IMPACT OF HIGH-FIDELITY SIMULATION TRAINING ON MEDICAL-SURGICAL NURSES' SELF-CONFIDENCE AND MOCK CODE BLUE PERFORMANCE: A PILOT STUDY

by

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ABSTRACT

SHANNON BOUCHER MORTON. Impact of high-fidelity simulation training on medical-surgical nurses' self-confidence and mock code blue performance: A pilot study. (Under the direction of DR. KELLY POWERS)

Nurses working on medical-surgical units are often responders to situations of acute patient deterioration and must be ready to act and implement life-saving interventions (Buckley & Gordon, 2011). Training programs that incorporate high-fidelity simulation (HFS) provide an effective and safe environment for nurses to learn and practice clinical skills required during emergency situations (Cant & Cooper, 2009; Huseman, 2012; Sullivan et al., 2015). The purpose of this pilot study was to evaluate the impact of a HFS training intervention on medical-surgical nurses' self-confidence and mock code blue performance. A one-group, pre- and post-test, quasi-experimental pilot study was conducted with 37 medical-surgical nurses at the project facility. A HFS training intervention was implemented and changes in self-confidence and mock code blue performance were evaluated. Overall response improved, but changes were not statistically significant ($t = 1.1754$, $p = .140$); however, time to defibrillation significantly improved ($t = 7.025$, $p = .001$). In addition, changes in participant satisfaction ($t = 6.556$, $p = .001$) and self-confidence ($t = 6.220$, $p = .002$) were statistically significant. HFS training can be used to improve medical-surgical nurses' self-confidence and performance for responding to in-hospital cardiac arrest (IHCA), and provides a safe environment for clinical staff to practice and refine skills necessary to improve outcomes of patients experiencing these events.

DEDICATION

This study is dedicated to all of the medical-surgical nurses at Carolinas HealthCare System NorthEast. You face hurdles and challenges constantly, all while providing evidence-based, patient-centered, excellent care to patients and their families. I admire all that you do and hope you know that your dedication and determination does not go unnoticed.

ACKNOWLEDGMENTS

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LIST OF ABBREVIATIONS

IHCA	In-hospital cardiac arrest
HFS	High-fidelity simulation
NLN	National League for Nursing
DNP	Doctor of Nursing Practice
BLS	Basic life support
AHA	American Heart Association
AED	Automated external defibrillator
CPR	Cardiopulmonary resuscitation
IRB	Institutional review board
RNs	Registered Nurses
BSN	Bachelor of Science in Nursing
SPSS	Statistical package for the social sciences
ADN	Associate’s Degree in Nursing

CHAPTER 1: INTRODUCTION

1.1 Background

High-fidelity simulation (HFS) is the term utilized to describe the use of manikins to simulate patients in realistic clinical scenarios, and it has been widely adopted in nursing education. HFS promotes skill acquisition and helps to develop clinical judgment and critical thinking skills (Basak, Unver, Moss, Watts, & Gaioso, 2016). Research has shown HFS improves response to patient care events, self-confidence level, and competence (Flood, Thompson, Lovell, Field & Daub, 2011). Recent findings demonstrate HFS is an effective method to prepare nurses for responding to cardiac arrest, or code blue, events (Huseman, 2012; Morrison et al., 2013).

In-hospital cardiac arrest (IHCA) rates have been estimated to occur at an incidence of 6.65 per 1000 adult admissions. Annually in the United States, there are an estimated 32.2 million adult hospital admissions, and approximately 200,000 adult IHCAs (Morrison et al., 2013). Morrison et al. (2013) suggested best practices to employ in hospitals, including educating and training staff to recognize and respond to code blue events, with HFS described as an effective method of education. Nurses working on all hospital units, including medical-surgical units, must be prepared for code blue events. Medical-surgical nurses are often first responders to situations of acute patient deterioration and must be ready to act and implement life-saving interventions (Buckley

& Gordon, 2011). Use of HFS can prepare medical-surgical nurses to effectively respond to code blue events.

1.2 Problem Statement

The current mock code blue program at the project facility has been in place since 2013, utilizing low-fidelity simulation to provide training to nursing staff. In this program, mock code blue events are simulated in empty patient rooms by members of the Clinical Education Services department using basic life support (BLS) manikins that lack the functionality to be electronically manipulated for a more realistic experience. Results from each event are tracked and monitored using the project facility's Mock Code Evaluation Tool. In addition to the simulation training, informal debriefing sessions are conducted and nurses report these practice events are extremely helpful and applicable to actual clinical situations, and they look back to the mock code blue event for guidance during patient emergencies.

The 2010 American Heart Association (AHA) BLS guidelines emphasized defibrillation should occur in less than 3 minutes from the time of cardiac arrest or presence of a shockable rhythm in order to improve patient outcomes (AHA, 2010). More recently, the AHA updated their guidelines to emphasize that defibrillation should occur as soon as the automated external defibrillator (AED) is available (AHA, 2015). At the project facility, the current goal for defibrillation is within 3 minutes of cardiac arrest or presence of a shockable rhythm. Data from across hospital units demonstrated the median time to defibrillation was 3.4 minutes in 2013, 2.8 minutes in 2014, and 3.6 minutes in 2015. The median time decreased by 18% from 2013 to 2014, coinciding with the start of the mock code blue program. However, in 2015 over 90 new nurses were hired to medical-surgical units, and this may have contributed to the increased time noted. In addition, a high patient census in 2015 resulted in decreased bed availability to conduct the simulations, with twelve less mock code events being conducted that year. The aim of this project was to design and implement mock code blue training for medical-surgical nurses using HFS in a dedicated simulation space, and to determine its impact on self-confidence and mock code blue performance.

1.3 Purpose of the Project

The purpose of this pilot study was to determine the impact of a HFS training intervention on medical-surgical nurses' self-confidence level and mock code blue performance.

1.4 Clinical Question

The guiding PICO question was: In medical-surgical nurses (P), what is the impact of HFS (I), measured pre- and post-test (C), on self-confidence level (O) and performance (O) during mock code blue events?

1.5 Project Objectives

Major objectives for this Doctor of Nursing Practice (DNP) scholarly project were to: (1) design and implement a HFS training intervention on mock code blue events; (2) conduct a pilot study to examine the impact of HFS training on medical-surgical nurses' overall performance and self-confidence for situations of patient clinical deterioration and code blue events; and (3) provide a safe environment to practice BLS skills.

CHAPTER 2: LITERATURE REVIEW

2.1 Search Terms

A literature review was conducted using the *Cochrane Database of Systematic Reviews, CINAHL,* and the NCBI database (*PubMed*). Keywords included “high-fidelity simulation”, “code blue response”, “comfort level”, “self-confidence”, “simulation”, “nurses”, and “code blue”. Initial searches revealed over two-hundred articles. After further refining the search and excluding articles that did not directly relate to the project PICO question, a total of 20 articles were selected for inclusion in this literature review. The retained articles were then divided into two sections based on overall theme; impact of simulation training on self-confidence and impact of simulation training on overall performance in code blue events.

2.2 Impact of Simulation on Self-Confidence

Cant & Cooper (2010) conducted a systematic review of twelve experimental and quasi-experimental research studies to determine the effectiveness of moderate and high-fidelity simulation as a teaching and learning method in comparison to traditional methodologies such as lectures and non-technical didactic training, debriefing, tests, and case scenarios. There was significant variation among the twelve studies in the design and methods selected to determine effectiveness of simulation training. Half used a control group to determine the effectiveness of simulation, and results demonstrated statistically significant improvements in participant confidence, critical thinking, and knowledge. Further, all twelve of the studies reviewed demonstrated simulation training is an effective methodology and may have advantages over traditional teaching methods such as lectures and other less interactive approaches (Cant & Cooper, 2010).

Results from individual studies also demonstrate simulation can improve nurses' and nursing students' self-confidence level. Beyea, Slattery, and von Reyn (2010) conducted a quasi-experimental study with novice practicing nurses ($N = 260$). A repeated measures design was used and data was collected over a period of three years. Using a visual analog scale and paired *t*-tests, researchers found confidence, competence, and readiness for independent practice all improved after participating in a nurse residency program utilizing simulation interventions ($p < .001$). Further, residency program evaluations were completed by participants and more than 99% indicated simulation should be included as part of nurse residency programs. Participants reported that realistic simulated patient crises allowed them to gain the skills needed to respond more effectively to actual clinical situations (Beyea et al., 2010).

The National League for Nursing (NLN) Student Satisfaction and Self-Confidence in Learning instrument (NLN, 2005) was developed in 2005 (Kardong-Edgren, Adamson, & Fitzgerald, 2008) and has been repeatedly used to evaluate satisfaction with simulation and changes in self-confidence level. Basak et al. (2016) conducted a quasi-experimental investigation with nursing students ($N = 66$) to determine their satisfaction and perception regarding high and low- fidelity simulation, as well as self-confidence scores. The students participated in simulations that utilized different levels of fidelity and students' satisfaction, self-confidence, and perception of the simulation design were measured with NLN instruments. HFS was found to be more effective than lower levels of simulation fidelity. Statistically significant differences in self-confidence scores resulted after participants were exposed to low-fidelity simulation and again after HFS (p = .01). In addition, statistically significant differences were also found when scores were compared for student satisfaction (p = .01) and simulation design (p = .01), with HFS resulting in better scores (Basak et al., 2016).

In another quasi-experimental study, the NLN instruments were used to determine the effect of integrating simulation into an undergraduate nursing program (Kardong-Edgren et al., 2008). Undergraduate nursing students' (N = 100) self-confidence and satisfaction with simulation were measured after participating in three different simulation events. Scores were not found to be statistically significantly different for each of the three simulation events; however, the scores did remain consistently high throughout the study. Researchers utilized the results to guide future simulations, obtain additional simulation equipment, and provide faculty with necessary simulation training and experience (Kardong-Edgren et al., 2008). Additionally, Cummings and Connelly (2016) surveyed nursing students (N = 54) to determine the effect of repeated simulation on satisfaction and self-confidence. Using the NLN instrument, they found eight scale items demonstrated statistically significant changes after repeated simulations (p < .001) to show improved self-confidence and an increase in active learning among study participants.

Specific to resuscitative care, lack of self-confidence is well-documented as a barrier to performing high quality cardiopulmonary resuscitation (CPR) and safe use of the AED (Hernandez-Padilla, Suthers, Fernandez-Sola, & Granero-Molina, 2014). Therefore, studies have sought to determine the effect of simulations involving emergent patient care scenarios on nursing students' self-confidence level. Bruce, Scherer, Curran, Erdley, and Ball (2009) evaluated undergraduate and graduate nursing students' (N = 118) knowledge, confidence, and clinical competence following a HFS mock cardiac arrest event. Paired t-tests showed significant improvements in knowledge scores for all items (p = .000). In addition, self-confidence scores increased for all items, with significant changes in participant self-confidence for identifying a shockable rhythm (p = .041) and identifying when a defibrillator should be used (p = .026) (Bruce et al., 2009).

Research has also repeatedly shown simulation improves practicing medical-surgical nurses' self-confidence in utilizing emergency skills and responding to cardiac arrest situations safely and effectively. Delac, Blazier, Daniel and N-Wilfong (2013) used a repeated measures quasi-experimental design to evaluate the self-confidence level of 250 medical-surgical nurses before and after receiving in-situ code blue training using HFS. Researchers found self-confidence level increased from 60.2% to 80.6%, suggesting HFS can improve self-confidence for providing emergency care (Delac et al., 2013). Similarly, Gordon and Buckley (2009) utilized HFS training to determine participants' (N = 50) rating of ability and self-confidence in responding to clinical emergencies. Pre- and post-test questionnaires developed by the researchers determined nurse participants reported increased confidence in their ability to perform technical (p = .02) and non-technical (p < .001) emergency interventions after HFS (Gordon & Buckley, 2009). Lastly, Herbers and Heaser (2016) developed an in situ mock code quality improvement program to increase nursing staff confidence and performance in responding to emergencies. Participants were administered surveys before and after participating in a mock code event and the difference in scores was assessed for statistical significance. Statistically significant improvements in confidence for performing chest compressions ($p < .001$), participating in a code ($p = .002$), and being the code team leader ($p = .005$) resulted (Herbers & Heaser, 2016).

2.3 Impact of Simulation on Code Blue Performance

Research has also investigated the effect of HFS on nurses' performance in situations of acute patient deterioration or medical emergencies. Sullivan et al. (2015) conducted a 4-arm, randomized controlled trial to evaluate the effectiveness of mock code blue training on time to call for help, initiate chest compressions, and perform defibrillation. Non-critical care nursing staff ($N = 66$) were randomized into four groups: standard AHA training (control group), and three groups participating in 15-minute simulation training every 2 months, 3 months, or 6 months. Results demonstrated more frequent simulation training sessions were associated with a decreased time to start of chest compressions ($p < 0.001$) and defibrillation ($p < 0.001$) (Sullivan et al., 2015).

In a quasi-experimental study, Huseman (2012) used chart review analysis and observation of critical care nurses' ($N = 178$) performance during mock codes. Random, unannounced mock codes using HFS were conducted for a period of three months. Response time to start of chest compressions, first dose of epinephrine, and implementation of defibrillation were measured pre- and post-intervention. Using *t*-tests, statistically significant results ($p < .05$) were found for chest compressions and epinephrine measures, demonstrating the positive impact of HFS. Time to defibrillation decreased, but was not statistically significant in this study ($p < .1008$) (Huseman, 2012). In addition to studying the impact that in situ mock codes have on confidence, Delac et al. (2013) also evaluated the effect on nurses' performance during the mock codes.

Researchers found a 65% improvement in participant response time of one minute to CPR and a 67% improvement in the goal of defibrillation within 3 minutes when comparing data pre- and post-simulation training interventions (Delac et al., 2013). Similarly, Herbers and Heaser (2016) evaluated the use of in situ mock codes on nurses' performance during these events. Researchers found a 12% improvement in the time to call for help from the first to second year of the program. Additionally, the response time to initiating compressions improved by 52% and time to initial defibrillation showed a 37% improvement (Herbers & Heaser, 2016). Resultant response times were better than the gold standard established by the 2010 AHA guidelines.

The literature review revealed research evidence supports the use of HFS as an effective method of education for nurses. Studies have examined the impact of HFS on self-confidence and performance measures for IHCA care, and the availability of recent research on this topic demonstrates its significance to nursing practice. Study findings show HFS is an effective intervention for improving nurses' performance and self-confidence for emergent resuscitative care. Evidence supports the use of HFS training to improve nurses' adherence to AHA guidelines, ultimately improving patient outcomes (Herbers & Heaser, 2016).

2.4 Theoretical Frameworks

The two theories guiding this pilot study were Knowles' Adult Learning Theory and Bandura's Theory of Self-Efficacy. Knowles' Adult Learning Theory stresses the importance of using experiential techniques with adult learners (Knowles, 1990). Educators should utilize and build upon experiences of the adult learner through the use of group discussions, case studies, simulation exercises, role playing activities and demonstrations (Knowles, 1990). All of these learning strategies are components of HFS (Clapper, 2010), which supports the use of HFS as an experiential technique for improving the mock code blue performance of medical-surgical nurses as adult learners. Knowles (1990) also described the importance of grouping learners into homogenous groups. This is important as learner interests will be similar, as well as experience levels. Thus, this pilot study focused on medical-surgical nurses as their patient care abilities and experiences are similar. In addition, Knowles' theory includes assumptions that must be considered by educators. Adult learners need to know and understand why they need to learn something, and they also need to be responsible for their own decisions. Experience level is important for adult learners to draw from during times of learning and readiness to learn must be considered because it promotes effective coping with life situations. Finally, orientation to learning is crucial to this theory because it implies adults are motivated to learn only to the extent they perceive learning will help them perform necessary tasks that may be encountered in their lives (Knowles, 1990). These assumptions were considered in the design and implementation of the HFS training intervention.

The design of this pilot study was also guided by Bandura's Theory of Self-Efficacy which states development of self-confidence for a particular task improves through experiences of mastery (Bandura, 1977). HFS is an experiential learning technique that allows for repeated mastery experiences (Basak et al., 2016) and thereby can improve self-confidence level. Increased self-confidence causes individuals to expend more effort and be more dedicated to reaching a goal (Bandura, 1977). The ultimate goal of implementing HFS training at the project facility is to improve time to defibrillation to 3 minutes or less to align with AHA recommendations. According to Bandura (1977), improving medical-surgical nurses' self-confidence will make them more dedicated to initiating defibrillation within the 3-minute timeframe recommended and thus has the potential to improve patient outcomes. HFS training was used in this pilot study to meet the learning needs of adult medical-surgical nurses and to improve their self-confidence for performing code blue care to result in positive patient outcomes.

CHAPTER 3: METHODS

3.1 Project Design

For this pilot study project, a one-group, pre- and post-test, quasi-experimental design was used to determine the impact of HFS on medical-surgical nurses' self-confidence and mock code blue performance.

3.2 Variables and Measurement Tools

The independent variable was a HFS training intervention created by the DNP student investigator. Best practices and standards for simulation design were used to guide the design and development of the HFS intervention (Lioce et al., 2015). Additionally, the NLN Simulation Design Template (NLN, 2015) provided a framework for which to develop the simulation in an organized and comprehensive manner.

The HFS training intervention was designed to be implemented twice; as a pre-test mock code blue event and again as a post-test mock code blue event, with data collected on performance during each event to determine significant changes. In addition, a 15-minute didactic training presentation was created based on the AHA (2015) BLS algorithm (Appendix A) and was designed to be presented after the first HFS mock code blue event. Didactic content was augmented with presentation of equipment for use in code blue events on medical-surgical units, as well as facility policies, procedures and practices related to code blue events.

The dependent variable of overall mock code blue performance was measured during the pre- and post-test HFS mock code blue events using the Mock Code Evaluation Tool (Appendix B). This tool was developed by the Clinical Education Services department of the project facility, and its use is familiar to members of Clinical Education Services who assisted in the implementation of the HFS training intervention. A total score of 11 points is possible on this tool and performance of the following items were evaluated: determine unresponsiveness, check pulse, call code blue, place bed in CPR mode, initiate CPR, retrieve crash cart, deliver rescue breaths, apply backboard, turn AED on and follow AED prompts, perform defibrillation, and assign a timekeeper. Points were awarded for each successful task performed, with no point awarded for defibrillation taking longer than 3 minutes to initiate. Utilizing the Mock Code Evaluation Tool, the dependent variable of time to defibrillation was recorded in seconds to allow for pre- and post-test comparisons.

The NLN (2005) Student Satisfaction and Self-Confidence in Learning instrument was administered twice to measure changes in the dependent variable of self-confidence. In addition, data on satisfaction with the HFS training was collected to improve future HFS trainings at the project facility. This 13 item questionnaire (Appendix C) utilizes a 5-point Likert-scale, with answer options ranging from strongly disagree (1) to strongly agree (5). To score this instrument, the 5 items that measure satisfaction are summed for a total score possible of 25 points and the 8 items that measure self-confidence are summed for a total score possible of 40 points. Content validity has been established in previous studies and Cronbach's alpha reliability was reported at 0.94 for items measuring satisfaction and 0.87 for items measuring self-confidence (NLN, 2005).

Permission to utilize the tool without revision for non-commercial use was requested and approved by the NLN (Appendix D).

3.3 Sample and Setting

A convenience sample of medical-surgical nurses employed at the project facility, a 457 bed community hospital in the southeastern United States, was obtained. A priori sample size calculation was conducted using G*Power 3 software for a paired samples *t*-test with the parameters of medium effect size 0.50, alpha 0.05, and power 0.80 (Cohen, 1992). A sample size of $N = 34$ participants was deemed appropriate to detect statistically significant changes in self-confidence and mock code blue performance.

3.4 Participant Recruitment

Nurses working on medical-surgical units of the project facility were recruited to participate in this pilot study after the appropriate institutional review board (IRB) approvals were obtained (Appendix E). To advertise the study, emails were sent to potential participants and flyers were posted on medical-surgical units within the project facility. Flyers included pilot study information, DNP student investigator contact information, and registration details (Appendix F). Potential participants were required to register for the pilot study with their name and employee identification number. This information was collected only for registration purposes, and was not collected again during the pilot study implementation or tied to the collected data. In addition, managers of medical-surgical units were asked to present the recruitment flyer to nursing staff during morning huddle sessions. Inclusion criteria were Registered Nurses (RNs) working on medical-surgical units at the project facility with the ability to read, write, and speak English. Exclusion criteria were RNs not working on medical-surgical units (such as those working on critical care, emergency, perioperative, obstetric, or pediatric units).

3.5 Standardized Implementation Training

The HFS training intervention was implemented by the DNP student investigator and Clinical Nurse Educators for the medical and surgical divisions at the project facility. All of these individuals are licensed RNs and hold a minimum of a Bachelor of Science in Nursing (BSN) degree. Training of all individuals involved in the implementation of this pilot study occurred prior to study commencement to ensure familiarity with study protocols, measurement tools, and HFS equipment.

3.6 Intervention Protocol and Data Collection Process

Data collection began after the design of the HFS intervention, training of Clinical Nurse Educator staff, IRB approval, and participant recruitment. Participants attended on the date and time in which they registered, with multiple dates offered to ensure small group sizes for the HFS training. Six groups consisting of no more than eight individuals per group participated in this pilot study. Each day the pilot study was conducted, participation began in a designated classroom at the project facility. The DNP student investigator first reviewed and provided participants with information on the pilot study (Appendix G); including the purpose, DNP student investigator contact information, and an explanation of record-keeping and data collection procedures. A notice of voluntary participation in the pilot study was also provided. A waiver of signed consent was requested and granted, since no personal health information or identifying participant information was collected during study implementation.

Following review of study information, participants completed a brief 14 item demographic questionnaire created by the DNP student investigator (Appendix H) and then the pre-test HFS was conducted. Each group of participants was accompanied to the HFS room by a member of Clinical Education Services to participate in the initial pre-test HFS. At this time, participants received briefing on the HFS that included an introduction to HFS and the equipment (Appendix I), and an oral and written report on the simulated patient (Appendix J). During the HFS, the simulated patient reported chest pain and became unresponsive and pulseless using HFS technology, and participants worked as a team to provide resuscitative care to the simulated patient manikin. Data collection of participant performance during this pre-test HFS mock code blue event occurred utilizing the Mock Code Evaluation Tool, and time to defibrillation was measured in seconds. Upon conclusion of the pre-test HFS, participants were escorted back to the classroom where they completed the pre-test NLN Student Satisfaction and Self-Confidence in Learning instrument. Debriefing followed and included a review of group performance in the HFS mock code blue event, including key actions implemented and missed. Debriefing was guided by the member of Clinical Education Services who accompanied participants in the HFS room.

Next, the 15-minute didactic presentation of the AHA (2015) BLS guidelines and facility policies, procedures and equipment occurred. Demonstrations using the code cart, defibrillation equipment, and HFS manikin were performed, along with guided discussion about responding to emergency situations (Appendix K). Each group of the same participants then returned to the HFS room with the same member of Clinical Education Services to participate in the post-test HFS mock code blue event, which consisted of the same patient scenario as used in the pre-test HFS. Post-test HFS data collection was again performed utilizing the Mock Code Evaluation Tool, including time to defibrillation measured in seconds. Lastly, participants returned to the classroom and debriefing occurred in the same format as previously implemented. Participants completed the post-test NLN Student Satisfaction and Self-Confidence in Learning instrument (identical to the pre-test instrument) and were then informed their participation in the pilot study was complete. Data collection was repeated in this same manner a total of 6 times over 10 weeks to facilitate sufficient sample size while also ensuring small groups for more active participation in the HFS. A simulation flow diagram was created to outline the data collection procedures (Appendix L).

3.7 Data Analysis

Data was stored and locked in the DNP student investigator's office at the project facility. Statistical Package for the Social Sciences (SPSS) version 23 was used for all data analyses, which first began with screening for non-credible and incomplete responses. Descriptive statistics were used to present information obtained from the demographic questionnaire. Overall results from the pre- and post-test Mock Code Evaluation Tool and pre- and post-test time to defibrillation (measured in seconds) were evaluated using descriptive statistics and paired-samples *t*-tests were conducted to determine statistically significant changes, with $p < .05$. Changes in total summed scores from pre- to post-testing for the two components of the NLN Student Satisfaction and Self-Confidence in Learning instrument were also analyzed using descriptive statistics and paired samples *t*-tests, with a significance level of $p < .05$.

CHAPTER 4: RESULTS

4.1 Sample Size and Demographic Information

The HFS training intervention was conducted with six groups of participants on six different dates between August and October 2016. Each session lasted approximately one hour, and the number of participants for each session ranged from five to eight. A total of 37 nurses participated in this pilot study and completed the demographic survey. The sample consisted primarily of white females, with the majority aged 25 to 34 years. Of the 37 participants, more than half (59%) were employed on medical units, with the remaining participants employed on surgical units (n = 7) and two women's health units that care for female patients with surgical or medical issues not associated with pregnancy (n = 8). Table 1 presents the basic demographic information.

Table 1. Demographic Information (N = 37)

	n (%)
Age	
18-24 years	10 (27)
25-34 years	14 (38)
35-44 years	4 (11)
45-54 years	5 (13)
55-64 years	4 (11)
65 years and older	0
Gender	
Male	1 (3)
Female	36 (97)
Work Location	
Medical	22 (59)
Surgical	7 (19)
Other	8 (22)
Race/Ethnicity	
White non-Hispanic	30 (81)
Hispanic/Latino	1 (3)
Black/African American	5 (13)
Asian	1 (3)
American Indian & Alaska Native	0
Native Hawaiian & Other Pacific Islander	0
Multiple/Other Race	0

In regards to professional attributes of the sample, the majority had either an Associate's Degree in Nursing (ADN) (n = 19) or BSN degree (n = 15). Twenty-seven of the participants had prior experience with HFS. In this sample, 62% had between 0 to 5 years of RN experience (n = 23), and only 5 participants had more than 20 years of RN experience. During their years of RN experience, 56% had performed CPR, with the majority performing it 1 to 5 times. Lastly, 30 nurses in this sample had previously participated in a mock code blue event. Table 2 displays the professional attributes of participants.

Table 2. Professional Attributes of Participants (*N* = 37)

Professional Attributes of Participants			
Highest Nursing Degree	**n (%)**	**Professional Organization Member**	**n (%)**
Diploma	0	Yes	10 (27)
Associate Degree	19 (51)	No	26 (70)
Baccalaureate Degree	15 (41)	No Response	1 (3)
Master's Degree	3 (8)	**Professional Organization Name**	**n (%)**
Doctoral Degree	0	ANA	6 (16)
Years of RN Experience	**n (%)**	NCNA	3 (8)
less than 1 year	10 (27)	AMSN	0
1-5 years	13 (35)	Other	3 (8)
6-10 years	6 (16)	Not Applicable	21 (57)
11-15 years	2 (5)	**Prior HFS Experience**	**n (%)**
16-20 years	1 (3)	Yes	27 (72)
More than 20 years	5 (14)	No	8 (22)
ACLS Certification	**n (%)**	Unsure	1 (3)
Yes	13 (35)	No response	1 (3)
No	23 (62)	**Prior Mock Code Blue Experience**	**n (%)**
No response	1 (3)	Yes	30 (81)
Specialty Certification	**n (%)**	No	5 (13)
Yes	14 (38)	Unsure	1 (3)
No	22 (59)	No response	1 (3)
No response	1 (3)	**Times Performed CPR**	**n (%)**
Certification Type	**n (%)**	Never	15 (41)
CMSRN	3 (8)	1-5 times	11 (29)
RN-BC	5 (14)	6-10 times	3 (8)
CNRN	0	11-20 times	3 (8)
ONC	0	More than 20 times	4 (11)
Not Applicable	18 (49)	No response	1 (3)
Other	5 (14)		
No response	1 (3)		

4.2 Performance Results

For each HFS mock code blue event, group data measured using the Mock Code Evaluation Tool was evaluated and pre- and post-training results were compared. This data was collected for each group and was not evaluated on an individual basis since the participants completed the HFS training in groups to mimic the performance of resuscitative care in clinical settings. Scores on the Mock Code Evaluation Tool could range from 0 to 11. The mean pre-test HFS score for all groups was 9.2 (range 7 to 10), while the mean post-test HFS score for all groups was 10.5 (range 9 to 11). Although the Mock Code Evaluation Tool was developed by the Clinical Education Services department and reliability was not established, a paired samples *t*-test was used to evaluate for statistically significant changes in group mean scores from pre- to post-HFS training. Results revealed that although mean scores increased, it was not a statistically significant change (t (5) = 1.754, p = .140). Table 3 presents the Mock Code Evaluation Tool scores for each group.

Table 3. Mock Code Evaluation Tool Scores

	Pre-HFS Total Score	**Post-HFS Total Score**
Group 1	7	11
Group 2	8	11
Group 3	10	10
Group 4	10	11
Group 5	10	9
Group 6	10	11
Mean Score All Groups	9.2	10.5

Time to defibrillation in seconds, as part of the Mock Code Evaluation Tool, was also measured for each group during the pre- and post-HFS. The mean time to defibrillation for all groups was 134.7 seconds during the pre-test HFS training and 63.4 seconds during the post-test HFS training. To determine if this improvement was statistically significant, a paired samples *t*-test was performed. Changes in time to defibrillation from pre- to post-HFS was found to be statistically significant, t (5) =

7.025, $p = .001$. Table 4 reflects the time to defibrillation in seconds for each group during the two time periods.

Table 4. Time to Defibrillation (seconds)

	Pre-HFS Defibrillation Time (sec)	**Post-HFS Defibrillation Time (sec)**
Group 1	115	57
Group 2	195	109
Group 3	91	56
Group	117	58.25
Group 5	144	56
Group 6	146	44
Mean Time all Groups	134.7	63.4

4.3 Self-Confidence and Satisfaction Results

Self-confidence scores obtained from the NLN Student Satisfaction and Self-Confidence in Learning instrument were analyzed using descriptive statistics and a paired samples *t*-test was conducted to evaluate for statistically significant changes in self-confidence scores for each group from pre- to post- HFS training. The highest score possible for self-confidence was 40 points. The mean pre-test HFS self-confidence score for all groups was 32.2 and the mean post-test HFS self-confidence score was 38.7, demonstrating an overall increase in self-confidence from pre- to post-HFS. Results of the paired samples *t*-test showed this was a statistically significant change in self-confidence (t (5) = 6.220, $p = .002$). Table 5 displays the mean self-confidence scores for each group on pre- and post-testing.

Table 5. Mean Self-Confidence Scores

	Pre-HFS Self-Confidence Mean Score	Post-HFS Self-Confidence Mean Score
Group 1	35.17	39.5
Group 2	29.17	37.8
Group 3	31.57	38.86
Group 4	37.5	39.83
Group 5	29.8	38
Group 6	30.13	38.13
Mean Score all Groups	32.2	38.7

As part of the NLN Student Satisfaction and Self-Confidence in Learning instrument, data on participants' satisfaction with the HFS training was also measured and evaluated. Descriptive statistics and a paired samples *t*-test to determine changes in satisfaction scores for each group were used. Scores on the 5 items to measure satisfaction were summed, with a highest possible score of 25. Mean scores from all groups increased from 21.0 after the pre-test HFS to 24.7 after the post-test HFS, and this change was found to be statistically significant (t (5) = 6.556, p = .001). Table 6 provides the mean satisfaction scores for each group.

Table 6. Mean Satisfaction Scores

	Pre-HFS Satisfaction Mean Score	Post-HFS Satisfaction Mean Score
Group 1	22	25
Group 2	19	24.8
Group 3	20.86	25
Group 4	23.33	25
Group 5	21	24.4
Group 6	19.88	24.13
Mean Score All Groups	21	24.7

CHAPTER 5: DISCUSSION

5.1 Impact on Performance

Mean total scores on the Mock Code Evaluation Tool, indicating overall response, improved from pre- to post-HFS mock code blue events. The mean total points obtained by the groups increased from 9.2 to 10.5, with a maximum score of 11 points. This is a clinically significant finding because participants were able to improve upon and increase the number of specific skills that are required to provide proper resuscitative care as defined by the AHA (2015) BLS guidelines. The results were further analyzed with a paired samples *t*-test, but statistical significance was not achieved ($p = .140$). This may be due to the fact that the Mock Code Evaluation Tool was developed by the Clinical Education Services department and has not been tested for reliability, or may be due to the small sample size obtained for this pilot study. Although 37 nurses participated, Mock Code Evaluation Tool scores are evaluated by group score, not by individual score and this resulted in analysis of only 6 pre- and post-HFS scores. Mean increases in total scores do indicate the HFS training helped to improve participant overall response in mock code blue events, which can promote better patient outcomes if participants adhere to the AHA (2015) BLS guidelines in clinical practice.

Further analysis of each group's score on the Mock Code Evaluation Tool was conducted to determine future changes to the HFS training intervention at the project facility. The project facility utilizes this overall performance data to guide training and educational interventions related to resuscitation. In reviewing scores for each group, it was determined that the scores obtained by Groups 3 and 5 did not increase from pre- to post-HFS training. For Group 3, a score of 10 was achieved on both the pre- and post-HFS training. The group's time to defibrillation improved, but the group forgot to use the backboard during the post-HFS mock code blue event. Group 5 achieved a score of 10 during the pre-HFS, but scored a 9 during the post-HFS training. Analysis of this group's post-test HFS score revealed the group did not utilize the backboard and did not verbalize that a member of the team was serving as the time-keeper. Both groups expressed frustration after forgetting these crucial steps in their response during the mock code blue event; however, debriefing revealed the participants felt the HFS experience would improve their response when caring for a live patient. Use of a backboard and communicating team member roles are essential when responding to IHCA (AHA,2015), and future HFS training interventions should stress the importance of these components of resuscitative care.

The results for change in time to defibrillation when compared pre- to post- HFS intervention were statistically significant (p = .001). A high level of importance was placed on this dependent variable because it has been repeatedly demonstrated that prompt defibrillation after cardiac arrest can improve patient outcomes and decrease mortality (AHA, 2015; Morrison et al., 2013). Defibrillation within three minutes (180 seconds) of the recognition of arrest is the goal of the project facility's mock code blue events and training. The mean time to defibrillation decreased from 134.7 seconds to 63.4 seconds in this pilot study, meeting the project facility goal. Further, post-test HFS time to defibrillation was under 180 seconds for all six participant groups (range 56 to

109 seconds). These findings are consistent with prior research (Delac et al., 2013; Herbers & Heaser, 2016; Huseman, 2012; Sullivan et al., 2015) and demonstrate that the use of HFS training can improve medical-surgical nurses' time to defibrillation. Results also provide evidence to support the continued need for the staff and equipment required for focused education efforts to prepare medical-surgical nurses to respond to IHCA events.

5.2 Impact on Self-Confidence

Participant self-confidence scores as measured on the NLN Student Satisfaction and Self-Confidence in Learning instrument significantly improved from pre- to post-HFS training. Mean self-confidence scores significantly increased (p = .002) and the mean post-HFS score was 38.7. As the maximum score possible for self-confidence was 40, participants in this study had a very high self-confidence level for performing resuscitative care following the post-HFS training. According to Bandura (1977), a high confidence level can result in participants striving to reach goals, in this case the goal of defibrillation within 3 minutes. A high self-confidence level is particularly important with high-risk, high-stress situations such as responding to IHCA events (Buckley & Gordon, 2011). These results reinforce previous research findings (Basak et al., 2016; Beyea et al., 2010; Bruce et al., 2009; Cant & Cooper, 2010; Cummings & Connelly, 2016; Delac et al., 2013; Gordon & Buckley, 2009; Herbers & Heaser, 2016) and support HFS as a method for improving nurses' self-confidence for responding to these stressful events.

Participant satisfaction also improved following the HFS training. Results indicated satisfaction significantly improved from pre- to post-HFS mock code blue events (p = .001). The mean post-HFS satisfaction score was 24.7 out of 25 points, demonstrating participants were very satisfied with the HFS training. Although satisfaction in learning was not a dependent variable under study, it is important to ensure learners are satisfied with the experience. This is especially important with simulation, as a major goal is to provide valuable learning in an environment where participants feel safe (Hertel & Millis, 2002).

5.3 Practice Implications

The findings of this pilot study provide several practice implications. The mock code blue program has been active at the project facility since 2013 and facilitators of these mock code blue events are always seeking out new and improved methods to train the nursing staff to respond to IHCA. HFS affords a unique training environment that simulates the real-world practice setting, while also offering nursing staff the opportunity to practice skills in a safe environment without the worry of harming a patient. Project findings support the use of HFS training at the project facility, because it resulted in a statistically significant improvement in the time to defibrillation, mirroring findings from earlier studies (Herbers & Heaser, 2016; Huseman, 2012; Sullivan et al., 2015). Early defibrillation is vital for positive patient outcomes (AHA, 2015) and the project facility seeks to ensure the goal of time to defibrillation of 3 minutes or less is met. In addition to the significant improvement in time to defibrillation noted in this pilot study, all groups met the project facility goal during the post-test HFS. This indicates mock code blue events incorporating HFS should be a routine, regularly offered training intervention for nursing staff at the project facility. In addition, this pilot study demonstrated HFS training was effective with medical-surgical nurses, but resuscitation can occur in any area of the hospital. Resuscitative training using HFS should be extended to nurses from other units, and the effectiveness should be evaluated.

Outcomes from this project have also provided the Clinical Education Services department with data to support expansion and growth of the project facility's mock code blue program. The department has received grant funding to purchase a wireless HFS manikin, offering the ability to provide in situ mock code blue events that the department was previously unable to provide to nursing staff. Because of this new technology, staff of the Clinical Education Services department will be able to take HFS training to the nursing units and will not have to rely on training programs confined to a classroom. Ensuring attendance at HFS training required nurse manager support to approve nurses' absence from the patient care unit. Being able to provide HFS training on nursing units will lessen the need to take nursing staff away from the bedside and caring for patients. This will provide a cost savings, as well as ensure more training availability for nurses (Huseman, 2012).

Lastly, every new medical-surgical nurse hired at the project facility participates in a mock code blue training simulation as part of orientation. The Clinical Education Services department has received informal positive feedback from nursing staff regarding these training interventions. In this pilot study, participants expressed feelings of increased self-confidence during debriefing after each HFS. Nursing staff described the HFS training as valuable and participant comments indicated they felt all nursing staff should participate in interventions to prepare them for these stressful situations. Results from this pilot study showed statistically significant improvements in participant self-confidence and satisfaction using a valid and reliable measurement tool, confirming anecdotal comments from nurses who participated in mock code blue training. Self-confidence is important to facilitate appropriate IHCA care, as it can improve motivation for accomplishing goals (Bandura, 1977); in this instance the goal is to initiate defibrillation within 3 minutes. Future HFS training at the project facility can utilize the NLN Student Satisfaction and Self-Confidence in Learning instrument to ensure learners are satisfied and the training is improving their self-confidence level. Having a standardized measurement tool that can be used for a wide variety of simulation trainings will be instrumental in assisting nurse educators to refine HFS training to meet the needs of the learners and the project facility. The Clinical Education Services department intends to use HFS to prepare nurses for a variety of clinical scenarios in order to benefit the facility's diverse nursing units with multiple subspecialties and unit-specific needs. Ongoing development and implementation of HFS training scenarios should utilize the NLN instrument to monitor learner satisfaction and self-confidence in a standardized manner.

5.4 Recommendations for Future Projects

The sample under study in this pilot project was not diverse with respect to gender and race. This is a limitation and results may not be generalizable. Further investigation is needed to determine the effect of HFS on a diverse sample of medical-surgical nurses. Additionally, the sample size was 37 participants, and further study using larger sample sizes would offer stronger evidence in support of HFS training for mock code blue events. Another limitation of this project was investigation of changes only at the group level and not at the participant level. For future studies, it would be beneficial to measure the changes in participant satisfaction and self-confidence on an individual basis as well. This would also allow for the identification of possible trends based on demographic information such as RN years of experience, prior HFS education and training, and prior experience with code blue events. This may provide further insight into factors that impact nurses' performance in responding to IHCA. Lastly, research should seek to examine the impact of HFS training with nurses from acute care settings other than medical-surgical units; such as pediatric, emergency, and critical care nurses.

In this pilot study, the impact of HFS training on medical-surgical nurses' self-confidence and performance during mock code blue events was investigated. Findings support the use of HFS training; however, the best method of training is not clear. Future studies should seek to compare the impact of different levels of simulation fidelity (high, moderate, low) on participant performance, defibrillation times, self-confidence, and satisfaction. Further, it would be interesting to determine how often HFS training related to IHCA should be implemented. Studies have suggested that more frequent simulation training improves participant performance (Sullivan et al., 2015). Further research is needed to compare groups of nurses who do not receive HFS training to those that receive it once and those who receive it repeatedly at regular intervals.

Data collection in this pilot study occurred immediately post-HFS, and a resultant limitation is the inability to determine long-term changes in nurses' performance and self-confidence. It would be helpful to repeat the study at a later time with the same participants to determine if there is a sustained effect on performance and self-confidence. Finally, research is needed to determine the impact of improved performance and self-confidence during mock code blue events on nurses' clinical performance when responding to IHCA with actual patients. Improved patient care outcomes are the ultimate goal of HFS training (Huseman, 2012), and data to link HFS training to better patient outcomes would be invaluable. This may involve tracking resuscitation outcomes throughout the project facility after all nurses are trained to provide IHCA care using HFS.

5.5 Project Summary

Simulation training can be utilized to provide education on a variety of clinical scenarios while ensuring a safe environment for participants (Cant & Cooper, 2009). It incorporates adult learning principles and provides authentic clinical scenarios from which knowledge can be applied to future situations (Clapper, 2010). Determining the impact of HFS training for resuscitative care is essential because it can provide nurses with opportunities to practice life-saving clinical skills in a controlled environment without the fear or worry of harming an actual patient. This pilot study used HFS to provide medical-surgical nurses at a 457-bed Level III trauma center with the opportunity to gain further knowledge and practice with resuscitative care.

This pilot study investigated the impact of HFS training on medical-surgical nurses' performance and self-confidence during mock code blue events. Medical-surgical nurses are often first responders to situations of cardiac arrest in the acute care setting and they must be prepared to act and deliver timely, life-saving interventions with confidence. Results demonstrate that the HFS training intervention significantly improved time to defibrillation and participant self-confidence. Participants were satisfied with the learning experience and anecdotally reported they felt they would be able to apply the skills learned in the HFS training to real-life patient situations of acute deterioration. With the high incidence of IHCA, it is important that nursing staff are able to properly respond and deliver interventions that can improve outcomes for patients.

Findings demonstrate HFS can be used to prepare medical-surgical nurses to provide the emergent patient care needed during IHCA.

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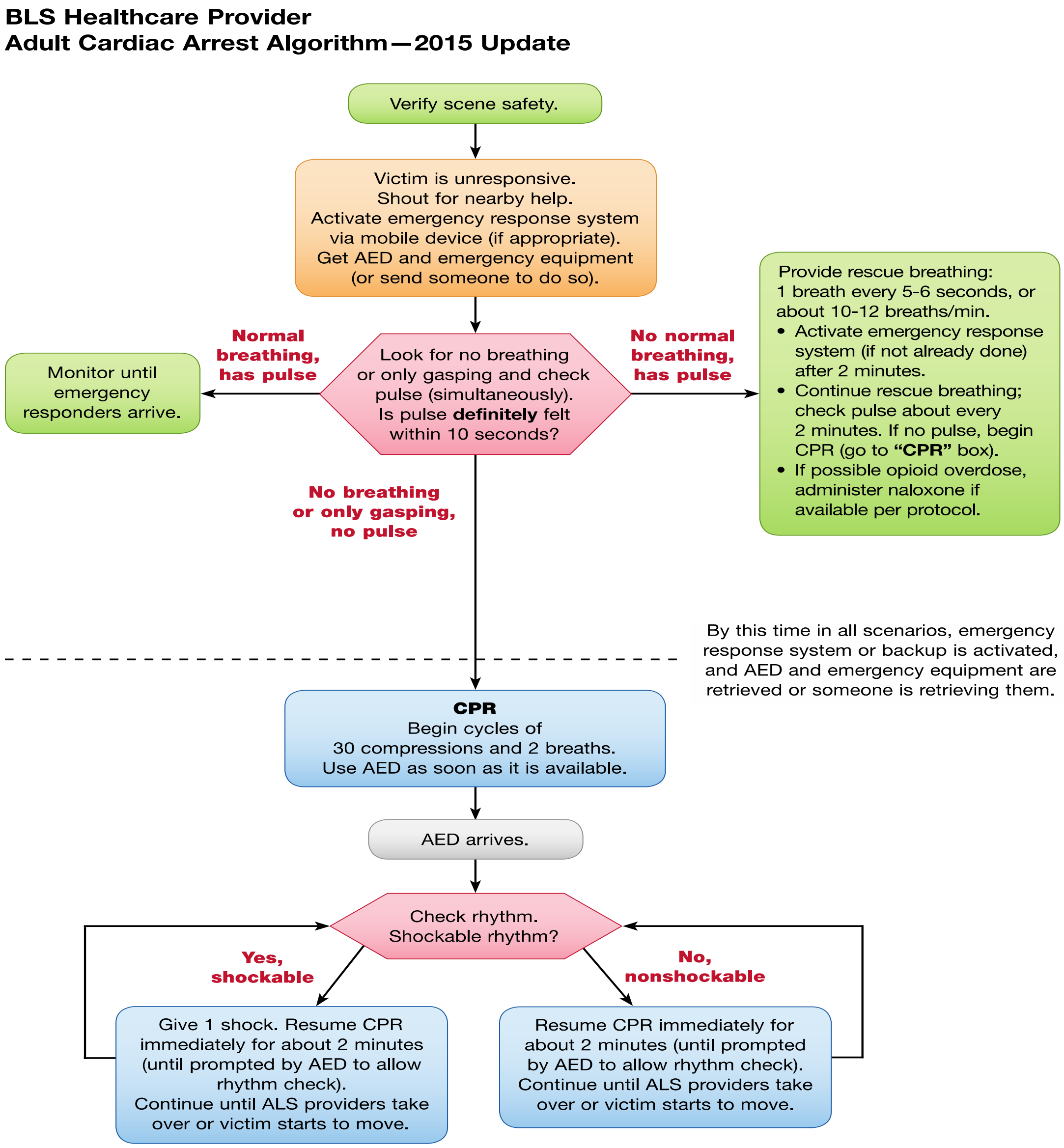
APPENDIX A: BASIC LIFE SUPPORT ALGORITHM



APPENDIX B: MOCK CODE EVALUATION TOOL

Mock Code Evaluation

Date	Time

	Yes	No
1. Determine unresponsiveness	☐	☐
2. Check pulse	☐	☐
3. Code Blue Called	☐	☐
4. Bed in CPR Mode	☐	☐
5. Begin CPR	☐	☐
6. Crash Cart to room	☐	☐
7. 2 breaths with Ambu Bag	☐	☐
8. Apply Backboard	☐	☐
9. Turn Lifepak on: ☐Follows prompts or ☐ Interprets Rhythms	☐	☐
10. Defibrillation time _____________	☐<3 min	☐> 3 min.
11. Verbalize time keeper/documentation	☐	☐

Total Points Received
____out of 11

Debriefing:

General Comments/Suggestions/Education Performed

____

____

____

____

Evaluator Signature

APPENDIX C: NLN STUDENT SATISFACTION & SELF-CONFIDENCE IN LEARNING SURVEY

Student Satisfaction and Self-Confidence in Learning

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

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

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

 Revised December 22, 2004

APPENDIX D: NLN PERMISSION TO USE TOOL

Dear Shannon,

It is my pleasure to grant you permission to use the NLN Student Satisfaction and Self-Confidence in Learning (click here for link to tool) in your DNP scholarly project.

In granting permission to use this instrument for your project, it is understood that the following caveats will be respected:

1. It is the sole responsibility of (you) the researcher to determine whether the NLN questionnaire is appropriate to her or his particular study.

2. Modifications to a survey may affect the reliability and/or validity of results. Any modifications made to a survey are the sole responsibility of the researcher.

3. When published or printed, any research findings produced using an NLN survey must be properly cited. If the content of the NLN survey was modified in any way, this must also be clearly indicated in the text, footnotes and endnotes of all materials where findings are published or printed.

For commercial use, please send a separate request to copyrightpermission@nln.org. Commercial use includes publishing in journals, books, or inclusion in any product that is sold through an organization or publisher.

Warm Regards, Amy

Amy McGuire | Administrative Coordinator | National League for Nursing | www.nln.org |
amcguire@nln.org | 202-909-2509 | 2600 Virginia Avenue NW, Washington, DC 20037

APPENDIX E: IRB APPROVAL

Carolinas HealthCare System

June 23, 2016

Shannon Morton, MSN
Director Policy, Clinical Practice & Nursing Education
CMC-NE
920 Church Street, N
Concord, NC 28025

**RE: The Impact of High-Fidelity Simulation Training on Medical-Surgical Nurses' Self-Confidence and Mock Code Blue Performance: A Pilot Study.
IRB File #07-16-09EX**

Dear Shannon:

I reviewed your proposal and determined your study meets the criteria for exempt status set forth in Code of Federal Regulations Title 45 Part 46 § 101(b), **Category #1**: *normal educational practices and settings* and **Category #2**: *anonymous educational tests, surveys, interviews, or observations.*

Protocol Appendices A-G were also approved.

Any changes to the research study must be presented to the IRB for approval prior to implementation. If we can be of further assistance, feel free to contact the IRB Office, 704-355-3158.

Sincerely,

Sherry Laurent, PhD

Sherry Laurent, PhD
Chair, IRB

/jaa

Note: The IRB complies with the requirements found in Part 56 of the 21 Code of Federal Regulations and Part 46 of the 45 Code of Federal Regulations. Federal-Wide Assurance # 00000387. The Registration Number is IORG 0000740. The Carolinas HealthCare System Institutional Review Board follows the ICH GCP guidelines with regard to the rights of human subjects.

PO Box 32861 • Charlotte, NC 28232-2861

APPENDIX F: RECRUITMENT FLYER

Responding to Patient Clinical Emergencies

A Course for the Med-Surg Nurse Utilizing High-Fidelity Simulation

Fall 2016

Dates/Times to be determined

CHS NorthEast

BLS Classroom

Register via email to diane.ross@carolinashealthcare.org or contact Shannon Morton at ext. 33693 for more details

Target Audience: Medical-Surgical RNs

Course Description: To provide a safe environment to practice clinical skills required during patient emergencies. This course is part of a research study to determine the impact of high-fidelity simulation training on medical-surgical nurses' self-confidence and response during mock code blue events. All data collected during this course will remain confidential.

Participation in this course will not impact your employment with Carolinas HealthCare System.

APPENDIX G: PARTICIPANT DISCLAIMER

High-Fidelity Simulation Training & Survey - Participation Disclaimer

Thank you for your participation in this study. Following is a brief description and important information related to your participation:

We are conducting an evidence-based practice project entitled The Impact of High-Fidelity Simulation Training on Medical-Surgical Nurses' Self-Confidence and Mock Code Blue Performance: A Pilot Study in conjunction with the University of North Carolina at Charlotte and Carolinas HealthCare System NorthEast.

The purpose of this pilot study is to determine the impact of High-Fidelity Simulation on medical-surgical nurses' self-confidence level and mock code blue event performance. We are asking you to participate in this program as a medical-surgical nurse working at Carolinas HealthCare System NorthEast. Your participation is voluntary. Choosing not to participate will not affect your access to any goods or services. There are no direct benefits to participating in this study.

We will be conducting the analysis of the training program by asking you to answer a series of questions related to your demographics and nursing experience, as well as your self-confidence level for mock code blue performance. We will then evaluate your performance in small groups of 5 to 6 participants during two mock code blue events with high-fidelity simulation manikins using a standardized tool. Participation will take less than 2 hours of your time.

We will not be collecting any data that can link you to the answers you provide and registration information will not be linked in any way to information you provide during participation in this study. Confidentiality of your responses will be protected as much as possible. If you are uncomfortable answering any question or participating in any part of the simulation, you may choose to not answer that question or to stop your participation and have any notes, data recordings or hard copy answers destroyed. To further protect the confidentiality of your responses, we will not be collecting a signed consent form but will instead consider your participation in the study as consent permitting us to collect the data you provide.

Shannon Morton, DNP Candidate will serve as the DNP Student Investigator for this study. Mrs. Morton may be contacted at smorto10@uncc.edu or 919-538-0255. Should you have any questions or concerns about participation in this study, you may contact Mrs. Morton, using the information provided.

APPENDIX H: PARTICIPANT DEMOGRAPHIC SURVEY

Demographic Survey
The following questions collect demographic and professional information. For each question, please select the answer option that **BEST** describes you:

1. What is your age?
   - ☐ 18-24 years' old
   - ☐ 25-34 years' old
   - ☐ 35-44 years' old
   - ☐ 45-54 years' old
   - ☐ 55-64 years' old
   - ☐ 65 years and older

2. What is your gender?
   - ☐ Male
   - ☐ Female

3. What best describes the location where you work?
   - ☐ Medical Unit
   - ☐ Surgical Unit
   - ☐ Other: ___________________

4. What best describes your race/ethnicity?
   - ☐ White non-Hispanic
   - ☐ Hispanic or Latino
   - ☐ Black/African American
   - ☐ Asian
   - ☐ American Indian & Alaska Native
   - ☐ Native Hawaiian & Other Pacific Islander
   - ☐ Multiple/Other Race

5. What is the highest nursing degree you have completed?
   - ☐ Diploma Degree in Nursing
   - ☐ Associate Degree in Nursing
   - ☐ Baccalaureate Degree in Nursing
   - ☐ Master's Degree in Nursing
   - ☐ Doctoral Degree in Nursing

6. How many total years of experience do you have working as a nurse?
   - ☐ Less than 1 year
   - ☐ 1 to 5 years
   - ☐ 6 to 10 years
   - ☐ 11 to 15 years
   - ☐ 16 to 20 years
   - ☐ More than 20 years

7. Have you ever attended an Advanced Cardiac Life Support (ACLS) certification class?
   - ☐ Yes
   - ☐ No

8. Do you have a specialty certification?
   - ☐ Yes
   - ☐ No

9. If you are specialty certified, what type of certification do you have? (You can select more than one option)
   - ☐ Certified Medical Surgical Nurse (CMSRN)
   - ☐ Registered Nurse – Board Certified (RN-BC)
   - ☐ Certified Neuroscience Registered Nurse (CNRN)
   - ☐ Orthopedic Nurse Certification (ONC)
   - ☐ Other: ___________________

10. Are you a member of a professional nursing organization?
    - ☐ Yes
    - ☐ No

11. If you are a member of a professional organization, what organization do you belong to? (You can select more than one option)
    - ☐ American Nurses Association (ANA)
    - ☐ North Carolina Nurses Association (NCNA)
    - ☐ Academy of Medical-Surgical Nurses (AMSN)
    - ☐ Other: ___________________

12. Have you ever participated in a class that used high-fidelity simulation (manikins)?
    - ☐ Yes
    - ☐ No
    - ☐ Unsure

13. Have you ever participated in a mock code blue event?
    - ☐ Yes
    - ☐ No
    - ☐ Unsure
14. How many times <u>in your nursing career</u> have you provided care to patients during a cardiopulmonary resuscitation (CPR) or code blue event?
    - ☐ Never
    - ☐ 1 to 5 times
    - ☐ 6 to 10 times
    - ☐ 11 to 20 times
    - ☐ More than 20 times

APPENDIX I: SIMULATION BRIEFING FOR PARTICIPANTS

Simulation Introduction Talking Points

Read these instructions prior to the pre-intervention simulation event:

- We will be utilizing a high-fidelity manikin to achieve the objectives of this simulation project. High-fidelity means that the manikin is very life-like. The manikin can speak, move his eyes, make noises, and allow for auscultation of lung, heart, and other sounds. His vital signs will be displayed on a monitor in the room.
- We want you to treat the manikin like you would a real patient. You can check vital signs, ask the simulator questions, listen to his heart and lungs, review medications and any pertinent history, and obtain any needed information that you desire.
- You will not be asked to administer medications or IV fluids in this simulation.
- The simulation leaders will not prompt nor guide you, but can offer answers to certain questions that help clarify part of the simulation.

Please treat this scenario as if it were a live patient situation.

APPENDIX J: SIMULATION SCENARIO

Date: 8/19/16 and multiple **Discipline:** Med-Surg **Expected Simulation Run Time:** 15 min **Location:** 3D Simulation Room	**File Name:** n/a **Student Level:** n/a **Guided Reflection Time:** 15 min **Location for Reflection:** BLS Classroom

Admission Date: 8/18/2016 | **Today's Date:** 8/19/2016

Brief Description of Client

Name: Mrs. Helen Smith
Gender: F **Age**: 77 **Race**: White **Weight**: 140 **Height**: 5'6
Religion: Christian
Major Support: **Support Phone:**
Allergies: NKDA **Immunizations:** Flu shot in 2015
Primary Care Provider/Team: Dr. Jones
Past Medical History: Smoker, COPD, and Diabetes
History of Present Illness: Mrs. Smith was admitted after seeing her primary care provider for shortness of breath, a productive cough, nausea/vomiting, and general malaise. Because of her smoking and COPD history, she was admitted to the hospital. A chest x-ray showed bilateral lung infiltrates, her WBC count was 30,000, and a sputum culture and blood cultures were collected. Her vital signs on admission were: Temperature 100.9 oral, BP 140/75, HR 90, RR 22, oxygen sats are 94% on 2L oxygen.
Social History: History of smoking since the age of 30, patient does not drink and wears oxygen via nasal cannula at home at 2L.
Primary Medical Diagnosis: Pneumonia and Dehydration
Surgeries/Procedures & Dates: none

Psychomotor Skills Required Prior to Simulation:

None

Cognitive Activities Required Prior to Simulation:

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

Brief lecture reviewing Mrs. Smith's history and case summary.

Simulation Learning Objectives

General Objectives: Improve self-confidence level and overall response of medical-surgical nurses to code blue events

Simulation Scenario Objectives:

- Apply the principles of the 2015 American Heart Association Basic Life Support Algorithm for In-Hospital Cardiac Arrest to a simulated patient scenario
- Recognize and respond to cardiac arrest (V Fib)
- Perform defibrillation within 3 minutes or less from time of arrest event

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

American Heart Association (AHA). (2015). *Guidelines for CPR & ECC*. Dallas, TX: American Heart Association.

Report Students Will Receive Before Simulation

Time: 0700

Mrs. Smith is a 77-year old with a history of COPD, Smoking, and Diabetes. She is admitted after seeing her PCP for shortness of breath, a productive cough, nausea/vomiting and general malaise. Due to her history, her PCP admitted her to the med-surg unit yesterday. Mrs. Smith called the night shift nurse into her room last night at 2100 complaining of increased fatigue, increased sputum production, and reports feeling chilled. She is awake, alert, and oriented with coarse rhonchi throughout all lobes. When the night shift RN takes her vital signs she finds the following: BP 155/80, HR 96, RR 23, O2 sats 92% on 2L. Her temperature is 101.8 so the RN gives her PRN Tylenol and calls respiratory therapy to administer her PRN nebulizer treatment.

At shift change, the day shift RN enters the room of Mrs. Smith to find her drowsy and confused. Her vitals are BP 110/64, HR 106, RR 26, O2 sat 89% on 2L and temperature 102.2. Mrs. Smith begins to wake up after having her vital signs taken and tells the day shift RN that she doesn't feel well and her chest hurts. The day shift RN begins to perform her head to toe assessment while Mrs. Smith continues to moan, and verbalize she doesn't feel well.

Significant Lab Values: WBC Count 30,000

Provider Orders:

- Chest x -ray completed
- Sputum and blood cultures collected
- IVF, LR at 150 ml/hr
- IV Antibiotics – Cefepime 2 grams IV every 8 hours
- CBC and BMP daily

Home Medications: Spiriva, Insulin, and Albuterol as needed

Scenario Progression Outline – **this sim should be performed twice (once pre intervention, once post-intervention)**

Timing (approx.)	Manikin/SP Actions	Expected Interventions	May Use the Following Cues
0-1 min	**Set VS to:** BP 155/80 HR 96 RR 23 O2 Sat 92% on 2L Temp 101.8	none	**Role member providing cue:** SM Cue: **these vitals will be written on white board in room and available on patient chart in room**

1-3 min	**To start, set VS to:** BP 110/64 HR 106 RR 26 O2 sat 85% on 2L Temp 102.2 **After complains of chest pain:** O2 sats drop to 80% Breath sounds: Rhonchi/Crackles Eyes ½ closed Manikin should moan, be confused, say she isn’t feeling well, making coughing noises, complain of chest pain	RNs should assess lung sounds, express need to collect vital signs, suggest interventions to be implemented (EKG, call RRT, apply O2, collect labs, call provider)	**Role member providing cue:** SM Cue: **summary of what day shift RN found when she went into patient’s room**
3-5 min	Patient should become unresponsive, lose pulse, and have VFib rhythm	Respond to cardiac arrest – call code, initiate BLS interventions, crash cart to room, defibrillate	**Role member providing cue:** SM Cue: **after staff discuss what interventions could be implemented, pt complains of chest pain then goes unresponsive**
Post-defibrillation	Patient should regain pulse and normal rhythm	Defibrillation	**Role member providing cue:** Cue: Defibrillation

Debriefing/Guided Reflection Questions for This Simulation

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

Start this debrief by reviewing the AHA In-Hospital Cardiac Arrest video and algorithm. Then review the results from the mock code blue evaluation tool. Use the information on the tool to guide debriefing using the questions below. This serves as the training intervention for the DNP scholarly project.

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. If you were able to do this again, how could you have handled the situation differently?
7. What did the group do well?
8. What were the key assessments (signs and symptoms of a problem) and interventions for this particular case?

APPENDIX K: SIMULATION TRAINING INTERVENTION

Simulation Training Intervention
Material to Review with Participants

- Review AHA 2015 Video
    - In hospital arrest response (7 min)
- Provide participants with copy of AHA 2015 BLS Cardiac Arrest Algorithm
- Review CHS NorthEast Code Blue Process
    - Call 33333 or use code blue button
    - Obtain crash cart
    - Defibrillate (if indicated) in three minutes or less from time of arrest
- Emphasize importance of good communication, teamwork, and documentation
- Utilize equipment on crash cart such as back board, suction, materials in the drawers of the cart
- Review warning signs or interventions that could have prevented cardiac arrest
- Discuss interventions that could be implemented when patient has a clinical emergency

APPENDIX L: SIMULATION FLOW DIAGRAM