

**Incorporating Malignant Hyperthermia Education into the Lutheran Health Network  
Nurse Residency Week**

Kyle Stevens

NURS 785

May 28th, 2022

I have read and understand the plagiarism policy as outlined in the course syllabus, the Nursing Student Handbook appropriate to my program of study and the USF Student Handbook relating to the USF Academic Integrity and Plagiarism Policy. By affixing this statement to the title page of my work, I certify that I have not violated any aspect of the USF Academic Integrity/Plagiarism Policy in the process of completing this assignment. If it is found that I have violated any of the above mentioned policy in this assignment, I understand the possible consequences of the act(s), which could include dismissal from USF.

# Incorporating Malignant Hyperthermia Education into the Lutheran Health Network

## Nurse Residency Week

### DNP Scholarly Project Final Approval Form

#### DNP Scholarly Project Final Approvals

The DNP student Kyle Rodney Stevens and the Scholarly Project Incorporating MH Education into the Lutheran Health Networks Nurse Residency Week meet all the requirements for the degree of Doctor of Nursing Practice at University of Saint Francis-Fort Wayne, IN.

Date of Final Approval: 6-24-22

DNP Student

Signature: 

DNP Faculty Advisor

Signature: 

Graduate Nursing Program Director

Signature: 

NAP Program Director

Signature: 

Copies to: Student File, Graduate office and attached to the Final Project Manuscript.

## **Executive Summary**

**Background** Research indicates clinician knowledge on managing rare events, such as Malignant Hyperthermia (MH), decreases over time, and new nurses are not adequately prepared to manage deteriorating patients in practice. Malignant hyperthermia is an infrequent medical event, but it can lead to devastating consequences. This rare disease can occur in multiple hospital units. To improve patient outcomes, nurses must understand MH can occur in multiple settings and recognize MH events early so treatment can be initiated. The Lutheran Health Network (LHN) identified a need for newly hired nurses to receive educational training on MH identification. **Methodology** This Doctor of Nursing Practice (DNP) project was an evidence-based quality improvement project designed to increase nursing knowledge on identification and treatment of MH. This project included an in-person MH educational intervention for newly hired OR and PACU nurses during nurse residency week. Participants completed a demographic questionnaire followed by a pre-test survey to assess MH knowledge. Then an educational MH intervention was administered. After the intervention, a post-test was administered to the participants. Data was collected from demographic questionnaires and the pre-test and post-test scores. **Findings** Five aims were used to identify if there was an increase in MH knowledge from the pre-test to post-test scores. As a group, the average percent change increase for all five aims was 152%. The average percent change increase for each question on the post-test was 139%.

**Conclusions and Implications** The findings reveal that an educational intervention as used in this DNP project can increase nursing knowledge on MH. Incorporating this MH DNP project into LHN's nurse residency week is recommended. Furthermore, experienced nurses may benefit from completing an educational intervention as in this project.

## Table of Contents

<b>Chapter 1: Introduction .....</b>	<b>6</b>
<b>Problem Statement .....</b>	<b>6</b>
<b>DNP Project Overview .....</b>	<b>9</b>
<b>Statement of Project Design Type.....</b>	<b>9</b>
<b>Budget and Resources .....</b>	<b>11</b>
<b>Cost.....</b>	<b>11</b>
<b>Description of Resources .....</b>	<b>11</b>
<b>Process and Outcomes .....</b>	<b>11</b>
<b>Chapter 2: Synthesis of Supporting Evidence and Project Framework.....</b>	<b>14</b>
<b>Theory.....</b>	<b>14</b>
<b>Literature Review .....</b>	<b>15</b>
<b>Chapter 3: Project Design.....</b>	<b>20</b>
<b>Chapter 4: Results and Outcomes Analysis.....</b>	<b>26</b>
<b>Data Collection Techniques .....</b>	<b>26</b>
<b>Data Analysis Inferences .....</b>	<b>31</b>
<b>Gaps.....</b>	<b>31</b>
<b>Chapter 5: Leadership and Management.....</b>	<b>32</b>
<b>Organizational Culture.....</b>	<b>32</b>
<b>Change Strategy .....</b>	<b>37</b>
<b>Leadership Style .....</b>	<b>38</b>
<b>Interprofessional Collaboration .....</b>	<b>39</b>
<b>Conflict Management .....</b>	<b>40</b>
<b>Chapter 6: Discussion.....</b>	<b>40</b>
<b>Impact of Project .....</b>	<b>40</b>
<b>Decisions and Recommendations .....</b>	<b>41</b>
<b>Limitations of the Project.....</b>	<b>42</b>
<b>Application to Other Settings .....</b>	<b>42</b>

<i>Strategies for Maintaining and Sustaining .....</i>	<b>43</b>
<i>Lessons Learned.....</i>	<b>43</b>
<i>Chapter 7: Conclusion.....</i>	<b>45</b>
<i>Potential Project Impact on Health Outcomes Beyond Implementation Site.....</i>	<b>45</b>
<i>Proposed Future Direction for Practice .....</i>	<b>46</b>
<i>References.....</i>	<b>47</b>
<i>Appendix A Project Team Agreement Letter.....</i>	<b>57</b>
<i>Appendix B Citi Training Documents .....</i>	<b>58</b>
<i>Appendix C Informed Consent.....</i>	<b>59</b>
<i>Appendix D Pre-test and Post-test Intervention .....</i>	<b>61</b>
<i>Appendix E Permission to Use Prodigy Questions .....</i>	<b>63</b>
<i>Appendix F Demographic Questionnaire .....</i>	<b>65</b>
<i>Appendix G IRB Approval .....</i>	<b>66</b>
<i>Appendix H MH Power Point Presentation .....</i>	<b>67</b>

## **Chapter 1: Introduction**

### **Problem Statement**

The Lutheran Health Network (LHN) identified a need for newly hired nurses to receive educational training on malignant hyperthermia (MH) identification. Literature indicates clinician knowledge on managing rare events, such as MH, decreases over time (Arab et al., 2017; Arriga et al., 2013; Harrison et al., 2006; Hepner et al., 2017; Kazior et al., 2017); and new nurses are not adequately prepared to manage deteriorating patients in practice (Bogossian et al., 2014; Cooper et al., 2010; Sapiano et al., 2018). Education on MH identification was not previously provided during LHN's nurse residency week. Nurse residency week is part of the orientation provided to nurses at the LHN. Malignant hyperthermia is an infrequent medical event, but it can lead to devastating consequences. Even with treatment, approximately five to ten percent of MH episodes can result in death (Nagelhout & Elisha, 2018, Larach et al., 2014). Malignant hyperthermia can occur in multiple settings including the Operating Room (OR), Post-Anesthesia Care Unit (PACU), Intensive Care Unit (ICU), and the Emergency Department (ED) (MAUS, 2021; Seifert et al., 2014). Immediate intervention is needed to prevent death during an MH crisis. To improve patient outcomes, nurses must understand MH can occur in multiple settings and recognize MH events early so treatment can be initiated.

### **Background**

Malignant hyperthermia is a genetically inherited disorder (MAUS, 2021). Commonly used volatile anesthetics (Sevoflurane, Desflurane, Isoflurane, Halothane) and a single depolarizing paralytic agent (Succinylcholine) trigger MH (Spruce, 2020, Cain et al., 2014). Although the exact incidence of MH is unknown, epidemiological data reveals that MH occurs in 1 in 100,000 adult surgeries and 1 in 30,000 pediatric surgeries (MAUS, 2021). Certain areas in

the United States such as Michigan have higher incidences. A MH episode can occur in many settings. The most common setting is in the OR once the patient is placed under general anesthesia; however, Cain et al. (2014) notes that the one-hour period after surgery is also a critical time. Thus, MH can occur in the PACU setting. Additionally, a MH episode can occur in any setting where triggering agents are used such as emergency departments, dental surgeries, a surgeon's office, or intensive care units (MAUS, 2021, Seifert et al., 2014).

### **Management of MH**

With early identification and treatment, the mortality rate for MH is less than 5%, compared to an 80% mortality rate thirty years ago (Nagelhout & Elisha, 2018, p. 775). In 1979, a medication called Dantrolene was introduced to treat MH. Dantrolene is the only medication available to treat MH, and subsequently contributed to a dramatic decrease in death and disability associated with MH (Nagelhout & Elisha, 2018, p.775).

Once a MH episode is triggered, a series of steps must be performed to protect the patient. Nagelhout and Elisha (2018) recommend immediately discontinuing the triggering agent, alerting the surgeon, and calling for help. Next, the definitive treatment, Dantrolene, should be administered. While Dantrolene is being administered, both the oxygen flow rate and the patient's respiratory rate should be increased. Once the patient develops a fever, the patient will need to be cooled. The patient's blood will need to be drawn for a series of lab tests to further guide management. Healthcare clinicians must remain vigilant as MH can cause other complications such as heart dysrhythmias and kidney failure. After the patient is stabilized, the patient will be admitted to the ICU for at least twenty-four hours because there is a 25% risk for the MH to reoccur again over the next thirteen hours (Nagelhout & Elisha, 2018, p. 777).

## **Incidence of MH**

Although the exact incidence of MH is unknown, certain areas in the United States have higher incidences. Michigan, Wisconsin, Nebraska, and West Virginia are higher incidence areas (MAUS, 2021). Additionally, eighty genetic defects are associated with MH, and many patients may not be aware they carry the MH gene (Spruce, 2020). Malignant hyperthermia affects children more than adults and half of all cases occur in children under the age of fifteen years old (Dagestead & Hermann, 2017). Over 90% of people with a MH episode have a negative family history and more than 50% have had a previous general anesthetic that did not trigger MH (Dagestead & Hermann, 2017).

## **PICOT Question**

(P) Among newly hired OR and PACU nurses in the Lutheran Health Network, (I) does completing MH educational training during nurse residency week, (O) improve nursing knowledge and identification of MH?

## **Practice/Knowledge Gap**

During a nurse's career, there are rare medical events such as MH that may never occur. However, a nurse must be able to recognize and initiate treatment for MH. If treatment is not sought, the mortality rate approaches 80% (Nagelhout & Elisha, 2018, p. 775). Nurses must be ready for an MH event, but research indicates that healthcare clinicians' knowledge on rare medical events decreases over time (Arab et al., 2017; Arriga et al., 2013; Cepeda et al., 2017; Harrison et al., 2006; Hepner et al., 2017; Kazior et al., 2017). If medical knowledge on rare events decreases with time, then nurses need periodic education to improve his or her ability to identify and treat MH.



## **Needs Assessment**

The LHN had a gap in practice related to MH knowledge and MH management. Previously, MH education was not included for newly hired nurses during nurse residency week. Sousa et al. (2014) illustrated that a MH educational intervention increases knowledge and qualifies professionals to practice safely. Sousa (2014) deems there is benefit for MH educational interventions. The Malignant Hyperthermia Association of the United States (MHAUS) (2021) explains reasons for continuing MH education. First, to decrease MH patient mortality rates, nurses must understand the basic molecular mechanisms behind MH. Second, MH awareness must increase to limit unnecessary loss of life related to MH. Furthermore, MHAUS (2021) does not indicate how often MH education should be received by nurses.

## **DNP Project Overview**

### **Statement of Project Design Type**

The project design is an evidence-based quality improvement project. As stated in existing literature, knowledge on rare events such as MH decreases over time. Literature also indicates that educational interventions increase knowledge on MH identification and treatment. A project designed to increase MH nursing knowledge has potential to improve nursing practice and patient outcomes when patients exhibit signs and symptoms of MH. Nursing practice related to MH should be improved once nurses complete an MH educational intervention.

### **Scope of Project**

The DNP project included an in-person MH educational intervention for newly hired OR and PACU nurses during nurse residency week. The project took place on February 21, 2022, on the Lutheran Hospital Campus. The DNP project was a quality improvement project because implementation of the project aimed to improve the nurses' ability to identify and treat MH by

incorporating MH education into the residency week curriculum. The DNP project had two overall goals. First, nursing knowledge and MH awareness will increase. Second, increased nursing knowledge will influence an interprofessional response to MH as nurses will be able to alert other team members. The participants completed a pre-test survey to assess MH knowledge. Then a MH education intervention was administered. The participants were seated in a classroom and viewed the presentation. After the intervention, a post-test was administered to the participants. Data was collected from both the pre-test and post-test scores.

### **Stakeholders**

Stakeholders for the quality improvement project included Kyle Stevens (Project Manager, University of Saint Francis DNP student), Dr. Winegarden (Project Advisor, University of Saint Francis faculty), Dr. Louck (University of Saint Francis faculty), and Mrs. Jill Lobacz, (Lutheran Health Network Surgical Services Educator). A project team agreement letter was signed giving permission to implement the project at Lutheran Hospital and that the project will not have to go through Lutheran Hospital's institutional review board (IRB) (See Appendix A).

### **Evidence of Training in Human Subject Protection [CITI Training Certificate]**

Training in human subject protection, CITI training, was completed and certifications were awarded (See Appendix B).

### **Letter of Support from Project Facility**

A letter of support from the project facility was obtained (See Appendix A).

## **Budget and Resources**

### **Cost**

The project budget accounted for direct costs. Overall, the cost for the quality improvement project was approximately \$150. This approximated cost included paper print outs for the pre-test and post-test, copies of the demographic questionnaire, copies of the slideshow, copies of the statistical data created from International Business Machines (IBM) Statistics SPSS Version 27 Software, software for statistical analysis, and the software used to create a MH education Power Point, use of a Lutheran Hospital classroom and the registered nurses' time.

### **Description of Resources**

The LHN generously offered resources for successful implementation of the project. This included the LHN staff's time and use of a classroom. The project manager was responsible for printing the pre-tests and pos-tests. International Business Machines SPSS GradPack was used for statistical analysis. Microsoft PowerPoint and Excel were also utilized.

## **Process and Outcomes**

### **General Timeline**

Initial literature review and planning for the project began March 2021. Development of the project started in April of 2021 and proceeded until faculty approval in November of 2021. The project went before the University of Saint Francis (USF) Institutional Review Board in September 2021. The project was implemented on the Lutheran Hospital campus February 21, 2022. Data analysis began in March of 2022 after implementation of the project ended.

### **Setting and Target Population**

The target setting was the Lutheran Hospital in Fort Wayne, Indiana. The target population was newly hired registered nurses participating in nurse residency week. Inclusion

criteria for the target population was new graduates or experienced registered nurses hired into the PACU or OR unit. Exclusion criteria for the target population included any participant who is not a registered nurse, and who is not participating in nurse residency week.

### **Expected Outcomes**

After the educational MH intervention, the expected outcome was to increase nursing knowledge on MH identification and treatment. The goal was to increase nursing knowledge by 20% compared to pre-test nursing knowledge.

### **Risk Analysis, Informed Consent Procedures, Participant Protection**

Feelings of test anxiety for completing the pre-test and post-test was an identified risk. Another risk was Covid-19 exposure; however, this risk was mitigated by following the LHN's Covid-19 safety protocols. Participants benefited by increasing nursing knowledge on MH. Ultimately, increasing MH nursing knowledge will improve patient outcomes. Also, participants have increased confidence in responding to needs of a MH patient.

### **Risk Analysis/Identification of Any Immediate and/or Long-Term Risks to Participants**

No immediate or long-term risks were identified for the participants. All participants voluntarily participated in the project and could withdraw from the project at any time. Participants were required to sign an informed consent explaining the risks and benefits of the project. A copy of the informed consent is attached in this document (See Appendix C). None of the participants were recorded (audio or video) for this project and deception was not used at any time. The participants were not offered any benefits or compensation for participating in the project.

### **Strategies to Mitigate Any Risks to the Participant**

No deception was used during this project. All participants' information was kept confidential and was not shared with anyone. Personal information was coded and stored on cloud under the protection of a password. The data collected included the pre-test, post-test, and demographic results. The following variables were not collected: the participant's name, the participants social security number, the participant's birth date, the participant's nursing license number, mailing address or phone number. Participation was completely voluntary, and participants could withdraw from the project at any time without penalty. If a participant withdrew, all information collected from the participant was shredded. The information collected was the responses from the demographic questionnaire, the pre-test, and the post-test.

### **Identification of Intent to Obtain Consent From Participants**

Before participants started the project, everyone was asked to fill out the informed consent, which was on paper. The informed consent was provided in person to participants on February 21, 2022. Once the participants understood the risks and benefits, the ability to withdraw without penalty, the nature of the project, the protocol to keep information confidential, the purpose of the project and his or her role in the project, the participants were able to proceed with the project.

### **Type of Document to be Used to Obtain Consent**

The informed consent document can be viewed in this document (See Appendix C).

### **Indication of Intent to Use any/all Audio, Video or Other Form of Recording/**

#### **Deception/Benefits**

Participants were not audio or video recorded nor any other form of recording was used during the project. Informed consent was signed by each participant. Furthermore, no benefits

were awarded to participate in the project other than increasing nursing knowledge on treatment and identification of MH. The participants did not receive any form of compensation. No deception was used in creating, implementing, or evaluating the project.

## **Chapter 2: Synthesis of Supporting Evidence and Project Framework**

### **Theory**

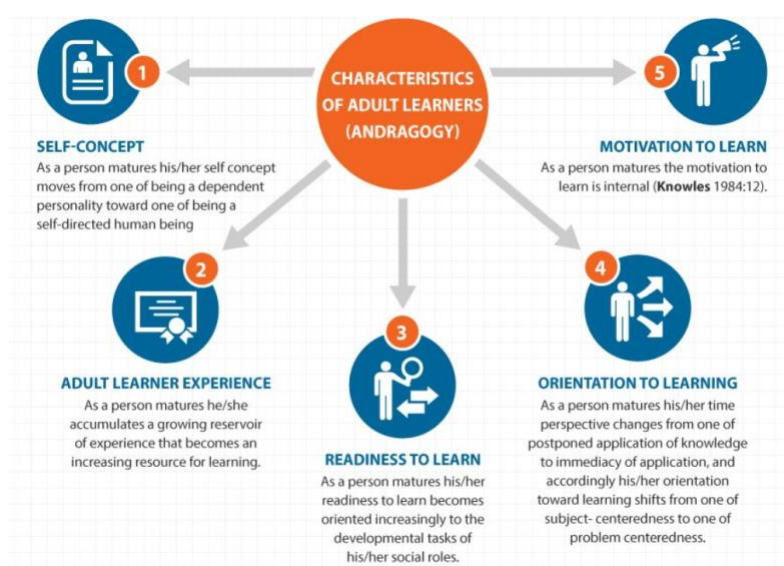
In 1968, Malcolm Knowles proposed that adult learning was different from pre-adult learning. Knowles' Adult Learning Theory is based on characteristics that distinguish the mature adult from the pre-adult learner (Clapper, 2010). These characteristics included self-concept, adult learner experience, readiness to learn, orientation to learning and motivation to learn. Clapper (2010) illustrates these adult learning characteristics in the form of a diagram. The diagram is presented in Figure 1. Each characteristic is unique to the adult learner. For example, Clapper (2010) explains an adult must understand the need to learn something. An adult's prior experience creates a foundation for learning. Next, adults are internally motivated and must want to learn. Finally, adults learn more readily if it is relevant to them (Clapper, 2010).

Nurse graduates and experienced nurses each bring unique experiences into learning. Adults have a greater depth, breadth, and variation in the quality of previous life experiences than younger people (Russell, 2006). Previous life experience is a foundation for new learning. The education provided during nurse residency week will be used by nurses to improve their nursing practice. The reasons most adults enter any learning experience is to create change, and this change can occur in skills, behaviors, or knowledge (Russell, 2006). The MH education is information a nurse needs to know because MH can occur in multiple settings. Nurses can now apply this education to improve patient outcomes by enhancing the nurse's ability to recognize and treat MH.

Since adults learn best when convinced of a need for information, the education for this DNP project illustrated how MH impacts nurses in multiple settings (Russel, 2006). Nurses in various units can create change by having the knowledge and skills to recognize and treat MH. Also, nurses can enhance the strength of the interprofessional team by having the skills to manage MH since treating MH will be an all-hands-on deck team approach.

**Figure 1**

### *Characteristics of Adult learners*



(Pappas, 2013)

## **Literature Review**

An exhaustive literature review was conducted on Malignant Hyperthermia in nursing. Five different data bases were utilized to conduct the search. The databases included CINAHL, Google Scholar, PubMed, Emcare, and Proquest. The search terms included *Malignant Hyperthermia, cognitive aid, simulation, nursing education, knowledge decay, and failure to recognize*. Articles were only used if they were published between 2006-2021. The literature review produced evidence that guided the course of this project.

Anesthesia has many parallels to the aviation industry. Crisis resource management was developed in the aviation industry and is incorporated into the medical specialties such as anesthesia (Krombach et al., 2015; Semler, 2015; Simmons & Huang, 2019; St. Pierre, 2017). The aviation industry developed emergency manuals (EM) to follow in emergent situations. Similarly, EM's exist for clinicians to follow during crisis situations. Two landmark studies introduced the importance of EM use in anesthesia. The first study, *Preventable Anesthesia Mishaps: A Study of Human Factors*, illustrated most preventable errors were human related (Cooper, 1978). Additionally, in 1987, Gaba et al. published, *Anesthesia Mishaps: Breaking the Chain of Accident Evolution*, which was the first study published that included using cognitive aids in anesthesia practice.

### **Safety**

Both simulation training and EM use increases patient safety. Simulation provides a safe environment for practicing technical and non-technical skills (Wunder, 2020). Simulation also enhances teamwork and collaboration (Leithead et al., 2019; Semler et al., 2015). Multiple studies have linked EM use to patient safety (Arriga et al., 2013; Hepner et al., 2017; Simmons & Huang, 2019). For example, Bliss et al. (2012), De Vries et al. (2010), and Neily et al. (2010) illustrated that surgical checklists reduce death rates and complications. Gillespie et al. (2014) and Treadwell et al. (2014) revealed that checklist use decreases post-operative complications and increases error detection. Emergency manuals standardize team performance across a wide range of scenarios. Aside from increasing safety, EM's strengthen teamwork and communication (Leithead et al., 2019; Simmons & Huang, 2019; Villemure et al., 2019).



## **Cognitive Aids Improve Performance**

Research indicates cognitive aids improve performance during simulation and clinical scenarios. Three randomized controlled studies indicated improved performance when a cognitive aid was used. St. Pierre et al. (2017) revealed cognitive aids improved task performance from guidelines and overall task performance for intraoperative ST-elevation myocardial infarction (STEMI). Arriga et al. (2013) illustrated cognitive aids enabled participants to follow life-saving steps during simulation compared to participants who did not have a cognitive aid. Marshall and Mehra (2014) demonstrated that cognitive aid use decreased time for insertion of an infra-glottic airway in a cannot intubate, cannot ventilate scenario. Original research conducted by Kazior et al. (2017) produced evidence that cognitive aids improve critical event management in novice physicians. Harrison et al. (2006) illustrated cognitive aid use correlated significantly with MH treatment scores. Harrison et al. (2006) stated teams that performed the best in treating MH used a cognitive aid extensively throughout the simulation. Neal et al. (2012) demonstrated that participants who utilized a cognitive aid during a local anesthetic systemic toxicity (LAST) scenario had higher medical performance compared to the group who did not use a cognitive aid. For this DNP project, information will be given on cognitive aid use during a MH event. Utilizing a cognitive aid would simplify steps during a MH crisis and prevent nurses from omitting key steps.

## **Non-technical Skills**

Non-technical skills, like teamwork and communication, are vital for safe nursing practice, and many studies examined if simulation improved non-technical skills. Simulation has shown to improve non-technical skills such as communication and teamwork (Arab et al., 2017; Bong et al., 2017; Flynn et al., 2017; Marshall & Mehra, 2014; Mossenson et al., 2020). Non-

technical skills can be learned from simulation (Garden et al., 2017). Simulation is superior in developing teamwork skills compared to traditional didactic education (Huang et al., 2018; Lai et al., 2018; O'Regan, 2016; Semler et al., 2015). Neal et al. (2012) demonstrated that using a checklist as a cognitive aid increased non-technical skill performance during a LAST simulation. Non-technical skills are critical during a crisis management scenario (Lai et al., 2018).

### **Knowledge Decay**

Malignant Hyperthermia is a rare medical event in nursing that a nurse may never encounter. Some studies suggest clinician knowledge on rare events decays over time. (Arab et al., 2017; Arriga et al., 2013; Cepeda et al., 2017; Harrison et al., 2006; Hepner et al., 2017; Kazior et al., 2017). Blanie et al. (2018) found learners decay of knowledge occurred significantly at three months. Interestingly, Hepner et al. (2017) presented evidence that key steps are omitted in crises. A cognitive aid is useful to help clinicians remember critical steps in managing these rare medical events (Harrison, 2006). Memory alone may not be enough for the clinicians to manage the event (Simmons & Huang, 2019).

Rare medical events are best managed by following certain steps. Emergency manuals and crisis checklists have shown to enhance patient safety by decreasing errors (Blanie et al., 2020; Kazior et al., 2017; Simmons & Huang, 2019, St. Pierre et al., 2017). Checklists standardize team performance across a wide range of scenarios. In similar fashion, crisis checklists help clinicians follow key steps during a crisis (Gillespie et al., 2014; Hepner et al., 2017, Krombach et al., 2015). Blanie et al. (2020), Hepner et al. (2017), and McEvoy et al. (2014) suggest that there is failure to adhere to best practices during an emergency situation.

### **Active Participant Versus Observer**

Simulation studies have examined the active participant role and the observer role. During a simulation, there are limited learning opportunities. This occurs due to cost and the high demand for simulation training. Also, there is a greater number of participants than there are instructors. Some participants are only able to observe the simulation and not actively participate. O'Regan et al. (2016) explains, "Increasing demand, cohort numbers and access limitations, particularly in professional entry programs has resulted in innovative approaches for learners using simulation" (p. 2). Participants who observe still have improved learning outcomes (Blanie et al., 2018; Blanie et al., 2020; Bong et al., 2017; Lai et al., 2016; Reime et al., 2017). The learning outcomes for observers and active participants are not significantly different (Blanie et al., 2018; Lai et al., 2016; Reime et al., 2017). In each study listed above, both active and observation participants took part in the debriefing period after the simulation. Even if nurses view a simulation, there is still educational benefit.

### **New Nurses Not Prepared to Handle Deteriorating Patient**

As students become practicing nurses, students may not integrate the management of a deteriorating patient into their knowledge and practical competency (Sapiano et al., 2018). New nursing graduates must practice safely in the clinical environment. Furthermore, new nurses must respond effectively to complex emergency situations (Sapiano et al., 2018). However, the literature indicates new nurses are not adequately prepared to manage deteriorating patients in practice (Bogossian et al., 2014; Cooper et al., 2010; Sapiano et al., 2018). The MH education provided during nurse residency week will afford nurses the opportunity to recognize and treat a MH patient. Thus, in practice the nurses will have the knowledge to manage a deteriorating patient and prevent a negative outcome.

## **Summary of Supportive Evidence**

Today, healthcare organizations encounter complications (Burke et al., 2020). Malignant Hyperthermia is a low frequency, high impact event with devastating consequences if not quickly recognized and treated. Early identification of an impending MH crisis and prompt emergency response is critical for a patient's survival (Nagelhout and Elisha, 2018, p. 775). Nurses must have the ability to recognize MH because early identification of an impending MH crisis and prompt emergency response is vital to achieve a positive patient outcome. Furthermore, MH can occur in multiple settings where triggering agents are administered.

As supported above by the literature, cognitive aid use, EM's, and simulation provide support to help clinicians manage MH events. As knowledge on rare events deteriorates over time, nurses must have the necessary tools and training to improve their ability to recognize and treat MH. Cognitive aids and EM's have shown to improve clinical performance during a rare event such as MH. Furthermore, research indicates simulation training provides valuable experience for improving one's ability to manage and treat a rare event. Concepts gained from the exhaustive literature search such as EM use, cognitive aids, and simulation was woven into the MH education presented to LHN nurses. The aim was to increase MH identification and treatment by providing education to LHN nurses.

## **Chapter 3: Project Design**

### **Project Design and Methodology**

The project design is an evidence-based quality improvement project. Incorporating MH education into the nurse residency week curriculum aimed to improve the nurses' ability to recognize and treat MH. As stated in existing literature, knowledge on rare events such as MH decreases over time (Arab et al., 2017; Arriga et al., 2013; Cepeda et al., 2017; Harrison et al.,

2006; Hepner et al., 2017; Kazior et al., 2017). Literature also indicates that educational interventions increase knowledge on MH identification and treatment (Sousa, 2014). A project designed to increase MH nursing knowledge has potential to improve nursing practice and patient outcomes. This project included an in-person MH educational intervention for newly hired OR and PACU nurses during nurse residency week. The goal of the project was to increase nursing knowledge and awareness on MH. Also, an additional goal was that increased nursing knowledge will influence an interprofessional response to MH as nurses will alert other team members. On the day of the project, participants completed a demographic questionnaire followed by a pre-test survey to assess MH knowledge. Then a MH educational intervention was administered. The participants were seated in a classroom and viewed the presentation. After the intervention, a post-test was administered to the participants. Data was collected from both the pre-test and post-test scores.

### **Intervention Plan**

The intervention plan was MH education in the form of a Power Point. The participants filled out the informed consent. Next, participants completed the demographic questionnaire. Then, the participants completed the pre-test. After completing the pre-test, the participants participated in the MH educational intervention, which lasted approximately one hour. The learning objectives for the project included discussing the epidemiology of MH, explaining triggering agents, identifying the early and late signs of MH, and discussing the process to mix dantrolene. After receiving the educational intervention, the participants completed the post-test. The informed consent, demographic questionnaire, pre-test, and post-test were placed in a locked bin next to the project manager for collection. The MH educational Power Point mirrors Lutheran's MH policy.

## **Ethical Considerations**

This project was submitted and approved by the University of Saint Francis Institutional Review Board (IRB) (See Appendix G). The project manager completed CITI training in human subject protection before submitting to the IRB at the University of Saint Francis. The CITI training documents were completed February 2021 (See Appendix B). The Lutheran Hospital IRB was consulted by Mrs. Jill Lobacz, and the Lutheran IRB said this DNP project did not need to be presented to the Lutheran Hospital IRB. Lutheran Hospital is the supporting site for this project. All participants in the project signed an informed consent before participating (See Appendix C). During implementation of the project, Lutheran Hospital Covid-19 protocols were followed. The dignity and respect of each participant were upheld. The information obtained from the participants was securely and non-identifiably collected. The project manager upheld the ethical standards of USF and the Lutheran Health Network.

## **Project Schedule**

Initial literature review and planning for the project began March 2021. Development of the project started in April of 2021 and proceeded until faculty approval in November of 2021. The project was submitted to USF's institutional review board in September 2021. The project was implemented at Lutheran Hospital on February 21<sup>st</sup>, 2022. After the project had ended, analysis of the data began in March of 2022.

## **Implementation Methods**

This project has an evidence-based quality improvement design. The project's goal was to increase nursing knowledge on MH identification and treatment. As indicated above, MH is a rare event, but if it occurs, devastating consequences can result. Furthermore, as evidenced above, clinicians' knowledge on rare events decreases over time, and new nurses are not

adequately prepared to manage deteriorating patients. Providing MH education during LHN's nurse residency week has the potential to improve nursing knowledge related to MH and ultimately improve patient outcomes. Nurses must understand MH symptoms, triggering agents, locations where MH can occur, and MH treatment. An increase in nursing knowledge can lead to improved identification and treatment of MH in the future.

The MH evidence-based quality improvement project was implemented in person at Lutheran Hospital. The project manager was responsible for presenting the MH educational Power Point and providing all materials to the participants. The learning objectives for the project include discussing the epidemiology of MH, explaining triggering agents, identifying the early and late signs of MH, and discussing the process to mix Dantrolene. The duration of the project was approximately one hour. Participants first filled out a demographic questionnaire and a pre-test. Next, a MH Power Point presentation was viewed by participants. Then, a post-test was completed by the participants. All documents were placed in a locked bin next to the project manager on the day of the project. The next day, the project manager compiled the data from the pre-test and post-test into a personal password protected computer. The data obtained from the pre-test, post-test and demographic questionnaire was then entered into IBM Statistics SPSS Version 27 Software, to compute descriptive statistics and a percent change to see if the project's aims were met. The project findings were presented to faculty and peers in June of 2022.

## **Tool**

The tool used to collect data was a pre-test and post-test. The questions were adapted with permission from Peter Stallo, owner of Prodigy Anesthesia. The tool can be viewed in this document (See Appendix D). The tool was reviewed by Dr. Cotrell, University of Saint Francis

Assistant Anesthesia Program Director, and Dr. Osborne, South College Anesthesia Program Director to confirm that the tool is valid.

### **Evaluation Plan**

The aims of the project included identifying the most common signs of MH, correctly identifying MH triggering agents, identifying the correct process to mix Dantrolene, identifying the early and late signs of MH, and increasing nursing knowledge and ability to recognize MH. Each participant viewed an educational MH Power Point. Each aim was evaluated by comparing the data from the pre-test and post-test collected on the day of implementation by the project manager. On the day after the project was completed, the project manager entered the data into a personal password protected computer. Next, the data was entered into IBM Statistics SPSS Version 27 Software, where a descriptive statistic and a percent change test was utilized to analyze the data. The percent change test was used to see if there was an increase in post-test scores by 20% for each aim. The data was permanently destroyed in the summer of 2022 after the dissemination of the project.

### **Methods for Collection of Data**

Data was collected in person on the day the project was implemented. Each participant filled out the demographic questionnaire, pre-test, post-test, and the informed consent. The informed consent, demographic questionnaire, pre-test, and post-test were in paper format and were given on the day of implementation. After completion of the project, data was entered in IBM Statistics SPSS Version 27 Software, where descriptive statistics and a percent change were performed.



## **Data analysis plan**

The data was cleaned and entered into IBM Statistics SPSS Version 27 Software. Descriptive statistics and a percent change test was performed. An increase in nursing knowledge on identifying the most common signs of MH was one of the aims of this quality improvement project; and an assessment of nursing knowledge gained following the educational MH Power Point was calculated with percent change analysis of both the pre-test and post-test results. An increase in nursing knowledge in correctly identifying MH triggering agents following the MH educational Power Point was calculated with a percent change analysis of both pre-test and post-test results. An increase in nursing knowledge in identifying the correct process to mix Dantrolene following the MH educational Power Point was calculated with a percent change analysis of both pre-test and post-test results. An increase in nursing knowledge following the MH educational Power Point was calculated with a percent change analysis of both pre-test and post-test results. An increase in nursing knowledge and ability to recognize MH following the MH educational Power Point was calculated with a percent change analysis of both pre-test and post-test results.

## **Dissemination Plan**

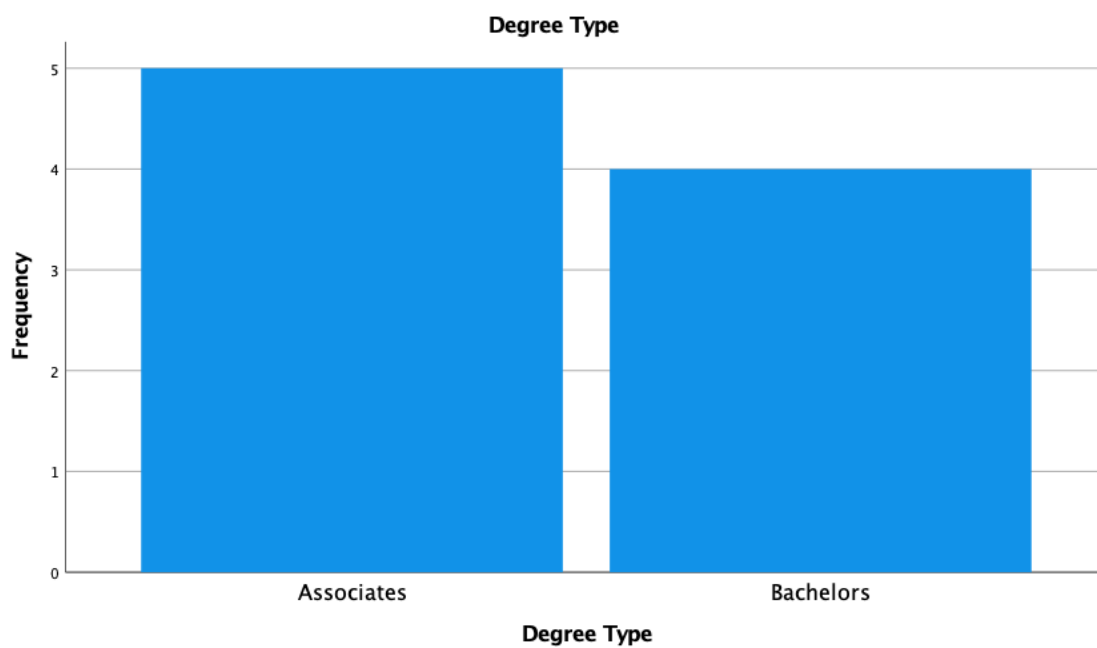
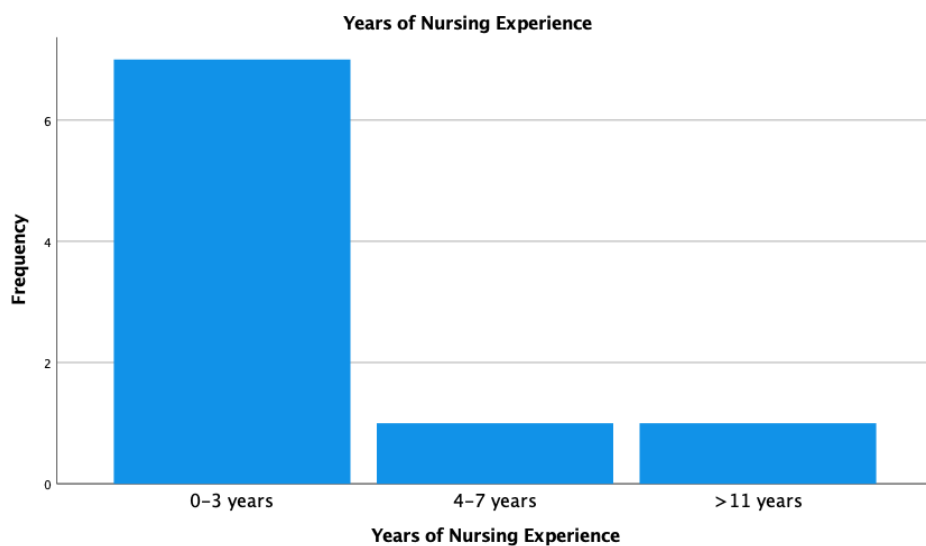
The project was disseminated in a formal presentation to the USF DNP faculty, Nurse Anesthesia program faculty, and peers. The final manuscript was shared with Mrs. Jill Lobacz, Lutheran Health Network Surgical Services Educator. The written proposal was submitted to faculty for review and approval. The project was conducted at Lutheran Hospital. The project was deposited in the USF DNP Project Repository. The written formal presentation included an executive summary and information about data analysis. The project manager discussed how the aims and outcomes for the project were met.

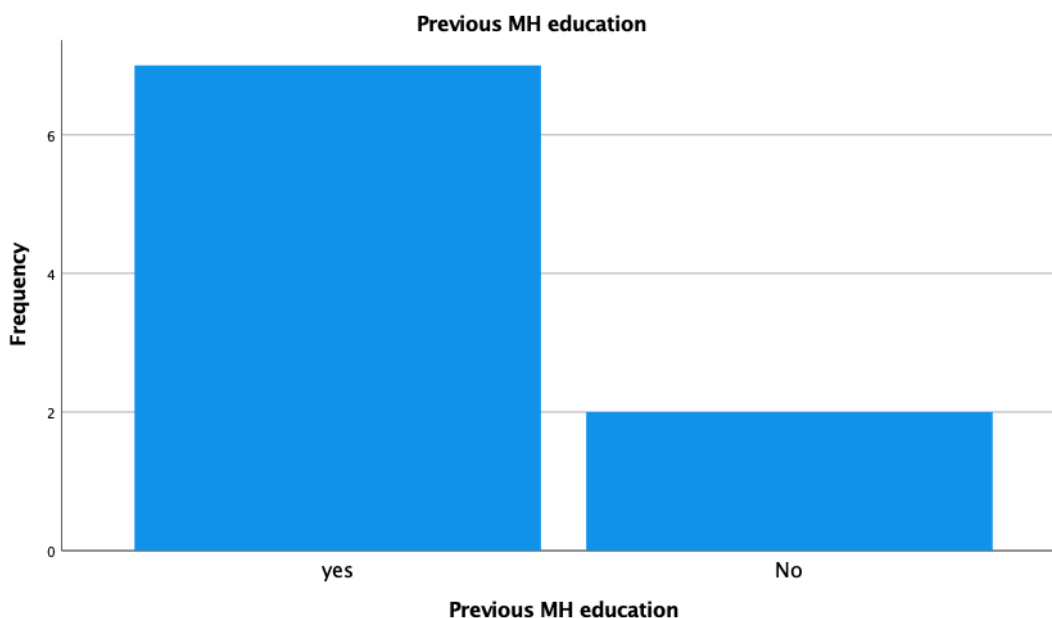
## **Chapter 4: Results and Outcomes Analysis**

### **Data Collection Techniques**

The data was collected in person on the day the project was implemented. Each participant filled out an informed consent, demographic questionnaire, and pre-test. Then, a MH educational Power Point was presented. After the presentation, the participants completed a post-test. The project manager was responsible for collecting the data. The data was entered into Microsoft Excel and IBM Statistics SPSS Version 27 Software. Descriptive statistics and percent change were calculated. Before project implementation, a power analysis was completed to determine the necessary sample size for statistical significance ( $p < 0.05$ ). The necessary sample size was thirty-four. The N participants were nine ( $N=9$ ). All nine participants completed the demographic questionnaire, pre-test, and post-test.

Of the nine participants, five had associates degrees and four held bachelor's degrees. Seven participants had between zero to three of nursing experience, one participant had four to seven years of nursing experience, and one participant had over eleven years of nursing experience. Seven participants had previous MH education, and two participants did not have previous MH education. See Figures 4.1, 4.2, and 4.3 below.

**Figure 4.1***Degree type***Figure 4.2***Years worked as a Nurse*

**Figure 4.3***Participants with Previous MH Education***Measures/Indicators**

The data was evaluated based on the aims of the project. The project's aims included (1a) identifying the most common signs of MH, (1b) correctly identifying MH triggering agents, (1c) identifying the correct process to mix Dantrolene, (1d) identifying the early and late signs of MH, and (1e) increasing nursing knowledge and ability to recognize MH. To meet the project's aims, the project manager's goal was to increase pre-test to post-test scores by 20% for each aim.

Questions from the pre-test and post-test were used to identify if the percent change for each aim was met. For (1a), identifying the most common signs of MH, question two from the pre-test and post-test was utilized. For (1b), correctly identifying MH triggering agents, questions three and five from the pre-test and post-test were used. For (1c), identifying the correct process to mix Dantrolene, question seven was utilized. For (1d), identifying the early

and late signs of MH, utilized questions two and four. And (1e), for increasing nursing knowledge and ability to recognize MH, questions one, three, and seven were utilized. Pre-test and post-test questions can be seen in Appendix D.

The first aim, (1a) correctly identifying MH triggering agents, was to increase the ability to identify the most common signs of MH. The desired outcome was to increase pre-test to post-test scores by 20%. Pre-test results for (1a) was 55.6%. Post-test results increased to 100%. The percent change increase for (1a) was 79%. Therefore, the outcome was met.

The second aim (1b) sought to identify MH triggering agents by utilizing pre-test and post-test results. The desired outcome was a 20% increase from pre-test to post-test scores. The 1(b) pre-test score was 50%, and the post-test score was 94.4%. The percent change for (1b) was 88.8%. Therefore, the outcome was met.

The third aim (1c) intended to identify the correct process to mix Dantrolene. The desired outcome was a 20% increase from pre-test to post-test scores. The pre-test score was 22.3%, and the post-test score was 100%. The percent change for (1c) was 350.5%. Therefore, the outcome was met.

The fourth aim (1d) sought to increase nursing knowledge on identifying the early and late signs of MH. The desired outcome was a 20% increase from pre-test to post-test scores. The pre-test score was 55.6% and the post-test score was 94.4%. The percent change for (1d) was 69.8%. Therefore, the outcome was met.

The fifth aim (1e) intended to increase nursing knowledge and the ability to recognize MH. The desired outcome was a 20% increase from pre-test to post-test results. The pre-test score was 36.8%, and the post-test score was 100%. The percent change increase for (1e) was

171.8%. Therefore, the outcome was met. The percent change results for each aim can be seen in Table 1 below.

**Table 1**

*Percent Change Results for Aims 1-5*

	Pre-test Result	Post-test Result	Percent Change Increase
Aim 1	55.6%	100%	79%
Aim 2	50%	94.4%	88.8%
Aim 3	22.2%	100%	350.5%
Aim 4	55.6%	94.4%	69.8%
Aim 5	36.8%	100%	171.8%

The project manager also analyzed the percent change for each question on the pre-test and post-test. Results can be seen in Table 2 below.

**Table 2**

*Percent Change Results for Questions 1-7*

	Pre-Test Score	Post-Test Score	Percent Change
Question 1	44.4%	100%	125.2%
Question 2	66.7%	100%	50%
Question 3	44.4%	100%	125.2%
Question 4	44.4%	88%	98.2%
Question 5	33.3%	100%	200.3%
Question 6	77.8%	100%	25.5%
Question 7	22.2%	100%	350.5%

### **Data Analysis Inferences**

The seven-question pre-test mean score was 46%. The mode score on the pre-test was 57.1% (N=3). The low score on the pre-test was 0% (N=1). The high score on the pre-test was 85.7% (N=1). Question seven on the pre-test (regarding what type of fluid is used to mix Dantrolene) was the most missed question with 77% (N=7) of the participants missing it. Question three (selecting two MH triggering agents) was the most common correct answer on the pre-test with 55% of participants answering it correctly (N=5). Compared to the pre-test mean score (46%), the post-test mean score was 97%. The lowest score on the post-test was 85.7% (N=3). The highest score was 100% (N=6). The mode score for the post-test was 100% (N=5). The most missed questions on the post-test were question four and five question (N=2). The most correctly answered questions on the post-test were one, two, three, five, six and seven with 100% of the participants answering the questions correctly.

### **Gaps**

A noted gap in the analysis was sample size. The recommended sample size was 34 for statistically significant data when calculating a paired t-test. A power analysis was calculated with a power of 0.8 for a significance interval of  $<0.5$  and effect size of 0.500. Nine participants completed the project. Thus, a percent change calculation was utilized to see if the project's outcomes were met as seen above.

### **Unanticipated Consequences**

The only unanticipated consequence was the project manager expected only newly hired nurses in the PACU and OR to participate in the project. However, new nurses from the ICU and ED also participated. Having ICU and ED nurse participants was unanticipated but helped to increase the number of participants for the study.

## **Expenditures**

No expenditures existed for the analysis portion of this project. Access to IBM Statistics SPSS Version 27 Software was available free of charge through the University of Saint Francis.

## **Chapter 5: Leadership and Management**

### **Organizational Culture**

Nursing innovation is fundamental for healthcare organizations to stay ahead of the curve. Healthcare organizations must continually evolve to meet demand and provide quality care. Before innovation or change occurs, there must be a willing organization. An organization's culture needs assessment to ensure that change will be accepted. Before the project manager implemented the Doctor of Nursing Practice (DNP) project, the Lutheran Health Network's (LHN) organizational culture was assessed. This assessment was important to understand so that a DNP project could be developed that fit into LHN's organizational culture. The Burke and Litwin Model will be discussed as a diagnostic tool for organizational effectiveness. The LHN will be examined, which will encompass the organizational and political culture, the leadership style, and the planned interprofessional collaboration. A change strategy will be introduced for incorporating Malignant Hyperthermia (MH) education into LHN's nurse residency week.

### **Burke and Litwin Model**

The Burke and Litwin Model as seen in figure 5.1, published in 1992, was created to diagnose organizational effectiveness (Spangenburg & Theron, 2013). Burke and Litwin (1992) created an encompassing model that combined what is understood in practice as well as what is known from research and theory. The Burke and Litwin Model hypothesizes how performance is affected by internal and external environments. Spangenburg and Theron (2013) emphasized that



the Burke and Litwin Model illustrated that environmental impact has the biggest influence on an organization's business strategy. This model is based on an open systems theory.

The Burke and Litwin Model predicts behaviors and performance outcomes. Changing or assessing a healthcare organization is a complex process. Healthcare organizations have many components that all must function together to successfully operate. The Burke and Litwin Model provides a framework to assess the organizational and environmental dimensions of a healthcare organization (Spangenburg & Theron, 2013). By assessing the organizational and environmental dimensions, a change in performance can be achieved. Furthermore, the Burke and Litwin Model is a guide for organizational diagnosis and organizational change.

**Figure 5.1**

*Burke and Litwin Model*



(Boone, 2015)

A strength for the Burke and Litwin Model is the differentiation between transformational and transactional leadership (Spangenburg & Theron, 2013). Transactional and transformational leadership are different leadership styles. Transactional leadership allows both the leader and the follower to obtain something (Grossman & Valiga, 2017, p.110). For example, the leader gets the goal completed, and the follower obtains a promotion (Grossman & Valiga, 2017, p.110). On the other side, transformational leadership motivates both the leader and the follower to new levels. Grossman and Valiga (2017) explain, “This motivation energizes people to perform beyond expectations by creating a sense of ownership in reaching the vision” (p. 110). Certain components of the Burke and Litwin Model relate to both transactional and transformational leadership. The model explains the difference between leadership and management (Spangenburg & Theron, 2013). Furthermore, leadership style is essential for creating a culture of innovativeness (Joseph, 2015).

The Burke and Litwin Model has twelve organizational dimensions that include external environment, mission and strategy, leadership, organizational culture, structure, management practices, systems, work unit climate, task and individual skills, individual needs and value, motivation, and individual and organizational performance (Reflect & Learn, n.d.). In *A Causal Model of Organizational Change*, by Burke and Lutwin (1992), each organizational dimension is explained. The external environment is any outside factor that influences the performance of the organization. The mission and strategy are defined by top level management. The mission and strategy also reflect employee beliefs, which is a central purpose of the organization. Leadership involves executives providing organizational direction and serving as role models to staff. Burke and Lutwin (1992) define culture as a collection of overt and covert rules, values, and principles that guide behavior. Structure divides functions and people into specific areas and levels of

responsibility, builds decision making authority, creates communication, and opens relationships. Burke and Lutwin (1992) define management practices as what managers do in the normal course of events to use human and material resources at their disposal to carry out the organizational strategy. Systems are policies and mechanisms in place that facilitate work. Climate is similar to the current impressions, feelings, and expectations that staff members have about the organization. Task requirements and individual skills are required behavior for task effectiveness. Staff must have the specific skills and knowledge to complete the work. Burke and Lutwin (1992) explains individual needs and values are physiological factors that provide desire and worth for individual actions or thoughts. Motivation allows employees to work towards goals. Individual and organizational performance is the outcome or the indicator of effort and achievement.

The Burke and Lutwin Model lists the different organizational dimensions on a chart. On the top is the external environment. Underneath is the internal environment consisting of transformational factors which include mission and strategy, leadership, and organizational culture. The bottom half of the chart lists transactional factors. Some transactional factors include structure, policies and procedures, work unit climate, and motivation. Boone (2012) explains, "It appears that the entire organization is affected in this case, thus requiring some degree of change in both transactional (day to day) and transformational (deep structure) levels of organization" (p. 3). Both transactional and transformational factors influence one another. The deep transactional factors trickle down to change the daily transactional factors. Likewise, transactional factors create feedback that directly ties into the transformational factors.

## **Lutheran Health Network Leadership Style**

The LHN has a mission statement and values that are incorporated into each LHN hospital. The mission statement and values are a foundation for the organizational culture that exists. The LHN mission statement reads, “Lutheran Hospital is committed to meeting the healthcare needs of its clients in northeast Indiana and the surrounding tri-state area through innovative services and network relationships that emphasize quality and value” (Lutheranhealth.net, n.d.) The LHN mission statement is patient centered and indicates providing a high standard of care for the people of northeast Indiana.

The LHN also outlines a set of values. The LHN provides services for diagnosis, treatment, rehabilitation, and health improvement (Lutheranhealth.net, n.d.). Next, high standards of ethics and professional performance are expected from staff members (Lutheranhealth.net, n.d.). The LHN is committed to exploring, developing, and implementing new concepts and re-evaluating existing programs with the aim of improving services and optimizing resources (Lutheranhealth.net, n.d.). Finally, the LHN serves the people regardless of race, gender, age, religious belief, or economic status (Lutheranhealth.net, n.d.).

By reviewing the LHN mission statement and values, an assessment can be made on the organizational culture and the readiness for transformational change and innovation. Certain elements of the LHN’s values highlight a readiness for change. For example, the LHN values a continual organizational improvement, which allows for outside ideas to enhance the overall organization’s performance. The LHN incorporates a belief that programs must continually be evaluated to improve performance. The LHN organizational culture illustrates a pro-active and not stagnant approach for improved services and optimization. The DNP project coalesces with the LHN values because it enhances organizational change and overall organizational

performance. Finally, the LHN mission statement and values set a standard for innovative practice.

### **Community Health Services**

The political environment is influenced by both Community Health Services (CHS) and the LHN. First, the LHN is affiliated with Community Health Services (CHS). CHS is a large corporation that encompasses multiple hospitals across the United States. CHS has a code of conduct that features a statement of beliefs that set the standard for the CHS organizational culture. The statement of beliefs illustrates that providing safe patient care is the fundamental responsibility (CHS.net, n.d.). Also, CHS values a work culture where employees are treated fairly and where their ideas are encouraged (CHS.net, n.d.). Furthermore, CHS advocates for positive change and supports innovation in the advances of healthcare delivery. The LHN employee handbook introduces policies including but not limited to employee practices, employee relations, risk management and safety, and employee separations (Lutheran Health Physicians Employee Handbook, 2020).

### **Change Strategy**

The Pettigrew and Whipp's Model of Strategic Management and Change was utilized as a change strategy for incorporating MH education into the LHN's nurse residency week. Incorporating change can be challenging. White et al. (2016) explains, "Commonly described challenges involved in any change implementation include gaining internal support, ensuring effective leadership, integrating with existing programs, and developing a supportive organizational culture" (p. 59). However, change is existential for organizational survival (White et al., 2016). For change to occur, behaviors must be modified. White et al. (2016) states, "Theories of behavior change plan for and manage attitudes, norms, intentions, self-efficacy,

benefits, fears, resistance and perceived barriers to change” (p. 60). Before the DNP project implementation, both the project manager and the LHN found common ground in agreeing that incorporating MH education into nurse residency week would be beneficial. Each side was agreeable in modifying ideas and plans so the DNP project could be implemented.

The Pettigrew and Whipp’s Model of Strategic Management and Change has three essential elements of strategic change that include context, content, and process (White et al., 2016). White et al. (2016) describes each element. First, the context includes both the internal and external factors driving the change. Second, the content describes the activities of change. And third, the process includes the methods and strategies for change. For the implementation of this DNP project, LHN acted as an internal force by demonstrating a need for MH education for newly hired nurses, whereas the project manager was an external force offering MH education to the LHN. The activities for change included creating MH education that was agreed by the project manager and the LHN. The process included presenting the MH education for newly hired nurses and allowing the LHN to utilize the MH education from this DNP project for future use.

### **Leadership Style**

Transformational leadership was utilized for implementing and disseminating this DNP project. As this project was created, refined, and eventually disseminated, many obstacles occurred. Transformational leadership demonstrated by the project manager and the interprofessional team ultimately allowed for a successful outcome for the DNP project. As explained above, transformational leadership allows people to perform beyond expectations by creating a sense of ownership in the vision (Grossman & Valiga, 2017, p.110). Each member of the interprofessional team and those who participated in the project had individual goals. For

example, the project manager of this project wanted to create a DNP project on MH, the LHN wanted MH education incorporated into nurse residency week, and the participants wanted to gain information on MH. Yet each party demonstrated ownership in the DNP project.

The DNP project offered more than a transaction where each member of the interprofessional team received something. The transformational leadership employed by the project manager allowed for the interprofessional team to benefit beyond their immediate self-interests. The DNP project manager welcomed and followed input from the LHN. Moving forward the LHN network will utilize the MH education for future nurses. The participants benefited by receiving MH education, but their participation allowed for the project manager to see what worked well and did not work well so future MH education presentations can be adjusted. This will help the LHN with future presentations on MH education. The participants were able to ask questions and offered views on MH during the presentation. A sense of belonging was felt among the interprofessional that fostered a successful DNP project implementation.

### **Interprofessional Collaboration**

The interprofessional team involved Mrs. Jill Lobacz, Dr. Winegarden, Dr. Louck, and newly hired nurses from the OR, PACU, ED, and ICU. Mrs. Jill Lobacz has a master's degree in nursing education. Dr. Winegarden has earned a DNP degree. Dr. Louck has a degree in Doctor of Nurse Anesthesia Practice. Mrs. Lobacz had the role of facilitating the MH education into nurse residency week and creating a time for when the education was disseminated. Mrs. Lobacz also aided in providing the date and time for the newly hired nurses to participate in the MH education. The newly hired nurses were the participants. They participated in the MH education and completed a pre-test and post-test evaluation. The interprofessional team was invested in the

project and worked well together. Those who participated in the project were engaged during the MH education.

### **Conflict Management**

To prevent conflict management, one must understand if the change is a fit into the organization and is feasible to implement (White et al., 2016). Malignant Hyperthermia education is relevant to OR, PACU, ICU and ED staff. As previously stated, MH can occur in multiple areas within the hospital. Also, the network surgical services educator at LHN voiced a need for further MH education during nurse residency week. By having internal support, a basis was formed to counter act any conflict. Also, the MH education will be incorporated into an existing nurse residency program. A nurse residency week already exists at the LHN.

However, the DNP project was not implemented without conflicts. For example, disputes over the extent of detail for the MH education arose. The extent of detail on the pathophysiology of MH and on the number of medications listed in the MH education that do not trigger MH were discussed among the interprofessional team. Additionally, the project manager was not aware that newly hired nurses from the ED and ICU would be participating in the project until shortly before the planned date for implementation. The original plan was for the participants to be newly hired OR and PACU nurses. These conflicts were overcome by having open communication and flexibility with the surgical services nurse educator. The DNP project was adjusted in order for each party to be satisfied.

## **Chapter 6: Discussion**

### **Impact of Project**

The overall goal of the project was to educate newly hired nurses on MH. The learning aims for the project included identifying the most common signs of MH, correctly identifying



MH triggering agents, identifying the correct process to mix Dantrolene, identifying the early and late signs of MH, and increasing nursing knowledge and ability to recognize MH. All five aims were met. As discussed in Chapter 4, there was a greater than 20% increase in scores from the pre-test to post-test for each aim. The participants in the project now have increased nursing knowledge related to MH and can create positive impacts when caring for a patient with a MH history. Also, the participants will be able to share the information with other nurses on their respective units. Additionally, the project will be incorporated into the LHN nurse residency week. The project will impact future LHN nurses because they will receive this education during nurse residency week.

### **Decisions and Recommendations**

This DNP project revealed an increase in learning related to MH. The demographic data revealed that seven of nine participants had previous MH education. And yet the pre-test to post test scores increased well over 20% for each aim and for each question. From the results of the project, the project manager believes it was beneficial for LHN to want MH education incorporated into nurse residency week. The project manager was glad the LHN nurse educators decided to include nurses from the ED and ICU. This increased the sample size, and MH education is very relevant to ED and ICU nurses. Finally, an initial idea by the project manager was to create a MH education video for newly hired nurses to view during nurse residency week. However, the project manager decided to create a Power Point presentation instead. The project manager believes the Power Point presentation created a better learning environment for presenting the MH education than would have a video. During the Power Point presentation, the participants were able to interact with the project manager and ask questions.

An additional recommendation for this DNP project would be to add a mock MH simulation. Participants could complete the project and then perform a mock MH simulation. A mock simulation is a possible addition to the project manager's DNP project and could help the participants solidify what they learned. Finally, the project manager would recommend that all nurses employed by LHN complete this project to improve their knowledge on MH.

### **Limitations of the Project**

The sample size was one limitation. Nine newly hired nurses participated in the project. Only newly hired nurses are required to attend the nurse residency week at LHN. Thus, the number of participants depended on how many nurses were recently hired. The project manager was informed by Mrs. Lobacz that it would be hard to determine how many participants would be available since it was uncertain to know the number of new nursing hires. Ultimately, the implementation date was set for February 21<sup>st</sup>, 2022, because Mrs. Lobacz believed this would ensure the largest sample size for the project.

### **Application to Other Settings**

This project could be merge into a nursing school's curriculum. The demographic data revealed two participants did not have prior education on MH, and this project could be used to teach nursing students. Furthermore, only nurses enrolled in nurse residency week completed the project. The LHN would benefit by having experienced nurses complete this project. Other members of the multi-disciplinary team such as respiratory therapists, physical therapists, occupational therapists, and patient care technicians would benefit by completing this project as these team members could be on the floor when a MH event occurs.

## **Strategies for Maintaining and Sustaining**

The LHN voiced a need for incorporating MH education into nurse residency week. The project was specifically created for LHN. After the project was implemented, the project was gifted to LHN. Moving forward, LHN will be able to use the project to educate nurses on MH. This project will also be published in the USF DNP repository and can serve as guide for future projects related to MH.

## **Lessons Learned**

Creating and implementing Malignant Hyperthermia education into Lutheran's nurse residency week provided many learning opportunities. First, it took a great deal of timing and planning to successfully implement. Clear and timely communication was key for the development and implementation of the project. Having flexibility was important. For example, the project manager was informed briefly before the project implementation date that nurses from the ICU and ED would be participating in addition to OR and PACU nurses.

Next, upon reflection, there was positive feedback and things that could have been improved. Mrs. Lobacz commented that she appreciated how the project manager presented the Power Point presentation and that the information was not read directly off the Power Point slides. During the presentation, participants were engaged and asked questions. One area of the project that could have been improved was the portion where participants mixed Dantrolene. The project manager could have placed participants in small groups and had a nurse educator help the participants in mixing the Dantrolene to provide more structure. Finally, the project manager could have brought an evaluation form for each of the three nurse educators in attendance to fill out during the implementation. After the project was implemented, the project manager emailed Mrs. Lobacz for feedback on the project.

Additionally, the project manager completed each of the eight DNP Essentials. The DNP Essentials are foundational competencies that are central to all advanced practice nurses. The project manager was required to meet each DNP Essential for successful completion of incorporating MH education into Lutheran's nurse residency week. A PICO question and literature review was conducted for the DNP project (DNP Essential I-Scientific Underpinning for Practice). Identifying stakeholders, choosing an organization, and completing an assessment of the Lutheran Hospital facility was completed (DNP Essential II- Organization and System Leadership for Quality Improvement and Systems Thinking). Statistical data analysis, IRB approval, and implementing a QI project at Lutheran Hospital was performed by the project manager (DNP Essential III-Clinical Scholarship and Analytical Methods for Evidence Based Practice). Multiple forms of technology including Microsoft Word, Microsoft Excel, PowerPoint, IBM Statistics SPSS Version 27 were used for completing the DNP project (DNP Essential IV- Information/Systems Technology and Patient Care Technology for Improvement and Transformation of Healthcare). The project manager critiqued peers DNP manuscripts (DNP Essential V-Healthcare Policy for Advocacy in Healthcare). The project manager collaborated with DNP advisors, Lutheran Hospital faculty, and peers throughout the project (DNP Essential VI-Interprofessional Collaboration for Improving Patient and Population Outcomes). The project manager utilized a PowerPoint to educate nurses on MH education and prevention (DNP Essential VII-Clinical Prevention and Population Health for Improving the Nation's Health). The project manager disseminated the DNP project results to faculty and peers (DNP Essential VIII-Advanced Practice Nursing).

## **Chapter 7: Conclusion**

### **Potential Project Impact on Health Outcomes Beyond Implementation Site**

Malignant Hyperthermia can occur in many healthcare settings. Furthermore, Indiana is near states such as Michigan where the incidence of MH is higher. Nurses in all specialties must understand the devastating impact that MH can inflict if not quickly identified and treated. As stated above, the mortality rate for MH is less than 5%. According to MHAUS (2021), MH causes two to three deaths yearly. However, the MH mortality rate and deaths per year is still too high. With proper education and training, there is great potential to decrease the MH mortality rate and prevent death. Healthcare professionals need to receive education and stay up to date on identification and treatment. Malignant Hyperthermia can be completely prevented if no triggering agent is administered. Therefore, patient deaths related to MH can be decreased. The knowledge gained by participants in this project has the potential to create positive patient outcomes by preventing MH from occurring, having the ability to identify MH, and starting treatment early.

Incorporating MH education into nurse residency week had direct impact on nine nurses. Seven nurses had previous MH education, and they were able to update their knowledge on MH. Two nurses had never received MH education and were able to learn about MH for the first time. Nine nurses can share the MH information they learned to other nurses once they are working on their respective units. Moving forward, MH education will be incorporated into LHN's nurse residency week. Incorporating MH education into Lutheran's nurse residency week has the potential to impact many future nurses. This project could create momentum for future MH projects. For example, a MH screening checklist could be developed for nurses who admit

patients into the ED, ICU, or Medical-Surgical floor. Also, annual MH mock simulations could be developed from the groundwork laid by this DNP project.

### **Health Policy Implications of Project**

Incorporating MH education into Lutheran's nurse residency week can impact the current LHN MH policy. The current LHN MH policy outlines a procedure statement, background, necessary equipment, procedure for general anesthesia areas, procedure for post-procedurals areas, and safety and education. The LHN policy could be updated to include that all newly hired nurses will receive MH education during nurse residency week. The current policy does not state that newly hired nurses will receive MH education during nurse residency week.

### **Proposed Future Direction for Practice**

The project manager gifted this DNP project to LHN for future use during nurse residency week. Incorporating MH education into Lutheran's nurse residency week will aid in future MH educational sessions. Additionally, the project manager encouraged LHN to share this project to experienced nurses already working at LHN to increase their knowledge on MH. Finally, two participants had not previously received MH education. A proposed future direction would be to incorporate this DNP project in a nursing school's curriculum or other health care organizations that do not offer MH education.

## References

- About Us*. Lutheran Health Network. (n.d.). <https://www.lutheranhealth.net/hospital-about-us>.
- Ambardekar, A. P., Black, S., Singh, D., Lockman, J. L., Simpao, A. F., Schwartz, A. J., Hales, R. L., Rodgers, D. L., Gurnaney, H. G., & Veyckemans, F. (2019). The impact of simulation-based medical education on resident management of emergencies in pediatric anesthesiology. *Pediatric Anesthesia*, 29(7), 753-759. <https://doi.org/10.1111/pan.13652>
- Arab, A., Alatassi, A., Alattas, E., Alzoraigi, U., Alzaher, Z., Ahmad, A., Albabtain, H., & Boker, A. (2017). Integration of simulation in postgraduate studies in Saudi Arabia: The current practice in anesthesia training program. *Saudi Journal of Anesthesia*, 11(2), 208-214. <https://doi.org/10.4103/1658-354X.203059>
- Arriaga, A. F., Bader, A. M., Wong, J. M., Lipsitz, S. R., Berry, W. R., Ziewacz, J. E., Hepner, D. L., Boorman, D. J., Pozner, C. N., Smink, D. S., & Gawande, A. A. (2013). Simulation-based trial of surgical-crisis checklists. *New England Journal of Medicine*, 368(3), 246-253. <https://doi.org/10.1056/NEJMs1204720>
- Blanié, A., Gorse, S., Roulleau, P., Figueiredo, S., & Benhamou, D. (2018). Impact of learners' role (active participant-observer or observer only) on learning outcomes during high-fidelity simulation sessions in anaesthesia: A single center, prospective and randomized study. *Anaesthesia of Critical Care & Pain Medicine*, 37(5), 417-422. <https://doi.org/10.1016/j.accpm.2017.11.016>
- Blanié, A., Kurrek, M., Gorse, S., Baudrier, D., & Benhamou, D. (2020). Use of cognitive aids: Results from a national survey among anesthesia providers. *Anesthesiology Research & Practice*, 1-6. <https://doi.org/10.1155/2020/1346051>

- Bliss, L. A., Ross-Richardson, C. B., Sanzari, L. J., Shapiro, D. S., Lukianoff, A. E., Bernstein, B. A., & Ellner, S. J. (2012). Thirty-day outcomes support implementation of a surgical safety checklist. *Journal of the American College of Surgeons*, 215(6), 766-776.  
<https://doi.org/10.1016/j.jamcollsurg.2012.07.015>
- Boet, S., Bould, M., Fung, L., Qosa, H., Perrier, L., Tavares, W., Reeves, S., & Tricco, A. (2014). Transfer of learning and patient outcome in simulated crisis resource management: A systematic review. *Canadian Journal of Anesthesia*, 61(6), 571-582.  
<https://doi.org/http://dx.doi.org/10.1007/s12630-014-0143-8>
- Boone, J. (2012). Improving employee engagement: Making the case for planned organizational change using the burke-litwin model of organizational performance and change. *Information Management and Business Review*, 4, 402-408. <https://doi.org/10.22610/imbr.v4i7.994>
- Bong, C. L., Lee, S., Allen, J. C., Lim, E. H. L., & Vidyarthi, A. (2017). The effects of active versus observer roles during simulation-based training on stress levels and non-technical performance: A randomized trial. *Advances in Simulation*, 2(7). <https://doi.org/10.1186/s41077-017-0040-7>
- Burke, J. R., Downey, C., & Almoudaris, A. M. (2020). Failure to rescue deteriorating patients: A systematic review of root causes and improvement strategies. *Journal of Patient Safety*, 18(1), 140-155. <https://doi.org/10.1097/pts.0000000000000720>
- Burke, W., & Litwin, G. (1992). A casual model for of organizational performance and change. *Journal of Management*, 18(3), 523-545.
- Clapper, T. C. (2010). Beyond Knowles: What those conducting simulation need to know about adult learning theory. *Clinical Simulation in Nursing*, 6(1), e7-e14.  
<https://doi.org/https://doi.org/10.1016/j.ecns.2009.07.003>



- Chamberland, C., Hodgetts, H. M., Kramer, C., Breton, E., Chiniara, G., & Tremblay, S. (2018). The critical nature of debriefing in high-fidelity simulation-based training for improving team communication in emergency resuscitation. *Applied Cognitive Psychology*, 32(6), 727-738. <https://doi.org/10.1002/acp.3450>
- Cepeda Brito, J. R., Hughes, P. G., Firestone, K. S., Ortiz Figueroa, F., Johnson, K., Ruthenburg, T., McKinney, R., Gothard, M. D., & Ahmed, R. (2017). Neonatal resuscitation program rolling refresher: Maintaining chest compression proficiency through the use of simulation-based education. *Advances in Neonatal Care*, 17(5), 354-361. <https://doi.org/10.1097/anc.0000000000000384>
- Cooper, J. B., Newbower, R. S., Long, C. D., & McPeck, B. (1978). Preventable anesthesia mishaps: A study of human factors. *Anesthesiology*, 49(6), 399-406. <https://doi.org/10.1097/00000542-197812000-00004>
- Corporate Governance*. Community Health Systems (CHS). (n.d.). <https://www.chs.net/company-overview/corporate-governance/>.
- Crowe, S., Ewart, L., & Derman, S. (2018). The impact of simulation-based education on nursing confidence, knowledge and patient outcomes on general medicine units. *Nurse Education in Practice*, 29, 70-75. <https://doi.org/https://doi.org/10.1016/j.nepr.2017.11.017>
- Dagestad, A., & Hermann, M. (2017). Keeping cool when things heat up during a malignant hyperthermia crisis. *Nursing for Women's Health*, 21(5), 338-347. <https://doi.org/https://doi.org/10.1016/j.nwh.2017.07.001>
- De Vries, E., Prins, H., Crolla, R., Den Outer, A. J., Van Andel, G., Van Helden, S., Schlack, W., Van Putten, M. A., Gouma, D. J., Dijkgraaf, M., Smorenburg, S. M., & Boermeester, M. A. (2010).

- Effect of a comprehensive surgical safety system on patient outcomes. *New England Journal of Medicine*, 363(20), 1928-1937. <https://doi.org/10.1056/NEJMsa0911535>
- Eriksen, M. B., & Frandsen, T. F. (2018). The impact of patient, intervention, comparison, outcome (PICO) as a search strategy tool on literature search quality: A systematic review. *Journal of the Medical Library Association*, 106(4), 420-431. <https://doi.org/10.5195/jmla.2018.345>
- Eyikara, E., & Baykara, Z. (2017). The importance of simulation in nursing education. *World Journal on Educational Technology*, 9(2), 2-7. <https://doi.org/10.18844/wjet.v9i1.543>
- Fung, L., Boet, S., Bould, M. D., Qosa, H., Perrier, L., Tricco, A., Tavares, W., & Reeves, S. (2015). Impact of crisis resource management simulation-based training for interprofessional and interdisciplinary teams: A systematic review. *Journal of Interprofessional Care*, 29(5), 433-444. <https://doi.org/10.3109/13561820.2015.1017555>
- Flynn, F. M., Sandaker, K., & Ballangrud, R. (2017). Aiming for excellence: A simulation-based study on adapting and testing an instrument for developing non-technical skills in Norwegian student nurse anaesthetists. *Nurse Education in Practice*, 22, 37-46. <https://doi.org/http://dx.doi.org/10.1016/j.nepr.2016.11.008>
- Gaba, D. M. (2013). Perioperative cognitive aids in anesthesia: What, who, how, and why bother? *Anesthesia & Analgesia*, 117(5) 1033-1036.
- Gaba, D. M., Maxwell, M., & DeAnda, A. (1987). Anesthetic mishaps: Breaking the chain of accident evolution. *Anesthesiology*, 66(5), 670-676.
- Gillespie, B. M., Chaboyer, W., Thalib, L., John, M., Fairweather, N., & Slater, K. (2014). Effect of using a safety checklist on patient complications after surgery: A systematic review and meta-analysis. *Anesthesiology*, 120(6), 1380-1389. <https://doi.org/10.1097/ALN.0000000000000232>

- Goldhaber-Fiebert, S. N., Lei, V., Nandagopal, K., & Bereknyei, S. (2015). Emergency manual implementation: Can brief simulation-based OR staff trainings increase familiarity and planned clinical use? *The Joint Commission Journal on Quality and Patient Safety*, 41(5), 212-217. [https://doi.org/https://doi.org/10.1016/S1553-7250\(15\)41028-1](https://doi.org/https://doi.org/10.1016/S1553-7250(15)41028-1)
- Goldhaber-Fiebert, S. N., Pollock, J., Howard, S. K., & Bereknyei Merrell, S. (2016). Emergency manual uses during actual critical events and changes in safety culture from the perspective of anesthesia residents: A pilot study. *Anesthesia & Analgesia*, 123(3), 641-649.
- Grossman, S., & Valiga, T. M. (2017). *The New Leadership Challenge: Creating the Future of Nursing*. FA Davis Company.
- Harder, B. (2010). Use of simulation in teaching and learning in health sciences: A systematic review. *Journal of Nursing Education*, 49(1), 23-28.
- Harrison, T. K., Manser, T., Howard, S. K., & Gaba, D. M. (2006). Use of cognitive aids in a simulated anesthetic crisis. *Anesthesia & Analgesia*, 103(3), 551-556.
- Hayden, J. K., Smiley, R. A., Alexander, M., Kardong-Edgren, S., & Jeffries, P. R. (2014). The national council of state board of nursing national simulation study: A longitudinal, randomized, controlled study replacing clinical hours with simulation in prelicensure nursing education. *Journal of Nursing Regulation*, 5(2), 3-40. [https://doi.org/10.1016/S2155-8256\(15\)30062-4](https://doi.org/10.1016/S2155-8256(15)30062-4)
- Hepner, D. L., Arriaga, A. F., Cooper, J. B., Goldhaber-Fiebert, S. N., Gaba, D. M., Berry, W. R., Boorman, D. J., & Bader, A. M. (2017). Operating room crisis checklists and emergency manuals. *Anesthesiology*, 127(2), 384-392. <https://doi.org/10.1097/ALN.0000000000001731>
- Huang, J., Parus, A., Wu, J., & Zhang, C. (2018). Simulation competition enhances emergency manual uses during actual critical events. *Cureus*, 10(8), e3188-e3188. <https://doi.org/10.7759/cureus.3188>

- Joseph, M. L. (2015). Organizational culture and climate for promoting innovativeness. *Journal of Nursing Administration*, 45(3), 172-178. <https://doi.org/10.1097/nnn.0000000000000178>
- Kazior, M. R., Wang, J., Stiegler, M. P., Nguyen, D., Rebel, A., & Isaak, R. S. (2017). Emergency manuals improved novice physician performance during simulated ICU emergencies. *Journal of Education in Perioperative Medicine*, 19(3), 1-11.
- Kolb, A., & Kolb, D. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education*, 4, 193-212.
- Kolb, D. (1984). *Experiential learning: Experience as the source of learning and development*, 1, 21-38 Prentice-Hall, Inc.
- Kolb, D., & Kolb, A. (2013). *The Kolb Learning Style Inventory 4.0: Guide to Theory, Psychometrics, Research & Applications*. <https://learningfromexperience.com/downloads/research-library/the-kolb-learning-style-inventory-4-0.pdf>
- Krombach, J. W., Marks, J. D., Dubowitz, G., & Radke, O. C. (2015). Development and implementation of checklists for routine anesthesia care: A proposal for improving patient safety. *Anesthesia & Analgesia*, 121(4), 1097-1103.
- Lai, A., Haligua, A., Dylan Bould, M., Everett, T., Gale, M., Pigford, A.-A., & Boet, S. (2016). Learning crisis resource management: Practicing versus an observational role in simulation training: A randomized controlled trial. *Anaesthesia Critical Care & Pain Medicine*, 35(4), 275-281. <https://doi.org/https://doi.org/10.1016/j.accpm.2015.10.010>
- Lanfranchi, J. A. (2013). Instituting code blue drills in the OR: The official voice of perioperative nursing. *Association of Perioperative Registered Nurses Journal*, 97(4), 428-434. <https://doi.org/http://dx.doi.org/10.1016/j.aorn.2013.01.017>

- Larach, M. G., Brandom, B. W., Allen, G. C., Gronert, G. A., & Lehman, E. B. (2014). Malignant hyperthermia deaths related to inadequate temperature monitoring, 2007-2012: A report from the North American malignant hyperthermia registry of the malignant hyperthermia association of the United States. *Anesthesia and Analgesia*, 119(6), 1359-1366.  
<https://doi.org/10.1213/ANE.00000000000000421>
- LeBlanc, V. R. (2012). Simulation in anesthesia: State of the science and looking forward. *Canadian Journal of Anesthesia*, 59(2), 193-202. <https://doi.org/10.1007/s12630-011-9638-8>
- Leithead, J., Garbee, D. D., Yu, Q., Rusnak, V. V., Kiselov, V. J., Zhu, L., & Paige, J. T. (2019). Examining interprofessional learning perceptions among students in a simulation-based operating room team training experience. *Journal of Interprofessional Care*, 33(1), 26-31.  
<https://doi.org/10.1080/13561820.2018.1513464>
- Lutheran Hospital (2020). Lutheran health physicians employee handbook. Fort Wayne, Indiana
- Malignant Hyperthermia Association of the United States. (2021). <https://www.mhaus.org/>
- Marshall, S. D., & Mehra, R. (2014). The effects of a displayed cognitive aid on non-technical skills in a simulated 'can't intubate, can't oxygenate' crisis. *Anaesthesia*, 69(7), 669-677.  
<https://doi.org/https://doi.org/10.1111/anae.12601>
- McEvoy, M. D., Field, L. C., Moore, H. E., Smalley, J. C., Nietert, P. J., & Scarbrough, S. H. (2014). The effect of adherence to ACLS protocols on survival of event in the setting of in-hospital cardiac arrest. *Resuscitation*, 85(1), 82-87. <https://doi.org/10.1016/j.resuscitation.2013.09.019>
- Mossenson, A. I., Tuyishime, E., Rawson, D., Mukwesi, C., Whynot, S., Mackinnon, S. P., & Livingston, P. (2020). Promoting anesthesia providers' non-technical skills through the vital anesthesia simulation training course in a low-resource setting. *British Journal of Anesthesia*, 124(2), 206-213. <https://doi.org/10.1016/j.bja.2019.10.022>

- Nagelhout, J. J., & Plaus, K. L. (2018). *Nurse anesthesia* (6<sup>th</sup> ed.). Elsevier.
- Neal, J. M., Hsiung, R. L., Mulroy, M. F., Halpern, B. B., Dragnich, A. D., & Slee, A. E. (2012). American society of regional anesthesia checklist improves trainee performance during a simulated episode of local anesthetic systemic toxicity. *Regional Anesthesia & Pain Medicine*, 37(1), 8. <https://doi.org/10.1097/AAP.0b013e31823d825a>
- Neily, J., Mills, P. D., Young-Xu, Y., Carney, B. T., West, P., Berger, D. H., Mazzia, L. M., Paull, D. E., & Bagian, J. P. (2010). Association between implementation of a medical team training program and surgical mortality. *Journal of the American Medical Association*, 304(15), 1693-1700. <https://doi.org/10.1001/jama.2010.1506>
- O'Regan, S., Molloy, E., Watterson, L., & Nestel, D. (2016). Observer roles that optimize learning in healthcare simulation education: A systematic review. *Advances in Simulation*, 1(1), 4. <https://doi.org/10.1186/s41077-015-0004-8>
- Pappas, C. (2013). *The adult learning theory: andragogy of Malcolm Knowles*. Elearningindustry.com
- Reflect & Learn. A Causal Model of Organizational Performance & Change (Burke & Litwin Model) | Reflect & Learn. (n.d.). <http://www.reflectlearn.org/discover/a-causal-model-of-organizational-performance-change-burke-litwin-model>.
- Reime, M. H., Johnsgaard, T., Kvam, F. I., Aarflot, M., Engeberg, J. M., Breivik, M., & Brattebø, G. (2017). Learning by viewing versus learning by doing: A comparative study of observer and participant experiences during an interprofessional simulation training. *Journal Interprofessional Care*, 31(1), 51-58. <https://doi.org/10.1080/13561820.2016.1233390>
- Russell, S. S. (2006). An overview of adult-learning processes. *Urology Nursing*, 26(5), 349-352, 370.

Segall, N., Kaber, D., Taekman, J., & Wright, M. (2013). A cognitive modeling approach to decision support tool design for anesthesia provider crisis management. *International Journal of Human-Computer Interaction*, 29(2), 55-66.

<https://doi.org/10.1080/10447318.2012.681220>

Semler, M. W., Keriwala, R. D., Clune, J. K., Rice, T. W., Pugh, M. E., Wheeler, A. P., Miller, A. N., Banerjee, A., Terhune, K., & Bastarache, J. A. (2015). A randomized trial comparing didactics, demonstration, and simulation for teaching teamwork to medical residents. *Annals of the American Thoracic Society*, 12(4), 512-519.

<https://doi.org/10.1513/AnnalsATS.201501-030OC>

Shin, S., Park, J.-H., & Kim, J.-H. (2015). Effectiveness of patient simulation in nursing education: Meta-analysis. *Nurse Education Today*, 35(1), 176-182.

<https://doi.org/https://doi.org/10.1016/j.nedt.2014.09.009>

Simmons, W. R., & Huang, J. (2019). Operating room emergency manuals improve patient safety: A systemic review. *Cureus*, 11(6), 2-8. <https://doi.org/10.7759/cureus.4888>

Sofer, D. (2018). The Value of simulation in nursing education: This clinical activity is transforming nursing training and practice. *American Journal of Nursing*, 118(4), 17-18.

<https://doi.org/10.1097/01.NAJ.0000532063.79102.19>

Spangenberg, H., & Theron, C. (2013). A critical review of the Burke-Litwin model of leadership, change and performance. *Management Dynamics*, 22, 29-48.

St.Pierre, M., Luetcke, B., Strembki, D., Schmitt, C., & Breuer, G. (2017). The effect of an electronic cognitive aid on the management of ST-elevation myocardial infarction during

- caesarean section: A prospective randomized simulation study. *Biomedical Central Anesthesiology*, 17(1), 46. <https://doi.org/10.1186/s12871-017-0340-4>
- Treadwell, J. R., Lucas, S., & Tsou, A. Y. (2014). Surgical checklists: A systematic review of impacts and implementation. *British Medical Journal: Quality and Safety*, 23(4), 299. <https://doi.org/10.1136/bmjqs-2012-001797>
- Villemure, C., Georgescu, L. M., Tanoubi, I., Dubé, J.-N., Chiocchio, F., & Houle, J. (2019). Examining perceptions from in situ simulation-based training on interprofessional collaboration during crisis event management in post-anesthesia care. *Journal of Interprofessional Care*, 33(2), 182-189. <https://doi.org/10.1080/13561820.2018.1538103>
- White, K., Dudley Brown, S., & Terhar, M. F (2016). Translation of evidence into nursing and health nursing and health care (3rd). Springer Publishing.
- Wunder, L. L. (2016). Effect of a nontechnical skills intervention on first-year student registered nurse anesthetists' skills during crisis simulation. *American Association of Nurse Anesthetists Journal*, 84(1), 46-51.
- Yunoki, K., & Sakai, T. (2018). The role of simulation training in anesthesiology resident education. *Journal of anesthesia*, 32(3), 425-433. <https://doi.org/10.1007/s00540-018-2483-y>



## Appendix A Project Team Agreement Letter



September 21, 2021

To the University of Saint Francis Institutional Review Board:

This letter is being written in support of the University of Saint Francis, NAP/DNP Kyle Stevens' Doctor of Nursing Practice Scholarly Project, entitled: Implementing Malignant Hyperthermia for New Nurses attending Fellowship. The Lutheran Health Network understands that the aim of the DNP scholarly Project is to increase nursing knowledge on Malignant Hyperthermia.

The Lutheran Health Network Educators are supportive of this project and the direction in which Kyle plans on presenting. Lutheran Health Network Educators will allow Kyle to present his subject matter as an educational session that will consist of an anonymous pre-test to determine the knowledge base of the nurses and a post-test to determine if that knowledge has increased based on the material presented.

The Lutheran Health Network does not require an institutional IRB for this project as it has been described.

Sincerely,

Handwritten signatures of Jill Lobacz and Judy Biggins.

Jill Lobacz, MSN, RN, CST/CSFA | Judy Biggins BSN, RN, CNOR | Network Surgical Services

Educator | Lutheran Health Network | 7836 W Jefferson Blvd Fort Wayne, IN 46804 |

[jlobacz@theduponthospital.com](mailto:jlobacz@theduponthospital.com) | [jbiggins@lutheran-hosp.com](mailto:jbiggins@lutheran-hosp.com)



## **Appendix C Informed Consent**

### **INFORMED CONSENT FORM**

#### **Educational Presentation on Recognizing and treating MH**

#### **Introduction and Explanation of the Purpose of the Research**

Hello,

My name is Kyle Stevens, and I am a Student Registered Nurse Anesthetist (SRNA) at the University of Saint Francis in Fort Wayne, Indiana. For my doctoral project, I am conducting an educational project on recognizing Malignant Hyperthermia (MH) for Registered Nurses. I appreciate your participation in this educational project, as it will improve your recognition of MH.

#### **Procedures**

The project will consist of taking a pre-test, viewing a video, followed by a post-test. The total anticipated time commitment is approximately sixty minutes.

#### **Risk and Benefits**

1. Risks: Taking a test can cause feelings of anxiety.
2. Benefits: Increasing knowledge on the recognition of MH.

#### **Safeguards**

1. Please do not include any identifying information about yourself.
2. You will not be asked to include any identifying information.
3. Any published data will be in aggregated (group) form with no identifiable factors.
4. Information obtained will be coded and kept under password on the cloud.

#### **Freedom to Withdraw**

1. Participation is completely voluntary, and you may withdraw from participation in the project at any time for any reason without penalty.
2. If you choose to withdrawal from participation in the project, any information we have from your participation will be securely disposed of.

#### **Answers to Inquiries.**

Once participation in the project is complete, if you wish to receive the results please contact me via the email provided below. In the meantime, any questions can be directed to:

Kyle Stevens, SRNA

University of Saint Francis

Department of Nurse Anesthesia

2701 Spring Street

Fort Wayne, Indiana 46808

(260) 399-7700

Email: [stevenskr@cougars.sf.edu](mailto:stevenskr@cougars.sf.edu)

**I have received an explanation of this project and agree to participate. I understand that my participation in this project is strictly voluntary.**

**Name:**

**Date:**

## Appendix D Pre-test and Post-test Intervention

Identification number: \_\_\_\_\_

Pre-test

**Please select one response unless otherwise noted in the question.**

1. The initial bolus dose of Dantrolene is:
  - A. 2 mg
  - B. 2.5 mg
  - C. 3 mg
  - D. 4 mg
  
2. What is the earliest sign of malignant hyperthermia?
  - A. Increased potassium
  - B. Increased end-tidal carbon dioxide levels
  - C. Increased core temperature
  - D. Myoglobinuria
  
3. **Select two** malignant hyperthermia triggering anesthetic agents.
  - A. Propofol
  - B. Succinylcholine
  - C. Sevoflurane
  - D. Nitrous oxide
  
4. Which sign or symptom has the most ominous prognosis in a patient experiencing malignant hyperthermia?
  - A. Disseminated intravascular coagulation
  - B. Hyperthermia

- C. Hyperkalemia
- D. Hypercarbia

5. Which of the following agents would be able to precipitate malignant hyperthermia in a susceptible patient?
  - A. Desflurane
  - B. Nitrous oxide
  - C. Ketamine
  - D. Propofol
6. Which of the following agent is a trigger for malignant hyperthermia?
  - A. Ketamine
  - B. Propofol
  - C. Succinylcholine
  - D. Rocuronium
7. What type of fluid is used to mix dantrolene?
  - A. Sterile Water
  - B. Lactated Ringers
  - C. Normal Saline
  - D. 3% Sodium Chloride

## Appendix E Permission to Use Prodigy Questions

Label: Default Email Retention (4 years) Expires: Mon 8/18/2025 10:56 AM



Stevens, Kyle R

Thu 8/19/2021 10:56 AM

To: pstallo@prodigyanesthesia.com



Mr. Stallo,

Would you permit me to use questions from Prodigy for my doctoral project?  
I am implementing an educational Malignant Hyperthermia project for OR nurses. My goal is to use some MH questions from Prodigy for my pre and post-test. Please let me know. I appreciate your time on this matter.

Sincerely,  
Kyle Stevens

Label: Default Email Retention (4 years) Expires: Thu 8/21/2025 2:00 PM



Peter Stallo <pstallo@prodigyanesthesia.com>

Sun 8/22/2021 2:00 PM

To: Stevens, Kyle R



**WARNING:** This email originated from outside of USF. Do **NOT** click links or attachments unless you recognize the sender and know the content is safe.

I can probably help you with this. Did you want them to answer the questions in Prodigy so you get the data analysis that faculty would get or are you just trying to print them on paper?

**Peter Stallo**

**Prodigy Anesthesia**

[www.prodigyanesthesia.com](http://www.prodigyanesthesia.com)

Visit [CRNA Partners](#) to find out how to save on core modules, virtual and destination conferences, ACLS, PALS, & more through our alliance of CRNA-owned businesses!

...



Label: Default Email Retention (4 years) Expires: Mon 9/8/2025 12:56 PM



Peter Stallo <pstallo@prodigyanesthesia.com>

Thu 9/9/2021 12:56 PM

To: Stevens, Kyle R



**WARNING:** This email originated from outside of USF. Do **NOT** click links or attachments unless you recognize the sender and know the content is safe.

I'm so sorry, I had missed it amid a ton of other emails. Certainly you may do so. How many questions will you use for the exam and will your final output be a paper, presentation, poster session. etc?

**Peter Stallo**

**Prodigy Anesthesia**

[www.prodigyanesthesia.com](http://www.prodigyanesthesia.com)

Visit [CRNA Partners](#) to find out how to save on core modules, virtual and destination conferences, ACLS, PALS, & more through our alliance of CRNA-owned businesses!



## Appendix F Demographic Questionnaire

Select only one answer.

1. Select the years you have spent practicing nursing
  - A. 0-3 years
  - B. 4-7 years
  - C. 7-10 years
  - D. > 11 years
2. Select type of highest nursing education that you have achieved
  - A. Associates
  - B. Bachelors
  - C. Graduate degree
  - D. Other\_\_\_\_\_
3. Have you received Malignant Hyperthermia education in the past?
  - A. Yes
  - B. No

## Appendix G IRB Approval

**University of Saint Francis  
Institutional Review Board  
Human Subjects Review Committee/ACUC/IBC  
Institutional Review Board Approval Form**

**Protocol Number:** 16327878546

**Reviewed by (underline one):** HSRC ACUC IBC

**Date Reviewed:** Monday, October 25, 2021

**Principal Investigator:** Kyle Stevens

**Faculty Advisor:** Dr. Megan Winegarden

**Protocol Title:** Malignant Hyperthermia Education for Nurses

**Study Site(s):** University of Saint Francis, Main Campus

Type of Proposal:

- ☐ Original research  
☐ Replication or extension of previous research  
☒ Quality Improvement/Evidence-Based Practice Project

Items submitted for review:

- ☒ CITI Certificate  
☒ Initial protocol  
☒ Abstract  
☒ Informed Consent Form (if applicable)  
☒ Approval letter from outside institution  
☐ Other – explain: Email request was made for waiver

Type of Review:

- ☒ Full Review  
☐ Expedited Review  
☐ Exempt Review

Approval:

- ☒ Approval granted on Monday, October 25, 2021 for a period of one year.  
☐ Conditional approval\* granted on \_\_\_\_\_ for a period of one year.  
☐ Not approved\*  
☐ IRB approval is not required:  
☐ Other

\*Comments:

The committee performing this review is duly constituted and operates in accordance and compliance with local and federal regulations and guidelines.

Michael P. Bechill, IRB Chair  
 Printed Name (Chair or designee)

Michael P. Bechill  
 Signature

2021.10.25  
 Date

## Appendix H MH Power Point Presentation

# MALIGNANT HYPERTHERMIA EDUCATION

---

KYLE STEVENS, BSN, SRNA

UNIVERSITY OF SAINT FRANCIS

2-21-22

## OBJECTIVES

---

- Discuss the incidence and epidemiology of MH
- List the early and late signs of MH
- Discuss MH triggering medications
- List non-triggering MH medications
- Discuss the importance of Dantrolene
- Explain how to reconstitute Dantrolene

## WHAT IS MH?

---

- A rare hyper-metabolic disease that occurs in skeletal muscle
- Life threatening, if not treated
- Early recognition and prompt treatment is imperative (Nagelhout, 2018)



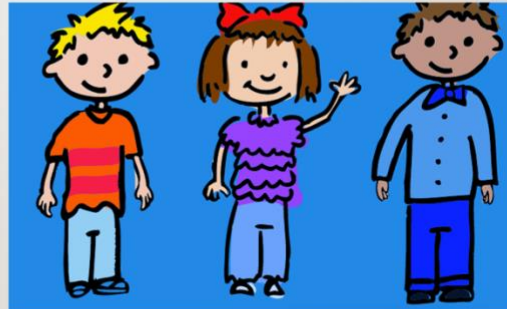
## WHAT IS MH?

---

- A. An allergic reaction to high temperatures
- B. A hypermetabolic syndrome triggered by inhalant gas and/or succinylcholine
- C. A variant of heat stroke
- D. A reaction to propofol

## INCIDENCE/EPIDEMIOLOGY

- 1 in 5,000 to 1 in 50,000 general anesthetics
- Higher incidence in pediatrics
  - Children under 15 years old account for 52% of all reactions
  - Prevalence is three times higher for pediatric males



(Apex Anesthesia, 2021)

## GEOGRAPHIC LOCATION



- Location plays a role in MH prevalence
- Certain states have a higher MH incidence
- These states include Michigan, Wisconsin, Nebraska, and West Virginia

(Apex Anesthesia, 2021)

## WHAT TRIGGERS MH?

- Certain anesthetic drugs
- Succinylcholine
- Sevoflurane, Desflurane, Isoflurane

(Apex Anesthesia, 2021)



## WHAT DRUGS TRIGGER MH?

- A. Desflurane
- B. Sevoflurane
- C. Succinylcholine
- D. All of the above

## WHERE CAN MH OCCUR?

---

- Any setting where triggering agents are administered
- Not only in the OR and PACU
  - Other places include:
    - ICU
    - ED
    - Medical-surgical
    - OB Unit
    - Endoscopy
    - Burn Unit

(Nagelhout, 2018)

## A MH CRISIS WILL ONLY OCCUR IN THE OR?

---

- A. True
- B. False

## WHAT MEDICATIONS ARE SAFE FOR A MH PATIENT?

Safe	Safe
Propofol	Opioids
Ketamine	Rocuronium
Nitrous Oxide	Etomidate

(Apex Anesthesia, 2021)

## WHAT MEDICATION IS CONSIDERED SAFE TO ADMINISTER TO A MH PATIENT?

- A. Desflurane
- B. Succinylcholine
- C. Propofol
- D. Sevoflurane



## SIGNS AND SYMPTOMS

Early	Late
Increased end-tidal CO <sub>2</sub> *	Fever
Tachycardia*	Cardiac arrhythmias
Masseter spasm (Clinched Jaw)*	Hyperkalemia
Tachypnea	DIC
Muscle rigidity	
Mottling of skin	
Profuse sweating	
Mixed metabolic acidosis and alkalosis	

Apex Anesthesia, 2021

## IS ELEVATED TEMPERATURE AN EARLY OR LATE SIGN?

- A. Early
- B. Late

## TREATMENT

---

- Dantrolene is the definitive treatment
  - Each vial contains 20 mg
  - Each vial must be mixed with 60 ml of sterile water
  - Initial bolus dose is 2.5 mg/kg
  - 8-10 vials for a 70 kg patient
- (Nagelhout, 2018)



## WHAT IS THE DRUG OF CHOICE TO TREAT MH?

---

- A. Dantrolene
- B. Propofol
- C. Succinylcholine
- D. Etomidate

## NECESSARY EQUIPMENT

---

- MH cart
- Crash cart
- MHAUS Hotline for guidance: 1-800-MH-HYPER (1-800-644-9737)
- Anesthesia drug cart, if applicable
- Ice and/or cooled fluids
- NG tubes, IV catheters, urinary catheters, core temperature sensing devices

## NURSING ROLES AND RESPONSIBILITIES

---

Activate a code/Alert	Draw labs as ordered
Hyperventilate patient with 100 oxygen (at least 10L/min)	Insert temperature sensing foley
Call MHAUS for guidance	Assist with central/arterial lines
Obtain MH cart	Give cold fluids as directed
Obtain Crash cart	Ice patient
Insert 2 large bore IV's	Apply a cooling blanket

## DOCUMENTATION

---

- Documentation should include
  - Time of MH Alert
  - Staff present
  - Medication doses
  - Administration times
  - Procedures completed
  - Patient response



## WHAT HAPPENS AFTER THE CRISIS?

---

- Once the patient is stable, the patient will be admitted to the ICU
- The patient will be considered stable once vitals return to baseline
- The patient will need monitored for at least 36 hours
- Dantrolene is administered for a minimum of 24 hours
- For 25% of patients, it is possible for MH to reoccur

(Nagelhout, 2018)

## IMPORTANT QUESTIONS TO ASK

- Identify if the patient or patient's family has a history of a sudden spiked fever during anesthesia
- Ask patient if he or she has a family history of MH
- Question if patient has a neuromuscular or muscular disorder
- Investigate an allergy to succinylcholine or anesthetic gases
- Alert the surgery front desk and anesthesia scheduling of a positive history

the Crisis?



## EMERGENCY MANUALS

- Available in most OR and perioperative settings
- Help guide clinicians on diagnosis and treatment on rare events such as MH
- Provides step by step instructions
- Very useful to have a designated reader during an emergency





## MALIGNANT HYPERTHERMIA

By Stanford Anesthesia Cognitive Aid Group and Henry Rosenberg, MD

### SIGNS

#### EARLY:

1. Increased  $\text{ETCO}_2$ .
2. Tachycardia.
3. Tachypnea.
4. Mixed Acidosis (ABG).
5. Masseter spasm/trismus.
6. Sudden cardiac arrest in young person due to hyperkalemia.

#### May be LATER

1. Hyperthermia.
2. Muscle rigidity.
3. Myoglobinuria.
4. Arrhythmias.
5. Cardiac Arrest.

1. **CALL FOR HELP.**
2. **CALL FOR MH CART.**
3. **INFORM TEAM.**
4. **START PREPARING DANTROLENE or RYANODEX!**

### DDX

- Light anesthesia.
- Hypoventilation.
- Insufflation of  $\text{CO}_2$ .
- Over-heating (external).
- Hypoxemia.
- Thyroid Storm.
- Pheochromocytoma.
- Neuroleptic Malignant Syndrome (NMS).
- Serotonin Syndrome.

### TREATMENT

1. **Discontinue** anesthetic triggers (volatiles and succinylcholine). Do **NOT** change machine or circuit.
2. Increase to **100%  $\text{O}_2$ , high flow 10 L/min.**
3. **Halt procedure** if possible. If emergent, continue with non-triggering anesthetic.
4. **Increase minute ventilation** (but avoid air trapping).
5. **Assign several people to prepare 2.5 mg/kg IV Dantrolene or Ryanodex bolus:**
  - **Dantrolene:** Dilute each 20 mg Dantrolene vial in 60 mL preservative-free sterile water (for 70 kg person give 175 mg so prepare 9 vials of 20 mg Dantrolene each as above).
  - **Ryanodex** (new formulation of Dantrolene): Dilute 250 mg Ryanodex vial in 5 mL preservative-free sterile water (for 70 kg person give 175 mg).
6. **Rapidly give Dantrolene or Ryanodex.** Continue giving until patient stable (may need >10 mg/kg, call MHAUS 800-644-9737 for advice).
7. For metabolic acidosis, give **sodium bicarbonate** 1-2 mEq/kg. MH Treatment continued on next page.

## MALIGNANT HYPERTHERMIA

*continued*

### TREATMENT

8. **Hyperkalemia** – or suspect from EKG, treat with:
  - **Calcium chloride** 10 mg/kg IV; Max dose 2000 mg or
  - **Calcium gluconate** 30 mg/kg IV, Max dose 3000 mg.
  - **D50** 1 Amp IV (25 g or 50 ml Dextrose) + **Regular Insulin** 10 units IV (monitor glucose).
  - **Sodium Bicarbonate** 1-2 mEq/kg, Max dose 50 mEq.
9. Arrhythmias are usually secondary to Hyperkalemia. Treat as needed except **avoid calcium channel blockers. Go to ACLS events** as relevant and return.
10. Actively **cool patient** with ice packs, lavage if open abdomen. Stop cooling at 38°C.
11. Send **labs** for ABG, Potassium, CK, urine myoglobin, coagulation studies, lactate.
12. Place Foley catheter. **Monitor UO.** Goal **1-2 mL/kg** per hour. Can give IV fluid and diuretics.
13. **Consider alkalinizing urine** if CK or urine myoglobin elevated (Sodium Bicarbonate 1mEq/kg/hour).
14. Arrange **ICU** bed. Mechanical ventilation usually required.
15. **Continue Dantrolene or Ryanodex:** 1 mg/kg every 4-6 hours or 0.25 mg/kg/hr infusion for at least 24 hours (**25 % of MH events relapse**). Observe patient in ICU for at least 24 hours.
16. Call **MH hotline** (below) for any suspected case with any questions.

Contact the Malignant Hyperthermia Association of the United States (MHAUS hotline) at any time for consultation if MH is suspected:

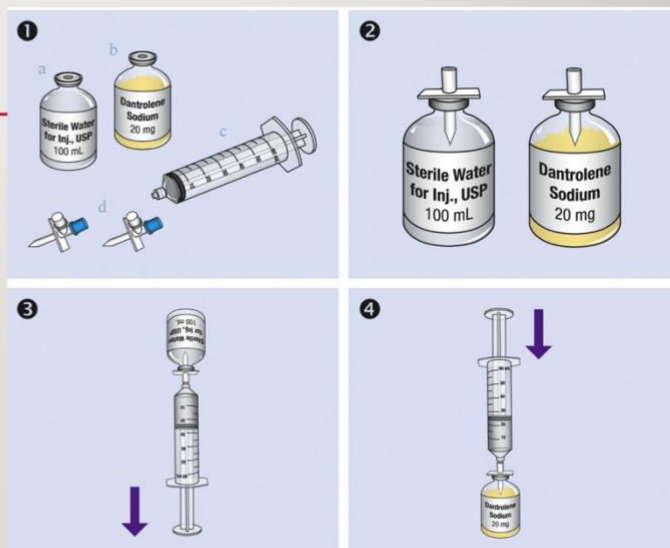
1-800-MH-HYPER (1-800-644-9737)

or see suggestions online at <http://www.mhaus.org>

## QUESTIONS?

## MIXING DANTROLENE

- Use a 60 ml syringe to draw 60 ml of sterile water
- Inject the 60 ml of sterile water into 20 mg Dantrolene vial
- Shake until solution is clear



## REFERENCES

- Apex Anesthesia Review. <https://www.apexanesthesia.com/>
- Dirksen, S., van wicklin, S., Mashman, D., Neiderer, P., & Merritt, D. (2013). Developing effective drills in preparation for a malignant hyperthermia Crisis. *Association of Perioperative Registered Nurses Journal*, 97, 329-353. <https://doi.org/10.1016/j.aorn.2012.12.009>
- Malignant Hyperthermia Association of the United States. (2021). <https://www.mhaus.org/>
- Nagelhout, J. J., & Plaus, K. L. (2017). *Nurse anesthesia* (6<sup>th</sup> ed.). St. Louis, MO: Elsevier.