TEAMWORK DURING CARDIOPULMONARY RESUSCITATIONS AT A RURAL MINNESOTA HOSPITAL

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Kayla Dale Dascher

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By

Kayla Dale Dascher

The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

DOCTOR OF NURSING PRACTICE

SUPERVISORY COMMITTEE:

Dr. Mykell Barnacle
Chair

Dr. Tina Lundeen

Professor Kara Falk

Dr. Daniel Klenow

Approved:

March 25, 2015
Date

Dr. Carla Gross
Department Chair

ABSTRACT

Cardiac arrest is a major public health problem affecting thousands of individuals each year in both out-of-hospital and in-hospital settings (Sutton, Nadkarni, & Abella, 2012). In 2012 nearly 383,000 out-of-hospital sudden cardiac arrests occurred and approximately 209,000 cardiac arrests occurred within a hospital (American Heart Association, 2012). Survival rates from cardiac arrest are improving, however overall rates of survival are still low (American Heart Association, 2012).

The purpose of this project was to enhance the teamwork, knowledge, and technical skills of all individuals involved in cardiopulmonary resuscitations at the project site. Expectations of the project were to (1) enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members, (2) clearly delineate roles of team members during resuscitations, and (3) develop a continuing education plan that will ensure the maintenance of quality cardiac resuscitations.

A survey to assess the needs of the cardiac resuscitation team members was distributed to all providers at the project site as well as all staff registered nurses, pharmacists, respiratory therapists, nurse anesthetists, and hospital unit coordinators. The survey results identified the nurses' perception that the providers lack leadership skills during resuscitations. Many survey responses noted confusion about the role of each individual during resuscitations. Nurses felt lack of confidence in knowledge of medications, as well as mixing and titration of medications.

Based on feedback from the survey, six mock resuscitation/simulations were facilitated utilizing four scenarios that were developed. Following each mock resuscitation/simulation, a debriefing occurred utilizing a debriefing tool. A post mock resuscitation survey was administered at the completion of the project. Eleven surveys were returned. Results of the

project were overall positive. Evidence based resources were developed and utilized by providers and nursing during both mock and actual resuscitations. Posters were developed and placed in the emergency department that clearly delineated each participant's role. A continuing education plan based upon feedback from a post resuscitation survey was developed. The continuing education plan includes having mock resuscitations/simulations once per month at various times of the day to accommodate all staff.

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CHAPTER 1. BACKGROUND AND SIGNIFICANCE

Introduction

Despite advances in modern medicine and increased knowledge of the importance of preventative medicine, there remains an alarming incidence of cardiac arrest and the need for cardiopulmonary resuscitations (CPR). Cardiac arrest is a major public health problem affecting thousands of individuals each year in both out-of-hospital and in-hospital settings (Sutton, Nadkarni, & Abella, 2012).

In 2012 nearly 383,000 out-of-hospital sudden cardiac arrests occurred and approximately 209,000 cardiac arrests occurred within a hospital (American Heart Association, 2012). Sandroni, Nolan, Cavallaro, & Antonelli (2007) state that between 370,000 and 750,000 in-hospital resuscitation attempts are made in the United States each year. Survival rates from cardiac arrest are improving, however overall rates of survival are still low. The out-of-hospital cardiac arrest survival rate in 2012 was 11.4 percent, and in-hospital survivor rate was 23.1 percent in adults and 35.0 percent in children (American Heart Association, 2012).

Cardiac arrests occur in all institutions regardless of size or resources available. This project focused on a small rural Minnesota hospital. The rural hospital chosen for this project is an 18-bed critical access hospital, with a 3-bed emergency department (ED). The ED experiences approximately 2,300 visits per year. There have been 27 resuscitation attempts over the past two years.

Despite the number of cardiac arrests that occur nationally, for some clinicians the thought of leading and participating in cardiopulmonary resuscitation may provoke anxiety. At the previously identified rural hospital, a medical center that has approximately 20 resuscitation

attempts per year, it is difficult to develop teamwork, skills, and confidence in cardiopulmonary resuscitations due to the lack of occurrences and resources.

Statement of the Problem

Good teamwork is essential to optimal patient care and patient safety (Baker, Day, & Salas, 2006). This is especially true during cardiopulmonary resuscitations (Hunziker et al., 2011). Poor teamwork and lack of leadership can result in poor clinical outcomes for groups performing cardiopulmonary resuscitation and other emergency tasks (Hunziker et al., 2011). A needs assessment survey was administered to providers, registered nurses, respiratory therapists, nurse anesthetists, health unit coordinators, and nurse's aides to determine level of confidence, skills, and areas for improvement at the project site. The survey results identified several problems and concerns. One problem identified during cardiopulmonary resuscitations at the project site involved the nurses' perception that the providers lack leadership skills during resuscitations. Many survey responses noted confusion about the role of each individual during resuscitations. Nurses felt lack of confidence in knowledge of medications, as well as mixing and titration of medications.

At the project site, providers consist of medical doctors (MD's), medical residents, and nurse practitioners (NP's). Most of the resident providers are in their second year of residency, and many have been involved in a cardiopulmonary resuscitation but have never functioned in the role of the team leader. The residents often lack confidence, leadership skills, and knowledge of best practice in these situations.

At the project site the medical surgical floor charge nurse also functions as the charge nurse of the emergency department (ED) and is responsible for caring for the ED patients. Some

of the charge nurses have only 1-2 years of nursing experience and have had minimal or no involvement in cardiopulmonary resuscitations.

Based upon results of the needs assessment survey administered, providers, nurses, and other ancillary staff expressed the need to enhance teamwork during resuscitations. They specifically requested participation in mock resuscitations/simulations. Nurses requested providers enhance communication and leadership skills. Nurses also requested further training in administration and titration of medications. The providers have requested an increase in the amount of mock resuscitations/simulations. One provider acknowledged difficulty with knowing each individual's role and delegating tasks. Another provider requested more resources available at that bedside.

Purpose of Clinical Dissertation Project

The purpose of this project was to enhance the teamwork, knowledge, and technical skills of all individuals involved in cardiopulmonary resuscitations at the project site. Information gathered from post-mock resuscitation surveys was used to assess how often participants felt mock resuscitations/simulations should occur, as well as what was found to be most helpful for use during not only mock resuscitations/simulations but also actual resuscitations. The project identified areas of improvement during mock resuscitations/simulations, and whether additional resources were needed for both mock resuscitations/simulations and actual resuscitations.

Expectations of the project were to (1) enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members, (2) clearly delineate roles of team members during resuscitations, and (3) develop a continuing education plan that will ensure the maintenance of quality cardiac resuscitations.

CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The American Heart Association (AHA) stated that nearly 383,000 out-of-hospital sudden cardiac arrests occurred and approximately 209,000 cardiac arrests occurred within a hospital (American Heart Association, 2012). Overall survival is astoundingly low and has not changed significantly in decades (Gaieski, Abella, & Goyal, 2012). Hunziker et al. (2011) also noted that despite substantial efforts to make cardiopulmonary algorithms known to healthcare workers, the outcome of CPR has remained poor. Individual characteristics of resuscitation team members such as technical skills, previous experience, communication, and leadership skills influence the course of action during a resuscitation (Bhanji et al, 2010; Anderson, Jensen, Lippert, & Ostergaard, 2010; Cooper, 2010).

Team and Teamwork

A team is defined as a group of people trained or organized to work together (Merriam-Webster, n.d.) Teamwork can be defined as the behaviors that facilitate effective team member interaction (Beaubien & Baker, 2004). Baker & Beaubien (2004) define teamwork as those behaviors that facilitate effective team member interaction. Common examples include communication, situational monitoring, and decision-making.

Teamwork has become a major focus in healthcare (Lerner, Magrane, & Friedman, 2009). Both the Institute of Medicine (IOM) and the Joint Commission for the Accreditation of Health Care Organizations (JCAHO) are calling for improvement in teamwork (Weinstock & Halamek, 2008). In 1999, the IOM issued a report *To Err is Human: Building a Safer Health System.* This report details a high rate of preventable medical errors, many of which are the result of dysfunctional or nonexistent teamwork (Lerner et al., 2009). The report also suggests that teamwork is required for effective patient management because of increased specialization of

tasks, increased complexity, risks associated with treatment options, and the need to ensure patient safety (Lerner et al., 2009). The 1999 IOM report was followed by a second report, *Crossing the Quality Chasm: A New Health System for the 21st Century.* In this report the IOM details what is necessary to improve the safe delivery of care (National Research Council, 2001). One of the imperatives listed in the follow-up report is the development of effective teams.

Teamwork is a critical aspect of CPR and is essential to optimal patient care and patient safety (Baker et al., 2006; Weinstock & Halamek, 2008). Thomas et al. (2006) noted good teamwork behaviors correlate with higher quality of care during resuscitation.

Weinstock & Halamek (2008) state that content knowledge and technical (hands-on or procedural) skills alone are insufficient to deliver optimal care while working as a team in a medical emergency under intense time pressure. Teamwork is critical during resuscitation, however little attention has been paid to acquiring these skills in the health care setting.

Most health care professionals participating in CPR lack sufficient training. Reports of team performance during CPR indicate that it is often suboptimal (Norris & Lockey, 2004). Emerging data suggest that resuscitation team members show lack of clear and expert teamwork skills (Hunt, Walker, Shaffner, Miller, & Pronovost, 2008).

The AHA has implanted teamwork skills including leadership, role clarity, and communication within the curricula of Pediatric Advanced Life Support (PALS) and Advanced Cardiac Life Support (ACLS) programs (AHA, 2005). The Neonatal Resuscitation Program (NRP) also implemented teamwork to its curriculum. Research has demonstrated that the addition of teamwork to the NRP curriculum has resulted in more frequent teamwork behaviors during simulated neonatal resuscitations (Thomas et al., 2006; Thomas et al., 2010).

Weinstock & Halamek (2008) identified key behavioral skills needed to work effectively as a team. These skills include

- Know your environment
- Anticipate and plan
- Assume the leadership role
- Communicate effectively
- Delegate workload optimally
- Allocate attention wisely
- Use all available information
- Use all available resources
- Call for help when needed
- Maintain professional behavior

The importance of teamwork has been illustrated by the multiple studies mentioned. An important component of strong teamwork is the development of strong leaders.

Leadership

Leadership is defined as the process of influencing others to accomplish individual or team goals (Fein, 2012). Emerging evidence suggests that in addition to technical skills of individual rescuers, human factors such as teamwork and leadership affect the outcome of CPR. Research has shown that a prolonged process of team building and poor leadership behavior are associated with significant shortcomings in the performance of rescuers, which may partly explain poor outcomes of CPR (Hunziker et al., 2011).

Cooper & Wakelam's (1999) research, which is cited frequently in the literature, studied the relationship between leadership behavior, team dynamics and task performance. They

performed an observational study using video recordings of 20 resuscitation attempts. The results of the study clearly indicated that when leaders initiate a structure within the team, not only do teams work better together, but they also perform the tasks of resuscitation quicker and more effectively. They also noted that the team leader needs to display a positive attitude, and motivate and encourage the team. An essential part of team leadership is assigning of team members to particular tasks. Cooper & Wakelam (1999) related the title of their paper, 'Lighthouse Leadership' to an analogy related to lighthouse keeping. Leaders may imagine themselves as a lighthouse keeper whose 'light' should guide and direct the team from afar, only occasionally launching themselves into the situation for those that require assistance. The findings of Cooper & Wakelam's (1999) study indicate that there is an effective way to lead a resuscitation team, namely though structure, establishing a system of control that directs, guides, coordinates and maintains performance standards. Cooper & Wakelam (1999) found that where leaders initiate a structure within the team, no only do teams work better together, but they also perform the tasks of resuscitation quicker and more effectively. Direction and command (verbal or non-verbal) were noted to be an essential component leading an effective team, but should not be confused with autocratic leadership. An effective leader demonstrates a holistic approach to the process of resuscitation, and they not only encourage but transform their teams approach.

Yeung, Ong, Davies, Gao, & Perkins, (2012) conducted a small study using two instruments to assess the technical performance of complex CPR skills and leadership skills. They established that teams led by individuals with the best leadership skills performed higher quality cardiopulmonary resuscitation with better technical performance. This study also concluded that leadership skills can be taught, and are associated with improved team performance.

Hayes, Rhee, Detsky, Leblanc, & Wax (2007) studied internal medicine residents' perceptions of the adequacy of their training to serve as in-hospital cardiac arrest team leaders by utilizing a cross-sectional postal survey. This survey demonstrated almost half of the respondents (49.3%) felt inadequately trained to lead cardiac arrest teams. Many of the residents (50.9%) felt that the advanced cardiac life support course did not provide the necessary training for team leadership. A number of respondents (40%) reported receiving no additional cardiac arrest training beyond the advanced cardiac life support course. Only 52.1% of respondents felt prepared to lead a cardiac arrest team, with 55.3% worrying that they made errors.

Hunziker et al., (2010) conducted a randomized control trial of 237 volunteer medical students in teams of three. The purpose of this study was to compare leadership instruction with a general technical instruction in a high-fidelity simulated cardiopulmonary resuscitation scenario. During this trial medical students participated in a simulated witnessed cardiac arrest. The students were randomized to receive instructions focusing on technical skills or on leadership and communication to enhance coordination. A follow-up simulation was conducted after four months. The performance of students randomized to focus on leadership instructions was superior to those who focused on technical instructions. The students who focused on leadership instruction demonstrated leadership skills and better overall CPR performance.

Schenarts & Cohen (2010) note that ACLS and PALS provide a logical algorithmic approach to resuscitation, however an actual resuscitation is far more complex. Schenarts & Cohen state that much of the complexity and confusion associated with resuscitation are related to human factors such as emotion, an inconsistent cohort of team members with variable levels of technical abilities, knowledge, experiences, as well as ineffective communication and inadequate leadership skills.

Schenarts (2007) described a different approach to resuscitation. He noted that in Advanced Trauma Life Support (ATLS), a single provider completes all elements of resuscitation in a sequential fashion with limited assistance. This is known as "vertical resuscitation" and is designed as a safe approach to the resuscitation and evaluation of injured patients for a single provider. In large hospital and trauma centers "horizontal" resuscitation is taught. In the horizontal model the components of resuscitation are performed in a simultaneous fashion by multiple providers, however there is a command-physician who is not directly involved in a particular task but is able to see the big picture. The command-physician is responsible for observing the simultaneous activities of other providers, synthesizing all data obtained, and formulating a treatment plan (Hoff, Reilly, Rotondo, DiGiacomo, & Schwab, 1997). The ability to serve as the command-physician is not based on seniority but rather on understanding of the roles of team members by both the leader and members of the team. Utilizing a command-physician has been found to improve team performance in both cardiac and trauma resuscitations.

Simulation

Simulation is defined as something that is made to look, feel, or behave like something else, especially so it can be studied or used to train people (Merriam-Webster, n.d.) Simulation is a technique used in health care education to replace or amplify real patient experiences with contrived scenarios designed to replicate real clinical encounters (McLaughlin et al., 2008).

Simulation-based training for healthcare providers is well established as a viable, efficacious training tool, particularly for the training of non-technical team-working skills. These skills are known to be critical to effective teamwork and important in the prevention of error and adverse events in hospitals (Walker et al, 2013).

Ziv, Wolpe, Small, & Glick (2003) state that medical training must at some point use live patients to enhance the skills of health professionals. But there is an obligation to provide optimal treatment and ensure patients' safety and well-being. Simulation-based learning can help by developing health care professionals' knowledge, skills, and attitude while protecting patients from unnecessary risk. Perkins (2007) also states that simulation allows teaching of theoretical knowledge and empirical algorithms, and improves the hands-on skills of rescuers without harming patients. Ziv et al. (2006) state that the prior learning model where one "sees one, does one and teaches one" is no longer regarded as ethical or effective.

There are many advantages of simulation and reasons to use this teaching method. Simulation provides a safe, supportive educational environment (Gordon, Wilkerson, Shaffer, & Armstrong, 2001). Simulation allows training to be targeted to the need of the learner, and not the patient. The method allows multiple practice attempts in order to achieve competence. Learners are given "permission to fail" and to learn from these experiences. Simulations can also provide objective feedback on performance allowing learners to evaluate their performance in detail (Kneebone, 2005). Among one of the most important advantages of simulation learning is it provides an opportunity for controlled clinical practice without putting patients or others at risk (Perkins, 2007).

Simulation can facilitate on-demand learning and scenarios can be created as required (Gordon, Oriol,& Cooper, 2004). Training through simulation may facilitate the transfer of skills to the real world setting of the clinical environment (Bradley, 2006).

There are many ways to categorize simulation. Simulation may be categorized based on the type of device used or on fidelity. The term simulation fidelity has traditionally been defined as the degree to which simulation reflects reality (Beaubien & Barker, 2004). Using this

definition, simulation is often labeled as either low or high fidelity depending on how closely it represents the real system. For example, a computer-based simulator would be considered low fidelity, while full-scale simulations that realistically simulate a clinical scenario with visual, auditory, and motion cues would be considered high fidelity. Beaubien and Barker (2004) state that using the simple definition of low fidelity or high fidelity suggest that simulation fidelity is a one-dimensional concept.

One of the first and frequently cited studies to describe simulation was performed by Rehmann, Mitmann, and Reynolds (1995). The authors described simulation fidelity in three dimensions. The first dimension, equipment fidelity, is the degree to which the simulator duplicates the appearance and feel of the real system. The second dimension, environment fidelity, is the extent to which the simulator duplicates motion cues, visual cues, and other sensory information from the task environment. The third dimension, psychological fidelity, is the degree to which the trainee perceives the simulation to be a believable substitute for the trained task. It could also be defined as the match between the trainee's performance in the simulation and the real world.

Rehmann, Mitmann, and Reynolds (1995) believed that the three fidelity dimensions are related, however psychological fidelity is generally considered to be the most crucial requirement for team training. Beaubien and Barker (2004) stated that without temporarily suspending disbelief, trainees are unlikely to behave in a simulation as they would in the real world. As a result, the training will have little application to the post-training environment.

Beaubien and Barker (2004) noted that the various dimensions of simulation fidelity require trainers to make conscious design choice as the results of which choice made can substantially reinforce or counteract the goals of training. It is essential that the simulation's

overall fidelity dimension-equipment, environment, and psychological fidelity-be carefully chosen to reinforce the goal of the simulation.

As stated earlier, there are various types and ways to categorize simulation. Beaubien and Barker (2004) categorized simulation technology into three categories: case studies and role plays, part task trainers and full mission simulations. Case studies and role play use fictional examples of team performance to reinforce the trained material. A case study typically includes background information about the event, a synopsis of the team's behavior during the event, description of the event's outcome, and a reason for why the team's performance was particularly effective or ineffective. During a case study the trainees will review factual concepts learned, and then discuss how the concepts they learned apply to the fictional example. A case study is well suited to reinforce factual knowledge and developing positive attitudes towards the importance of teamwork. Role plays are slightly different than case studies. Instead of simply describing what they might have done differently, the trainees re-enact the event without the use of props. Role plays are well suited to developing positive attitudes towards the importance of teamwork, reinforce factual knowledge about teamwork concepts, and help develop teamwork skills. Case studies and role plays can be defined as low in equipment fidelity.

The second category is part task trainers. Part task trainers may take many forms. Perkins (2007) gives examples of resuscitation skills that can be taught with part task trainers including:

- Laryngeal mask airway insertion
- Tracheal intubation
- Needle cricothyroidotomy
- Peripheral and central venous cannulation
- Chest drain insertion

- Arterial blood gas sampling
- Rhythm recognition
- Defibrillation
- Cardiac pacing

Part task trainers are most commonly used to develop basic psychomotor skills such as intravenous cannulation or tracheal intubation, to virtual reality devices which use computer technology to provide visual, auditory, and touch feedback that closely resemble the clinical experience (Perkins, 2007). Part task trainers can be described as medium in equipment fidelity, low to medium in environmental fidelity, and medium in psychological fidelity. Strengths of part task trainers include low cost and the ability to develop competence in a distraction free environment. One limitation of part task trainers is that they do not allow for dual task practice, which inhibits the development of time or resource sharing skills (Beaubien & Barker, 2004).

The third category that Beaubien and Barker (2004) describe is full mission simulation. Full mission simulations are designed to simulate a complex task with all the environmental complexities that go along with it. When used for training teamwork related skills, full mission simulations usually begin with a pre-briefing. During the briefing, the team discusses their mission, delineates roles and responsibilities, identifies likely problems, and establishes backup plans for resolving the problems. The team then performs the simulated mission. The mission may be practiced several times. Once the simulation is complete, the team members participate in a post-training debrief to identify the lesson they learned. Full mission can be described as high in equipment fidelity, medium to high in environmental fidelity, and high in psychological fidelity. The strengths of full mission simulation include allowing trainees the opportunity to practice skills under realistic conditions in a safe environment. It also allows trainees to prepare

for rare, but otherwise difficult to train for critical emergency situations. The primary weakness of full mission simulations is cost. The personnel costs associated with developing, implementing, and maintaining full mission simulations makes them impractical for some organizations.

As stated earlier, simulation can be delivered in many ways, from low-fidelity part-task simulation to integrated fully immersive environments with higher fidelity being a key advantage (Kneebone, 2005). However, simulation suites are costly to develop, and releasing clinical staff to attend training is difficult (Weinstock et al., 2005). In situ simulation takes place in a clinical setting. These simulations occur in the clinical environment and the participants are on-duty clinical providers during their workday (Walker et al, 2013). In situ simulation has the benefit of providing training with all the contextual cues, practical difficulties, interruptions and distractions of the real clinical environment (Kneebone et al., 2010). The familiarity of the clinical environment heightens the realism of the simulation and reduces the feeling that participants are 'performing', enabling them to behave as they would normally (Beaubien & Barker, 2004). Walker et al. (2013) state that in situ simulation is a useful training tool that conveys a greater sense of realism and team interaction at a fraction of the cost of laboratory-based simulation. In situ simulation can play an important role in reinforcing skills and providing a bridge to the clinical environment. In situ simulation is particularly valuable for the training and assessment of non-technical skills critical for successful teamwork, and is something that could be implemented in every hospital even when finances are stretched and space for simulation suites is not available. Overall, in situ simulation has the potential to significantly improve the safety of patients in hospitals. Beaubien and Baker (2004) state that the choice of

simulation depends on a number of factors, such as the training needs, the available resources, and the number of people to be trained.

Studies have demonstrated that simulation affects patient outcomes. Seethala, Esposito & Abella (2010) reviewed various methods to improve the delivery of resuscitation and found that by adopting techniques such as simulation the quality of resuscitation performance can be increased. They also noted that simulation provides the benefit of enhancing teamwork and increasing familiarity with resuscitation equipment thereby avoiding more frequent errors.

Wayne et al. (2008) performed a retrospective case-control study of cardiac arrest team response at a university-affiliated internal medicine residency program. In this study all residents received traditional ACLS education. Second-year residents also attended an education program featuring ACLS scenarios using a human patient simulator. Third-year residents were not trained using the simulator. The results of this study demonstrated that simulator-trained residents showed a significantly higher adherence to AHA standards. The study also demonstrated that a simulation-based educational program significantly improved the quality of care provided by residents during actual ACLS events.

Andreatta, Saxton, Thompson, and Annich (2011) attempted to evaluate the viability and effectiveness of a simulation-based pediatric mock code program on patient outcomes, as well as residents' confidence in performing resuscitations. In this study clinicians responsible for pediatric resuscitations responded to randomly called mock codes at increasing rates over a 48 month period. This study demonstrated that survival rates increased to approximately 50% correlating with the increased number of mock codes. The results suggest that a simulation based mock code program may significantly benefit pediatric patient cardiopulmonary arrest outcomes.

Debriefing

The word debrief means to officially question someone about a job that has been done or about an experience (Merriam-Webster, n.d.) Debriefing is a broad topic, and definitions may vary depending on the field of reference such as medical education opposed to aviation (Joshi, 2012). Fanning and Gaba (2007) define debriefing as a facilitated or guided reflection in the cycle of experimental learning. Raemer et al. (2011) define debriefing as a process that involves active participation of learners, who are guided by a facilitator or instructor whose primary goal is to help learners identify and close gaps in knowledge and skills.

Debriefing and feedback remain fundamental elements of simulation-based learning (Fanning & Gaba, 2007; Dieckmann, Molin, Lippert, & Ostegaard, 2009). Regardless of simulator usage, the post scenario debriefing is important to maximize learning and facilitating change on an individual and systematic level (Dieckmann et al., 2009).

There is no universally accepted gold standard approach to debriefing in simulation-based medical education (Gardner, 2013). Lederman (1992) identified key structural elements of debriefing. These include:

- Debriefer
- Participants to be debriefed
- An experience (simulated case)
- The impact of the experience (simulated case)
- Recollection
- Report
- Time

Rudolph, Simon, Raemer, & Eppich, (2008) reviewed a three-step model of debriefing with a reactions phase, an understanding phase, and a summary phase. The reactions phase occurs immediately after the simulation. During the reactions phase participants may clear the air, review the facts, and the stage is set for addressing learning objectives. In the second phase, the understanding phase, participates explore what happened. In this phase the debriefer may serve as a 'cognitive detective' who uses observations of a participant's or team's performance and outcomes, and works backwards to identify what frames drove their actions. The debriefer is to apply good judgments to teach and help participants gain new understanding or skills. The debriefer also generalizes lessons learned to real situations. In the summary phase of debriefing the lessons learned are reviewed and there is discussion of how these lessons will be applied in future events.

Debriefing is important not only following simulations but also following critical health events such as cardiopulmonary resuscitation. Goals of debriefing include future clinical performance improvement, education, improved team morale, and emotional processing. Despite recommendations, debriefings rarely occur after resuscitations (Hayes, Rhee, Detsky, Leblanc, & Wax, 2008; Pittman, Turner, & Gabbott, 2001).

Pittman, Turner, and Gabbott (2001) surveyed Resuscitation Training Officers (RTO) in 237 hospitals across the United Kingdom. They found that only 10 out of 130 (7.7%) respondents believed that a debriefing session was offered to the cardiac arrest team after a cardiopulmonary arrest. They found that the use of a debriefing session encourages better care because it enables reflection on clinical performance. Debriefing improves morale among both the medical and nursing staff by allowing time for the emotional needs of staff to be expressed.

Theoretical Framework

The theoretical framework chosen for this project was the Plan-Do-Study-Act Cycle (PDSA). The PDSA framework has phases that give an opportunity for the researcher to determine the need for a quality change. The first phase includes the development of the quality improvement question, review of information indicating whether it is necessary to create the change, if change is needed, and which change option will effect the best result. The second phase includes the development of a plan for the quality improvement project. In this phase the researcher implements the quality improvement project, reviews the results of the project, and determines if the changes is needed. This framework has a well-defined format that requires the researcher to reflect and think about the motivation behind the perceived need for the quality improvement project. This framework also allows for data gathering from a small study that can then be utilized for potential impact on a larger scale (Terry, 2015).

Plan: As stated earlier the purpose of the project was to enhance the teamwork, knowledge, and technical skills of all individuals involved in cardiopulmonary resuscitations. In this phase a survey was developed to assess confidence level and needs for participants involved in cardiopulmonary resuscitations (Appendix I & J). Based upon survey feedback, the following objectives were developed: (1) enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members, (2) clearly delineate roles of team members during resuscitations, and (3) develop a continuing education plan that will ensure the maintenance of quality cardiac resuscitations.

Several scenarios were developed that were utilized during mock simulations/resuscitations (Appendix C). The frequency and timing of the mock resuscitations/simulations was determined based upon team member responses, team member

availability, and the literature review. Six mock resuscitations/simulations were planned. The nursing educator at the project site developed a debriefing tool (Appendix E). This tool was developed by reviewing other institutions debriefing tools and conforming the tool to the project sites specific needs. A poster was developed by the nurse educator and this author that demonstrated correct positioning of team members around the patient's bed during a resuscitation (Appendix F). A poster was also developed that displayed each team member's role and holds cards that explain each individual's role (Appendix G). At the beginning of each resuscitation, an individual took a card from the poster and assumed that role. This writer predicted that there would be improved teamwork, knowledge, and technical skills of all individuals involved in cardiopulmonary resuscitations.

Do: In this phase the project plan was implemented. A mock resuscitation cart was assembled to resemble the current resuscitation cart. Six mock resuscitation/simulations were facilitated utilizing the four scenarios that were developed. Following each mock resuscitation/simulation, a debriefing occurred utilizing the debriefing tool. After the six mock resuscitation/simulations the post-mock resuscitation survey (Appendix H) was administered to participants.

Study: In this phase data analysis was completed and compared to the stated predictions. The data was summarized and a reflection of what was learned occurred. During this step the nurse educator, emergency department coordinator, and this writer reviewed the debriefings from the mock resuscitations/simulations.

Act: This phase involved determining what modifications should be made to the project (Institute for Healthcare Improvement, n.d.). This step also consisted of developing a continuing education plan that will ensure the maintenance of high quality cardiac resuscitations. Staff were

given the opportunity to provide further feedback, and request change including additional training.

CHAPTER 3. PROJECT DESIGN

Project Implementation

A survey to assess the needs of the cardiac resuscitation team members was distributed to all providers at the project site as well as all staff registered nurses, pharmacists, respiratory therapists, nurse anesthetists, and hospital unit coordinators.

Based on the survey results, providers, nurses, and other ancillary staff have expressed the need to enhance teamwork during resuscitations. They specifically requested participation in mock resuscitations/simulations. Nurses requested that providers enhance communication and leadership skills. Nurses also requested further training with administration and titration of medications. The providers requested an increase in the amount of mock resuscitations/simulations as well. One provider acknowledged difficulty with knowing each individuals role and delegating tasks. In addition, another provider requested more resources available at that bedside.

The key stakeholders involved in this project include patients, providers, registered nurses, respiratory therapists, pharmacists, and hospital unit coordinators, and administrators.

In order to identify needs associated with the project a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was completed. The SWOT analysis helped analyze the internal attributes and external attributes as well as threats to the project.

The positive internal attributes included:

- Team members' recognition and desire to improve teamwork.
- Requests from team members to participate in mock resuscitations/simulations.
- Increased teamwork among team members at the project site was expected to benefit patient.

The potential negative internal attributes included

- Time and productivity lost from the actual work environment for participation in mock resuscitations/simulations.
- Expensive to develop a mock resuscitation cart.
- Mock resuscitations/simulations were planned to take place in situ (in the emergency department). This may be considered disruptive to patients and patient care.

The potential positive external attributes included:

- Many organizations including Regions Hospital in St. Paul, MN have mobile mock resuscitations suites available for use.
- Carol Fahje, nursing education specialist, at St. Mary's emergency department in Rochester, MN was willing to help with mock resuscitations/simulations.

The potential negative external attributes included:

- The project site may change how emergency departments are staffed in the future. The emergency department at the project site may be staffed differently in the future and none of the current providers will be present for cardiac resuscitation after hours.

As previously stated in Chapter 2, this project involved several steps. The first step, Plan, involved developing the following objectives based upon the needs assessment findings: (1) enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members, (2) clearly delineate roles of team members during resuscitations, and (3) develop a continuing education plan that will ensure the maintenance of high quality cardiac resuscitations.

In the second step of the project, Do, a mock resuscitation cart was assembled to resemble the current resuscitation cart. Evidence based resources were developed and placed on both the actual resuscitation cart and mock resuscitation cart (Appendix D). These resources included the current ACLS algorithms, PALS algorithms, and starting doses of medications that are used during resuscitations. Resources also included a quick reference guide for drugs used in rapid sequence intubation, and how to choose the appropriate endotracheal tubes and chest tube.

Six mock resuscitation/simulations were facilitated over a six-month timeframe. Following each mock resuscitation/simulation, a debriefing occurred utilizing the debriefing tool.

The third step, Study, consisted of reviewing the results of the post resuscitation survey (Appendix H) and determining if modifications needed to occur. Results of the data analysis are further discussed in Chapters four and five.

The final step, Act, consisted of developing a continuing education plan that will ensure the maintenance of quality cardiac resuscitations. The continuing education plan will be discussed in Chapters four, five, and six.

Institutional Review Board Approval

Prior to implementation of this project, approval was obtained through the Institutional Review Board (IRB) of North Dakota State University (#PH14182) (Appendix A). Completion of the survey presented little or no risk for the participants. The perceived benefits for the participants were educational in nature, along with the potential to improve job satisfaction. An informational letter (Appendix B) was provided with the surveys explaining the project and that completion of the survey implied consent. Individual names were not submitted with the survey; therefore, participants remained anonymous.

Data Collection

Data collection was obtained by using a debriefing tool following each mock resuscitation/simulation. As stated previously, the nursing educator at the project site developed the debriefing tool (Appendix E). This tool was developed by reviewing other institutions debriefing tools and conforming the tool to the specific needs of the project site. The debriefing tool was reviewed by the nursing educator and this writer after each mock resuscitation/simulation. The purpose in utilizing the debriefing tool was to review facts and explore what happened during the simulation. The debriefing tool was also used as a guide for the facilitator to help participants gain understanding of the event and review how lessons learned will be applied in future events.

Additional data collection was obtained utilizing a post mock resuscitation survey (Appendix H) that was developed by this writer. The survey was placed at the site nurses' station. Participants of resuscitations/simulations were given the opportunity to complete the survey at the completion of the project. The surveys were placed in an envelope at the nurses' desk and returned to the nursing educator at the project site. The purpose of the post mock resuscitation survey was to aid in developing a continuing education plan that will ensure the maintenance of high quality cardiac resuscitations. The post mock resuscitation survey was also utilized to assess if participants had any further requests for learning and to determine what they felt most helpful. Twelve surveys were completed by participants and reviewed by the nursing educator and this writer. Further discussion of survey results is included in Chapters four, five, and six.

CHAPTER 4. EVALUATION METHODS USING THE PLAN-DO-STUDY-ACT CYCLE

Instruments

A needs assessment survey was administered to providers (Appendix I) to give direction for the project and inform the educational offerings of the project. In addition a post-intervention evaluation was completed anonymously by utilizing a post assessment survey (Appendix H). An additional instrument, the debriefing tool (Appendix E) was also utilized. As stated previously, the debriefing tool was used to review facts and explore what happened during the simulation. The debriefing tool was also used as a guide for the facilitator to help participants gain understanding of the event and review how lessons learned will be applied in future events.

Plan

The plan for the project was developed as a result of the needs assessment survey (Appendix I). Based upon results of the needs assessment survey administered, providers, nurses, and other ancillary staff expressed the need to enhance teamwork during resuscitations. They specifically requested participation in mock resuscitations/simulations. Because of the request for participation in mock resuscitations/simulations, six mock scenarios were developed and were anticipated to occur over a six-month time frame.

Nurses also requested further training in administration and titration of medications. In order to aid the nursing staff in developing skills in administration and titration of medications the assembly of a mock resuscitation cart was planned. The mock resuscitation cart was to be utilized during mock resuscitations/simulations.

The needs assessment survey also revealed that provider's acknowledged difficulty with knowing each individual's role and delegating tasks. Due to the difficulty expressed with

knowing each individual's role the nurse educator and this writer planned to develop a poster to clearly delineate each person's role.

Providers also noted on the needs assessment survey that more resources need to be available at the bedside. The providers requested that ACLS algorithms be placed at the bedside. In addition they requested information regarding rapid sequence intubation including medication doses, as well as pediatric tube sizes. One provider requested the Glasgow Coma Scale be placed in a binder at the bedside. As a result of these requests this writer planned to develop a binder of resources to be placed at the bedside.

Do

The "do" phase of the project consisted of assembling a mock resuscitation cart to resemble the current resuscitation cart. To meet objective (2) clearly delineate roles of team members during resuscitations, two posters were developed by this writer and the nursing educator to assist in delineating roles (Appendix F and G). In order to create the posters, the nursing educator and this writer reviewed similar posters at Saint Mary's emergency department in Rochester, MN. The posters that were created were hung in the emergency department at the project site and utilized during mock resuscitation/simulations as well as during actual resuscitations. The poster in Appendix G clearly illustrates the roles and positions for all involved in resuscitations. The bottom right box on the poster holds laminated cards that participants take and hold during the resuscitation. The cards are exactly the same as those listed on the poster and are meant as a reminder to each team member of what their role and obligations are.

Objective (1) “enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members” was met as evidence-based resources were developed and placed on the actual resuscitation cart and mock resuscitation cart (Appendix D).

Following the assembly of the mock resuscitation cart, the development of the evidenced based resources and posters, six mock resuscitations/simulations were then completed over a six-month time period.

Study

Following each mock resuscitation/simulation a debriefing occurred utilizing the debriefing tool (Appendix E). During the debriefing participants were given opportunities to make suggestions regarding the scenario they participated in and expectations for future scenarios. The entire scenario was reviewed and a reflection of what was learned occurred.

In addition to debriefing a post resuscitation survey (Appendix H) was administered to all participants after six mock resuscitations/simulations occurred. The post resuscitation survey was studied to determine how frequent mock resuscitations/simulations should occur, what participants found most helpful, and also what participants felt could improve mock resuscitations/simulations.

Act

After reviewing the debriefings and the post resuscitation survey several changes and ideas were suggested. Objective (3), to develop a continuing education plan that will ensure the maintenance of quality cardiac resuscitations was met. The post resuscitation survey results revealed that participants requested participation in mock resuscitation scenarios from once per month to twice per quarter. The continuing education plan is to continue with mock resuscitations/simulations once per month.

In addition, participants requested future scenarios involve more respiratory cares. Staff nurses requested reviewing second and third-line medications instead of only first-line medications utilize during resuscitation. As a result, further mock scenarios will be developed to accommodate these requests.

CHAPTER 5. RESULTS

Presentation of Findings

Post mock resuscitation surveys were administered to fifty participants. Eleven participants completed the survey resulting in a response rate of 22 %. The nursing educator and this author reviewed the surveys. Overall, feedback gleaned from the surveys was felt to be positive. All of the respondents felt that participating in mock resuscitations/simulations enhanced teamwork, knowledge, and technical skills. Respondents acknowledged participation in at least one simulation and up to three over a six-month time frame.

Objective One

To address objective one: Enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members; a post-mock resuscitation survey (Appendix H) was administered to all participants. Question number one on the post-mock resuscitation survey was, "Do you feel that you have enhanced teamwork, knowledge, and technical skills after participating in mock resuscitations/simulations?" Eleven out of eleven respondents answered "yes" to question number one indicating objective one was met.

Objective Two

To address objective two: Clearly delineate roles of team members during resuscitations; a post-mock resuscitation survey (Appendix H) was administered to all participants. In addition this writer and the nurse educator observed all mock resuscitations/simulations. There were no specific questions on the post-mock resuscitation survey that specifically questioned if roles were clearly delineated. However, question number four "What did you find most helpful from participating in mock resuscitations/simulations" aids in determining if objective number two was met. Responses included: "It was helpful to talk out loud and communicate with all

participants. Another participant stated, “Mock simulations are good practice and help with team building.” One participant noted, “It’s helpful as a charge and emergency department nurse to get more practice in general without the pressure of a real patient.” In addition both the nursing educator and this writer noted through direct observation that resuscitation team member were removing a card off of the poster and utilizing the card to fulfill their role.

Objective Three

To address objective three: Develop a continuing education plan that will ensure the maintenance of quality cardiac resuscitations; the post mock resuscitation surveys were reviewed. Question number two on the post mock resuscitation survey specifically asked participants how often they felt mock resuscitations/simulations should occur. Results varied from once per month to twice per quarter. Two individuals wrote comments that mock resuscitation/simulations need to occur “more.” One individual wrote a comment requesting resuscitation/simulations every other month. Two individuals answered once per quarter, three answered twice per quarter, and three answered once per month. Objective three was also met.

Although this writer feels that all objectives were met there were some perceived barriers. One barrier noted was provider participation. Specifically, one provider refused to participate in any of the mock resuscitations/simulations. The provider stated he was “too busy.” Additionally another provider complained to this writer and nursing staff that mock resuscitations/simulations took too much time out of their day and they felt it would be better if nursing just participated in the mock resuscitations/simulations with no provider involvement. Nursing staff made comments to the nurse educator and this writer stating that they felt disappointed and as though the providers were not as engaged in improving and learning skills involved in resuscitations/simulations as the nursing staff were.

CHAPTER 6. DISCUSSION AND RECOMMENDATIONS

Interpretation of Results

As stated earlier in Chapter Two overall survival from cardiac arrest is astoundingly low and has not changed significantly in decades (Gaieski, Abella, & Goyal, 2012). Individual characteristics of resuscitation team members such as technical skills, previous experience, communication, and leadership skills influence the course of action during a resuscitation (Bhanji et al, 2010; Anderson, Jensen, Lippert, & Ostergaard, 2010; Cooper, 2010).

This project attempted to (1) enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members, (2) clearly delineate roles of team members during resuscitations, and (3) develop a continuing education plan that will ensure the maintenance of high quality cardiac resuscitations. This writer feels that all objectives of the project were met. Each objective will be specifically reviewed below as well as discussion of additional data obtained.

Objective One

Objective one was to enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members. This objective clearly was achieved as eleven out of eleven respondents answered, “yes” to question number one. Evidence based resources were developed and placed on both the actual resuscitation cart and mock resuscitation cart (Appendix D). These resources included the current ACLS algorithms, PALS algorithms, and starting doses of medications that are used during resuscitations. Resources also included a quick reference guide for drugs used in rapid sequence intubation, and how to choose the appropriate endotracheal tubes and chest tube. Direct observation revealed that some providers still did not utilize the binders placed on the resuscitation carts. One provider specifically stated that they

preferred to use applications on their phone versus the binder. It was also noticed that the staff registered nurses frequently utilized the binders.

Objective Two

Objective two was to clearly delineate roles of team members during resuscitations. This writer feels the objective was achieved. Individuals were asked, "What did you find most helpful from participating in mock resuscitations/simulations." Responses included: "It was helpful to talk out loud and communicate with all participants. Another participant stated, "Mock simulations are good practice and help with teambuilding." One participant noted, "It's helpful as a charge and emergency department nurse to get more practice in general without the pressure of a real patient." One respondent commented that the resuscitations/simulations helped clearly identify their role and aided them in locating items needed in a resuscitation.

In addition, both the nursing educator and this writer noted through direct observation that resuscitation team members removed a card off of the poster as directed and utilized the card to fulfill their role. Initially, providers appeared confused as to which team member was fulfilling which role, however with increased participation in mock resuscitations/simulations less confusion was noted. Team members appeared to demonstrate more confidence in the given role through increased participation in the number of mock resuscitations/simulations. During several mock resuscitation/simulations team members were observed exchanging cards with one another as they preferred fulfilling one role versus another role. This writer believes that this objective was met based on the above survey responses and through direct observation.

Debriefings were utilized after each mock resuscitation/simulation. Several participants stated that they understood and felt more confident in their role during the mock resuscitation/simulation. Comments during three debriefings noted that the team leader assigned

specific tasks to individuals. Participants felt this was valuable and that they could fulfill their assigned role. In two different debriefings, participants reported that additional clarity would have occurred during the mock resuscitation if they had called back orders to indicate that the order was understood or being fulfilled.

Objective Three

Objective three was to develop a continuing education plan that will ensure the maintenance of quality cardiac resuscitations was met. This objective was met. Question number two on the post most resuscitation survey specifically asked participants how often they felt mock resuscitations/simulations should occur. Results varied from once per month to twice per quarter. Two individuals wrote comments stating that mock resuscitation/simulations need to occur "more." One individual wrote a comment requesting resuscitation/simulations every other month. Two individuals answered once per quarter, three answered twice per quarter, and three answered once per month. As stated previously the nursing educator and this writer have developed a continuing education plan based upon feedback from the post resuscitation survey. The continuing education plan includes having mock resuscitations/simulations once per month at various times of the day to accommodate all staff.

In addition, survey respondents made several comments regarding what they perceived as most helpful after participating in mock resuscitations/simulations. Respondents felt that participating in mock resuscitations/simulation was good practice, and helped with team building skills. One respondent stated that allowing them to participate in mock resuscitations/simulations improved communication skills. Another respondent stated, "It's helpful as a charge and emergency department nurse to get more practice in the 'leader role.' It's also a great way to get more comfortable with resuscitations in general without the pressure of a real patient." Another

respondent found the debriefing as helpful to review what went well and what could be improved.

Participants were also surveyed and asked what they thought could improve mock resuscitations/simulations. One respondent requested to have resuscitations/simulations at different times of the day. Additional comments included: “Have a mock code on the medical/surgical floor. Involve just the nursing staff on the floor practicing because there are too many people and not all can get involved.” “Have a real person play sick as opposed to a manikin.” “Review charting in the electronic medical record for resuscitations and how to fill out the log sheet. It may be helpful to make a copy for new nurses just so they can get an idea on the layout. Once in a resuscitation, things are shouted and it would be good to know where to write it down.”

Another respondent requested having simulations that lead up to the actual resuscitation. “For example, having a patient in the emergency department with chest pain and having it progress to a resuscitation.” One respondent suggested, “Make scenarios as real as possible-meaning everyone attends including the provider and plays it out to the end.” The final respondent recommended focusing on different medications each time. “For example we have frequent reviews of first line drugs but maybe further dopamine or levophed infusions.” These suggestions have been logged and passed on to the nurse educator, who will continue to refine and implement mock code scenarios.

Limitations of Project

One limitation of the project was that only 11 out of 50 post resuscitation surveys were received. The information obtained from the surveys was valuable but it would have been more valuable to have a higher return rate of surveys.

An additional limitation of the project was that it was conducted at convenient times to allow for provider involvement, but not necessarily for nursing involvement. One post resuscitation survey respondent requested that timing for mock resuscitation/simulations occur as different times of the day to allow more participation from nursing staff.

This writer feels that an additional limitation of the project may be the attitudes displayed by two of the providers. This was noted through direct observation of the mock resuscitation/simulations. One provider refused to participate in any mock resuscitation/simulations and another provider stated to nursing staff that he was 'too busy to participate." Two respondents made note of provider attitudes on the post resuscitation survey and requested more provider involvement in mock resuscitation/simulations.

This writer also notes that this project was conducted during a time when an enormous amount of change was occurring within the project site including loss of services. Much of the changes occurring were felt to be negative by both nursing staff and providers. The perceived negative attitudes may have affected participation in the project and survey results.

Recommendations

There were many positive comments noted on the post resuscitation surveys. Based on survey results this project should be continued. For purposes of this project, recommendations for further improvements should include allowing for mock resuscitations/simulations to occur at many different times of the day to allow for equal participation from all participants and not simply to accommodate the providers. Directives from hospital administration indicating support of this project may lead to more provider buy-in and an increased effort to attend and participate from the providers.

Another recommendation is to have an actor playing the role of a patient instead of using a manikin. This may allow for a more "real" scenario. Nursing staff noted on the post resuscitation survey that it would be helpful to have a patient talk to them. The project may also be enhanced by having the researcher use interviews rather than self administered surveys to increase response rates and data quality.

A final recommendation is to develop more mock scenarios including post resuscitation care. This would include teaching nursing and providers appropriate use of second and third line medications. Mock resuscitations/simulations should occur monthly.

Implications for Practice

The positive results from the post resuscitation survey have practice implications. Implications for staff nurses include the need for continued education regarding medication administration during resuscitations. Nurses felt more confident with medication administration after participating in mock resuscitations/simulations, however some nurses requested further training in second and third line medications used during resuscitations. Based on survey results it is necessary to continue to have mock resuscitations/simulations in order to continue learning, meet continued educational needs, and to promote teamwork.

Participants perceived an increase in teamwork following participation in mock resuscitations/simulations. As previously stated, teamwork is a critical aspect of CPR and is essential to optimal patient care and patient safety (Baker et al., 2006; Weinstock & Halamek, 2008). Thomas et al. (2006) noted good teamwork behaviors correlate with higher quality of care during resuscitation. The mock resuscitations/simulations should continue to foster and promote teamwork and should include provider involvement.

The dissemination component of a project is an important step to study results and improve practice. The results of this project will be presented at the site to hospital administration, the providers, and staff nurses. This writer will also attempt to publish the results as well as present findings at a poster presentation at a conference. The nurse educator who participated in this project was given permission to continue the project and utilize all resources developed. Providers at the site will also use resources developed at the site.

Implications for Future Research

Future research of mock resuscitations/simulations could potentially benefit all individuals involved in actual resuscitations. In this project only a small portion of surveys were returned. It would be helpful to have more participation from providers to see if there is continued benefit from their perspective in participating in mock resuscitations/simulations.

Future research should include utilizing more scenarios and also allow nursing to practice medication administration of second and third line drugs. It may also be helpful to utilize an actual simulation lab and/or actors versus manikins. Both the needs assessment survey and post resuscitation survey could be re-administered in six to twelve months to evaluate the need for continued education and the benefits of continuing mock resuscitations/simulations.

Future projects may benefit from an increased number of participants to create a more dynamic source of interpretation and utilization of the interventions. Repeating or creating a new project in a larger institution may also enhance the project and identify further methods of improving teamwork, quality, and patient outcomes.

Application to Other Nurse Practitioner Roles

Advanced practice nurses have held roles in emergency departments for at least the last 40 years. These roles have continue to evolve over time and are expanding from a primarily

education and resource focus to an advanced clinical function with the initiation of the nurse practitioner role (Cole et al., 2002). McGee and Kaplan (2007) state that nurse practitioners are successfully fulfilling a vital role in the delivery of non-urgent, urgent, and emergency care. Nurse practitioners are performing a multitude of functions including skin and wound procedures; head, eye, ear, nose, and throat procedures; neck back, and spine procedures; chest and abdomen procedures; gynecologic, genitourinary, and rectal procedures; as well as many other procedures not listed. Nurse practitioners are also now performing advanced level procedures such as chest tube insertion and performance and interpretation of bedside ultrasound (Semonin-Holleran, 2010). Semonin-Holleran also believes that nurse practitioners in the emergency department are a resource in the provision of emergency care to diverse populations. A high degree of patient satisfaction and the delivery of quality care are well documented. More facilities are beginning to consider the employment of nurse practitioners in emergency departments.

Nurse practitioners are taking quality improvement to a new level while retaining costs. Sonday, Grecsek & Del Casino (2010) describe a program at St. Luke's Hospital and Health Network in Allentown, PA that implemented a unique nurse practitioner led rapid response model. This model illustrated that nurse practitioners reduce critical events, lower transfer rates to the intensive care units, and support a broad range of services.

As stated above, nurse practitioners are vital in the role of urgent and emergency care. The American Nurses Credentialing Center now offers certification in the emergency nurse practitioner role. This project may help nurse practitioners improve not only their teamwork, knowledge, and skills involved in cardiopulmonary resuscitations but may also help equip them for leading resuscitations.

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APPENDIX A. NDSU IRB LETTER OF APPROVAL

NDSU NORTH DAKOTA STATE UNIVERSITY

February 11, 2014 FederalWide Assurance FWA00002439

Mykell Barnacle
Nursing
Sudro 118B

Re: IRB Certification of Exempt Human Subjects Research:
Protocol **#PH14182 , "Teamwork During Cardiopulmonary Rescuscitation at Mayo Clinic Health System in Lake City"**

Co-investigator(s) and research team: **Kayla Dascher**

Certification Date: 2/11/14 Expiration Date: 2/10/17
Study site(s): **Lake City**
Funding: **n/a**

The above referenced human subjects research project has been certified as exempt (category # 1) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*). This determination is based on original protocol materials (received 2/7/14) and revised consent (received 2/11/14).

Please also note the following:

- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- Conduct the study as described in the approved protocol. If you wish to make changes, obtain approval from the IRB prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.
- Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.
Sincerely,

Kristy Shirley

Kristy Shirley, CIP, Research Compliance Administrator

INSTITUTIONAL REVIEW BOARD
NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | ndsu.edu/irb
Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo, ND 58102

APPENDIX B. PROJECT LETTER CONSENT

NDSU North Dakota State University
Department of Nursing
Sudro Hall 136
Fargo, ND 58108-6050
701.231.5692

Title of Project: Teamwork During Cardiopulmonary Resuscitations At Mayo Clinic Health System In Lake City (MCHS-LC)

Dear Colleague,

My name is Kayla Dascher. I am currently a family nurse practitioner and post master's doctoral student at North Dakota State University. I am asking for your help with a project. The purpose of this project is to enhance the teamwork, knowledge, and technical skills of all involved in cardiopulmonary resuscitations at MCHS-LC. As part of this project, mock resuscitations will be carried out for health care personnel who conduct cardiopulmonary resuscitations at MCHS-LC.

You are invited to participate in this project, where you will be asked to complete a survey following the mock resuscitations to assess what was learned and to gather information for continued improvements in actual resuscitations.

All survey responses will be kept confidential. The survey is anonymous and contains no personal identifying items. Your participation is voluntary. If you do not wish to participate, your may decline or withdraw from participation at any time without penalty. The questionnaire should take less than 10 minutes to complete. Completion of the survey will constitute your consent to participate in the survey. [All procedures for the study have been approved by the Institutional Review Board at North Dakota State University.]

Thank you in advance for your participation in mock resuscitations/simulations and my survey. I believe that this information will be vital for identifying best practices and for continuing to enhance teamwork, knowledge, and skills for those involved in resuscitations.

You have three weeks to complete the survey. It must be completed by [to be determined]. Please follow the instructions on the survey and return in the enclosed return addressed stamped envelope.

If you have any questions or comments, please feel free to contact me at dascher.kayla@mayo.edu or call me at 651-345-1119. You may also contact my advisor, Dr. Mykell Barnacle by email at mykell.barnacle@ndsu.edu or by phone at 701.231.7730. You have rights as a research participant. If you have questions about the rights of human participants in research, or to report a problem, contact the North Dakota State University IRB Office by telephone at 701.231.8908 or toll-free at 1-855-800-6717, by e-mail at NDSU.IRB@ndsu.edu, or by mail at, 1735 NDSU Research Park Drive, NDSU Dept 4000, PO Box 6050, Fargo, ND 58108-6050.

APPENDIX C. MOCK RESUSUCITATION/SIMULATION SCENARIOS

Mock Code Scenarios

Scenario #1

You are working in the ED when a patient walks in the ambulance bay doors. The patient appears weak and states he is not feeling well. You take him over to one of the beds and start to ask further questions.

He states his name is Bill and he is 75 years old. He has not been feeling well for the last couple of days. He wonders if he is coming down with the flu. He says he has had diarrhea many times for the past 2 days. He sits on the edge of the bed and you begin to get him in a gown when he suddenly becomes unresponsive.

Initial reactions:

*Call a code

*Apply monitor

*Place IV

The monitor shows ventricular fibrillation.

*Begin ACLS algorithm for VF

*2 minute cycles of compressions/breaths/drugs with appropriate

pulse/rhythm checks

After third cycle the patient responds and the rhythm is sinus tachycardia.

*Follow return of spontaneous circulation algorithm.

Key Points:

1) Patient is shocked as quickly as possible
2) Epinephrine given followed by amiodarone
3) CPR is resumed immediately after the patient is shocked.

Scenario #2

Patient arrives to the ED by wheelchair. Mr. Jones states he is dizzy and not feeling well.

You place the patient on a monitor, place in gown, and obtain IV access.

Once patient is on monitor you note sinus bradycardia with a heart rate of 40, respiratory rate of 18, blood pressure 70/40, and SpO2 90% on room air.

*Follow the bradycardia algorithm:

*Atropine

*Pacing

*Epinephrine infusion

*Dopamine

The patient improves. You note a heart rate of 70, BP 90/50, SpO2 95% on 2L. Suddenly the patient clutches his chest and becomes unresponsive. You note PEA.

*Epinephrine

*CPR

*Consideration of advanced airway

*H's & T's

You have now attempted to resuscitate the patient for 30 minutes and despite quality CPR you have no return of spontaneous circulation.

*Consider terminating efforts

Scenario #3

Mr. Smiley arrives to the ED with his wife. She states that she is concerned about him because he has complained of shortness of breath for the past two hours. He also feels like his heart is racing.

You place the patient in the closest bed, get him in a gown, and apply the cardiac monitor. You immediately note ventricular tachycardia. The patient's blood pressure is 120/78.

*Place IV

*Apply defibrillation pads

*Page provider

As the provider arrives to assess Mr. Smiley he begins to complain of increasing shortness of breath and chest pain. His blood pressure is now 74/44.

*Cardiovert the patient immediately

After you cardiovert the patient you note the rhythm is now ventricular fibrillation.

*Shock the patient

*Begin CPR

*Epinephrine 1 mg

*Amiodarone 300mg

*Continue CPR

After 5 cycles of CPR the respiratory therapist states he is having difficult getting adequate chest rise and fall wit the bag valve mask.

*Place an advanced airway

After an additional 2 minutes of CPR a pulse check is performed and you note a bounding pulse. The cardiac monitor shows sinus tachycardia. The patient's blood pressure is 80/60.

*Dopamine infusion

*Transfer to higher level of care

Scenario #4

Mrs. Roberts presents to the ER complaining of a rapid heart rate. You place her on the cardiac monitor and note SVT.

*Obtain IV access.

*Adenosine 6mg IV

After adenosine 6mg IV you do not note any change in rhythm.

*Adenosine 12mg IV

*Adenosine 12mg IV

You recheck the patient's blood pressure and note that it is now 68/40 and she is diaphoretic and complaining of chest pain.

*Cardiovert (synchronized)

Immediately after you cardiovert her she becomes unresponsive and you now note ventricular fibrillation.

*Shock the patient

*Resume immediate chest compressions/CPR x 5 cycles

After 5 cycles of CPR you perform a rhythm and pulse check and now note sinus tachycardia. The patient's blood pressure is 80/46.

*Dopamine drip

*Fluid bolus

*Labs

APPENDIX D. PROVIDER RESOURCES

Rapid Sequence Intubation

1) Prepare Equipment

   ET SIZE MALE = 8-9
   ET SIZE FEMALE= 7-8
   ET SIZE PEDS= 4+ AGE/4

2) Pre-oxygenate: Nasal cannula @ 4L, 100% by mask, bag

3) **Premedicate:**

   a. PEDS: Atropine 0.02mg/kg (maximum 0.5mg)

   b. Lidocaine 1.5mg/kg (use if head injury or asthma)

4) Push **Sedative:**

   a. Etomidate 0.3mg/kg

   b. Ketamine 1-2mg/kg

   c. Midazolam (Versed) 0.1-0.3 mg/kg

5) **Paralyze:**

   a. Succinylcholine: 2mg/kg IV

   b. Rocuronium (Zemuron) 1mg/kg IV

6) Position airway

7) Pass the tube

8) Patent airway assessment: CO2 detector, lung sounds, Chest x-ray

9) Post intubation plan:

   a. **Paralysis:** Vecuronium 0.1mg/kg IV

   b. **Sedation:** Midazolam 0.05 – 0.3mg/kg

   c. **Analgesia:** Fentanyl 1-2 mcg/kg IV

   Morphine 2-4 mg (titrate to BP)

Rapid Sequence Intubation Medications

Sedation for Rapid Sequence Intubation

Agent/Class	**Dose**	**Onset**	**Duration**	**Key Notes**
Etomidate/imidazole derivative	0.3mg/kg given over 30 to 60 seconds	<1 minute	5 to 14 minutes	Best all-around profile, suppresses cortisol
Midazolam/benzodiazepine	0.1 to 0.3 mg/kg	2 to 3 minutes	30 to 60 minutes	Amnesia, reversible, may cause hypotension
Fentanyl/opiate	1 to 2 micrograms/kg IV	< 1 minute	30 to 60 minutes	Analgesia, reversible
Ketamine/dissociative	1 to 2 mg/kg	1 minute	10 to 30 minutes	Bronchodil-ation, amnesia, analgesia
Propofol	1 to 2 mg/kg	30 to 60 seconds	3 to 5 minutes	May cause hypotension

Paralytics for Rapid Sequence Intubation

Agent/Class	Dose	Intubation	Duration	Key Note
Succinylcholine/depolarizing	2mg/kg	45 to 60 seconds	6 to 12 minutes	Avoid in hyperkalemia, neuromuscular disease, or ocular trauma
Rocuronium/non-depolarizing	1 to 1.2mg/kg	45 to 75 seconds	25 to 60 minutes	Alternative to succinylcholine for initial paralytic agent
Vecuronium/non-depolarizing	0.1mg/kg	90 to 240 seconds	25 to 120 minutes	Most useful after intubation for longer-term paralysis

GLASGOW COMA SCALE- Adults, Pediatric, Infant

Eye Opening

Infant (<1 year)	Pediatric (>1 year)	Adult	
Spontaneous	Spontaneous	Spontaneous	4
Voice	Voice	Voice	3
Pain	Pain	Pain	2
None	None	None	1

Verbal Response

Infant (<1 year)	Pediatric (>1 year)	Adult	
Coos, babbles	Appropriate word/phrase	Oriented	5
Irritable but consolable	Disoriented/converses	Confused	4
Persistent cries/screams	Inappropriate word	Inappropriate	3
Moans/grunts to pain; restless	Incomprehensible sounds	Incomprehensible	2
None	None	Non	1

Motor Response

Infant (<1 year)	Pediatric (>1 year)	Adult	
Spontaneous	Obeys	Obeys	6
Localizes	Localizes Pain	Localizes Pain	5
Flexion-withdrawal	Flexion-withdrawal	Withdraws	4
Flexion/decorticate	Flexion/decorticate	Flexion/decorticate	3
Extension/decerebrate	Extension/decerebrate	Abnormal extension (decerebrate)	2
None	None	None	1

PEDIATRIC TUBE SIZES

ET TUBE SIZE= 4 + AGE/4

SUCTION CATHETER AND URINARY CATHETER= ET TUBE SIZE X 2

DEPTH OF ET TUBE= SIZE OF ET TUBE X 3

SIZE OF CHEST TUBE= SIZE OF ET TUBE X 4

APPENDIX E. DEBRIEFING TOOL

Post Code Blue Debriefing

This report documents the debriefing held at the conclusion of a resuscitative event. The purpose is to evaluate the effectiveness of actions, equipment, and supplies. It is not a disciplinary action. It is a performance improvement tool.

Code date & time: _____ **Patient ID #:** _____

Item	YES	NO	Comments
What went well during the code?			
Was there anything that did not go well?			

If something did not go well is there anything that we can do to ensure that it goes well the next time?			
Was staff present at the start of the code? Was it prior to admit? Was it a witnessed code.			
Did all the team members respond in a timely manner?			
Did you have all the equipment, supplies, drugs required?			
Did all of the equipment work?			
Who was the provider leader?			
Was there something the team thought the provider could do differently?			
Did he/she provide clear direction on what needed to be done?			
Who was the nurse leader?			
Did she/he lead effectively?			
Did the team function effectively?			
What ACLS/PALS/NRP protocol was followed?			
Was the rest of the department staffed during the code?			

Was the family present? Who was the liaison?			
Did the team communication with the family/patient? Who was responsible for communicating with the family?			
Was the Code sheet completed?			
Were there any observers, not participants? **Were too many people involved?**			
Did all staff wear appropriate Personal Protective equipment (PPE)?			
Was a HUC available to assist with orders?			
Please list the debriefing participants in the comments section to the right.			1. 2. 3. 4. 5. 6. 7. 8. 9.

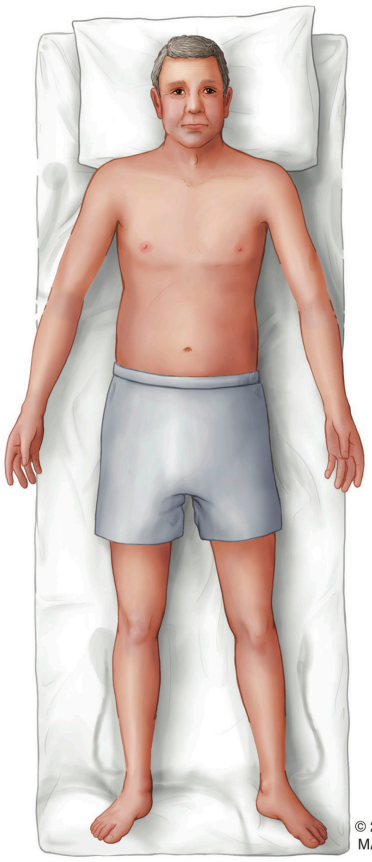
APPENDIX F. CODE BLUE POSITIONING POSTER

MAYO CLINIC
HEALTH SYSTEM

Code Blue Positioning

RT | CRNA

Nurse Assistant



Registered Nurse #1

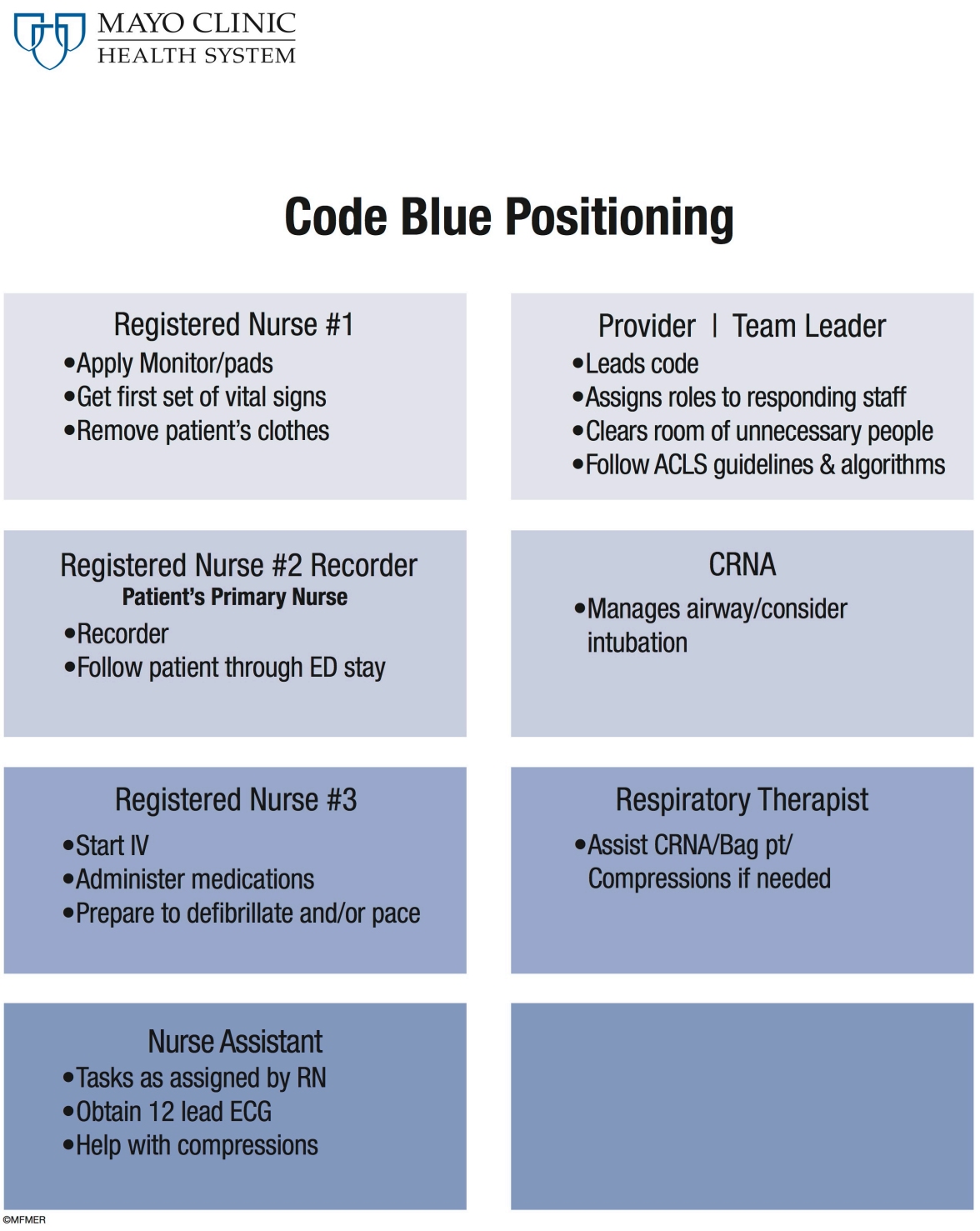
Registered Nurse #3

Provider | Team Leader

Pharmacist

Registered Nurse #2 Recorder
Patient's Primary Nurse

APPENDIX G. CODE BLUE ROLES AND POSITIONING POSTER



APPENDIX H. POST-MOCK RESUSCITATION SURVEY

Post-Mock Resuscitation/Simulation Participation Survey

1) Do you feel that you have enhanced teamwork, knowledge, and technical skills after participating in mock resuscitations/simulations? Yes or No

2) How often should mock resuscitations/simulations occur?

- Once per month
- Once per quarter
- Twice per quarter
- Once every 6 months

3) How many mock resuscitations/simulations have you participated in?

4) What did you find most helpful from participating in mock resuscitations/simulations?

5) What could improve mock resuscitations/simulations?

6) What additional resources would you like for actual resuscitations?

7) What additional resources would you like for mock resuscitations/simulations?

8) General Comments/Suggestions:

APPENDIX I. NEEDS ASSESSMENT SURVEY FOR PROVIDERS

Cardiopulmonary Resuscitation Assessment Needs Survey (providers)

Please rate your own personal confidence level in leading a cardiopulmonary resuscitation by circling a number. 1 = least confident, 5= most confident.

1 2 3 4 5

In which areas of cardiac resuscitation would you like to feel *more* confident? Circle all that apply.

- Teamwork
- Knowledge of medications
- Skills (IV placement, IO placement, intubation)
- Use of defibrillator and pacing function
- Delegation
- ACLS guidelines/algorithms
- CPR
- Selection and titration of medications
- Skills (IV placement, IO placement, intubation)
- All of the above
- Other (explain)_____

In which areas of cardiac resuscitation do you feel *most* confident? Circle all that apply.

- Teamwork
- Knowledge of medications
- Skills (IV placement, IO placement, intubation)
- Use of defibrillator and pacing function
- Delegation
- ACLS guidelines/algorithms
- CPR
- Selection and titration of medications
- Skills (IV placement, IO placement, intubation)
- All of the above
- Other (explain)_____

Which individuals do you feel are crucial to have in attendance at cardiopulmonary resuscitations? Circle all that apply.

- Charge nurse
- Nurse manager
- Hospital unit coordinator (HUC)
- X-ray technicians
- Lab technicians
- Respiratory therapy
- Recorder
- Nurse aide
- CRNA
- Pharmacist
- Hospital Incident Commander (HIC)
- RN's
- Other (explain)_____

What do you feel would help to improve the teamwork, skills, and knowledge of all involved in cardiopulmonary resuscitations?

- Skills labs
- Having bedside resources available
- Mock codes
- Other (explain)_____

What would you like to see from the nurses, respiratory therapists, CRNA's, and pharmacists to improve teamwork, skills, and knowledge?

If you could name one thing that would improve cardiopulmonary resuscitations what would that be?

Please write any general comments regarding cardiopulmonary resuscitations that you want to share.

APPENDIX J. NEEDS ASSESSMENT SURVEY FOR NON-PROVIDERS

Cardiopulmonary Resuscitation Assessment Needs Survey (non-providers)

Please rate your own personal confidence level in participating in cardiopulmonary resuscitation by circling a number. 1= least confident, 5= most confident.

1 2 3 4 5

What areas would you like to feel more confident in during cardiopulmonary resuscitations? Circle all that apply.

- Teamwork
- Knowledge of medications
- Skills (IV placement, IO placement, NG/OG placement, foley catheter)
- Use of defibrillator and pacing function
- Other (explain)_____

Other than the provider and ER nurse, which individuals do you feel are crucial to have in attendance at cardiopulmonary resuscitations? Circle all that apply.

- Charge nurse
- Nurse manager
- Hospital unit coordinator (HUC)
- X-ray
- Lab
- Respiratory therapy
- Recorder
- Nurse aide
- CRNA
- Pharmacist
- Hospital Incident Commander (HIC)
- Other (explain)_____

In which areas of cardiac resuscitation do you feel most confident?

- Administration of medications
- Titration of medications
- CPR
- Skills (IV placement, IO placement, NG/OG placement, foley catheter)
- Use of defibrillator and pacer
- Other (explain)_____

What do you feel would improve the teamwork, skills, and knowledge of all involved in cardiopulmonary resuscitations?

- Skills labs
- Having bedside resources available
- Mock codes
- Other (explain)_____

What would you like to see from the providers to improve teamwork, skills, and knowledge?

If you could name one thing that would improve cardiopulmonary resuscitations, what would that be?

Please write any general comments regarding cardiopulmonary resuscitations that you want to share.

What is your current role? Circle all that apply.

- RN
- CRNA
- Respiratory Therapist
- Nurses Aide
- HUC
- Lab technician
- X-ray technician
- Charge nurse
- Pharmacist

How many years of experience do you have in your current role?

- 0-2 years
- 2-5 years
- 5-10 years
- >10 years

Do you have any advanced emergency department training? If yes please describe.

APPENDIX K. EXECUTIVE SUMMARY

Background

Cardiac arrest is a major public health problem affecting thousands of individuals each year in both out-of-hospital and in-hospital settings (Sutton, Nadkarni, & Abella, 2012). In 2012 nearly 383,000 out-of-hospital sudden cardiac arrests occurred and approximately 209,000 cardiac arrests occurred within a hospital (American Heart Association, 2012). Sandroni, Nolan, Cavallaro, & Antonelli (2007) state that between 370,000 and 750,000 in-hospital resuscitation attempts are made in the United States each year. Survival rates from cardiac arrest are improving, however overall rates of survival are still low (American Heart Association, 2012). Teamwork is a critical aspect of CPR and is essential to optimal patient care and patient safety (Baker et al., 2006; Weinstock & Halamek, 2008). Thomas et al. (2006) noted good teamwork behaviors correlate with higher quality of care during resuscitation.

Project Summary

The purpose of this project was to enhance the teamwork, knowledge, and technical skills of all individuals involved in cardiopulmonary resuscitations at the project site. Information gathered from post-mock resuscitation surveys was used to assess how often participants felt mock resuscitations/simulations should occur, as well as what was found to be most helpful for use during not only mock resuscitations/simulations but also actual resuscitations. The project identified areas of improvement during mock resuscitations/simulations, and whether additional resources were needed for both mock resuscitations/simulations and actual resuscitations.

Expectations of the project were to (1) enhance cardiopulmonary resuscitation knowledge by providing evidence-based resources to team members, (2) clearly delineate roles of team

members during resuscitations, and (3) develop a continuing education plan that will ensure the maintenance of high quality cardiac resuscitations.

Results

Eleven post mock resuscitation surveys were completed and reviewed by the nursing educator and myself. Overall, feedback reviewed from the surveys was felt to be positive. All of the respondents felt they had enhanced teamwork, knowledge, and technical skills after participating in mock resuscitations/simulations. Respondents acknowledged participation in at least one simulation and up to three over a six-month time frame.

Evidence based resources were developed and placed on both the actual resuscitation cart and mock resuscitation cart (Appendix D). These resources included the current ACLS algorithms, PALS algorithms, and starting doses of medications that are used during resuscitations. Resources also included a quick reference guide for drugs used in rapid sequence intubation, and how to choose the appropriate endotracheal tubes and chest tube.

To clearly delineate roles of team members during resuscitations, posters were developed and placed in the emergency department that clearly delineated each participant's role. A continuing education plan ensured the maintenance of high quality cardiac resuscitations was developed after reviewing results of post mock resuscitation survey. The continuing education plan included having mock resuscitations/simulations once per month at various times of the day to accommodate all staff.

Recommendations

The goal of this practice improvement project was to continue to utilize the resources produced, continue mock resuscitations/simulations, and improve teamwork. Participants perceived an increase in teamwork following participation in mock resuscitations/simulations.

The mock resuscitations/simulations should continue to foster and promote teamwork and should include provider involvement.

Future research of mock resuscitations/simulations could potentially benefit all individuals involved in actual resuscitations. It would be helpful to have more participation from providers to see if there is continued benefit from their perspective in participating in mock resuscitations/simulations. Future research should also include utilizing more scenarios and also allow nursing to practice medication administration of second and third line drugs. It may also be helpful to utilize an actual simulation lab and/or actors versus manikins.

Future projects may benefit from an increased number of participants to create a more dynamic source of interpretation and utilization of the interventions. Repeating or creating a new project in a larger institution may also enhance the project and identify further methods of improving teamwork, quality, and patient outcomes.