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Use of Simulation to Improve Nurse's Response to COVID-19 Code Blue: A Literature Review

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Using Simulation to Improve COVID-19 Code Blue Outcomes

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Section I: Abstract

Background

Healthcare workers in the acute care setting must be ready to respond to emergencies at any given time. The recent COVID-19 pandemic put strains on the healthcare workforce that have brought challenges and new competencies for how healthcare workers safely respond to emergencies. To ensure healthcare workers maintain these competencies, specific training must occur to improve emergency response and outcomes. Specifically, there needs to be training for healthcare workers to respond to COVID-19 code blue emergencies safely and with skilled interventions.

Problem

A code blue in the acute care setting is a medical emergency that requires nurses, physicians, and respiratory therapists to react urgently and with precision to deliver life-saving interventions. Responders must be confident in performing their skills in this high stress environment. With the current COVID-19 pandemic, healthcare workers are tasked with caring for COVID-19 patients with additional precautions to avoid potential exposure to self and others.

Methods

Sixty-four healthcare workers (registered nurses, physicians, and respiratory therapists) participated in COVID-19 code blue simulation training. Each participant completed a pre- and post- survey to evaluate the simulation training. Data was collected on time to first chest compressions, first defibrillation, and first dose epinephrine from COVID-19 code blue case pre- and post- simulation training. Observations were done on COVID-19 code blue cases pre- and post- simulation training.

Interventions

The purpose of this project was to develop, implement, and evaluate a simulation training class that allows for responders to safely practice their COVID-19 code blue skills including how to properly don and doff appropriate personnel protective equipment (PPE). This simulation training was provided to nurses, physicians, and respiratory therapist so they could practice their skills and responses to this life-threatening emergency.

Results

COVID-19 code blue simulation training had a positive impact on healthcare workers knowledge, skills, and comfort levels that was statistically significant ($p=<0.00$). Two out of three key code blue metrics improved (time to first defibrillation by 48 and first dose epinephrine by 76%). Donning and doffing compliance improved by 10% after simulation training.

Conclusion

The project had a positive effect on healthcare workers safely conducting a code blue during the COVID-19 pandemic. While there were some limitations to the project, it is recommended that the organization continue the COVID-19 code blue simulation training with spread to all departments.

Keywords: *Code blue, COVID-19, personal protective equipment*, *safety*, simulation

Section II: Introduction

Background

Healthcare workers working in acute care settings need to be ready to respond to any emergency that happens, including a code blue. Training to maintain competency and skills is needed to ensure health care workers can provide high quality emergency care to patients. The COVID-19 pandemic has dramatically affected healthcare workers and how they give care. They have been forced to quickly change the way they deliver care to COVID-19 patients to ensure safety by not being infecting or transmitting the virus. In order to adapt and change how care is delivered, healthcare workers require training to ensure they can safely provide care in the new era of the COVID-19 pandemic.

Problem Description

A code blue is a cardiac emergency that occurs within the healthcare setting. The American Heart Association (2019) reports that in the United States, 292,000 cardiac emergencies occur in hospital settings each year. When a code blue is called for a patient, responders must act quickly and be confident of their response skills. The COVID-19 pandemic has brought on a heightened awareness among health care workers of protecting patients and themselves from contracting the COVID-19 virus while conducting a code blue. For this to happen, responders need to be trained properly in COVID-19 code blue competencies.

While cardiac emergencies are a stressful event for healthcare workers, the COVID-19 pandemic has added additional stress on responders as they are tasked with responding to code blue emergencies in a different way. Health care workers have experienced increased anxiety and fear from caring for COVID-19 patients. Fear of personal exposure can lead to errors and a decrease in the quality of patient care (Galehdar et al, 2020). To safely respond to COVID-19 code blue events, healthcare workers will need to have a clear understanding of how to safely don and doff personal protective gear (PPE) in order to protect themselves and others.

There have been many deaths due to COVID-19. According to the San Francisco Chronicle (September 7, 2020), there were 189,069 deaths in the United States related to COVID-19. Many of these deaths occurred in acute care settings. Because of this, healthcare workers must be properly prepared to respond to a COVID-19 code blue emergency. COVID-19 code blue responders will need to have the knowledge, skills, and comfort level to care for this population in life and death emergency situations.

Setting

The setting for this project is a 300-bed not-for-profit acute care medical center located in Northern California. The facility is part of a larger integrated healthcare organization that consists of 39 hospitals that spans across nine different states. On average, the facility has 96 code blue emergencies a year, and currently cares for 10-14 COVID-19 patients a day. Responders in this setting who typically deliver care during a code blue are nurses, physicians, and respiratory therapists. The mission of the organization is encompassed with the idea that health care workers provide high quality to care to the patients and the community they serve in order to improve overall health. An assessment at the beginning of the project revealed there was no current training for healthcare workers related to COVID-19 code blue. To be true to the mission of the organization, this project was developed to ensure high quality care can be given to this population during cardiac emergencies.

Specific Aims

There are three aims for this project. Simulation training was the intervention used to meet these aims. A comparison of pre- and post-simulation surveys was done to determine if the project aims were met.

(1) The first aim is to increase knowledge, skills, and comfort levels among healthcare professionals who work in ICU, telemetry, and medical surgical settings within the medical center in running or participating in a code blue with COVID positive patients from baseline to end of intervention by 25% by June 2021.

(2) The second aim is to improve compliance of donning and doffing PPE in a COVID-19 code blue by 25% by June 2021.

(3) Lastly, the third aim of this project strives to increase the timeliness of interventions delivered during a COVID-19 code blue (time of first compression, defibrillation, and first dose of epinephrine) by 5% by June 2021.

Available Knowledge

PICOT Question

A PICOT question was developed to guide a literature search of evidenced-based practices that promote effective training for code blue emergencies and donning and doffing of PPE. The question included what population will be targeted, what is measured, and in what time frame the intervention took place. The PICOT question is: In COVID-19 code blue responders (P), does the implementation of COVID-19 code blue simulation training (I), compared to no intervention (C), increase responders' knowledge, skills, and comfort levels, and improved code blue outcomes (O) over a 6-month period (T)?

Search Methodology

A literature search was conducted in May 2020 and updated in October 2021 using the following databases: CINAHL Plus, PubMed, Cochrane Database of Systemic Reviews within the University of San Francisco's Gleeson Library. Over 300 articles were found when an initial search was done using key words *simulation* and *code blue*. To narrow the search, additional key words used were hospital *setting*, *personal protective equipment*, *isolation*, and *infectious disease*. This yielded 25 articles relevant in answering the PICOT question. After reviewing the abstracts of these articles for content, a total of nine articles were selected. These articles were then appraised using the John Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal Tool (Dearholt & Dang, 2018). Each article was rated for level and quality of evidence (see Appendix A).

Integrated Review of the Literature

There were three identified themes that emerged during the literature review. Each of these themes will be presented.

Improvement in Code Blue Outcomes

Crowe et al. (2017) reviewed the impact simulation has on a nurse's confidence and knowledge. The researchers chose an analytic design as their methodology. Three hundred and thirty-one nurses participated from various medical centers. They found that nurses who participated in code blue simulations had a statistically significant improvement in their level of confidence ($p < 0.001$) and knowledge ($p < 0.001$) of how to perform during a code blue. When participants were evaluated three months after their participation, they were able to recognize early signs of cardiac emergencies and begin interventions sooner. Furthermore, it was noted that there was a 59% decrease in the number of pulseless cardiac arrests, and a 52% increase in pre-cardiac arrests calls, or rapid responses. Crowe et al. concluded that using simulation to train nurses how to respond to a code blue lead to increased confidence levels in responding to code blues.

Huseman (2012) studied improving code blue response times using simulation as a training method. One hundred and twelve nurses and sixty-six nurse aides participated in the study. The variables studied were the time to start chest compressions, time to first epinephrine given, and time to the first defibrillation given. Analysis of their pre and post training data revealed a statistically significant improvement in response times for the start of compressions ($p=.0079$) and epinephrine administration ($p=.0001$). There was no statistically significant difference in response time for first defibrillation post-training ($p=.1008$). Huseman concluded that code blue simulation training had a significant positive effect on the performance of the interventions delivered during a code blue.

Vincelette et al. (2018) studied nurse response time to recognize ventricular fibrillation and whether simulation could improve it. Through their exploratory descriptive cross-sectional study, the researchers were able to demonstrate that nurses were able to identify ventricular fibrillation faster and felt that participation in simulation was beneficial to learning. Of those who participated in the study, 91% were able to correctly identify ventricular fibrilization after simulation. The researchers concluded that nurses had improved skills regarding the recognition of ventricular fibrillation after participating in the simulation training.

Improved Confidence

Webbe-Janek et al. (2011) studied nurses' perceptions of simulation-based training for rapid response and code blue events. A total of 360 nurses participated in their mixed-method study. They found that participants had an increase in knowledge, skills, and awareness of how they were to participate and respond to a code blue emergency after they participated in the simulation training. Ninety-seven percent of participants reported improved communication and practice skills as a direct result of participating in the simulation setting. The researchers concluded that simulation is a favorable training tool for nurses to practice their code blue skills.

Williams et al. (2016) conducted a quality improvement study that was requested by nurses working on surgical inpatient units at Eastern Health. These nurses requested simulation training for code blue scenarios. Nurse participants (n=x) were given code blue scenarios to practice responding in a simulation environment. After the training, nurses were given a qualitative survey that asked them to reflect on their confidence level for responding to a code blue. Nurses perceived their confidence levels for responding to code blue increased after participating in simulation training. The researchers concluded that code blue simulation had a positive effect on nurse comfort levels as code blue responders.

Ngo et al. (2020) conducted a quality improvement study at Desert Regional Medical Center. The aim of their study was to see if providing simulation to residents would improve their reported confidence levels in leading a code blue within the acute care setting. Over a seven-month time span, 19 residents went through code blue simulation trainings. Each participant was given a pre- and post- test survey to complete. After analysis, results of the study showed an improvement in confidence levels from 31.6% to 58.3% and 15.8% to 20& in participants responding to agree and strongly agree on a Likert scale question regarding improved confidence levels.

Improvement in Use of PPE

Plazikowski et al. (2018) conducted an experimental study to examine the effectiveness of simulation as a training tool for airway management in patients who have a highly infectious disease. This study included 30 anesthesiologists working in emergency services who donned the correct PPE before entering a patient room to intubate a patient with a highly infectious disease. The results demonstrated that anesthesiologists were able to timely intubate patients after putting on the correct PPE. Intubation time was less than 60 seconds in 409 simulations. Participants also stated that intubating patients with highly infectious diseases was more difficult because of the added requirement of donning the correct PPE. Because of this, participants felt they needed to pay closer attention to how they donned and doffed PPE as to avoid risk exposure. The study's conclusion was that simulation of airway management of patients with highly infectious disease was beneficial to managing airways for this population. Simulation gave the participants time to focus on properly donning and doffing of PPE in order to decrease the risk of exposure.

Anderson et al. (2015) studied compliance of nurses (n=x) putting on PPE correctly when entering an isolation room. The researchers used a quasi-experimental study to see if simulation could be used as a training method to improve compliance. In addition, they wanted to see if simulation would give nurses a better understanding of the importance of adhering to isolation procedures to decrease risk exposure. Results of the study demonstrated that there was a statistically significant increase in nurse's knowledge about the importance of donning and doffing PPE correctly ($p < 0.00001$). The researchers concluded that simulation training for donning and doffing of PPE is a beneficial training tool to increase nurse's knowledge and understanding of PPE requirements for patients with highly infectious diseases.

Beam et al. (2015) studied the benefits of simulation for nursing practice of donning and doffing PPE. The researchers aim was to see if simulation would enhance nurse's compliance of adhering to proper adherence of donning and doffing of PPE. Twenty-four nurses participated in this study. Initial findings and observations showed a greater than 50% variation in how nurses donned and doffed PPE. Simulation demonstrated that participants were able to practice proper donning and doffing of PPE. These findings suggest that simulation as a training tool is needed to help increase nurse's knowledge and compliance with donning and doffing PPE in order to reduce potential exposure among nurses.

Summary/Synthesis of the Evidence

In summary, the literature review provided three themes: improved code blue outcomes, improved comfort levels, and improved use of PPE. The three themes combined suggest that simulation as a training tool for COVID-19 code blue could lead to positive effects on participants knowledge, skills and comfort levels. One identified gap in the review was that there were no articles focusing specifically on simulation for improving COVID-19 code blue outcomes. This gap was driven by the COVID-19 pandemic being relatively new and research on it not yet published. Given the strong literature identified in the three themes described above, the review supports the use of simulation in training healthcare workers on COVID-19 code blue response.

Rationale

The conceptual frameworks that guided this project were Kolb's theory of experiential learning and NLN Jeffries simulation theory. Each of these components of the framework are described.

Kolb's Theory of Experiential Learning

Kolb's theory of experiential learning (ELT). ELT's foundation is based on individuals learning through experience, and consists of four stages: concrete, reflective, abstract, and active (see Appendix B). For effective learning to occur, all four staged must be included (Kolb, 2015). Kolb's theory provides the ideal framework for a simulation project.

Code blue simulation training encompasses all four stages of the theory. The simulation training sessions provided the concrete stage of learning as participants had hands-on experience and practice with how to respond to a COVID-19 code blue. The reflective stage is seen during the debrief after the simulation sessions. Debriefers were trained to ask the same questions and use the same model for debriefing. By having consistency of practice for the debriefers, the debriefing phase was constant for participants. Here participants had the opportunity to reflect on their experience, and what they learned from participating. During the conceptualize stage, participants were able to form new ideas on their response to a COVID-19 code blue, based on their experiences and reflections of their time in simulations. Lastly, the active stage is seen as the participants begin to use what they have learned and embed their improved skills into their practice.

NLN Jeffries Simulation Theory

NLN Jeffries simulation theory has five conceptual components that guide the development, implementation, and evaluation of simulation. The five components are the facilitator, participants, identification of educational needs, simulation design, and the learning outcomes. Simulation design characteristics should incorporate the following elements: objectives, fidelity, problem solving, participant support, and reflective thinking strategies such as debriefing. Jeffries's theory supports concepts of experiential learning and growth, cognitive skills, and sociocultural dialogue (Jeffries, 2012).

Section III: Methods

Context

The COVID-19 pandemic has left nurses feeling fearful anxious and stressed when caring for COVID-19 patients (Tayyib & Alsolami, 2020). Studies have shown that there is a negative relationship between level of anxiety and level of self-confidence (Espinosa-Rivera et al., 2019). Similar reports of fearful anxiety, stress, and its negative effects on self-confidence were expressed by COVID-19 code blue responders in the setting where this project was conducted. The objective of the project was to address this need by providing COVID-19 code blue responders with simulation training sessions so they could practice their skills in a safe setting. The use of simulation provided an environment for participants to improve their knowledge, skills, and comfort levels in responding to these emergencies.

Specifically, simulation was provided for donning and doffing of PPE and remaining safe during code blue interventions. Participants for this project included nurses, physicians, and respiratory therapists. Key stakeholders for this project were the organization's chief nurse executive (CNE), director of education, educators, director of adult services, department managers, frontline staff, and patients cared for in the acute care setting. Stakeholders were aware of the gap caused by the pandemic and were open to the need for change. They saw value added for this simulation training for frontline staff, patients, and the organization. To order to move forward with this project, a letter of non-research approval was obtained (see Appendix C). In addition, a letter of support was provided from the organization CNE (see Appendix D).

Interventions

The overall goal of the project was to build a highly skilled response team to COVID-19 code blues that decreased risk to any potential exposures for both patients and healthcare professionals. A simulation of donning and doffing of PPE and safe code blue response was the intervention used for this project. Simulation training followed the International Association for Clinical Simulation and Learning (INACSL) standards for conducting simulation. The INACSL's healthcare simulation standards include professional development, prebriefing, simulation design, facilitation, debriefing process, operations, outcomes and objectives, professional integrity, simulation-enhanced interprofessional education, and evaluation of learning and performance. (International Nursing Association for Clinical Simulation and Learning, 2021). Simulation was chosen as the intervention of choice by this writer as it was a method to training staff safely in a controlled environment where participants could learn without fear of mistakes or exposure.

Nurses, physicians, and respiratory therapists were the participants in the project. Simulation took place in the form of mock COVID-19 code blue drills. Dates and times of the COVID-19 code blue drills was posted on the medical surgical and telemetry units for nurses to know when sessions were taking place. Nurses were able to sign up for sessions, as well as invited to walk-in as needed. Dates and times were given to the respiratory therapy department and hospital medicine department so respiratory therapist and physicians could sign up for selected dates.

Facilitators were trained on how to conduct simulation based on the INACSL standards. The facilitators included clinical nurse educators and clinically skilled nurses. An evidence-based tool was developed to facilitate the simulation (see Appendix E). The template used for designing the simulation scenarios, was developed by the Clinical Simulation Alliance (CSA). This template includes scenario, learning objectives and activities, debriefing questions, and the Quality and Safety Education for Nurses (QSEN) competencies that the simulation is designed to meet.

The tool was validated by the organization's clinical nursing director, by using a scenario validation checklist developed by the CSA. Once validated, the tool became the manual to guide COVID-19 code blue simulation. This manual includes pre-brief and debrief guidelines.

Debriefings were done using the good judgement approach. By using this approach, participants were able to process what is being said without feeling defensive or feeling the instructor was being critical. This debriefing approach created a safe environment for learners, broadened the debrief to allow participants to discuss their assumptions and knowledge and instructors to explicitly share any critical insights they had about the simulation (Rudolph et al., 2007). The organization's local simulation educator trained the trainers on how to use this methodology prior to simulations taking place.

In summary, the manual developed used the Clinical Simulation Alliance template to design the scenario and address QSEN competencies, learning objectives and activities. There was a checklist for the facilitator to follow while participants were doing the simulation, tools for the facilitators to use to guide the participants through the simulation, and the pre- and post-simulation surveys. The manual can serve as a tool for future COVID-19 code blue simulations and will be shared with others in the organization.

Gap Analysis

A gap analysis was conducted to review the current state of COVID-19 code blues and what was needed to get to future state for the project (see Appendix F). Department managers, frontline staff, physicians, educators, and respiratory therapist were interviewed to see what our current state looked like to them and recommendations for improvement. In addition, observations were made during COVID-19 code blues in the medical center to gather additional information. Interviews and observations showed a lack of understanding, skill, and comfort in responding to COVID-19 code blue.

Gaps for this project fell under the need for a standard approach for education for responders. The current state has no structure to support education on how to respond to a

COVID-19 code blue. There was no formal training or simulation used to educate health care staff on code blue emergencies or how to don and doff PPE properly. To fill this gap, a partnership was created with the education team to build a simulation training manual for COVID-19 code blue emergencies. Simulation was to include proper techniques for donning and doffing, as well as safe life-saving interventions for performing a code blue. Simulations were to be done on multiple units and include a variety of disciplines.

Gantt Chart

To ensure the project timeline was maintained, a Gantt Chart was used to monitor progression of the project (see Appendix G). The Gantt Chart consists of three main headings: project planning, project implementation, and post-project evaluation. During the planning stage, all project approvals were achieved, training tools were developed, staff were trained to teach the simulations, and pre- and post-training survey questions were created. The project implementation phase was the time frame when the project occurred on the various units. Lastly, the post-project phase was where the data were analyzed, and results reviewed to see if the aims of the project were achieved.

Work Breakdown Structure

A work breakdown structure (WBS) was used to ensure key components of the project were identified so the project could be successful (see Appendix H). Categories for the WBS included stakeholders, budget, training plan, data collection, and evaluation. Stakeholders were identified who have a vested interest in the project. These stakeholders were the chief nurse executive (CNE), director of education, union representatives, educators, and department managers. Their approval of the project was essential and was needed in the early planning phases. As the project developed, continued project updates were given to all stakeholders for their continued support and project success.

A budget was developed for the project. Cost for this project included participant and trainer time, as well as any equipment purchases needed to run simulation training. During the project, the overall cost was reviewed by the project lead and stakeholders to see if the project had continued support to move forward as budgeted. As the project continued to move forward, frequent review of budget was needed to ensure the project stayed financially on track.

A well-defined training plan was in place to run the simulation training. Nurse educators and highly skilled and trained clinical nurses were identified as the instructors for the classes. Dates and times were established, so they knew when they were expected to do the training. Training manuals and tools were established for educators to use. Data collection for this project was done by administering and collecting a pre-and post-simulation surveys from project participants.

Evaluation of the project was done after all simulations had taken place and surveys had been collected. Pre- and post-simulation survey data were analyzed to determine if the project's aims were achieved. If the project met its aims, spread of the project will be reviewed for sustainability. A plus/delta of the project process was done, so learnings and opportunities from this project can be shared with those who want to implement similar evidence-based projects.

Responsibility/Communication Matrix

A communication plan was established to ensure all stakeholders were well informed of the project and its development (see Appendix I). To make sure key stakeholders were appraised of how the project was progressing, initial and ongoing meetings were established to maintain communication pathways. Initial and monthly meetings were conducted with the chief nurse executive, director of education, educators, nurse mangers, and union leaders. Additional meetings were held as needed to keep communication lines open and fluid.

SWOT Analysis

A SWOT analysis was conducted to review the project's strengths, weaknesses, opportunities, and threats for project implementation (see Appendix J). Strengths for the project included organizational buy-in for the project, nurses' desire to have the training, an invested education department, and an engaged CNE. Weaknesses included short timeframe to complete the simulation project, cost of the project, and the need to train multiple disciplines. Opportunities for the project were to enlist frontline staff to assist with training, use of simulation technology, and to partner with union staff to implement project. Threats consisted of an unknown potential of a second COVID-19 wave that may affect resources, and potential union opposition to training.

Budget and Financial Analysis

While there is a financial investment to this project, the financial impact shows a cost avoidance to the organization. For the project to be initiated and executed, the total budget/expenses were $24,012.00 (see Appendix K). This expense included salary and wages for project development, implementation, and participation, as well as supplies needed to begin the program. The facility was already equipped with a high-fidelity mannequin for simulation, which added no cost to the project and allowed for total expenses to remain low. With this initial investment into the project, there was a projected cost avoidance of $21,703.32 (see Appendix L). This amount included cost avoidance of employee exposures, employees' injuries from ineffective CPR, and the cost of utilizing a simulation facility outside of the organization.

Assumptions can also be made that there may be less staff turnover and a reduction in length of stay (LOS) because of this project. A decrease in turnover could come from staff who feel more comfortable and less afraid of exposure to COVID-19 during a code blue because of this training. If staff feel supported and confident in their skills, they are more likely to remain within the organization versus leaving. Decreased patient LOS could potentially be seen because of this project because when code blues are run efficiently, there are fewer errors made. Errors lead to longer LOS. So, by decreasing errors, this project may have a positive impact on LOS.

When looking at this project over a three-year time frame, the total cost avoidance begins to exceed expenses starting in year two and continues through year three, resulting in a cost avoidance of $71,213.28 over three years (see Appendix M). Assumptions made for this projection are that exposure risk and CPR injuries continue to be avoided in years two and three, with four avoided each subsequent year. In addition, an assumption is made that cost for utilizing an outside simulation remains the same with no cost adjustments per contract. With this project expanded over three years, the cost avoidance exceeds the budgetary expense making this project an initiative that benefits the organization by keeping their staff and patients safe.

Study of the Interventions

A simulation manual was developed to run the simulation training. The manual was developed using current literature on COVID-19 code blue scenarios. To validate prior to using, the tool was reviewed by the for clinical content accuracy by organizational educators deemed to be experts locally on simulation. The pharmacy director reviewed the document for accuracy with regards to medication use. Once validated as an appropriate COVID-19 code blue scenario, the organization's director of education reviewed the entire document for accuracy and alignment with evidence-based research and QSEN competencies. Finally, prior to implementation, nurse educators and facilitators of the simulation did simulation trials of the tool to ensure use would be appropriate for training. Input was given on tool development from educators and frontline clinical experts.

Outcome Measures

The scope of this project was to measure three outcome measures. Each is described below.

COVID-19 Code Blue Skills of Participants

A simulation checklist was used by facilitators to determine if participants demonstrated the appropriate skills in the simulation. This checklist is found in the simulation manual.

Knowledge, Skills, and Comfort Levels of Participants

Author-developed pre- and post-simulation surveys were used to measure perceived knowledge, skills, and comfort levels of participants. Both pre- and post-simulation surveys consisted of the same 15 questions. Questions on these surveys used Likert-type responses ranging from 1 to 5, as well as open-ended questions asking participants to explain their responses if they select responses 1 or 2 on the question (see Appendix N). The questions on the survey were written to evaluate whether the intervention of simulation training for COVID-19 code blue response had a positive effect on responders' knowledge, skills, and comfort levels. Items 7, 9, 11, and 15 on the pre- and post-simulation surveys measure knowledge. Skills are measured with item 13. Comfort level is measured with item 5. The surveys also include four questions to elicit demographic data.

Facilitators used a checklist of necessary skills during the simulation. During the simulation, skills were assessed, and the checklist completed by facilitators as they observed participants. Feedback was given during the debrief after the simulation was complete.

Response Times for Code Blue Outcomes

Donning PPE can add time to code blue response times but should be monitored to make sure this is minimal. Data was collected and logged on an Excel spreadsheet for response times of first chest compression, defibrillation, and first dose of epinephrine for COVID-19 code blues prior to simulation training and after completion of the simulation training.

Compliance with proper donning and doffing of PPE

To ensure decreased risk to exposure to COVID-19, responders must follow strict procedures of donning and doffing of PPE. Observations were made of healthcare workers responding to COVID-19 code blue pre- and post-simulation training. Compliance to proper donning and doffing of PPE was recorded on an Excel spreadsheet for review.

CDI Method and/or Data Collection Tools

The primary date collection tool used were the pre- and post-simulation surveys. This tool gathered participants' perceived knowledge, skills, and comfort levels before and after the simulation intervention. This author-developed tool was designed from feedback gathered prior to intervention from staff on how they felt about responding to COVID-19 code blue. Open-ended questions were added to the survey to allow participants an opportunity to expand on their participation. Survey was specific to code blues from patients who had COVID-19 and was not built to solicit feedback for other patient who experience a code blue emergency.

Analysis

Survey analysis was conducted on the quantitative questions using SPSS software. Descriptive statistics showed that there was in total 64 participants who participated in the simulation training. Of the 64 participants, 48 were bedside registered nurses, 8 were physicians, and 8 were respiratory therapists (see Appendix O). There were 51 females and 13 males that participated in simulation. Ten participants were in their role for 5 years or less, 14 were 5-10 years in the role, and 40 had greater than 10 years' experience in their current role.

Survey questions 5, 7, 9, 11, and 13 were analyzed in SPSS using Wilcoxon Signed-Rank test to compare the pre- and post- survey responses from the participant to see if there was a significant correlation. Analysis of question 5 revealed a p value of 0.000 with the standard mean increasing by 0.75. Survey question 7 showed a standard mean increase of 0.57 with a p value of 0.00. Survey question 9 had a standard mean increase of 0.81 with a p value of 0.00. Question 11 had a p value of 0.00 with a standard mean increase 0.37. And question 13 had a p value of 0.00 with an increase in mean score of .051. Overall analysis revealed a statistically significant improvement in healthcare workers perception of knowledge, skills, and comfort levels after participation in the COVID-19 code blue simulation training. There was a total standard mean improvement for all questions of 13% (see Appendix P).

Qualitative data was collected from the open-ended questions on the pre- and post-simulation surveys. Questions 6, 8,10, 12, and 14 focused on why participants scored themselves a 1 or 2 on knowledge, skills, and comfort level questions. On the pre-simulation survey, 32 participants responded to the above questions. The theme throughout all responses was that these participants had "little to no experience participating in a COVID-19 code blue". On the post-simulation survey, only 5 participants responded, and the same theme was identified (see Appendix Q). A review of the qualitative data shows simulation gives healthcare workers more exposure and experience with COVID-19 code blue scenarios.

Observations of compliance with donning and doffing procedures were gathered both pre- and post-simulation. A total of 42 observations were made of healthcare workers donning and doffing in response to a COVID-19 code blue pre-simulation training. A total of 8 responder participants were observed not following protocol, resulting in a 19% error in compliance. Post-survey observations revealed 2 out 17 responder participants not following protocol procuring a 9% error rate. Analysis of pre- and post- simulation shows a 10% improvement in compliance to donning and doffing (see Appendix R).

Time to first compression, first defibrillation, and first dose of epinephrine were collected on two COVID-19 code blue cases pre-simulation and two COVID-19 code blue cases post-simulation for a total of 4 cases. The average time to first compression pre-simulation was 1 minute with a post-simulation time of 1.5 minutes revealing an increase in time by 33%. The increase was accounted for in one case where time to first compression took 2 minutes. The average time to first defibrillation pre-simulation for two cases was 19.5 minutes with an average post-simulation time of 10 minutes for 2 cases revealing that time to first defibrillation improved by 48%. The average time to first dose epinephrine pre-simulation for 2 cases was 17 minutes, while the average post-simulation time for 2 cases was 4 minutes. Total improvement time for first dose of epinephrine was 76%. The combined improvement on all three measures was 30% for the three code blue metrics (see Appendix S).

Ethical Considerations

This project was reviewed by the author's University of San Francisco DNP Committee and was approved as a non-research evidence-based practice project. In addition, the project was reviewed and approved by the facility where the project was conducted. Based on these approvals, this change of practice project was not required to be reviewed by the USF IRBPHS Committee.

No other COVID-19 simulation training or project was taking place within the facility. There were no conflicts of interest identified for the author. Participants of the training were voluntary. Pre- and post-simulation surveys and any other data collected were anonymous to protect the privacy of participants. This allowed responder participants to answer surveys and participate in simulation training without concerns about threats to privacy. No individual data collected from surveys or observations was shared with anyone in the organization.

The American Nurses Association (ANA) (2015) has established a code of ethics to guide nursing practice. This code of ethics outlines a nurse's responsibilities to ensure she acts in a manner that upholds the nursing profession while maintaining quality nursing care and maintaining ethical obligations to patients. This project upholds the code of ethics and allows nurses to be committed to patient care by providing quality evidenced-based interventions needed during a code blue emergency.

Specifically, provisions 2 and 5 of the ANA code of ethics were evident in this DNP project. Provision 2 calls for nurses to have their primary commitment to the patient (American Nurses Association, 2015). This project supports this provision as it provided an opportunity for nurses to improve their skills in safely responding to COVID-19 code blue thus protecting their patients. This project supported code blue responders' commitment to caring for this patient population.

Provision 5 of the ANA code of ethics speaks to nurses' responsibility to have the same duties to self as to others. This includes promoting health, safety, and continued personnel and professional growth. This DNP project aligns with this provision as it allows nurses to improve and grow their skills in responding to COVID-19 code blue (American Nurses Association, 2015).

The University San Francisco's mission statement is to promote learning in the Jesuit Catholic tradition. Jesuit commitment for education is to explore, engage, and improve the world around us. The University holds the Jesuit value that excellence be the standard for teaching and learning is humanizes and is a social activity as opposed to a competitive experience for the learners. In addition, the value of cura personalis, care of the whole person is a Jesuit value that is upheld at the university (University San Francisco, 2020).

This DNP project demonstrates both of these Jesuit values by providing a safe space for health care workers to practice skills necessary in a COVID-19 code blue. By providing this training, learners were able to improve their knowledge, skills, and comfort level and become better equipped to care for this patient population wholistically. The training allowed these participants to advance their knowledge and skills and improve outcomes, in a safe environment, to better serve and care for the high risk COVID-19 patient in need of critical, life-saving interventions.

Section IV: Results

The COVID-19 code blue simulation training provided in this project had a positive effect on healthcare workers knowledge, skills, and comfort levels in responding to a COVID-19 code blue. Evaluation of participants' pre- and post-simulation surveys demonstrated that increases in knowledge, skills, and comfort post-intervention were statistically significant. Post-simulation debriefs, aligned with these results as well as participants' comments that the participating in the simulations training made them feel more comfortable and prepared to attend an actual COVID-19 code blue. Furthermore, participants suggested to have ongoing simulations trainings in the medical center.

The qualitative data collected from the surveys also showed that participants benefitted from the simulation. All comments focused on individuals having little to no experience in COVID-19 code blue. The simulation allowed these participants to practice their skills in a safe environment. While not every participant responded to these questions, results showed the need for ongoing simulation training for healthcare workers who have never participated in such emergencies.

Compliance with donning and doffing procedures was improved post intervention. Participants acknowledged in the debrief how training is a good reminder of the importance of complying with proper donning and doffing procedures. By having individuals' practice a code blue with actual PPE was identified as a plus as participants thought they would not get to do this due to fear of PPE shortages. Results suggest ongoing training on donning and doffing is beneficial for healthcare providers.

Improvement was seen in two of the three code blue metrics. Time to first compression had a slight increase, while both time to first defibrillation and first epinephrine showed improvement when comparing pre- and post-intervention times. Timely lifesaving measures are crucial in a code blue. Practicing how to administer these interventions while maintaining PPE precautions lead to improved timeliness of two out of three interventions. Debrief discussions revealed that participants benefited from simulating these interventions as during a real-life emergency they want to be prepared with the necessary skills.

Over the two-month timeframe that the simulations took place, there were a few unexpected problems that occurred. The first issue that developed was that the hospital was experiencing higher than expected census during the time resulting in having to cancel a class. To mitigate this, an additional class was added so the project could remain on track. An additional issue that presented itself was the high-fidelity mannequin used in the simulation was beginning to fail during the training. To mitigate this, a second mannequin was purchased through capital budget funding. Thankfully, the original mannequin was able to be used for all simulations and the second mannequin was never needed for this project. The new mannequin will be used moving forward for simulations at this facility.

This simulation project had a positive effect on the organization. Nurses, respiratory therapists, and physicians received training sessions to safely improve their knowledge, skills, and comfort levels when responding to a COVID-19 code blue emergency. Through the organization's support of this project, healthcare workers knowledge, skills, and comfort levels, which contributed to improved protection against Covid-19 for staff and patients.

Section V: Discussion

Summary

In summary, the project was effective in significantly improving healthcare workers knowledge, skills, and comfort levels for participating in a COVID-19 code blue. Several outcomes fell short of the percentage increase set in the aims of the project. The first aim was to improve knowledge, skills, and comfort levels by 25%. The data analysis revealed an improvement of 13% when looking at the total mean improvement. The second aim of the project was to improve donning and doffing compliance by 25%. The project improved compliance by 10%. The third aim was to improve time to first compressions, first defibrillation, and first epinephrine improved by 5%. Data showed an overall improvement of 30% for the three metrics.

One key lesson learned from this project is to ensure adequate number of participants and thus responses to survey questions. In addition, learnings are to include many observations of donning and doffing, yielding a larger sample size of cases both pre- and post-simulation. The bigger sample size would bring more validity to the project results. Despite these lessons learned, the project was successful due to the organization's support for simulation, the active participation of the nurses, physicians, and respiratory therapists, and the positive outcomes. The participants' willingness and desire to participate in simulation training to improve outcomes contributed to the project's success. The information shared in the debrief sessions included personal lessons learned from the experience was shared with others in the simulation and provided growth opportunities for all participants. One future possibility that emerged from the project that may improve future simulations is the idea of videotaping the simulation and playing it back to the participants. This would give an additional layer of visual learning that the participants could use to improve their performance. This project has many implications for advance practice nurses in other settings to use simulation as an evidence-based training tool to improve healthcare workers' performance in a COVID-19 code blue.

Interpretation

There was a significant improvement in healthcare worker's perception of their knowledge, skills, and comfort levels after participating in simulation for COVID-19 code blue. The project outcomes were consistent with findings from the literature. The simulation manual developed was a key instrument used to guide this simulation. Recommendations are to use and refine this manual with a larger group from other departments and/or medical centers.

Limitations

Limitations to this project included the small sample size of nurses, respiratory therapists, and physicians who participated in the simulation training. A larger sample of each group would have provided greater statistical power for data analysis. Other limitations were the unavailability of previous code blue data in the organization. COVID-19 code blue records were missing pre-simulation. Post-simulation, there were only a few COVID-19 code blues that occurred. This was due to a decrease in the number of patients admitted with COVID-19 who experienced a code blue. Thus, the lack of previous code blue documentation, and post-simulation COVID-19 code blues led to a smaller data set to analyze.

Conclusions

In conclusion, the project was effective in improving healthcare workers' perception of their knowledge, skills, and comfort levels in participating in a COVID-19 code blue emergency. This project demonstrated cost-effective benefit to the organization, healthcare workers, and patients.

Next steps for this project are to spread the project to departments that did not initially participate at the organization and to other medical centers in the organization. The findings and learnings from this project will also be shared with new employees of the organization including educators, frontline staff, and leaders.

Implications for practice are that this project improved frontline workers response to COVID-19 code blues. It improved safety and PPE compliance as well as timely code blue interventions and could be replicated in other settings.

Future research and evidence-based practice projects should continue to be designed and evaluated that use simulation training to improve code blue responses and outcomes. Projects could include a larger sample size and all health care workers that participate in code blues.

Section VI: Funding

Funding for this project was approved through the organization's budget process. No additional funding was required for this project.

Section V: References

American Heart Association. (2019). Cardiac arrests in hospitals may be more common than previously thought. *American Heart Association*. https:www.heart.org

American Nurses Association. (2015). Code of ethics for nurses. https://www.nursingworld.org/practice-policy/nursing-excellence/ethics/code-of-ethics-for-nurses/

Anderson, N., Johnson, D., & Wendt. (2015). Use of a novel teaching method to increase knowledge and adherence to isolation procedures. *MedSurg Nursing, 24(3), 159-164*. https://pubmed.ncbi.nlm.nih.gov/26285370/

Beam, E., Gibbs, S., Hewlett, A., Iwen, P., Nuss, S., & Smith, P. (2015). Clinical challenges in isolation care. *American Journal of Nursing*, *115*(4), 44-49. https://www.ajononline.com

Crowe, S., Ewart, L., & Derman, S. (2017). The impact of simulation based education on nursing confidence, knowledge and patient outcomes on general medical units. *Nurse Education in Practice, 23*(2018), 70-75. https://doi.org/10.1016/j.nepr.2.17.11.017

Dang, D. & Dearholt, S. (2018). *John Hopkins nursing evidence-based practice: Model and guidelines, 3rd edition.* Sigma Theta Tau International

Espinosa-Rivera, B., Moran-Pena, L., Garcia-Pina, M., Gonzalez-Ramirez, P., & Lopez-Ruiz, C. (2019). Self-confidence and anxiety as intervening factors in clinical decision-making in newly nursing bachelor graduates. *American Journal of Nursing Science*, *8*(2), 59-67. htpps://doi:10.11648/j.ajns20190802.14

Galehdar, T., Toulabi, T., & Kamran, H. (2020). Exploring nurse's perception of taking care of patients with coronavirus disease (COVID-19): A qualitative study. *Nursing Open*. https://doi.org/10.1002/nop2.616

Huseman, K. (2012). Improving code blue response through the use of simulation. *Journal for Nurses in Staff Development*, *28*(3), 120-124. https://doi:10.1097/NND.0b013e3182551506

International Nursing Association for Clinical Simulation and Learning. (2021). Healthcare simulation standards of best practice. https://www.inacsl.org/healthcare-simulation-standards-ql

Jeffries, P. R. (2012). *Simulation in nursing education: From conceptualization to evaluation (2nd* ed.). National League for Nursing.

Kolb, D. (2015). *Experiential Learning: Experience as the Source of Learning and Development*. Pearson Education, Inc.

Ngo, D., Vu, C., Nguyen, T., Sotolongo, P., Talati, M., Zahabi, N., & Platt, K. (2020). The Effect of Mock Code Blue Simulation and Dedicated Advanced Cardiac Life Support Didactics on Resident Perceived Competency. Cureus, 12(11). https://doi.10.7759/cureus.11705

Plazikowski, E., Grief, R., Marschall. J., Pedersen, T., Kleine-Brueggeney, M., Albrecht, R., & Theilrt, L. (2018). Emergency airway management in a simulation of highly contagious isolated patients: Both isolation strategy and device type matter. *Infection Control & Hospital Epidemiology*, *39*(2), 145-151. https://doi:10.1017/ice.2017.287

Rudolph, J., Simon, R., Rivard, P., Dufresne, R., & Raemer, D. (2007). Debriefing with good judgement: Combining rigorous feedback with genuine inquiry. *Anesthesiology Clinics, 25*(2), 631-376. https://doi:10.1016/j.anclin.2007.03.007

San Francisco Chronicle. (September 7, 2020). Coronavirus tracker. https://projects.sfchronicle.com

Tayyib, N. & Alsolami, F. (2020). Measuring the extent of stress and fear among registered nurses in KSA during the COVID-19 outbreak. *Journal of Taibah University Medical Sciences, 15*(5),410-406. https://doi.org/10.1016/j.jtumed.2020.07.012

University San Francisco. (2020). Vison, mission, and values statement. https://www.usfca.edu/about-usf/who-we-are/vision-mission

Vincelette, C., Quiroz-Martinez, H., Fortin, O., & Lavoie, S. (2018). Timely recognition of ventricular fibrillation and initiation of cardiopulmonary resuscitation by intensive care unit nurses: A high-fidelity simulation observational study. *Clinical Simulation in Nursing, 23, 1-9.* https://doi.org/10.1016/j.ecns.2018.07.005

Webbe-Janek, H., Lenzmeier, C., Ogdan, P., Lambden, M., Sanford, P., Herrick, J., Song, J., Pliegio, J., & Colbert, C. (2012). Nurse's perceptions of simulation-based interprofessional training program for rapid response and code blue events. *Journal of Nursing Care Quality*, *27*(1), 43-50. https://doi10.1097/NCQ.0b013e3182303c95

Williams, K., Rideout, A., Pritchett-Kelly, S., McDonald, M., Mullins-Richards, P., & Dubrowski, A. (2016). Mock code: A code blue scenario requested by and developed for registered nurses. *Cureus, 8*(12). https://doi:10.7759/cureus.938

Appendix A

Evidence Table

Purpose of Article or Review	Design/ Method	Sample/ Setting	Conceptual Framework	Findings	Conclusions	Critical Appraisal Tool and Rating/Worth to Practice
Crowe, S., Ewart, L., & Derman, S. (2017). The impact of simulation based education on nursing confidence, knowledge and patient outcomes on general medical units. *Nurse Education in Practice*, *23*(2018), 70-75. https://doi.org/10.1016/j.nepr.2.17.11.017						
To explore if simulation education for nurses in identifying patient deterioration increased nurses' knowledge and confidence levels.	Pre- and post-analytic design.	Sample: Convenience sample of 161 nurses. Setting: 650 in-patient Canadian teaching hospital.	Knowles Adult Learning Theory. Theory of Constructivism, Theory of Social Constructivism (Dewet).	Improvement in confidence level improved initial after training and continued three months post training (M= 47 07SD = 8.09 and M=55.67, SD = 5.63). Improvement in knowledge increased after initial training and three months post (M=12.67 SD=2.19 and M=13.34, SD=2.06). Statistical and significant improvement.	Simulation education is an effective educational tool to increase nurse confidence and knowledge levels for identifying and acting on a patient who is deteriorating.	Level: 1 Quality: A Worth to Practice: Simulation should be used to educate nurses on code blue response as it has a positive correlation to confidence levels.
Webbe-Janek, H., Lenzmeier, C., Ogdan, P., Lambden, M., Sanford, P., Herrick, J., Song, J., Pliegio, J., & Colbert, C. (2012). Nurse's perceptions of simulation-based interprofessional training program for rapid response and code blue events. *Journal of Nursing Care Quality*, *27*(1), 43-50. https://doi10.1097/NCQ.0b013e3182303c95						

Purpose of Article or Review	Design/ Method	Sample/ Setting	Conceptual Framework	Findings	Conclusions	Critical Appraisal Tool and Rating/Worth to Practice
To study nurses' perception of the use of simulation for code blue training.	Mixed-methods study. Qualitative methodology to analyze narrative data and quantitative methodology to analyze Likert-response items.	Sample: 360 nurse participants. Setting: Medical-surgical units.	None Identified.	Favorable results for opportunity for hands on practice (18.4%), Increased awareness (15.1%), role clarity (12.7%), teamwork (12.7%), knowledge (9 9%), confidence (7.1%), and patient outcomes (2.4%).	Nurses perceived that simulation improved their confidence, knowledge, skills and awareness of how to respond to a medical emergency.	Level: II Quality: A Worth to practice: Nurses feel simulation is a learning tool that helps improve their confidence and knowledge levels.
Huseman, K. (2012). Improving code blue response through the use of simulation. *Journal for Nurses in Staff Development*, *28*(3), 120-124. https://doi:10.1097/NND.0b013e3182551506						
To study if simulation of code blue improved response times f initiating life saving measures such as chest compressions.	Single-sample quasi-experimental descriptive design.	Sample:17 8 direct care workers. Setting: Acute care setting,	None Identified.	25% improvement from time of loss of pulse to chest compression initiation. Time of first dose of epinephrine increased by 23%. Defibrillation response improved by 30%.	Simulation of code blue emergencies has a positive effect on performance of staff that respond to a code blue.	Level: II Quality: B Worth to practice: Simulation of code blue improves performance of responders.

Purpose of Article or Review	Design/ Method	Sample/ Setting	Conceptual Framework	Findings	Conclusions	Critical Appraisal Tool and Rating/Worth to Practice
Vincelette, C., Quiroz-Martinez, H., Fortin, O., & Lavoie, S. (2018). Timely recognition of ventricular fibrillation and initiation of cardiopulmonary resuscitation by intensive care unit nurses: A high-fidelity simulation observational study. *Science Direct*. https://doi.org/10.1016/j.ecns.2018.07.005						
To study if identification of ventricular fibrillation improves after simulation training.	Exploratory descriptive cross-sectional study,	Sample: 82 nurses. Setting: University health center in the Province of Quebec Canada. 615 beds	None identified.	91% of participants correctly identified ventricular fibrillation. Improved identification time was 12 seconds after simulation to identify. 95% confidence interval, 9.3-14.8	Simulation improved skills and response time to identify ventricular fibrillation.	Level: III Quality: B Worth to practice: Simulation enhances the performance of code blue responders.
Plazikowski, E., Grief, R., Marschall. J., Pedersen, T., Kleine-Brueggeney, M., Albrecht, R., & Theilrt, L. (2018). Emergency airway management in a simulation of highly contagious isolated patients: Both isolation strategy and device type matter. *Infection Control & Hospital Epidemiology*, *39*(2). https://doi:10.1017/ice.2017.287						
To study the impact of patient isolation on airway management. To see if simulation	Experimental Study	Sample: 30 anesthesiologists. Setting: Bern University	None Identified.	Timely intubation after simulation. 409 airway management attempts were successful in less than 60 seconds.	Simulation had a positive effect on intubation times. Participants need to be mindful of how to don protective gear to prevent exposure.	Level: 1 Quality: B Worth to practice: Simulation is a valuable tool in

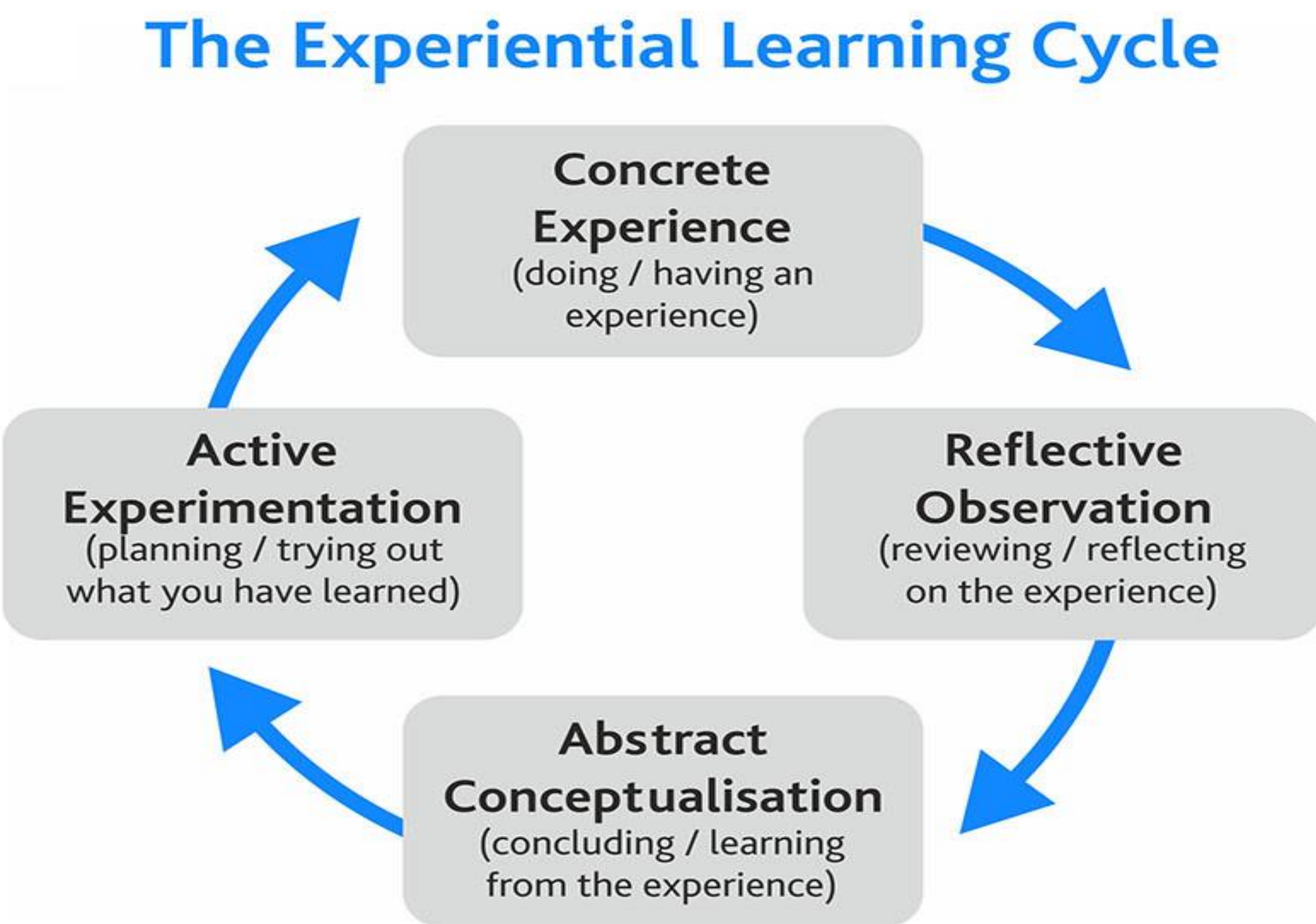
Purpose of Article or Review	Design/ Method	Sample/ Setting	Conceptual Framework	Findings	Conclusions	Critical Appraisal Tool and Rating/Worth to Practice
can improve compliance of putting on protective gear accurately and to improve intubation times and comfort level of responders to intubation needs.		Hospital, Bern Switzerlan d.				educating responders to intubate a patient in an isolation room.
Anderson, N., Johnson, D., & Wendt. (2015). Use of a novel teaching method to increase knowledge and adherence to isolation procedures. *Med Surg Nursing, 24(3), 159-164*. https://www.ncbi.nlm.gov/pubmed/26285370						
To determine is simulating would be an effective learning tool for adherence to entering isolations rooms.	Quasi-experimental design	Sample: 30 nurses. Setting: 36-bed medical oncology unit in a community -based hospital setting.	None Identified.	Isolation knowledge improved after simulation. From 71% to 86%.	Simulation improved nurse knowledge and understanding of isolation procedures.	Level: II Quality: C Worth to practice: Simulation can enhance nurse understanding of PPE and how to don and doff correctly for isolation rooms.
Villamaria, F., Pliego, J., Wehbe-Janek, H., Coker, N., Hasan, J., Sibbitt, S., Ogden, P., Musick, K., Browning, J., & Hays-Grudo, J. (2008). Using simulation to orient code blue teams to a new hospital facility. *The Journal of the Society for Simulation in Healthcare, 3*(4), 209-216.						

Purpose of Article or Review	Design/ Method	Sample/ Setting	Conceptual Framework	Findings	Conclusions	Critical Appraisal Tool and Rating/Worth to Practice
https://doi:10.1097/SIH.0b013e3181817f3						
To use simulation as a teaching method to orient individuals a code blue emergency in a new hospital facility.	Prospective study	Sample:115 healthcare workers. Setting: Scott & White CAM hospital. 417 beds.	None identified.	69% of participants reported simulation was beneficial and prepared them to respond to a code blue. Perception of timeliness to respond to code blue alert and deliver first shock was perceived by 95% of participants as timely without delay.	Simulation was a valuable tool in educating healthcare workers to how to respond to a code blue in a new facility.	Level: I Quality: C Worth to practice: Simulation of code blue scenarios is a valuable teaching tool for ode blue responders.
Williams, K., Rideout, A., Pritchett-Kelly, S., McDonald, M., Mullins-Richards, P., & Dubrowski, A. (2016). Mock code: A code blue scenario requested by and developed for registered nurses. *Cureus*, *8*(12). https://doi:10.7759/cureus.938						
To use simulation as a means for educating nurses on responding to a code blue.	Quality improvement study.	Sample: Medical surgical nurses. Setting Eastern Health teaching hospital.	None Identified.	Post survey results showed that nurses increased their comfort level in responding to code blue scenarios after participating in simulation.	Simulation of code blue has a positive effect on nursing comfort level in responding to code blue.	Level: V Quality: C Worth to practice: Nurses' comfort levels improve when given a chance to practice responding to a code blue in a simulation environment.
Beam, E., Gibbs, S., Hewlett, A., Iwen, P., Nuss, S., & Smith, P. (2015). Clinical challenges in isolation care. *American Journal of Nursing*, *115*(4).						

Purpose of Article or Review	Design/ Method	Sample/ Setting	Conceptual Framework	Findings	Conclusions	Critical Appraisal Tool and Rating/Worth to Practice
https://ajononline.com						
To evaluate nurses' practice of properly donning and doffing of personal protective gear by simulation.	Quality improvement study.	Sample: 24 nurses. Setting: Acute care setting.	None identified.	Greater than 50% variation on how nurses donned and doffed personnel protective gear.	Nursing education in acute care settings need to invest in education on the importance of donning and doffing personnel protective gear. Simulation can be a tool used for education.	Level: V Quality: C Worth to practice: There is a need to have education using simulation to improve compliance to correctly donning and doffing PPE for isolation rooms.
Costa, R., Medeiros, S., Coutinho, V., Mazzo, A., & Araujo, M. (2019). Satisfaction and self-confidence in the learning of nursing students: Randomized clinical trial. *Escola Anna Nery, 24*(1). https://doi:10.1590/2177-9465-EAN-2019-0094						
To evaluate nursing students' satisfaction and self-confidence in learning by combining traditional teaching methods with simulation teaching methods.	Control and randomized clinical trial.	Sample: 34 undergraduate nursing students. Setting: Brazilian Federal Public University.	None identified.	Nurse student's satisfaction and self-confidence in 8 out of 13 markers when traditional teaching methods were combined with simulation training.	Combined use if traditional education methods and simulation is a preferred and effective way to teach nursing students.	Level: I Quality: B Worth to practice: Simulation is a useful teaching tool for nursing students.
Ngo, D., Vu, C., Nguyen, T., Sotolongo, P., Talati, M., Zahabi, N., & Platt, K. (2020). The Effect of Mock Code Blue Simulation and Dedicated						

Purpose of Article or Review	Design/ Method	Sample/ Setting	Conceptual Framework	Findings	Conclusions	Critical Appraisal Tool and Rating/Worth to Practice
Advanced Cardiac Life Support Didactics on Resident Perceived Competency. Cureus, 12(11). https://doi10.7759/cureus.11705						
To use simulation as a training tool to improve Residents perceived levels of confidence.	Quality Improvement Study	Sample:19 Residents. Setting: Acute care hospital	None identified	Residents reported improved levels of confidence with an increase from 31.6% - 58.3% and 15.8% - 20.8% for Likert question responses agree and strongly agree on simulation training improved participant confidence levels.	Simulation training classes for Residents improved their overall confidence levels for responding to a code blue within the acute care setting.	Level: V Quality: C Worth to practice: Simulation of code blue scenarios improves confidence levels in Residents.

Appendix B: Kolb's Theory of Experiential Learning



Appendix C: Non-RDO

April 7, 2020

Subject:	RDO KPNC 20 -044
Title:	Code Blue Simulation: Using Airborne PPE

Dear Ms. Shelton:

As a Research Determination Official (RDO) for the [redacted], I have reviewed the documents submitted for the above referenced project. The project does not meet the regulatory definition of research involving human subjects as noted here:

[X] Not Research

The activity does not meet the regulatory definition of research at 45 CFR 46.102(d):

Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

[ ] Not Human Subject

The activity does not meet the regulatory definition of human subjects at 45 CFR 46.102(f):

Human subject means a living individual about whom an investigator conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information.

Therefore, the project is not required to be reviewed by a [redacted] Institutional Review Board (IRB). This determination is based on the information provided. If the scope or nature of the project changes in a manner that could impact this review, please resubmit for a new determination. Also, you are responsible for keeping a copy of this determination letter in your project files as it may be necessary to demonstrate that your project was properly reviewed.

Provide this approval letter to the Physician in Charge (PIC), your Area Manager, and Chief of Service, to determine whether additional approvals are needed.

Sincerely,

Director

Research Compliance and IRB Administration

Financial Conflict of Interest Officer

Appendix D: Organizational Approval

[redacted] [redacted]

July 1, 2020

To Whom it May Concern,

Please accept this letter of approval for Charity Shelton's proposed DNP project, Simulation to Improve Knowledge, Skills, and Confidence in COVID-19 Code Blue. This project is in alignment with the organization's goals for patient care and staff education and engagement. I look forward to seeing how this project benefits the patients and staff and [redacted].

Sincerely,

[redacted]

Appendix E: Simulation Tool/Manuscript

SECTION I: SCENARIO OVERVIEW

Scenario Title:	COVID-19 Code Blue
Original Scenario Developer(s):	Charity Shelton
Date - original scenario	November 14, 2020
Validation:	January 28, 2021 T. Murray, MSN, RN, RN-BC (Informatics), NEA-BC
Revision Dates:	
Pilot testing:	February 9, 2021
QSEN revision:	January 28, 2021

Estimated Scenario Time: 20 Minutes Debriefing time: 30 Minutes.

Target group: Registered Nurses (med surg/med tele, Respiratory Therapists, Physicians

Core case: Respiratory distress with deteriorating COVID-19 positive patient on the medical surgical/ telemetry unit, resulting in code blue.

QSEN/IOM Competencies: Patient-Centered Care, Teamwork and Collaboration, Evidenced-based Practice, Safety.

Brief Summary of Case: A 71-year-old male with confirmed COVID-19 is on the medical surgical/ telemetry unit. Patient length of stay is 2 days. During dayshift nurse assessment, patient is shown to have a fever, cough, chest pain 4/10 and difficulty breathing. Patient history shows he was at a family event 9 days ago where 2 people have since tested positive for COVID. Patient medical background shows hypertension, diabetes type 2, chronic kidney disease, and obesity. Patient's physician has not rounded yet for the day. Vital signs: 170/90, heart rate, sinus tachycardia 120, respirations 24/min, temperature 103.5 Fahrenheit, O2 sat 87% on 8L nasal cannula. As the nurse continues her assessment, the patient becomes less responsive and becomes pulseless with no respiratory effort with a Junctional/PEA rhythm. The nurse calls for the code blue team to come to the room.

EVIDENCE BASE / REFERENCES (APA Format)
American College of Emergency Physicians. (2021). ACEP COVID-19 Field Guide. Lab Abnormalities. https://www.acnp.org/corona/covid-19-field-guide/assessment/laboratory-abnormalities/
American Heart Association. (2020). Advanced Cardiovascular Life Support Provider Manual. First American Association Printing
American Heart Association. (2020). Basic Life Support Provider Manual. First American Association Printing
Centers for Disease Control and Prevention. (2020). Using Personal Protective Equipment (PPE). https://www.cdc.gov/coronavirus/2019-ncov/hcp/using-ppe.html
Quality and Safety Education for Nurses, QSEN Institute. (2020). Graduate QSEN Competencies. https://qsen.org/competencies/graduate-ksas/

SECTION II: CURRICULUM INTEGRATION

A. SCENARIO LEARNING OBJECTIVES
Learning Outcomes
1. Recognize patient is clinically deteriorating.
2. Don and Doffing appropriate PPE. Following CDC guidelines
3. Perform interventions per ACLS guidelines.
4. Clear communication between code blue team members
Specific Learning Objectives (QSEN tip – select objectives from Competency KSA)
1. Follows infection prevention guidelines for hand hygiene and donning and doffing of appropriate PPE
2. Identifies patient in distress
3. Gathers appropriate information on patient condition to successfully intervene
4. Recognize the need to call for additional help
5. Ensure all equipment is readily available for intubation
6. Adhere to ACLS algorithms and AHA/ACCF guidelines for leading resuscitation efforts during a code blue
7. Demonstrate effective leadership, commutation, and teamwork during a code blue
8. Perform timely interventions for resuscitation and evaluate their effectiveness
9. Perform a team debrief post code blue
Critical Learner Actions
1. Perform hand hygiene and proper donning of appropriate PPE
2. Identifies patient is in distress, notes patient's vital signs and unresponsiveness
3. Activates a code blue response team
4. Assures crash cart, PAPR cart, and glide scope arrive to room
5. Observer checking code blue team's compliance with donning PPE
6. Follows ACLS guidelines for resuscitation
7. Timely compressions, medication administration, and defibrillation
8. Accurate recognition of cardiac rhythms
9. Perform proper offing of PPE when leaving patient room
10. Perform post code blue debrief

B. PRE-SCENARIO LEARNER ACTIVITIES	
Prerequisite Competencies	
Knowledge	**Skills/ Attitudes**
❑ How to activate code blue response team	❑ Recognition of cardiac/respiratory arrest
❑ Location of emergency equipment	❑ ACLS protocol for code blue
❑ Infection control guidelines and recommendations for donning and doffing of PPE	❑ Cardiac rhythm recognition
❑ SBAR Communication	❑ Teamwork and communication in high stress situations
❑	❑ Donning and doffing PPE for COVID-19

SECTION III: SCENARIO SCRIPT

A. Case summary
A 71-year-old male with confirmed COVID-19 is on the medical surgical/ telemetry unit. Patient length of stay is 2 days. During dayshift nurse assessment, patient is shown to have a fever, cough, chest pain 4/10 and difficulty breathing. Patient history shows he was at a family event 9 days ago where 2 people have since tested positive for COVID. Patient medical background shows hypertension, diabetes type 2, chronic kidney disease, and obesity. Patient's physician has not rounded yet for the day. Vital signs: 170/90, heart rate, sinus tachycardia 120, respirations 24/min, temperature 103.5 Fahrenheit, O2 sat 87% on 8L nasal cannula. As the nurse continues her assessment, the patient becomes less responsive and becomes pulseless with no respiratory effort with a ventricular fibrillation rhythm. The nurse calls for the code blue team to come to the room. Learners will active the code blue response team. Learners will don PPE as entering room while primary RN initiates chest compressions. Learners will identify a shockable rhythm and administer shock per defibrator guidelines. Orders will be given for epinephrine 1mg IV, and to continue chest compressions for 2 minutes. During cycle, patient will be intubated. Learners will receive orders for amiodarone 300 mg IV. After 3 cycles of chest compressions, defibrillation, and drug therapy, patient found to be asystole and code is terminated. Once code is terminated, learners will doff PPE appropriately and exist room to conduct post code debrief.

B. Key contextual details
Day Shift, 0800.

C. Scenario Cast		
Patient/ Client	❑ High fidelity simulator	
	❑ Mid-level simulator	
	❑ Task trainer	
	❑ Hybrid (Blended simulator)	
	❑ Standardized patient/participant	
Role	Brief Descriptor	SP/Actor (SP/A) or Learner (L)
Primary Nurse	Enters room to conduct nursing assessment. Activates code blue	(L)
Code Team	Enters room, receives SBAR communication of event and performs code blue response	(L)

D, Patient/Client Profile

Last Name:	Williams		First Name:	George
Gender: Male	Age: 71	Ht: 5'11"	Wt: 256 lbs	Code Status: Full Code
Spiritual Practice: N/A		Ethnicity: African American		Primary Language spoken: English

1. Past history

Patient history shows he was at a family event 9 days ago where 2 people have since tested positive for COVID. Patient medical background shows hypertension, diabetes type 2, chronic kidney disease, and obesity

Primary Medical Diagnosis	COVID-19 Disease

2. Review of Systems

CNS	Within normal limits
Cardiovascular	Sinus tachycardia, HR 120. BP 170/90
Pulmonary	Short breath, bilateral crackles, O2 87% 8L nasal cannula
Renal/Hepatic	Within normal limits
Gastrointestinal	Within normal limits
Endocrine	Within normal limits
Heme/Coag	Mild thrombocytopenia
Musculoskeletal	Generalized weakness
Integument	Skin moist and intact
Developmental Hx	Normal
Psychiatric Hx	None
Social Hx	Married, 3 adult children. No alcohol lor drug use
Alternative/ Complementary Medicine Hx	None

Medication allergies:	None	Reaction:	
Food/other allergies:	None	Reaction:	

3. Current medications

Drug	Dose	Route	Frequency
Remdesivir	100mg	IV	Q24 hours
Oxygen therapy for maintaining O2 saturation greater than 90%			
Lisinopril	20mg	PO	Q24 hours
Metformin HCL	1,000mg	PO	BID
Acetaminophen 650mg	650mg	PO	Q4 hours PRN temperature greater than 100.5 Fahrenheit

4. Laboratory, Diagnostic Study Results

Na: 136	K: 3.4	Cl:	HCO3:	BUN: 30	Cr: 1.5
Ca:	Mg:	Phos:	Glucose: 132	HgA1C: pending	
Hgb: 13.6	Hct: 39.4	Plt: 343	WBC: 11.7	ABO Blood Type:	
PT: 13.5	PTT: 55	INR: 2.4	Troponin: 0.12	BNP: 150	

ABG-pH:	paO2:	paCO2:	HCO3/BE:	SaO2: 90	
VDRL:	GBS:	Herpes:	HIV:	Cxr: Patchy alveolar disease noted bilaterally in lower lobes	EKG: Sinus Tachycardia

E. Baseline Simulator/Standardized Patient State (This may vary from the baseline data provided to learners)					
1. Initial physical appearance					
Gender: Male		Attire: Patient hospital gown			
<u>Alterations in appearance (moulage)</u>:					
X	ID band present, accurate		ID band present, inaccurate		ID band absent or not applicable
	Allergy band present, accurate		Allergy band inaccurate	X	Allergy band absent or N/A

2. Initial Vital Signs Monitor display in simulation action room:					
	No monitor display	X	Monitor on, but no data displayed		Monitor on, standard display

BP: 170/90	HR: 120	RR: 24	T: 103.5	SpO^2: 87
CVP:	PAS:	PAD:	PCWP:	CO:
AIRWAY:	$ETC0^2$:	FHR:		
Lungs: Sounds/mechanics	Left: Crackles at base	Right: Crackles at base		
Heart:	Sounds: No Murmur, rate accelerated			
	ECG rhythm:		Sinus Tachycardia	
	Other:			
Bowel sounds:	Within normal limits		Other:	

3. Initial Intravenous line set up

X	**Saline lock #1**	Site:					IV patent (Y/N)
X	**IV #1**	Site: Left forearm		Fluid type: Remdisivir 100mg	Initial rate: 100mg/hr		IV patent (Y/N): Yes
	Main						
X	Piggyback						
	IV #2	Site:		Fluid type:	Initial rate:		IV patent (Y/N)

	Main						
	Piggyback						

4. Initial Non-invasive monitors set up					
X	NIBP		ECG First lead:		ECG Second lead:
X	Pulse oximeter	X	Temp monitor/type		Other:

5. Initial Hemodynamic monitors set up					
	A-line Site:		Catheter/tubing Patency (Y/N)	CVP Site:	PAC Site:

6. Other monitors/devices					
	Foley catheter	Amount:		Appearance of urine:	
	Epidural catheter		Infusion pump:	Pump settings:	
	Fetal Heart rate monitor/tocometer			Internal	External

Environment, Equipment, Essential props

Recommend standardized set ups for each commonly simulated environment

1. Scenario setting: (example: patient room, home, ED, lobby)
Medical Surgical/Telemetry in patient room at an acute health care setting

2. Equipment, supplies, monitors
(In simulation action room or available in adjacent core storage rooms)

X	Bedpan/ Urinal		Foley catheter kit		Straight cath. kit	X	Incentive spirometer
X	IV Infusion pump		Feeding pump	X	Pressure bag	X	Wall suction
	Nasogastric tube	X	ETT suction catheters	X	Oral suction catheters		Chest tube kit
X	Defibrillator	X	Code Cart	X	12-lead ECG		Chest tube equip
	PCA infusion pump		Epidural infusion pump	X	Central line Insertion Kit		Dressing Δ equipment
X	IV fluid Type: Normal Saline		IV fluid additives:				Blood product ABO Type: # of units:

3. Respiratory therapy equipment/devices							
X	Nasal cannula	X	Face tent	X	Simple Face Mask	X	Non re-breather mask
X	BVM/Ambu bag		Nebulizer tx kit	X	Flowmeters (extra supply)		

4. Documentation and Order Forms							
X	Health Care Provider orders		Med Admin Record	X	H & P	X	Lab Results
X	Progress Notes		Graphic record		Anesthesia/PACU record		ED Record
	Medication reconciliation		Transfer orders		Standing (protocol) orders		ICU flow sheet
X	Nurses' Notes		Dx test reports	X	Code Record		Prenatal record

	Actual medical record binder, constructed per institutional guidelines		Other Describe:

5. Medications (to be available in sim action room)								
#	Medication	Dosage	Route		#	Medication	Dosage	Route
1	Epinephrine	1mg	IV					
2	Amiodarone	300mg	IV					
3	Normal Saline	1-liter bag	IV					

Case Flow / Triggers/ Scenario Development States			
Initiation of Scenario: Primary RN enters room 4033 to do morning nursing assessment. PPE cart is outside of room for RN to don. Patient, Mr. George Williams, is lying in bed. Mr. Williams was admitted for COVID-19 disease they day prior. Pt history: George Williams is a 71-year-old male who tested positive for COVID-19 after attending a family event 9 days ago. He has a history of hypertension, diabetes type 2, chronic kidney disease, and obesity.			
State / Patient Status	**Desired learner actions & triggers to move to next state**		
1. Baseline Patient is lying in bed with HOB elevated to 30 degrees. Patient is diaphoretic with labored respirations. Patients tells nurse he doesn't feel good and can't breathe.	**Operator** BP – 170/90 HR – 120 Resp – 24 T – 103.5 F. O2 saturation 87% 8L **Triggers:** Vital signs and assessment to be completed within 5 minutes	**Learner Actions** 1. Appropriately completes hand hygiene and donning of PPE prior to going into patient room 2. Introduces self and checks patient arm band 3. Completes nursing assessment, obtains vital signs 4. Formulates and verbally plans for next steps to take for patient.	**Debriefing Points:** 1. Strategies for adhering to CDC guidelines for donning PPE. 2. Identifying abnormal vital signs and possible risks associated with them. 3. Factors involved in performing a nursing assessment on patient. What benefit knowledge is gained 4. Based on assessment what are next actions the learning is considering? Why chose those actions?
State / Patient Status	**Desired actions & triggers to move to next state**		
2. After assessment, patient continues to state, "I don't feel good" and becomes unresponsive.	**Operator:** Cardiac Rhythm - VFib	**Learner Actions:** 1. Identifies patient is unresponsive 2. Activates Code Blue Team 3. Begins BLS standard while waiting for team to arrive	**Debriefing Points:** 1. Significance of early activation of Code Blue Team 2.Significance of early implementation of BLS standards

	Triggers: Activities completed in under 5 minutes		3. Importance of communication that will need to be shared when team arrives
STATE / PATIENT STATUS	**DESIRED ACTIONS & TRIGGERS TO MOVE TO NEXT STATE**		
3. Code Blue Team arrives to unit	**Operator:** Cardiac rhythm continues to be VFib **Triggers:** Activities completed in 5 minutes	**Learner Actions:** 1. Team members bring code blue cart and PAPR cart to room. 2. Team members don PPE prior to entering 3. Primary RN provides SBAR to team on patient events 4. Team takes over and begins ACLS interventions	**Debriefing Points:** 1. Significance of teamwork in high stress and critical situations 2. Significance of using SBAR to communicate to code team members 3. Strategies and importance of performing rapid interventions (chest compressions, defibrillation, medication) 4. Strategies for ensure all team members appropriately don PPE prior to entering room 5. Strategies for ensuring all equipment needed is brought to the room

State / Patient Status	**Desired Actions & Triggers to move to next state**		
4. Three rounds of chest compressions, defibrillation, and medications have occurred. Patient is asystole	**Operator:** HR – 0 Resp – 0 Rhythm - asystole **Triggers:** Activities completed in less than 2 minutes	**Learner Actions:** 1. Team lead recognizes patient is asystole 2. Team lead decides to end the code 3. Time of death recorded 4. Team doffs PPE appropriately 5. Team performs post code blue debrief	**Debriefing Points** 1. Rationale for ending code blue 2. Strategies for adhering to CDC guidelines for doffing PPE 3. Strategies for debriefing after high stress and critical situations
Scenario End Point: Patient is pronounced deceased, and team leaves the room to debrief.			
Suggestions to <u>decrease</u> complexity: Patient only has a respiratory arrest and not both cardiac and respiratory			

Suggestions to increase complexity: Patient can be found unresponsive in the prone position, PAPR cart is not readily available, too many people respond to the code blue

HEALTH CARE PROVIDER ORDERS

Patient Name: **DOB:** **Age:** **MR#:**	**Diagnosis:**

☐ No Known Allergies
☐ Allergies & Sensitivities

Date	Time	**HEALTH CARE PROVIDER ORDERS AND SIGNATURE**

Signature		

APPENDIX B: Digital images of manikin and/or scenario milieu	
Insert digital photo here	**Insert digital photo here**

Insert digital photo here	**Insert digital photo here**

DEBRIEFING GUIDE

General Debriefing Plan			
☐ Individual	x☐ Group	☐ With Video	☐ Without Video
Debriefing Materials			
x☐ Debriefing Guide	x☐ Objectives	☐ Debriefing Points	x☐ QSEN

QSEN Competencies to consider for debriefing scenarios		
x☐ Patient Centered Care	x☐ Teamwork/Collaboration	x☐ Evidence-based Practice
x☐ Safety	x☐ Quality Improvement	☐ Informatics

Sample Questions for Debriefing

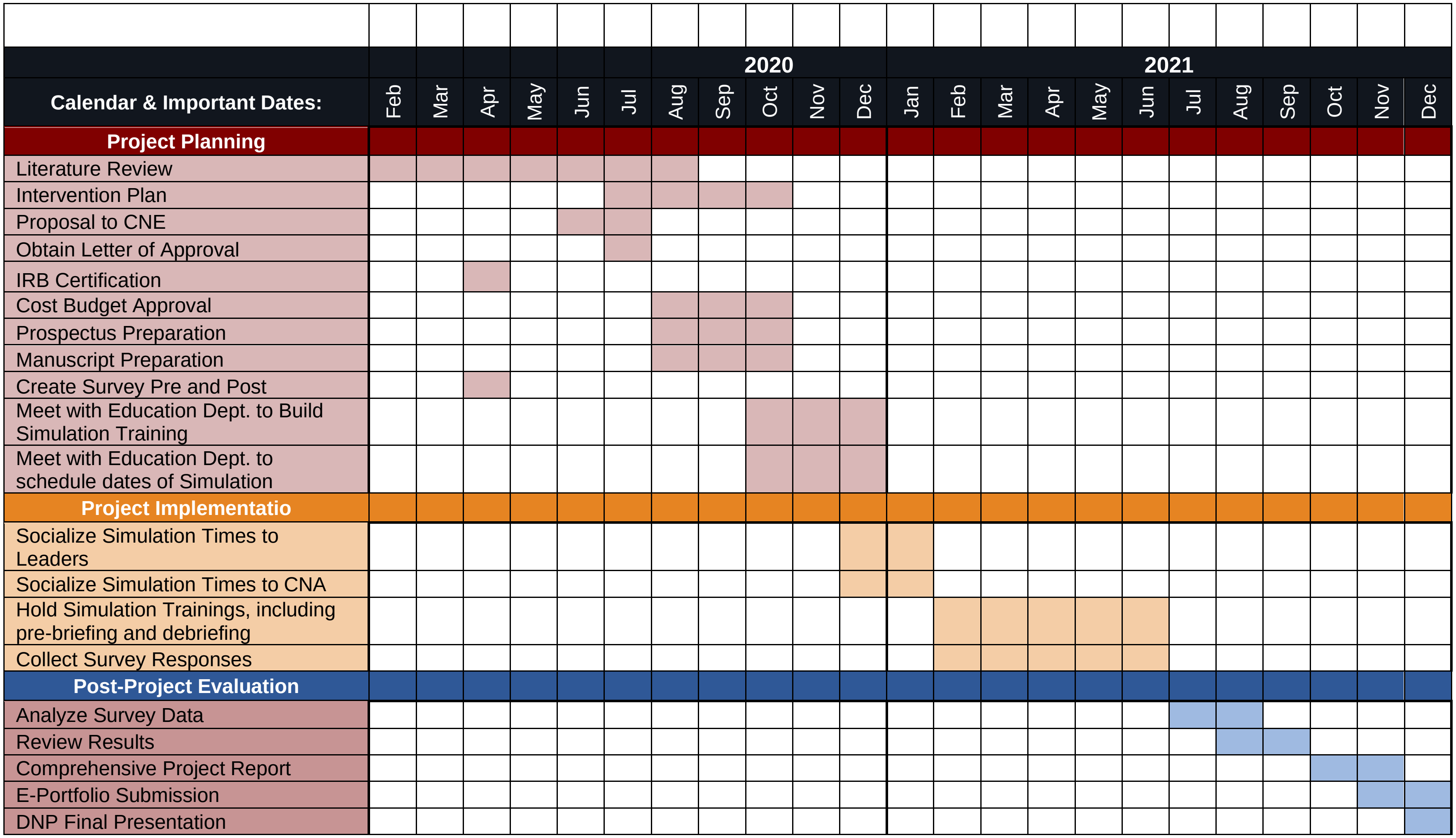
1. How did the experience of caring for this patient feel for you? the team?
2. How would you handle the scenario differently if you could?
3. In what ways did you perform well?
4. How did you validate the ACCURACY of the data you were provided? (QSEN Safety)
5. What communication strategies did you use to validate ACCURACY of your information? (QSEN Safety)
6. What communication strategies did you use to create a shared mental model for decision making with your team members? (QSEN Teamwork/Collaboration)
7. At what points in the scenario were your nursing actions specifically directed toward PREVENTION of a negative outcome? (QSEN Safety)
8. Discuss actual experiences with diverse patient populations. (QSEN Patient-centered Care)
9. Discuss roles and responsibilities during a crisis. (QSEN Teamwork/Collaboration, Safety)
10. Discuss how current nursing practice continues to evolve in light of new evidence. (QSEN Evidence-based Practice)

11. Describe actual and potential safety risks and how to mitigate them. (QSEN Safety) 12. Discuss the nurses' role in design, implementation, and evaluation of information technologies to support patient care. (QSEN Informatics; Evidence-based Practice) 13. Did you have the knowledge and skills to provide the care needed for this patient? (QSEN Quality Improvement) 14. What GAPS did you identify in your own knowledge base and/or preparation for the simulation experience? 15. How did you attempt to fill in your knowledge GAPS? Did you access evidence-based practice protocols? (QSEN Evidence-based Practice) 16. What three factors were most SIGNIFICANT that you will transfer to the clinical setting?
Notes for future sessions:

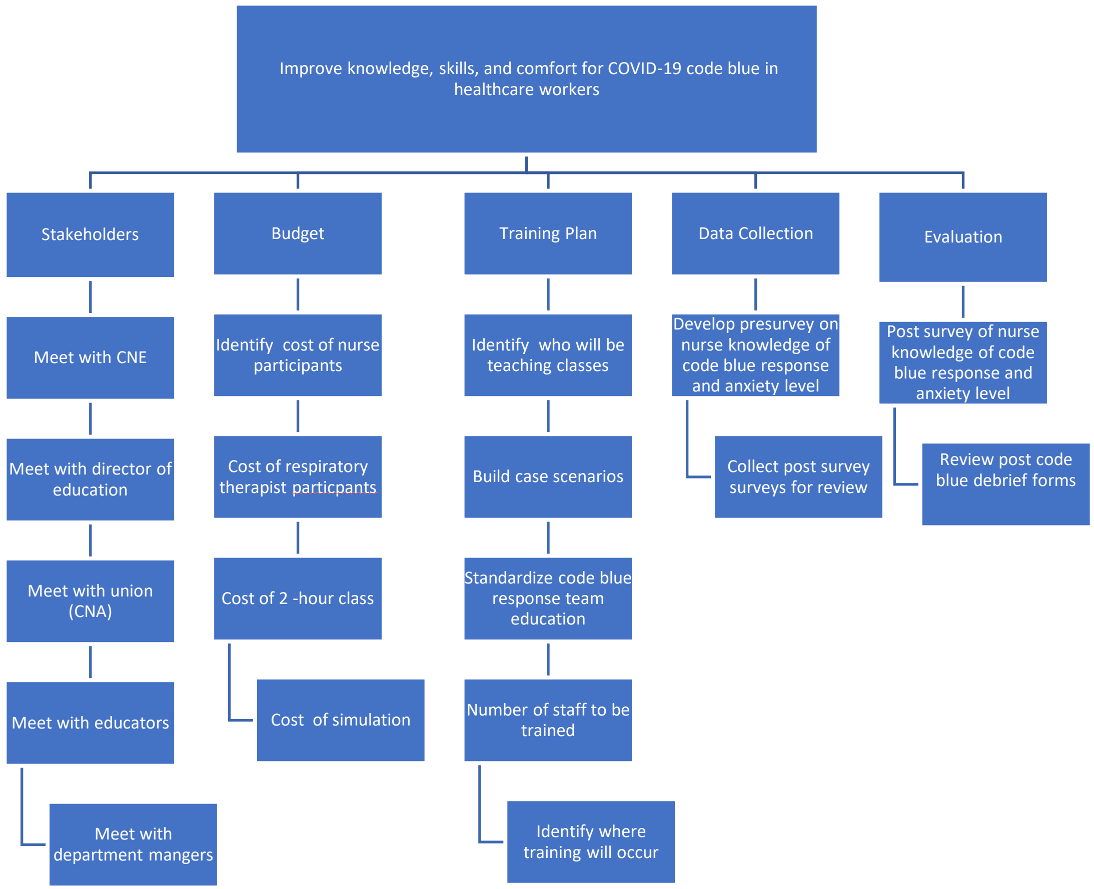
Appendix F: Gap Analysis

Reference Number	Item	Current State	Desired State	Assigned To	Action Item	Priority	Risks	Complete
1	No standard education on how to respond to code blue	Code blue education is limited. Current responders have BLS training, some with ACLS training	Standard education training sessions on how to respond to code blue be given to responders	Clinical Education Department/Charity Shelton	Create code blue training manual	High	Lack of commitment from education department. Time constraints and competing priorities	No
2	Simulation equipment not utilized	Education department currently does not use the simulation equipment on hand	Simulation equipment will be used to train responders to code blue	Clinical Education Department	Educators to be proficient in using simulation for training	High	Lack of commitment to using simulation	No
3	No standard donning and doffing of PPE training	Inconsistent training of donning and doffing done. Not given to all responders	Standard training of donning and doffing of PPE for responders	Clinical Education Department/Charity Shelton	Create training tools for donning and doffing of PPE	High	Lack of commitment to provide resources for training	No

Appendix G: Gantt Chart



Appendix H: Work Breakdown Structure

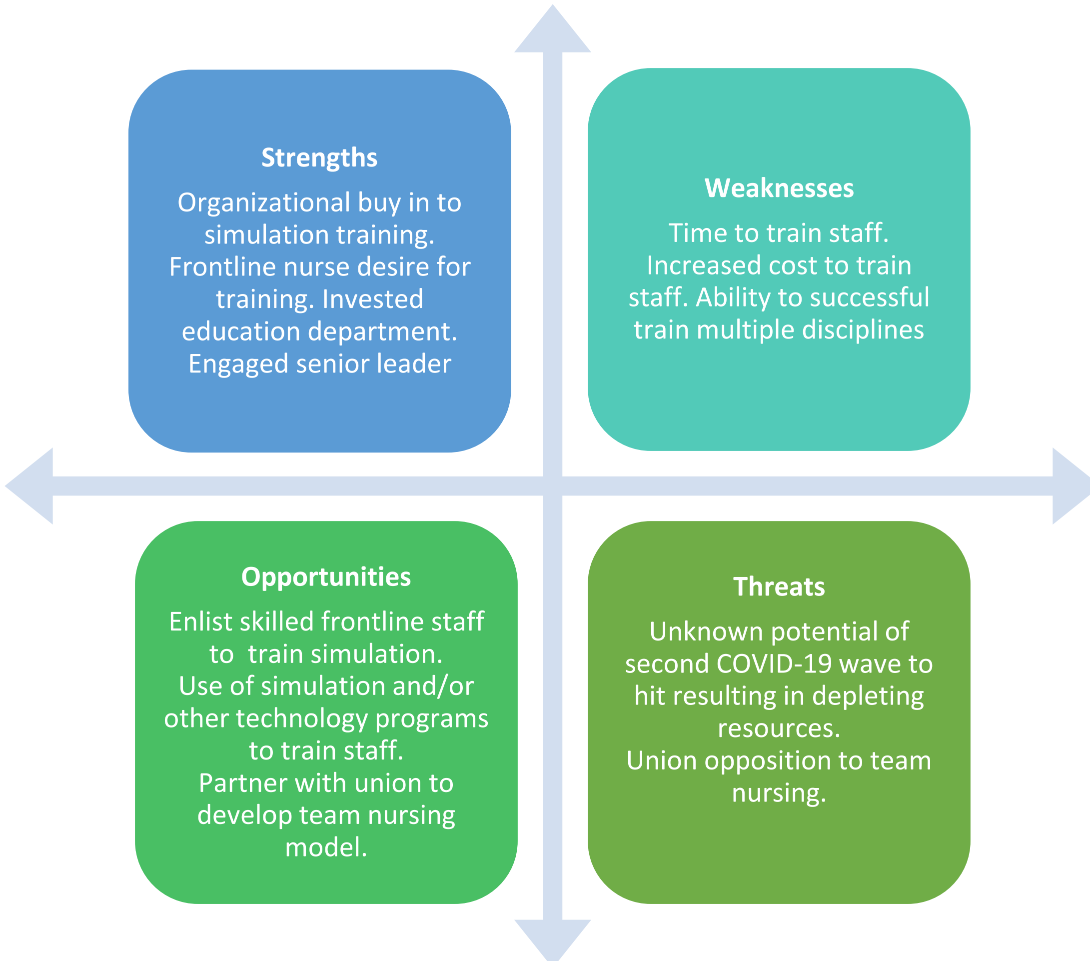


Appendix I: Communication Plan

Communication Type	Deliverable	Description	Delivery Method	Frequency	Owner	Audience
Meeting	Establish approval for DNP project. Present monthly updates on project	Project introduction & updates & timelines	In-Person & Virtual Teams	Monthly	C. Shelton	Chief Nurse Executive
Meeting	Present project agenda and goals	Project introduction & updates & timelines	In-Person & Virtual Teams	Monthly	C. Shelton	Director of Education
Meeting	Present project agenda and goals	Meet with team to discuss project	In-Person & Virtual Teams	Monthly	C. Shelton	Clinical Educators
Meeting	Present project agenda and goals	Meet with team to discuss project	In-Person & Virtual Teams	Monthly	C. Shelton	Department Nurse Managers
Meeting	Present project agenda and goals	Meet with representative to discuss project	In-Person & Virtual Teams	Monthly	C. Shelton	CNA Nurse Representative
Meetings/Email	Project Plan & Timeline	Discussion on progress of project	Zoom Meetings	Biweekly and Ad Hoc	C. Shelton	DNP Committee Chair

Email	Project Plan & Timeline	Discussion on progress of project	Email	As needed/Defined by DNP Chair	C. Shelton	DNP Project Committee

Appendix J: SWOT Analysis



Appendix K: Budget

Cost of nurse educator per hour	Cost of director per hour	hrs planning 48 director, 3 educator	Educators	Director			**Expense**
$120.00	$142.00	51.00	3	1			**$7,176.00**
Cost of nurse educator per hour	Hours for simulation training class	Educators	Nurses	Nurse cost	Resp. Therapist	Resp. Therapist cost	**Expense**
$ 120.00	16.00	3.00	40	$120.00	8	$ 86.00	**$16,736.00**
Supplies (misc)							**Expense**
$100.00							**$100.00**
Total Expense							**$24,012.00**
* Salaries based on organizational data. Benefits included. Participants expected 40 nurses, 8 respiratory therapists							

Appendix L: Cost Avoidance:

COVID-19 positive ee	**Cost for ee to work 2 weeks**	**Replacement cost with OT**	**Cost avoidance**	**Total cost avoidance**
1	$1,198.40	$1,797.60	$599.20	
2	$2,396.80	$3,595.20	$1,797.60	
3	$3,595.20	$5,392.80	$1,797.60	
CPR Injuries				$1,797.60
1	$1,435.24		$1,435.24	
2	$2,870.48		$2,870.48	
3	$4,305.72		$4,305.72	$4,305.72
Cost for simulation facility outside of organization			**$15,600.00**	$15,600.00
				$21,703.32

Appendix M: Proforma

COVID-10 Code Blue Simulation	Initial Planning	Year 1	Year 2	Year 3	Total
Cost Avoidance					
Employee Exposure *		$1797.60	$2,396.80	$2,996.00	$7,190.40
CPR Injuries *		$4,305.72	$5,740.96	$7,176.20	$17,222.88
Use of with California State University of Sacramento Simulation lab *		$15,600.00	$15,600.00	$15,600.00	$46,800.00
Total Cost Avoidance		$21,703.32	$23,737.76	$25,772.20	$71,213.28
EXPENSES					
Salaries and Wages (benefits included) *					
Director hours for project development	$5,680.00				
Nurse Educator hours for project development	$360.00				
Nurse Educator hours to conduct simulation Training.		$5,700.00	$5,700.00	$5,700.00	$17,280.00
Nurse staff participation		$9,600.00	$9,600.00	$9,600.00	$28,800.00
Respiratory Therapist participation		$1,376.00	$1,376.00	$1,376.00	$4,128.00
Total Wages	$6,040.00	$16,676.00	$16,676.00	$16,676.00	$56,068.00
Supplies					
Misc. Office		$100.00	$50.00	$50.00	$200.00
Total Supplies		$100.00	$50.00	$50.00	$200.00
Total Expenses	$6,040.00	$16,776.00	$16,726.00	$16,726.00	$56,268.00
Cost-avoidance		$21,703.32	$23,737.76	$25,772.20	$71,213.28
Total Cost Avoidance		($1,112.68)	$7,011.76	$9,046.20	$14,945.28

- Hourly wages based on organizational date with benefits
- Assume 3 exposures avoided 1st year and increasing to 4 for year 2 and 3
- Assume 3 injuries avoided 1st year and increasing to 4 for year 2 and 3
- Assume contract stays same without rate changes for year 1, 2, and 3

Appendix N: Pre and Post Simulation Surveys

Pre-Simulation Survey: COVID-19 Code Blue Simulation

Q1 What is your Profession?

- ○ Registered Nurse (1)
- ○ Physician (2)
- ○ Respiratory Therapist (3)

Q2 If you are a registered nurse, do you work at the bedside?

- ○ Yes (1)
- ○ No (2)

Q3 How long have you been in your profession?

- 5 years or less (1)
- 5-10 years (2)
- greater than 10 years (3)

Q4 What gender do you identify with?

- Male (1)
- Female (2)

Q5 What is your comfort level in participating in COVID-19 code blues?

	Not comfortable (1)	Somewhat comfortable (2)	Moderately comfortable (3)	Comfortable (4)	Very comfortable (5)
	○	○	○	○	○

Q6 If you answered the above question (question #5) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q7 Do you have a clear understanding of your role in a COVID-19 code blue?

	Definitely do not have a clear understanding (1)	Have some understanding (2)	Sometimes have a clear understanding and other times do not (3)	Mostly have a clear understanding (4)	Definitely have a clear understanding (5)
	○	○	○	○	○

Q8 If you answered the above question (question #7) with 1, 2, or 3, please briefly explain your answer? Otherwise, skip to the next question.

Q9 Do you have a clear understanding of all the roles individuals have in a COVID-19 code blue?

	Definitely do not have a clear understanding (1)	Have some understanding (2)	Sometimes have a clear understanding and other times do not (3)	Mostly have a clear understanding (4)	Definitely have a clear understanding (5)
	○	○	○	○	○

Q10 If you answered the above question (question #9) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q11 Do you know what PPE is required to wear in a room caring for a patient that is COVID-19 positive?

	Definitely do not have this knowledge (1)	Have a little knowledge (2)	Have moderate amount of knowledge (3)	Have most of this knowledge (4)	Definitely have this knowledge (5)
	○	○	○	○	○

Q12 If you answered the above question (question #11) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q13 Do you have a clear understanding of the skills needed to don and doff PPE when caring for a patient that is COVID-19 positive?

	Definitely do not have a clear understanding (1)	Have some understanding (2)	Sometimes have a clear understanding and other times do not (3)	Mostly have a clear understanding (4)	Definitely have a clear understanding (5)
	○	○	○	○	○

Q14 If you answered the above question (question #13) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q15 List all individuals that should enter the room during a COVID-19 code blue.

Post-Simulation Survey: COVID-19 Code Blue Simulation

Q1 What is your Profession?

- ◯ Registered Nurse (1)
- ◯ Physician (2)
- ◯ Respiratory Therapist (3)

Q2 If you are a registered nurse, do you work at the bedside?

- ◯ Yes (1)
- ◯ No (2)
- ◯ No (3)

Q3 How long have you been in your profession?

- ○ 5 years or less (1)
- ○ 5-10 years (2)
- ○ greater than 10 years (3)

Q4 What gender do you identify with?

- ○ Male (1)
- ○ Female (2)

Q5 What is your comfort level in participating in COVID-19 code blues?

	None (1)	Little (2)	Moderate (3)	Comfortable (4)	Confident (5)
	○	○	○	○	○

Q6 If you answered the above question (question #5) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q7 Do you have a clear understanding of your role in a COVID-19 code blue?

	Definitely not (1)	Probably not (2)	Might or might not (3)	Probably yes (4)	Definitely yes (5)
	○	○	○	○	○

Q8 If you answered the above question (question #7) with 1, 2, or 3, please briefly explain your answer? Otherwise, skip to the next question.

Q9 Do you have a clear understanding of all the roles individuals have in a COVID-19 code blue?

	Definitely do not have a clear understanding (1)	Have some understanding (2)	Sometimes have a clear understanding and other times do not (3)	Mostly have a clear understanding (4)	Definitely have a clear understanding (5)
	○	○	○	○	○

Q10 If you answered the above question (question #9) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q11 Do you know what PPE is required to wear in a room caring for a patient that is COVID-19 positive?

	Definitely no (1)	Probably not (2)	Might or might not (3)	Probably yes (4)	Definitely yes (5)
	○	○	○	○	○

Q12 If you answered the above question (question #11) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q13 Do you have a clear understanding of how to don and doff PPE when caring for a patient that is COVID-19 positive?

	Definitely do not have a clear understanding (1)	Have some understanding (2)	Sometimes have a clear understanding and other times do not (3)	Mostly have a clear understanding (4)	Definitely have a clear understanding (5)
	○	○	○	○	○

Q14 If you answered the above question (question #13) with 1, 2, or 3, please explain your answer? Otherwise, skip to the next question.

Q15 List all individuals that should enter the room during a COVID-19 code blue.

Appendix O: Descriptive Statistics

What is your Profession?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Registered Nurse	48	37.5	75.0	75.0
	Physician	8	6.3	12.5	87.5
	Respiratory Therapist	8	6.3	12.5	100.0
	Total	64	100.00	100.0	
Total		64	100.0		

How long have you been in your profession?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5 years or less	10	7.8	15.6	15.6
	5-10 years	14	10.9	21.9	37.5
	greater than 10 years	40	31.3	62.5	100.0
	Total	64	100.0	100.0	
Total		64	100.0		

What is your gender?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	13	10.2	20.3	20.3
	Female	51	39.8	79.7	100.0
	Total	64	100.0	100.0	
Total		64	100.0		

Appendix P: Survey Analysis
Comparison of Pre- and Post-Simulation Survey Mean Scores

Question #	Pre-Test Score Mean	Post-Intervention Score Mean	Significance Level
#5	3.17	3.92	0.000
#7	3.91	4.48	0.000
#9	3.73	4.53	0.000
#11	4.52	4.89	0.000
#13	4.33	4.84	0.000
Average Mean for all Questions	3.93	4.53 (13% Improvement)	

Appendix Q: Qualitative Data

	Number of Respondents	Theme
Pre-Q6	17/64	Little to no experience
Post-Q6	4/64	Need more practice
Pre-Q8	5/64	Little to no experience
Post-Q8	0/64	N/A
Pre-Q10	7/64	Little to no experience
Post-Q10	1/64	Need more practice
Pre-Q12	1/64	Little to no experience
Post-Q12	0/64	N/A
Pre-Q14	2/64	Little to no experience
Post-Q14	0/64	N/A
Pre-Q15	43/64	Able to identify primary code team members with minimal errors. Reinforcement on number of people in a room
Post-Q15	23/64	Minimal errors in identifying code team members. Needs Reinforcement.

Appendix R: Results of Donning and Doffing Observations

Pre-simulation Observations of Donning/Doffing	Correct protocol followed	Errors in following protocol	% of errors to total observations	
42	34	8	19%	
Post-simulation Observations of Donning/Doffing	Correct protocol followed	Errors in following protocol	% of errors to total observations	
21	17	2	9%	
Total Improvement/Reduction in % of Errors			**10%**	

Appendix S: Comparison of Pre- and Post-Simulation Times for First Compression, First Defibrillation, and First Dose of Epinephrine
(n=4 cases)

Cases	Time to 1st Compression	Time to 1st Defibrillator	Time to 1st dose Epinephrine	
1 (pre-simulation)	1 minute	27 minutes	28 minutes	
2 (pre-simulation)	1 minutes	12 minutes	6 minutes	
Average (Pre)	**1 minute**	**19.5 minutes**	**17 minutes**	
1 (Post-simulation)	1 minute	N/A	3 minutes	
2 (Post-simulation)	2 minutes	10 minutes	5 minutes	
Average (Post)	**1.5 minutes**	**10 minutes**	**4 minutes**	
Total Improvement	**(33 %)**	**48%**	**76%**	**30%**