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This is to certify that the doctoral study by

Pamela Joy Corey

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Walden University
2016

Abstract

The Effectiveness of Adult and Pediatric Code Blue Simulation-Based Team Trainings

by

Pamela Joy Corey

MSN, Walden University, 2008

BSN, Graceland College, 1992

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

October 2016

Abstract

The adult and pediatric healthcare providers at a New England medical center attended simulation training for responding to cardiac arrests that incorporated the current American Heart Association (AHA) evidence-based standards. The purpose of this concurrent mixed method program evaluation was to compare the adult code blue and pediatric team training programs to the AHA's standards and identify if the staff learned the necessary skills to care for patients in cardiac arrest. The conceptual models used for the study were Crisis Resource Management and the transfer of learning model. The study sample was 660 adult and 269 pediatric healthcare providers who participated in both programs between 2012 and 2015. The research questions explored how the adult and pediatric programs compared, if they provided staff with necessary skills to care for cardiac arrests using current standards, and the staff perceptions of program effectiveness and barriers encountered. The data were collected using evaluation and observation forms and needs-assessment surveys. A chi square analysis identified differences between the programs on staff preparedness and transfer of knowledge into practice. The coding of the qualitative data identified themes from the participants' perceptions on program design. Results prompted a program and curriculum redesign to include multiple opportunities to allow staff to learn and practice skills for low volume high acuity situations. The study promotes social change by giving healthcare providers opportunities to translate evidence-based training into clinical practice. The ability to function effectively as a team in a crisis improves patient outcome and potentially reduces mortality and morbidity within the institution and community. Simulation education also improves staff confidence in performance of low volume and high acuity situations.

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Dedication

I would like to dedicate this work to those who supported me unconditionally throughout this long journey. Thank you to my husband, Philip, and my children, David and Liz. Their sacrifices during this time allowed me to concentrate and complete this project and degree. Your love and support made me succeed.

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Section 1: The Problem

The Local Problem

Even with the advances in technology and knowledge, a significant number of people worldwide succumb to sudden cardiac events. According to Ahern et al. (2011), more than 135 million people worldwide die annually from cardiovascular events. Survival of the hospitalized patient receiving cardiopulmonary resuscitation (CPR) varied depending on factors such as the quality of the CPR, the location within the hospital, and time of the day (Meaney et al., 2013). Standards to ensure the best patient outcome include monitoring team performance in providing high-quality CPR (Meaney et al., 2013). Therefore, quality outcomes depend on well-trained staff training practicing and maintaining their skills.

Teams, consisting of medical, nursing, and professional ancillary professionals need specific knowledge and skills for responding effectively to patient emergencies. The Robert Wood Johnson Foundation (2011) discovered that collaborative training was not available or offered to the majority of healthcare providers. Until the recent integration of the interprofessional core competencies, healthcare professionals received minimal exposure in collaborative practice before graduation (Interprofessional Education Collaborative Panel [IPEC], 2011). IPEC defined a team as a small group of interprofessional healthcare providers working together towards a defined patient goal (IPEC, 2011). Examples of these interprofessional teams included a patient's primary care team or the code blue and rapid response teams.

Patient outcomes improved when team-based training reinforced collaborative practice and provided necessary skills. Jones Medical Center's (pseudonym) educational activities included simulation-based programs for the different subspecialty teams who cared for the patient in crisis. Jones Medical Center's code team training consisted of two models. One model offered multiple sessions over a 4-week period twice yearly, and the other model provided sessions on a repeated schedule throughout the year.

Jones Medical Center's code programs focused on developing teamwork, role responsibility, and communication; the core competencies of collaborative practice and interprofessional education defined by IPEC (2011). Understanding team roles and communicating effectively in the care of the patient resulted in highly effective teams and decreased adverse outcomes (Salas & Rosen, 2013). However, what remains unknown was whether the presence of an educational program ensured sustained transfer of knowledge, skills, and behaviors to the clinical environment.

The purpose of this mixed method, goal based, program evaluation was to examine Jones Medical Center's recent adult code blue and pediatric team training programs and compare these programs to both the current literature and established professional standards on the topic. Also, an exploration of the participants' perception of learning transfer from the activity to practice, sustained skill retainment, and perceived and actual barriers to participation in the program occurred.

Definition of the Problem

Though the medical center provided sporadic, multidisciplinary, and basic life support (BLS) staff training, but barriers remained to prevent full team participation. The

largest barrier was scheduling conflicts that prevented the bedside practitioners from attending trainings. Skilled staff are essential for positive patient outcomes in emergent situations. The barriers that prevented team participant attendance at the training should be identified through an evaluation of both the adult and pediatric team training programs at Jones Medical Center. Also, the research review describes how staff needed frequent opportunities to practice the newly learned skills to remain competent.

Jones Medical Center is a New England academic teaching hospital licensed for over 400 beds serving the local urban community. The medical center serves a multicultural and immigrant patient population where 53% of the patients classified as minority and 35% of the patients received public insurance or free care (United States Census Bureau, 2014). The medical center employs over 6,000 full-time staff and collaborates with a major school of medicine for 44 residency tracks. Multiple schools of nursing, pharmacy, and other allied health programs utilize the medical center for student clinical experiences. Jones Medical Center, a Level 1 trauma center, provides a full scope of services including pediatric and maternity care.

Medical center staff who care for a diverse patient population need adequate training for any potential situations they may encounter. Team training provided participants the knowledge, skills, and attitudes necessary to provide safe, evidence-based patient care. To provide staff these skills, Jones Medical Center developed two models of simulation-based programs for code team education. One simulation-based program was for the adult internal medicine team (adult code blue program) while the other simulation-based program was for the pediatric medicine team (pediatric team training

program). These programs adhered to the then current 2010 American Heart Association's (AHA) recommendations for advanced cardiac care training by incorporating the Advanced Cardiac Life Support (ACLS) standards for adults and Pediatric Life Support (PALS) standards for the pediatric patients throughout the curricula (Mancini et al., 2010; Peberdy et al., 2010). Additionally, both programs incorporated concepts from Crisis Resources Management (CRM) to improve team functioning in an emergency (Boet et al., 2014; Fanning, Goldhaber-Fiebert, Undani, & Gaba, 2013; Sundar et al., 2007). Effective simulation-based curricula design required active participation for all participants and that they performed within their professional role in the simulated scenario (Meakim, Fey, Chmil, Mariani, & Alinier, 2015). This design concept stresses entire team presence during each learning session.

The participants in the adult code blue program included internal medicine residents, anesthesiologists, pharmacists, respiratory therapists, and inpatient nursing staff. The participants of the pediatric team training program included the pediatric residents, nursing staff, and respiratory therapy staff. Medical students occasionally attended the programs. The goals of both programs were to increase medical knowledge and teamwork skills for team response to code blue cardiopulmonary arrests. The importance for all providers to know these emergent situation skills was crucial; for all bedside clinicians assist in patient care after the specialized code team arrived at Jones Medical Center.

Education for professional healthcare practitioners includes prelicensure clinical training followed by residencies and institutional discipline specific orientation (IPEC,

2011). These institutional educational activities provided minimal collaborative practice skills needed to practice effectively postlicensure (IPEC, 2011). The ability to function effectively in collaborative practice depended on prior experiences (Tarantinos, Chalkias, Giotakis, & Xanthos, 2014). Exposures to different situations varied by the individual provider's patient care experience during prelicensure clinical and residency period.

Today, most bedside practitioners lack exposure to the high risk, low volume situations resulting in cardiopulmonary arrests. The incorporation of Rapid Response Teams (RRTs) further reduced staff participation in high-risk patient emergencies (Beitler, Link, Bails, Hurdle, & Chong, 2011). The interception of decompensating patients with earlier interventions by RRTs before cardiopulmonary arrests reduced mortality (Beitler et al., 2011; Kotsakis et al., 2011). Jones Medical Center has both RRTs and code blue teams responding to emergent patient situations.

Patient survival from a cardiopulmonary arrest relies on effective team functioning and individual performance during emergency procedures, from quality BLS to skilled tracheal intubation (Meaney et al., 2013). The quality of an individual's performance within the code team correlated to their number of previous similar experiences (Tarantinos et al., 2014). Those without experience performed less than ideally (Knight et al., 2014). Providers trained as a team increased their skills in providing emergency patient care (Fanning et al., 2013). The medical center's adult medicine code blue and pediatric team training model provided limited opportunities for practice of essential skills needed during an emergency response.

Jones Medical Center's vision states all employees provide high-quality, comprehensive patient care in a financially and ethically sound manner, "Exceptional Care, without exception" (www.[redacted].org). The team leader's ability for rapid decision-making, combined with individual team members' communication skills during resuscitation, affected patient outcomes (Meaney et al., 2013). Highly functioning teams established clear role expectations and required individual member proficiency with the equipment and medications (Dorney, 2011). Therefore, team-based training allows staff to achieve this level of skill.

Team training expenses include more than instructor salary and space procurement. Collaborative practice training costs include clinical coverage as well as staff tuition for courses such as ACLS and PALS provided outside the institution (Yeng et al., 2012). Competent staff training consisted of more than the initial teaching of knowledge and skill (Meaney et al., 2013). Jones Medical Center should have a plan in place to address skill maintenance by providing staff with more opportunities to practice care of this low volume, high risk situation. Medical center administrators had the ongoing dilemma of providing programs that reinforced these skills and behaviors while maintaining educational costs and ensuring patient quality.

Since the inception of RRTs, fewer patients reached severe decompensation resulting in cardiopulmonary arrest (Beitler et al., 2011; Kotsakis et al., 2011). There were fewer code blues at Jones Medical Center since the inception of the RRT process in 2008. Please refer to Table 1 for details of this trend. The medical center averaged seven

to eight adult cardiopulmonary emergencies and less than one pediatric code blue per month over the last 3 years.

Table 1

Average Number of Code Blue and RRT Calls Per Month

	2008	2009	2010	2011	2012	2013	2014
Code blue	17.75	16.3	14.2	11.7	8.4	7.3	7.4
RRT	15.1	29.8	33	22.5	25.7	25.2	28.7

Note. Data presented at Jones Medical Center Code Committee Meeting, June 9, 2015.

At Jones Medical Center, when a patient experiences a cardiopulmonary arrest, the patient's immediate caregivers provide the emergency care until the code blue team arrives, then they remain to assist the code team. All medical center direct care providers need the skills and knowledge necessary for responding to a cardiopulmonary emergency. Per the institution’s code committee (Jones Medical Center, May 12, 2015), multiple issues in code blue care continued, including lack of postincident debriefing to review team performance, communication issues, equipment usage, appropriate team activation, and event documentation. Therefore, staff training on equipment usage, ACLS knowledge and skills, and code blue protocols remains essential.

Healthcare providers require technical skills for medication administration, equipment use, and procedure performance (Bhanji et al., 2015). Team skills of effective communication, decision-making, and leadership to respond efficiently to cardiopulmonary arrest are also requisite (Bhanji et al., 2015). The medical center

developed two simulation-based code blue programs for the adult and pediatric teams. Each program at Jones Medical Center began as physician based training for the specific medical specialty and was scheduled during existing educational time when the residents were free of clinical responsibilities. Incorporating the training at Jones Medical Center into a fixed schedule limited the adult medical team program to twice annually, usually September and March. The same scheduling restrictions limited the medical center's pediatric program to meet on the set same day, weekly, during the midday educational conference time. There remain flaws in the program scheduling inhibiting staff attendance.

Other ongoing issues with the team training at Jones Medical Center included limited program availability for the other staff resulting in poor attendance when clinical responsibilities remained, and decreased skill retention after the program. A self-completed evaluation tool given to the participant's post training focused on program satisfaction and perceived a change in confidence level for the crisis response. Although Jones Medical Center's code blue training program provides training for staff for cardiopulmonary response, it has gaps within the design to reach all staff who need the skills and ensure that they maintain competency once skills learned.

Rationale

Evidence of the Problem at the Local Level

The hospital's education department has the responsibility for developing programs that allow for the implementation of evidence-based practice based on evolving science (Bruce, 2013). The desired outcome of hospital-based education should be

improved patient care. Team training on crisis resource management, code blue, and rapid response skills led most institutions program development lists (Beitler et al., 2011; Doumouras, Keshet, Nathans, Ahmed, & Hicks, 2014; Tarantinos et al., 2014). Staff development led educational activities at Jones Medical Center included programs focused on Crisis Resource Management (CRM) and response skills of the code team.

The standards developed by the AHA in 2010 recommended recertification on ACLS skills at least every 2 years (Bhanji et al., 2010). The 2015 update to the guidelines now finds that the 2-year retraining cycle remains suboptimal and more frequent, shorter interval training should be considered for those health care providers who care for patients who have a cardiac arrest (Bhanji et al., 2015). The 2015 guidelines also recommended that ongoing training include team functioning and event leadership (Bhanji et al., 2015). A review of ACLS performance retention by Yeng et al. (2012) found an increasing decay in knowledge, skills, and attitude at the intervals of 6 weeks, 3 months, 6 months, 12 months, and 18 months. Those providers who had prior clinical experience or worked in a specialty area retained knowledge and skills longer than the providers with only general experience and less clinical exposure (Tarantinos et al., 2014; Yeng et al., 2013). Jones Medical Center's educational model provided minimal and inconsistent team based opportunities for ACLS and team response practice.

Jones Medical Center's adult code blue simulation-based program ran over 3 years, from December 2012 through March 2015. During this time, six educational blocks totaling 130 separate training sessions occurred at the medical center with each session lasted approximately 90 minutes. This schedule allowed each internal medical

resident to have an active role within the scenario. Schedule limitations restricted resident participation in the program to annually for the residents and, at best, biannual for other disciplines such as anesthesia, pharmacy, and respiratory therapy staff at Jones Medical Center. The nonphysician disciplines were in the clinical setting caring for the patients, and arrangements for clinical coverage during the program was required. Nursing attendance was poor with some dates without staff nurse presence. Therefore, only a few staff nurses from the hundreds who worked in the medical and surgical units at Jones Medical Center attended an adult code blue team training.

The pediatric team training program at Jones Medical Center began as an in situ program on the inpatient pediatric floor and pediatric intensive care unit (PICU), but moved to the medical center's simulation center in 2013. The pediatric team training occurred weekly or biweekly. Respiratory therapists joined the program in 2014. Eleven 60 minute, sessions occurred in the academic year 2012-2013, while in the academic year 2014-2015, the program expanded to 90 minutes, with a total of 40 sessions for the medical center’s pediatric team training program. Each session consisted of a rotating relevant pediatric scenario. Pediatric residents participated each time they were on clinical rotation in the pediatric inpatient, PICU, or neonatal intensive care unit (NICU) at the medical center, allowing each resident one to three opportunities to attend annually. Nursing attendance was poor for this program as well, with many dates without the pediatric staff nurse presence.

Jones Medical Center provided additional educational and training outside of the simulation-based team training programs for providers. Clinical staff received discipline

specific equipment training through annual competency assessments and unit based updates. Online education modules for new and complex changes in protocols, as well as just in time reviews for issues in an individual's practice, occurred as necessary. Staff at the medical center maintained required biannual certifications such as ACLS, PALS, and BLS (Bhanji et al., 2015). The medical center's deficit remained in entire team presence at the programs focusing on collaborative practice and maintenance of clinical skills. A program evaluation of the adult code blue and pediatric team training programs should identify any curriculum gaps as well identify strategies for improving program planning to meet the institutional and individual participants' needs.

Evidence of the Problem from the Professional Literature

Jones Medical Center was not the only institution struggling with code related staff education. In situ team training research discovered the following reoccurring latent errors for code blue responses: (a) multiple medical teams that responded with leadership confusion; (b) locked units that prevented access to the team; (c) lack of a code team debrief at conclusion of event; (d) unfamiliarity with equipment; (e) inability to locate supplies; and (f) confusion over RRT or code blue activation (Knight et al., 2014). Jones Medical Center's code committee identified similar latent errors documented from internal code performance reports. These similarities were the lack of a team debriefings at the conclusion of the code blue and unfamiliarity with specific code response equipment (Code Committee Meeting, Jones Medical Center, May 12, 2015). An additional concern of the medical center's code committee was the construction of a new

mother baby unit. The code committee was concerned about code team knowledge of navigation because of the unit's new location in a different building.

Since Jones Medical Center's institution of RRTs, the number of code blue calls has steadily decreased at the hospital. Variables that influenced positive outcomes from RRT implementation included initiation criteria, team membership, education and training, and locations or departments included (Beitler et al., 2011). RRTs that used initiating criteria of clinical judgment and vital sign triggers resulted in increased number of RTT calls with decreased mortality and cardiopulmonary arrests (Beitler et al., 2011). Sarani et al. (2011) discovered that medical units had more RRT calls than surgical units even though the triggers that activated the system are similar no matter which type of adult unit initiated the call. A patient's age triggers different teams at Jones Medical Center. An understanding of the differences related to age is critical for the responders providing appropriate care.

Kotsakis et al. (2011) found 46% of pediatric RRT calls were about respiratory presentations and 21% about cardiac conditions. The broad scope of pediatric patient presentations required that a pediatric team training program design instead of focusing solely on common PALS algorithms include scenarios that mimicked the actual patient population and situations encountered (Figueroa, Sepanski, Goldberg, & Shah, 2013). Hunt et al. (2014) discovered that traditional simulation-based team training programs did not provide pediatric residents with skills or knowledge for quality care at the response. The knowledge gaps discovered included continuous, uninterrupted cardiac compressions, defibrillation within 2 minutes, and appropriate ventilation rates (Hunt et

al., 2014). Also, recent investigations on the pediatric team training recommended integration of CRM techniques into emergency response training (Bank, Snell, & Bhanji, 2014; Bhanji et al., 2015; Knight et al., 2014). A gap in CRM training remains when trainings do not have all responders represented.

A concurrent, mixed methods, program evaluation established if a transfer of newly learned behaviors occurred after attendance at the medical center's simulation-based programs and if patient outcomes changed as a result. The purpose of this study was to evaluate if Jones Medical Center's current adult code blue and pediatric team training programs met the AHA standards and if staff transferred the skills and knowledge learned into bedside practice.

Definition of Terms

Advanced Cardiac Life Support (ACLS): Standards that guide the care of the adult patient with a cardiopulmonary arrest first published in 1974 and revised 5 years by the AHA (Bhanji et al., 2015). Providers certified in ACLS retrain currently every 2 years (Yeng et al., 2012). The standard course model consists of a 2-day instructor led didactic and skill-based modules and simulated cardiopulmonary arrest scenarios for practice and assessment (Perkins et al., 2012).

Competency: Competency, as defined by Whelan (2006), is the provider's knowledge, skills, and attitudes that allow them to perform the components of their role safely, accurately, and with skill. The Joint Commission (2015) developed competency standards for assessment of critical thinking, decision-making, technical skills, and communication, all necessary for team functioning. The Joint Commission states that

methods for assessing competencies include test taking, skill observation, and peer feedback.

Crisis Resource Management (CRM): Carne, Kennedy, and Gray, (2010) define CRM as a set of behaviors combined with competent skills and evidence-based knowledge by health care teams that decreased the incidence of adverse events during an emergency. Components of CRM include an identified team leader, effective communication, environmental awareness, workload distribution, resource allocation and access, anticipation and planning of care (Carne et al., 2010; Howard, Gaba, Fish, Yang, & Sarnquist, 1992).

In situ: A simulated scenario that occurs in the actual clinical environment with participants who work in that environment (Volk et al., 2011). In-situ programs introduce context into simulated programs (Stocker et al., 2014). Use of in situ occurs for ongoing team-based training, issue identification, or root cause analysis, and as dress rehearsals for new systems, teams, or locations (Geis, Pio, Pendergrass, Moyer, & Patterson, 2011).

Pediatric Advanced Life Support (PALS): Standards to guide the care of the pediatric patient experiencing a life-threatening event (Bhanji et al., 2015). This AHA training included the standardized treatment algorithms for common pediatric resuscitation presentations (de Caen et al., 2015). The course required biannual recertification and is required for most pediatric acute setting practitioners (Bhanji et al., 2015).

Rapid Response Teams (RRTs): A specialized team that responds to any patient on a general inpatient floor who is showing signs of decompensation (Winters et al.,

2013). According to Winters et al. (2013), the RRT assists the care team to prevent further patient decompensation, cardiopulmonary arrest, and reduce mortality. A patient, family member, or care team member may summon the team, or the activation may occur from a criteria-based scoring system (Winters et al., 2013).

Significance of the Study

Healthcare institutions are financially liable for adverse patient outcomes that result from poorly trained providers (Wolosin, Ayala, & Fulton, 2012). Standards for care established by the AHA ensure a patient receives quality evidence-based care during a cardiopulmonary arrest (Bhanji et al., 2015). Institutions, including Jones Medical Center, publish performance data for the public review. This information provided patients with information about where to receive their care. An institution's financial health relied on their national benchmark ranking on these quality measures (Ferman, 2011; Lindenauer et al., 2007; Wolosin et al., 2012).

Program evaluations allow the stakeholders to participate in future decision-making and design programs to meet the established standards. Locally, a program evaluation prompts the design of a program that enhances skills and knowledge for frontline providers responding to cardiopulmonary emergencies. Competent staff decrease adverse patient outcomes, reduce mortality and morbidity, and improve the quality of the care (Ahern et al., 2011; Beitler et al., 2011; Jones, Skinner, High, & Reiter-Palmon, 2013). Learning transfer of team skills to similar response situations has the potential for improvement of team communication skills and identification of role responsibility.

Research Questions and Hypotheses

Healthcare institutions must provide ongoing skill training and competency assessment for staff that care for the hospitalized patient experiencing cardiopulmonary arrest (Bhanji et al., 2015). Since the initiation and implementation of RRTs for early symptom recognition and intervention, there were reduced numbers of cardiopulmonary arrests on inpatient floors (Beitler et al., 2011). Healthcare providers who received training experienced a rapid skill decay if they did not practice the skills frequently, thus decreasing their performance and affecting their level of confidence (Beitler et al., 2011).

High functioning teams occur when all members participate in team training (Salas & Rosen, 2013). At Jones Medical Center, staff attended the simulation-based code program that included CRM training. In my study I investigated if the poor interprofessional attendance combined with perceived lack of behavior change prevent significant interprofessional collaborative practice adoption at the bedside. These code-training programs utilized different modalities to address staff needs and maintain clinical competencies. With the absence of a formal program evaluation, goal achievement and the level of staff skill and knowledge retention was unknown. In this mixed method program evaluation, I addressed several research questions.

Quantitative Question

RQ1: How did the adult code blue program and the pediatric team-training program compare in providing staff of Jones Medical Center with the skills and knowledge needed per the established evidenced-based standards needed to respond to a code blue?

$H_0$1: There was no difference between the adult and pediatric programs in providing staff with the skills and knowledge needed to respond to a code blue.

H_a1: There was a difference between the adult and pediatric programs in providing staff with the skills and knowledge needed to respond to a code blue.

Qualitative Questions

RQ2: What were the staff perceptions of the effectiveness of the adult code blue program in providing and maintaining the skills and knowledge needed to respond to a code blue?

RQ3: What were the staff perceptions of the effectiveness of the pediatric team-training program in providing and maintaining the skills and knowledge needed to respond to a code blue?

RQ4: What perceived and actual barriers existed in the adult code blue and pediatric team training program related to scheduling and staff attendance?

Review of the Literature

Introduction

I performed a literature search of the current research on hospital-based team training, CRM, learning skill transfer, staff competency, quality metrics, evidence-based practice, educational training modalities, and program evaluation. I utilized the electronic databases provided by the Walden library that included Thoreau, CINHAL, Medline, and ProQuest. I also utilized the *Google Scholar* features to locate future reference citations and for exploration of topics to reach saturation. I included in my search the individual journal databases of *Simulation in Healthcare* and *Clinical Simulation in Nursing.* Some

of the keywords used within these topic searches included *CRM, crisis resource management, teams, skills, competency, hospital, healthcare providers, staff, learning transfer, codes, code teams, mock codes, emergency, CPR, ACLS, PALS, training,* simulation *programs, evaluation, rapid response*, *rapid response teams*, and *RRT*. The details of this literature review follow in the next sections.

Conceptual Framework

There were two conceptual frameworks utilized during this program evaluation. The first framework was the incorporation of CRM concepts into the curricula for the development of skills and knowledge necessary for improved team functioning. The second framework explored the learning transfer into clinical practice after training. A stronger curriculum exists when conceptual frameworks form the foundation (Caffarella & Daffron, 2013).

Based originally on a framework for the aviation industry called crew resource management, early CRM team training in healthcare began within operating rooms and military hospital settings and focused on individual role performance within a team during a crisis (Sundar et al., 2007). Healthcare institutions developed training programs with the goal of improved team functioning and quality in patient care. Programs based on a CRM framework utilized teaching strategies that ensure all individuals within a team learned evidence-based skills for effective clinical practice (Bank et al., 2014; Carne et al., 2010; Doumouras et al., 2014; Figueroa et al., 2013). The CRM concepts used currently in healthcare training are (a) the timely mobilization of resources, (b) workload distribution, (c) role clarity, (d) leadership designation, (e) efficient communication, (f)

situational awareness, (g) plan establishment, (h) cognitive aid use, and (i) dynamic decision-making (Fanning et al., 2013). Groups untrained in CRM functioned in chaos and placed the patient at risk for an adverse event (Paull, DeLeeuw, Wolk, Paige, & Neily, 2013). Exposure to CRM concepts should assist staff in understanding their unique role within a team response.

Multiple studies have focused on group dynamics and team functioning. Roberts et al. (2014), in a three-phase perspective, observational, longitudinal study, demonstrated improvement from the precourse assessment of the multiple disciplines performance in leadership, communication, and role clarity immediately after a simulated teams training. The third phase, which consisted of the teams repeating a simulated scenario 3 weeks later, demonstrated a minimal retention of the skills (Roberts et al., 2014). This study by Roberts et al. (2014) and additional studies by Capella et al. (2010) and Steinenmann et al. (2011) reinforced the important skills learned in multidisciplinary team training and their influence on team functioning. The three studies highlighted common barriers to team training that included logistics in scheduling all the professions involved which affected the limited research on the subject (Capella et al., 2010; Roberts et al., 2014; Steinenmann et al., 2011). The specific components deemed important within these three studies mirror the concepts within the CRM model: leadership, role clarity, and effective communication.

Successful adult educational programs relied on the inclusion of real world content applicable to the participant's practice. Program development based on learning transfer increased staff to transfer knowledge into practice (Baldwin & Ford, 1988). The

transfer of learning model developed by Baldwin and Ford (1988) identified factors that affected this transfer of learning. The factors identified were training inputs, training outputs and conditions of transfer (Baldwin & Ford, 1988). Grossman and Salas (2011) further adapted Baldwin and Ford's original learning transfer model after their comprehensive literature review and analysis of transfer to practice issues for critical skills. Grossman and Salas's adapted model of transfer found three main factors affected transfer as described in Baldwin and Ford's initial model. Each of the three major factors affected the knowledge transfer along the training continuum from program attendance to the application in practice (Grossman & Salas, 2011). Please refer to Table 2 for the factors and indicators included in Grossman and Salas' adapted model.

Table 2
Transfer of Learning Model Elements

Factors	Indicators
Training input	Trainee Characteristics Training design Work environment
Training output	Learning Retention
Conditions of transfer	Generalization Maintenance

Blume, Ford, Baldwin, and Huang (2010) identified cognitive ability as the participant characteristic that most strongly influenced transfer into practice, followed by perceived usefulness of the training. The inclusion of error management and the use of a realistic environment in the training design demonstrated the successful transfer of learning post program (Bertrand, Moskaliuk, & Cress, 2015). The final training input

included characteristics related to the work environment (Grossman & Salas, 2011). The inclusion of these indicators strengthen a program.

After training, management support and the opportunity to perform the new skills in practice ranked most significant as success indicators (Blume et al., 2010). Figueroa et al. (2013) and Jones et al. (2013) demonstrated how programs designed with these integral components promoted learning retention and skill transfer for similar situations. The low incidence of cardiopulmonary arrests at Jones Medical Center reduced provider opportunities for transfer of the newly learned skills into practice.

The post program self-evaluation tool developed by the medical center's simulation staff combined the two conceptual frameworks of CRM and learning transfer. The tool's questions were based on the team-training learning objectives. Greidanus, King, LoVerso, and Ansell (2013) studied how adapting the educational design to include transformative learning increased collaboration among teams, specifically in established core competencies. Core competencies identified by IPEC (2011) included in Jones Medical Center evaluation tool were role responsibility, interprofessional communication, and teams and teamwork. The quantitative and qualitative data collected and analyzed by this tool describes the participants' perceptions of how the learning, role clarification, and communication skills incorporated into their practice.

Staff Perceptions and Confidence

Staff perceptions about simulation-based education within the hospital setting have been a subject of recent research. Also, research on simulation established modality as a viable method for promoting collaboration and decision making within teams

(Greidanus et al., 2013; Maxson et al., 2011). Simulation research initially focused on the participant perceptions of the experience and recently evolved to explore learning transfer and changes in patient outcomes based on Kirkpatrick's four levels of evaluation (Levine, DeMaria, Schwartz, & Sim, 2013; Kirkpatrick & Kirkpatrick, 2007). I explored perception and confidence research as it related to team training and code response.

Figueroa et al. (2013) found that the implementation of relevant situations into CRM simulation-based team training increased staffs' perceived confidence in the performance of advanced airway and defibrillation/cardioversion skills as well as confidence in effective leadership, immediately after and 3-months after the training. Bank et al. (2014) confirmed that simulation-based CRM training enhanced pediatric emergency medicine physicians' perceptions of crisis management and demonstrated continued ability to self-identify teamwork errors 1-month post intervention. Patterson, Geis, LeMaster, and Wears (2013) demonstrated knowledge retention at 8-10 months after simulation-based training for adult medicine teams. Although these few studies confirmed the effectiveness of the programs on learners' experiences with the training, there remained a gap in research on skill transfer and prolonged practice retention.

Skill and Learning Transfer

ACLS training provided standardization to cardiopulmonary emergency care. The 2-day ACLS course incurs significant institutional costs to cover clinical staff responsibilities as well as trainer fees. In an open-labeled randomized study of 3,732 healthcare professionals, Perkins et al. (2012) found that a computerized self-learning module combined with a skill demonstration methodology performed slightly poorer for

ACLS pass rates than the traditional classroom didactic followed by skill demonstration model. The lack of social interaction practice of the teamwork skills limited the usefulness of computerized learning for courses based on team training (Perkins et al., 2012). Jones Medical Center utilized computerized based online modules for other staff training and educational review, but ACLS courses followed the traditional didactic and skill performance model.

Multiple studies documented the post course decline of ACLS skills and knowledge (Bhanji et al., 2015; Tarantinos et al., 2014; Yeng et al., 2012). Bhanji et al. (2015) recommended that the retraining frequency of every 2 years for skills was no longer optimal. Variables that affected skill decay included lack of prior attendance at an ACLS course (Tarantinos et al., 2014) and nonspecialty practice in emergency medicine or intensive care (Yeng et al., 2012). A consensus for the standard on retraining frequency has yet to be established (Bhanji et al., 2015).

Historical studies on healthcare and CRM found that teams, unskilled in certain nontechnical behaviors, were prone to adverse events in crises (Gaba, Howard, Fish, Smith, & Sowb, 2001; Helmreich, Merritt, & Wilhelm, 1999; Howard et al., 1992; Salas et al., 2008; Sundar, et al., 2007; Wilson, Burke, Priest, & Salas, 2005). Providers' lack of participation in team training affected resuscitation performance and skill retention (Bhanji et al., 2015). Jones et al. (2013) confirmed that staff that did not have the opportunity to participate in team training were poorly adapted to the team based collaboration concepts. Jones Medical Center provided training, but a gap remained for support in the maintenance of skills learned during in situ codes.

The researchers who studied effective team behaviors identified focal areas for training. Communication was a major component studied in team performance (Rabol, McPhail, Ostergaard, Andersen, & Mogensen, 2012; Taylor, Ferri, Yavorska, Everett, & Parshuram, 2014). Taylor et al. (2014) discovered the phenomenon of outer loop communication, defined as the discussion between nonteam leaders in task delivery, patient safety maintenance, status updates, and documentation. Team leader distraction caused by the outer loop phenomenon resulted in potential loss of vital information within the verbal chaos of the situation (Taylor et al., 2014). The potential chaos of the code environment prevented safe patient information handoff, missed task assignments, multiple agendas, and generalized chaos (Rabol et al., 2012). Prince, Hines, Chyou, and Heegeman (2014) confirmed that these barriers of unspoken agendas, multitasking, and multiple interruptions inhibited vital information transfer. Teaching providers about these communication concepts and providing opportunities to practice evidence-based communication skills remains the foundation of healthcare team-based training.

Participant perception of learning and transfer of skills into the clinical practice after simulation-based training was studied. Jansson, Kaariainen, and Kyngas (2013) performed a comprehensive review of the simulation literature from 2002 to 2011 on the modality's effectiveness for skill and knowledge retention. Their review found that there remains a need for continued research on the transfer and retention of learning due to lack of published studies.

Garbee et al. (2013) and Fransen et al. (2012) further explored the topic of participant perception of learning in simulation-based education. Garbee et al. (2013), in

a quasi-experimental pre/posttest design with 35 interprofessional healthcare students in high fidelity simulation, demonstrated immediate perceived and actual improvement of team-based competencies and retention over a 6-month period. In an additional cluster randomized control study with 74 obstetric teams, Fransen et al. (2012) found that simulation-based team training improved team performance and technical skills. Researchers explored effects of simulation-based learning transfer as well as participant perceptions from the programs. Further research needs to focus on the changes in patient outcomes after providers participate in team-based training.

Patient Outcomes and Quality Monitoring

The hospital's academic faculty and education departments were responsible for ongoing competency assessment of staff skills and knowledge. Jones Medical Center evaluated provider competency with programs that used didactic material and/or skill demonstration. The use of healthcare simulation as an educational and competency assessment modality moved the validation process into the simulation center environment. According to Kirkpatrick and Kirkpatrick (2006, 2007), evaluation occurs at four levels: reactions, learning, behavior changes, and results. Nestel, Groom, Eikeland-Husebo, and O'Donnell (2011) and Schaefer et al. (2011) performed reviews of the simulation literature and found that the majority of simulation research focused on participant learning and participant perceptions and few studies researched lasting behavioral changes. According to these reviews, changes in patient outcomes were not explored (Nestel et al., 2011; Schaefer et al., 2011). Patient outcome changes related to simulation-based education remains an area needing further exploration.

Simulation-based researchers have few validated and reliable tools available for the assessment of participant behavioral changes and effect on patient outcomes (Adamson, Kardong-Edgren, & Willhaus, 2013). Doumouras et al. (2014) demonstrated that with a validated behavioral observational tool developed for simulation-based, team trauma, resuscitation assessment that CRM skills remained at the 6-month mark. New skill retention post-training improved with each repeated exposure, including participation in continued simulation activities, in situ exercises, or real patient care exposures (Bittencourt-Couto, Kerrey, Taylor, Fitzgerald, & Geis, 2015; Stocker, Burmester, & Allen, 2014). Participants retained learning when they were able to practice skills in repeated exposures. A program evaluation should identify whether Jones Medical Center was able to provide staff with skills and knowledge for resuscitation care.

There remains a deficit in research supporting improved patient outcomes because of participation in simulation-based education. One study by Meaney et al. (2013) stated that ACLS and BLS provider assessment post-training must include continuous CPR metric monitoring of compression and ventilation rate and depth, blood pressure, and end-tidal CO_2 during compressions. High-fidelity mannequins supply simulation data for facilitators to use for debriefing feedback and competency skill assessment (Griffin, Cooper, Glick, & Terndrup, 2014; Scalese & Hatala, 2013). Thoughtful program design provided metrics that demonstrated continued improvement in both patient outcomes and staff performance. Jones Medical Center collects metrics on patient outcomes and documentation on cardiopulmonary arrest care. An analysis of this data can identify gaps that remain affecting patient outcomes.

Educational Modality Research

The diversity of Jones Medical Center's healthcare providers required the educational staff to integrate multiple learning strategies. A needs assessment on learning preference identified staff's preferred learning modality, but implementation restrictions existed due to available resources. The medical center has a simulation center on site and the staff listed simulation-based education as a preferred modality in the needs assessment and on program evaluations.

Simulation, a proven methodology for healthcare team training, allowed experiential learning through skill practice within a safe environment combined with reflective discussion of performance and self-identified knowledge gaps (Bank et al., 2014; Cumin, Boyd, Webster, & Weller, 2013; Doumouras et al., 2014; Fanning et al., 2013; Figueroa et al., 2012; Paull et al., 2013). Healthcare providers' poor performance during inpatient emergencies affected mortality rates (Ornato, Perberdy, Reid, Feeser, & Dhindsa, 2012). The use of deliberate practice for nontechnical, role-specific skills in simulation-based learning opportunities combined with facilitator feedback led to behavioral changes in practice (Hunt et al., 2014). Stocker et al. (2014) demonstrated that when participants' failed or experienced difficulty in simulation, their self-reflection and motivation to learn increased. Simulation curricula designed to push participants outside their practice comfort zone assists the learner in self-identification of performance gaps.

Participation in the simulation scenario and debriefing session provided learning opportunities. Decker et al. (2013) identified that learning occurred during participation in reflective debriefing discussions after simulation-based activities. Facilitators that

utilize observational checklists completed during the simulation activity to identify performance gaps and specific behavior to discuss during debriefing discussion (Decker et al., 2013). Eppich and Cheng (2015) demonstrated that identifying performance gaps within the scenario promoted feedback-based discussions on individual and group performance and encouraged the development of strategies for improving future performance. Checklist-driven feedback discussion, reflective learning, and deliberate practice through scenario repetition reinforced expected behavior performance, narrowing the performance and knowledge gaps (Franklin et al., 2013).

Facilitators use participant discussion of self-observation and perception of change in knowledge, skill, and attitude as methods for assessment of learning (Franklin et al., 2013). Team-training based research for behavior change assessment remained scarce. Stocker et al. (2013) used a validated tool for assessment of team-based self-monitoring for utilization of CRM behaviors after a simulation of reality-based critical events. They found using the tool a feasible method in evaluation performance.

Multiple researchers performed reviews of the literature to identify relationships of team training and patient outcomes. Havyer et al. (2013) reviewed published team training instruments for validity and their relationship to patient outcomes. Their review included 178 articles out of an original list of 12,922 potential citations that identified 78 teamwork assessment tools (Havyer et al., 2013). In this review, 85% of the tools assessed interprofessional teams while only 18% of the tools explored relationships between teamwork and patient outcomes (Havyer et al., 2013). The results of this review demonstrated that the majority (74%) of teamwork assessment tools had established

validity, but an association of teamwork training to patient outcomes continues to be minimal (Havyer et al., 2013). The Safety Attitudes Questionnaire (SAQ), the only tool validated and related to patient outcome, demonstrated a relationship with decreased patient morbidity in the OR setting (Haynes et al., 2011) and in pediatric critical care units (Poley, van der Starre, van den Bos, van Dijk, & Tibboel, 2011). There remains little research on teams training effects on patient outcomes using validated observation tools.

Additional examples of team assessment tool validation included research by Wright et al. (2013) and Weller et al. (2013). These two studies proved instrument validation but not a relationship to patient outcome. Wright et al. developed the SAFE-TeamS (Standardized Assessment for Evaluation of Team Skills) instrument, which measured participants on conflict resolution, communication, and situational awareness behaviors before and after a simulated care episode. The tool was validated for team skill training at reliability greater than 0.8 (Wright et al., 2013). Weller et al. (2013) used a teamwork self-assessment tool for team training of ICU staff and validated the tool with a correlation of assessor and participant scoring. With more research, Weller et al. suggested that the tool could assist in self-directed teamwork improvements. The research continues on the topic of simulation based programs that utilize team training to improve staff skills and knowledge for team functioning.

Conclusion

I demonstrated through this literature review the evidence of the effectiveness of simulation-based team training on improving the healthcare providers' confidence in

emergencies, learning, and skill transfer (Figueroa et al., 2013: Jones et al., 2013). Healthcare practitioners who attended simulation-based team training benefited with increased knowledge and confidence in the CRM skill performance including effective communication, understanding role responsibilities, and the importance of utilizing all available resources (Paull et al., 2013). The most important CRM skill was the use of effective communication techniques that reduced the chaos seen in a code blue situation (Rabol et al., 2012). There was limited evidence that provided a link between simulation-based educational modality and patient outcomes (Havyer et al., 2013).

Implications

There are multiple tentative uses for the study results. A recommendation for code team training curriculum redesign is one use. Simulation-based educational programs incur a financial burden, so if the results demonstrate a return on investment, Jones Medical Center may continue the team training. Agarwal, Sands, Schneider, and Smalz, (2010) demonstrated how the financial burden of medical errors and adverse events related to how ineffective communication and wasted time. If Jones Medical Center decides to redesign the programs, they could develop a standardized generic template for how all the various service teams respond to code blues. Some examples of future department specific teams that may benefit include the emergency, perioperative, and obstetrical providers. Code team members' input collected during the study helped determine the training effectiveness and skill transfer to practice (Caffarella & Daffron, 2013). The results of the study identified the participant perceptions of the training importance and practice implications. Also, the needs assessment data identified the

participants' self-determined performance gaps. Program evaluations assist in the discovery of participant perception of issues and actual flaws in the learning activity design.

Another use for the study results could be a program evaluation report for the medical center. An evaluation report details the exploration performed and includes recommendations for decision-making purposes regarding changes to the program (Spaulding, 2014). Jones Medical Center could use the results from the evaluation report to improve attendance, learning modalities, or redesign of the curriculum to meet industry standards and regulations. The actual project designed based on the study results appears in Appendix A.

Summary

In the first section of this project study, I outlined the importance of team training and the need for maintaining staff competency for cardiopulmonary arrest response. Evidence supported that Jones Medical Center staff needed education as a team on CRM for effective collaboration during an emergency response. Staff practice in using these skills reinforced the knowledge and aided in retention.

An extensive review of the current literature on team-based training for health care workers, crisis resource management, and learning transfer established the need for a program evaluation. I outlined the significance of this problem for the medical center. Based on the current evidence-based practice, need to assess staff effectiveness after attendance at the code blue or team-training program proved necessary. In the conclusion

of Section 1, I detailed the potential local implications of a program evaluation. In Section 2, I discuss the study methodology, data collection, and analysis.

Section 2: The Methodology

Research Design and Approach

In this section, the rationale for research methodology, data collection, and analysis are discussed. I explored the effectiveness of the adult code blue and pediatric team training, staff perceived presence of knowledge, and skill transfer into bedside practice. Also, I investigated the perceived and actual barriers preventing staff attendance at the adult code blue and pediatric team training programs.

Mixed Method Design and Approach

The research process began with a determination of the appropriate methodology that will align with the purpose of the study. Every methodology has differing strengths, and each design utilizes various methods of data collection. The type of data drives the collection and analysis protocols. Pure quantitative or qualitative studies explore the problem, but only from a single viewpoint (Creswell, 2012). Quantitative methodologies focus on the testing of a hypothesis to demonstrate an assumption or compare relationships of variables through statistical analysis (Creswell, 2012). A quantitative study provides answers through experimental, correlational or survey designs (Lodico, Spaulding, & Voegtle, 2010). Qualitative designs focus on understanding perspectives, phenomenon, and identifying themes (Merriam, 2009). An analysis of the data from interviews, discussions, and observations discovers patterns explaining perspectives and phenomenon (Creswell, 2012).

A decision on methodology is determined by reviewing the research questions and the types of data needed to answer them (Creswell, 2009). This study's purpose was

the exploration of the participants' perspective and a determination if the two programs were effective through an assessment of learning and skill retention. Qualitative and quantitative research design aligns with the proposed research questions. Finally, as all the data were archival and came from programs that have already occurred, a program evaluation was the appropriate choice.

As a researcher, I explored the struggle Jones Medical Center had in maintaining staff competency. Kronick et al. (2015) stated that optimal team performance depends on the collaboration of the responding teams as well as the interdisciplinary practice of all skills. Fernandez-Castelao et al. (2011) used CRM concepts to reinforce that code blue teams function better when the leader was clear and all participants were aware of their roles during the resuscitation. Kronick et al. noted that ACLS and PALS courses often did not provide adequate and specific training in the processes that the healthcare providers needed for optimum functioning in their unique hospital setting. An additional challenge was assessing and monitoring the use of evidence-based practice per the established AHA protocols (Bhanji et al., 2015). The process of program evaluation includes the review of program goals, objectives, and expected outcomes, followed by an assessment of sustained change in skills and behaviors (Caffarella & Daffron, 2013). The purpose of this program evaluation was to identify the effectiveness of the simulation-based code team training for the adult and pediatric staff at Jones Medical Center.

This study's methodology consisted of an evaluation of the adult code blue and pediatric team training programs using a concurrent mixed methods approach. The rationale for this design stems from the desire to utilize the strengths of both

methodologies through analysis of the quantitative and qualitative data collected simultaneously (Lodico et al., 2010). Data assessing the attainment of goals came from the comparison of the adult code blue and pediatric team training programs using statistical analysis and identification of participant perceptions described in the programs postactivity evaluation. Goal based evaluations analyzed the degree to which the predetermined program goals were achieved (Warren, 2013). A mixed methodology approach combined the strengths of both qualitative and quantitative research into one study; this design allowed the richness of the qualitative information to provide meaning to the quantitative data (Creswell, 2009).

The American Nurses Credentialing Center (ANCC) identified various rationales for using program evaluations including the identification of both positive and negative aspects of the program, attainment of goals and objectives, participant perception of learning, and the assessment of return on investment for an institution (DeSilets & Dickerson, 2009; Kotnour, Landaeta, & Lackey, 2013; Warren, 2013). With a mixed method data approach to data collection and analysis, the results identified programmatic changes that were needed to improve the participants' perceptions of learning and increase return on investment for Jones Medical Center.

Quantitative data collected from surveys, pretest/posttests, and documentation are useful for determining if the program goals were met (Caffarella & Daffron, 2013). Data from the program reflecting participant outcomes, program outcomes, and institutional outcomes identified the metrics for assessment of program effectiveness (Caffarella & Daffron, 2013). In healthcare training programs, the goals determine the criteria for

knowledge assessment and competency performance necessary for evidence-based quality care (Warren, 2013). The quantitative data analysis provided metrics that show the amount of return of investment that occurred from the program based on achievement of stated goals.

The participants' understanding of a topic, their perspective of any learning that occurred, and positive and negative aspects of the program occurred through qualitative data collection and analysis (Merriam, 2009). This study's qualitative data described staff perceptions on training and education needs. The staffs' perceptions of learning came from the survey data and needs assessments. Further analysis of the data identified themes in the participants' responses.

Through mixed method data collection and analysis, this program evaluation examines how effective the adult code blue and pediatric team training programs were in the transfer of skills and knowledge into sustained bedside practice. Also, an exploration of the perceived barriers preventing attendance at the program occurred through trends and theme identification from the qualitative data.

Setting and Sample

Setting

The two programs for resuscitation training occurred at the institution's interprofessional simulation center. The Jones Medical Center's simulation center provided both skill-based competency programs and team-based interprofessional training programs for staff. The simulation center implemented multiple team training programs. The simulation center's multiple simulation spaces supported programs

designed for simultaneous sessions that allowed for larger groups attendance. The capability of the debriefing areas to stream video in real time provided observers the opportunity to view the scenario and participate in the debriefing discussion when they were not actively participating in the scenario (Meakim et al., 2015).

A comprehensive simulation-based program includes a defined debriefing plan. The simulation space should have the capability for video playback of the simulated scenario to promote reflective learning during the debriefing sessions (Morrison & Deckers, 2015). Simulation best practice encouraged video to use for enhanced self-reflection during the debriefing process (Decker et al., 2013). The Jones Medical Center employs three full-time simulation technicians to support the programs. All program facilitators attended a debriefing workshop. Facilitators needed education on the evidence-based theories that promote a safe and reflective learning environment (Boese et al., 2013; Franklin et al., 2013). A Certified Healthcare Simulation Educator (CHSE) on staff oversees facilitator training and monitors the debriefing sessions for quality.

Participant feedback is necessary for any program evaluation. Jones Medical Center's simulation protocol requires that all participants complete a self-evaluation tool at the program's end. Program stakeholders designed each tool as part of the curriculum development process. All of the medical center's team based program evaluation tools used Likert scale style questions for participants to self-assess their scenario performance and their confidence in future practice. Each tool also contained opened-ended questions that solicited feedback on the participants' plan to incorporate content learned into practice.

Sample

This study's population consisted of a convenience sample. Any staff member working within the adult medical/surgical and the pediatric units during the time the programs occurred was considered part of the eligible population. The two populations within the study consisted of the adult and pediatric care teams who worked at the medical center during 2012-2105.

The adult sample population included all internal medicine residents, medical/surgical nurses, respiratory therapists, anesthesiologists, and pharmacists. I needed to determine an appropriate sample size for meaningful results (Triola, 2012). The appropriate size sample required for both populations was determined using a confidence level of 0.95, a margin of error of +/- 5% and one standard deviation (Triola, 2012). The eligible population for the adult code blue program consisted of 450 staff employed at the medical center from 2012-2015. The appropriate sample size for the adult code blue program needed at least 207 participants to be considered meaningful. From 2012-2015, 660 participants attended the adult code blue program. Therefore, the sample met the established size criteria for the adult code blue program. Some adult team employees attended more than one session during the length of the program. Residency in internal medicine and the pediatric medicine lasts 3 years. There was potential for residents to attend the program annually during their residency. Other attendees may also have attended more than one session during 2012-2015.

The pediatric sample population included pediatric residents, pediatric nurses, and respiratory therapists. The pediatric team training eligible population consisted of 200

pediatric employees who worked at the medical center from 2012-2015. A sample size of 132 participants, using the same criteria as above, was needed for a meaningful pediatric team training sample. From 2012-2015 269 participants attended the pediatric team training program. This sample met the established size criteria. As with the adult program, some of the pediatric team may have had multiple opportunities to attend training throughout their residency.

Participants for both programs consisted of a convenience sample from staff working or on resident rotation at Jones Medical Center. There was no control group or randomization for the study sample. The supervisor of each discipline (residencies, respiratory therapy, and pharmacy) assigned staff working on the day of the program to participate, except the nursing staff. Attendance at the adult code blue and pediatric team training programs was not mandatory for nursing staff. The majority of nursing staff participation was voluntary. The only nursing staff members assigned by management to attend the training were the new members in orientation who did not need coverage to leave the unit. Nurses were encouraged to sign up for nonmandatory classes on nonclinical or off time. Jones Medical Center employees were members of labor unions and nonmandated program attendance relied on voluntary attendance through paid education time.

Jones Medical Center simulation protocol required that during the program's prebriefing section, facilitators provided the participants with a description of the entire session's process including disclosure of scenario videotaping, and the overall purpose of the program. This prebriefing included whether the program was for staff evaluation or

learning opportunity. Best simulation practice suggested that all program orientations include disclosures to participants to establish the trusting environment needed for reflective learning (Meakim et al., 2015). The participants' verbal acknowledgment and participation in the scenarios signified consent to the simulation fiction contract. The use of generic role nametags such as code leader, bedside nurse, anesthesia resident, rather than nametags with identifying information identified the participants' roles throughout the scenario. Total anonymity was impossible related to staff familiarity with colleagues and the requirement that staff sign in for the session to obtain departmental credit for attendance, but confidentiality was stressed in the prebriefing for the entire scenario and debriefing discussion, and all evaluations were completed anonymously.

Both the adult code blue and pediatric team training programs utilized participant completed evaluation tools as part of their curriculum. The process for the two programs varied initially. In 2012, the adult code blue program utilized a precourse/postcourse self-assessment of confidence and knowledge, and then for the remaining sessions, in 2013-2015, transitioned to a posttest only format. The format of the pediatric team training program consisted a postcourse self-assessment from the onset.

The designers of both programs developed questions on the tool that allow participant self-assessment on the perception of learning and changes in confidence or performance related to the activity. According to Bhanji, Gottesman, de Grave, Steinert, and Winer (2012), participant self-assessment provided data to identify when learning occurred in the program. The information obtained from post learning evaluations influenced future programming decisions (Bhanji et al., 2012). Programmatic changes

based on learning were more relevant than those changes made from participant satisfaction alone (Bhanji et al., 2012). The combination of data collected from the tools provided both participant perception on learning and satisfaction with the program.

Data Collection Strategies

Multiple sources provided archival data for this mixed method program evaluation. Please see Appendix B for the Team Training Self-Assessment Survey and Appendix C for the Team Training Evaluation. The other tools included the facilitator observation tool titled Adult Mock Code Observer Worksheet and the Code Blue Debriefing form completed by code participants after an actual patient cardiopulmonary arrest. Please refer to Appendix D for the Adult Mock Code Observer Worksheet and Appendix E for the Code Blue Debriefing form.

According to Caffarella and Daffron (2013), techniques for collecting evaluation data included observations, surveys, interviews, pretests/posttests, focus groups, and participant self-assessments. Results are validated through the triangulation of multiple data sources (Lodico et al., 2010). The use of multiple sources validated the participant perceptions of skill and knowledge learned from these programs. The participants completed the self-evaluations at the time of attendance at the programs during the study period. Archival data originating from the code blue documentation gathered during patient codes within the study period of 2012-2015 were used. Refer to Table 3, Evaluation matrix for program evaluation.

Table 3

Evaluation Matrix for Program Evaluation

Data type	Research question	Stakeholders	Data collection tools	When data collected
Quantitative	RQ1. How do the adult medicine code blue program and the pediatric team-training program compare in providing staff of Jones Medical Center with the skills and knowledge needed per the established evidenced-based standards to care for the patient in cardiopulmonary arrest? Null hypothesis: There will be no difference between the adult and pediatric programs in providing staff with skills and knowledge needed to respond to a code. Alternative Hypothesis: There will be a difference between the adult and pediatric programs in providing staff with the skills and knowledge needed to respond to a code	Adult code blue and pediatric team training program participants, institution, patients, and hospital leadership	Likert-scaled items on the Team Training Self-Assessment Survey, Team Training Evaluation, Needs assessment surveys	Archival: collected at completion of each session and needs assessment at leadership discretion
Qualitative	RQ2. What are the staff perceptions of the effectiveness of the adult code blue program in providing and maintaining the skills and knowledge to care competently for patients in cardiopulmonary arrest?	Adult code blue program participants	Open-ended questions on the Team Training Self-Assessment Survey, Team Training Evaluation, Mock Code Observer worksheet, and Code Blue Debrief	Archival: collected during and at completion of program sessions, after actual code blue events
Qualitative	RQ3. What are the staff perceptions of the pediatric team-training program in providing and maintaining the skills and knowledge needed to care for patients in cardiopulmonary arrest?	Pediatric team training participants	Open-ended questions on the Team Training Evaluation, Code Blue Debrief	Archival: collected at completion of program sessions, after actual code blue events
Qualitative	RQ4. What perceived and actual barriers exist in the adult code blue and pediatric team training program related to scheduling and staff attendance?	All program participants and hospital leadership	Open-ended questions on the Team Training Self- Assessment Survey, Team Training Evaluation Needs assessments	Archival: collected at completion of program, needs assessments at leadership discretion

Quantitative

The archival quantitative data came from the two self-evaluation tools used after participation in both the adult code blue and pediatric team training program. The simulation center had two versions of evaluation forms during the study period for team training programs. One tool was the Team Training Self-Assessment Survey (Appendix B), and the other was the Team Training Evaluation (Appendix C). Until the data collection was completed, it was not known which form each program used. Both programs used the Team Training Evaluation tool.

The archival quantitative data collected addressed the first research question; how the adult program and pediatric program compared in providing the Jones Medical Center's staff with skills and knowledge around code blue care. The data from the team training evaluations consisted of the participants' perceptions of team skills learned about decision-making and role clarification. The evaluation tools also asked the participants about their perceptions of learning opportunities. Jones Medical Center's simulation staff in collaboration with the program facilitators internally developed both the Team Training Self-Assessment Survey and the Team Training Evaluation. The medical center modeled questions on these tools after the Elfrink-Cordi, Leighton, Ryan-Wegner, Doyle, and Ravert (2012) Simulation Effectiveness Tool (SET).

Development of a local tool. Elfrink-Cordi et al. (2012) developed the SET for the assessment of the effectiveness of simulation learning for nursing students. Originally, the SET was modeled after the METI (Medical Education Technologies

Incorporated) standardized simulation program for nursing called PNCI (Program for Nursing Curriculum Integration) (Elfrink-Cordi et al., 2012). Over 100 nursing faculty experts in simulation developed five different evaluation tools for the PNCI and the SET originated from these non-validated tools (Elfrink-Cordi et al., 2012). The original METI tool had 20 questions with a 5-point Likert scale that assessed for learning, confidence, and satisfaction, three concepts considered important to simulation-based experiences. After piloting, Elfrink-Cordi et al. decreased the tool to 13 questions using a 3-point Likert scale and renamed it the SET.

Elfrink-Cordi et al. (2012) used construct validation to validate the SET. According to Lodico et al. (2006), construct validity is a determination if the tool accurately measures abstract traits such as confidence and perception of learning. The SET demonstrated a Cronbach's alpha of .91 for the overall tool with a standard error of measurement of 1.56 and the Cronbach's alpha for learning subscale was .87 and the confidence subscale was .84 (Elfrink-Cordi et al., 2012). Reliability testing occurred through a multisite investigation. Elfrink-Cordi et al. report the overall tool's Cronbach's alpha for reliability was .93 with the learning subscale at .87 and the confidence subscale at .88.

There are very few validated and reliable tools available for the assessment of the experience from reactions to learning transfer affecting patient outcomes in simulation programs (Adamson et al., 2013; Elfrink-Cordi et al., 2012). When Jones Medical Center's simulation center opened in 2012, the simulation staff researched the evaluation

tools available and determined that the SET best meet the needs of the center for participant learning self-assessment.

Elfrink-Cordi et al. (2012) based their tool on Kirkpatricks' (2007) first two levels of evaluation for learner perception of confidence and learning. The tool consisted of questions that assessed student attitudes about simulation, perceptions about their confidence, and perceptions of their learning. Although the validation and reliability testing of the SET instrument occurred only with a nursing student population, Jones Medical Center's simulation staff felt that the residents were in training and consisted of the bulk of the center's participants. The center staff did adapt the questions from the tool to focus on the different groups of participants expected to attend programs.

The medical center's model for evaluation of other learning activities, such as competency assessment and procedural based learning, utilized the Kirkpatrick model (Kirkpatrick & Kirkpatrick, 2007). The simulation center started programs soon after opening and needed a participant self-evaluation tool for formative and summative evaluation. The SET was the tool that evaluated the concepts the simulation center was interested in quantifying. The Team Training Evaluation should undergo validity and reliability testing in the future.

Jones Medical Center's Team Training Evaluation included questions from both the confidence assessment and learning assessment domains. The questions in the team based training section were adapted from the SET and identified participant perceptions on changes in confidence and learning. See Table 4 for a sample of the questions from

the Team Training Evaluation currently used by both the adult code blue program and the pediatric team training.

Table 4

Team Training Evaluation Questions

Category	Questions[a]
Team Training	My assessment skills improved.
	I am more confident in determining what to communicate to the health care providers in the clinical team.
	I feel better prepared to care for patients in the clinical environment.
	I feel more confident in my decision-making skills.
Program Evaluation	I plan to incorporate what I learned today in my clinical practice.
	The objectives of this program were clearly stated.
	The format of the program was effective.
Open Ended	What did you like best about the program?
	What did you like least about the program?
	How can we improve your experience in future programs?

Note: [a] The team training questions use a 3-point Likert scale. The generic program evaluation questions use a 5-point Likert scale.

Team training evaluation tools. The Team Training Evaluation used a combination of 5-point and 3-point Likert scales. The tool utilized a 3-point Likert scale with categories of do not agree (1), somewhat agree (2), and strongly agree (3) for team training questions and 5 point Likert scale (strongly disagree to strongly agree) for the program evaluation questions. This tool did not undergo reliability or validation studies. The relevant self-assessment questions targeted the topics of confidence, skill, and application to practice. At the conclusion of the simulation experience, each participant

completed this paper tool. Facilitators and stakeholders of the original programs were involved in the development process. This process led to the use of the standardized Team Training Evaluation for all team based code programs within the center in 2014

Needs assessment surveys. Participant needs assessment surveys provided additional quantitative data. Jones Medical Center's department based leadership periodically survey staff to identify perceived educational gaps. In June of 2015, a needs assessment survey solicited the inpatient nursing staff on their frequency and comfort in using the emergency code cart. An additional needs assessment conducted in summer of 2015, asked nurses for their preferred learning styles and ideas for future educational programs. The use of multiple data sources validated the final results (Creswell, 2012). Results from these surveys triangulated the self-evaluation tool data.

The adult code blue and pediatric team training simulation sessions each required a specific number of participants for all to have active learning experiences. Standard of simulation best practice recommended that all learners participate in the simulation scenario and debriefing process (Meakim et al., 2015). Each adult code blue session required 14 to 28 participants depending on space and facilitator availability. The pediatric team training required four to eight participants. Therefore, multiple sessions were necessary to collect adequate data for the program evaluation.

Qualitative

The archival qualitative data obtained during the adult and pediatric code programs reflected the participants' perceptions at the time of the program and came from multiple sources. A section on the Teams Training Evaluation survey solicited

participant perceptions through open-ended questions. The Adult Mock Code Observer Worksheet collected data reflecting the facilitators' perception of the participants' performance in comparison to the identified program objectives expected in the scenario. Additional archival data came from the Code Blue Debriefing form used for documenting care during a code blue for adult and pediatric patients at Jones Medical Center.

Team training evaluation survey. Participants described their perceptions on the simulation activity through the open-ended questions on the Team Training Evaluation survey. Questions addressed both the positive and negative aspects of the program. Also, the final question solicited potential ideas for future learning activities desired by the Jones Medical Center staff. A list of the open-ended questions is in Table 3. All of this data paints a comprehensive picture of the participants' perception (Creswell, 2012).

Adult mock code observer worksheet. The Adult Mock Code Observer Worksheet helped the facilitator in identifying debriefing topics and performance gaps in the adult code blue program. This tool was developed in 2013 and completed during the fall of 2013 and spring of 2014 only. The facilitators assessed participant code performance on meeting the program's objectives through observation. No inter-rater reliability testing occurred during the development of this observer worksheet.

Code blue debriefing form. The final source of archival qualitative data came from the Code Blue Debriefing form attached to the patient code blue documentation in the medical record. Jones Medical Center currently uses paper documentation for code blues in the inpatient units. This two-page, double-sided form provided a transcript of care received on the front side. The removable back page provided data for quality

control and real-time review of care and was not part of the patient's permanent medical record. The removable page has a copy of the code blue transcript on the front side and the debriefing tool on the backside. The Code Blue Debriefing questions identified certain points recommended by the AHA for cardiopulmonary resuscitation and post-arrest care quality monitoring at the time of the study (Bhanji et al., 2010) and after the guidelines were updated in 2015 (Bhanji et al.,2015). Quality points on the tool included technical skills (cardiac compression performance, bag-valve mask use and timely intubation success), team functioning (leadership, communication, and role performance) and process (notification and arrival of team, equipment availability, adherence to ACLS/PALS algorithms). Please refer to Appendix E: Code Blue Debriefing Tool for the specific questions.

An analysis of the data from the debriefing tool provided an identification of trends and themes seen by Jones Medical Center's responding code teams. The tool was a combination of checklist type questions and free text responses. This tool's data provided validation through triangulation process for the other sources. Additionally, the document provided patient outcome data.

All the archival data addressed the qualitative three research questions for this program evaluation. Data from the Team Training Evaluation surveys, Code Blue Debriefing forms, and open-ended questions on the needs assessments answered the first two qualitative questions on how both the adult and pediatric programs compare in capturing staff perceptions about the effectiveness of the training for equipping them with the skills and knowledge needed to participate in code blues. The needs assessment open-

ended questions identified perceived barriers to attendance at both programs, the final qualitative research question.

The concurrent collection of archival qualitative and quantitative data provided a rich source of the staffs' perceptions of training quality, learning received, and code performance. The data analysis process combined results from both qualitative and quantitative sources giving depth and breadth to the study (Creswell, 2012). Mixed methods approach using multiple sources of data provided triangulation of the results and provided a deeper and richer study (Creswell, 2012; Lodico et al., 2010). The concurrent collection of the qualitative and quantitative data provided the researcher with an understanding of the participants' perspectives (Creswell, 2012). The data for this program evaluation came from historical data recorded during the program and retained by the simulation center for future analysis. The code committee retained the code debriefing form data for purposes of quality measurement and comparison.

The majority of the data originated from participant-completed documents. The data collection on the facilitator observation tool was the only data not to originate from the training participants. I was a coordinator of the adult code blue program and my role was assisting the facilitators in the running of the program. During the study period, I did not participate in the analysis of data from the observation tools. My role as simulation staff was to ensure participants completed the self-evaluation tool when the training session ended and to provide generic facilitator debriefing training for team-based simulation programs. I was a member of Jones Medical Center code committee during the study period, as a representative of the simulation center. After approval from the

Walden (IRB Approval No. 03-22-16-0046404) and Jones Medical (IRB Approval No. H-35017), my role transitioned to the researcher for this study and included identification of the data to collate, statistical analysis, and trend identification followed by the development of recommendations based on the findings for use in the revision of the program.

Data Analysis

The archival adult code blue and pediatric team training evaluation forms were stored physically in the simulation center and electronically in the simulation center's database. The code committee stored the Code Blue debriefing form aggregated data in an electronic database with hard copies stored in the respiratory department. Although data from self-evaluations was archival and collected at the time of the program, no analysis comparing the programs or assessing participant perception had occurred. After both IRB approvals, I obtained permission to access the data sources. For the program evaluation, I asked the simulation center’s medical director and program manager for permission to use data from the participant self-evaluations and Mock Code Observation Worksheets residing in their database for the program evaluation. I obtained permission from the nursing director of the education department to gain access to the nursing needs assessment data for the purpose of this program evaluation. I asked for permission to review the archival Code Blue Debriefing form data from the chair of the code committee.

Quantitative

The analysis of results from the multiple data sources reflected the participant perceptions from both programs. The quantitative data provided numerical evidence addressing the research questions on participant perceptions for knowledge learned and transferred (Triola, 2012). The statistical analysis of the study used central tendencies and chi square test data comparison.

Central tendencies will measure interval variables such as the value of responses quantified through a Likert scale completed in the post-learning self-evaluations (Creswell, 2012). The mean ranking of each training's combined responses provided a group numerical value to use for comparison between the two samples. Both team trainings used the same tool, but group experience possibly differed related to variables that included program scheduling, individual and team performance, and the facilitation of the debriefing discussion. The group means provided values to use in trend and pattern identification within the individual program. I used a chi-square distribution test to identify if there was any statistical significance between the programs (Creswell, 2012).

The participants' responses on post activity self-evaluations provided numerical values of their perceptions using a Likert scale. After making the Likert scale items dichotomous, a chi square distribution test compared interval values between the adult code blue and the pediatric team-training participants. This statistical test compared data while decreasing the likelihood that the results occurred by chance (Triola, 2012). I determined statistical significance with an alpha level of 0.05. Any presence of statistical significance supports the participants' perception of change that resulted from the

training. This comparison between the groups occurred for each of the Likert scale questions listed in Table 4 using the chi square distribution test.

Needs assessment data identified knowledge gaps perceived by the participants. The current and new code carts survey used data about staff cart use in practice. This data identified the staff's perceptions of their clinical skills confidence measured by the Team Training Evaluation tool. Also, the staff needs survey identified learning topics perceived as clinical practice performance gaps. This survey asked staff to rate topics in order of importance and quantify those they felt were of higher importance. Refer to Table 5, the needs assessment questions.

Table 5

Examples of Needs Assessment Questions

Please rank your preferred method of learning from favorite (1) to least favorite (12)
If you are an adult medical surgical nurse, please choose top 5 priorities for competency sessions[a]
Please identify the top 5 topics for annual or periodic Continuing Education programs
Please choose your five top 5 Nursing Grand Rounds topics
What two offerings in the last year did you find most helpful to your personal practice
What were the two least helpful educational activities for your practice

Note:[a] Each specialty area of nursing had a separate area in the survey to identify the unique needs of the specialty, the other questions were generic to all nurses.

A comparison of the results with the highest rankings of the data between the adult and pediatric nursing groups occurred. The qualitative analysis contained results from the open-ended questions on the needs assessment.

Qualitative

Qualitative data provided the researcher with a better understanding of the quantitative data. One source of qualitative information consisted of the participants' written comments on the Team Training Evaluation. This data identified common

statements describing the benefits and deficits of the programs. A thorough review and tallying of the compiled comments for each program identified common themes (Merriam, 2009). Then a coding process to identify similar comments assisted the categorizing and labeling of the data (Creswell, 2012). The final step consisted of the identification of themes from the categorized comments (Creswell, 2012). A comparison of the themes from each program allowed for the identification of common issues and performance gaps.

The identified themes addressed the research question related to participants' perception of skills learned to care for the patient with cardiopulmonary arrest. If the participants continue to request code team training in the needs assessment, the program will not be meeting the participants' needs for knowledge retention and skill transfer to practice. The qualitative data from the needs assessment written in questions provided other topics related to team training that the participant identified as a performance gap. After categorizing data into themes, a comparison of the themes from both groups occurred.

A review of the Code Blue Debriefing forms for participants' qualitative comments identified if the training provided needed skills. The questions identified performance within the specific code blue roles, CPR quality, comfort using the equipment, and ability to perform procedures. Both adult and pediatric providers used the same Code Blue Debriefing form for documentation of the code response.

Also, for the adult code blue sessions where the facilitators used the Adult Mock Code Observer Worksheet, the data gathered validated the other data from the

participants' self-perspectives. Some of the worksheet's questions documented the facilitator's observations relating directly to questions on the self-evaluation tool. Multiple methods of assessing the participants' perception validated overall results (Creswell, 2012). In aggregate, this data provided participant self-evaluation validation.

Combining the results from the quantitative data's statistical analysis with the themes from the qualitative data represented the complete participant perspective from both programs. The concurrent analysis of both sources of data identified the individual program's strengths and performance gaps. A comparison of the two programs highlighted which strategies were successful and identified common issues that needed addressing for overall program improvement.

Data Analysis Results

My choice of a program evaluation provided the foundation for the mixed method design for concurrent data collection and analysis. Collecting the data simultaneously allowed me to compare the two programs statistically, understand the participants' perspectives on knowledge gained, and if any skills transfer to practice. Information collected from multiple sources provided triangulation of the data, increasing the validity of the results (Creswell, 2012). Depending on the results, recommendations may be made for the development of a revised simulation-based team training activity, a complete revision of the emergency response training curriculum, or to continue the current program format at Jones Medical Center.

The data analysis occurred simultaneously, and each data source addressed specific research questions listed in Table 3. All of the tools were used at some point

during the study period of 2012-2015. Multiple data sources were collected simultaneously and came from the same sessions, such as the self-evaluations and the mock code observer worksheets.

The self-evaluations from the adult code blue and pediatric team training programs were collected at the end of each session. These evaluations solicited the participants' perspective of the activity, including reflection on knowledge gained and effectiveness of the training. The Adult Mock Code Observer worksheet was also completed during the adult code blue program for each session in fall of 2013, and spring of 2014. This data represented the facilitators' observations on the staff performance within the scenario. The Code Blue Debrief forms completed at the conclusion of an actual patient's code blue were collected for the study period. This data provided subjective evaluation of staff performance and perceived performance gaps during actual patient code responses.

The two needs assessment surveys, nursing and code cart usage, were collected during the summer of 2015. These surveys provided data on the nursing staff's continuing education needs, performance gaps, and reported use of the code cart. The data were analyzed using quantitative and qualitative methods providing a comprehensive portrait of the perceived effectiveness of the adult code blue and the pediatric team training programs for the nursing staff.

Quantitative Results

The quantitative data addressed the first research question and was obtained from the adult code blue and pediatric team training programs evaluations. Seven questions on

the evaluation tool pertained to this study's research question of how the two programs compared in providing staff with the skills and knowledge needed to care for the patient in cardiopulmonary arrest based on the established evidence-based standards. The Team Training Evaluation tool (Appendix C) was used consistently throughout the study period for both programs. The Team Training Assessment Survey (Appendix B) was not used for either of these programs during the study period. It was used for other similar programs that were not part of this study.

The four questions on the evaluation tools that reflected team training concepts used a 3 point Likert scale, 1 (*do not agree*), 2 (*somewhat agree*) and 3 (*strongly agree*). The three questions targeting the participant evaluation of the program used a 5 point Likert scale, 1 (*strongly disagree*), 2 (*somewhat disagree*), 3 (*neutral*), 4 (*somewhat agree*), and 5 (*strongly agree*). Each Team Training Evaluation Tool collected was given a unique identifier and recorded on an Excel spreadsheet classified by the program, date, and session. The participants' responses to the seven questions were recorded using the ordinal value of the Likert scale. The mean of the responses for each question was determined by session. Please refer to Table 6 and Table 7 for the complete listing of the individual sessions mean for each question by the program.

Table 6

Means for Each Adult Program Question

Adult Code Blue Session	Assessment improved	Confident to determine what to communicate	Feel better prepared	Confident in decision making skills	Incorporate into practice	Objectives clearly stated	Format of program effective
1	2.43	2.64	2.57	2.50	4.64	4.36	4.54
2	2.71	2.65	2.53	2.47	4.50	4.40	4.63
3	2.40	2.45	2.27	2.36	4.00	3.33	4.00
4	2.43	2.67	2.62	2.43	4.71	4.67	4.71
5	2.17	2.67	2.54	2.38	4.33	4.62	4.62
6	2.39	2.72	2.67	2.50	4.44	4.79	4.81
7	2.67	3.00	2.67	2.67	4.64	4.50	4.57
8					4.81	4.67	4.57
9	2.30	2.60	2.40	2.30	4.39	4.48	4.43
10	2.45	2.65	2.60	2.55	4.59	4.68	4.55
11	2.50	2.76	2.62	2.52	4.71	4.76	4.62
12	2.57	2.79	2.64	2.57	4.58	4.67	4.67
13	2.35	2.82	2.94	2.71	4.63	4.69	4.63
14	2.61	2.78	2.78	2.56	4.56	4.44	4.61
15	2.76	2.76	2.82	2.65	4.88	4.82	4.88
16	2.63	2.75	2.75	2.63	4.81	4.81	4.75
17	2.30	2.50	2.50	2.30	4.70	4.70	4.80
18	2.50	2.58	2.58	2.58	4.40	4.90	4.80
19	2.77	2.69	2.69	2.46	4.58	4.75	4.83
20	2.50	2.86	2.64	2.79	4.67	4.76	4.81
21	2.55	2.73	2.45	2.55	4.55	4.64	4.82
22	2.72	2.72	2.83	2.72	4.59	4.41	4.41
23	2.93	2.79	2.79	2.57	4.29	4.43	4.43
24	2.67	2.87	2.67	2.40	4.69	4.85	4.77
25	2.33	2.43	2.57	2.14	4.50	4.67	4.50
26	2.25	2.75	2.75	2.63	4.86	4.88	4.50
27	2.44	2.78	2.44	2.67	5.00	5.00	5.00
28	2.57	2.64	2.43	2.43			
29	2.61	2.52	2.70	2.48			
30	2.63	2.94	2.75	2.75			
31	2.50	2.87	2.67	2.60			
32	2.63	2.75	2.63	2.50			
33	2.69	2.69	2.62	2.46			
Question Mean	**2.53**	**2.71**	**2.63**	**2.53**	**4.59**	**4.62**	**4.64**

Note: Due to a photocopying error responses were missing for Session 8 and Sessions 28-33.

Table 7

Means for Each Pediatric Program Question

Session	Assessment improved	Confident to determine what to communicate	Feel better prepared	Confident in decision-making	Incorporate into practice	Objectives stated clearly	Format of program effective
1					4.6	4.8	4.6
2					4.67	5.00	5.00
3					5.00	4.75	4.75
4					5.00	4.75	4.75
5					4.50	5.00	5.00
6					4.80	4.80	4.80
7					4.67	4.83	4.50
8					4.50	4.75	4.50
9					4.75	4.75	4.75
10					4.75	5.00	5.00
11					4.60	4.80	5.00
12					4.60	4.80	4.80
13	2.33	2.33	2.33	2.00	4.67	4.33	4.33
14	2.67	3.00	3.00	2.67	5.00	5.00	4.83
15					4.80	5.00	5.00
16					4.80	4.60	4.60
17					4.50	4.50	4.75
18					4.63	4.75	4.50
19	2.20	2.80	3.00	2.80	4.20	4.40	4.40
20	2.50	3.00	3.00	3.00	4.75	5.00	4.50
21	2.29	2.71	2.86	2.14	4.88	4.88	4.88
22	2.43	2.86	2.43	2.29	4.71	4.86	4.71
23	2.67	3.00	3.00	2.67	4.75	4.75	5.00
24	2.25	3.00	2.75	2.25	5.00	5.00	5.00
25	2.43	2.86	2.86	2.29	4.71	5.00	4.71
26	2.57	2.71	2.71	2.43	4.86	4.71	4.86
27	2.71	2.71	3.00	2.57	4.71	4.71	5.00
28	2.38	2.75	3.00	2.75	4.75	4.50	4.75
29	2.67	2.50	2.67	2.50	4.50	4.50	4.50
30	2.00	3.00	2.00	2.00	4.67	4.17	4.50
31	2.80	2.80	2.80	2.60	4.67	4.50	4.83
32	2.86	3.00	2.88	2.63	4.88	4.75	4.75
33	2.43	2.71	2.57	2.43	4.86	4.86	4.71
34	2.50	2.67	2.50	2.50	4.50	4.33	4.50
35	2.25	2.75	2.75	2.50	4.80	4.80	4.80
36	2.63	2.50	2.75	2.38	4.50	4.50	4.38
37	2.60	2.80	3.00	2.80	4.60	4.40	4.60
38	2.20	2.60	2.40	2.00	4.67	4.50	4.67
39	2.60	2.80	3.00	2.40	4.86	4.57	4.86
40	2.67	3.00	3.00	2.67	5.00	5.00	5.00
41	2.33	2.50	2.83	2.50	4.50	4.50	4.83
42	2.60	2.60	2.60	2.60	4.80	4.60	4.80
43	2.60	2.50	2.80	2.40	4.80	4.80	4.80
44	2.50	2.50	3.00	3.00	4.50	4.00	4.50
45	2.20	2.40	2.80	2.40	4.00	4.00	4.00
46	2.40	2.80	2.60	2.40	4.80	4.60	4.00
47	2.75	3.00	3.00	2.75	5.00	5.00	5.00
48	2.67	3.00	2.67	2.67	4.67	4.67	4.67
49	2.67	2.67	3.00	3.00	5.00	5.00	5.00
50	2.50	3.00	2.50	3.00	5.00	4.50	5.00
Mean	**2.50**	**2.76**	**2.77**	**2.53**	**4.71**	**4.69**	**4.72**

Note: Due to photocopying error responses missing from Sessions 1-12 & 15-18.

Of the 660 participants who attended the adult code blue program, 644 completed the Team Training Evaluations. Team training evaluations were completed in 33 individual sessions of the adult code blue program. The pediatric team training had 50 sessions with 259 participants completing the Team Training Evaluation out of the 269 attendees. The number of the individual and combined program total evaluations completed meets the sample size necessary for a confidence level of 0.95 with a margin of error of +/- 5%. The adult code blue required 207 staff to attend, and there were 644 participants who completed the evaluation tool, and the pediatric team training required 132 participants and had 269 staff attended and 259 completed the evaluation tool. Some of the returned evaluations were not completed in entirety with some questions left blank. Additionally, due to photocopying errors, there were a few sessions where participants only had one side of the two-sided document to complete, resulting in incomplete data for those sessions. Please see Table 8 for listing of respondents per question by program.

Table 8
Number of Respondents to Each Evaluation Question

Question	Total respondents	Adult respondents	Pediatric respondents
1	644	477	167
2	644	477	167
3	643	477	166
4	640	474	166
5	623	369	259
6	623	369	259
7	628	374	259

Note: 660 total adult staff participated and 269 pediatric staff participated. Not all staff completed the evaluation or completed in entirety.

The null research hypothesis was that there was no difference between the adult and pediatric programs in providing skills and knowledge necessary to respond to the

code. Both programs' individual scores by question were entered into SPSS version 23 for a determination of chi square for statistical significance using an alpha level of 0.05 for each of the seven evaluation questions. Questions 1-4 related to teams training concepts and Questions 5-7 asked about program effectiveness. The data were analyzed using a Pearson chi square test.

Results of the team training questions. The first team training program question was *I feel better prepared to care for my patients in the clinical environment*. The Pearson chi square test determined that there was a significant statistical difference between the adult and pediatric participants' perception of feeling better prepared for the clinical care of their patients, X^2 (2, N=644) = 10.246, p = .006. Of the 477 adult participants who responded to this question, 34.6% "somewhat agreed" and 64.8% "strongly agreed". Of 167 pediatric participants who responded to this question, 22.2% "somewhat agreed" and 77.8% "strongly agreed". The results for this question demonstrated that the pediatric team training participants felt more prepared after attending the simulation-based team training. Refer to Table 9 for the complete listing of the four team-training questions.

The second team training question was *I feel more confident in my decision-making skills*. The Pearson chi square test determined that there was no significant statistical difference between the two programs, X^2 (2, N =644) = .550, p = .759. Of the 477 adult participants who responded to this question, 44.4% "somewhat agreed" and 53.9% "strongly agreed" that they had increased confidence in their decision-making skills, while of the 167 pediatric participants who responded to this question, 46.1%

"somewhat agreed", and 51.5% "strongly agreed". Participants in both perceived increase in confidence in decision-making skills.

Table 9

Percentages of Respondents for Team Training Questions by Program

	Do not agree	Somewhat agree	Strongly agree
I feel prepared - adult	0.6%	34.6%	64.8%
I feel prepared- pediatric	0.0%	22.2%	77.8%
Confident in decision making-adult	1.7%	44.4%	53.9%
Confident in decision making-pediatric	2.4%	46.1%	51.5%
Confident in communication- adult	0.8%	27.0%	72.1%
Confident in communication- pediatric	0.6%	24.1%	75.3%
Assessment skills improved-adult	3.6%	40.3%	56.1%
Assessment skills improved- pediatric	1.2%	47.0%	51.8%

The third team training question was *I am more confident in determining what to communicate to the health care providers in the clinical team*. The Pearson chi square test determined that there was no significant statistical difference between the two programs, X^2 (2, N =643) = .667, p = .717. Of the 477 adult participants who responded to this question, 27% "somewhat agreed", and 72.1% "strongly agreed", and of the 166 pediatric participants who responded to this question, 24.1% "somewhat agreed" and 75.3% "strongly agreed" that there was an increased confidence in communication with healthcare providers in the clinical team. Participants for both programs perceived a similar increase in their confidence in communication.

The fourth team training question was *My assessment skills improved*. The Pearson chi square test determined that there was no significant statistical difference between the two programs, X^2 (2, N =640) = 4.075, p = .130. Of the 474 adult participants

who responded to this question, 40.3% “somewhat agreed”, and 56.1% “strongly agreed”, and of the 166 pediatric participants who responded to this question, 47% “somewhat agreed” and 51.8% “strongly agreed” that they perceived an improvement in assessment skills. Participants in both programs perceived a similar increase in assessment skills.

Results of the program effectiveness questions. The first program effectiveness question was *I plan to incorporate what I learned today into my clinical practice*. The Pearson chi square test determined that there was a significant statistical difference between the two programs, X^2 (3, N =623) = 11.502, p = .009. Of the 369 adult participants who responded to this question, 5.1% stated they were “neutral”, 29% “agreed”, and 65.9% “strongly agreed”, and of the 254 pediatric participants who responded to this question, 0.8% stated they were “neutral”, 26% “agreed” and 72.8% “strongly agreed”. The results demonstrated that more pediatric program participants planned to incorporate the knowledge learned from the activity into their clinical practice. Refer to Table 10 for the percentages for the three program evaluation questions.

Table 10

Percentages of Respondents for Program Effectiveness Questions by Program

	Disagree	Neutral	Agree	Strongly agree
Incorporate into practice-adult	0.0%	5.1%	29.0%	65.9%
Incorporate into practice-pediatric	0.4%	0.8%	26.0%	72.8%
Objectives met-adult	0.3%	5.4%	22.5%	71.8%
Objectives met-pediatric	0.0%	3.5%	23.6%	72.8%
Format effective-adult	0.3%	3.7%	26.2%	69.8%
Format effective-pediatric	0.0%	2.4%	24.8%	72.8%

Note: There were no respondents who chose strongly disagree for these questions.

The second program effectiveness question was *The objectives of this program were clearly stated*. The Pearson chi square test determined that there was no significant statistical difference between the two programs, X^2 (3, N =623) = 1.932, p = .587. Of the 369 adult participants who responded to this question, 5.4% stated they were "neutral", 22.5% "agreed", and 71.8% "strongly agreed", and of the 254 pediatric participants who responded to this question, 3.5% stated they were "neutral", 23.6% "agreed" and 72.8% "strongly agreed". Participants in both programs felt similar that the objectives were clearly stated.

The final program effectiveness question was *The format of this program was effective*. The Pearson chi square test determined that there was no significant statistical difference between the two programs, X^2 (3, N =628) = 1.899, p = .594. Of the 374 adult participants who responded to this question, 3.7% stated they were "neutral", 26.2% "agreed", and 69.8% "strongly agreed", and of the 254 pediatric participants who responded to this question, 2.4% stated they were "neutral", 24.8% "agreed" and 72.8% "strongly agreed" that the format of the program was effective. Participants in both of the programs felt the format of the simulation-based activity was effective. Refer to Table 11 for Pearson chi square results of each of the seven questions.

Table 11

Pearson Chi Square Test Results

Question	Value	df	asymptotic significance
I feel prepared	10.246	2	.006**
Confident in decision making	.550	2	.759
Confident in communication	.667	2	.717
Assessment skills improved	4.075	2	.130
Incorporate into practice	11.502	3	.009**
Objectives met	1.932	3	.587
Format effective	1.899	3	.594

Note: ** $p < .05$ for statistical significance.

Quantitative Analysis

The null hypothesis, there was no difference between the adult and pediatric programs in providing skills and knowledge necessary to respond to a code was supported for five of the seven questions. There was similarity between the programs for the three team training questions about the participants' perceptions of increased confidence in decision making, improved team communication and assessment of the patient.

A review done by Yuan, Williams, and Fang, (2012) demonstrated that there was a mixed contribution to the literature on simulation-based education on increasing confidence and more study on this topic was recommended. Since the review, multiple studies have demonstrated an increase in confidence after participation in simulation-based educational activities (Ballangard, Hall-Lord, Hedelin, & Persenius, 2014; Bloch & Bloch, 2015; Dawson, Russ, Sevdalis, Cooper, & DeMuntes, 2013; Figueroa et al., 2013). The learners of both programs perceived an increase in their confidence after participation in the simulation-based activity.

The literature supported an increase in communication and skill after simulation training activities (Bultas, Hassler, Ercole, & Rea, 2014: Klipfel, et al., 2014; Paull et al., 2013). Team based simulations allowed for practice of crisis resource skills including the critical skill of effective communication and the participants of both programs perceived an increase in both communication, decision making, and assessment skills.

The alternative hypothesis, there was a difference between the two programs was supported for the feeling of preparedness after the training. The pediatric program had smaller groups, which allowed for more participation during the scenarios and debrief discussion. Tanner's (2006) model of clinical judgment, which includes four areas of learning; noticing, interpreting, responding, and reflection can be applied to simulation-based educational design (Kelly, Hopwood, Rooney, & Boud, 2016). The pediatric format with the smaller groups allowed for the participants to have a more active role in the scenario, actively noticing, interpreting, responding, and then utilizing reflection during the debriefing session. Larger groups split between active involvement and observing use all of the aspects of Tanner's model but not all with the same perspective than always having an active role demonstrates. The larger group format of the adult program may have decreased their feeling prepared as the participants' had less opportunities to be active in the scenario and reinforce the learning.

The format of the program for the pediatric program rotated a series of clinical scenarios of typical pediatric patient presentations such as respiratory distress, seizures, sepsis, and acute gastrointestinal bleed as well as pulseless electrical activity (PEA). Medical simulation through experiential learning provided the participants with

opportunities to critically think, practice decision making, and implement knowledge into their clinical environment (Pasquale, 2013). The use of relevant situations for the scenarios could have increased their feelings of preparedness as the participants could draw on personal experiences.

The null hypothesis was supported for two of the three program effectiveness questions. Participants of the both programs thought the format effective and the objectives for learning clearly stated. These results supported that although the programs were slightly different in design the overall effectiveness of a simulation-based code team training program was perceived as effective by participants in both programs.

The perception by both groups supported the effectiveness of stating the objectives in the prebriefing segment of the program. The simulation standards of best practice stated the importance of adequate preparation for the activity lead to the understanding of expectations for performance within the session (Meakim et al., 2015). At Jones Medical Center, the simulation lead facilitator stated in the team training prebrief that the objective of the simulation session was for learning and practicing team roles and responsibilities and appropriately demonstrate care in an emergent situation.

The alternative hypothesis, there was a difference between the adult and the pediatric programs in providing staff with the skills and knowledge needed to respond to a code blue, was supported by the program evaluation question, *I plan to incorporate the what I learned today in my clinical practice*. More pediatric participants planned to incorporate what they learned into the clinical setting after the simulation-based training. This difference could also be a result of the content of the individual scenarios. Both

programs used low volume high acuity scenarios, but the pediatric program alternated six scenarios where the adult program utilized one main scenario. The probability of the pediatric participants in encountering one of the scenarios was perceived as more likely due to the variety of the relevant scenarios.

The quantitative results from two of the seven questions on the Team Training Evaluation form demonstrated statistical significance. The pediatric participants perceived that they felt more prepared to care for the patient in the clinical environment after the simulation-based education and that they would incorporate the knowledge and skills into their clinical practice. The possible reasons for the differences between the programs included smaller groups and a variety of relevant scenarios. Otherwise the participants felt similar about confidence, decision making, assessment skills, clarity of objectives, and effectiveness of the format of the program.

Qualitative Results from Team Training Evaluation

The mixed method approach for this study allowed for both quantitative and qualitative data collection and analysis in addressing the research questions. Research Questions 2, 3, and 4 specifically explored the qualitative component of the study. The program evaluations from the adult code blue and pediatric team training programs solicited staff perceptions on effectiveness of both programs and any barriers encountered. The second and third research questions specifically related to the individual programs' effectiveness in providing the staff with skills and knowledge needed. Open-ended questions asked participants what they liked best, what they liked

least, and how they thought the training could be improved. The data were analyzed by question for the adult and pediatric program.

What did you like best about the program? Of the 929 (634 adult staff, 269 pediatric staff) participants, this open-ended question was answered by 505 respondents (264 adult and 244 pediatric participants). The responses for this question were recorded, coded, categorized and then five themes were identified. The adult and pediatric programs had similar themes. These themes were (a) feedback and debriefing, (b) simulation and realism, (c) multidisciplinary presence and teamwork, (d) hands-on practice and participation, and (e) educational design, facilitation, and environment of the programs. Each of these themes addressed important components of simulation-based education. See Table 12 for categories and themes.

Feedback and debriefing. This theme reflected that the participants' valued the debriefing process and the feedback that was provided at the conclusion of the scenario. According to Meakim et al. (2015), debriefing and feedback are different but critical elements, where debriefing effectiveness is related to facilitator training and preparation adding to the richness of the learning, and feedback is the guided response to improve or confirm participant practice. This theme's categories were debriefing, feedback, video, discussion after, immediate feedback, and safe feedback. These categories demonstrated the participants' perspective on timing of feedback in relation to the performance during the scenario and skill that facilitators used to provide the feedback in a safe effective format. Participants valued feedback on performance and identification of any remaining performance gaps.

Table 12

What was Liked Best about the Program

Theme	Adult Categories	Pediatric Categories
Feedback and Debriefing	Debriefing, video, collaborative discussion, constructive feedback, communication in debriefing, debriefing education	Video, debrief time, immediate feedback, reflection, communication, debrief takeaways, safe feedback
Simulation and Realism	Realistic experience, reality, simulation scenario, realism, mannequin	Monitors, mannequin, reality of scenario, high fidelity, high-stress environment, accurate, relevance, case
Multidisciplinary presence and Teamwork	Multidisciplinary, team-oriented, interdisciplinary, practice, teamwork, pharmacist presence, nursing presence, team building, collaboration	Leadership, multidisciplinary, interdisciplinary, communication, teamwork, teambuilding, determining roles, RN, and respiratory presences
Hands-on practice and Participation	Hands on, participation, practice, code cart, BLS, equipment, practice being in different roles, skills, the practical experience	Interactive, hands-on, practice skills, opportunity to use real equipment, communication practice, code cart review, drug doses, decision-making practice, PALS
Educational design, Facilitation, and Environment of Program	Watching ourselves, preparation, facilitator, informal setting, assigned roles, communication, interactive, chaos, where to stand diagram, organization, learning, good cases, integrated, nonjudgmental, protected learning environment, learning as goal, value of CRM new experience, positive learning experience	Well-coordinated, controlled setting, safe environment, clear expectations, increased confidence, space, technology, experiential learning, awesome experience, repeating scenario, takeaways, facilitation, stretching outside comfort level, small group

Simulation and realism. The theme of simulation and realism reflected participation in a relevant and realistic educational activity. Simulation best standards and guideline statements on quality simulation-based education encourage clinical scenario development include a backstory, realistic clinical progression, and consistency from session to session with the use of scripting (Meakim et al., 2015). Well-designed programs incorporate realistic scenarios that ensure a validity of content, reliability, and standardization for all program participants (Schaefer, et al., 2011). This theme's categories included realism, fidelity, reality of the scenario, lifelike, and real life.

Fidelity has two definitions in the simulation literature, one definition refers to the ability of the mannequin to mimic human characteristics, the higher the fidelity, the more lifelike the responses to interventions, and the second refers to the realism of the experience; environmental, and personal aspects (Slone & Lampotang, 2015). The best practice simulation standard criterion referring to fidelity states that objectives of a simulation-based program are achieved through attention to the physical, conceptual, and psychological realms throughout the design of the experience (Lioce et al., 2013). The participants' responses reflected the value of realism during the educational experience.

Multidisciplinary practice and teamwork. The theme of multidisciplinary practice and teamwork described how the participants' valued the importance of training as a team. Often in health care settings, educational activities are designed and implemented to meet the needs of a single discipline. Program outcomes in single discipline-focused activities target the specific educational needs of the learners. Healthcare simulation-based education provides opportunities for team members to practice collaboratively (Sundar et al., 2007). Hospitalized patients are cared for by a multidisciplinary team of professionals. Team members must have effective communication skills, clear role definition, and an ability to allocate resources during a patient crisis (Fanning et al., 2013). This themes' categories included multidisciplinary, interdisciplinary, teamwork, team oriented, collaboration, team building, and having all roles present. The participants' responses for this category demonstrated the importance of interdisciplinary learning in strengthening team function.

Hands-on practice and participation. This theme reflected the participants' desire to practice application of knowledge and perform skills in a safe environment. Simulation-based education allows the participant to improve their knowledge, competence, and performance (Zigmont, Wade, Lynch, & Coonfare, 2015). Many healthcare providers have limited opportunities to practice team-based care during their education and training and interprofessional simulation training allowed for opportunities to practice together (Bittencourt-Couto et al., 2015). Simulation-based learning increased skill retention and reduced the decay of essential skills and the knowledge needed for the infrequent occurrence of resuscitation (McGaghie, Issenberg, Barsuk, & Wayne, 2014). The theme's categories included interactive, hands-on, participation, practicing codes, using equipment, practical experience, role practice, and practice of high acuity, low volume situations. The participants' responses in this category supported the importance of hands-on learning and active involvement during an educational activity.

Educational design, facilitation and environment of the program. This final theme highlighted the importance of design and implementation of the program. The 2015 AHA guidelines for cardiopulmonary resuscitation recognized the importance of experiential learning and reflective debriefing that occurred in simulation-based education (Bhanji et al., 2015). For simulation-based training to be effective, the trained facilitator performs three roles during the debriefing; creation of a safe environment, fostering reflective practice, and gaining a commitment to change in practice based on the participation in the activity (Paige, Arora, Fernandez, & Seymour, 2015). This theme's categories included observation, safe environment, preparation for activity, supported

positive learning experience, experiential active learning, clear expectations, nonjudgmental, relevant, and facilitators. These responses demonstrated the perception of positive learning with a supported safe environment.

Overall, the participants' responses to this question identified positive elements of the two simulation-based team training programs. Both groups were similar in their expressed perspectives within the training. The participants' appreciated immediate feedback during the debriefing session to assist them in identifying what was done well and what remained a performance gap in practice. Relevant realistic clinical situations were important for effectiveness of simulation-based education. The presence of the entire team was important for effective learning of team related roles and responsibilities for emergent patient care situations. The active involvement within a simulation scenario allowed participants to practice skills in a meaningful way and apply the knowledge to their professional practice. The participants of both programs perceived simulation as a positive learning experience in a safe and supported environment. The themes identified through this open-ended question support that staff perceived elements of effectiveness in learning skills and knowledge for patient care.

What did you like least about the program? This question was answered by 182 respondents (96 adult and 86 pediatric participants) out of 929 total participants in the programs. These data were also recorded, coded, categorized and four themes identified. The themes were consistent across both programs. Themes were (a) time and frequency of the program, (b) lack of realism regarding missing team members and simulation limitations, (c) educational design including orientation, clarifications of role

expectations, and use of video, and (d) identification of knowledge gaps and performance anxiety. Refer to Table 13 for categories and themes.

Table 13

What was Liked Least about the Program

Theme	Adult Categories	Pediatric Categories
Time and Frequency	Not enough time, felt rushed, no time to repeat, infrequent, not enough sessions, more scenarios needed, make on regular basis, not enough times a year	Ability to attend when on duty, not enough time, too rushed, repeat scenario, more scenarios, more practice time, too little debrief time, infrequent
Lack of realism	Expectations of participation and simulation, clarification on manikin capabilities, equipment issues, simulation limitations, role confusion, missing whole team, need nurses	Manikin limitations, lack of realism, lack of RN presence, anxiety provoking, suspending disbelief, lack of actual equipment
Educational Design	Organization, expectations, everyone should be able to participate, unfamiliar with equipment, limited resources, coordination, inability to watch video, pre-brief more, want different scenario, repeating simulation, video	Orientation, want to watch video, role expectations, repeat different scenario, preparation, video playback
Identification of Knowledge Gap/Performance Anxiety	Lack of knowledge of adult disease, review algorithms post, normal code anxiety, stressful, skill practice time needed, add didactics	Lack of knowledge on equipment, anxiety, intimidating, felt unprepared

Time and frequency. This theme related to the availability of simulation educational activities for the staff. All of this theme's categories spoke of a desire for more types of programs occurring more frequently. The adult program was only offered twice annually, both for four consecutive weeks, but the adult residents and interns were only allowed to attend one session during the four weeks for a 90-minute session. The pattern of the adult program responses focused on frequency over time with the

categories such as infrequent, not enough sessions, increase frequency, make on regular basis, and not enough times a year. The adult categories on time reflected the 90-minute session time frame and included time constraints, felt rushed, short simulation, not enough time to repeat. The adult participants were dissatisfied with the frequency of the program and the length of the program. The program was not offered enough, nor was it long enough.

The pattern of the responses from the pediatric evaluations demonstrated a focus on time over frequency. Time-related categories included the ability to attend when on duty, too rushed, short time during the clinical scenarios, limited time, make longer, only one scenario, more practice time, decrease debrief, and add another scenario. The difference in focus reflected the format of the programs. The pediatric team training format scheduled programs throughout the year, once or twice a month. The initial time frame for the pediatric program was only an hour and did not always allow for a repeat simulation. The ability to immediately put into practice the concepts discussed during the debriefing has led to a higher probability of sustained change (Boet et al., 2014). The responses from the pediatric evaluation showed that the participants' desired an opportunity to repeat the simulation scenario to reinforce and practice debriefing topics. The pediatric participants were less focused on how often the program occurred.

Lack of realism. The lack of realism specifically targeted the limitations of simulation-based education and incomplete care teams. This theme was consistent between both adult and pediatric programs. Realism in simulation design included mannequin fidelity, replication of work environment, presence of entire care team and

relevant scenarios reflective of actual patient presentations (Slone & Lampotang, 2015). Mannequin fidelity refers to ability of the simulator to replicate the responses of a patient to the scenario and interventions (Lopteiato et al., 2016). Categories supporting this theme identified by both programs included equipment missing, mannequin limitations, inability to replicate the environment exactly and team members missing, especially nurses. Both programs struggled with nursing attendance throughout the study period, and this was reflected in this question's responses. The adult program, which occurred on Friday mornings presented conflicts for nursing due to staffing and patient care needs. Although the pediatric program occurred on various days, it was always during the noon hour, which was difficult for pediatric nurses to attend due to staff lunch breaks and the need to feed the infant and toddler patient population.

Participants at both programs struggled with limitations of simulation-based education. Human patient simulators cannot replicate patient perfusion assessment via skin color changes and capillary refill, skin temperature, and muscle tone (Epps, White, & Tofil, 2013). An additional issue identified for the pediatric program related to the lower fidelity of the pediatric mannequins. The simulation center at Jones Medical Center had two high fidelity SimBaby© and a lower fidelity MegaCode Kid©. The lower fidelity mannequin lacked chest rise and fall and presence of retractions, important visual cues of pediatric respiratory distress, decreasing the realism for the pediatric participants. Two scenarios for the pediatric team training program related to respiratory decompensation. Health care providers rely on visual cues to assist in identifying a

patient's signs and symptoms and prioritizing interventions and this limitation dissatisfied the pediatric program participants.

Educational design. This theme referred to categories of orientation, clarification of role expectations, and use of video. Responses on both program evaluations were categorized to reflect participant preparation and format of the program. Categories identified were orientation, role expectations, have a different scenario as a repeat, disliked watching video playback, defining roles, orientation to equipment, prebriefing, change scenario, and organization. The simulation standard for best practice on simulation design identified that effective simulation-based educational programs contain the following criteria; needs assessment, measurable objectives, the format of the program, clinical scenario, fidelity, facilitation, briefing, debriefing, evaluation, and participant preparation (Meakim et al., 2015). The participants specifically identified the format of the program, briefing and participant preparation as major weaknesses in the design.

The structure of a simulation-based activity refers to the entirety of the program and participant engagement (Meakim et al., 2015). The format for the two programs varied. The adult code blue program had large participant groups at each session necessitating two scenarios during the 90-minute session, so all participants had an active role in a scenario. The benefit of this design was all participants were involved in both scenarios through either active participation or observation allowing for reflection and participation in both scenario debriefing sessions (Bloch & Bloch, 2015; Kaplan, Abraham, & Gary, 2012; Kelly et al., 2016). The disadvantage to this format was the

organization needed for placing a large group into balanced teams and less time available for debriefing. The format of the adult code blue program only allowed 5 minutes of prebriefing time, and 5 minutes of orientation to the simulator and environment, which was reflected in the adult participant responses asking for more equipment orientation, better organization, and clearer role definition.

The pediatric team training format had smaller groups resulting in one team, and this allowed more time for prebriefing and orientation. With a smaller group and the need for only one scenario for all participants to have an active role, there was adequate time left for debriefing. Initially, the pediatric program was only one hour, but based on evaluation feedback, it was increased to two hours to include a second scenario for reinforcement of skills related to the debriefing discussion. The pediatric team training dissatisfaction responses after the increase to two hours concentrated more on the use of video and incorporating a different case for the second scenario.

The briefing category was identified by both program participants as important. Briefing sets the stage for participant expectations, should be structured, consistent, and occur directly before the simulation scenario experience (Husebo, Friberg, Soreide, & Rysteadt, 2012; Page-Cutrara, 2014; Rudolph, Raemer, & Simon, 2014). The simulation center at Jones Medical Center has a standardized prebriefing format that includes orientation to simulation education, scenario environment, the simulator, equipment available, and participant expectations. The process for both programs included a standardized room and equipment prebrief performed by the simulation technologist for consistency. This prebrief included and opportunity for participants to engage with the

simulator by auscultating, palpating, and visualizing the features and limitations of the mannequin. The participants of both programs identified gaps in the prebriefing process.

Identification of knowledge gaps and performance anxiety. This theme focused on the participants' self-identification of personal knowledge gaps in practice, familiarity with emergency equipment, and their perception of anxiety. The categories identified included lack of knowledge, nervousness, felt unprepared, go through algorithms, normal code anxiety, stressful, skill practice time needed, and add didactics. Simulation-based education utilized reflective learning techniques through the use of video playback and facilitated debriefing discussions (Poore, Cullen, & Schaar, 2014; Reed, Andrews, & Ravert, 2013). Reflective learning encouraged participants to self-identify on performance gaps, and the video playback provided an additional opportunity to self-critique clinical performance.

The need to respond to a medical emergency where the potential to impact patient outcomes causes participants to feel nervous, anxious and stressed. These responses demonstrated discomfort with the method of learning for some of the participants. Research demonstrated that feelings of stress caused by participation in the simulation are contextual and usually mirror the responses felt in an actual clinical situation (DeMaria & Levine, 2013). DeMaria and Levine (2013) found that skillfully facilitated debriefing sessions following relevant, realistic, stressful simulation scenarios enhanced long-term knowledge retention. Although the perceived stress felt uncomfortable for the participants, long-term knowledge retention hopefully occurred as a result.

The participants were dissatisfied with some aspects of simulation-based learning and the format of the two team training programs. Both groups felt that the programs were too short and not offered frequently enough. The adult participants felt rushed and wanted to have the program occur more frequently than twice annually. The pediatric program dissatisfaction was accommodated by increasing the program length. There were fewer comments from the pediatric participants on frequency, but their responses indicated a desire for more programs.

Overall, both groups felt the lack of realism affected learning. The pediatric group identified mannequin fidelity as an issue, while all participants struggled with mannequin limitations. Both groups also displayed dissatisfaction when not all disciplines were present affecting their ability to learn team roles and responsibilities.

The participants were dissatisfied with the format of the program. Both groups identified a need for improved prebriefing and clarification on participation expectations. The adult participants expressed dissatisfaction with large group learning and inability to participate twice. Both groups of participants desired different second cases. Both groups had participants that disliked the use of video playback during debriefing.

The participants of both programs also felt unprepared related to knowledge gaps and unfamiliarity with the emergency equipment, leading to feelings of anxiety and stress. The participants also felt some discomfort. This was related to internal factors such as their knowledge gap or external factors in emergent situation patient care.

The staff perception of a continued knowledge gap identified that the programs were not as effective in giving the staff knowledge and skills for practice. The themes

identified by staff included a lack of realism. This perception was specifically related to missing nursing staff and supported the existence of barriers to attendance.

How can we improve your experience in future programs? This final open-ended question was answered by 264 (153 adult and 111 pediatric participants) of the 929 participants. The responses were recorded, coded, categorized and themes identified. Themes were similar in both programs with a few categorical differences among the two programs. The three main themes identified were (a) increased in frequency and length of the program, (b) increase realism, and (c) improvement in preparation for participation. Refer to Table 14 for categories and themes.

Increase in frequency and length of the program. Respondents in both programs wanted an increase in frequency and length of the program, but the adult participants wanted an increase in additional cases, while the pediatric participants wanted more opportunities to practice the case. The differences between the response focus may be a result of the different program designs. The adult program used the same basic scenario for each session, while the pediatric program alternated between a series of 5-6 cases over the study time. The adult program had the participants repeat the scenario in each session, but the pediatric team training initially only allowed the one scenario. After the pediatric program had increased to two hours, this response diminished.

Table 14

How to Improve Experience in Future Programs

Theme	Adult Categories	Pediatric Categories
Frequency and length of the program	More code simulations, cases/sessions, similar programs, more frequent, more practice, longer than 90 minutes, earlier in year, more access to the sim lab, more individual sessions, offer quarterly, run 2 different scenarios	More time in sim center, more often and longer, more scenarios, longer session, do this during a non-lunch time, more debrief times, more time for skills, free time to learn, more experiences, have earlier in training, do some in situ
Increase realism	More nurses, multidisciplinary roles, labs result too soon, ensure equipment functions, relevant staff present, faster vital responses, more realistic scenarios,	Technical difficulties, multidisciplinary, manikin responses, higher fidelity simulator, have opportunity to do procedures, having nursing present, have pretend parents, match intern roles with # interns, more clear physical signs of patient distress,
Improvement in preparation for participation	Repetition/overview of sim capabilities, review of ACLS guidelines, organize faster, improve prebrief, have different scenarios, define roles, email a prep packet, review CRM, prebrief, define the code process in the sim, less debriefing, more equipment orientation, videos prior for example, list of role responsibilities, include a procedure session	Explanation of realism and suspension of disbelief, orientation to code cart, better organization of the case, orient to what is performed and what simulated, clarify medical management pre and post, practicing communication and roles, learning sheet to take away, show more video playback

Increase realism. Both programs participants wanted an increase in realism with attendance of all team members and the inclusion of actual patient care equipment, but the pediatric participants also desired increase in fidelity. Team attendance categories included ensuring presence of all disciplines, team collaboration, nursing and respiratory therapist presence, more realistic scenarios, multidisciplinary, and nursing roles added to sim would be helpful. Both programs significantly identified the inability of nursing to

attend the team-based training. A review of the disciplines participating in the programs showed that the adult code blue program was missing or did not have adequate nursing representation in 70% of the sessions, and the pediatric team training was missing nurses in 68% of the sessions.

To increase realism, an increase in fidelity was necessary for the pediatric program. The adult code blue program used a high-fidelity mannequin, while the pediatric team training was limited by the use of a lower fidelity child mannequin in some scenarios. The missing fidelity was particularly noticeable for the respiratory cases, as the mannequin did not mimic chest rise or retractions, important visual cues for pediatric providers. Categories identified supporting this pediatric theme included more realistic mannequins, high fidelity child mannequins, more advanced mannequins, clearer physical signs of patient distress.

Improvement in preparation for participation. The final theme identified the importance of clarification of expectations of participation and orientation to the program. Simulation-based healthcare education became more prevalent in the mid to late 1990s (Rosen, 2013). More senior Jones Medical Center staff may not have experienced simulation-based education in their prelicensure training or continuing education activities. These team-based programs often were the first experience in simulation for some staff. Now that more nursing and medical schools have simulation-based education as part of their curriculum, the new to practice staff have more experience in this methodology.

This lack of exposure and comfort with simulation-based education required a comprehensive prebriefing reviewing expectations on roles and participation as well as the functionality of the equipment (Rudolph et al., 2014). Categories identified included a more comprehensive prebrief, equipment orientation (including mannequin), clear definition of role expectations, provision of a prep packet before the activity, and explanation of the process of a simulation activity.

The role of prebriefing in simulation-based education continues to be an area of focus in the current research. McDermott (2016) found that the experts in simulation education agreed on the importance of including a comprehensive prebriefing in simulation-based education and the role it had on the improved experience of both the participation within the scenarios and reflective learning during the debriefing. The categories related to this theme reinforced the participants' perceptions around prebriefing and simulation satisfaction.

The *How to Improve Experience in Future Programs* question's themes summarized what the staff of Jones Medical Center wanted from simulation-based education programs and answered the research questions on the effectiveness of the adult and pediatric programs. The participants' perceived that more frequent and longer sessions with a variety of scenarios would increase the effectiveness of the programs. Participants of both programs perceived that increased realism of environment, staffing, and fidelity would improve the experience and provide skills and knowledge for effective team performance. Participants wanted the format of the learning activity to include more preparation so they would understand their role and performance expectations.

Qualitative Results From the Nursing Needs Assessments

Specific questions on the two needs assessments provided additional perspectives of the nursing staff for the overall analysis. The nursing needs assessment survey that occurred in the summer of 2015 clarified outstanding self-identified nursing performance gaps. The needs assessment was administered using Survey Monkey© and was open to all staff nurses at the medical center. A total of 230 nurses out of over 1200 nurses who work inpatient at Jones Medical Center answered the survey.

Preferred method of learning. The survey asked the nurses about their preferred method of learning. Survey Monkey© ranked the results for 12 common methods used for education delivery from the 189 responders to this question. Please refer to Table 15 for the complete list. The top four ranked preferred methods were (a) classroom lecture with an instructor, (b) hands-on sessions, (c) classroom lecture with audience response system (ARS), and (d) unit based in-services. The least favored methods were (a) independent activities such as videos/ DVDs, (b) emails/newsletters, (c) self-directed packets, (d) posters, and (e) SharePoint©, a repository for educational materials. These results demonstrated that nursing staff preferred engaged and interactive learning methods over the less interactive methods.

Electronic platforms and simulation-based learning were in the middle of the rankings. The electronic learning platform and webinars included some interactive components such as embedded questions in the content, pretests, and posttests, and videos making it more interactive than each of the components alone. Simulation-based education was not a common method of learning for healthcare before the late 1990's and

early 2000s (Rosen, 2013). Much of the medical center nursing staff are senior and have been practicing more than 15 years. This lower ranking for simulation may result from decreased comfort with the methodology. The same rationale could explain why electronic platforms and webinars ranked in the middle. All of the learning methods listed as choices were utilized by the nursing education department to provide evidence-based updates in practice, competency assessment, and continuing education.

Table 15

Staff Ranking of Preferred Learning Methods

Learning Method	Ranking
Classroom lecture/instructor	1
Hands-on sessions	2
Classroom lecture/ARS	3
In-services on the unit	4
HeathStream©[a]	5
Simulation team training	6
Electronic/webinars	7
Video/DVDs	8
Email/Newsletters	9
Self-directed learning packets	10
Posters	11
SharePoint© repository	12

Note:[a] Healthstream© is a learning platform used by JMC
[b] SharePoint© is a repository where educational materials are stored and accessed by staff

Topics for annual competency sessions. The design of the survey separated out the respondents by practice area to better clarify educational gaps particular to that specialty. All nurses were asked by specialty to rank the top five topics desired for annual competency sessions. SurveyMonkey© tabulated the responses of 40 adult nurses and 21 pediatric nurses who responded to this question. Please refer to Table 16 for top priorities by specialty.

Table 16
Staff Top 5 Priorities for Competency Sessions

Adult	%
Telemetry review ECG	55%
Rapid response/ patient decompensation	45%
Mock code skills	43%
Team Training in a mock code	43%
Care of the withdrawing patient CIWA, COWS	35%
Pediatric	**%**
DKA/Diabetes- carb counting and insulin	53%
Mock Codes/ team training	43%
Updates on evidence-based practice	43%
Telemetry review/ ECG	39%
High-risk medication review	33%
Care of the sickle cell patient	33%

The adult nurses ranked telemetry review, rapid response/ decompensating patient, mock code skills, team training in a mock code, and care of the withdrawing patient as the top five. Pediatric top five topics were diabetic ketoacidosis/diabetic carbohydrate counting and insulin, mock codes/team training, updates on evidence-based practice, telemetry review, and high-risk medication administration and care of the sickle cell patient were tied for fifth ranking. Both specialty groups ranked team based training and emergency patient care situations as one of the top priorities.

The staff in both specialties chose as top priorities topics related to their specific patient population. These topics reflected situations that were less frequent but higher in acuity or commonly seen among the patient population. These results assisted the nursing education department to narrow the scope of educational opportunities to those relevant to the staff.

Most helpful and least helpful activities. The survey asked nursing staff which of the educational offerings provided by the medical center were most helpful to their individual practice. The 195 written in comments for most helpful and second most helpful categories were coded, categorized and several themes emerged. The same process was used for the least helpful and second least helpful programs. Both questions were categorized into five main themes. Please refer to Table 17 for the themes identified.

Table 17

Staff Ranking of Educational Activities

Top 5 ranked most helpful	%	Top 5 ranked least helpful	%
Continuing education programs	53	In-services on the clinical unit	28
Electronic learning/ webinars	16	Electronic learning/HealthStream©	25
Code team training/simulation	12	Continuing education programs	12
EHR training	7	Competency day sessions	11
Competency day sessions	4	Hands on/simulation trainings	5

Note: Responses also included "NA" or "nothing" written in comments which were 8% of most helpful and 16% of least helpful.

The responses to these two questions showed the nurses' perspective on most helpful and least helpful programs. Continuing education programs were ranked high in the most helpful but were also listed within the least helpful category. The variety of continuing education programs offered at Jones Medical Center ranged from all day programs to one-hour grand rounds style activities. SurveyMonkey© did not differentiate which type of continuing education activity model was most helpful or least helpful. The study state requires that RNs obtained a minimum 15 contact hours per license period for renewal. The original version of the simulation-based team training programs did not offer continuing education contact hours. The data from the most helpful activities

questions suggests that providing continuing education credits for simulation-based training could increase their value to nursing staff.

The results demonstrated that electronic learning and webinars were helpful to 16% of respondents, and not helpful to 25%. Combined with the responses from the preferred method of learning data, where electronic learning methods were ranked fifth and seventh, the appearance of electronic learning methods on both lists confirmed staffs' perspective on the methodology and its effectiveness. The medical center uses an electronic learning platform, HealthStream© for providing and tracking required education for staff. The number of mandatory modules has increased over the past few years, and the nursing education department has become concerned about staff dissatisfaction with this increase (Jones Medical Center Clinical Nurse Educators Operations Meeting, Spring 2015). This concern prompted the needs assessment survey to streamline content and expand on using different methodologies.

Continuing education needs. There were two questions on the needs assessment survey about topics for continuing education both in day long and one-hour formats. See Table 18 for the results of these questions.

Table 18

Requested Topics for Educational Activities

Top 5 day long programs	%	Top 5 one-hour long programs	%
Dealing with difficult patients/families	56	Evidenced based practice	74
Current risk management/near misses	47	Ethical issues	69
Clinical practice updates	43	Quality and nursing practice	50
Conflict management	42	Patient safety	43
Interpreting lab values	39	Schwartz rounds	

Note: Percentages were tabulated by Survey Monkey© based on respondent choosing five topics.

Many of the requested topics for continuing education reflect the nurse's desire to remain current with evidence-based practice and care of specific patient populations served at the medical center. Simulation and team training were not activities listed by the staff for this question. Continuing nursing education programs grant continuing education unit learning credits (CEU) toward license renewal for the registered nurse. Historically during the study period, CEUs were not attached to simulation-based activities.

The needs assessment survey identified the methods of learning preferred by the nursing staff to be interactive by design, allow for skill practice and implementation of knowledge at the clinical level. Staff ranked the top topics for competency training focusing on relevant patient clinical situations and increasing skills to care for emergent patient situations.

Nursing staff also ranked the most helpful type of educational activities to include continuing education based programs, electronic learning and simulation code training and the least helpful as in-services on the clinical unit, electronic learning, and continuing education. These results supported the preferred methods of learning rankings, where the educational activities of electronic learning, in-services on the unit, and webinars were mid-range. The topics for future educational activities focused on specific patient populations, evidence-based practice and risk management and quality.

The nursing needs assessment data analysis confirmed that the nursing staff identified mock codes as a priority, although simulation was not the top learning modality, nor was it the least favored. The nursing staff expressed the need to maintain

competency in those situations they felt critical. The results supported the content choice of the simulation-based team training programs. There were only 230 respondents out of the 1500+ inpatient nursing staff, therefore this was only a snapshot of staff perspectives.

Qualitative Results From the Code Cart Usage Needs Assessments

The second needs assessment completed by the nursing staff in the summer of 2015 pertained to the emergency code cart use. The survey was administered and tabulated by SurveyMonkey©. Jones Medical Center needed to replace the code carts and wanted nursing input on the new carts' design. Information from this needs assessment survey validated the use and comfort level of the nursing staff. Only 132 staff nurses of the 1500+ inpatient nursing staff responded to the survey. The nurses were asked how many years they practiced in nursing, what unit they worked on, which cart they have used (the medical center has three code carts, an adult code cart, a pediatric cart, and a neonatal cart), and how frequently they have used the cart.

Of the nurses who answered the survey, 81% have worked more than 10 years in nursing (61% over 20 years), 18% have been in nursing 2-10 years and only 2% less than 2 years. The medical center has adult medical surgical units, intensive care units, emergency services, perioperative services, maternal services, and pediatric inpatient and pediatric intensive care unit. Of the 134 nurses who responded, 47 respondents worked in medical-surgical areas, and seven respondents worked in the pediatric areas. One hundred thirty-three nurses responded that they had used the adult code cart, and 22 have used the pediatric code cart. The demographics of the respondents reflect the medical center's 17

adult units and three pediatric areas. This sample was small compared to the actual number of inpatient staff nurses who potentially use the code cart.

The frequency of code cart use results validated the decrease in code blue responses throughout the medical center over the recent years after implementation of rapid response teams. Medical center policy dictates that the code cart cannot be accessed unless there was an emergent situation. The staff nurses' only opportunity to open the cart occurred in three situations; an actual patient code, code team training, and during annual nurse competency day skill stations. The question on the survey asked about code cart use during an actual patient code. Refer to Table 19 for the frequencies.

Table 19

Code Cart use by Staff RN

Frequency	%
Weekly	1.5%
Every 2-4 weeks	14%
Every 3-6 months	31%
Every 1-3 years	29%
Less than every 3 years	16.5%
Not used at all	9%

The majority of the staff nurses who responded did not use the code cart frequently, only 16% used it on a monthly basis. The remaining staff used the cart less often than every three months. One nursing role during a code was the responsibility of operating the code cart, including supply retrieval, medication preparation, and administration. Knowledge of the location of the cart's supplies and comfort in medication preparation by the nurse were important for timely treatment and improved patient outcome. Chan et al. (2016) found that hospitals that implemented resuscitation

training, reviewed cardiac arrest data monthly, and monitored for compression interruptions had higher patient rates of survival after in-hospital cardiac arrests.

The code cart use survey identified that 81% of the responding nursing staff had experience in nursing greater than 10 years. Most nursing staff reported that they used the cart less than every three months. Literature demonstrated that skills needed for proper use of emergency equipment decayed in as little as three months (Yeng et al., 2012). The code cart use survey reinforced the need for increasing the frequency of the code cart exposures based on the nurses' responses. Nursing staff that attended the simulation-based code team training had additional opportunities to use the code cart in a safe learning environment.

Qualitative Results from Code Blue Observer Worksheet

The Code Blue Observer Worksheet was only used in the fall 2013 and spring 2014 sessions of the program. In total, there were 51 worksheets completed for 16 different sessions. There were two to four facilitators present for each session and the same facilitators observed in both 2013 and 2014. Facilitators were trained together on ideal use of the form, but no interrater analysis was performed at the time. Only the date and session were noted on the worksheet; the facilitators remained anonymous. At least one worksheet was documented for each of the 16 sessions. There were 27 worksheets for fall 2013 and 24 for spring 2014. Refer to Table 20 for the combined results for both years.

Table 20

Performance Observation Adult Code Blue

Observation of performance	2013		2014	
	% Consistent Performance	% Inconsistent/ Not Performed	% Consistent Performance	% Inconsistent Not Performed
CRM: Role delegation	52	48	56	44
CRM: Closed loop communication	33	67	30	70
CRM: Frequent summarization	55	45	63	37
BLS: No compression interruptions	32	68	44	56
BLS: Proper compression rate/ depth	43	57	58	42
BLS: Correct breath/compression ratio	19	81	78	22
ACLS: Algorithm identification	53	47	59	41
ACLS: Proper use of Defibrillator	48	52	38	62

Note: 2013 participants included PGY 2 & 3 (postgraduate year) residents and 2014 participants included PGY 1 interns and PGY 2 residents.

The responses were reviewed, and tabulated for the three categories of *performed consistently*, and *inconsistent,* or *not performed*. Percentages were tabulated for each question and categories. The observation worksheet targeted three areas of performance; CRM observations, BLS performance, and ACLS performance. The CRM observations included role delegation, closed loop communication, and summarization of the situation at frequent intervals or what was called “State of the Union” at Jones Medical Center. The BLS category targeted criteria thought to improve patient outcomes; minimizing compression interruptions, appropriate depth, and rate of compressions, and maintaining proper ventilation compression ratios (Chan et al., 2016). The ACLS category observed if the correct rhythm and algorithm were identified and if the defibrillator was used appropriately per the algorithm. All of the criteria identified for the worksheet, related to the main objectives of the program.

These two sessions occurred in the same academic year for the medicine residency program. The fall session attendees consisted mainly of the slightly more experienced second and third-year residents who have completed at least one year of internship post medical school. Interns attended the spring session during their first-year post-graduation of medical school and a few second-year residents. At Jones Medical Center, third year and some second-year residents assume leadership during a code, supported by the attending level physician.

CRM. The results of the role delegation observation for the CRM category captured the lack of experience that the code leaders had in leading the situation. The small numbers of code blue incidents within the hospital do not allow a majority of the interns and residents to have active roles in actual patient cardiac arrests during their time as code team responders. The residents are code team responders only when on rotation in two units, the cardiac care unit on one campus and the medical intensive care unit on the other.

The CRM techniques of closed loop communication and summarization of the situation were also observed. Staff were not observed using the closed loop technique as often as they implemented summarizing the situation. The observations were consistent with the interns and residents for both of the communication techniques. Closed loop communication remains a necessary skill for the relay of critical requests and acknowledgment of completed tasks in the emergent situation (Fanning et al., 2013). Closed loop communication remained an area for improvement for the training.

BLS. The BLS performance included observations that assessed if participants performed high-quality CPR evidenced by minimal compression interruptions, appropriate depth and rate of compressions, and proper ventilation to compression ratios. Higher patient survival rates occurred in those hospitals where staff consistently performed high-quality BLS; specifically, minimal interruptions on compressions demonstrated higher patient survival rates after in- hospital cardiac arrest (Chan et al., 2016). The observations on this criterion showed that the participants in the adult program did improve their BLS skills from the fall of 2013 to the spring of 2014. There was still room for improvement in this category for improved patient outcomes

ACLS. The ACLS performance included observations on the proper, correct identification of presenting cardiac rhythm, leading to the use of the correct ACLS algorithm. The importance of rhythm identification at the onset of a cardiac arrest lies in that it dictates the treatment algorithm. The leader of the code blue needs to know whether the rhythm is responsive to defibrillation or medications. Missing the opportunity to administer the correct treatment at the appropriate time impacts the survival of the patient (Link et al., 2015). The adult participants improved in the identification of the rhythm from 2013-2014, but did not improve in the use of the defibrillator.

The observations of two sessions of the adult code blue program gave a snapshot of the team's performance within the simulated scenarios. There remains a performance gap in CRM performance, BLS performance, and use of the defibrillator. There was observed consistency in ACLS rhythm identification among the adult participants. The

data from the observer worksheet demonstrated that the adult staff needed more knowledge and skills after the adult code blue program. This data did not support that the adult program was effective in providing necessary skills and knowledge for responding to a code blue response.

Qualitative Results From the Code Blue Debrief Form

The Code Blue Debrief form was used by the staff of Jones Medical Center to document the quality of care and code team function at the completion of a patient cardiac arrest. The debriefing form was on the back side of the code blue documentation record. The policy of Jones Medical Center requires that the physician and nurse leaders gather the responding team at the conclusion of the code blue to review the quality of performance and document the process.

Each month the medical center's code committee reviewed the previous month's code blues. The code committee examined the number of code blue pages, the number of code blue forms collected and the number of debrief forms completed. The code committee reviews each document for patient outcomes, staff performance and system issues. According to Chan et al. (2016), institutions with higher patient survival rates after in-hospital cardiac arrests regularly reviewed cardiac arrest cases on a monthly basis. Jones Medical Center followed this recommendation by reviewing code records during the monthly code code committee meeting.

The medical center had multiple struggles with collection and compliance of the code and debrief documentation. The respiratory therapist was responsible for the collection of the code blue debrief form at the end of the code blue situation. The

respiratory therapist who responded to the code blue also had patient care responsibilities and often left the situation when no longer needed. Often the documentation was not complete when the respiratory therapist left and then the debrief portion was never collected, leading to missing and incomplete debrief documentation. The top page becomes part of the patient's medical record, scanned into the electronic record at discharge. The second bottom page was what the respiratory therapist collected and where the debriefing tool was located.

The medical center incorporated a comprehensive electronic medical record in 2014. Due to an inability to interface the weight-based medication doses for the pediatric population, the electronic code documentation was placed on hold for all patients and remains an area that the medical center hopes to develop. Please refer to Table 21 for the data on returns of this form.

Table 21

Code Blue Debrief Form Documentation

Year	# Code blue documents returned	# Debrief forms completed	# Issues identified	Issues
2013[a]	88	44	1	Medication missing from code cart
2014[a]	111	49	2	1-Medication missing 1-Defibrilator left on wrong setting after daily check
2015	89	35	6	1-BLS- ventilations too fast, corrected 5-Medications or equipment missing

Note[a]: that due to a water pipe break and subsequent flood into the office where the paper forms were kept, data for January 2013 through May 2014 were destroyed. The annual totals for a number of code forms completed and debriefs completed was available, but review for actual issues was not able to be discerned. The discussion includes only the review for June 2014 through December 2015.

The majority of the debrief forms that were completed documented that there were no issues with the code blue performance. The issues that were documented included missing medications and equipment, and the defibrillator not being left in the proper mode. Policy at Jones Medical Center required that nursing staff do a quality performance on the defibrillator daily, including a check on the function of the pad mode and the paddle mode. The nursing staff were required to leave the defibrillator in the pad mode. The paddle mode remains available only as a backup function. One additional error related to the defibrillator included a process issue where the electrical shock was discharged without the confirmation that all personnel were safely out of range. The staff member performing chest compressions was not able to clear everyone from the immediate bedside before the shock was performed. A final issue documented related to BLS performance where the ventilation rate was documented as being too rapid, but was identified and corrected.

There were never more than 50% of the code debriefs documentation completed for a calendar year during the study period. The compliance has decreased over the last two years since the incorporation of the comprehensive electronic documentation to as little as 40%. All of the returned forms were for adult code blues. There were pediatric codes during the time frame, but no debrief forms were returned.

Limitations on the data from the debrief form included poor compliance with adequate completion of the form and that the form was completed by the participants of the code blue response and was subjective. There was room for improvement for the completion of the documentation. Many forms were not collected, or incomplete. The

Jones Medical Center code committee has petitioned the IT department to prioritize the implementation of electronic code documentation and to include a mandatory section for debriefing (Jones Medical Center Code Committee meeting, May 2016).

It was also unclear if the entire responding team was present and contributed to the debriefing process. Only the physician and nurse leaders sign the form. The purpose of the debrief form was to solicit staff perception on their performance during the emergent situation. If team members were missing their perspective was not captured. Chan et al. (2016) report that institutions that regularly review code blues had a higher rate of survival. Jones Medical Center's return rate was below 50% self-review of performance. The missing debrief forms also hindered the code committee review of all code blues.

Another limitation of this form was that the same form was used for urgent elective intubations, urgent elective cardioversions, and other non-cardiac arrest emergencies when the contents of the code cart were accessed. The front side, where events of the emergency was documented, asks if the emergency was an elective or urgent intubation, cardiac arrest, or other. The code committee reviewed the forms and noted there was inconsistent completion of required sections (Jones Medical Center Code Committee Meeting, April 2016). During the debriefing session in the adult code blue simulation team trainings, the facilitators reviewed the need for accurate and complete documentation for all cardiac arrests. In addition, the annual nursing competency day for the past three years included a brief session on code carts, defibrillators, and documentation requirements.

The information from the debrief form was incomplete and when considered alone, does not provide enough information to validate effectiveness of the training based on staff performance. Considered with the other data collected, it contributed to staff perceptions on performance at actual code blues. This data supported somewhat that the adult responders for code blue situations had adequate skill and knowledge to care for the adult cardiac arrest patient.

Limitations

There were multiple limitations to this study. Since the program evaluation data came from previously collected documentation, the Team Training Evaluations only provided participant perceptions of the program as they existed at that point in time. Because of inconsistent nursing and ancillary staff attendance, program participation consisted mostly of adult or pediatric medical residents. The adult and pediatric residencies both last 3 years. Many physicians who participated in some of the earlier sessions may have already moved on from Jones Medical Center after their residency completed. If any type of post program interviews needed to occur, it would be difficult to track participants that were no longer in residency. In addition, because of an early retirement incentive at Jones Medical Center, staff turnover increased within the nursing and respiratory departments.

The Code Blue Debriefing documentation for the adult team program provided real time snapshots of patient care. The adult program was on hold related to scheduling issues after April 2015. The current residency educational curriculum only allowed twice annual code blue preparation participation. Administrative stakeholders realized that in

order to increase the frequency of the program, the curriculum needed revision. Participants were limited in attending training programs that required time away from their clinical responsibilities. In addition, a labor contract regulated the number of hours that residents may be on duty, and this total time incorporated educational activities.

The Team Training Evaluation form has not undergone reliability or validation testing at Jones Medical Center. The post activity self-evaluation was not validated for the population in the study, originally developed for nursing students (Elfrink-Cordi et al., 2012). The limited availability of validated and reliable tools for hospital based team training (Adamson et al., 2013) when the programs were developed, influenced the decision to use a locally developed tool.

The version of the program was considered in final analyzation of the data. Both programs had slight changes over the proposed study period. Curriculum documentation tracking reflected any changes that occurred over the course of the programs. Changes to the adult code blue program included the adaptation of the format from a two scenario program (the second scenario was different from the first) to a repeating the same scenario design. Additionally, the scenario changed during the last academic year of the adult program. The pediatric program changed in length from one to two hours and added a set rotation to the scenarios, rather than the previous random rotation schedule.

The two needs assessments were only for nursing staff, not the entire care team. There was no assessment of learning style preference or prioritization of topics from the other disciplines involved in the team trainings. There was no way explore whether their needs were different than the nursing staff. Data on entire teams' needs was solicited

from the question on how to improve the program found on the self-evaluation. As the evaluations were completed anonymously, there was no way to identify priorities by discipline.

At Jones Medical Center, nursing staff are the discipline in charge of the code cart during a cardiac arrest. There was a process change implemented during the study period, where the pharmacists started to assist the nursing staff in preparation of the emergency medications. The code cart needs assessment only included nursing staff. There was no data on how frequently the pharmacist used the cart, or their experience and comfort levels.

The adult code blue observation forms were only collected for two sessions within the same academic year. Observations of all the sessions could have been used to identify if the adult participants' performance improved over the study period. Additionally, observations of the pediatric team training performance were not documented at all.

The missing data on the Code Blue Debrief forms also limited the validity of the effectiveness of the responding teams to actual patient code blues. Absence of pediatric team observations combined with the lack of pediatric code blue debrief data prevented validation of the pediatric team training program effectiveness from this data source.

Conclusions

This mixed method, program evaluation allowed a view into the effectiveness of the adult and pediatric team training programs in responding to cardiac arrests. The research questions explored whether there was a difference between the programs, whether the programs were effective, and what barriers existed preventing attendance at

the trainings. Collection and analysis of archival data sources provided quantitative and qualitative results.

The quantitative data addressed the null hypothesis for Research Question 1 that there was no difference between the two programs. The null hypothesis was supported for confidence in decision making, confidence in team communication, assessment skill improvement, clarification of program objectives, and program effectiveness. The analysis supported the alternate hypothesis for a significant difference between the two programs for a perceived increased feeling of preparedness and incorporation of the knowledge and skills into practice for the pediatric participants.

Fisher and King's (2013) literature review supported that repetitive, experiential learning increased confidence and feelings of preparedness. Brown, Howard, and Morse (2016) identified that role preparedness improved after interprofessional simulation-based trainings for trauma. These studies both identified the need for further research on whether simulation-based training promoted the transfer of skills into clinical practice (Brown et al., 2016; Fisher & King, 2013). The goal of simulation-based education in health care, remains the transfer of skill and knowledge to practice, but the majority of the research supporting transfer were on a perceived transfer versus an actual transfer (Fisher & King, 2013).

Mixed method data collection and analysis provided multiple sources of data that described staff perspectives in detail. The qualitative data explored Research Questions 2, 3 and 4; the staff perception of the effectiveness of each program and the perceived existence of any barriers to scheduling and attendance. The results from the post activity

self-evaluations addressed staff perceptions on effectiveness for each programs and explored barriers perceived. Themes identified the positive and negative aspects of the training by the participants.

The second and third research questions each explored the effectiveness of both the adult code blue and pediatric team training programs in providing knowledge and skills needed to respond to a code blue. The analysis of multiple sources addressed these two questions. Both programs effectiveness was supported by the results of the self-evaluation question on what the participants' liked about the program, the nursing needs assessment survey, and the code blue debrief documentation.

The themes identified from the self-evaluations about what was liked in the program were feedback and debriefing, simulation and realism, multidisciplinary presence and teamwork, hands-on practice and participation, and educational design, facilitation and environment. These themes supported the program design of active participation and reflective learning provided by realistic simulation-based education. The analysis of the nursing needs assessments further supported the perspective of the program's effectiveness from the perspective of the nurses. Nursing staff ranked the need to maintain competence in code blue and rapid response situations as a priority.

Additionally, the Code Blue Debriefing documentation analysis supported the adult program's effectiveness. The majority of the returned debriefing forms indicated no issues with leadership identification, BLS and ACLS performance, and ability to use equipment safely. The few issues identified were related to missing medications or equipment, not performance. There were no debrief forms collected for any pediatric

patients during the study period, either due to poor return rates or data loss from water damage, so validation of the effectiveness of performance in pediatric code blues from this data source did not occur.

Data from the self-evaluation question on what was liked least identified the themes of time and frequency of the program, lack of realism, educational design, and identification of knowledge gaps and performance anxiety. Results that supported a lack of effectiveness of the programs came from the questions on what was liked least and how the program could be improved. Staff identified continued knowledge gaps from a lack of didactic supporting material. The lack of realism also decreased the effectiveness of the programs.

The second research question was not supported by the data from Code Blue Observer worksheet. The facilitators identified a continued gap in performance. Simulation-based training has demonstrated an increase in performance of CRM skills (Blackwood, Duff, Nettle-Auguirre, Djogovic, & Joynt, 2014). High quality BLS and ACLS has been shown to improve patient outcomes after cardiac arrests (Kleinmann et al., 2015). There were gaps in CRM skills observed in communication, high quality BLS performance, as well as an inconsistency with appropriate defibrillator usage.

Data from the questions on what participants liked least and how the experience could be improved identified barriers that reduced perceptions of effectiveness. Cook et al. (2013) identified in a literature review and meta-analysis of 23 studies on simulation instructional design features that longer time in simulation increased effectiveness. Participants' identified that there needed to be more frequent simulation-based team

training, as well as more programs, supported the existence of a scheduling barrier. This was further supported by the theme identified in the how to improve future programs on increasing program frequency and length.

Data from code cart usage needs assessment identified that nurses did not have a lot of exposure to the code cart as a whole. A lack of familiarity with resuscitation equipment impacted patient outcomes (Borak et al., 2014). Nursing, staff who are at the bedside, were the owners of the code cart and setting up the defibrillator. The decrease in code blue responses after rapid response team implementation decreased code blue responses and staff nurse familiarity of the equipment (Avis, Grant, Reilly, & Foy, 2016). The effectiveness of the simulation-based training was not completely supported by the data as gaps in usage of the cart (code cart needs assessment) and observed inappropriate defibrillator use (Code Blue Observer worksheet and Code Blue Debriefing form).

The fourth research question explored staff perceptions on barriers and attendance. The themes of lack of realism from what was liked least and to increase realism from the how to improve future programs both included that there were members of the multidisciplinary team missing from the training. These two factors prevented the participants from experiential learning in relation to roles and responsibilities. Crimlisk, Silva, Krisciunas, Grillone, and Gonzalez (2014) discovered that missing disciplines hindered the effectiveness of team training and role clarity. Each discipline has specific responsibilities within the code response, gaps in team performance occur when one role is missing. Fanning et al. (2013) stated that attendance of the entire team in simulation-

based programs allowed participants to practice appropriate roles, responsibilities and discipline-specific skills.

The data collection and analysis results supported that the two simulation-based programs were only somewhat effective in providing the participants with the skills and knowledge necessary to respond to cardiac arrests. Although the pediatric staff felt more prepared and more likely to bring skills to practice, both groups perceived an increase in confidence in decision making, communication and assessment skills. The adult and pediatric staff identified gaps from the programs through the post-activity evaluations. There were also identified gaps discovered from the Adult Mock Code Observer worksheet in areas of CRM, BLS, and ACLS.

This mixed method, program evaluation demonstrated that a revision in curriculum was needed to improve the transfer of evidence-based knowledge into practice. Specific changes in format for increasing the length and frequency are needed. Strategies to engage the missing disciplines, including nursing staff, must occur to increase realism in the team training. Review of the content to ensure relevancy to practice and that the scenarios incorporate evidence-based science was needed. Any curriculum changes should use resources appropriately ensuring the stakeholder's goals of cost effectiveness and staff competency can be accomplished. Patient care needs must be met while staff attend programs. A sustainable revised simulation-based team training program can increase staff satisfaction, knowledge, and competency, ultimately resulting in improved patient outcomes.

Section 3 will describe the recommended project, a curriculum revision based on the results of the study. I will discuss the rationale for the recommended changes and include the results of a literature search on issues identified through the data analysis. I will describe the project in detail including timeline, staff responsibilities, resources needed, barriers anticipated and their solutions, and the plan for evaluation of the new curriculum.

Section 3: The Project

Introduction

This mixed method, program evaluation identified multiple areas needing improvement in the current simulation-based team training programs at Jones Medical Center. Several barriers identified included attendance of all necessary team members including nursing, and the program's frequency was not adequate for skill exposure and maintenance. Staff identified that they wanted more opportunities to participate in multiple scenarios relevant to practice. The quality of the programs will improve when the identified gaps are addressed. The project consists of a curriculum change from the two simulation-based team trainings to a comprehensive yearlong program for all adult and pediatric staff (see Appendix A).

The first change is revising the scheduling format for the adult code blue training from a twice-annual blitz to a sustainable monthly program. The pediatric program frequency of a few times a month should be continued. Participants wanted a variety of the case scenarios, relevant to typical patient situations. The pediatric program used six revolving cases. Incorporating multiple scenarios in a rotating format would address the adult participants identified the gap. Increasing the adult program from 90 minutes to 2 hours provides more learning and reflection time and decreases the rushed feeling the previous program caused. The pediatric program satisfaction increased when it was extended from 1 hour to 2 hours. Also, with more frequent sessions and smaller groups per session, opportunities increase for active participation within the scenario and debriefing results.

The overall curriculum goal is to provide the participants with relevant skills and evidence-based knowledge enabling them to perform within a healthcare team effectively and provide quality care to a decompensating patient. Improvements include not only changing the simulation-based program but also supplementing the team training with skill sessions and didactic presentations. Increasing opportunities allow for multiple exposures to the situations and opportunities to practice in a safe clinical setting. The expansion of the program will include scenarios that are more frequent in clinical practice than cardiac arrest, but also considered high acuity.

Rationale

The study results identified gaps in the simulation-based team training for cardiac arrest response. Addressing these gaps produces a more effective program. A comprehensive simulation-based educational program that aligns with adult learning theory and includes relevant, realistic cases and equipment increased learning (Knowles, Holton, & Swanson, 2012; Meakim et al., 2015). Adding relevant scenarios that represent the diverse patient conditions to the program provides participants with more opportunities to practice the skills and apply learning to clinical practice.

Participants in the study perceived that more frequent and varied simulation learning sessions would provide them opportunities to increase knowledge and skills needed for cardiac arrests and other emergent situations. Simulation-based education in healthcare has been shown to improve skills and knowledge transfer to clinical practice (Fransen et al., 2012; Garbee et al., 2013). A revised curriculum that provides more and

frequent exposures to cardiac arrests and other emergencies should improve skill and knowledge retention than the previous adult code blue twice-annual blitz style format.

Team functionality was another goal of the two programs in the study. When a healthcare team functions efficiently during a crisis, patient outcomes improve (Paull et al., 2013). The AHA updated cardiopulmonary resuscitation guidelines recommend team training for cardiac arrests (Bhanji et al., 2015; Link et al., 2015). Strategies need to be implemented to increase the presence of all team members at the training. The study results of the nursing needs assessment demonstrated the value of Continuing Education (CE) credits for the nursing staff. Attaching CE to the team training programs may provide additional motivation for nursing staff attendance at the programs (Dadiz & Baldwin, 2016). Breckelmans, Poell, and van Wijk (2013) found that opportunities for workplace learning and attractive educational programs were motivating factors for attendance at continuing education programs. Additionally, obtaining funding to supplement the nursing education budget and pay staff for attendance above regular work hours may increase manager support for attendance and ease staffing conflicts.

The goal of healthcare simulation-based training is to improve patient care. An improvement in staff performance both individually and within a team leads to improved patient outcomes that resulted in decrease length of stay (Fanning et al., 2013; Meaney et al., 2013; Tarantinos et al., 2014). Healthcare staff needs frequent opportunities to practice crisis resource skills together.

Diverse learning opportunities address different aspects of performance. A combination of different learning strategies addressed the various learning styles of all

participants (Kolb, 1999, 2000). Revision of the curriculum to include a multiple teaching methodologies addressed the different learning styles present in team training.

Active learning increased staff comfort and feelings of preparedness for responding to complex patient situations by allowing the practice of the skills and application of knowledge in the clinical setting (Bank et al., 2014; Doumouras et al., 2014; Hsu, Huang, & Hsieh, 2014). By providing multiple opportunities in a safe learning environment, staff feels more prepared for their performance of emergent response skills (Hunt et al., 2014). Study participants' addressed the desire to have more hands-on practice with equipment as well as increased simulation opportunities.

A curriculum revision based on the findings of the study's gaps will increase staff knowledge, skill learning, and retention. Changing the format by lengthening the time of the program, providing programs that are more frequent throughout the year, and include a variety of patient situations addresses the format flaws identified. Developing strategies to increase nursing participation will add to the realism of the training. Supplementing the simulation-based training with additional learning opportunities using different learning methodologies addresses various learning styles.

Based on the findings of the study, the revised program needs to continue providing feedback on skill performance and with comprehensive debriefing sessions provide opportunities for reflective learning. The program should continue focusing on CRM skills for team-based responses to emergent situations. In addition, the reinforcement on BLS, ACLS, and PALS algorithm performance should remain a priority.

Review of the Literature

I performed a review of the literature to identify the current state of research and evidence-based practice on simulation training and professional development. Broad topics searched included resuscitation science, curriculum development, simulation modality, patient deterioration, team training, and educational theory to provide an evidence-based foundation for the curriculum development. The search focused on the years 2012-2016. The Walden University ProQuest database and Google Scholar were used. Search terms and phrases included: *continuing education and motivation, resuscitation, team training, CRM, simulation, in hospital survival, health care skill improvement, educational modalities, deteriorating patients, skill transfer, education theory,* and *learning theory*.

Medical professionals require continuing education and opportunities to practice new skills. Simulation-based training is an educational modality that allows participants to have an active role in the learning process (Meakim et al., 2015). Participation in reality based scenarios and an opportunity to practice procedures in safe environments makes this modality well suited to medical professionals (Levine et al., 2013). Simulation training includes team trainings, task or procedure training, and may be supplemented with didactic lectures to provide updates on the evidence-based practice changes (Levine et al., 2013). The AHA guidelines for cardiopulmonary resuscitation stated that repeated exposures and opportunities to practice these skills individually and as a team assisted the medical professional to retain the knowledge and skills thus improving patient outcomes (Bhanji et al., 2015).

Status of Resuscitation Science

The number of patients who experienced an in-hospital cardiac arrest and required CPR increased 33.3% over the years of 2000-2009 (Kazuare, Roman, & Sosa, 2013). Although the survival rate of these patients increased 41% since 2000, a higher percentage of the patients were discharged to hospice and more patients experienced neurological deficits or required ongoing respiratory and nutritional support (Kazuare et al., 2013). Kolte et al. (2015) reviewed regional survival rates of in-hospital cardiac arrests, and found that the northeast region of the United States had the lowest survival to discharge rate. Jones Medical Center is located in the northeast region. BLS and ACLS performance gaps still existed after the trainings at Jones Medical Center. There remains a prevalence of cardiac arrests in the hospital setting and staff proficiency must improve to affect the survival rates and the survivor's quality of life.

Patient survival from an in-hospital cardiac arrest relied on the effective functioning of a multidisciplinary healthcare team comprised of individuals with various skill levels who only work together at the point of crisis (Clarke, Apesoa-Varano, & Burton, 2016). A literature review performed by Weaver, Dy, and Rosen (2014) described code blue teams as rapidly formed, short-lived groups with limited experience working together as a team. In the research on highly reliable health care teams, Riley, Lownik, Parrotta, Miller, and Davis (2011) identified three classifications of clinical healthcare teams: (a) ongoing or conventional, (b) microsystem, and (c) rapidly formed. The individual team members in a rapidly formed team were well-trained professionals who often did not know fellow responders, have never worked the other team members,

and most likely would never work in the same situation again as a whole group (Riley et al., 2011). The Jones Medical Center code blue team falls into the classification of a rapidly formed team, where the roles remain constant, but the individuals who fill the roles vary from situation to situation.

Even those in rapidly formed teams like code blue responders benefit from education on CRM concepts (Fung et al., 2015). The inclusion of CRM in multiple programs provided throughout the curriculum reinforced concepts and allowed for repeated practical simulated experiences (West et al., 2012). Chan et al. (2016) implemented a classroom-based educational activity on various aspects of CRM and found it effective for understanding the leadership role, communication in a team setting, and situational awareness.

Multiple studies explored CRM training and leadership at resuscitation. Effective leadership improved patient outcomes in cardiac arrest resuscitations (Castelao, Russo, Reithmuller, & Boos., 2013; Hunziker, Tschan, Semmer, & Marsh, 2013; Tschan et al., 2014). Simulation followed by comprehensive debriefing was proven an effective methodology for teaching leadership skills and knowledge (Norris & Lockey, 2012). Castelao, Boos, Ringer, Eich, and Russo (2015) found that training the leaders of code blue teams improved the response of the entire team, especially in leadership behavior and adherence to treatment guidelines. A focus on the leadership education of the residents who lead code blue responses should be included in the program revisions. Leader communication and guideline adherence were identified as continuing gaps after attendance at the prior program at Jones Medical Center.

Code management skills are necessary for the leader of an emergent event. CRM encouraged the use of tools to assist participants to remember algorithms, medication doses, and protocols (Fanning et al., 2013). Through my role as a member of the Code Committee at Jones Medical Center I developed two additional tools for code management: the ASAP OMIT mnemonic and the "Where do I stand?" code footprint. Multiple mnemonics have been used for assistance in cardiac arrests including assessment using ABCDE (Thim, Krarup, Grove, Rohde, & Lofgren, 2012), H's and T's diagnosis for PEA, (Beun, Yersin, Osterwalder, & Carron, 2014) and the CEASE mnemonic for stopping a resuscitation (Tork, Bledsoe, Wocial, Bosslet, & Helff, 2015). One Jones Medical Center pulmonary fellow who trained at another institution described a tool passed down from class to class that assisted the leader in decision making during a code blue. He introduced the mnemonic, ASAP OMIT, to the Jones Medical Center code committee. The Jones Medical Center code committee decided to include the tool in the team and discipline specific trainings (Jones Medical Center Code Committee Meeting, June 14, 2016).

Code teams vary institution to institution. As a member of the code committee at Jones Medical Center, I designed a diagram that outlined the specific roles and responsibilities of the code team responders and developed the "Where do I stand?" diagram that was informally presented at past code blue trainings during the debriefing sessions. In the revised curriculum, this diagram will become part of the code management tools content for medicine interns and residents and discussed at all cardiac

arrest team trainings code management sessions. Both the ASAP OMIT and "Where do I Stand?" diagrams are included in Appendix A.

Teams Training

Riley, Davis, Miller, and McCullough (2010) postulated that when high reliability teams were present a culture of safety results. High reliability teams combined technical skills [training and competence], nontechnical skills [CRM skills], and process design [steps to produce an outcome] (Riley et al., 2010). The simulation-based team trainings at Jones Medical Center used aspects of this model by the inclusion of technical and nontechnical skills. The previous program's effectiveness was reduced when not all team members were present thus reducing the ability of attendees to realistically portray their unique role within the resuscitation. Lack of technical skills competence was evident by the participants' perceived and observed deficit with equipment in the study trainings.

Additional research on team training identified that team training prepared teams to adapt to situational changes and demands in clinical practice (Baard, Rench, & Kozlowski, 2014). Team training programs that included CRM strategies in a simulation context of realistic situations promoted individual and group effectiveness (Kozlowski, Grand, Baard, & Pearce, 2015). Kozlowski et al. (2015) defined teams as a group of individuals with specific roles and responsibilities who perform relevant tasks, often independently, for a common goal within a larger organizational system. The composition of a team includes the individual members that combine their skills and knowledge to fulfill the functions of the entire team. When a critical member is missing from a team training, the goal of all members learning to function efficiently may not

occur. This gap in participation affected the performance of the code blue teams that trained without benefit of nursing presence. The curriculum revision must address the missing members' attendance at team-based trainings.

Curriculum Development and Educational Theories

There has been considerable research on educational theory and the teaching modality of simulation. Pasquale (2015) found that simulation teaching combined aspects of the following learning theories; Dewey and Kolb's (1999) experiential learning theory, Schon's (1987) reflective practice theory, Brunner's constructivist theory (Rutherford-Hemming, 2012), and Lave and Wenger's (1991) situated learning theory. Learners needed to reflect on experiences to construct new knowledge that they could apply in new situations to those similar previously experienced (Pasquale, 2015). Hauer and Kogan (2012) discussed how in the absence of reflection, a learner may not realize what progress or lack of progress in knowledge acquisition occurred and may not identify potential performance gaps. Simulation programs that combined situational opportunities allowed for experiential learning with reflection leading to the construction of new knowledge.

Participant learning and knowledge retention was influenced by the design and format of the program. The previous adult code blue program at Jones Medical Center followed the format of a twice yearly offering of simulation training over a brief period of time. A study by Patoka, et al. (2015) demonstrated that spaced out learning formats were effective for knowledge and skill learning as the all at once learning format, but the spaced out over time learners had quicker response times for performing critical skills

such as intraosseous insertion. The improvement in response times of skills learned in simulation resuscitation training could lead to improved patient outcomes. This study supported changing the program to be more than just a simulation session.

Eddy, Jordan, and Stephenson (2016) reviewed qualitative research on team training, discovered that participants valued realistic teamwork programs that prompted reflective discussion. They also found that high fidelity simulation scenarios that incorporated communication techniques were valued as an effective modality for practicing teamwork roles (Eddy et al., 2016). The final major finding of this study reinforced that when participants in team training programs increased their confidence they were motivated to apply the skills in their professional practice (Eddy et al., 2016). Participants who increased confidence after attending a team-based training were more likely to transfer the learning into their clinical practice. The participants in Jones Medical Center's team based trainings who perceived an increase in confidence may have transferred the knowledge gained into their professional practice.

Participants' learning styles should be considered when designing curriculum. Robinson, Scollan-Koliopoulis, Kaminieski, and Burke, (2012) examined learning styles for nursing and found that there was an evolution as the nurses' career progressed and experience increased. Nurses in their early career often used a balanced learning style that included both reflective learning and hands-on learning, similar to the teaching methods utilized in prelicensure nursing education such as reflective journaling, case studies, simulation labs and clinical experiences (Shinnick & Woo, 2015). Kolb's Learning Style Inventory assessment demonstrated that practicing nurses favored the concrete or

accommodator learning style (Kolb, 1999, 2000). According to Kolb (1999), accommodators are intuitive, concrete learners who put ideas into action and adapt well to a changing situation. Simulation-based education provides opportunities for this type of learner. The Jones Medical Center nursing needs survey showed that the nursing staff used a variety of learning styles and preferred multiple learning methodologies.

Healthcare professionals must be lifelong learners to keep up with the rapid in evidence-based practice changes that occur in the medical sciences. One model associated with lifelong learning and reflective practice was self-regulated learning (Brydges & Butler, 2012; Embo, Dreissen, Valcke, & van der Vleuten, 2014). Self-regulated learning model consisted of three stages; observational, self-control and self-regulated (Schunk & Zimmerman, 1997). The curriculum revision includes aspects of this model. Participants observed the performance of defibrillator use by a facilitator, then during the self-control stage, the responsibility for learning moved to the participant through the hands-on practice of the skill, and during the self-regulation stage, the participant adapted performance of the skill in other similar situations (Schunk & Zimmerman, 1997). Supported self-regulated learning included practice with a facilitator providing continuous feedback (Brydges et al., 2015). The skills stations integrated this style of learning by initial demonstration by an expert, followed by a hands-on opportunity and then with integration of the skill during a simulation activity.

Simulation Modality

Activity theory was associated with simulation-based learning because activity learning postulates that the purpose and goals were best understood in the context of the

activity such as the scenario or skills based learning (Battista, 2015). The use of an activity theory model allowed simulation program designers to understand the complexity of the learning that occurred in team training scenarios. Facilitators using this theory as a foundation identified the role complexities and made decisions on when to guide debriefing discussions in a certain direction to assist participants in reaching programmatic goals (Battista, 2015).

There have been researchers who identified how effective simulation was as a teaching strategy. The most common rationale for using-simulation-based education as a teaching strategy was that it provided exposure too realistic but rare clinical situations in a safe non-threatening environment (Buykx et al., 2011; Schubert, 2012; Unsworth, McKeever, & Kelleher, 2012; Wehbe-Janek et al., 2012). These studies support continuing curriculum rich in simulation-based learning.

There were multiple recent literature reviews on simulation learning, team training, and participant outcomes. Simulation and classroom learning were studied by Weaver et al. (2014) for team-based training and found it effective for improving team communication and coordination resulting in improved patient outcomes. Griswold-Theodorson et al. (2015) reviewed the literature on effects of simulation-based mastery learning. They found that simulation-based mastery learning improved participant individual performance and competence and lead to success in task performance, improved patient outcomes, and lowered complication rates (Griswold-Theodorson et al., 2015). The revised curriculum includes multiple exposures and repeated opportunities for

skill-based simulation sessions with the goal of increased participant competence that should translate into improved professional practice.

The active learning within the scenarios was augmented by reflective learning during the debriefing. Lavoie, Pepin, and Cossette (2015) developed a model to understand how nurses reflected on deteriorating patient scenarios during the debriefing using a clinical judgement model. Simulation training for deteriorating patient included non-technical elements such as situational awareness and clinical decision making (Stayt, Merriman, Ricketts, Morton, & Simpson, 2015). Situational awareness and clinical decision making are part of CRM training and reinforced within the debriefing discussion.

Deteriorating Patient Situation

The staff in the study expressed a desire to participate in varied scenarios, including the deteriorating patient situations. Schubert (2012) defined failure to rescue as missing the critical point in a patient's deterioration where interventions result in better outcomes. Cooper et al. (2011) identified that patient deterioration situations occurred more frequently than cardiac arrests and not all healthcare professionals had the critical thinking skills and knowledge to identify and intervene in the situation. Further research concluded that the first responders at the deteriorating patient's bedside needed effective assessment skills and knowledge of appropriate interventions to affect the clinical outcome positively (Disher et al., 2014; Tait, 2010). Simulation-based education and active learning improved the participants' knowledge and skills in the identification of the deteriorating patient (Cooper et al.,2013; O'Leary, Nash, & Lewis, 2016). Research

supported that expanding the current simulation-based team training courses at Jones Medical Center to include deteriorating patient scenarios, thus addressing the participants' desired curriculum change.

Changes to the AHA ACLS guidelines included the incorporation of an additional decompensating patient algorithm. The current opioid overdose epidemic (Rudd, Aleshire, Zibbell, & Gladden, 2016; Von Korff & Franklin, 2016) prompted staff at Jones Medical Center to request more training on this specific case presentation. The opioid overdose algorithm is now included in the ACLS content (Kleinmann et al., 2015). The revised curriculum includes a patient overdose simulation to meet this need.

The rapidly changing knowledge on resuscitation for cardiac arrests required continuing education on the topic for all frontline healthcare providers to remain current and improve patient outcomes. As evidenced by the current literature simulation-based learning for team training was effective for knowledge gain, skill transfer and improving patient outcomes. Other approaches including classroom learning was effective for CRM training and code management skills. Integrating various education learning theories into the curriculum design allowed for development of programs that provide multiple opportunities for active and reflective learning increasing the likelihood of skill and knowledge transfer into clinical practice.

Conclusion

This review of the literature on topics identified from the project study supports the revision of the previous curriculum. The status of resuscitation science suggests that although cardiac arrests are lower than in the past, patient survival rates are improved

when high reliability teams respond. These teams need to have comprehensive team training not only on cardiac arrest care and deteriorating patient conditions, but also CRM concepts including communication, leadership, and role clarity. A curriculum developed using learning theories focusing on reflection and situated learning provides participants who have multiple learning style preferences with multiple educational modalities including simulation-based programs.

Project Description

The project consists of a curriculum revision for adult and pediatric staff development through simulation-based team training courses and other additional learning activities. The study identified gaps that will be addressed in a more comprehensive curriculum consisting of multiple courses with various educational methodologies. This revision requires additional resources and involves multiple stakeholders. The education leaders from the individual healthcare disciplines need to assist in the implementation of the various portions of the new program and collaborate in the development of the content.

Resources, Supports, Barriers, and Solutions

The previous program was exclusive to the simulation center, and the majority of the support was from the simulation center's staff. The new program uses various spaces, facilitators, and modalities. The curriculum will include simulation-based team training and procedural sessions in the simulation center, CRM lectures and skills sessions in a classroom setting, and equipment skills stations in both the simulation center and the nursing education and professional development center. Both the simulation center and

the nursing professional development center have a combination of classroom and task room spaces allowing for diversity in teaching modalities. The simulation center moved to a new location in 2015, and the previous simulation space became the nursing education and professional development center. The new nursing space no longer has simulation capability.

Personnel resources for the development of the curriculum include the medicine, pediatric, nursing, and respiratory academic staff. This staff includes 18 clinical nurse educators in the nursing professional development department. The simulation center has a staff of three simulation specialists, a Certified Healthcare Simulation Educator, and six physician medical directors, each representing a subspecialty; surgery, anesthesia, medicine, pediatrics, obstetrics and emergency medicine. The simulation nursing educator and six physician medical directors are the main facilitators for the implementation and debriefing of the team training, as 20% to 50% of their roles are funded for simulation.

Additional physician facilitators are provided by the adult and pediatric physician departments including attendings and chief residents who are trained to facilitate the implementation and debriefing of the simulation and procedural activities. The entire nursing education department has also been trained to facilitate simulation-based learning. Facilitators who are properly trained in debriefing maintain quality in the reflective portion of the simulation-based activity (Cheng et al., 2015). The respiratory and pharmacy department also employ educators who assist in design and facilitation of the programs. The presence of discipline-specific facilitators assists in ensuring realistic

perspectives for the individual team members within the design of the scenarios and also serve to have content experts present for the debrief.

In the past senior hospital and departmental leadership have supported educational activities for the staff. The department of quality and risk supports the curriculum change, funds the simulation center, and offers annual safety grants for projects within the medical center that strive to improve patient outcomes. A safety grant that supports nursing attendance at team training activities was obtained. This grant reimburses the individual nursing unit budget for nurses that attend the training when not working clinically. This grant reduces the pressure the nursing managers had to remain in the budget, reduce overtime, and meet staff/patient ratio levels. The staff nurses, free from clinical responsibilities, can focus more on the activity than worrying about their patients and peers.

The nursing education department is an approved nursing CE provider through the Ohio Nurses Association. The two team training simulation-based courses meet the criteria for nursing continuing education. Nurses who attend the revised curriculum programs will receive continuing education hours commiserate with the length of the activity. The budgetary support and CE hours address the significant gap in the previous programs related to the nursing attendance barrier. Additionally, the program dates and times need to be decided in advance. Nursing staff plan their work schedule up to six weeks in advance and knowledge of the upcoming events can assist the staff nurse in planning to attend when more convenient for their individual schedule. Attendance at the

team-based simulation programs for nursing remains voluntary. There potentially could continue to be gaps in attendance.

Other portions of the revised curricula will be mandatory for the nursing staff. The annual nursing competency day will include sessions that focus on skills needed for emergent situations for all specialty areas. Included will be stations for equipment use, such as the defibrillator and new code carts, CRM concepts, and documentation at critical events. All of this content was identified in the study as areas needing additional educational training. The nursing unions mandate that the hospital provide annual competency training. The nursing budget is designed to support each inpatient nurse's attendance at one eight-hour competency day annually.

A plan for the next cycle of competency day includes to institute nursing simulation sessions that focus on nursing assessments and interventions for responding to a deteriorating patient. Due to the large number of inpatient nurses, and space constraints, this will change the footprint of the competency day from past years. Simulation-based activities are more effective with smaller groups. Traditionally, due to the large numbers of nurses, about 40 nurses attend each day. The large group was further broken down into smaller groups of 12-14. In order for the simulation sessions to be effective learning modalities, a significant portion of the competency day needs to be devoted to the simulation stations. Dividing the attendees into smaller groups and rotating them through pods each lasting 1 hour and 45 minutes, alternating with other content would make the simulation learning more active. The size of each subgroup needs to be kept to a maximum of nine staff so all will have an active role within a scenario. Please see Table

A1 in Appendix A for the footprint of the competency day. This change in size may require more competency days for the nursing department.

The limiting factors for implementing the new footprint includes space for the activities and facilitators. The simulation center and the nursing education center are located at different ends of the medical center campus, so travel time needs to be built into the plan. Also, the competency day uses all the available clinical nurse educators to facilitate the skills and content sessions. The Certified Healthcare Simulation Educator is part of the clinical nurse educator group, and with the assistance of the simulation center staff will facilitate the simulation-based content for each competency day.

Due to the large numbers of the medical-surgical, critical care and pediatric nursing staff, there are usually about 45 separate nursing competency days. Ideally, including the medical staff in the simulation sessions would improve the realism of the sessions, but because of the large number of days and the length of the three combined sessions, it would be impossible to free up medical residents to assist in this part of the training. The residents in medicine and pediatrics have protected educational times, but these blocks are scheduled for the entire academic year and there is a set curriculum for each discipline. Both residencies will adapt their curriculum to include emergent events in their orientation and in an additional training activity to maximize number of exposures and opportunities to practice associated skills.

The intern and resident orientations occur at the beginning of the academic year. During the orientations for both the adult and pediatric medical staff, there are modules for emergency equipment usage, CRM skills and related skills. There are also additional

sessions scheduled throughout the year to revisit the content and add opportunities to practice the clinical skills. Adult residents also have procedural tasks simulation sessions on central line placement, paracentesis, thoracentesis, and ultrasound diagnostics.

New interns and third year residents attend either ACLS or PALS at the start of the academic year. Nurses and respiratory therapists who are required for their role to have ACLS and PALS certification attend every two years to remain current. These courses are provided by the medical center but administrated through the emergency services department at an offsite location. The courses are free for medical center staff.

BLS is required for all nursing staff. The nursing education department assigns the eLearning portion of AHA HeartCode© monthly prior to expiration and then staff are required to attend a skills verification station to receive recertification. BLS courses are free for staff, but the medical center purchases the eLearning modules from the AHA for the nursing staff. The other departments that require staff BLS certification, such as the medical and other disciplines, receive training outside the hospital.

Program Timeline and Staff Responsibility

The new curriculum should start at the beginning of an academic year, to coincide with intern and resident orientations. The revised curriculum outline is listed in Table 22. Appendix A provides the entire curriculum plan.

Table 22

Revised Curriculum Plan

Session	Content	Modality	Audience	Location
Emergent Situation Simulation Trainings	Emergent Situations	Team based simulation	MD, RN, Pharmacist, RT	Simulation center
Pediatric Team training	Pediatric emergent situations	Team based simulation	pediatric MD, RN, RT	Simulation center
Adult code skills	Defibrillator usage	Equipment stations	Adult MDs	Simulation center task rooms
	CRM skills	Lecture, case studies	Adult MDs	Classroom setting
	Code management	Lecture/eLearning	Adult MDs	Classroom setting
Pediatric Orientation	Defibrillator usage	Equipment stations	Pediatric MDs	Simulation center task rooms
	Respiratory, Neuro Emergencies and Sepsis	Team and discipline based simulations	Pediatric MDs, RNs	Simulation center
	CRM skills	Lecture, case studies	Pediatric MDs	Classroom setting
	IV Skills	Skills station	Pediatric MDs	Simulation center
Procedural Skills	Central lines, ultrasound, para/ thoracentesis	Skills stations	Adult and Pediatric residents	Simulation center task rooms
Healthstream	CRM concepts	eLearning	All staff	Computers
	New Code cart implementation	eLearning	All nurses	Computers
IO Insertion	IO insertion	Cadaver Lab	Resource Nurses	Offsite Location
Nursing Competency Sessions	Code Cart, Defibrillator	Equipment stations	All nurses	Nursing Education center
	Medication Administration	Equipment stations, lecture	All nurses	Task room, classroom
	Decompensating patient	Nursing Simulation	All Nurses	Simulation center
	Code Blue Documentation	Computer skills	All nurses	Computer Lab
BLS	CPR, AED	eLearning and skills stations	All Nurses, RT	Computers and task rooms
ACLS	ACLS algorithms, IO insertion, CRM skills	Lecture and skills stations	Adult MD, RN, RT, Pharmacists	Offsite location
PALS	PALS algorithms, IO, CRM skills	Lecture and skills stations	Pediatric MD, RN, RT	Offsite location
Pharmacist Skills	Medication Administration	Lecture and skills stations	Pharmacists	Task room, classroom

Medical and pediatric intern orientation contain the initial portion of the didactic and skills stations for the equipment, laying a foundation for all future sessions. The new team training simulation curriculum will start in the mid to late summer for all disciplines. The code team training for the adult medicine staff is introduced in orientation, then reinforced later in the year during longer, more intense sessions allowing for continued practice and competence assessment. Nursing's annual competency day begins in the fall and completes in the spring. The eLearning courses on Healthstream are assigned to the staff around the time of the attendance at either competency day for nursing or code skills for interns and residents. Staff will have an entire academic year to attend all the required components for their discipline. The staff are assigned to code skills, competency days, and eLearning by management but the attendance at the emergent situation team training will be voluntary with the expectation of attendance at least one a year. Please see the timeline for the courses in Table 23.

All staff will be responsible for attending as assigned to the different components. They will be expected to participate when attending, portraying their role and scope of practice during the simulation sessions, and engaging in the debriefing sessions. All staff will demonstrate skills and equipment usage for their role. Management will be responsible for assigning staff to mandatory sessions and providing support for attendance at other sessions. Nursing management will be responsible for maintaining a record of nurses who attend from home for the reimbursement of their unit budget from the grant. Nursing management will also be responsible for ensuring that staff is able to

go to the sessions, by sufficiently staffing the unit, freeing the participants from clinical responsibilities during the education time.

Table 23

Timeline

Component	When occurs	Length of session
Orientation for medical and pediatric staff	2-day program in June	Adult: 2 hours (3 sessions of 40 minutes Pediatric: 8 hours (IV, CRM, Equipment 1 hour each, simulations-90 minutes each
Nurse competency sessions	8-hour day in Sept-April	20 minutes for defib/code cart/and medications; 45 for documentation; 1:45 for decompensating patient
Emergent situations team training (Adult)	Aug-May	2-hour sessions twice a month, rotating cases
Pediatric team training	June-May	2-hour sessions 2-3 times month, rotating cases
Adult code skills	Dec & April	3-hour sessions; one hour each for CRM, Equipment, code management
Procedural Skills	Aug & Jan	6 hours-2 hours each for Central lines and ultrasound (para and thoracentesis each one hour)
IO Insertion	May	4-hour program off site
BLS	Biannually	1 hr. eLearning/20 min skills
ACLS/PALS	Biannually	2 -8 hour days or 1 8-hour day for recertification
eLearning	Annually and as needed	1-4 courses at 30-60 minute sessions
Pharmacist skills	annually	2-hour sessions

The simulation staff will monitor the registration for the emergent situation team training and pediatric team training and notify senior leadership when there are gaps in attendance. The simulation staff will also be responsible for ensuring tech support and facilitators for the simulation, skills, and task stations. Nursing education will facilitate the annual nursing competency day sessions.

Project Evaluation Plan

The revised curriculum includes multiple learning activities. Each activity will be evaluated separately for learning effectiveness and overall learner satisfaction. It will be important to do formative evaluations during the first year to identify gaps in the

program, barriers to attendance and to solicit learner feedback for improvements. A summative evaluation will be completed at the end of the first year of programming to evaluate the revised curriculum as a whole.

The simulation sessions throughout the curriculum will continue to evaluate team training skills, learner satisfaction, and perception at the conclusion of the activity. The same evaluation form will be used as in the previous programs so that the programs can be compared. Simulation best practices recommends that all levels of facilitators are assessed for quality in performance in leading a simulation activity (Zigmont, Oocumma, Szyld, & Maestre, 2015). Peer review and self-reflection are recommended methods of evaluation (Zigmont et al., 2015).

McGaghie, Issenberg, Cohen, Barsuk, and Wayne (2011) identified that deliberate practice allowed advancement to the next level of practice. As a facilitator advances in proficiency, it is necessary to reflect on their own performance. This can be accomplished by videotaping and observing their debriefings, having a peer review their performance and utilizing self-reflection and feedback to address gaps identified (Zigmont et al., 2015). A new document developed will be completed by the facilitators at the end of the simulation activity to promote self-reflection on performance.

Facilitator reviews prompt self-reflection on the activity, learners' engagement, and their performance in prebrief and debrief session. This document will have questions on logistical components of the program, assessment of learners' participation, barriers to performance, details of any issues during actual simulation including technical difficulties or equipment issues, and a self-rating of prebriefing and debriefing

performance. See Appendix F for the Facilitator Self-Reflection tool. All facilitators will be educated in completion of the document and this process will be included in all future facilitator workshops. The simulation leadership team will review all documents and identify trends and periodically evaluate the facilitators during a program. The simulation center is purchasing additional cameras for the debriefing space for self-review and performance assessment.

The remaining non-team training sessions will be evaluated by the participants at the completion of the session. The form will include statements on the learner's perception of whether the program met the identified goals. Any gaps identified by the learners will be evaluated by the facilitators and planners of the specific activity to make improvements to remedy the gap. The procedural simulation sessions; central line placement, paracentesis, thoracentesis, ultrasound, IV placement, and intraosseous placement all have observational checklists completed by the facilitator. Critical elements necessary for the participant to meet the goal of the activity are listed on the checklist. Learners are required to complete the elements successfully. Immediate feedback and remediation are provided by the facilitator on technique. If a learner does not meet the critical elements, they will repeat the session.

Hospital metrics provide data for the summative evaluation of these sessions. Hospital rates of infections and complications related to central line placement, intravenous therapy, intraosseous use, paracentesis, and thoracentesis can be monitored for changes from previous years. Ideally the programs should impact the rates with decreases in prevalence.

The AHA programs; BLS, ACLS, and PALS, have processes in place for evaluations. Instructors are required to have certification and complete clinical updates with each new release of the guidelines. The ACLS and PALS courses also have student completed evaluations at the conclusion of the program.

The nursing competency sessions will use formative assessment of clinical performance using observational checklists. The goal of the sessions is for the participant to demonstrate competency in use of the equipment. Both the defibrillator and code cart session have critical elements identified and need to be observed during the station. Refer to Appendix G for Defibrillator and Code Cart checklists. Hospital metrics on equipment issues during code blues are typically documented on both the code blue debriefing form and within the medical center's incident reporting system and followed by the code committee and the quality/risk department.

The overall goal of the revised curriculum is to provide the adult and pediatric care-givers with the knowledge and skills to appropriately respond to a cardiac arrest or urgent patient care situation. The knowledge and skills include the following, ability to assess and identify the patient situation, implement the appropriate interventions, use all resources (including equipment) appropriately, and perform within scope of professional role in a team. The evaluation goals include an assessment of each component of the curriculum in meeting the overall goals of the program and the specific goal of the activity. Each activity should provide participants with knowledge and skill necessary for their role in responding to an urgent patient situation. The tools used to identify if goals

are met include participant completed evaluations, observation checklists, and facilitator self-reflection tool.

Combining multiple sources of evaluative data provides a complete picture of the effectiveness of the program. The stakeholders can review the data for progress in meeting the program's overall goals. The stakeholders include departmental leadership in medicine, nursing, respiratory, and pharmacy, as well as hospital senior executives. They will want to know if the metrics on patient care and quality are improving after attendance at the program.

Other stakeholders include the program developers who will use the evaluation data to assess the effectiveness of their portion of the curriculum. The medical and pediatric leadership will want to ensure that interns and residents receive the training to respond safely to an urgent patient situation. Nursing leadership will also want to ensure the nurses are competent to perform their role for emergent patient care.

The patient is also a stakeholder for the program. They complete patient satisfaction surveys that provide data about their perception of the care received. There is a question asking the patient how well their providers worked together to care for them and the data from this will give further information on program effectiveness. If staff learn effective communication for the response to code blues, ideally they should transfer the skill into all aspects of their practice.

Project Implications

This project study of a revised curriculum for Jones Medical Center has implications for possible social change at the institution level, community level and in

hospital-based simulation education. The major social change that could occur as a result of this project would be better prepared medical professionals and improved patient outcomes. The institutional impacts include professional staff who have participated in active learning and self-reflection after participation in the active learning. Reflective professional development allows participants to grow personally by increasing knowledge and improving clinical practice through behavioral changes (Zigmont et al., 2015). The resulting reflective practice continues to support lifelong learning based on the Kolb's (2000) learning theory. Participants who perceive value from simulation-based education may continue to attend programs to further their knowledge and skill.

The community impact is twofold. First patients will have improved outcomes related to the increase feeling of being prepared that staff will have. More effective teams with improved communication should be able to assess and treat emergent situations in a timelier manner, reducing adverse outcomes. Second, Jones Medical Center can join the simulation community in their major New England city to share the program and its outcomes on staff training. Local collaborative groups allow institutions to work together to benefit the both the institution and the individual practitioner by improving knowledge, skills and ultimately patient outcomes (Maxworthy & Waxman, 2015). This collaboration often encourages further sharing of successes in a national and international setting of simulation and professional development conferences. By the sharing of the effects of an enhanced curriculum, future professional development programs at other institutions may also benefit.

Another implication of this program revision is whether the interventions applied to overcome attendance barriers will have an effect. Jones Medical Center is not alone in struggling with this situation. Including staff in process of the program development from needs assessment through evaluation makes them active stakeholders in the final product. There needs to be a change in the educational programs at Jones Medical Center from passive attendance to active involvement embracing evidence-based practice changes. This program revision will allow the senior leadership to evaluate whether voluntary attendance at the activities increases with the addition of grant funding and continuing education hours.

Section 4: Reflections and Conclusions

Introduction

In this section, I address the strengths and limitations of the project and implications for social change. I also discuss what I have learned about scholarship, leadership, project development, and change on a personal level as well as related to the project. I conclude this section with discussion of the impact the project will have on social change, and implications for future research.

Project Strengths

Jones Medical Center strives to provide quality evidence-based care for all of their patients. Cardiac arrests remain a high acuity and low volume incident. This type of situation requires specialized training of all who may encounter such a patient. Effective performance is reduced when skills are not frequently used (Bhanji et al., 2015). A study by Roh, Issenberg, and Chung (2014) identified the most common barriers perceived by staff nurses in resuscitation performance as insufficient training, lack of competence, lack of self-confidence, and workload. Roh et al. (2014) recommended that hospitals review the current state of education and implement a curriculum to address the needs identified. The Jones Medical Center nursing staff identified a need for increased training to improve both competence and confidence in their responses to cardiac arrest situations.

This project study identified staff perceived barriers, as well as the positive and negative aspects of the current simulation-based team training programs. The proposed project consists of a curriculum revision that expands upon the previous team training and adds additional educational activities to develop further skills and knowledge

necessary for the quality care of the patient experiencing an emergency. A study by Panesar, Ignatowicz, and Donaldson (2014) identified the four major errors in cardiac arrest management as miscommunication, lack of staff attendance, equipment difficulties, and poor implementation of knowledge during the code blue. The curriculum revision addresses effective team communication, equipment usage, and increasing knowledge and confidence through multiple exposures to the content.

When creating a staff development curriculum that includes multidisciplinary staff with varying levels experience and education, the individual professional scope of practice must be considered in the design. Although the regulatory agency, the Joint Commission, does not mandate which professionals make up a cardiac response team, it does mandate that all team members receive adequate training for their role in the response (Morrison et al., 2013). Jones Medical Center provides training in code blue response for all members of the team. The barrier of all disciplines attending together may persist unless the leadership of Jones Medical Center mandates the training sessions.

A multifaceted curriculum using a variety of educational modalities addresses the different learning styles present with a staff of varying experiences, scopes of practice, and from different generations. Generational research supports using a combination of learning strategies to foster engagement from all the generations that comprise the health care field (Meretoya, Numminen, Isoaho, & Leino-Kilpi., 2015; Hawala-Druy & Hill, 2012; Robinson et al., 2012). The revised curriculum includes active learning strategies that address the multiple learning styles identified with different generations of learners.

This project is founded on providing the staff with learning activities specific to their unique role on the health care team throughout the year. It will initially introduce concepts in orientation sessions and provide an opportunity for practice of skills before patient contact. Competency sessions assess all staff performance. Medical staff is assessed after procedural skill stations and code skills stations. Nurses' competencies will be assessed annually at competency sessions focused on critical aspects of their role in responding to patient emergencies.

Discipline based and team training sessions spaced out through the year allow staff from all disciplines to practice roles and responsibilities as well as further develop and demonstrate learned skills. Training nurses for the role of obtaining intraosseous access adds to team competence. Intraosseous access training increases the likelihood of first-pass vascular access success in critical situations, and patients experienced fewer complications than attempts at central venous catheters (Lee et al., 2015). A study by Eng et al. (2014) demonstrated that simulation-based training for pharmacists increased their knowledge, competence, and confidence in responding to a code situation. Training that brings all disciplines together allows the various staff to function within their team role during the patient crisis.

Well-trained facilitators provide the formative and summative feedback to staff during each point of contact reinforcing correct practice. The self-reflection process, introduced and modeled by the facilitators, encourages staff to continue the reflection in practice. Self-reflection is important in changing the culture of learners (Schon, 1987). Debriefing after the patient code blue allows the participants to reflect on practice and

performance both individually and as a team. The code blue responders must consider the postcardiac arrest group debriefing as an important part of the review and reflection process. Khpal and Matthewman (2016) identified that instances where a postcardiac arrest debriefing occurred, future cardiac arrests have a quicker return of spontaneous circulation, improved neurological outcomes, and fewer pauses in cardiac compressions. The current completion of this form is far less than 100%. Staff participating in simulation activities will gain an understanding of debriefing and transfer the process into practice.

The strengths of the project study are numerous. The revised curriculum encompasses various learning strategies over a prolonged period. Learners with different styles of learning may encounter a strategy that addresses their preference. All disciplines have opportunities for discipline specific and team-based learning throughout the curriculum and this allows each member to gain confidence in their professional role and apply the skills in the context of a team situation (Adams et al., 2015). Code blue training is necessary for all staff who may encounter a cardiac arrest, as it is a low volume, high acuity situation. Repeated opportunities to practice in safe situations maintain the skills learned.

Recommendations for Remediation of Limitations

Limitations include potential issues with essential staff members not being present for the team-based components. All of the team being present adds to the realism of the situation training and provides staff with knowledge of others roles and responsibilities (Tun, Alinier, Tang, & Kneebone, 2015). There should also be opportunities for staff to

reach out to facilitators for additional training on equipment and processes if they self-identify a continuing gap.

Adequate training for all facilitators can be a limiting factor. Simulation and task training sessions rely on a safe environment for staff to apply new knowledge and skills (Franklin et al., 2013). Feedback should be presented in such a manner as to encourage reflection and self-identification of gaps (Kolbe, Grande, & Spahn, 2015). There should be ongoing facilitator development as the science of simulation education is continuing to grow.

Recommendations for Alternative Approaches

There are multiple paths to achieving competence. Other educational approaches can assist staff in obtaining these important skills. In the needs assessment, staff identified that they prefer learning across a spectrum of modalities. Each staff member knows what methodology works best for their learning. Staff identified active simulations, case study, electronic, and hands-on styles preferred learning methods. The proposed curriculum revision may not fit the learning needs of all staff members. Simulation sessions that occur in the simulation center may lack realism for some providers (Tun et al., 2015). These providers may prefer to implement the skills in the actual practice environment.

In situ simulation allows staff to implement or reinforce skills learned in their practice environment (Lopteiato et al., 2016). They use equipment in the setting where they practice and function as they would with their fellow colleagues on a unit. In situ simulations can be spontaneous, without prior planning, just as in a real patient cardiac

arrest. In situ scenarios discover system problems such as equipment/location deficits, policy issues, work culture barriers, and poor leadership and team functioning (Barbeito et al., 2015). Jones Medical Center is implementing this model in the new maternity center to monitor paging and response time, as well as other logistical issues by having twice-monthly simulated maternal cardiac arrests in the new space.

The program revision would have a higher probability of success if senior leadership mandated that staff attend a specified number of team-based training within each calendar or academic year. By doing this, the leadership demonstrates to the staff the importance of the training as well as how their competence in low volume high acuity situations is valued.

An alternative strategy is to require all staff including those who work on medical surgical and general pediatric wards to obtain the higher level of either ACLS or PALS. Currently, only the intensive care areas or areas that provide moderate sedation require these certifications. If the leadership had staff alternate ACLS/PALS one year and BLS the next, it would guarantee annual review and demonstration of compressions and ventilation skills. The goal of the curriculum revision and any alternative programs is to provide staff with multiple opportunities for learning and practicing skills.

Scholarship

The process of this project study was lengthy, intense, and gratifying. By undertaking the process, I embraced evidence-based research and practice in the field of simulation curriculum development. This research allowed me to implement theories learned into a practical product. As a clinical nurse educator, I was familiar with the adult

learning theories and the education planning process as it relates to health care professionals.

Analysis of Self as a Scholar

One goal for me as an educator is to develop learning activities that promote the practice of lifelong learning. Adults who demonstrate an ability to be self-directed need to be able to identify performance gaps, critically evaluate themselves and peers, reflect on practice, and critically think (Ellis, 2013). I need to recognize these elements and include them in the development of programs. There must be time for the learners to reflect on the activity and their role in the process. Supported learning sessions such as simulation allow identification of performance gaps through critical evaluation and reflection.

Project Development and Evaluation

The standards for educators in nursing professional development encourage process based design for meaningful learning (Bruce, 2013). Healthcare professionals need to constantly update their practice based on the latest evidence-based research. Time constraints require that all learning activities address the healthcare learners' current practice issues for their patient population, highlighting the need for frequent needs assessments and review of evaluation data in a formal manner (Gooding, 2013). A quick glance at evaluation forms at the conclusion of a program assists the program designer in identifying what the participants perceived during the activity. Following all the evaluations for the entire program allows for trend identification and consistent

knowledge on performance gaps (Spaulding, 2014). Combining both of these processes provides a comprehensive picture of the program's effectiveness.

Analysis of Self as a Program Developer

The quantitative data collection and analysis allowed me statistically to support a rationale for a program change. The qualitative data analysis identified staff perception and trends on positive and negative aspects of the current programs. The thorough review, coding and theme identification supported the quantitative findings as well as further identified staff perceptions on their expectations of code blue training. I was able to support my initial perceptions on the programs gaps.

The process also highlighted for me how important it was to use a conceptual or theoretical platform in the development of a curriculum. Botma, Van Rensburg, Coetzee, and Heyns (2015) developed a framework for curriculum design that promoted a transfer of learning. This model included four steps; an activation of existing knowledge, engagement with new knowledge, an opportunity to demonstrate competence, and application of knowledge into the real world (Botma et al., 2015). Basing the design on an accepted model gives it credence when presenting the proposal for a change to the stakeholders. Simulation-based education is an expensive modality and institutions look for a return of investment on large programs (Apeles, 2013). The equipment is expensive; there needs to be a dedicated, highly technical environment for the programs to occur as well as trained staff available to implement the programs.

Leadership and Change

Analysis of Self as a Practitioner

This project study gave me confidence in my knowledge and skills as a simulation educator. The multiple literature searches and research analysis gave me different perspectives on simulation education, healthcare education, educational design, and the research process. Before this journey, I felt that I had an understanding of educational design, but now near the end of the process, I realized that I was only a novice. All the research for this project has given me multiple perspectives on the topic and assisted me to appreciate other models of learning in healthcare. Before this study, I did have the confidence to approach senior leadership and propose a change that affected learners outside my discipline. Now I am confident that I can articulate the need for a revision in the program, providing research supported rationale and explaining the benefits of a change for the learners, the institution, and effect patient outcome.

The Project's Potential Impact on Social Change

This study has identified how a past training, although offering hospital staff knowledge and skills necessary to care for patients experiencing a cardiac arrest, had gaps for long term skill maintenance. Exploring the staff perceptions of the training, facilitator observations, and patient care data detailed the specific issues with the former program. The curriculum revision proposed from this program evaluation addresses the gaps and offers additional learning opportunities based on multiple educational methodologies.

Patient safety and quality care are important outcomes in the healthcare industry. Regulatory agencies such as the Joint Commission, stipulate initial and annual staff competency assessments to ensure the quality of the care. Not all training provides sustainable learning. Thoughtful and systematic program design to address identified needs and skills provides a learning platform leading to changes in clinical practice (Tsai et al., 2016). Using evidence-based research and adult learning theory in the curriculum development makes for sustainable programs. Stakeholders who invest in a well-designed curriculum want a return on investment resulting in trained staff who are competent to provide evidence-based care to the patient population.

Healthcare reform has impacted hospital revenues by allowing patients the choice of where to get their medical care (Brooks-Carthon, Kutney-Lee, Sloane, Cimiotti, & Aiken, 2011). Hospitals are also mandated to report metrics on the care quality, such as rates of mortality, morbidity, hospital acquired infections and patient satisfaction with care (Deshpande, Green, & Schellhase, 2015). Improved simulation-based team training programs help staff define and practice their roles on the code blue team in a safe environment (Fanning et al., 2013). Offering multiple opportunities increases both confidence and competence of the staff (Ballangard et al., 2014). Improved team performance in crisis situations impacts the patient outcome.

This study demonstrated locally how staff perceptions on training were important for the evaluation process, specifically for the previous programs. The data collection and analysis showed that although the programs were well received, gaps persisted after the training. When planning a curriculum revision, it remains critical that all future program

evaluators continue to explore the evaluations of the training to ensure gaps are quickly identified and remedied.

Globally, this study adds to the research on how simulation-based team training adds to staff knowledge and skill set; as well as identifies remaining performance gaps. Patient outcomes are impacted when educational programs include evidence based content delivered through a well-developed curriculum. Ongoing program evaluations are necessary for continued monitoring of the quality of simulation-based team training programs that impact team is functioning in emergent situations, ultimately effecting positive patient outcomes and staff knowledge.

Implications, Applications, and Directions for Future Research

This project study has a potential impact on healthcare education on cardiac arrest team responses. Individual staff will gain competence in their specific skill set resulting in improved performance in critical situations (Tsai et al., 2016). Repeated practice in simulation-based programs gives the healthcare provider opportunity to transfer and apply the skills and knowledge to clinical practice. Staff can move past simple task performance and into advanced critical thinking and team functioning necessary for cardiac arrest response (Garden, Fevre, Waddington, & Weller, 2015).

The medical center will benefit from staff trained on not just skills associated with their role, but an increased understanding of team functioning, ideal team skills, and importance of self-reflection on performance. High-reliability teams know their individual roles and how to combine their specific skill set with others on the team to optimize efficiency and affect patient outcomes (Schmutz, Hoffman, Heimberg, &

Manser, 2015). Staff who can do this in a critical event will apply similar actions to non-urgent team-based patient care situations affecting patient outcome and satisfaction.

This project study adds to the research on simulation-based team training for cardiac arrests in the hospital setting. The study explored how one method of simulation training for healthcare providers impacted clinical practice. The examination of evaluation data for staff perceptions combined with observational and patient care data provided areas where improvements could occur. The sharing of the study results and subsequent curriculum revision within the simulation and healthcare realms would broaden the scope of impact.

This project study adds to the research that simulation-based team training was effective in providing staff with skills and knowledge at the point of the activity, but that the training was not able to sustain and maintain long-term changes in practice. A proposed curriculum revision may increase the chances of long-term clinical practice changes by adding additional programs to support the skills used in the team response. The combination of the initial and additional simulation-based team training further increases competence and confidence at both the individual and team level of performance.

The mixed method, program evaluation assessed archival evaluation data and reflective comments to reinforce the staff perceptions about the previous curriculum. Team training and CRM skills were found crucial to improving confidence in cardiac arrest responses. The program effectiveness depends on the ability of staff to incorporate

what they learned and transfer it clinical into practice to affect positive change in patient outcome.

Future research includes a program evaluation on the proposed changes from this project study and its effects on staff perceptions of effectiveness and transfer into practice. Research is still needed to identify how much knowledge is retained, and for how long after a multifaceted approach for cardiac arrest training, and this research would assist in identifying if the curriculum revision improved clinical practice. Future research could also monitor patient outcomes after cardiac arrest and if effective debriefings occur, and how the reflection on performance affected subsequent cardiac arrests.

Conclusion

Cardiac arrests in the hospital setting continue to occur despite the implementation of rapid response teams intercepting and preventing further decompensation in a critically ill patient. The instance of in hospital cardiac arrests has decreased, but staff must always be prepared to respond to the situation. These events are considered high risk and low volume situations. A code blue team responding to a cardiac arrest has specialized advanced skills to provide evidence-based care for this critical event.

Hospitals are mandated to ensure that their staff can respond to a code blue, including having the knowledge and skills specific to their role. Staff training for code blues takes on many forms. Simulation-based education for teams training in code blue

responses are shown to improve staff performance, confidence, and competence. However, there is a reduction in effectiveness when skills that are not often used.

The AHA reviews the research every five years for the guideline updates (Bhanji et al., 2015). In the 2015 guidelines, the research has demonstrated that there needs to be continued practice past the initial training to maintain the skills. The training also targets team functioning in a crisis or CRM. Simulation-based team training allow for both the implementation of knowledge and skills into practice in a safe environment, but also allows each member of the team to practice their role and responsibilities in a safe environment free from patient harm.

This mixed method, program evaluation reviewed the current status of two simulation-based team training for the adult and pediatric code response. Archival data was collected and reviewed to identify if the programs provided responding staff with skills and knowledge they needed to care for a cardiac arrest victim. The post program staff completed evaluations from 2012-2015 were analyzed and compared for each program. There were four research questions explored in the study. The quantitative question addressed how the two programs compare in providing staff with skills and knowledge. The remaining three focused on qualitative data on how the staff perceived the programs were and what barriers were impeding attendance for the activities.

The data analysis demonstrated that there were significant differences between the two programs. The staff who attended the pediatric program felt more prepared after participation in the team training and also had an increased comfort in decision-making skills for a crisis. The qualitative data identified gaps in both programs. Staff felt that

simulation-based education needed to be realistic, relevant, offered frequently, and all the team members who respond to the code blue need to be part of the training. One barrier identified was that there were many times in the activity that not all roles were present and that made it difficult for those who were participating to practice their role and responsibilities within a functioning team. Staff also wanted the program to occur more often and also have added sessions for learning the equipment used in a code blue response.

A nursing needs assessment survey identified that the nurses favored educational programs that included continuing education hours, were more active or hands-on, and were relevant to their areas of practice. A code cart use needs assessment survey also reinforced that nursing staff did not have much hands-on use of the code carts in clinical practice. Since the nurse is the main person responsible for the code cart in the code blue response, this area needs to be addressed in more depth.

Observational data from the simulation sessions collected by the program facilitators showed that the staff was still struggling with CRM skills, equipment use, BLS performance and knowledge in ACLS/PALS protocols. The quality of the staff performance in BLS and timely responses to a cardiac arrest improve patient outcomes. This gap in the application of skills and knowledge to clinical practice needed to be addressed in the curriculum redesign.

This mixed method, program evaluation demonstrated that gaps in performance still existed. The project developed to address the findings of the program evaluation is a revised curriculum that addresses staff preparedness for response to a code blue. Rather

than providing one specialty specific simulation-based team training program, the approach should be the provision of multiple learning sessions for the staff addressing the skills and knowledge needed. The content will be broken down into various components that address the individual disciplines roles, skills, and responsibilities in the code blue response. Then all team members will attend simulation-based team training to put it all together and practice their role within the team in the safe environment that simulation provides. The learning is built upon over a year rather than provided in one session. The multiple exposures also assist in the maintenance of critical skills such as BLS and equipment familiarity.

The responding code blue team includes multiple disciplines that have various levels of education and experience. By providing skills stations and procedural training before team training occurs, it allows the staff to gain experience and confidence in their skill set. The team training can then focus more on team functioning, communication, and leadership, important qualities that combine to improve the team function and affect patient outcomes. Infrequent critical situations still require the staff responding to be well-prepared, skilled and knowledgeable. Every patient deserves a healthcare team that can perform efficiently in an emergent response.

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Appendix A: The Project Study-Revised Curriculum

Overall Goal of the Curriculum

The overall goal of the revised curriculum is to provide the adult and pediatric caregivers with the knowledge and skills to appropriately respond to a cardiac arrest or urgent patient care situation. The knowledge and skills include the following; ability to assess and identify the patient situation, implement the appropriate interventions, use all resources (including equipment) appropriately and perform within the scope of an individual role in a team.

Emergent Situation Team Training

Description of course. This is a simulation-based team training for physicians, nurses, respiratory therapists and pharmacists. The cases are based on care of the decompensating patient with a focus on assessment and interventions specific to the patient situation and implementation of crisis resource management skills. This course is offered twice a month

Participants. Adult medicine residents and interns, adult medical-surgical and critical care nurses, resource nurse, respiratory therapist, and unit-based pharmacists. A minimum number of participants: 2 residents/ interns, 2 RNs, 1 RT. A maximum number of students: 4 interns/residents. 4 RNs, 2 RTs, 2 pharmacists, 1 resource nurse.

Facilitators. There should be at least two facilitators- a medicine based (adult medicine or critical care) and a nurse educator; a respiratory therapist educator may also assist in the facilitation.

Goal of the course. Participants will gain experience and understanding of assessment and care of the decompensating adult patient, in the context of a team approach utilizing crisis resource management concepts.

Behavioral outcomes.

1. The participant will perform a thorough assessment and identify the cause of patient's change in condition.
2. The participant will effectively communicate with other healthcare providers throughout the situation.
3. The participant appropriately uses equipment and available resources.
4. The participant will perform all responsibilities associated with their specific role.
5. The participant will implement the appropriate interventions for the patient's condition (following any algorithms as appropriate).
6. The participant will reflect and discuss performance within the scenario during the debriefing process, sharing positive actions and identifying gaps in performance.

Educational Modality. The course consists of a combination of active and reflective learning. A simulation scenario will be followed by a debriefing discussion.

Equipment/Supplies/Space.

1. Equipment: Appropriate fidelity manikin, bed/stretcher, IV pole and pump, code cart, defibrillator, monitor, computer station.

2. Supplies: Medications, oxygen equipment, handoff report, images, ECG, Lab results.
3. Inpatient room in the simulation center and classroom for debriefing.

Format of the Course. The format of the course is as follows: 2-hour session

Simulation session agenda

1. Staff and facilitator Introductions: 5 minutes
2. Prebrief: Brief standardized introduction to simulation-based learning: 10 minutes, refer to the standardized prebrief content in Appendix G.
    a. Confidentiality (of case content, scenario performance, and debriefing discussion)
    b. Video usage, simulation limitations, suspension of disbelief
    c. Participant responsibilities and expectations of performance
    d. Introduction to the simulation environment-manikin, equipment, and space
3. Simulation scenario: 10-15 minutes (one of the following scenarios- cases will rotate). Each case will have identified behavioral outcomes specific for the patient presentation.
    a. Opioid overdose
    b. Change in neurological status, rule out acute stroke
    c. Respiratory distress related to congestive heart failure
    d. Chest pain rules out myocardial infarction

   e. Sinus Ventricular Tachycardia (SVT) unresponsive to medical management and requiring cardioversion
   f. Sepsis/ sepsis shock
   g. Pulseless Electrical Activity (PEA) arrest

4. Debriefing session: 30-40 minutes. The debriefing session addresses through reflection and a facilitated group discussion the following:
   a. The emotional aspect of participating in the scenario- how it felt, was it realistic.
   b. Understanding what happened: what was the patient's situation, what actions were done well, what were the performance gaps, were the team roles identified, was communication effective.
   c. What will be brought back to practice as a result of this activity, personal goals for the future?
5. Repeat scenario: 10 minutes (usually the same general situation, although case presentation may be slightly changed). Have participants switch roles (leader, bedside nurse).
6. Debrief second scenario: 30-40 minutes, using the same approach as in first debriefing, but also asking how performance in this scenario was different, including both positive actions and performance gaps self-identified.
7. Evaluations: 5 minutes

Evaluation.

1. Participants will complete an evaluation form that includes the perspective of participation in the activity and anticipated changes in practice.
2. Facilitators will complete an observational checklist that identifies the critical elements for each scenario (medical and team based)
3. Facilitators will complete a post debriefing self-evaluation (a new process implemented in the simulation center for reflection on facilitator performance).

Pediatric Team Training

Description of the course. This is a simulation-based team training for pediatric physicians, nurses, and respiratory therapists. The cases are based on care of the decompensating pediatric patient with a focus on assessment and interventions specific to the patient situation and implementation of crisis resource management skills. This course is offered two to three times a month.

Participants. Pediatric interns and residents, pediatric nurses (pediatric inpatient, PICU, and pediatric ED) and respiratory therapists. A minimum number of participants-1-2 MDs. 1 RN. A maximum number of participants- 4 MDs. 2-3 RNs and 1 RT.

Facilitators. There should be at least two facilitators, a pediatric physician and nurse educator, respiratory educator when able.

Goal of the course. Participants will gain experience and understanding of assessment and care of the decompensating pediatric patient, in the context of a team approach utilizing crisis resource management concepts.

Behavioral outcomes.

1. The participant will perform a thorough assessment and identify the cause of pediatric patient's change in condition.
2. The participant will effectively communicate with other healthcare providers throughout the situation.
3. The participant appropriately uses equipment and resources available.
4. The participant will perform all responsibilities associated with their specific role.
5. The participant will implement the appropriate interventions for the pediatric patient's condition (following any PALS algorithms as appropriate).
6. The participant will reflect and discuss performance within the scenario during the debriefing process, sharing positive actions and identifying gaps in performance.

Educational modality. The course consists of a combination of active and reflective learning. A simulation scenario will be followed by a debriefing discussion.

Equipment/Supplies/Space.

1. Equipment: Appropriate fidelity pediatric manikin, bed/stretcher/crib, IV pole and pump, pediatric code cart, defibrillator, monitor, computer station.
2. Supplies: Medications, oxygen equipment, handoff report, images, ECG, Lab results.

3. Space: Inpatient room in the simulation center and classroom for debriefing.

Format of the course. The format of the course is as follows: 2-hour session

Simulation Session Agenda

1. Staff and facilitator Introductions: 5 minutes
2. Brief introduction to simulation-based learning: 10 minutes, refer to the standardized prebrief content in Appendix G.
    a. Confidentiality (of case content, scenario performance, and debriefing discussion
    b. Video usage, simulation limitations, suspension of disbelief
    c. Participant responsibilities and expectations of performance
    d. Introduction to the simulation environment-manikin, equipment, and space
3. Simulation scenario: 10-15 minutes (one of the following scenarios- cases will rotate). Each case will have identified behavioral outcomes specific for the patient presentation
    a. Worsening asthmatic (school age)
    b. Arm cellulitis progressing to sepsis (infant)
    c. Ingestion and PEA arrest (toddler)
    d. Status epilepticus (school age)
    e. GI bleed (school age)

4. Debriefing session: 30-40 minutes. The debriefing session addresses through reflection and a facilitated group discussion the following:
    a. The emotional aspect of participating in the scenario- how it felt, was it realistic.
    b. Understanding what happened: what was the patient's situation, what actions were done well, what were the performance gaps, were the team roles identified, was communication effective.
    c. What will be brought back to practice as a result of this activity, personal goals for the future?
5. Repeat scenario: 10 minutes (usually the same general situation, although case presentation slightly changed). Have participants switch roles (leader, bedside nurse).
6. Debrief second scenario: 30-40 minutes, using same approach as in first debriefing, but asking how performance in this scenario was different both in positive actions and performance gaps self-identified
7. Evaluations: 5 minutes

Evaluation.

1. Participants will complete an evaluation form that includes the perspective of participation in the activity and anticipated changes in practice.
2. Facilitators will complete an observational checklist that identifies the critical elements for each scenario (medical and team based).

3. Facilitators will complete a post debriefing self-evaluation (a new process implemented in the simulation center for reflection on facilitator performance).

Adult Medicine Orientation and Code Skills Review

Description of the orientation course. This course is for the first year interns just starting their residency. This component of their orientation focuses on equipment-defibrillator, code cart, and CRM overview. The second and third-year residents have an abbreviated orientation, and this component focuses on a review of the emergency equipment, CRM skills, and code management. This course is offered in June-July of the academic year.

Description of the code skills review. This longer version of the orientation provides interns and residents an opportunity to review CRM skills, code management, use code related equipment and practice code blue response skills. This course is offered twice annually, and interns and residents attend one additional session throughout the academic year.

Participants. Interns and residents in the medicine services.

Facilitators. Medicine attendings, medicine simulation director and simulation staff. Clinical nurse educator for adult critical care areas assists with defibrillator skills stations.

Goal of course.

Orientation. The medical intern and resident will understand their role in a patient emergent event, and have the knowledge and skills necessary to care effectively for the patient experiencing an emergent event.

Code skills review. The medical resident and intern will demonstrate their role responsibilities, describe code management techniques and appropriately demonstrate the use of equipment.

Behavioral outcomes.

1. Defibrillator station: The participant will demonstrate correct usage of the defibrillator for:
    a. Defibrillation
    b. Cardioversion
    c. External pacing
2. CRM Overview/Skills:
    a. The participant will describe their role and responsibility in an emergent situation.
    b. The participant will describe effective communication techniques.
    c. The participant will list resources available for emergencies.
    d. The participant will describe how situational awareness improves patient outcomes.
3. Code Management:
    a. The participant will use the ASAP OMIT mnemonic in case discussion of emergent situations. See Figure A1.
    b. The participant will describe roles and responsibilities of the code team using the “Where do I stand?” model. See Figure A2.

Educational modality. These components utilize classroom style didactic in lecture format, case discussion, skills stations for equipment.

Equipment/Supplies/Space.

1. Equipment: Defibrillator, pads, manikin with different rhythms.
2. Supplies: Handouts on CRM skills and code management.
3. Space: Classroom with a projector for CRM lecture, task space for equipment station, inpatient space for "Where do I stand" exercise, Whiteboard for ASAP OMIT discussion.

Format of the course.

Orientation. This is a two-hour session with three individual sessions that are 40 minutes long. The participants are divided into three groups that rotate through the three stations. Each station begins with of a brief overview of the content. The defibrillator station will be in a task room with three defibrillators available for participants to practice the three uses after a demonstration of each by the facilitator. The CRM session consists of an introduction to the CRM concepts and then a case study presentations and discussions. The code management session will present two strategies to assist the physician in managing the situation- ASAP OMIT and "Where do I stand?" I developed both of these diagrams as part of my role as a member in the Jones Medical Center Code Committee. Case studies will be used to demonstrate the concepts.

Code blue skills. This is a longer version of the orientation, three hours with each session expanded to one hour. The group will be divided into three sections and rotate through the stations. The stations are similar to orientation with the following changes:

Defibrillation station will include practice time, then the participants will demonstrate how to use the defibrillator for each situation. The CRM session will include videos of codes to be reviewed with participants on how CRM was instituted in a case discussion. The code management session will be similar to the orientation session. Opportunities in each session will be provided for participants to discuss their experiences in codes and how they implemented knowledge learned and if they identified performance gaps

Evaluation.

Orientation. There will be feedback provided at each of the stations to the participants in real time. There is no formal evaluation of skills or knowledge at orientation. Participants will be encouraged by facilitators to continue to review the content and use the resources available on the internal website for defibrillator review.

Code blue skills. There will be critical element observation checklists for the defibrillator station and real-time feedback given to the participants as they demonstrate each of the three uses. Real-time feedback will be provided in the CRM and code management session. Any participant identified by the facilitator in the group discussions as having a performance gap will be approached individually and provided with individual feedback.

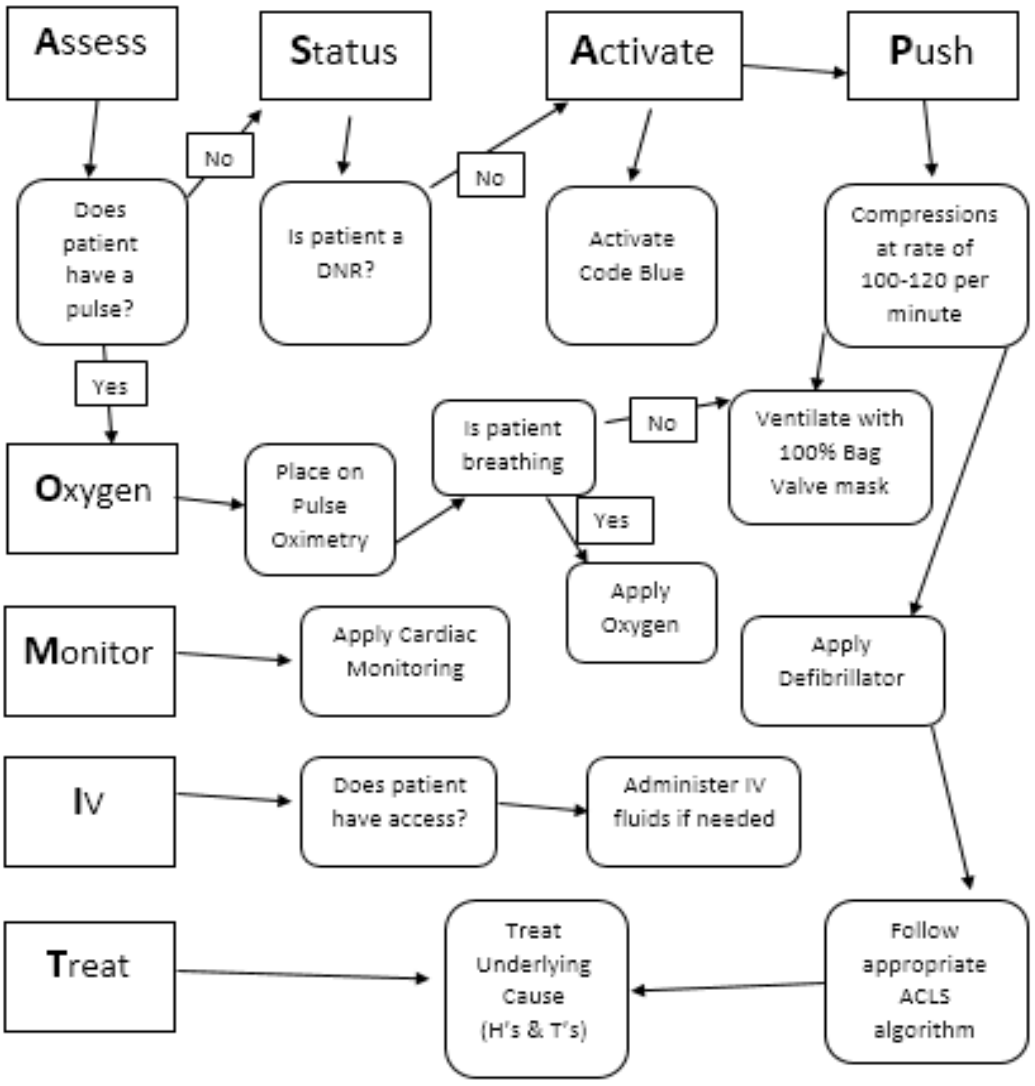


Figure A1: ASAP OMIT: Mnemonic flow diagram to guide actions in emergent patient situation developed by Jones Medical Center Code Committee.

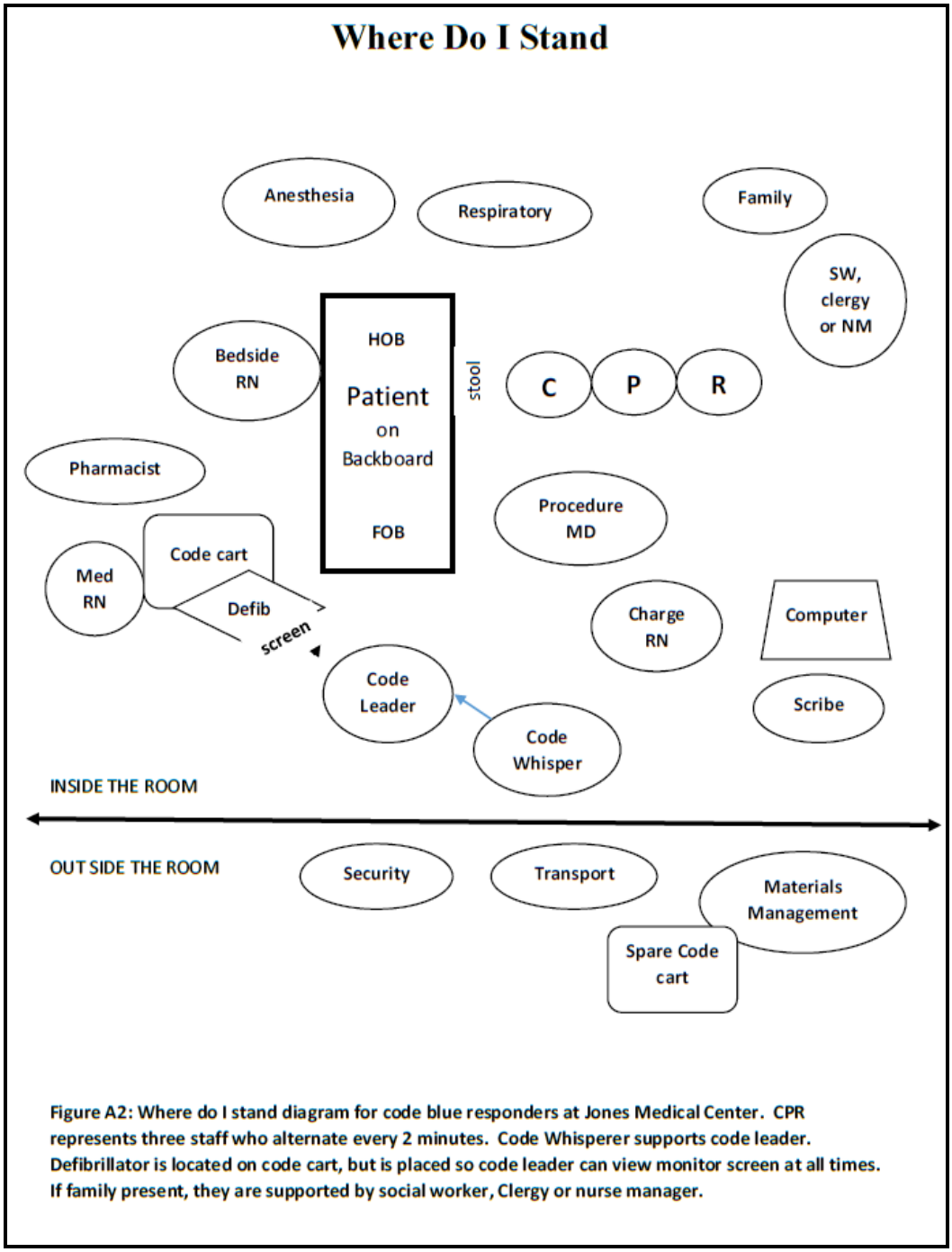


Figure A2: Where do I stand diagram for code blue responders at Jones Medical Center. CPR represents three staff who alternate every 2 minutes. Code Whisperer supports code leader. Defibrillator is located on code cart, but is placed so code leader can view monitor screen at all times. If family present, they are supported by social worker, Clergy or nurse manager.

Pediatric Orientation

Description of the course. This course is for first-year pediatric interns just starting their residency. This component of their orientation focuses on equipment-defibrillator and code cart, CRM skills, pediatric IV placement skills and simulated emergencies. This course is offered in June of the academic year.

Participants. First year pediatric interns.

Facilitators. Pediatric attendings, and the pediatric medical director of simulation center and simulation center staff. Pediatric clinical nurse educator assists with IV insertion skills station.

Goal of the course. The pediatric intern will understand their role in a pediatric patient emergent event, and have the knowledge and skills necessary to care effectively for the patient experiencing an emergent event.

Behavioral outcomes.

1. Defibrillator and code cart station:
    a. The participant will demonstrate correct usage of the defibrillator for:
        i. Defibrillation
        ii. Cardioversion
    b. The participant will locate essential equipment from the pediatric code cart as needed for intubation, IV placement, and emergent procedures.
2. CRM Overview/Skills:
    a. The participant will describe their role and responsibility in an emergent pediatric situation.

b. The participant will describe effective communication techniques.

c. The participant will list resources available for pediatric emergencies.

d. The participant will describe how situational awareness improves patient outcomes.

3. Pediatric IV placement:

    a. The participant will demonstrate placement of an IV in a simulated pediatric patient (child and infant).

4. Simulated pediatric emergencies:

    a. The participant will demonstrate appropriate assessment and care of pediatric patient experiencing:

        i. Respiratory emergency

        ii. Neurological emergency

        iii. Sepsis

    b. The participant will utilize CRM concepts while caring for a pediatric patient in an emergent situation.

Educational modality. This orientation utilizes classroom style didactic in lecture format, case discussion, skills stations for equipment and simulation scenarios and debriefing discussion for simulated patient situations.

Equipment/Supplies/Space.

1. Equipment: Defibrillator, pediatric pads, child and infant manikin, stretcher, crib, IV pole and IV pump, pediatric IV insertion task trainers; child arms, infant arms and infant foot.

2. Supplies: Pediatric code cart, pediatric airway, and oxygen administration supplies, IV insertion and administration supplies, handouts on CRM skills.
3. Space: Classroom with a projector for CRM lecture, task space for equipment station and IV placement skills, inpatient rooms and debriefing space for each simulated case scenario group.

Format of the course. The participants will be divided up into three groups. The groups will rotate through the defibrillator, CRM, and IV placement stations as a cohort in the morning session, and then rotate through the simulation stations as a cohort during the afternoon.

Defibrillator and code cart. This one-hour session will include a brief overview of the content, followed by hands-on time with both the defibrillator and pediatric code cart. Facilitators will review the process for defibrillation and cardioversion of the pediatric patient and aspects of the code cart that are pertinent to the pediatric interns' role and scope of practice.

CRM skills. This one-hour session will have an overview of CRM concepts followed by case presentations and discussions.

IV placement. This one-hour station will include a brief review of pediatric IV insertion techniques followed by a demonstration of an IV insertion. Participants will then practice IV insertion techniques on the task trainers.

Simulated emergencies. Each simulated emergency will be 1 hour and 30 minutes long. The large group will be divided into three smaller groups to rotate through each session.

Simulation session agenda

1. Staff and facilitator Introductions: 5 minutes (this is only in the first session and additional time added to session 2 and 3)
2. Prebrief: Brief standardized introduction to simulation-based learning: 10 minutes, refer to the standardized prebrief content in Appendix G. (this is only in the first session)
    a. Confidentiality (of case content, scenario performance, and debriefing discussion)
    b. Video usage, simulation limitations, suspension of disbelief
    c. Participant responsibilities and expectations of performance
    d. Introduction to the simulation environment-manikin, equipment, and space
3. Simulation scenario: 10 minutes (one of the following scenarios- cases will rotate). Each case will have identified behavioral outcomes specific for the patient presentation.
    a. *Respiratory:* This case focused on assessment of a pediatric patient with respiratory compromise and use of oxygen delivery systems common in pediatrics
    b. *Neurological:* This case focused on assessment of a pediatric patient with seizures and common interventions and medication administration.

c. *Sepsis:* This case focused on the assessment of a septic pediatric patient and interventions per the pediatric sepsis protocol, specifically, IV access, IV fluid bolus administration and blood pressure support medications.

4. Debriefing session: 30 minutes. The debriefing session addresses through reflection and a facilitated group discussion the following:
    a. The emotional aspect of participating in the scenario- how it felt, was it realistic.
    b. Understanding what happened: what was the patient's situation, what actions were done well, what were the performance gaps, were the team roles identified, was communication effective.
    c. What will be brought back to practice as a result of this activity, personal goals for the future?
5. Repeat scenario: 10 minutes (usually the same general situation, although case presentation slightly changed). Have participants switch roles (leader, bedside nurse).
6. Debrief second scenario: 20-30 minutes, using the same approach as in first debriefing, but asking how performance in this scenario was different both positive actions and performance gaps self-identified.
7. Evaluations: 5 minutes (at the end of entire simulation session.

Evaluation. There is no formal evaluation for the orientation modules. Facilitators will provide real-time feedback at the skills stations and in the case study discussions.

Debriefing sessions will follow the simulated experiences and participants will be encouraged to reflect on actions and self-identify performance gaps.

Adult Procedural Skills.

Description of the course. This course is for medical interns and residents and includes a didactic session followed by a skills station on central line placement, ultrasound use for pneumothorax and cardiac tamponade, paracentesis, and thoracentesis.

Participants. Adult medicine interns and residents.

Facilitators. Adult medicine attendings and simulation medical director.

Goal of the course. To provide the participant with the knowledge and skills needed to perform procedures used in urgent and emergent patient situations.

Behavioral outcomes.

1. The participant will perform a central line placement on a task trainer using proper technique.
2. The participant will perform diagnostic ultrasound procedures to identify pneumothorax and cardiac tamponade.
3. The participant will perform paracentesis on a task trainer using proper technique.
4. The participant will perform thoracentesis on a task trainer using proper technique.

Educational modality. Brief didactic sessions followed by a demonstration of skill and practice skills stations, and performance evaluation sessions on task trainers.

Equipment/Supplies/Space.

1. Equipment: Task trainers – chests, paracentesis models, thoracentesis models, ultrasound machines.
2. Supplies: Central line placement kits, paracentesis and thoracentesis kits, gowns, sterile gloves, hats, drapes, computer station.
3. Space: Classroom with a projector for didactic, task rooms for each procedure.

Format of the course (includes evaluation method per session).

1. Central line placement: A two-hour session that includes a didactic session on central line techniques, sterile technique and procedural time out documentation as well as CLABSI (central line-associated blood stream infection) prevention bundle followed by facilitator demonstration of the process. A skills station will follow the didactic. Participants will be allowed to practice central line insertion and then be evaluated. The evaluation will be completed by an attending level physician credentialed in central line placement. Feedback on performance gaps and positive actions will be provided. Participants are not credentialed at this session but required to practice in the lab and complete an Observed Clinical Simulation Evaluation (OSCE) for credentialing at a later point in residency. The evaluation observation of strict adherence to sterile technique.
2. Ultrasound: This two-hour session starts with a didactic lecture on Ultrasound and its use as a diagnostic tool at the bedside. A skills station to practice using the machine will follow with special task trainers that can virtually mimic

pneumothorax and cardiac tamponade. Participants are not credentialed at this basic level course. Attending level physicians provide real-time feedback.

3. Paracentesis: This one-hour session includes a brief didactic session and demonstration of the process by a facilitator is followed by a skills station for the practice of paracentesis on a task trainer specific for this procedure. Attending level physicians will provide real-time feedback to the participants. They are not credentialed during this introductory session.
4. Thoracentesis: This one-hour session includes a brief didactic session and demonstration of the process is followed by a skills station for the practice of thoracentesis on a task trainer specific for this procedure. Attending level physicians will provide real-time feedback to the participants. They are nor credentialed during this introductory session.

Evaluation.

1. Facilitators will provide feedback to participants during skill practice sessions and encourage reflection on performance.
2. Facilitators will evaluate each participant using critical elements checklist during final skill performance providing constructive feedback on performance gaps.

HealthStream:

Description of the courses. This eLearning course provides knowledge for the healthcare professional on selected topics specific for emergent situations in the hospital setting.

Participants. Interns, residents, nurses, respiratory therapists.

Facilitators. The course will be designed by clinical educators with input from all relevant stakeholders for content.

Goal of the courses. To provide the healthcare professional with knowledge of critical information related to emergent patient situations.

Behavioral outcomes.

1. CRM concepts: The participant will implement CRM concepts in emergent situations in practice related to professional role and responsibilities.
2. New code cart implementation: The participant will use the new code carts in their care environments.

Educational modality. eLearning platform used by the medical center to provide staff with the relevant knowledge to perform their role**.** Individual assignments tailored for professional roles and assigned to the participants.

Format of the course. Each course will have a module presenting content.

1. The CRM skills course will include specific case study examples with embedded Q&A. Embedded videos are demonstrating poor and ideal implementation of the skills. There will be a posttest evaluation at the

conclusion of the module that the learner will need to pass with a score of 90% or better. This course is for all healthcare professionals.

2. The new code cart implementation course is for nursing and pharmacy, the users of the code cart. Included in the module are schematics of content and pictures of each drawer with embedded Q&A. A brief posttest concludes the module.

IO insertion.

Description of the course: This didactic and skills-based course provide the participant with knowledge and opportunity to practice Intraosseous placement. This course is provided off site at a local medical school.

Participants: Resource nurses who respond to a code blues

Facilitators: Educators at the outside facility that provides the course.

Goal of the course. This course will provide the participant with the knowledge and practical skills needed to place an intraosseous access in a critically ill adult or pediatric patient.

Behavioral Outcomes:

1. The participant will identify the appropriate locations where IO access can occur
2. The participant will place an IO in an appropriate location for the patient condition using correct technique.

Educational Modality: This course consists of a didactic overview, facilitator demonstration and practice on IO placement in a cadaver lab.

Nurse Competency Day:

Description of the course. Annual nurse competency day provides the medical center's nursing staff with the opportunity to demonstrate required skills necessary for the performance of their role. Included in the day are required lectures on infection prevention, skin care, hospital initiatives (active shooter, compliance), specialty specific mandatory skill and equipment usage demonstration, code response skills, and simulation sessions on specific patient situations. Code response skills and simulation sessions will be detailed here.

Participants. Medical Center inpatient nursing staff

Facilitators. Clinical nurse educators and simulation staff

Goal of the course. The participants will demonstrate skills necessary for their professional role within a code response.

Behavioral outcomes.

1. Defibrillator station: The participant will use the defibrillator correctly and appropriately for the patient situation.
2. Code Cart station: The participant will locate all necessary equipment within the code cart promptly.
3. Medication Administration: The participant will correctly prepare and administer emergency medications in a code blue setting.
4. Code Documentation station: The participant will accurately document within the medical record the events that occur during a code blue.

5. Decompensating patient: The participant will assess the decompensating patient and implement appropriate interventions for the specific patient issue.

Educational modality. Skills stations for code cart, defibrillator with critical event observation checklists. Computer lab station with case scenarios to document in the medical record. Simulation for the decompensating patient scenarios.

Equipment/Supplies/Space:

1. Equipment: Code carts, defibrillators, manikins, IV poles, IV pumps, computers.
2. Supplies: Emergency medications, IV fluids and IV administration supplies, oxygen administration supplies.
3. Space: Task rooms for skills stations, a computer lab for documentation, and inpatient room and debriefing room in the simulation center for decompensating patient scenarios.

Format of the course (including evaluation process). Refer to Table A1 for format timeline template. Participants will be divided into three groups of 12 and further divided into groups of 4 to rotate through the Code cart station, defibrillator station, medication administration stations. The larger groups of 12 will attend the computer documentation session and simulation session.

1. Defibrillator station: Skills station lasting 20 minutes where staff nurses in groups of 4 will each demonstrate appropriate use of the defibrillator for defibrillation, cardioversion, and external pacing. There will be three defibrillators available at the skill station. Each nurse will be observed by a

clinical nurse educator for performance, feedback provided as needed on performance gaps. Each nurse will have the Defibrillator Performance checklist completed by one of the educators. See Appendix G for the form.

2. Code Cart station: Skills station lasting 20 minutes where staff nurses in groups of 4 will have given a scavenger hunt to complete, active cooperative learning. Each nurse will complete a checklist documenting the location of the equipment. See Appendix G for the form. There will be three code carts available at the station.
3. Medication administration: Skills station is lasting 20 minutes where staff nurses in small groups of 4 where each nurse will demonstrate the preparation of emergency medications used in a code blue. Nurses will also describe the process of administration. There will be four code cart medication trays available for this station. Nurses will be observed in the medication administration process by a clinical nurse educator.
4. Code Documentation station: This 45-minute station in a computer lab will have a group of 12 nurses each at a computer terminal. The nurses will observe a video on a simulated code blue scenario and document the event in a simulated version of the code blue documentation system. Clinical nurse educators will be present in the room providing support and reviewing the performance of the nurse giving real-time feedback.
5. Decompensating patient: This 1 hour and 45-minute session that occurs in the simulation center for a group of 12 participants with one clinical nurse

educator and simulation staff. The participants will be divided into smaller groups of four. Each group of four will participate in one scenario as the providing team (bedside nurse, charge nurse, peers on the unit). The remaining eight students will observe the scenario via live streaming. All twelve students will participate in the debriefing. This process will be repeated two more times so all students will have an active role. The clinical educators for the area of practice will determine the three scenarios, based on staff needs but all will focus on caring for a decompensating patient and nursing care required. The format of this session will be:

Simulation session agenda

a. Prebrief: Brief standardized introduction to simulation-based learning: 5 minutes, refer to the standardized prebrief content in Appendix G.
    i. Confidentiality (of case content, scenario performance, and debriefing discussion)
    ii. Video usage, simulation limitations, suspension of disbelief
    iii. Participant responsibilities and expectations of performance
    iv. Introduction to the simulation environment-manikin, equipment, and space
b. Simulation scenario: 10 minutes (one of the following scenarios- cases will rotate). Each case will have identified behavioral outcomes specific for the patient presentation.

c. Debriefing session: 20 minutes. The debriefing session addresses through reflection and a facilitated group discussion the following:
    i. The emotional aspect of participating in the scenario- how it felt, was it realistic.
    ii. Understanding what happened: what was the patient's situation, what actions were done well, what were the performance gaps, were the team roles identified, was communication effective.
    iii. What will be brought back to practice as a result of this activity, personal goals for the future?
d. Repeat scenario two more times: 10 minutes with participants switching from active to an observer role.
e. Debrief each of two remaining scenarios: 20 minutes, using the same approach as in first debriefing, but asking how performance in this scenario was different in comparison, both positive actions and performance gaps self-identified.
f. Evaluations: 5 minutes

Table A1
Nursing Annual Competency Day Schedule Template

Time	Group A	Group B	Group C
7:30-9:30	Mandatory content for all in classroom		
9:30-9:50	Break /travel all		
9:50-11:35	Simulation	Content A	Content B
11:35-12:10	Lunch / travel all		
12:10-1:55	Content B	Simulation	Content A
1:55-2:15	Break/travel all		
2:15-4:00	Content A	Content B	Simulation

Note: Code cart/defibrillator and code documentation in Content A session

BLS

Description of the course. This course combines AHA HeartCode© eLearning module with a skills performance station providing the participant with healthcare provider BLS certification. (Jones Medical Center provides for nursing and respiratory staff only)

Participants. All medical center nursing staff and respiratory therapists.

Facilitators. AHA certified BLS instructors.

Goal of the course. To provide the participant with the knowledge and skills needed to perform basic life support as a healthcare provider.

Behavioral outcomes.

1. The participant will perform cardiac compressions on a task trainer using proper technique (including correct rate, placement, depth and use of backboard and stool).

2. The participant will perform correct bag valve ventilation with a mask and via the endotracheal tube, using the correct rate and ratio in time with cardiac compressions for the patient's age.
3. The participant will activate the emergent response system.
4. The participant will use the AED correctly when indicated.

Educational modality. eLearning modules and simulated skills performance

Equipment/Supplies/Space.

1. Equipment: CPR Task trainers, AED, stool, and backboard.
2. Supplies: Ambu bag, defibrillator pads, AHA documentation and observation checklists.
3. Space: Task rooms for skills station. eLearning is done at computers in either participants' work environment or home.

Format of the course (includes evaluation method per session).

1. eLearning: Modules assigned via HealthStream platform to participants before their certification expires. After successful completion of the eLearning modules, participant prints certificate of completion and brings to skills station. The module needs to be completed in the 30 days before participation at the skills station.
2. Skills station: A brief (usually 20 minute) session where the participant demonstrates adult and infant BLS including compressions ventilation and AED use. Success at the skills station allows the participant to be certified in BLS for a two-year period.

Evaluation: Successful completion of both portions of the course. BLS certification is good for a two-year period.

ACLS.

Description of the course. This course is for adult healthcare providers who may care for a patient needing advanced life support measures.

Participants. Adult healthcare providers (medical center requires for all incoming interns in adult medicine areas, nurses in critical care areas, providers who care for patients receiving moderate sedation, and respiratory therapists).

Facilitators. ACLS certified instructors.

Goal of the course. To provide the participant with the knowledge and skills needed to perform advanced life support.

Educational modality. Two-day course that includes didactic sessions followed by practice skills stations, and performance evaluation sessions on simulation manikins. A posttest evaluation is given to assess knowledge. This course is provided off campus by non-medical center employees.

Evaluation. Participants will pass the posttest evaluation and perform correctly at the skills stations completing critical skills on the observation checklist. Certification is good for two years.

PALS

Description of the course. This AHA AAP (American Academy of Pediatrics) course is for pediatric healthcare providers who may care for a patient needing advanced life support measures.

Participants. Pediatric healthcare providers (medical center requires for all incoming interns in pediatric areas, nurses in pediatric critical care areas, providers who care for pediatric patients receiving moderate sedation, and respiratory therapists).

Facilitators. PALS certified instructors.

Goal of the course. To provide the participant with the knowledge and skills needed to perform pediatric advanced life support.

Educational modality. Two-day course that includes didactic sessions followed by practice skills stations, and performance evaluation sessions on simulation manikins. A posttest evaluation is given to assess knowledge. This course occurs off campus by non-medical center employees.

Evaluation. Participants will pass the posttest evaluation and perform correctly at the skills stations completing critical skills on the observation checklist. Certification is good for two years.

Pharmacist Skills

Description of the course. This course is about code cart medication tray familiarity and emergency medication preparation and administration for the clinical pharmacists whose role includes responding to a code blue.

Participants. Clinical pharmacists whose role includes attending a patient code blue.

Facilitators. Pharmacy clinical educator.

Goal of the course. To provide the participant with the knowledge and skills needed to prepare and administer emergency medications and provide expertise knowledge to the code blue team.

Behavioral outcomes.

1. The participant will prepare emergency medications frequently given in a code situation.
2. The participant will administer emergency medications to a manikin during a simulated emergency.
3. The participant will locate medications and necessary medication administration supplies within the code cart.

Educational modality. Brief didactic sessions followed by practice skills stations and performance evaluation sessions on task trainers or simulation manikin.

Equipment/Supplies/Space.

1. Equipment: Task trainers, manikin, code cart and code cart drug administration tray
2. Supplies: Emergency medications and medication administration supplies within the code cart.
3. Space: Classroom with projector for didactic, task rooms for skills stations

Evaluation: Pharmacist clinical educator observes for correct technique when preparing and administering emergency medication in a simulated code situation and provides real-time feedback on performance. A performance observation checklist with critical actions identified is completed.

Appendix B: Initial Team Training Self-Evaluation

Team Training Self-Assessment Survey

Date: _____ Program: _____

1. **Do you feel that this simulation scenario will influence your overall practice?**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

2. **Do you feel this simulation scenario will influence how you function in a team situation in the future?**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

3. **Do you feel this simulation scenario has improved your communication skills?**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

4. **Do you feel this simulation scenario has improved your assessment skills?**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

5. **Do you feel this simulation scenario has helped you improve on your technical skills?**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

6. **Do you feel confident in your role in future critical events after attending this simulation?**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

7. **This program was appropriate for my learning level.**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

8. **The objectives of this program were clearly stated.**

   Strongly Disagree 1 | Somewhat Disagree 2 | Somewhat Agree 3 | Strongly Agree 4

9. **The format of this program was effective**.

Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
1	2	3	4

10. Was this your first experience at the simulation center?

☐ Yes ☐ No

11. What other topics would you like to see covered in programs at the simulation center?

_____

12. How can we improve your experience in future programs?

_____

13. What did you like best about the program?

_____

14. What did you like least about the program?

_____

15. Some of the things that I learned today that I plan to incorporate into my clinical practice are.

_____

16. I would like to participate in a program like this again:

Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
1	2	3	4

THANK YOU FOR COMPLETING THIS DOCUMENT

Appendix C: Current Team Training Self-Evaluation Tool

Team Training Evaluation

Program Date: _____ Program Name: _____

1. Was this your first experience at the simulation center?

☐ Yes ☐ No

2. What other topics would you like to see covered in programs at the simulation center?

_____

3. How can we improve your experience in future programs?

_____

4. What did you like best about the program?

_____

5. What did you like least about the program?

_____

6. I plan to incorporate what I learned today in my clinical practice.

1	2	3	4	5
Strongly Disagree				Strongly Agree

7. I would like to participate in a program like this again.

1	2	3	4	5
Strongly Disagree				Strongly Agree

8. This program was appropriate for my learning level.

1	2	3	4	5
Strongly Disagree				Strongly Agree

9. **This program was challenging**.

1	2	3	4	5
Strongly Disagree				Strongly Agree

10. The format of the program was effective.

1	2	3	4	5
Strongly Disagree				Strongly Agree

11. The objectives of the program were clearly stated.

1	2	3	4	5
Strongly Disagree				Strongly Agree

1. **I feel better prepared to care for patients in the clinical environment**.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

2. I feel more confident in my decision-making skills.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

3. I am more confident in determining what to communicate to other health care providers.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

4. I feel more confident that I will be able to recognize changes in my patients.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

5. I am able to better predict what changes may occur with my patients.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

6. I developed a better understanding of the pathophysiology of the conditions in the simulated experience.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

7. **My assessment skills improved**.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

8. I was challenged in my think and decision-making skills.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

9. I learned as much from observing my peers as I did when I was actively involved in caring for the simulated patient.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

10. The debriefing and group discussion was valuable.

Do Not Agree	Somewhat Agree	Strongly Agree
1	2	3

Appendix D: Facilitator Observation Tool

Adult Mock Code Observer Worksheet

Expected Behavior in Scenario	Observed		
First Scenario	**Yes**	**Partial**	**No**
Delegates and performs role identification			
Communicates with closed loop communication			
Summarizes “state of the union”			
Performs BLS compressions correctly			
Minimal interruptions to compressions during BLS			
Maintains correct ventilation to compression ratio			
Identifies correct ACLS algorithm			
Uses the defibrillator correctly			

Expected Behavior in Scenario	Observed		
Second Scenario	**Yes**	**Partial**	**No**
Delegates and performs role identification			
Communicates with closed loop communication			
Summarizes “state of the union”			
Performs BLS compressions correctly			
Minimal interruptions to compressions during BLS			
Maintains correct ventilation to compression ratio			
Identifies correct ACLS algorithm			
Uses the defibrillator correctly			

Appendix E: Code Blue Debriefing Tool

Not To Be Included in Medical Record
Completed By Critical Care RN & Physician In Charge

Patient Label

CODE BLUE DEBRIEFING

IF NON CRITICAL CARE PATIENT

1. Transferred to floor within prior 24 hours: □ Yes □ No
2. Rapid Response within prior 24 hours: □ Yes □ No

QUALITY OF CARDIOPULMONARY RESUSCITATION

1. Were compressions interrupted for > 10 secs at any time other than ET tube placement?
   □ Yes □ No If yes: _____
2. Did ventilation rate exceed 10/min (or >20/min for pediatrics) excluding confirmation ET Tube placement?
   □ Yes □ No If yes: _____

CODE RESPONSE

1. **Alerting Hospital Wide Response** □ No Issues
   □ Delay □ Page Issues
   Specify: _____
2. **Arrival Code Team Member** □ No Issues
   Delay in personnel arrival: □ Physician #1 □ Physician #2 □ Anesthesia □ Respiratory
   □ Critical Care RN #1 □ Critical Care RN #2 □ Transport
   Describe: _____
3. **Physician Leadership** □ No Issues
   □ Delay in identifying leader □ Did not clearly assign roles □ Did not oversee BLS quality
   □ Did not follow ACLS/PALS/NRP protocols □ Did not control # of individuals in room
   Other: _____
4. **Medications** □ No Issues
   □ Delay □ Sequence of Medications □ Dose □ Route □ Other
   Specify: _____
5. **Equipment** □ No Issues
   □ Delay to Defibrillation □ Missing □ Malfunction □ Other
   Specify (item & serial number): _____
6. **Airway** □ No Issues
   □ Multiple intubation attempts (# ____) □ Surgical Airway Team notified
   □ Surgical Airway Team delay □ Delayed recognition of misplacement/displacement
   Specify: _____
7. **Chest Compression** □ No Issues
   □ No Board □ Rate several times < than 100/min □ Switch off exceeded 2 mins □ Other
   Specify: _____
8. **Vascular Access** □ No Issues
   □ Delay □ Intraosseous required □ Inadvertent arterial cannulation □ Infiltration
   □ Unrecognized disconnection □ Other
   Specify: _____
9. **Lab Results** □ No Issues □ Delay > than _____
10. **Transfer Delay to Critical Care** □ No Issues
    □ Bed availability □ Staffing □ Change in patient condition □ Other
    Specify: _____
11. **Debriefing Done** □ Yes □ No □ To be scheduled

Comments/Problems: _____

_____

_____

Follow-up: _____

Clinical RN (Print Name): _____
Critical Care RN (Print Name): _____
Physician In Charge (Print Name) :_____

Revised 09/2009

Appendix F: Facilitator Self-Reflection Tool

Post Simulation Course Reflection

Date: *Course:*

Facilitators:

Type of Prebrief*:* (*circle all that apply*) How long was the Prebriefing? _____

Introductions Standardized PowerPoints Informal review of process

Simulation environment orientation---(Simulation Specialist or Facilitator)

Review of confidentiality and videotaping policies

Was there opportunity for participant questions? YES NO

Scenario**:** How long was the simulation scenario? _____

Was there video streaming during the scenario? YES NO

Did participants fill all roles? YES NO

What was facilitator's role in Scenario? (*circle any that apply*)

Observer in control room Voice of patient

Observer in simulation room Observer in streaming room

Were there any technical difficulties? YES NO

Mannequin related Audio related Video related

Was there any equipment or supplies missing for the scenario? YES NO

If yes, what was missing? _____

Was there any observational tool used for the simulation? YES NO

Were all participants in scenario engaged in the activity? YES NO

Debriefing**:** How long was the debriefing session? _____

Were there any co-debriefers? _____

What style of debriefing was used? (*circle all that were used*)

Plus/ Delta Advocacy/ Inquiry Good Judgement model

Emotions discussion/diagnosis review/summary and incorporate into practice

Other _____

Video review in debriefing YES NO

Any technical issues with video—YES NO Audio Visual

Overall thoughts on participant engagement in the debriefing: (consider observers' participation if that model used).

_____

_____

Skills Stations

Were there any associated skills stations in the program YES NO

Were there any issues with the skill station? Missing equipment Technical issues

Supplies missing Documentation missing

Who facilitated the skills station?

General Questions:

What rooms were used for the simulation?

HPS 1 HPS 2 HPS 3 HPS 4 OR Room Nursing Station

What rooms were used for the debriefing?

Entire classroom Classroom A Classroom B OR Room Task Room

Was there enough room for all participants: YES NO

Did you serve food or drink? YES NO

Was there continuing education associated with the program? CME CNE OTHER None

Was a sign in sheet provided? Standard Simulation Form Special program Form

Were Evaluation forms completed YES NO

Feedback/ comments for Simulation Center to improve the program:

Simulation Staff Comments and Feedback:

Appendix G: Defibrillator and Code Cart Checklists

DEFIBRILLATOR PERFORMANCE CHECKLIST NAME: DATE

OBJECTIVE: The learner will locate the following components on the Heart start XL	**Met**	**Unmet**	**Comments**
Power Switch/AC Power Cord Battery Compartment Paper compartment ECG Cable Connection Paddles: Adult and Pediatric Soft Key Buttons: ECG Size, Print Strip Key, Volume control, mark key, Event summary key Pacer Controls			
OBJECTIVE: The Learner will operate the AED Mode MONITORING Function	**Met**	**Unmet**	**Comments**
Place pads correctly on patient Turn machine to AED mode Connect pads to cable/monitor Follow voice and text prompts Utilize shock button when prompted			
OBJECTIVE: The Learner will operate the MANUAL Mode MONITORING Function	**Met**	**Unmet**	**Comments**
Turn on machine to MANUAL mode Attach the 5 lead electrodes Operate Soft Key buttons: heart rate alarms, Change leads, Change ECG size, Change ECG volume			
OBJECTIVE: The learner will generate an ECG strip	**MET**	**UNMET**	**Comments**
Change paper Run a strip Mark a strip Label medication administered Generate Event Summary			
OBJECTIVE: The learner will perform the defibrillator test	**MET**	**UNMET**	**Comments**
Turn knob to off and unplug the machine Press and hold strip Key and turn to manual on Follow prompts Check machine using paddles Check machine using pads with test load Demonstrate ability to switch between cables			

OBJECTIVE: The learner can operate manual Mode DEFIBRILLATION functions	**Met**	**Unmet**	**Comments**
Turn machine on to manual mode Attach the appropriate cable (pads and ECG cable-remove test block) Demonstrate pad placement Choose the appropriate level of electricity Describe process of charging/ shock delivery			
OBJECTIVE: The Learner can demonstrate <u>SYNCHRONIZED CARDIOVERSION in the Manual mode</u>	**Met**	**Unmet**	**Comments**
Locate Sync on off key and turn on Sync function Apply appropriate electricity setting Identify Sync markers on the QRS complex Charge and Shock			
OBJECTIVE: The learner can demonstrate PACING <u>Function in the MANUAL Mode</u>	**Met**	**Unmet**	**Comments**
Attach both ECG leads and Pads to Patient Identify the two pacing modes Turn on PACER function Change Mode Adjust Output Adjust rate Begin Pacing by pushing the START button			
JECTIVE: <u>The learner will demonstrate usage of FR2 AED</u>	**Met**	**Unmet**	**Comments**
Turn on FR2 AED Place pads correctly on patient, plug into FR2 AED Assure no one touching patient during analysis phase Verbally and visually assess for clearance before administering shock Follow the prompts Discusses need for CPR and reanalysis			

Employee Signature_____

Educator Signature_____

Adult Code Cart

Case Study

Name: _____ Unit: _____ Date: _____

Mr. W is a 60-year-old male admitted yesterday for unstable angina. He is room 406W bed 2 on the West Campus. He calls you to his room c/o severe crushing substernal chest pain. As you are obtaining a 12 lead EKG, Mr. W becomes unconscious, pulseless and breathless. What do you do?

1. What do you do first?

2. What phone # do you call and what do you say?

3. Who is paged after the code team?

4. Where are the defibrillator pads located?

5. Where is the backboard?

6. Where do you find the AMBU (Airway-breathing-mask-unit)?

7. To continuously monitor the patient's heart rhythm, you should use which item?
   a. Cardiac monitor electrodes
   b. AED pad

8. Where is the intubation equipment?

9. When do you use the ETCO2 detector? What does a purple color change indicate?

10. They need an ABG stat. Where is it located?

11. The ABG kit has electrolyte balanced dry heparin, a safety needle and filter cap. Explain how the safety needle and filter cap are used.

12. Where is the Valium located on the code cart?

13. Where is the epinephrine for anaphylaxis located?

14. What is the difference between Anaphylaxis epinephrine dose/route and code dose/route**?**

15. Identify the location where you document that the family was notified.

16. Who must sign the portion of the code record that belongs in the medical record?

17. What is the yellow section of the code record for and who signs it?

18. Where should the yellow copy go?

19. What is in the code cart for use if suction does not work?

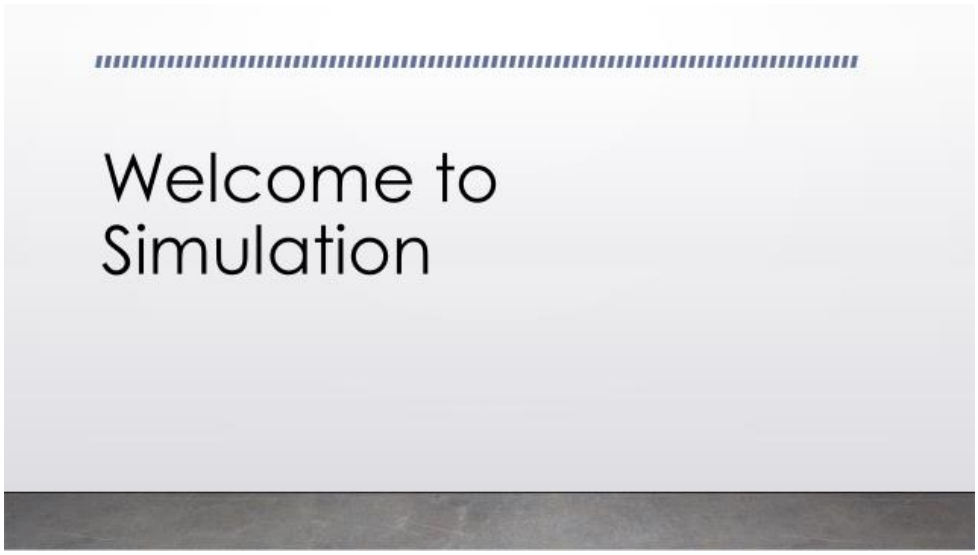
20. If labs are drawn in a code, where the lab supplies other than ABG- and what are is the best way to have them sent to the lab?

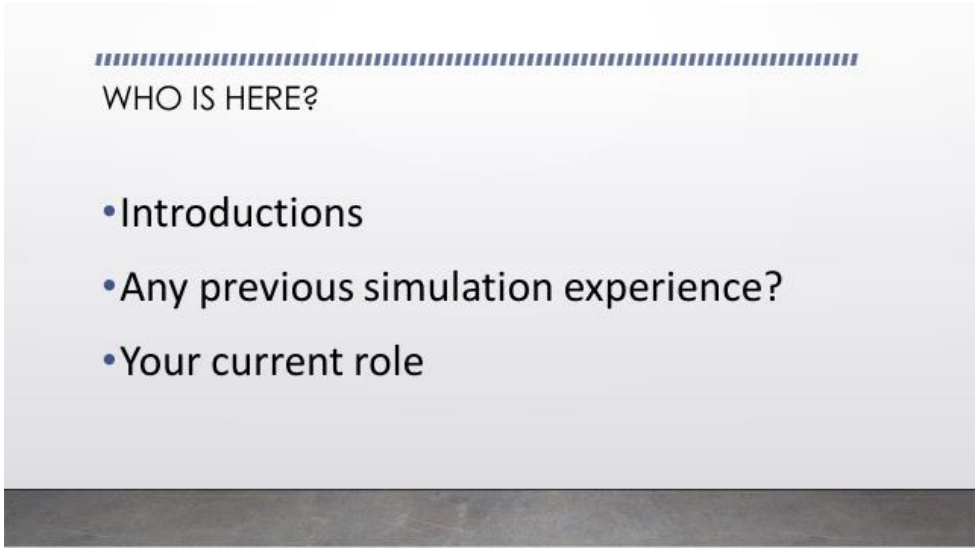
21. What drawer is the dopamine pre mixed bag located?

22. What steps does the RN need to take before sending the cart back to MDC?

Reviewed by: _____

Appendix H: Standardized Simulation Pre-Brief Content





SIMULATION ASSUMPTIONS

- You are **intelligent** and **well-trained**
- You want to **work hard** and **do your best**
- You want to **learn** and **improve** as a clinician and professional

EXPECTATIONS

- **Suspend disbelief**
  - Strive for realism
  - Accept the limitations
- **Maintain confidentiality**
  - Keep the cases to yourself
- **This is a safe space**
  - Engage in reflective learning
- **This is non-evaluative**
  - This simulation is not an assessment

After the simulation, please refrain from discussing the case until your facilitators start the debrief.

- Engage in this scenario as **yourself** (your role)
  - Actually perform procedures
  - Provide care in your scope of practice
- Think about the medicine
- Consider how you function within the team

IN the Debriefing that follows the simulation we will discuss the following.