the change(s), except where necessary to eliminate apparent immediate hazards to the subject(s). Changes made to eliminate apparent immediate hazards to subjects must be reported to the HSC within 24 hours.
2. So long as this project continues to involve human subjects, filing for continuing review and re-approval of this study (at least 6-8 weeks) prior to the expiration date noted above. Once the study is complete or no longer involves human subjects, filing a closure report with the HSC.
3. For FDA-regulated studies, compliance with IND and/or IDE requirements, including applicable sponsor and/or investigator responsibilities and adherence to Good Clinical Practice standards. Please contact the HSC for detailed information, guidance, and resources to assist you in fulfillment of these responsibilities.
4. Submission, in writing, of any reportable events as required by HSC policy. Please ensure you are familiar with HSC reporting policies. Should you have questions about whether or not an event is reportable or how to report an event, you are strongly encouraged to seek guidance by contacting the HSC. You are also responsible for any reporting requirements imposed by the FDA, OHRP, sponsor, funding agency or others.
5. Use of only current and HSC validated copies of the consent/authorization form(s), in your research. Do not use expired consent/authorization forms.
6. Informing all personnel listed on the protocol of changes, adverse events, and unanticipated problems.
7. FDA-regulated research: Maintaining study documentation in accordance with FDA requirements and Good Clinical Practice standards. Please use the Harvard Catalyst Regulatory Binder template (available on the SharePoint site) if a binder has not been provided by the sponsor. MEE template logs are available on the HRPP SharePoint site for use and should be adapted to meet the needs of your study. If you have any questions about the applicability of record requirements please contact the HRPP staff for assistance. Please note that all study-related records must be accessible for inspection by authorized individuals including the FDA, HSC, and study monitors (as applicable).
8. For all research: Maintaining up-to-date and comprehensive study files, you are encouraged to review the Harvard Catalyst Regulatory Binder template as a helpful resource in organizing study documents related to the conduct of this study.
9. For retaining all records associated with the conduct of this study for at least 6 years following the completion of the study (unless otherwise required by the HSC to destroy them sooner (e.g., master key, identifiable data)). This is the minimum institutional requirement however, you should ensure you are aware of any record retention requirements imposed by the FDA, funding agency, or sponsor.

ENCLOSED DOCUMENTS: Stamped Information Sheet

Please do not hesitate to contact the HSC with questions or for assistance or guidance. You may also contact the sender of this communication, name and contact information is provided below.

Sincerely,

Jan Trott

Jan_Trott@meei.harvard.edu

The HSC acknowledges your submission which includes the following item (s):

- Application Form - Prospective Study Application Form 9 8 2016.docx (UPDATED: 02/7/2017)
- Consent Waiver - Waiver of Consent and HIPAA Authorization Request Form 7 25 16 kch (1).docx (UPDATED: 02/7/2017)
- Cover Sheet - Response to Request for Additional Information.docx (UPDATED: 02/7/2017)
- Letter - Cover Letter Information Sheet or Oral Consent Script and HIPAA Authorization.docx (UPDATED: 02/7/2017)
- Questionnaire/Survey - modified nln-instrument_simulation-design-scale2.docx (UPDATED: 02/7/2017)

Appendix I: Respiratory Distress/PEA Simulation Design Qualitative Analysis

Survey # 1

Use the following section to provide written assessment of the simulation design element for strengths, weaknesses, and suggested additions/eliminations.

Objectives and Information

1. There was enough information provided at the beginning of the simulation to provide direction and encouragement.

Data (Participant 1)

I think in the report given to the oncoming nurse a little more information should be given to drive the scenario without giving it away.

Data (Participant 2)

Yes, brief but concise

Data (Participant 3)

Psychomotor skills-return demonstration of skills

Data (Participant 4)

Not answered

2. I clearly understood the purpose and objectives of the simulation.

Data (Participant 1)

I would consider a general objective of identifying increased respiratory effort/distress in the sim scenario objectives. I would change the order: 1) Demonstrate suction of lary tube, 2) Recognize respiratory failure, 3) call for help, 4) recognize PEA, 5) call a code, 6) start chest compressions.

Data (Participant 2)

Purpose was not clear-should there be a purpose statement? Objectives were clear

Data (Participant 3)

Yes

Data (Participant 4)

Yes

3. The simulation provided enough information in a clear matter for me to problem-solve the situation.

Data (Participant 1)

I would include breath sounds (set up on Sim Man) ie, rhonchi/crackles etc.

Data (Participant 2)

No answered

Data (Participant 3)

Report needs to include RR and heart rate.

Data (Participant 4)

Not answered

4. There was enough information provided to me during the simulation.

Data (Participant 1)

No answer

Data (Participant 2)

No answered

Data (Participant 3)

Expected interventions: RN would first change patient position, encourage coughing etc. Get to clear own airway.

Data (Participant 4)

Not answered

5. The cues were appropriate and geared to promote my understanding.

Data (Participant 1)

Yes, available as the student/staff inquires.

Data (Participant 2)

Suggest adding more cues for possible RN responses. (i.e. if the RN asks or hears crackles-yes there is crackles). RN will meet resistance may be more of an expected intervention.

Data (Participant 3)

0-5 cues: state what lung sounds are heard and if patient was able to cough and clear secretions.

Data (Participant 4)

Not answered

Support

6. Support was offered in a timely manner.

Data (Participant 1)

Yes, will be handled by facilitator

Data (Participant 2)

Difficult to answer this, picked NA. Unsure if support is given as this seems more if you are involved in simulation vs. reviewing accuracy of content.

Data (Participant 3)

NA

Data (Participant 4)

Not answered

7. My need for help was recognized.

Data (Participant 1)

Yes, will be handled by facilitator

Data (Participant 2)

Difficult to answer this, picked NA. Unsure if support is given as this seems more if you are involved in simulation vs. reviewing accuracy of content.

Data (Participant 3)

NA

Data (Participant 4)

Not answered

8. I felt supported by the facilitator's assistance during the simulation.

Data (Participant 1)

Intended

Data (Participant 2)

Not answered

Data (Participant 3)

NA

Data (Participant 4)

Not answered

9. I was supported in the learning process.

Data (Participant 1)

Not answered

Data (Participant 2)

Not answered

Data (Participant 3)

NA

Data (Participant 4)

Not answered

Problem Solving

10. Independent problem-solving was facilitated.

Data (Participant 1)

Not answered

Data (Participant 2)

Not answered

Data (Participant 3)

NA

Data (Participant 4)

Not answered

11. I was encouraged to explore all possibilities of the simulation.

Data (Participant 1)

Not answered

Data (Participant 2)

Not answered

Data (Participant 3)

Yes, critical thinking

Data (Participant 4)

Not answered

12. The simulation was designed for my specific level of knowledge and skills.

Data (Participant 1)

Yes

Data (Participant 2)

Not answered

Data (Participant 3)

Pre-education required

Data (Participant 4)

Appropriate objectives were basic and clear

13. The simulation allowed me the opportunity to prioritize nursing assessments and care.

Data (Participant 1)

Yes

Data (Participant 2)

Not answered

Data (Participant 3)

Yes, steps to interventions

15-20 minutes (1) press emergency button by pt. bedside. (2) initiate chest compressions

Data (Participant 4)

Yes, cues keep with prioritizing

14. The simulation provided me an opportunity to goal set for my patient.

Data (Participant 1)

Yes

Data (Participant 2)

Not answered

Data (Participant 3)

NA

Data (Participant 4)

Assess and intervention appropriate

Feedback/Guided Reflection

15. Feedback provided was constructive.

Data (Participant 1)

Not answered

Data (Participant 2)

Difficult to answer, picked NA for same reason as support. Feedback/Guided Reflection questions seem to be more if involved in simulation.

Data (Participant 3)

NA

Data (Participant 4)

NA

16. Feedback was provided in a timely manner.

Data (Participant 1)

Not answered

Data (Participant 2)

Difficult to answer, picked NA for same reason as support. Feedback/Guided Reflection questions seem to be more if involved in simulation.

Data (Participant 3)

NA

Data (Participant 4)

NA

17. The simulation allowed me to analyze my own behavior and actions.

Data (Participant 1)

Not answered

Data (Participant 2)

Difficult to answer, picked NA for same reason as support. Feedback/Guided Reflection questions seem to be more if involved in simulation.

Data (Participant 3)

NA

Data (Participant 4)

NA

18. There was an opportunity after the simulation to obtain guidance/feedback from the facilitator in order to build knowledge to another level.

Data (Participant 1)

Not answered

Data (Participant 2)

Not answered

Data (Participant 3)

Built into design

Data (Participant 4)

NA

Fidelity (Realism)

19. The scenario resembled a real-life situation.

Data (Participant 1)

Yes, very population specific

Data (Participant 2)

Page #7 of simulation add under 5-10 minutes add ambu patient. Add under 10-15 minutes add remove Lary tube.

Data (Participant 3)

Yes

Data (Participant 4)

This is realistic and can happen with these patients, mucus plug

20. Real life factors, situations, and variables were built into the simulation scenario.

Data (Participant 1)

Yes

Data (Participant 2)

Psychomotor skills on page 2 of simulation scenario-include demonstrations/return demonstration during IMCU orientation.

Page 3 of simulation-add more references, i.e. AHA Guidelines

Page 4 of simulation add IMCU as setting

Page 5 of simulation add suction, additional RN or Charge Nurse, 02 delivery device

Page 6 of simulation change Trach to Lary tube

Data (Participant 3)

Yes

Data (Participant 4)

Yes, correct supplies

Appendix J: Unstable Hemodynamic Simulation Design Qualitative Analysis

Survey #1

Use the following section to provide written assessment of the simulation design element for strengths, weaknesses, and suggested additions/eliminations.

Objectives and Information

1. There was enough information provided at the beginning of the simulation to provide direction and encouragement.

Data (Participant 1)

Yes

Data (Participant 2)

Yes

Data (Participant 3)

Yes

Data (Participant 4)

Information needed: vital signs and last void

2. I clearly understood the purpose and objectives of the simulation.

Data (Participant 1)

Yes, however simulation scenario objectives #1: change attach cardiac 12 leads to 5 leads.

Data (Participant 2)

Clear and noncomplex

Data (Participant 3)

Purpose unclear-should there be a purpose statement

Objectives clear

Data (Participant 4)

Yes

3. The simulation provided enough information in a clear matter for me to problem-solve the situation.

Data (Participant 1)

Not answered

Data (Participant 2)

What is “up by 3L mean”? Weight gain might be more helpful

Data (Participant 3)

Not answered

Data (Participant 4)

Unsure

4. There was enough information provided to me during the simulation.

Data (Participant 1)

Recommend adding under manikin scenario progression line:

0-5min add under manikin/actions: NSR to HR, crackles at bases. Expected interventions, listen to lung sounds, hears crackles, IV fluid at 125ml/hr. Cue, ankle edema change +3 to 3+

0-10min add under manikin actions: add with frequent premature atrial contractions (PAC’s) to HR 100, increased crackles. Expected interventions: change 12 lead to 5 lead

10-15min add under manikin/actions: add rapid AF to HR 150. Expected interventions: add recognize “rapid” afib.

Data (Participant 2)

Cardiac rhythm with HR, cues were helpful but I was not sure if Afib was new onset or existing.

Data (Participant 3)

Suggest adding more information: is the patient NPO, is the patient voiding, add other patient complaints

Data (Participant 4)

0-5min is patient coughing?

5-10min: Have RN call for help from the Charge RN or other RN

5. The cues were appropriate and geared to promote my understanding.

Data (Participant 1)

Yes

Data (Participant 2)

See answer to number 4

Data (Participant 3)

Add more cues to possible RN questions

Data (Participant 4)

Unsure

Support

6. Support was offered in a timely manner.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

NA

Data (Participant 4)

7. My need for help was recognized.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

Difficult to answer, seems more for those involved in simulation

Data (Participant 4)

NA

8. I felt supported by the facilitator's assistance during the simulation.

Data (Participant 1)

Is intended based on scenario

Data (Participant 2)

NA

Data (Participant 3)

Difficult to answer, seems more for those involved in simulation

Data (Participant 4)

NA

9. I was supported in the learning process.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

Difficult to answer, seems more for those involved in simulation

Data (Participant 4)

NA

Problem Solving

10. Independent problem-solving was facilitated.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

NA

Data (Participant 4)

Yes

11. I was encouraged to explore all possibilities of the simulation.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

NA

Data (Participant 4)

Set up to do so

12. The simulation was designed for my specific level of knowledge and skills.

Data (Participant 1)

Yes, required education prior to participation

Data (Participant 2)

Yes

Data (Participant 3)

yes

Data (Participant 4)

Yes, pre-education requirements

13. The simulation allowed me the opportunity to prioritize nursing assessments and care.

Data (Participant 1)

Yes, based on scenario design

Data (Participant 2)

Yes

Data (Participant 3)

Not answered

Data (Participant 4)

Set up to do so

14. The simulation provided me an opportunity to goal set for my patient.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

Data (Participant 4)

unsure

Feedback/Guided Reflection

15. Feedback provided was constructive.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

NA

Data (Participant 4)

NA

16. Feedback was provided in a timely manner.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

NA

Data (Participant 4)

NA

17. The simulation allowed me to analyze my own behavior and actions.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

NA

Data (Participant 4)

NA

18. There was an opportunity after the simulation to obtain guidance/feedback from the facilitator in order to build knowledge to another level.

Data (Participant 1)

NA

Data (Participant 2)

NA

Data (Participant 3)

NA

Data (Participant 4)

Design has this built in

Fidelity (Realism)

19. The scenario resembled a real-life situation.

Data (Participant 1)

Yes

Data (Participant 2)

Yes

Data (Participant 3)

Yes

Data (Participant 4)

Yes

20. Real life factors, situations, and variables were built into the simulation scenario.

Data (Participant 1)

Yes

Data (Participant 2)

Yes

Data (Participant 3)

Yes

Data (Participant 4)

Yes

Appendix K: *t*-Test Statistical Data

	Respiratory								Hemodynamic							
	Simulation #1				Simulation #2				Simulation #1				Simulation #2			
Objectives and Information																
1	5	4	5	3	5	5	5	5	2	5	4	5	5	5	5	5
2	5	5	4	5	5	4	5	5	5	5	5	4	5	4	4	5
3	5	4	4	5	5	5	5	5	4	5	4	5	5	5	5	5
4	NA	4	5	4	5	5	5	5	NA	5	4	4	5	NA	5	5
5	5	4	3	NA	5	5	5	5	4	3	5	4	5	5	5	5
Support																
6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Problem Solving																
10	NA	NA	4	NA	NA	5	5	5	NA	NA	NA	4	NA	NA	5	4
11	NA	NA	4	5	NA	4	5	NA	4	5	4	NA	5	4	4	NA
12	5	5	5	NA	5	5	5	5	4	5	5	5	5	5	5	5
13	NA	4	5	5	5	4	5	5	4	5	5	5	5	5	4	5
14	NA	3	4	NA	5	4	5	NA	NA	NA	NA	4	5	5	4	NA
Feedback/ Reflection																
15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	NA	NA	NA	NA	NA	NA	5	NA	NA	NA	NA	NA	NA	5	NA	NA
18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fidelity																
19	5	4	5	5	5	5	5	5	4	5	5	4	5	5	5	4

Respiratory #1	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.25	5
Variance	0.91666667	0
Observations	4	4
Pooled Variance	0.45833333	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1.5666989	
P(T<=t) one-tail	0.08411374	
t Critical one-tail	1.94318028	
P(T<=t) two-tail	0.16822747	
t Critical two-tail	2.44691185	

Hemodynamic #1	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4	5
Variance	2	0
Observations	4	4
Pooled Variance	1	
Hypothesized Mean Dif	0	
df	6	
t Stat	-1.41421356	
P(T<=t) one-tail	0.103515625	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.20703125	
t Critical two-tail	2.446911851	

Respiratory #2	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	Variable 2
Mean	4.75	4.75
Variance	0.25	0.25
Observations	4	4
Pooled Variance	0.25	
Hypothesized Mean Difference	0	
df	6	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	1.94318028	
P(T<=t) two-tail	1	
t Critical two-tail	2.44691185	

Hemodynamic #2	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.75	4.5
Variance	0.25	0.333333333
Observations	4	4
Pooled Variance	0.291666667	
Hypothesized Mean Dif	0	
df	6	
t Stat	0.654653671	
P(T<=t) one-tail	0.268481662	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.536963324	
t Critical two-tail	2.446911851	

Respiratory #3	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.5	5
Variance	0.33333333	0
Observations	4	4
Pooled Variance	0.16666667	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1.73205081	
P(T<=t) one-tail	0.0669873	
t Critical one-tail	1.94318028	
P(T<=t) two-tail	0.1339746	
t Critical two-tail	2.44691185	

Hemodynamic #3	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.5	5
Variance	0.333333333	0
Observations	4	4
Pooled Variance	0.166666667	
Hypothesized Mean Dif	0	
df	6	
t Stat	-1.73205081	
P(T<=t) one-tail	0.066987298	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.133974596	
t Critical two-tail	2.446911851	

Respiratory #4	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.33333333	5
Variance	0.33333333	0
Observations	3	4
Pooled Variance	0.13333333	
Hypothesized Mean Difference	0	
df	5	
t Stat	-2.39045722	
P(T<=t) one-tail	0.03117621	
t Critical one-tail	2.01504837	
P(T<=t) two-tail	0.06235242	
t Critical two-tail	2.57058184	

Hemodynamic #4	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.333333333	5
Variance	0.333333333	0
Observations	3	3
Pooled Variance	0.166666667	
Hypothesized Mean Dif	0	
df	4	
t Stat	-2	
P(T<=t) one-tail	0.058058262	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	0.116116524	
t Critical two-tail	2.776445105	

Respiratory #5 **NSD**

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	4	5
Variance	1	0
Observations	3	4
Pooled Variance	0.4	
Hypothesized Mean Difference	0	
df	5	
t Stat	-2.07019668	
P(T<=t) one-tail	0.04660816	
t Critical one-tail	2.01504837	
P(T<=t) two-tail	0.09321632	
t Critical two-tail	2.57058184	

Hemodynamic #5 **SD**

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	4	5
Variance	0.666666667	0
Observations	4	4
Pooled Variance	0.333333333	
Hypothesized Mean Dif	0	
df	6	
t Stat	-2.44948974	
P(T<=t) one-tail	0.024912631	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.049825263	
t Critical two-tail	2.446911851	

Respiratory #10

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	4	5
Variance	#DIV/0!	0
Observations	1	3
Pooled Variance	0	
Hypothesized Mean Difference	0	
df	2	
t Stat	65535	
P(T<=t) one-tail	#NUM!	
t Critical one-tail	2.91998558	
P(T<=t) two-tail	#NUM!	
t Critical two-tail	4.30265273	

Hemodynamic #10

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	4	4.5
Variance	#DIV/0!	0.5
Observations	1	2
Pooled Variance	0.5	
Hypothesized Mean Dif	0	
df	1	
t Stat	-0.57735027	
P(T<=t) one-tail	0.333333333	
t Critical one-tail	6.313751515	
P(T<=t) two-tail	0.666666667	
t Critical two-tail	12.70620474	

Respiratory #11	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.5	4.5
Variance	0.5	0.5
Observations	2	2
Pooled Variance	0.5	
Hypothesized Mean Difference	0	
df	2	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.91998558	
P(T<=t) two-tail	1	
t Critical two-tail	4.30265273	

Hemodynamic #11	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.333333333	4.333333333
Variance	0.333333333	0.333333333
Observations	3	3
Pooled Variance	0.333333333	
Hypothesized Mean Dif	0	
df	4	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.131846786	
P(T<=t) two-tail	1	
t Critical two-tail	2.776445105	

Respiratory #12	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	5	5
Variance	0	0
Observations	3	4
Pooled Variance	0	
Hypothesized Mean Difference	0	
df	5	
t Stat	65535	
P(T<=t) one-tail	#NUM!	
t Critical one-tail	2.01504837	
P(T<=t) two-tail	#NUM!	
t Critical two-tail	2.57058184	

Hemodynamic #12	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.75	5
Variance	0.25	0
Observations	4	4
Pooled Variance	0.125	
Hypothesized Mean Dif	0	
df	6	
t Stat	-1	
P(T<=t) one-tail	0.177958842	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.355917684	
t Critical two-tail	2.446911851	

Respiratory #13	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.66666667	4.75
Variance	0.33333333	0.25
Observations	3	4
Pooled Variance	0.28333333	
Hypothesized Mean Difference	0	
df	5	
t Stat	-0.20498002	
P(T<=t) one-tail	0.42283557	
t Critical one-tail	2.01504837	
P(T<=t) two-tail	0.84567113	
t Critical two-tail	2.57058184	

Hemodynamic #13	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.75	4.75
Variance	0.25	0.25
Observations	4	4
Pooled Variance	0.25	
Hypothesized Mean Dif	0	
df	6	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	1	
t Critical two-tail	2.446911851	

Respiratory #14	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	3.5	4.666667
Variance	0.5	0.333333
Observations	2	3
Pooled Variance	0.38888889	
Hypothesized Mean Difference	0	
df	3	
t Stat	-2.04939015	
P(T<=t) one-tail	0.06642092	
t Critical one-tail	2.35336343	
P(T<=t) two-tail	0.13284184	
t Critical two-tail	3.18244631	

Hemodynamic #14	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4	4.666666667
Variance	#DIV/0!	0.333333333
Observations	1	3
Pooled Variance	0.333333333	
Hypothesized Mean Dif	0	
df	2	
t Stat	-1	
P(T<=t) one-tail	0.211324865	
t Critical one-tail	2.91998558	
P(T<=t) two-tail	0.422649731	
t Critical two-tail	4.30265273	

Respiratory #19	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.75	5
Variance	0.25	0
Observations	4	4
Pooled Variance	0.125	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1	
P(T<=t) one-tail	0.17795884	
t Critical one-tail	1.94318028	
P(T<=t) two-tail	0.35591768	
t Critical two-tail	2.44691185	

Hemodynamic #19	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.5	4.75
Variance	0.333333333	0.25
Observations	4	4
Pooled Variance	0.291666667	
Hypothesized Mean Dif	0	
df	6	
t Stat	-0.65465367	
P(T<=t) one-tail	0.268481662	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.536963324	
t Critical two-tail	2.446911851	

Respiratory #20	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.75	5
Variance	0.25	0
Observations	4	4
Pooled Variance	0.125	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1	
P(T<=t) one-tail	0.17795884	
t Critical one-tail	1.94318028	
P(T<=t) two-tail	0.35591768	
t Critical two-tail	2.44691185	

Hemodynamic #20	NSD	
t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	*Variable 2*
Mean	4.75	5
Variance	0.25	0
Observations	4	4
Pooled Variance	0.125	
Hypothesized Mean Dif	0	
df	6	
t Stat	-1	
P(T<=t) one-tail	0.177958842	
t Critical one-tail	1.943180281	
P(T<=t) two-tail	0.355917684	
t Critical two-tail	2.446911851	