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Nurse Confidence Levels in Malignant Hyperthermia

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Nurse Confidence Levels in Malignant Hyperthermia Simulation

by

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Abstract

Malignant hyperthermia is a life threatening medical emergency. When individuals with a certain genetic predisposition are exposed to certain pharmaceutical triggering agents, a malignant hyperthermia crisis can occur. If the crisis is not recognized early and symptoms are not treated, the ending result will be patient death. The ability to recognize and intervene in a malignant hyperthermia crisis demonstrates knowledge and confidence by the nurse. Simulation training is an educational tool that nurses can use to increase confidence levels in recognizing and intervening in this type of medical emergency in a safe environment. The findings from this research indicate a significant increase in the confidence level of the nurses prior to and following the simulation training. The results support the use of simulation training in improving nurses' confidence levels, while preparing them for life threatening emergencies in a safe environment.

Keywords: malignant hyperthermia, simulation, nurses, confidence level

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CHAPTER I

Introduction

Malignant hyperthermia (MH) is a disease process that develops from a rare genetic condition. It involves an interaction between genetics and the exposure to certain pharmaceutical triggering agents or general anesthetics, such as succinylcholine or inhalation anesthetics (Denholm, 2015). Malignant hyperthermia crisis can occur in any healthcare facility that administers these triggering agents, such as the operating room (OR) and post anesthesia care unit (PACU).

Skeletal muscles have a ryanodine receptor (RYRI) that is responsible for calcium release (Cain, Reiss, Gettrust, & Novalija, 2014). Malignant hyperthermia crisis occurs as a result of a defect in this receptor combined with the exposure to these pharmaceutical triggering agents (Cain et al., 2014). This exposure causes an excessive intercellular calcium release, resulting in skeletal muscle contractions and rigidity, increased oxygen consumption, arrhythmias, respiratory and metabolic acidosis, hypercarbia, hyperkalemia, and a rapid body temperature elevation (Cain et al., 2014). If MH is not recognized early and continues to progress, it can lead to renal failure, skeletal muscle damage, arrhythmias, cardiac arrest, and possible death (Dirksen, Van Wicklin, Mashman, Neiderer, & Merritt, 2013). These symptoms can occur shortly after the induction of general anesthesia (Cain et al., 2014). The most critical time for a MH crisis to occur is during the induction of general anesthesia and one hour immediately following surgery (Cain et al., 2014). A MH crisis can also occur up to 12 hours postoperatively past the critical timeframe (Hommertzheim & Steinke, 2006).

Significance

Malignant hyperthermia is a life-threatening emergency and nurses must be prepared to recognize the symptoms and intervene to prevent impending death (Dirksen et al., 2013). The incidence rates for malignant hyperthermia range from 1:5,000 and 1:50,000 to 100,000 (Denholm, 2015). Since the pediatric population receives mostly inhalation anesthetics, they have an increased risk of malignant hyperthermia. Pediatric patients between the ages of 0-17 years old have a mortality rate of 2.9% of 310 cases identified malignant hyperthermia (Denholm, 2015). Males and individuals with a family history of malignant hyperthermia are also at an increased risk of developing this condition (Cain et al., 2014). The mortality rate of malignant hyperthermia patients is higher in the South at 15.8% versus 7.0% in the West (Rosero, Adesanya, Timaran, & Joshi, 2009).

The Malignant Hyperthermia Association of the United States (MHAUS) has a detailed plan of action that should take place in the event of a MH crisis. They have a hotline that staff can call any time of the day and they will provide information and guidance during a MH crisis. Any staff member involved in the care of a patient receiving anesthesia must be familiar with the MHAUS plan, along with the policies of their facility when dealing with a malignant hyperthermia crisis.

Dirkson et al. (2013) presented a case study that demonstrated the importance of conducting regular MH education sessions and MH mock drills. This case study is an example of the perioperative team being unprepared for a MH crisis (Dirkson et al., 2013). Specific areas of weakness noted included the length of time to prepare dantrolene, get the ice for cooling the patient, and failure to contact the MHAUS hotline

(Dirkson et al., 2013). When a MH crisis is suspected, dantrolene must be prepared and administered immediately (Dirkson et al., 2013). The nurses in this case study took 15 minutes to prepare the dantrolene (Dirkson et al., 2013). In order to prevent complications from MH or death, dantrolene should be given immediately (Cain et al., 2014). Due to hyperthermia, patients must be cooled with ice packs or other types of cooling measures (Dirkson et al., 2013). In this case study it took 10 minutes for staff to obtain ice packs (Dirkson et al., 2013). The nurses failed to contact the MH hotline because the telephone number was faded on the MH cart. The MH hotline offers guidance to staff during a MH crisis. This scenario demonstrates the importance of understanding the pathophysiology, recognizing malignant hyperthermia symptoms, and intervening appropriately (Dirkson et al., 2013). Malignant hyperthermia simulation training is an educational tool that can be used to determine areas of weakness, such as preparing the medication and assisting nurses in making improvements concerning patient care in a safe environment. Studies support the use of simulation training for not only improving clinical knowledge but also increasing staff confidence in critical care environments (Boling & Hardin-Pierce, 2015).

Malignant hyperthermia (MH) is a rare but potentially fatal genetic disorder. When this genetic disorder is combine with general anesthetics, such as inhalation anesthetics or succinylcholine, the patient may exhibit signs of muscle rigidity, arrhythmias, increased oxygen consumption, and hyperthermia (Rosero et al., 2009). These symptoms must be recognized early and treated immediately in order to prevent possible death. MH has also been referred to as the “hidden killer” because individuals with this genetic disorder are otherwise healthy (Rosero et al., 2009, 89).

Since MH crisis has a low occurrence but potentially devastating results, it is vitally important to recognize the signs and symptoms early and treat immediately (Cain et al., 2014). Nurses working in the preoperative area may be unprepared to recognize and intervene in a MH crisis, due to the low frequency (Cain et al., 2014). The case study presented by Dirkson et al. (2013) is one example of nurses not being prepared for an MH crisis. Nurses at another facility, working in the perioperative area, did not receive annual training or education about MH (Cain et al., 2014). The facility did not have a policy concerning the management of MH and the MH cart was outdated. The nurses developed a quality improvement project in the identification and management of MH because they felt they had limited knowledge in the treatment of MH (Cain et al., 2014).

Simulation training is an educational tool that can be used to train staff for medical emergencies in a safe environment. This type of training can be used to enhance patient safety (Schaad, 2017). The Institute of Medicine 2009 recommends using simulation training to improve patient safety (Askew, Trotter, Vacchiano, Garvey, & Overcash, 2012). Simulation training provides staff with an opportunity to identify areas of weakness in the knowledge and treatment of medical emergencies (Mullen & Byrd, 2013).

Simulation training research offers the following benefits of this type of training for staff by increasing communication skills, self-confidence, and critical thinking skills (Rice et al., 2016). Improvements in performance, clinical confidence, and teamwork have been noted in helping staff deal with medical emergencies or unexpected medical events through simulation (Mullen & Byrd, 2013). Simulation training provides nurses with the opportunity to enhance their knowledge, confidence, and skills (Askew et al.,

2012). Nurses and other healthcare team members reported an increase in confidence and knowledge following malignant hyperthermia crisis simulation training (Cain et al., 2014).

Purpose

The purpose of this thesis was to determine if nurses' confidence levels increase in recognizing and intervening in a malignant hyperthermia crisis after simulation training.

Simulation

"High fidelity simulation (HFS) is defined as a replicated clinical experience using a computer-driven, full bodied mannequin simulator with physiologic response to intervention" (Warren, Lucktkar-Flude, Godfrey, & Lukewich, 2016, p.99). Self-confidence among nursing students increases with HFS training (Bowling & Underwood, 2016). Research supports simulation training in improving the knowledge, confidence, skill performance, and critical thinking in undergraduate nursing programs, medical programs, and residency (Warren et al., 2016). In 2000, the Institute of Medicine recommended the use of HFS to improve patient safety (Warren et al., 2016). Malignant hyperthermia is a low occurrence but high risk medical event, simulation is as an educational tool to help prepare nurses for this type of emergency. Simulation training is also used in other settings, such as the airline industry, space exploration, nuclear power industry, and the armed forces (Hotchkiss & Mendoza, 2001). These different settings require staff to have an understanding of complex systems and be able to react quickly, using their psychomotor skills to prevent hazardous outcomes (Hotchkiss & Mendoza, 2001). Malignant hyperthermia requires nurses to recognize and intervene with

confidence to prevent possible patient death. HFS was selected as the educational method to assist nurses in preparing for a malignant hyperthermia crisis.

Theoretical Framework

Donald Kirkpatrick's Level of Evaluation Model is the theoretical framework to guide this thesis. This model evaluates training programs. This model looks at four levels of evaluation: reaction, learning, behavior, and results (Kirkpatrick, 1996). This research project was guided by reaction and learning. The researcher will not be able to examine the behavior or results from this theoretical framework in the simulation setting. Reaction was described as the participant's view of the training program (Kirkpatrick, 1996). Learning was described as acquired knowledge, improvement in skills, and change in attitudes (Kirkpatrick, 1996). Behavior was described as transferring the skills acquired during the training to demonstrating on the job (Kirkpatrick, 1996). Results were described as the final outcome from the training (Kirkpatrick, 1996).

The reaction level, for this research project, examined whether nurses found the simulation training helpful. This level can assist the instructor in measuring the motivation and interest of the learner in the program content (Kirkpatrick, 1996). The learning level explored whether nurses improved their skills in recognizing and intervening in a MH crisis with confidence.

Thesis Question

Does simulation training increase nurses' confidence levels in recognizing and intervening in a malignant hyperthermia crisis?

Definition of Terms

- Malignant hyperthermia is a disease process that develops from a rare genetic condition. It involves an interaction between genetics and the exposure to certain pharmaceutical triggering agents, such as succinylcholine or inhalation anesthetics (Denholm, 2015).
- "High-fidelity simulation is defined as a replicated clinical experience using a computer driven, full-bodied mannequin simulator with physiologic response to intervention" (Warren et al., 2016, p.99).
- Confidence is "faith or belief that one will act in a right, proper, or effective way" (Merriam-Webster's Dictionary and Thesaurus, 2006).

Summary

Malignant hyperthermia is a life-threatening crisis. Nurses need to be able to recognize and intervene in a malignant hyperthermia crisis with confidence. Simulation training is an educational tool that nurses can use to practice recognizing and intervening in a malignant hyperthermia crisis in a safe environment. The goal of this thesis was to determine if simulation training increases nurses' confidence levels in this type of crisis.

CHAPTER II

Literature Review

Malignant Hyperthermia (MH) is a life-threatening medical emergency (Cain et al., 2014). MH is caused by a rare genetic condition, when combined with the exposure to certain pharmaceutical agents that can develop into MH and potentially death (Denholm, 2015). The pharmaceutical agents that can trigger MH include inhalation anesthetics or the drug Succinylcholine (Cain et al., 2014). MH can occur after the induction of general anesthesia, during surgery, or within 12 hours following surgery (Hommertzhein & Steinke, 2006).

Due to the low occurrence but high risk medical emergency of MH, critical care nurses in the post anesthesia care unit (PACU) need to be prepared to recognize and intervene in a MH crisis (Schaad, 2017). Simulation training provides nurses with the opportunity to prepare for medical emergencies, such as MH in a safe environment (Schaad, 2017). Nurses' confidence and competency levels increase after simulation training in recognizing early changes in a patient's condition (Elder, 2017). The purpose of this thesis was to determine if nurses' confidence levels increase their ability to recognize and intervene in a malignant hyperthermia crisis after simulation training. PubMed and Cumulative Index for Nursing and Allied Health Literature (CINAHL) were the databases used for this literature review. The keywords included malignant hyperthermia, simulation, nurses, and confidence level.

Simulation and Confidence Level

Simulation is one educational tool that can be used to prepare nurses for critical patient situations in a safe environment, while increasing confidence levels among nurses

(Rice et al., 2016). Ortiz (2016) conducted a study on the confidence level of new graduate nurses. One reason new graduate nurses felt that they lacked professional confidence was due to making mistakes, such as medication errors and patient falls (Ortiz, 2016). Simulation is an educational method that nursing programs can use to prepare the undergraduate nursing student for the role of a new graduate nurse (Ortiz, 2016). Educators can develop case scenarios that mimic patient care experiences, while providing students an opportunity to prepare for these situations in a safe environment (Ortiz, 2016). Boling and Hardin-Pierce (2015) examined current research on high-fidelity simulation knowledge and confidence/self-efficacy with critical care providers. They concluded that simulation training and continuing education can improve clinical knowledge and increase provider confidence in critical care situations (Boling & Hardin-Pierce, 2015). Simulation training is one way to expose new graduate nurses to critical situations in a safe environment, while assisting them in the development of professional confidence (Ortiz, 2016).

Lubbers and Rossman (2016) examined the effect of pediatric community simulation on the self-confidence of nursing students. This research study showed an increase in self-confidence from nursing students following the completion of the pediatric community simulation course (Lubber & Rossman, 2016). The study conducted by Khalaila (2013) also showed support for simulation with nursing students and the increase in self-confidence, while decreasing anxiety.

Jeffries (2005) developed a framework for the implementation of simulations in nursing education. Simulation activities increase nursing students' confidence in their problem solving and critical thinking abilities. Simulation provides students the

opportunity to transfer the skills developed through simulation into the clinical setting, thereby increasing self-confidence (Jefferies, 2005). Leach (2014) also cited that nursing students felt as if they had improved their knowledge base through the simulation experience and would be able to transfer it to clinical practice.

Elder (2017) conducted a study examining the use of simulation to assist nurses in recognizing the early signs of patient deterioration. The purpose of this study was to examine simulation as an educational tool to increase nurse's knowledge, self-confidence, and competency when providing care to patients that are exhibiting signs of clinical deterioration (Elder, 2017). This study supported using simulation to improve nurses' self-confidence as an educational tool (Elder, 2017). The study conducted by Bultas, Hassler, Ercole, and Rea (2014) also looked at using high-fidelity simulation training with staff nurses and the ability to recognize and intervene with a deteriorating pediatric patient. This study supported the use of high-fidelity simulation and continuing education as improving knowledge and in some cases the ability to recognize and intervene with a deteriorating pediatric patient (Bultas et al., 2014).

Rice et al. (2016) conducted a study examining the implementation and evaluation of a simulation training program focusing on team performance. After the program was completed, most of the participants either agreed or strongly agreed that they had gained confidence with the team simulation training program (Rice et al., 2016).

Herbers and Heaser (2016) conducted a quality improvement program in which simulation was used for a mock code in situ. One objective of this program was to increase staff confidence levels during medical emergencies (Herbers & Heaser, 2016). Staff reported an increase in confidence levels, critical thinking, and teamwork (Herbers

& Heaser, 2016). Staff also had positive comments about the controlled environment (Herbers & Heaser, 2016).

Zapko et al. (2015) investigated simulation using a disaster drill with nursing and radiology students. The findings from this study included an increase in self-confidence by the students in caring for patients during a disaster drill (Zapko et al., 2015). The students also reported this type of interdisciplinary simulation drill as beneficial because they were able to work with another health care discipline (Zapko et al., 2015).

Askew et al. (2012) conducted a project involving oncology nurses participating in simulation exercises. These exercises consisted of nurses' ability to recognize and intervene with a patient that was deteriorating (Askew et al., 2012). Once the simulation was completed, nurses had increased confidence, gained knowledge, improved skills, and communication between staff members (Askew et al., 2012).

The Confidence Scale (C-Scale) originally developed by Susan Grundy is a tool used to measure confidence levels of nursing students demonstrating physical assessment skills (Grundy, 1993). The C-Scale is five statement Likert-type scale (Grundy, 1993). The statements range from one to five, with a one indicating a low confidence level and five indicating a higher confidence (Grundy, 1993). A total score of five is a low confidence score (Grundy, 1993). A total score of 25 is a higher confidence score (Grundy, 1993). This scale was determined to be reliable. The internal consistency for this scale remains high at .91 (Grundy, 1993). The reliability for the test-retest is high (Grundy, 1993).

Construct validity for this scale was established by using staff nurses, working on a medical-surgical unit at a local hospital, with at least one year of experience (Grundy,

1993). The hospital administration granted permission for the recruitment of these nurses to complete this scale (Grundy, 1993). The scale was completed by 22 nurses that volunteered (Grundy, 1993). In order to support the concurrent validity for The Confidence Scale, the confidence visual analogue scale (C-VAS) and the confidence verbal descriptor scale (C-VDS) were also administered with The Confidence Scale, with a correlation of moderate to high (Grundy, 1993).

Simulation and Malignant Hyperthermia

Simulation based training is an educational tool that educators can use to assess staff members reaction to low volume high risk circumstances. This type of assessment helps educators and staff members improve patient care in a safe environment (Schaad, 2017). After completing a malignant hyperthermia simulation training at a facility in the southeast, staff felt empowered in addressing safety concerns and had the opportunity to practice in a safe environment without patient harm (Schaad, 2017). Education was also provided to staff concerning detailed explanations of pertinent actions for the care of a patient during a malignant hyperthermia crisis (Schaad, 2017).

Hotchkiss and Mendoza (2001) examined using simulation technology as an educational tool with low occurrence but high risk medical emergencies, such as malignant hyperthermia. The advantage of simulation is the participants have an opportunity to experience medical emergencies in a controlled environment (Hotchkiss & Mendoza, 2001). They are able to review their own performance and practice the skills or areas of weakness in a safe environment without patient harm (Hotchkiss & Mendoza, 2001). Cain et al. (2014) article discussed a quality improvement project using simulation for a malignant hyperthermia drill. This drill provided staff with a safe

environment to become efficient in preparing and caring for a patient during a malignant hyperthermia crisis (Cain et al., 2014). At the conclusion of the drill, staff reported feeling better prepared to handle a malignant hyperthermia crisis. As a result of the success of the malignant hyperthermia drill at this facility, annual malignant hyperthermia drills using simulation were implemented for perioperative staff (Cain et al., 2014). Dirksen et al. (2013) wrote an article discussing the development of malignant hyperthermia drills. In the conclusion, they expressed the importance of preparing staff for low occurrence high risk medical emergencies such as malignant hyperthermia using simulation to improve knowledge and skill level in these type of events (Dirksen et al., 2013). Mullen and Byrd (2013) examined improving perioperative patient safety through simulation training. In the perioperative environment, medical emergencies can be in the form of OR fires, cardiac arrest, respiratory depression, and malignant hyperthermia (Mullen & Byrd, 2013). Simulation is a technique that can be used to prepare staff for these type of emergencies, while increasing clinical confidence, improving teamwork and performance during a medical emergency (Mullen & Byrd, 2016).

Summary

The Institute of Medicine Forum on the Future of Nursing 2009 discussed the importance of incorporating simulation into training programs focusing on patient safety by healthcare providers (Askew et al., 2012). Simulation training is beneficial to staff by providing them a safe environment to practice for medical emergencies without harming

patients. This type of training increases self-confidence, critical thinking, familiarity with equipment, and improves communication skills among team members (Rice et al., 2016).

CHAPTER III

Methodology

A malignant hyperthermia crisis can occur in any individual with a rare genetic condition that is exposed to general anesthetics or pharmaceutical triggering agents (Denholm, 2015). All patients that receive health care, from a facility that administers these medications or anesthetics and have this genetic condition, are at increased risk of developing a malignant hyperthermia crisis (Cain et al., 2014). If the signs and symptoms of MH are not recognized early and intervention is delayed, the result could be patient death (Cain et al., 2014).

Simulation training provides healthcare staff with an environment to prepare for medical emergencies in a safe environment without fear of patient harm (Rice et al., 2016). The benefits of this type of training program include increasing self-confidence during a crisis, improved communication skills, and critical thinking skills (Rice et al., 2016). The purpose of this thesis was to determine if nurses' confidence levels increase in their ability to recognize and intervene in a malignant hyperthermia crisis, after simulation training.

Study Design

This study was a quantitative study. The study design was a pretest-posttest survey. The Confidence Scale (C-Scale) originally developed by Susan Grundy is the tool that was used for this project (Grundy, 1993). Susan Grundy granted the researcher permission to use and modify this tool (Appendix A). The researcher modified the wording in the directions, so they would be appropriate for a self-confidence scale involving a MH crisis. PACU nurses completed the Confidence Scale, as a pretest survey

was placed in an envelope, prior to the simulation and the same survey as a posttest placed in another envelope after the malignant hyperthermia drill simulation. If nurses chose not to participate, they turned in a blank survey in the envelope provided by the researcher.

Setting and Sample

The sample consisted of nurses from the PACU at one facility. The sampling method used was convenience sampling. Eighteen nurses were at the MH drill. Although the MH drill was mandatory for all nurses working in the PACU for the healthcare system, the self-confidence research focused only on the PACU at one facility. Participation in this research project was strictly voluntary. The MH drill took place during the month of April 2018 on the first Wednesday. This drill replaced the unit staff meeting that is usually scheduled on this day. There were not any patients in the PACU during the drill. The unit resource nurse worked with the medical director from the simulation lab to conduct the MH drill. In the event the medical director was unable to attend, the unit resource nurse would conduct the malignant hyperthermia drill using the medical director's case scenario. A MH case scenario was selected by the simulation medical director. The simulation lab for the healthcare system is accredited through the Society for Simulation in Healthcare (SSH).

Design for Data Collection

Potential participants received an interdepartmental email informing them of the MH drill and the date of this training (Appendix B). The email described the survey being conducted and how to contact the researcher via email with questions. The email

emphasized that the survey is strictly voluntary. All PACU nurse were reminded prior to the MH drill that completing the survey is voluntary and they would not be penalized for not participating. The researcher gave PACU nurses a copy of the Consent to Participate in a Research Study at the MH drill in an envelope, along with the pretest survey. Participants gave consent by completing the survey. Those participants that chose not to participate returned the consent and a blank pretest survey to the researcher in the envelope provided. This same procedure was followed for the posttest survey. The researcher collected the pretest and posttest survey. PACU nurses remained at the PACU nurse's station during the pretest survey, pre briefing, MH drill, debriefing, and posttest survey. The original IRB application stated that those PACU nurses that participate in the survey will be taken to the unit conference room to complete the survey. A change was made to the original application, to state that all nurses will remain in the PACU and PACU nurses will receive the pretest survey in an envelope, along with the consent, and a posttest survey in a separate envelope after the MH drill and debriefing.

No personally identifying information was collected. PACU nurses completed the MH drill. All anonymous paper pretest and posttest survey results were collected and placed in the primary investigator's locked office for three years and then will be destroyed.

Measurement Methods

The Confidence Scale developed by Susan Grundy was used to determine if there was an increase in self-confidence after completing the MH drill using simulation. The Confidence Scale is a five item Likert type scale with responses ranging from one to five

(Grundy, 1993). A score of five indicates a higher level of confidence and a score of one indicates a lower level of confidence (Grundy, 1993).

This scale was determined to be reliable. The internal consistency for this scale remains high at .91 (Grundy, 1993). The reliability for test-retest is high (Grundy, 1993).

The results of the scale between experienced nurses and students conducting a physical assessment support the construct validity (Grundy, 1993). In order to support the concurrent validity for The Confidence Scale, the confidence visual analogue scale (C-VAS) and the confidence verbal descriptor scale (C-VDS) were also administered with the Confidence Scale (Grundy, 1993). The correlation between the C-VAS, C-VDS, and the C-Scale are moderate to high (Grundy, 1993).

Data Collection Procedure

This research project took place on the first Wednesday of April 2018 at one facility with the malignant hyperthermia drill in the Post Anesthesia Care Unit (PACU), using simulation. The malignant hyperthermia drill was conducted on a staff meeting day when patients arrive at a later time for surgery and took the place of the staff meeting for that day. Prior to the pre-brief, all staff were informed that participation in the survey is voluntary and there will be no retribution. All Post Anesthesia Care Unit (PACU) nurses remained at the Post Anesthesia Care Unit (PACU) nurse's station. All Post Anesthesia Care Unit (PACU) nurses received a copy of the consent and pretest survey in an envelope. If they chose not to participate, they returned the survey to the researcher in the envelope provided. This protected anonymity for the non-participants. This way the researcher is unaware of who participated and elected not to participate. If they choose to participate, they

completed the survey and return it in the envelope provided to the researcher. The survey tool that was used is The Confidence Scale developed by Susan Grundy (Grundy, 1993). The researcher attempted to give all post anesthesia care unit (PACU) nurses a copy of the consent and a pretest survey contained in an envelope to be completed prior to the malignant hyperthermia drill. Participants were provided time to complete the survey. All Post Anesthesia Care Unit (PACU) nurses returned the envelope with the survey either completed or blank, to the researcher. At the completion of the malignant hyperthermia drill and following the debriefing, all Post Anesthesia Care Unit (PACU) nurses received a posttest survey contained in an envelope. Those Post Anesthesia Care Unit (PACU) nurses that chose not to participate in the survey gave the researcher the envelope. Those Post Anesthesia Care Unit (PACU) nurses that chose to participate in the posttest survey, completed the survey contained in envelope and gave it to the researcher. The researcher collected the surveys and placed them in the primary investigator's locked office. The paper surveys will remain in the primary investigators office for three years and then will be destroyed.

Protection of Human Subjects

After receiving IRB approval from the facility and the University, the researcher treated the participants graciously, polite, and respectful. The researcher explained via interdepartmental email about the project and that participating in this survey was voluntary. The participants received an informed consent copy. Consent was implied by completing the survey. The participants may feel uncomfortable about being asked to participate in a research survey. No personally identifiable information was collected. The participants were reassured that the project was voluntary and no consequences

would arise from lack of participation. The participants were protected from coercion and any perceived risk to their job. The information was placed in a secure website provided by the facility. No personally identifying information was collected and the paper surveys are being kept in the primary investigator's locked office.

Data Analysis

The researcher entered the data into SPSS software for analysis. A paired *t* test was used to evaluate the confidence level of critical care nurses prior to and after the MH drill, using simulation (Grundy, 1993). The data analysis was used to assess the impact of simulation on nurse's confidence level during a MH drill.

CHAPTER IV

Results

Predisposed individuals having procedures that require them to receive general anesthesia or succinylcholine risk developing malignant hyperthermia (Cain et al., 2014). Symptoms must be recognized early with immediate intervention or the result can be deadly (Cain et al., 2014). Simulation training can be used as an educational tool to prepare staff for medical emergencies, such as malignant hyperthermia (Cain et al., 2014). The purpose of this thesis was to determine if nurses' confidence levels increased in recognizing and intervening in a malignant hyperthermia crisis, after simulation training.

Sample Characteristics

Post Anesthesia Care Unit (PACU) nurses received a pretest and posttest survey following the completion of malignant hyperthermia simulation training. The Confidence Scale (C-Scale) originally developed by Susan Grundy is the survey tool that was used for this project (Grundy, 1993). This scale is a five item Likert type scale with responses ranging from one to five (Grundy, 1993). A score of five indicates a higher level of confidence and a score of one indicates a lower level of confidence (Grundy, 1993). There were 18 eligible participants with 15 nurses completing the pretest survey and 14 nurses completing the posttest survey. The completion rate was 77%.

Major Findings

The researcher used the SPSS program to analyze the data. The results were based on the pretest and posttest survey total scores for The Confidence scale (C-Scale

(Grundy, 1993). The total score for each survey was computed by adding up the responses ranging from one to five.

Descriptive Statistics

The minimum score for the pretest was 10 and the maximum score was 20. The mean score for the pretest was 13.73. The minimum score for the posttest was 10 and the maximum score was 25. The mean for the posttest was 20.00 (Figure 1). The pretest histogram had a mean score of 13.73 with the most frequent scores being 10 and 15, respectively (Figure 2).

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	**15**	**10**	**20**	**13.73**	**2.963**
Posttest	**14**	**10**	**25**	**20.00**	**4.385**
Valid N (listwise)	**14**				

Figure 1: Pretest and Posttest Descriptive Statistics

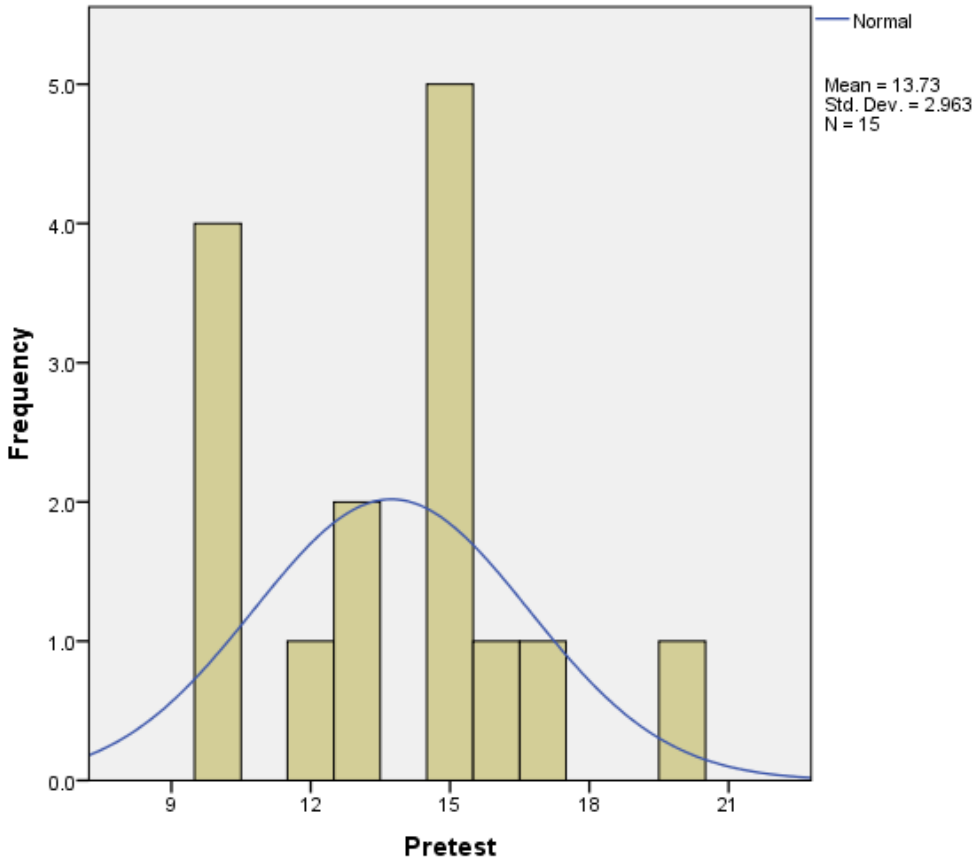

Figure 2: Pretest Histogram

The posttest histogram revealed a much stronger normal distribution, with the mean at 20. This is higher than the pretest mean (Figure 3).

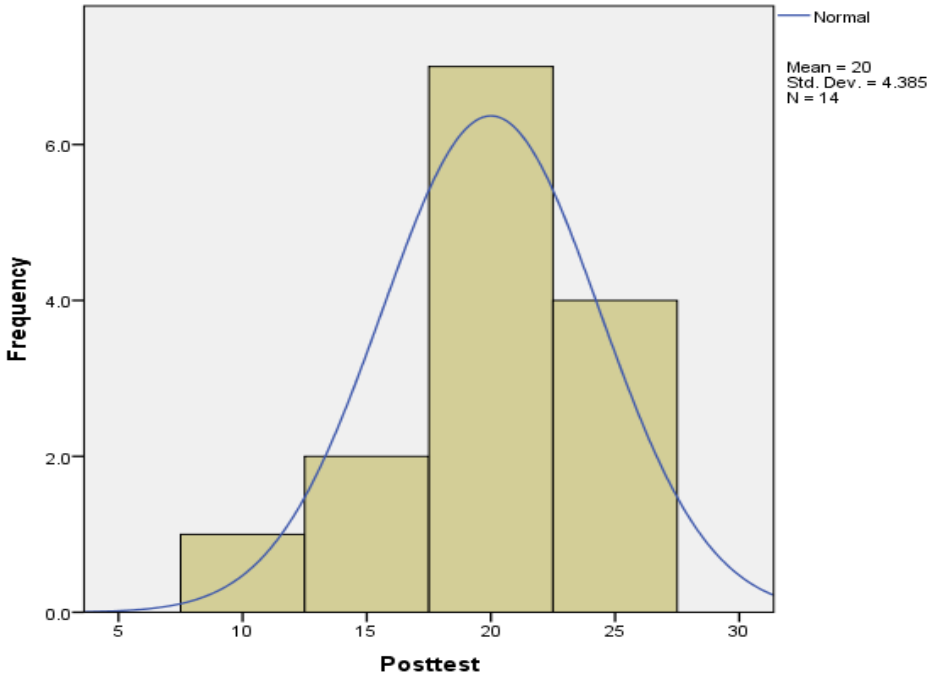

Figure 3: Posttest Histogram

A paired t-test was used to assess the differences in the pretest and posttest scores, since the same group completed the simulation training. The pretest and posttest survey was completed on the same day. The pretest was given prior to the Malignant Hyperthermia simulation training to assess nurse confidence levels in recognizing and intervening in a malignant hyperthermia crisis. The posttest survey was given immediately following the malignant hyperthermia simulation training. The t-test revealed a statistically significant improvement in confidence levels after the MH drill ($t=-4.079$, $p=0.001$, $df=13$).

Summary

The mean score for the pretest total survey score was 13.73 with a standard deviation of 2.963. The mean score of the posttest was 20.00 with a standard deviation of 4.385. The paired t- test was used to provide additional data analysis of the scores with a p-value of .001, which indicates a significant difference in the pretest and posttest scores. A significant improvement was noted in nurses' confidence levels following the MH simulation training, as evidenced with a p-value of 0.001.

CHAPTER V

Discussion

Malignant hyperthermia is a rare genetic disease that is usually triggered by the administration of general anesthetics (Hommertzheim & Steinke, 2006). If the symptoms of malignant hyperthermia are not recognized early and treated, patient death is imminent (Dirksen et al., 2013). Simulation training can be used to prepare staff for these types of emergencies in a safe environment without patient harm (Cain et al., 2014). The purpose of this research project was to determine if there was an increase in nurses' confidence levels in recognizing and intervening in a malignant hyperthermia crisis after simulation training.

In order to determine if there was an increase in nurses' confidence levels following simulation training, the researcher administered a pretest survey prior to the MH simulation training. A posttest survey was administered immediately after completing the MH simulation training. The results of the posttest survey indicated a significant increase in the confidence level of PACU nurses following the simulation.

Implications of Findings

Malignant hyperthermia is a rare genetic condition of the skeletal muscle, when exposed to general anesthetics or succinylcholine, this condition can be fatal (Rosero et al., 2009). Perioperative staff must be prepared to recognize and intervene in a MH crisis (Cain et al., 2014). Simulation training provides a safe environment for staff to prepare for medical emergencies, while increasing self-confidence (Rice et al., 2016). This research project supported the literature review in that simulation increases confidence

levels. The MH simulation training should improve patient outcomes since this type of training improves confidence.

Application to Theoretical/Conceptual Framework

Donald Kirkpatrick's Level of Evaluation Model was the theoretical framework used to guide this research (Kirkpatrick, 1996). There are four levels of evaluation to this model: reaction, learning, behavior, and results. Using this model, the researcher was only able to evaluate reaction and learning. Behavior and results are related to transferring the acquired skills to actual job situations with an improvement in quality (Kirkpatrick, 1996).

Based on the data results, there was a significant difference in the nurses' confidence levels prior to and following the simulation training. This supports the first two levels of this theoretical model used for this research, which was reaction and learning. The reaction level is related to the participant's feelings about the training program (Kirkpatrick, 1996). The learning level is related to an improvement in skills and knowledge acquired (Kirkpatrick, 1996). The data supported an increase in nurses' confidence levels, which coincides with the reaction and learning level of the evaluation model.

Limitations

The limitations of this research project included a small sample size. The data collection took place in one unit at the facility. This research project focused on simulation training for one case scenario. While every attempt was made to give all the PACU nurses a pretest survey, consent, and posttest by the researcher. Circumstances

beyond the researchers control prevented this from happening. There were 18 eligible participants and only 15 received the surveys.

Implications for Nursing

The results of this thesis support the use of simulation training to prepare students and current staff members in the healthcare field for life threatening emergencies in a safe environment. This type of training can be incorporated in annual competencies for staff members. Nursing faculty can incorporate simulation in the nursing curriculum. Simulation training for healthcare professionals can be used to train staff, while improving patient safety.

Recommendations and Conclusion

Recommendations for future research would be to expand to several facilities, more than one unit, and have different case scenarios. This could provide additional support for simulation training in the healthcare environment and confirm the findings from this research project. Additional research could provide further evidence of the importance of simulation training to increase patient safety.

The purpose of this thesis was to determine if there was an increase in nurses' confidence levels in recognizing and intervening in a malignant hyperthermia crisis after simulation training. As supported by the data, there was a significant increase in nurses' confidence levels following the simulation training. The results from this research project support the findings from the literature review.

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Appendix A

Susan Grundy's Permission Letter to the Researcher to Use the Self-Confidence Scale

SACRAMENTO STATE

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January 10, 2018

To Whom It May Concern:

I have given permission to Paige Wilson to use and modify the C-Scale to measure self-confidence in her MSN research at Gardner-Webb University. The C-Scale was originally published in *Nurse Educator* 1992. It was reprinted in 1993 (Vol. 18, No. 1, pp 6-9) with information that was lacking in the first printing.

Sincerely,

Susan Grundy

Susan Grundy, Ed.D., M.S.N., R.N.

Professor Emeritus

School of Nursing

California State University, Sacramento

Appendix B

Malignant Hyperthermia Drill

Dear Post Anesthesia Care Unit Nurses at Greer Memorial,

I am a MSN student at Gardner-Webb University conducting research for my thesis involving simulation training and nurses' confidence levels. I have received permission from Mandy Thompson, Perioperative Clinical Resource Nurse, as well as Greenville Health System and Gardner-Webb University Institutional Review Boards to conduct my research.

During the mandatory Malignant Hyperthermia Drill using simulation on April 4, 2018, I will be administering a voluntary survey before and after the drill. The survey will be completed on paper and will only take about 5 minutes. There will be no personally identifiable information collected. Participation in the survey is voluntary, and there will not be any consequences for staff who choose not to participate. All Post Anesthesia Care Unit Nurses will receive a copy of the consent and the pretest survey in an envelope, prior to the Malignant Hyperthermia Drill. If you choose to participate, you need to complete the survey and return to the researcher in the envelope provided. Consent to participate in this research project will be implied by completing the survey. If you choose not to participate, you will need to return the consent and a blank pretest survey in the envelope to the researcher. The same procedure will be followed for the posttest survey. If you have any questions regarding this research, please contact me or my faculty using the information below.

Thank you for your time,

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