ASSESSING MALIGNANT HYPERTHERMIA PROTOCOL FAMILIARITY THROUGH THE INCORPORATION OF SIMULATION TRAINING IN OPERATING ROOM REGISTERED NURSES (RNs)

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Abstract

Objective: The purpose of this DNP project is to assess the effectiveness of simulation training in increasing a clinician's confidence and knowledge in efficiently recognizing and treating a malignant hyperthermia (MH)crisis. During a staff meeting at an urban tertiary care hospital, operating room nurses were recruited.

Background: MH represents an acute, rare medical crisis that can arise when susceptible patients are administered succinylcholine or volatile anesthetic agents. Members of the OR team must be familiar with and able to recognize MH risk factors and symptoms of a crisis promptly; the OR nursing staff should also quickly implement the treatment algorithm effectively with other OR team members. Research supports simulation training as an effective educational practice due to increasing clinicians' confidence in managing crises.

~~**Design: A mixed-methods quality improvement project.**~~

Methods: A mixed-methods QI design with a pre-and post-test intervention survey were implemented to collect data concerning clinician confidence and role awareness in managing malignant hyperthermia. This project received approval from the UNCG IRB and the facility's IRB and was implemented in June 2020.

Results: Data revealed that RNs felt more confident in managing an MH crisis following the simulation. Additionally, after the educational intervention, RNs felt that simulation education was superior to a PowerPoint presentation in teaching the management of an MH crisis.

Conclusion: This project suggests that simulation in teaching MH management is superior to traditional forms of education, such as a PowerPoint or online module. Through simulation training, the confidence of RNs regarding their role in an MH crisis increased.

Keywords: Malignant hyperthermia, education, simulation, clinician confidence

Background and Significance

Malignant Hyperthermia (MH) represents a severe hypermetabolic crisis that can arise when susceptible patients are administered succinylcholine or volatile anesthetic agents. The underlying pathophysiology of MH is characterized by the improper release of calcium by the sarcoplasmic reticulum. This crisis presents with hypercarbia, muscle rigidity, arrhythmias, hyperthermia, and myoglobinuria (Yang et al., 2020). Early symptoms include increased heart rate, increased carbon dioxide levels, and masseter muscle rigidity. Hyperthermia represents a late sign of an MH crisis (Gupta & Hopkins, 2017). Many of these symptoms can occur in other conditions, such as anaphylaxis or rhabdomyolysis, and, in isolation, would not lead to an MH diagnosis. Due to the presentation of vague symptoms, prompt assessment and diagnosis are necessary to provide timely treatment.

Approximately "1 in 2,000 people is genetically predisposed" to MH, with an estimated "1 in 100,000 surgical procedures in adults and 1 in 30,000 surgical procedures in children" resulting in an MH crisis (Traynor, 2016). Because of its rare occurrence in the operating room, staff members may not be confident in the assessment and treatment of MH. To provide prompt, effective, and efficient care, it is crucial that OR staff know current evidence regarding MH recognition and treatment protocols. The Malignant Hyperthermia Association of the United States (MHAUS) is a nonprofit organization whose mission is to promote awareness and the provision of prompt care in a situation in which MH is suspected. According to MHAUS practice guidelines, treatment recommendations include the timely administration of Dantrolene, the only FDA-approved medication for treating an MH crisis (Traynor, 2016).

A coordinated team response is paramount for recognition and management in handling an MH crisis. An active MH crisis requires resources and team coordination to achieve patient stability and reduce mortality within the operating room. Therefore, education is necessary for equipping staff with the tools needed to identify and manage an MH crisis. Hands-on education and simulation represent essential tools in learning and retention. Simulation, in particular, represents a highly effective method that can be used in continuing education and training (Murray et al., 2015). Simulation improves skills retention and the ability to recall learned information in a crisis. Through hands-on training and simulation, specific skills can be practiced in a learning environment where stress is minimized, and retention is increased. This project explores the effectiveness of simulation training in identifying and treating an MH crisis.

Purpose

This project aims to test the individual effectiveness of an educational briefing and simulation on MH identification and treatment in the operating room. Other variables of interest include clinician confidence in recognizing initial MH signs and symptoms and confidence in understanding one's particular role in managing an MH crisis.

Review of Current Evidence

A thorough literature search was conducted using four medical databases: PubMed, Cochrane Library, Medline, and CINAHL. The search was limited to the years 2014 through 2021. Keywords searched included "malignant hyperthermia", "simulation and education", "recognition and response", "staff confidence" and "efficacy", "treatment protocol", and "anesthesia". Included article types were peer-reviewed journals, retrospective and prospective cohort studies, and organizational references. Excluded article types included blogs, newspaper articles, and articles that were not peer-reviewed. Of the articles that met the inclusion criteria,

15 were reviewed. The articles reviewed focused on the impact of both simulation and conventional teaching methods on the prompt recognition and treatment of malignant hyperthermia within an acute care setting (OR, PACU, and ICU).

Malignant Hyperthermia

Malignant Hyperthermia (MH) represents a hypermetabolic crisis that occurs due to an inherited autosomal dominant disorder. A fulminant MH event can occur within any critical care setting where triggering agents are administered. An adverse metabolic process leads to the production of heat, excess lactate, and carbon dioxide; oxygen is consumed, muscular contractures and cellular breakdown occur, and eventual cardiovascular collapse and patient death will ensue without prompt intervention (Yang et al., 2020). Therefore, multimodal treatment should begin swiftly; this therapy includes the administration of Dantrolene, the initiation of cooling measures and hyperventilation, and the treatment of cardiac dysrhythmias (Riazi et al., 2018). Prompt recognition by clinicians is essential in reducing the morbidity and mortality associated with MH. In addition, operating room staff is required to have the ability to promptly recognize a fulminant MH event and feel comfortable and confident intervening during a crisis (Murray et al., 2015).

The mortality rate of MH is about 1.4% when treated appropriately, but mortality can be as high as 80% when left untreated (Rosenberg et al., 2015). Other significant contributors to increased MH mortality include misdiagnosis of various syndromes that share similar symptoms, such as thyrotoxicosis, pheochromocytoma, neuroleptic malignant syndrome, serotonin syndrome, and cocaine or ecstasy intoxication (Riazi et al., 2018). In the first decade of the 21st century, mortality from MH has increased by 14% (Riazi et al., 2018). This increased mortality was assumed to be associated with the increased use of MH-triggering agents outside

conventional hospital settings as anesthetic administration in outpatient settings increased, confirming the importance of continued education for anesthesia providers in managing an MH crisis.

Due to the emergent nature of an MH crisis, the operating room care team must be adequately trained in recognition of MH and the treatment protocol guidelines published by the Malignant Hyperthermia Association of The United States, or MHAUS (Kollman-Camaiora et al., 2016). The patient care team, consisting of OR nurses and CRNAs, should feel comfortable and confident utilizing the MH treatment algorithm and protocol if an MH event arises (Traynor, 2016). Sufficient training to produce staff confidence in recognizing and managing a fulminant MH crisis can improve patient outcomes. Annual training and education are recommended, with additional education provided when current treatment protocols are updated and amended. Effective, regularly scheduled sessions must encompass the pathophysiology of the disease, MH signs and symptoms, and current MH treatment guidelines (Sousa et al., 2015).

Annual training must include educational opportunities and simulation training to produce adequately trained staff members. In an MH crisis, roles must be predetermined and understood by operating room staff to allow for efficient intervention. Simulation training encourages the formation of team roles and provides clarity of assigned responsibilities (Elder, 2017). Through the repetition of clinical MH scenarios, confidence, efficiency, and experience improve, leading to a cohesive and organized team response in the event of an actual fulminant MH event (Mejia et al., 2018).

Simulation Training

Simulation training is an effective teaching method that can aid in the conceptual understanding of how to recognize various clinical situations and handle them efficiently. In

addition, simulation provides the clinical team member the opportunity to practice clinical scenarios in a controlled environment where repetition is allowed, and constructive criticism is encouraged (Mejia et al., 2018). Mejia et al. found that simulation training, compared to conventional computer-based instruction, garnered higher efficacy rates in recognizing and treating an MH fulminant event (2018). Murray et al. (2015) reached similar conclusions concerning the positive impact simulation training had on producing confident clinicians and team members. In general, simulation can teach a protocol efficiently, especially when the protocol concerns a situation that does not occur frequently but is emergent (La Cerra et al., 2019).

The Joint Commission (2005) recommends enhancing teamwork with simulation as an adjunct to traditional education methods. Adding simulation training to augment formal education allows participants to practice crisis scenarios in a risk-free environment (Boling & Hardin-Pierce, 2015). In addition, simulation training allows the trainee to experience rare scenarios (Wunder, 2016). Thus, simulation training is a valuable tool in clinical education that improves retention and confidence.

Staff Confidence

There is an abundance of evidence that stimulation can improve the knowledge and confidence of the care team. Simulation training and conventional teaching methodologies aim to create efficient, confident, and able-minded OR team members. Confidence allows the timely and efficient implementation of learned actions and tools in a crisis such as an MH crisis (Rice et al., 2016). With simulation, operating room staff members are provided the opportunity to practice skills, acquire a hands-on understanding of managing medical crises, and develop confidence. In addition, simulation activities allow for the quick implementation of learned

behaviors and actions during a medical emergency (Wunder, 2016). Simulation prepares the OR team to recognize and treat an MH crisis promptly and efficiently.

Gaps in Literature

As simulation training becomes more commonplace in healthcare, more research is needed that compares the efficacy of simulation-derived training to the effectiveness of more conventional and established training methods. The value of simulation training and its relationship to confidence and learning within the healthcare setting have been thoroughly discussed. Research that links confidence and knowledge obtained through simulation to better patient outcomes is needed. It is crucial to understand how the confidence and self-efficacy gained through simulation translates into increased patient safety and better patient outcomes in a medical crisis (La Cerra et al., 2019).

Theoretical Framework

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The Awareness to Adherence Model was used to guide the creation and implementation of this DNP project. This model assists in the transition from old guidelines to the implementation of new evidence-based practice recommendations and standards. For educational briefings to be effectively implemented in practice, using a step-wise introduction, and teaching of new material is essential. This model provides four areas of cognizance that must occur for the utilization of new guidelines to be successful. First, practitioners must be aware of new evidence-based practice through an educational intervention. The introduction of new concepts and protocols in MH treatment was provided through a live simulation. The efficacy of that simulation tool was assessed by its ability to create clinician confidence and effectively teach updates in MH treatment (Pathman, D.E. et al., 1996).

The healthcare team must agree to begin implementing the practice guidelines in clinical practice. Through this DNP project, operating room nurses will be exposed to simulation and teaching. In addition, by using simulation, nursing staff can facilitate organizational change by requesting the incorporation of simulation into annual MH crisis training.

In the third stage of this model, new practices must be adopted in practice once proper education and instruction have been provided. Barriers and satisfaction with the project will be shared with stakeholders to facilitate adoption. Lastly, practitioners should adhere to the new evidence-based practices and feel comfortable doing so regularly in the field. By incorporating simulation into annual MH training, OR nurses should feel more confident and comfortable enacting MH protocol in the event of a crisis within the operating room setting.

Evidence-Based Practice Model

The Evidence-Based Practice (EBP) Model utilized by this DNP project was the Johns Hopkins EBP Model (Johns Hopkins Medicine, 2017). This model implements a three-step clinical process known as PET, which aids in question development, rating, and appraising evidence. The model's goal is to implement current research into patient care through three steps. The first step is to determine the practice question of interest through defining the problem, recruiting the research team, and selecting leadership roles. A literature review is conducted within the second step, and data is gathered about the populations of interest. Lastly, the evidence is translated into an achievable clinical action plan. Finally, the discovered findings are reported to the organization(s) of interest, and the necessary resources required to implement the action plan are determined (Johns Hopkins Medicine, 2017).

In this project, the three steps of the Johns Hopkins EBP Model were utilized. First, the PI researched issues of relevance at a particular facility, defined the problem, recruited

participants, and selected research roles. Second, personnel resources were allocated based on the identified problem of malignant hyperthermia simulation, education, and clinician confidence. Third, the PI performed a literature review about MH, simulation training, and clinician confidence. Once the literature review was completed, the methods and design of the research project were devised and delivered to the appropriate IRBs for approval.

Methods

Design

A mixed-methods quality improvement project was implemented to assess the effectiveness of simulation of garnering proficiency and confidence in operating room staff in utilizing a Malignant Hyperthermia (MH) protocol. This project's principal investigator, or PI, was a Student Registered Nurse Anesthetist at UNCG. The outcome of this project was to understand the effectiveness of a simulation tool on clinician confidence compared to the use of a PowerPoint alone. In addition, the knowledge and confidence gained by operating room nurses in managing an MH crisis after implementing simulation training were assessed through post-test surveys. The simulation was provided to operating room (OR) nurses in a designated OR space in which the researchers and chosen participants simulated a scripted MH crisis.

Three phases were implemented through this DNP project: (1) development of the MH simulation and PowerPoint (Appendix C), (2) development of the pre-and post-test surveys (Appendix A and B), and (3) evaluation of the simulation and education briefing in creating confidence (Appendix C) via a pre-and post-test paper survey created by the PI. The pre-and post-test surveys assessed changes in knowledge that occurred after the simulation was provided to the staff. Because this was not a controlled study, participants were not divided into intervention and control groups; this allowed participants an equal opportunity to learn.

Permissions

Written approval to conduct this DNP project at the facility was obtained from the assistant chief CRNA and the clinical coordinator. The MH educator served as the advisor and clinical point of contact for implementing this project. In addition, IRB approval was obtained by the University of North Carolina at Greensboro (UNCG) and the facility before implementing the educational briefing and MH simulation training (Appendix C).

Sample and Setting

The educational presentation and MH demonstration were conducted at a 156-bed urban tertiary care facility with 11 operating rooms. Convenience sampling was used, and the target population was RNs employed at the designated healthcare facility. There were 35 eligible project participants, but only 10 RNs participated on the training day. Participation in this quality improvement project was strictly voluntary, and participants could withdraw participation at any time without penalty. This project was conducted in an empty OR suite, which was done to enhance the demonstration's efficacy in utilizing the proper personnel and emergency equipment. The anesthesia department's MH educator coordinated with the research team to implement this educational presentation and MH demonstration for operating room staff.

Implementation Plan

Once approved by the UNCG and designated hospital IRBs, the project was implemented on June 11, 2021. The training was conducted during a morning staff meeting and again during the afternoon staff meeting for the evening shift. A 30-minute educational briefing and MH demonstration on symptom recognition and crisis management were conducted in an empty OR suite. RNs were informed and recruited for the MH educational briefing and demonstration training during morning and afternoon staff meetings through a recruitment speech ~~(Appendix~~

E). Before completing the pre-test survey, an information sheet (Appendix F) was distributed to the RNs detailing the rights of the participants.

After completing the pre-test survey, the RNs participated in an educational presentation and an MH crisis demonstration. The educational briefing was a concise PowerPoint presentation that discussed MH pathophysiology, differentiation of early and late signs, perioperative stabilization, and postoperative management. In addition, the presentation included specific MH management and policies particular to the facility, and the RN's role in an MH crisis. The educational briefing was followed by a scripted demonstration of an active MH crisis. One researcher portrayed an OR nurse, and the other took on the role of a CRNA to establish and clarify role responsibilities. The demonstration encompassed a patient care scenario from beginning to end regarding the appearance of early MH symptoms under general anesthesia to intraoperative stabilization and postoperative disposition of this patient population.

Vital sign changes were portrayed during the scenario to simulate hemodynamic instability throughout a real MH crisis. These changes assisted in facilitating visual confirmation of successful and unsuccessful interventions during the demonstration. Facility-owned supplies to manage an MH crisis were utilized, predominantly the MH cart. Participants were also tasked with going to obtain ice buckets, the MH cart, and the code cart from their designated locations. The researchers went through a step-by-step breakdown of what a proper response should entail, from early symptom detection to postoperative disposition. During the patient scenario, the MH cart was opened to allow clinicians to learn where supplies were and how to utilize them. At the end of the demonstration, time was dedicated to familiarizing the RNs with the MH cart's contents and location. All questions were answered after of the simulation.

Four weeks after the project implementation, a paper post-test survey developed by the PI was used to collect data regarding clinician confidence and competence of RNs in managing an MH crisis after the simulation training session. The post-test survey was left in the operating room lounge for completion by RN staff for one week.

No personal identifying information was collected during this quality improvement project. A unique identifier was used to link the pre-and post-test paper surveys (Appendix A and B). Anonymous paper survey results were collected before and three weeks after the MH demonstration. The pre-and post-test surveys (Appendix A and B) served as the data to determine the intervention's effectiveness on clinician confidence and competence in MH management.

Data Collection

Manilla envelopes containing the information sheet, pre-test survey, and the MH demonstration script were distributed to potential participants at the beginning of the morning and afternoon staff meetings. Implied consent was obtained before the educational PowerPoint presentation and demonstration by completing the pre-test survey. The completed pre-test surveys were placed back into the envelopes and returned to the researcher. These results were used to establish a baseline of knowledge and clinician confidence. The participants that chose not to participate returned the blank questionnaires to the researcher in the envelopes provided, protecting the anonymity of the non-participants. Thus, the researcher was unaware of which staff members elected to participate.

Post-test surveys were distributed four weeks after the demonstration training. The data collection period lasted for one week. The ~~researcher~~ PI provided envelopes containing the post-test surveys to assess changes in clinician confidence and practice. The envelopes containing the

post-test surveys were placed in the operating room lounge for RNs present during the MH educational briefing and demonstration to complete.

Instruments

The pre-test survey included 12 Likert-scale questions to assess baseline knowledge and clinician confidence regarding MH management. Confidence in management of general cardiac and airway emergency management was evaluated, followed by questions concerning MH management, role responsibility, symptom recognition, and dantrolene administration. Lastly, two questions assessed the value of the MH demonstration, comparing it to the PowerPoint. A paper post-test survey was utilized to collect data specific to clinician confidence and training satisfaction and determine the overall need for MH simulation training. It was administered to RNs three weeks after the MH demonstration and mirrored the pre-test survey given before the educational intervention. A unique identifier was used to link the pre-and post-test surveys for data analysis. Once completed, the surveys were placed in a sealed envelope and returned to the PI.

Data Analysis

Of the 35 eligible participants, 7 RNs completed both the pre and post-test surveys. The matched survey data from the 7 RN participants were analyzed using Microsoft Excel on the matched data from the remaining 7 participants. The pre-and post-test survey results were compared to evaluate the effectiveness of the MH simulation in enhancing clinician confidence and to understand further the benefits of simulation over a traditional PowerPoint or an online module. The statistical test used was the Wilcoxon signed-rank test, a non-parametric statistical hypothesis test that compared matched samples. This test was selected due to the small sample size and the possible departure from normality. An alpha value of 0.05 was chosen for a two-

tailed test. The test statistic, or 'W,' was determined. If the obtained value was less than or equal to the critical value of the data set, the difference between the data was statistically significant. Using Excel, this test compared the pre-and post-intervention data to determine the effectiveness of simulation on clinician confidence.

Qualitative content analysis was implemented to analyze the qualitative data from the pre-and post-test surveys for commonalities between responses given by RNs before and after the educational intervention and demonstration (Hsieh,H & Shannon, S.. 2005). In addition, correctness and knowledge attainment was assessed through content analysis to determine if the MH simulation successfully increased the knowledge and confidence of RNs concerning the recognition and management of an MH crisis.

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Budget, Time, and Resources

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No financial resources were required to implement this DNP project. This quality improvement project required one hour to implement. Five minutes of the participants' time were dedicated to the recruitment speech, information sheet, and potential questions before the PowerPoint presentation. Participants spent ten minutes completing the pre-test survey (Appendix A). The PowerPoint presentation and MH demonstration comprised a total of thirty minutes of the participants' time. Lastly, ten minutes were dedicated to going through the MH cart and familiarizing anesthesia staff with its contents at the end of the demonstration. The post-test surveys took ten minutes to complete by the participants.

Results

Before the educational intervention took place, operating room RNs were asked to complete a pre-test survey in which they rated their level of confidence about MH symptom recognition, roles and responsibilities in an MH crisis, and the utilization of technical MH skills.

Additionally, they were asked to report their opinions of the incorporation of simulation training in technical education. On a Likert scale of 1 to 5, with 1 being 'strongly disagree' and 5 being 'strongly agree', the operating room RNs indicated their opinions and confidence levels. Four weeks after receiving the educational intervention and simulation, RN participants completed a post-test survey in which the same Likert scale was utilized to assess for any changes in clinician confidence and knowledge attainment.

The questions in the pre- and post-test surveys (Appendix A and B) were grouped into five categories. These categories were: clinician confidence, management of MH, roles and responsibilities, symptom recognition, and simulation. The questions about general clinician confidence were questions 1 through 4. The management of MH questions were 5, 6, 7, and 11. Questions pertaining to the roles and responsibilities of RNs in an MH crisis were 4 and 9. Question 8 assessed symptom recognition. Lastly, questions related to simulation were 10 and 12.

Assessing changes in clinician confidence was central to this educational intervention. In general, operating room nurses did not feel confident in their ability and skill level in managing a patient during a medical crisis. According to the pre-test survey, 71.4% of RNs did not feel confident in managing a direct patient care crisis or cardiac arrest. Also, 85.7% of RNs did not feel confident in assisting in an airway emergency. Lastly, 100% of RNs reported that they did not feel confident in their ability to manage and assist in an MH crisis. The post-test survey results indicated that increases in confidence level occurred after the educational intervention and simulation were provided. According to post-test survey results, 85.7% of RNs felt comfortable in managing a direct patient care crisis, cardiac arrest, and airway emergency. Lastly, 100% of RNs felt confident in managing an MH crisis following the educational intervention.

In examining survey questions that pertained to MH management, 100% of RNs did not feel confident with their current knowledge state about initial MH crisis interventions. After the simulation was provided, 85.7% of RNs felt confident in intervening in an MH crisis. When questioned about their comfortability in reconstituting and dosing dantrolene, only 14.3% of RNs reported feeling confident in this skill. After the intervention was provided, 85.7% of RNs reported feeling confident in dantrolene's reconstitution and dosing. Lastly, 85.7% of RNs were familiar with both the location and contents of the MH cart before the educational intervention. After the intervention was provided, 100% of RNs were familiar with the contents and location of the MH cart.

Next, confidence and knowledge levels pertaining to the roles and responsibilities during an MH crisis were assessed. According to the pre-test survey, only 28.6% of RNs felt confident in their roles and responsibilities during an MH crisis; additionally, only 14.3% of RNs reported understanding and knowing their role. After the intervention, 85.7% of RNs reported that they were confident in their role and understand their role. Therefore, these questions demonstrated both an increase in knowledge and confidence following the educational intervention.

Question 8 examined the confidence of RNs in MH symptom recognition. Prior to the intervention, only 14.3% of RNs felt confident in their ability to recognize MH symptoms in a crisis within the operating room. According to the post-test survey, 85.7% of RNs reported feeling confident in MH symptom recognition after the educational intervention and simulation were provided. Lastly, 100% of RNs reported that simulation was superior to a PowerPoint or online module alone in MH education. According to the post-test survey results, RNs reported increased confidence in each area of assessment including overall crisis management, MH management, roles and responsibilities during an MH crisis event, and symptom recognition.

Discussion

After the educational intervention operating room RNs who took part in the simulation activity reported increases in confidence in overall crisis and MH management, particular roles and responsibilities in an MH crisis, and symptom recognition. A strong relationship exists between simulation education and the development of clinician confidence (Mitchell et. al., 2020). Clinician confidence represents an integral piece in the efficient management of a medical crisis. Its importance is two-fold. First, it aids in the development of a clinician's technical skills and competence. Secondly, it allows clinicians to quickly make appropriate decisions in emergent clinical situations in which a patient's condition is rapidly deteriorating (Nagendran & Chen, 2019).

Studies suggest that confidence is extremely beneficial in increasing competence in healthcare clinicians and medical teams. Confidence represents a highly significant and instrumental tool that impacts a clinician's competence (Owens & Keller, 2018). A clinician's perceived level of confidence can affect his or her ability to make effective decisions quickly. A clinician's effective decision-making during a medical crisis affects patient outcomes and is linked to accurate patient diagnosis and early intervention in rapid patient decline (Philips, 2021). In both an MH crisis and any other emergent medical situation, the ability to accurately detect and diagnose is important in preventing further patient insult and demise. In an MH crisis, it is important that operating room medical personnel are armed with the knowledge and confidence to make prompt and beneficial decisions. In medical crises where patient outcomes are contingent upon the skills and knowledge of a clinician, quick recognition, diagnosis, and treatment must take place. In these emergent situations, the quick and proficient utilization of knowledge is directly related to clinician confidence (Kim et al., 2020).

The ability of a clinician to maintain confidence across different clinical situations is very important. Not only does this ability help secure positive patient outcomes, but confidence also aids in the development and maintenance of a strong healthcare team (Philips, 2021). This is important in many healthcare scenarios and settings, including the operating room. The cohesiveness of an operating room team is paramount in providing optimal patient care and managing emergencies effectively. A healthcare team that is both confident and cohesive can manage challenges and swiftly intervene in an emergency (Owens & Keller, 2018). Also, increasing a clinician's confidence has been linked to decreased levels of stress and increased feelings of resilience. Stress can have a negative impact on the cohesiveness of a clinical care team and can lead to detrimental patient consequences. Therefore, placing importance on clinician confidence is important in any high-stakes clinical setting (Owens & Keller, 2018). Specifically, in the treatment of an MH crisis, resiliency, confidence, and cohesiveness are imperative amongst the clinical care team to ensure prompt identification and delivery of effective care.

Confidence is an integral part of creating a competent and cohesive healthcare team and can be established through skill acquisition, technical knowledge attainment, and educational intervention. Research suggests that clinical simulation is an effective way to increase a clinician's knowledge base and confidence levels, allowing for the development of efficient decision-making skills and optimal patient management abilities (Owens & Keller, 2018). When compared to verbal and written forms of education, such as a PowerPoint module or pamphlet, high-fidelity simulation creates higher levels of engagement and more confident clinicians. While oral and written forms of education are still important in creating a strong knowledge base, the incorporation of simulation allows for the utilization of hands-on training and

familiarization. When both simulation training and traditional forms of education are utilized together, higher levels of confidence are achieved than would be achieved with oral/written education alone (Kim et al., 2020).

In the post-test survey, operating room RNs were asked to provide their opinion concerning simulation training when compared to other forms of education, such as a PowerPoint, online module, or pamphlet. According to this survey, RNs agreed that simulation represented the superior form of education when compared to other listed forms. Simulation training aided in both the knowledge acquisition and skills development in the setting of an MH crisis. Research suggests that simulation training is the preferred method of learning in the development of non-technical skills, such as confidence attainment and critical thinking utilization (Mitchell et al., 2020). Not only does simulation training help in the acquisition of both non-technical and technical skills, but it also aids in the development of a collaborative multidisciplinary team (Philips, 2021).

Limitations and Barriers

The target population was operating room RNs at one facility, a small pool of potential participants, which decreased the sample size. Of the potential participants, there was a low participation percentage, which may be attributed to COVID-19 and nurse burnout. Additionally, not all participants filled out both the pre- and post-test surveys, further limiting the sample size. The use of convenience sampling led to a selection bias, which may not be representative of nurses working at the facility. The data used in this analysis were collected from one facility only on one implementation day. This data may not be generalizable to the general nursing population.

During the simulation, the MH cart lacked vital supplies necessary for the treatment of an MH emergency. This limited the realism of the scenario but identified an area of improvement for the facility. In general, an MH cart is located within an operating room suite and is accessible to personnel when an MH emergency is suspected. The MH cart contains essential components for the treatment of MH. The contents of the cart are recommended by MHAUS as well as the hospital's anesthesia department and pharmacy.

Recommendations for Future Study and Practice

This project could be implemented in other perioperative settings at different healthcare facilities to increase the reliability of the results obtained through this quality improvement project. The educational briefing and simulation should be repeated at different times and days to increase participation and provide education to all members of the OR team at the facility. Participation may also be increased with the use of an online survey to provide the post-test survey for participants to complete at their leisure.

MH training should occur annually and when MHAUS updates are made to improve knowledge retention and provide staff updates. The educational demonstration provided by this project can be replicated and given annually in all settings that have the potential for MH to further educate and familiarize staff with the treatment of MH. Additionally, MH education should also be incorporated into new staff orientation.

Conclusion

This project aimed to assess the effectiveness of an educational briefing with simulation training on clinician confidence and knowledge. The educational intervention improved knowledge, confidence, and role clarity in participants. Consistent utilization of simulation training in MH crisis education can advance MH management, improving patient outcomes and

increasing patient safety within the operating room. The results of this project are consistent with previous studies that found positive effects of incorporating simulation training into crisis management. Simulation-based training should be used in MH education within hospital and outpatient facilities to increase clinician confidence and knowledge in responding to and managing an MH crisis.

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Appendix A

Malignant Hyperthermia Pre-Test Survey

Part I

1. What is your mother's birthday (mm/dd/yy)? _____
2. In what role/capacity do you practice (e.g. MD, CRNA, RN)? _____
    a. If you are an RN, do you primarily work in the OR? _____

Part II

SD: (strongly disagree); D: (disagree); UN: (undecided): A: (agree); SA: (strongly agree)

Questions	SD	D	UN	A	SA
1. I feel confident in my skills during a crisis involving direct patient care.					
2. I feel confident in my role during a cardiac arrest.					
3. I feel confident in my role during an airway emergency (e.g. cannot ventilate or intubate).					
4. I feel confident in my role during the management in an MH crisis.					
5. I know the initial interventions in MH management.					
6. I feel confident in dosing Dantrolene during an MH crisis.					
7. I feel confident in my ability to reconstitute Dantrolene.					
8. I am confident in my ability to recognize initial MH signs and symptoms					
9. I know my role and responsibilities during an MH crisis.					
10. An MH educational briefing and demonstration is beneficial to increase confidence and competence in the management of an MH crisis?					
11. I know the location of the MH cart.					

12. Simulation education is superior to a PowerPoint or online module alone in teaching the management of an MH crisis.					

Appendix B

Malignant Hyperthermia Demonstration Post-test Survey

Part I

1. What is your mother's birthday (mm/dd/yy)? _____
2. In what role/capacity do you practice (e.g. MD, CRNA, RN)? _____
    a. If you are an RN, do you primarily work in the OR? _____

Part II

SD: (strongly disagree); D: (disagree); UN: (undecided): A: (agree); SA: (strongly agree)

Questions	SD	D	UN	A	SA
1. I feel confident in my skills during a crisis involving direct patient care.					
2. I feel confident in my role during a cardiac arrest.					
3. I feel confident in my role during an airway emergency (e.g. cannot ventilate or intubate).					
4. I feel confident in my role during the management in an MH crisis.					
5. I know the initial interventions in MH management.					
6. I feel confident in dosing Dantrolene during an MH crisis.					
7. I feel confident in my ability to reconstitute Dantrolene.					
8. I am confident in my ability to recognize initial MH signs and symptoms.					
9. I know my role and responsibilities during an MH crisis.					
10. An MH educational briefing and demonstration is beneficial to increase confidence and competence in managing an MH crisis?					
11. I know the location of the MH cart.					
12. Simulation education is superior to a PowerPoint or online module alone in teaching the management of an MH crisis.					

13. There are barriers to MH treatment at this facility.					
If yes, what are the barriers?					

Appendix C

MH crisis Demonstration Script

Roles:
CRNA: Sabrina Zaleski
OR circulator: Liz McKeithan
Anesthesia tech: ~~David Salzer~~DS

MH Scenario: Barbara Jones is a healthy 18-year-old scheduled for a right knee arthroscopy who weighs 154 lb (70 kg). Her past surgical history includes a tonsillectomy at the age of 7. There is no other significant healthy history to report and no history of problems with anesthesia. The patient is scheduled to have a general anesthetic with an LMA (laryngeal mask airway).

The patient has been under anesthesia for 15 minutes. The surgeon is complaining the patient's right leg feels rigid while trying to position the patient.

VS:

- Temperature is 39 C.
- ETCO2 70 mmHg.
- Blood pressure is 169/88.
- Oxygen saturation is 90%
- Respiratory rate is 26/min.
- Heart rate is 130.

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Responsibility	Action
CRNA	Announce the suspicion of MH to the staff in the room. - Call for the MH cart and code cart to be brought to the room. Tell circulator to call overhead for additional help. Notify the surgeon about concern for MH and to stop the procedure. - If the procedure is emergent, discontinue the use of volatile agents and continue with non-triggering anesthetics (convert to a TIVA). - If the procedure is non-emergent - abort the procedure to stabilize the patient.
OR Circulator	Call for help overhead. - "MH Crisis in OR 5" - This will get anesthesia and additional personnel in the operating room quickly to help and provide additional hands. Call the OR charge nurse and notify them of the situation. Will be delegating tasks to OR staff. - Assign roles to OR staff: o Obtain the MH cart and code cart. o Call the MHAUS hotline. o Getting bags of ice and cooled saline. o Running labs. o Grabbing supplies - new anesthesia gas machine or regular ventilator, ISTAT, etc.
Anesthesia tech	Runs to bring the MH cart from the OR front desk area. - Go ahead and break open the MH cart.
In the MH Cart:	Drugs:

	- Dantrolene at least 36 vials. - Sterile water to reconstitute Dantrolene. - Sodium Bicarbonate 50 mL x4. - Dextrose 50% - 50 mL vials x 2. - Calcium Chloride 10% 10 mL vials x2. - Regular Insulin - 100 units/mL x 1 (needs to be refrigerated). - Lidocaine 2% 100 mg/5 mL or 100 mg/10 mL in preloaded syringes x 3. o Amiodarone is also acceptable. - Refrigerated cold saline - minimum of 3L for IV cooling. General equipment: - Charcoal filters - 2 pairs. Check expiration date. - 60 mL syringes x 5 - to dilute Dantrolene. - IV catheters - multiple different sizes x 4 each. - Catheters for an arterial line. - NGT - multiple sizes and irrigation syringes - 60 mL x 2 with adapters for NGT irrigation. Monitoring equipment: - Core temp probes - esophageal, nasopharyngeal, tympanic, rectal, bladder, PA, etc. - CVP kits. - Transducer kits for arterial and central venous cannulation. Nursing supplies: - Large sterile steri-drape - for rapid drape of a wound. - Urine meter x1. - Irrigation tray with piston - 60 mL irrigation syringe. - Large clear plastic bags for ice x 4. - Small plastic bags for ice x 4. - Bucket for ice. - Test strips for urine hemoglobin. Lab supplies: - Syringes (3 mL) for ABGs or ABG kits x 6 for point of care monitors - ISTAT. - Blood specimen tubes for CK, myoglobin, LDH, electrolytes, thyroid studies, PT/PTT, fibrinogen, fibrin split products, lactate, CBC, platelets. - Blood cultures - useful to rule out bacteremia. - Urine collection container for myoglobin level.
OR circulator – or any additional staff member can do this.	Runs to bring the code cart from the OR front desk area. - Attach defibrillator pad to the patient.
Additional RN	Calls MHAUS hotline (1-800-644-9737) from personal cell phone. - There is only 1 OR phone which will be used to call for additional assistance and/or supplies. - MHAUS hotline will provide additional advice for acute management. - May want to speak with an anesthesia prover - can place them on speaker to communicate.
Anesthesia tech	Runs to grab bags of ice and cooled saline from the refrigerator from the OR front desk area. - Can get extra ice from the coffee shop on the 1st floor near the main entrance. - The clinical administrator can also get ice downstairs if needed.

CRNA and additional anesthesia providers.	Discontinue the triggering agent. Turn off any anesthetic gas. - Hyperventilate with 100% oxygen with high flows of at least 10 L/min to enhance the elimination of the anesthetic gas. Since the patient is not intubated - go ahead and intubate to secure the airway. - For neuromuscular relaxation use a nondepolarizing neuromuscular blocking agent (Rocuronium). Do not use Succinylcholine since it is a trigger for MH and will make the situation worse. - Increase ventilation rate and/or tidal volume to maximize ventilation and attempt to reduce ETCO2. - Maintain anesthetic with a Propofol drip. Insert activated charcoal filters into the inspiratory and expiratory limbs of the breathing circuit on the gas machine. - There are 2 sets of the charcoal filters on the MH cart and extra filters in the anesthesia office. - Run for 10 minutes. - Depending on the type of charcoal filters used - Vapor-Clean filters become saturated after 1 hour and should be replaced hourly. Another option is to maintain ventilation with an ambu bag and Propofol drip. - Can request either a new gas machine or a regular ventilator to be brought into the operating room. Turn off bair hugger to facilitate cooling the patient.
All staff	Actively cool patient with ice packs or chilled saline, lavage if the abdomen is open. - Pack groin, neck, head, and axilla with ice packs. - But in reality, will actually just place ice in places you can get to. Stop cooling at core temp of 38°C.
Anesthesia tech	Runs to obtain a new anesthesia gas machine or obtain a regular ventilator if needed. Also available to run and grab any needed supplies. - Istat machine - for blood gases. - Glucometer - to monitor glucose levels. - Other necessary supplies.
CRNA - In a real crisis, will have additional help. This will be done by multiple anesthesia providers simultaneously.	Will need more IV access. - Start additional large bore IV. Place arterial line for close monitoring of blood pressure and lab draws. - Obtain labs: ABG, BMP, CKMB, Lactate, Coagulation studies. Based on ABG results, may need to give sodium bicarbonate 1-2 mEq/kg to treat metabolic acidosis to maintain a base excess > -8 mEq/L. - Max dose of sodium bicarbonate is 50 mEq.
OR circulator - In a real crisis, will have additional hands to help.	To place the lab orders in the computer and print out necessary patient labels - Type in “MH” and an order set should appear with all the required labs. - Print labels and attach to the correct lab vials after receiving them from anesthesia. - Give labs to the anesthesia tech to deliver to the lab.

	Start preparing Dantrolene. - Designate at least two people to reconstitute 2.5 mg/kg IV bolus. Dilute each 20 mg Dantrolene vial in 60 mL preservative-free sterile water - mix until the solution is clear. - Ex: 70 kg person give 175 mg - prepare 9 vials of 20 mg Dantrolene - Can also pour the sterile water into a sterile bowl to mix Dantrolene - this allows you to make more at a time. If the institution has Ryanodex supplied in 250 mg vials - it should be reconstituted with 5 mL sterile water and shaken until the orange color is a uniform, opaque suspension. There is extra Dantrolene in the central Pyxis. - Type in "Malignant" into the Pyxis in order to pull it out.
CRNA	Begin administering Dantrolene when it is available. - Rapidly administer Dantrolene 2.5 mg/kg IV bolus. - Dantrolene reverses the acute hypermetabolic process caused by MH within minutes. Continue giving Dantrolene until the patient is stable. - Administer subsequent doses of 1 mg/kg IV until the signs of MH decrease. May need to give > 10 mg/kg for patients with persistent contractures or rigidity. This can be seen with muscular males. - Will see decreased ETCO2, decreased muscle rigidity, and/or a lowered heart rate.
CRNA and Anesthesia tech	If necessary, swap out gas machines to a new anesthesia gas machine or a regular ventilator. If using a new gas machine: - Remove the vaporizer cartridges from the machine, so no anesthetic gas can be accidentally delivered to the patient.
Anesthesia tech	Run to deliver drawn labs to the lab.
OR circulator	Place Foley and monitor urine output. - Perform cold lavage to the bladder. If able to - can insert rectal tube for lavage. - If one is already present, can perform a rectal lavage to facilitate cooling.
CRNA	Fluid Management: Administer cool IV fluids (Normal Saline 0.9%) to maintain a urine output of at least 1-2 mL/kg/hr. Monitor renal function - rhabdomyolysis can occur. - Monitor for cola-colored urine. This indicates myoglobinuria. Might have to administer Lasix to reduce fluid overload and promote excretion of K+ and Na+ to help prevent myoglobin-induced renal failure.
CRNA	Treat hyperkalemia: - Calcium chloride 10 mg/kg or Calcium gluconate 10-50 mg/kg - D50 1 Amp IV (25g/50 ml Dextrose) and Regular Insulin 10 units IV - Sodium Bicarbonate 1-2 mEq/kg

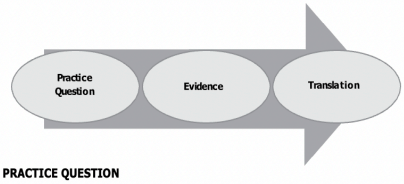
	For refractory hyperkalemia, consider albuterol or other beta-agonists, kayexalate, and dialysis in extreme cases. Monitor glucose levels hourly.
CRNA	Treat dysrhythmias with Beta-blockers. - Do not give Calcium channel blockers. They may cause hyperkalemia or cardiac arrest in the presence of Dantrolene.
CRNA	Continue Dantrolene 1 mg/kg every 4-6 hours or 0.25 mg/kg/hr infusion for at least 24 hours (25 % of MH events relapse) - Provide supportive care to maintain hemodynamic stability. - Continue resuscitation. - Will need ventilatory and may require vasopressor support.
OR Circulator	Once stable, arrange ICU bed and call report. - The patient will be observed in the ICU for at least 24 hours.
CRNA	Continue to monitor heart rate, core temperature, ETCO2, minute ventilation, ABGs, K+, CK, urine myoglobin, and coagulation studies. - Maintain the patient on a Propofol drip.
	Signs of stability: - ETCO is declining or normal. - Heart rate is stable or decreasing with no signs of dysrhythmias. - Hyperthermia is resolving. - Generalized muscle rigidity has resolved. Monitor for MH recurrence: - Occurs in approximately 20% of patients after initial treatment. - Mean of 13 hours afterwards. - Additional boluses of Dantrolene may be needed.

In the event of an MH crisis at night:
Call a code blue overhead to bring in ICU and Emergency Department providers and staff to get extra hands available to help.

Appendix D

Johns Hopkins Nursing Evidence-Based Practice: PET Management Guide

Appendix A
PET Management Guide



PRACTICE QUESTION
Step 1: Recruit interprofessional team
Step 2: Define the problem
Step 3: Develop and refine the EBP question
Step 4: Identify stakeholders
Step 5: Determine responsibility for project leadership
Step 6: Schedule team meetings

EVIDENCE
Step 7: Conduct internal and external search for evidence
Step 8: Appraise the level and quality of each piece of evidence
Step 9: Summarize the individual evidence
Step 10: Synthesize overall strength and quality of evidence
Step 11: Develop recommendations for change based on evidence synthesis
- Strong, compelling evidence, consistent results
- Good evidence, consistent results
- Good evidence, conflicting results
- Insufficient or absent evidence

TRANSLATION
Step 12: Determine fit, feasibility, and appropriateness of recommendation(s) for translation path
Step 13: Create action plan
Step 14: Secure support and resources to implement action plan
Step 15: Implement action plan
Step 16: Evaluate outcomes
Step 17: Report outcomes to stakeholders
Step 18: Identify next steps
Step 19: Disseminate findings

Johns Hopkins Nursing Evidence-Based Practice

Appendix A
PET Management Guide

Initial EBP Question: Does the incorporation of simulation training into traditional educational briefings regarding Malignant Hyperthermia (MH) aid in MH protocol familiarity among OR nursing staff and CRNA staff?

EBP Team Leader(s): David Salzer

EBP Team Members: Sabrina Zaleski and Elizabeth McKeithan

Activities	Start Date	Days Required	End Date	Person Assigned	Milestone	Comment/ Resources Required
PRACTICE QUESTION:						
Step 1: Recruit interprofessional team	date	# days	date	name	milestone	comments
Step 2: Define the problem	date	# days	date	name	milestone	comments
Step 3: Develop and refine the EBP question	date	# days	date	name	milestone	comments
Step 4: Identify stakeholders	date	# days	date	name	milestone	comments
Step 5: Determine responsibility for project leadership	date	# days	date	name	milestone	comments
Step 6: Schedule team meetings	date	# days	date	name	milestone	comments
EVIDENCE:						
Step 7: Conduct internal and external search for evidence	date	# days	date	name	milestone	comments
Step 8: Appraise the level and quality of each piece of evidence	date	# days	date	name	milestone	comments
Step 9: Summarize the individual evidence	date	# days	date	name	milestone	comments
Step 10: Synthesize overall strength + quality of evidence	date	# days	date	name	milestone	comments
Step 11: Develop recommendations for change based on evidence synthesis: • Strong, compelling evidence, consistent results • Good evidence, consistent results • Good evidence, conflicting results • Insufficient or absent evidence	date	# days	date	name	milestone	comments

Johns Hopkins Nursing Evidence-Based Practice

Appendix A
PET Management Guide

Activities	Start Date	Days Required	End Date	Person Assigned	Milestone	Comment/ Resources Required
TRANSLATION:						
Step 12: Determine fit, feasibility, and appropriateness of recommendation(s) for translation path	date	# days	date	name	milestone	comments
Step 13: Create action plan	date	# days	date	name	milestone	comments
Step 14: Secure support and resources to implement action plan	date	# days	date	name	milestone	comments
Step 15: Implement action plan	date	# days	date	name	milestone	comments
Step 16: Evaluate outcomes	date	# days	date	name	milestone	comments
Step 17: Report outcomes to stakeholders	date	# days	date	name	milestone	comments
Step 18: Identify next steps.	date	# days	date	name	milestone	comments
Step 19: Disseminate findings.	date	# days	date	name	milestone	comments

Appendix E

Recruitment Speech

Good morning/afternoon,

My name is Sabrina Zaleski, and this is Liz McKeithan. We are both 2nd year Student Registered Nurse Anesthetists (SRNAs) at the University of North Carolina at Greensboro. We are conducting our Doctorate of Nursing Practice (DNP) project on Malignant Hyperthermia (MH) and the effect of an educational briefing and simulation on clinician confidence in managing an MH crisis. Our population of interest includes certified registered nurse anesthetist (CRNAs) and operating room (OR) nurses. Participation is strictly voluntary. You may take breaks as needed or withdraw participation at any time. Participants will partake in an interdisciplinary MH educational briefing that includes a PowerPoint presentation and MH crisis demonstration in the operating room, which will take 30 minutes. We plan to walk through a hypothetical MH crisis scenario from start to finish and interventions necessary to maintain hemodynamic stability. Lastly, we plan to familiarize the perioperative staff with the MH cart and its contents and location. Written surveys will be given to participants before the training and 3 weeks after to assess any changes in clinician confidence and practice. The surveys will take approximately 5-10 minutes to complete. The surveys will be anonymous. To link the surveys, we plan to use a unique identifier listed on the surveys. No one will know individual responses. Completed paper surveys will be kept in a locked cabinet at UNCG. We would be grateful for your participation in our quality improvement project. Any questions or concerns?

Appendix F

UNIVERSITY OF NORTH CAROLINA GREENSBORO
School of Nursing

Information Sheet

DNP Project Title: Assessing Malignant Hyperthermia (MH) Protocol Familiarity Through the Incorporation of Simulation Training in Certified Registered Nurse Anesthetists (CRNAs) and Operating Room Registered Nurses (RNs)

Student conducting project (Principal Investigators): Sabrina Zaleski, BSN, RN, and Elizabeth McKeithan, MSN, RN

Faculty Advisor: Vadim Korogoda, DNP, CRNA

You are being asked to participate in a DNP Project conducted by *Sabrina Zaleski, BSN, RN, and Elizabeth McKeithan, MSN, RN* Nurse Anesthesia, Doctor of Nursing Practice students at UNC Greensboro, School of Nursing. Your participation is strictly voluntary – You may drop out of the quality improvement project at any time with no penalty for doing so.

What is the study about?
This DNP project aims to evaluate the effectiveness of educational briefings and simulation on clinician confidence in managing an MH crisis at a selected healthcare facility. Operating room RNs and CRNAs will be provided a concise refresher regarding evidence-based MH protocols, and recognition strategies will be provided in addition to an MH crisis management demonstration to increase familiarity and understanding. Pre-and post-briefing assessments will be administered to assess overall clinician confidence concerning MH crisis management.

Why are you asking me?
You are a part of the operating room staff.

What will you ask me to do if I agree to be in the study?
You will be asked to participate in a 30-minute MH educational briefing and MH crisis demonstration and a 10-minute pre-and post-test survey. Everyone will have the chance to receive the education and participate in the demonstration. If you become tired at any point, you may take breaks, or if you no longer wish to participate, you can stop at any time. The pre-and post-test surveys will be kept confidential in a locked cabinet. The information will only be shared as a summary. No identifying information will be collected. A unique identifier will be used to link the surveys. Everyone will be asked to complete a post-test survey in one month to assess for any changes in confidence and practice.

Is there any audio/video recording?
No, there will be no audio or video recording involved in this quality improvement project.

What are the risks to me?

There are minimal risks in participating in this quality improvement project. If you become tired, you can stop at any time. Risks include potentially feeling embarrassed and short-term loss of confidence. The Institutional Review Board at the University of North Carolina Greensboro has determined this quality improvement project poses a low risk for participants.

Are there any benefits to *me* for taking part in this research study?
You will gain improved confidence and competence in managing an MH crisis.

Will I get paid for being in the study? Will it cost me anything?
There are no costs or payments made for participating in this quality improvement project.

How will you keep my information confidential?
A unique identifier will be used to link the pre-and post-test surveys. No one will know individual responses. Completed paper survey forms will be filed at UNCG in a locked cabinet. After 3 years of secure storage, the surveys will be securely shredded. Paper scores will be kept in a secured locked cabinet at all times. No one's names will be attached to any of the scores collected. Unique identifiers will be used to link the pre-and post-test surveys. The survey information will be entered into an Excel file and will be stored on the PI's password-protected and firewalled personal laptop, which is under her control at all times. The file will be uploaded to BOX.uncg.edu (a secure 3-lock system) for faculty team members to check data and backup during the DNP project. Box is rated a "3-lock" and is secure as long as files are not synced to a hard drive.

Data analysis will be on the investigator's personal password-protected and firewalled computer or secure computers on the UNCG Campus, depending on where the student and faculty are working on the analysis and interpretation. All electronic files and Box files for the project will be deleted after 5 years using an Eraser program.

All information obtained in this quality improvement project is strictly confidential unless disclosure is required by law. The project results will be shared with the hospital but will be done so in a summary format upon the PI's program completion, and no participant names will be used. Only the PI and the DNP faculty project team will have access to the anonymous raw data.

What if I want to leave the study?
You have the right to refuse to participate or withdraw at any time, without penalty. If you do withdraw, it will not affect you in any way. If you choose to withdraw, you may request that any of your data that has been collected be destroyed unless it is in a de-identifiable state. The investigators also have the right to stop your participation at any time. This could be because you have had an unexpected reaction, or have failed to follow instructions, or because the entire project has been stopped.

If you have questions, want more information, or have suggestions, please contact:

Sabrina Zaleski, BSN, RN
Phone: 713-459-2596 Email: sabuckin@uncg.edu

~~Elizabeth McKeithan, MSN, RN~~
~~Phone: 276-732-4207 Email: ecmkeit@uncg.edu~~

~~Vadim Korogoda, DNP, CRNA (Faculty Advisor)~~
~~Phone: 315-272-7557 Email: v_korogoda@uncg.edu~~

~~If you have any concerns about your rights, how you are being treated, concerns or complaints about this project, or benefits or risks associated with being in this project, please contact the Office of Research Integrity at UNCG toll-free at (855) 251-2351.~~