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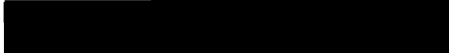
Malignant Hyperthermia Crisis Preparedness


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Abstract

Phase II Site: Walter Reed National Military Medical Center/Kimbrough Ambulatory Care Center

Project Title: Malignant Hyperthermia Crisis Preparedness

Authors: LT Elizabeth Gallegos, RN, NC, USN; LT Bryan Hennen, RN, NC, USN

Background or Problem/Issue: Malignant Hyperthermia (MH) is a rare but potentially fatal hypermetabolic reaction precipitated by exposure to commonly used anesthetic agents. Prompt recognition and appropriate can significantly reduce morbidity and mortality rates associated with MH.

Clinical Question or Purpose: The purpose of this project was to improve Anesthesia and Operating Room staff's perception of the Stanford Emergency manual in the management of a patient with MH and include critical event checklists as part of their treatment plan.

Project Design: The project was a pre- and post-implementation design. A pre-implementation survey measured preconceptions amongst multidisciplinary perioperative staff about the use of cognitive aids in the treatment of MH. An in-service on MH and the benefits of cognitive aid use was given, and an MH simulation exercise utilizing the Stanford Emergency Manual was conducted. A post implementation survey assessed participants for changes in their thoughts on cognitive aid use for future practice. A critical care transfer protocol based on an MH management checklist was presented to the anesthesia department.

Analysis of the Results: The post-implementation survey showed improved perceptions of and willingness to use the Stanford Emergency Manual during an MH crisis. A new critical care transfer protocol was implemented within the anesthesia department which included a transfer checklist specific to MH management.

Organizational Impact/Implications for Practice: The routine use of cognitive aids in the management of MH decreases the number of missed critical treatment steps and may improve patient outcomes in true emergencies. Training for an MH crisis using a cognitive aid improved staff perception of the tool and increased their likelihood of using it in a real MH crisis.

Introduction

Malignant Hyperthermia (MH) is a rare but potentially fatal reaction precipitated by exposure to inhaled volatile anesthetics and succinylcholine in patients with a specific autosomal dominant genetic mutation (Rosenber, Davis, James, Pollock, & Stowell, 2007). It occurs in 1:5000 to 1:50,000 anesthetic cases with equal penetrance across races and ethnicities; however, males, younger patients, and family members of people with known MH history may be at greater risk (Rosenber, Davis, James, Pollock, & Stowell, 2007). As a medical event, MH is as serious as it is rare. Mortality is 5% when appropriately treated with cooling and dantrolene pharmacotherapy, but was previously high as 70% before effective treatments were developed (MHAUS, 2014). Mortality is dependent upon the speed with which healthcare providers recognize and treat the reaction; for every twenty minutes that dantrolene administration is delayed in an MH crisis, mortality increases by >1% (Michaelson, Muldoon, Nyamkhishge, Voelkel, & Litchfield, 2016). Without appropriate and timely treatment, malignant hyperthermia may progress to respiratory distress, severe hemodynamic instability, and cardiac dysrhythmia or arrest (Barash, Cullen, & Stoetling, 2013).

A life-threatening MH crisis is triggered by specific anesthetic agents which cause dysregulation of intracellular calcium (Ca^{++}) through genetically altered ryanodine Ca^{++} channels on the sarcoplasmic reticulum of cells (Rosenber et al., 2007). Ryanodine Ca^{++} channels allow the release of stored intracellular Ca^{++} which under normal conditions facilitate muscle contraction (Rang, Ritter, Flower, & Henderson, 2016). However, in patients susceptible to MH, ryanodine channels release an inappropriate amount of intracellular Ca^{++} depleting ATP reserves following exposure to a triggering agent (Rosenber et al., 2007). Unregulated intracellular Ca^{++} release triggers the rapid development of a hypercatabolic state, characterized

by severe tachypnea, tachycardia, elevated temperature, hyperkalemia, muscle rigidity, and myoglobinuria (Barash, Cullen, Stoelting, 2013).

Problem Significance

Malignant Hyperthermia is potentially fatal if not quickly recognized and appropriate treatment provided. Current treatment standards include: the administration of dantrolene which blocks calcium outflow from ryanodine channels, cooling techniques, systemic symptom management, and transfer to an Intensive Care Unit (Malignant Hyperthermia Association of the United States [MHAUS], 2014). Timely recognition and execution of the treatment plan requires a coordinated response by the entire operating room staff. Given the rarity of an MH event, operating room staff members do not often experience an MH crisis in their career, thus clinical expertise in treating the disease is often lacking. We conducted a thorough review of literature on MH preparedness training to find the best way for staff to prepare for an MH crisis and retain their knowledge and skills.

We found several inpatient facilities have trialed mock MH drills to prepare staff for an MH crisis and increase the speed of MH treatment implementation. Critical interventions identified by MH training research includes MH crisis recognition, dantrolene administration, cooling measures, appropriate supportive care, and calling the MH Association of the United States hotline, which connects facilities to a trained physician consultant (Hirshey Dirksen, Van Wicklin, Mashman, Neiderer & Merritt, 2013) (MHAUS, 2014). Implementation of rapid, comprehensive MH crisis management plan may be improved with the use of surgical crisis checklists by operating room staff, which prompt staff to remember key interventions in the midst of rapid patient deterioration and potential confusion (Ziewacz, et. Al., 2011). The American Association of Nurse Anesthetists (2015) position statement on MH crisis

preparedness recommends ongoing team competency training and conducting annual MH team training. Timely response to an MH crisis can be directly linked to the military health system's Quadruple Aim Initiative by improving patient health outcomes, providing access to safe, quality patient care, and increasing medical readiness to respond rapidly to a medical crisis (Middleton & Dinneen, 2011).

Clinical Question

In operating room staff at Kimborough Ambulatory Care Center (KACC), how does the implementation of a multidisciplinary malignant hyperthermia training program emphasizing the benefits of cognitive aid use and consisting of an in-service training and simulation exercise, impact staff adoption of cognitive aids thereby improving patient outcomes?

Focus Areas

The primary area of focus for our project is to train anesthesia and operating room staff to utilize cognitive aids during an MH crisis in the OR. By incorporating the Stanford Emergency manual into their practice, providers may increase the speed in which critical treatment is provided and decrease the number of missed critical treatment steps thus improving patient outcomes. Providers will see the benefit that cognitive aids offer them and incorporate their use into other high-risk low-frequency events further improving patient outcomes beyond that of just MH emergencies.

Relevance to Military Nursing

Staff trained and stationed at Kimborough Ambulatory Care Center (KACC) are part of the active duty Army, Navy, and Air Force military medical forces frequently called to deploy in times of war or other crises. Sheehan (2005) notes that in austere environments military patients

presenting with significant trauma will not have a preoperative history available to be screened for MH susceptibility. Civilian casualties, allies, and non-government personnel in wartime and on humanitarian missions may also necessitate emergent surgery without an available medical history. The case study by Plurad, Blaschke, Jones, & Pfeiffer (2008) on a military humanitarian mission illustrates how an unexpected MH crisis may arise in this scenario. Exposure to severe heat and physical stress may also predispose susceptible patients to a fulminant MH crisis (Michaelson, et. al., 2016); these conditions may be unavoidable in the deployed environment. In such cases, early recognition and appropriate team response to MH are paramount. Considering these examples, we understand that training at KACCC may increase readiness not just at our facility but at all locations where staff is called to deploy.

Organizing Framework

We base our DNP project implementation strategy on the Social Cognitive Theory. Our review of the literature on MH education shows promising results in knowledge retention and skill improvement with cognitive aids. White and Dudley-Brown (2012) state that “social cognitive theory is particularly useful when dealing with educational programs aimed at changing behavior, such as implementing new knowledge into practice” (p. 54). Social Cognitive Theory states that people learn through direct experience, peer dialogue, interaction, and observation (White & Dudley-Brown, 2012). Our project will purposefully incorporate each of these components to maximize participants’ learning potential.

Our focus areas are the (1) creation of an educational in-service presentation on cognitive aid use for operating room staff at KACC, (2) creation of a simulation scenario for staff to rehearse an MH response plan utilizing the Stanford Emergency Manual, (3) creation of a post-test assessing participants’ level of comfort using an emergency manual during a perioperative

MH crisis to be administered immediately following the drill and (4) ensuring placement of the Stanford Emergency Manual in easily accessible areas including the top of the MH cart and in each OR.

Project Design

General Approach

A pre-educational assessment was given prior to the education intervention, a multi question assessment was given to Anesthesia and other perioperative staff including nurses, surgical technicians, and nursing assistants to evaluate their current opinions of, use of, and perceived benefits of cognitive aids during emergency situations. The questionnaire utilized a likert scale allowing for further analysis of participant's answers.

Following the assessment, an interactive in-service for operating room staff explaining the history of cognitive aid development and the benefit of their use for perioperative emergencies such as MH was delivered. During the in-service, staff were given copies of the Stanford Emergency manual to further familiarize themselves with the tool. Additional time was allotted for to answer questions and address concerns. Finally, all staff were made aware that Stanford Emergency manuals would now be hung on the side of the anesthesia medication cart. Additionally, an evidence-based checklist of physiologic parameters which must be met prior to safe patient transport was presented to the anesthesia staff. This checklist was adapted from the MH transfer guidelines developed by MHAUS. After initial treatment and resuscitation recommended by the Stanford Emergency Checklist initiated, this checklist will guide the anesthesia provider caring for the patient to make decisions about safe patient transfer to the nearest tertiary care facility.

Next, a simulated scenario of a patient presenting in fulminant MH crisis following

halogenated ether agent exposure in an operating room at KACC was conducted. This allowed the entire perioperative staff to practice their response as a team and incorporate the Stanford Emergency manual when deciding on treatment steps.

Following the simulation, a post-intervention questionnaire was administered to all participants. Questions mirroring the pre-educational assessment with added questions to measure if the educational intervention changed their views of the cognitive aids and if the training was effective.

Setting

Fort George G. Meade located in Fort Meade, Maryland employs the third largest workforce of an army installation in the United States. Its' medical treatment facility, Kimborough Ambulatory Care Center, provides same day surgical services to a population of more than 100,000 Army, Navy, and Air Force service members stationed in the greater Washington D.C. area. The nearest tertiary care center is University of Maryland Laurel Regional Hospital, located 12 miles from KACC and approximately 20 minutes by ambulance. Like all facilities which deliver MH triggering anesthetic agents, KACC maintains an MH cart with dantrolene. MH response training is not a part of KACC staff's orientation or annual training, and an emergency manual is not stocked in anesthesia carts or used for ongoing staff training. Its' active duty staff are worldwide assignable and deployable wherever medical care is required in support of military missions.

Procedural Steps

Analysis of the findings will be conducted using Microsoft Excel. The pre and post intervention questionnaires will be compared to explore the staff's opinions of the effectiveness of the training and use of the Stanford Emergency Manual for an MH crisis. Based on staff

feedback, future MH drills can be adapted and modified to increase the efficacy of the training and a potential broadening use of the Stanford Emergency Manual in other crisis scenarios.

Sustainment of the intervention will be accomplished by adapting the educational presentation into a handout that new staff members will be required to read during orientation. The Stanford Emergency Manual will also be provided to the new staff member to allow for familiarization. This will allow new staff members to gain an understanding of the benefits of cognitive aids and sustain their use at KACC. Lastly, MH simulation drills will be run as part of continuing education for operating room staff on an annual basis.

Dissemination of the findings will be accomplished through several avenues. First, the findings will be presented to the staff members of KACC in presentation format with allotted time to answer further questions they may have. In addition, the findings will also be presented during nursing research week at the Uniformed Services University of Health Sciences. Further dissemination of the findings is currently being considered.

HIPAA Concerns

Our project will consist of a rehearsed response to a simulated MH crisis with operating room staff in a simulation center, as well as a pre- and post-intervention assessment of knowledge (written test). These are considered educational tests or surveys conducted in a commonly accepted educational setting for healthcare personnel per IRB exemption guidelines (HHS, 1991). This project involves no risk of physical harm to participants and minimal risk of psychological stress to participants, although this would not exceed the level of stress experienced in the regular operating room environment during emergencies. No sensitive information or vulnerable populations will be involved. Personal identifiers of participants such as age, sex, education etc. were not included in our project manuscript in such a manner that a

participant's individual performance in the project could be identified or be potentially damaging to their reputation or employability. Specific personal identifiers such as name or employee ID number were not collected (HHS, 1991).

The risks and benefits of participation were given to subjects in writing and a verbal acknowledgement of informed consent form required prior to participation in the project.

Project Results

Overwhelmingly, staff found the cognitive aid useful in helping them to manage a patient with MH in a simulated exercise and rated that they are more likely to use a cognitive aid in future potential MH crisis. These findings are consistent with currently available literature as cognitive aids have been shown to improve performance in participants treating simulated MH crisis patients (Marshall, 2013). Anesthesia department staff and base leadership were quick to adopt the updated critical care transfer guidelines ensuring safer patient transport if an MH event were to occur at KACC.

The transfer policy at KACC was reviewed and updated to include new critical care transfer guideline during an MH crisis recommended by MHAUS. This guide is designed to help the anesthesia provider make decisions to ensure the safest possible critical care transport to a higher level of care. The researchers met with the anesthesia department base leadership to ensure a critical care transport team can quickly be called and access the surgical center on base.

Analysis of the Results

A total of 13 staff members took part in the pre-education assessment. Of the 13 staff members, five were Registered Nurses (RN), two were CRNAs, five were operating room technicians, and one did not respond to the job title question. The years of practice was quite varied with two participants having zero to four years of experience, one with five to nice years,

one with ten to fourteen, one with fifteen to nineteen, and five having more than twenty years of experience. Three participants did not respond to the years in practice question. In regard to having previously used a cognitive aid during an emergent situation, five responded that they had and seven responding that they had not. One participant did not respond to the question. Of the five that had used a cognitive aid before, all had found it helpful with a majority of the aids being ACLS cards.

Prior to the in-service training, eleven participants felt cognitive aids were very helpful and very practical for use during an MH crisis. One participant rated cognitive aids as being neutral on their practicality for use during an MH crisis. Two participants did not respond to how helpful cognitive aids are and one did not respond to their practicality of use during an MH crisis. Surprisingly, twelve stated that they are very likely to use a cognitive aid during an MH crisis and one participant not answering the question. If they are likely to use a cognitive aid during other perioperative emergencies, two stated not likely, nine said very likely, and 1 was neutral on the issue. One participant did not respond to the question.

Despite answering that they would use a cognitive aid, four of respondents wrote that the use of cognitive aids can be associated with a negative stereotype. On the other side of the spectrum, five staff members felt their use connotated a positive stereotype and four indicated a neutral rating.

Seven participants stated they had received prior training on the use of cognitive aids. The prior training received ranged in delivery methods from “in-service,” “in-service video,” “classroom/presentation simulation,” “ACLS course classroom/simulation,” and “classroom simulation.” Barriers participants saw to cognitive aid use were also elucidated. Responses included “not being easily located,” “Focusing too much on the aid and not paying attention to

the patient responses,” “taking time away from emergency at hand to read material,” “Sometimes too much volume of info, should be kept to bare essentials,” and “in an emergency can be quite ineffective, takes too much time to read.” The participants also identified numerous benefits of the use of cognitive aids with the general themes in their responses being a memory aid so important details or steps would not be missed, and they provide an organized step by step approach to manage patients with conditions not often seen.

Following the in-service and simulation training, nine staff members completed the post-educational survey. Of the nine staff members, three were RNs, two were CRNAs, and four were operating room technicians. All nine staff members stated they were more likely to use a cognitive aid in an MH crisis and in perioperative emergencies. Eight participants felt cognitive aids were very helpful in emergencies and 1 stated they were helpful.

Regarding if training helped reduce a negative stereotype associated with the use of cognitive aids, seven participants rated them as having a positive stereotype in their use while two still indicated a negative connotation to their use. All nine participants felt the training was beneficial in treating a patient with MH and on the use of cognitive aids in general.

Organizational Impact / Implications to Practice & Policy

The overall impact of this project is improved patient care especially in high risk low volume occurrences such as patients experiencing an MH crisis. As reported in the analysis of results section, all the participants found the cognitive aid helpful and were very likely to utilize them in their future practice. This will positively impact patient care as cognitive aids have been shown to improve clinician performance.

During the simulation portion of the training program, it was discovered that KACC may benefit from adding several items to their MH cart. The inclusion of charcoal filters that can be

placed on the anesthesia machine so anesthetic gases can be more readily removed from the anesthesia circuit were one area of improvement that was offered. Unfortunately, these filters are expensive however, the anesthesia staff at KACC is now looking into purchasing them.

The other area of improvement that was seen was an update to KACC transfer protocol. An MH specific transport protocol was created using recommendations from The Society for Ambulatory Anesthesiology; Malignant Hyperthermia Association of the United States; Ambulatory Surgery Foundation; Society for Academic Emergency Medicine; and National Association of Emergency Medical Technicians. This transport checklist and was reviewed with the anesthesia department and adopted as a new part of their critical care transport policy.

Future Directions for Research and Practice

The use of cognitive aids in supporting medical providers is likely to expand into other high-risk low volume scenarios. The Stanford emergency manual contains 33 different clinical algorithms for providers to utilize in these difficult clinical situations. Due to this, the use of cognitive aids, specifically the Stanford emergency manual, should be encouraged and training with all of these clinical situations, not just an MH scenario. With the routine application of cognitive aids, the quality and outcomes of patient care could be drastically improved.

Conclusion

Malignant Hyperthermia is a life-threatening emergency that can occur in any setting where anesthesia is delivered. A review of the literature found that the use of simulated exercises incorporating cognitive aid tools was the best way to ensure participants would include critical MH treatment steps in their response and retain this information in the long term. Perioperative staff at Kimborough Ambulatory Care Center in Fort Meade, MD participated in a successful inservice and simulation exercise that introduced them to the Stanford Emergency Manual tool

and increased their willingness to use this cognitive aid in the event of a real life MH crisis. The critical care transfer policy and evidence-based guidelines for transfer of a patient in fulminant MH crisis were also introduced to the anesthesia department and base leadership, which readily accepted these new policies. We believe these changes have better prepared the staff at KACC to respond appropriately to an MH emergency and potentially improve patient outcomes in the face of this crisis.

References:

- American Association of Nurse Anesthetists. (2015). *Position Statement: Malignant Hyperthermia Crisis Preparedness and Treatment*. Retrieved from <http://www.aana.com/resources2/professionalpractice/Pages/Malignant-Hyperthermia-Crisis-Preparedness-and-Treatment.aspx>.
- Arriaga, A. F., Bader, A. M., Wong, J. M., Lipsitz, S. R., Berry, W. R., Ziewacz, J. A., 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), 246-54.
- Barash, P.G., Cullen, B.F., & Stoelting, R.K. (Eds). (2013). *Clinical Anesthesia* (pp. 380-404). 7th ed. Philadelphia, PA: Lippincott Williams & Wilkins.
- Cannon-Deihl, M. R., Rugari, S. M., and Jones, T. S. (2012). High Fidelity Simulation for Continued Education in Nurse Anesthesia. *American Association of Nurse Anesthetists Journal*, 80(3) 191-196.
- Department of Health and Human Services. (1991). Subpart A – Basic HHS Policy for Protection of Human Research Subjects 46.101. Retrieved from [https://www.hhs.gov/ohrp/regulations-and-policy/regulations/45-cfr-46/index.html#46.101\(b\)](https://www.hhs.gov/ohrp/regulations-and-policy/regulations/45-cfr-46/index.html#46.101(b))
- Edmondson P. & Damani Z. (2014). Emergencies in anaesthesia: Improving patient safety. *Anaesthesia*, 69 (3), 31.
- Goldhaber-Fiebert, S. N., & Howard, S. K. (2013). Implementing Emergency Manuals: Can Cognitive Aids Help Translate Best Practices for Patient Care During Acute Events? *Anesthesia & Analgesia*, 117(5), 1149-1161. doi:10.1213/ane.0b013e318298867a
- Gupta, K., (2007). *A Practical Guide to Needs Assessment*. San Francisco, CA: John Wiley & Sons; 2007.
- Harrison, T. K., Manser, T., Howard, S. K. & Gaba, D. M. (2006). Use of Cognitive Aids in a Simulated Anesthetic Crisis. *Anesthesia and Analgesia*, 103 (3), 551-6.
- Hirshey Dirkson, S. J., Van Wiklin, S. A., Mashman, D. L., Neiderer, P., & Merritt, D. R. (2013). Developing Effective Drills in Preparation for Management of a Malignant Hyperthermia Crisis. *AORN Journal*, 97(3) 329-52. Retrieved from <http://dx.doi.org/10.1016/j.aorn.2012.12.009>
- Johns, C. D., Stoudt, R. S., Scholtis, M. P. & Gavel, T. (2012). Malignant hyperthermia: a crisis response plan. *OR Manager*, 28 (6), 18-21.

- Malignant Hyperthermia Association of the United States (MHAUS). (2014). About Malignant Hyperthermia. Retrieved from <http://www.mhaus.org/>
- Manser, T. H., Gaba, D. M. & Howard, S. K. (2012). Coordination patterns related to high clinical performance in a simulated anesthetic crisis. *Anesthesia and Analgesia*, 108 (5), 1606-1615.
- Marshall, S. (2013). The use of cognitive aids during emergencies in anesthesia: A review of the literature. *Anesthesia and Analgesia*, 117 (5), 1162-1171.
- McEvoy, M. D., Hand, W. R., Furse, C. M., Field, L. C., Clark, C. A., Vivek M. K., Nietert, P. J., O'Connor, M. F. & Nunnally, M. E. (2014). Validity and reliability assessment of detailed scoring checklists for use during perioperative emergency simulation training. *Journal of the Society of Simulation in Healthcare*, 9 (5), 295-303.
- McEvoy M. D., Smalley J.C., Field L.C., Furse C.M. & Rieke H. (2010). Use of cognitive aids significantly increases retention of skill for management of cardiac arrest [abstract]. Paper presented at: American Society of Anesthesiologists Annual Meeting, 2010, San Diego, CA
- Michaelson, L., Muldoon, S., Nyamkhishge, S., Voelkel, M., & Litchfield, J. (2016). Malignant Hyperthermia [Powerpoint slides]. Retrieved from: <https://learning.usuhs.edu/portal/site/5ca3164a-e799-4474-960e-333a081903a3/page/477047e7-7eed-4940-8c9b-14faeb963713>
- Middleton, A. & Dinneen, M. (2011). Military Health System Conference: Achieving the Quadruple Aim Focusing on Strategic Imperatives [Powerpoint slides]. Retrieved from file:///C:/Users/Liz/Downloads/ADA556276.pdf.
- Plurad, D., Blaschke, G., Jones, S., & Pfeiffer, J., (2008). A case of Malignant Hyperthermia in a Child Encountered during a Humanitarian Assistance Mission to the Philippines. *Military Medicine*, 173(8), (805-8).
- Pugel, A. E., Simianu, V. V., Flum, D. R., & Dellinger, E. P. (2015). Use of the Surgical Safety Checklist to Improve Communication and Reduce Complications. *Journal of Infection and Public Health*, 8(3), 219-225. doi:10.1016/j.jiph.2015.01.001
- Rang, H. P., Ritter, J. M., Flower, R. J., & Henderson G. (2016). *Rang & Dale's Pharmacology* (pp.52-54). 8thed. Edinburgh: Elsevier, Churchill Livingstone.
- Rosenberg, H., Davis, M., James, D., Pollock, N., & Stowell, K., (2007). Malignant hyperthermia. *Orphanet Journal of Rare Diseases*, 2(1), 21.
- Riazi, S., Larach, M.G., Hu, C., Wijeyesundera, D., Massey, C., & Kraeva, N., (2014). Malignant Hyperthermia in Canada: characteristics of index anesthetics in 129 malignant hyperthermia susceptible probands. *Anesthesia and Analgesia*, 118(2) 381-87. doi:

10.1213/ANE.0b013e182937d8b.

Sheehan, J. A. (2005). Malignant Hyperthermia Susceptibility and the Trauma Patient. *Military Medicine*, 170(6), 510-512.

White, K.M. & Dudley-Brown, S. (2012). Translation of Evidence into Nursing and Healthcare Practice. Springer Publishing Company: NY

Ziewacz, J. E., Arriaga, A. F., Bader, A. M., Berry, W. R., Edmondson, L., Wong, J. M., Lipsitz, S. R., Hepner, D. L., Peyre, S., Nepson, S., Boorman, D. J., Smink, D. S., Ashley, S. W., & Gawande, A. A. (2011). Crisis Checklists for the Operating Room: Development and Pilot Testing. *American College of Surgeons*, 213(2), 212-217.

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

**COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS***

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- Name: Elizabeth Gallegos (ID: 5745556)
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- Curriculum Group: OUSD P&R Human Research
- Course Learner Group: Biomedical Investigators and Research Study Team
- Stage: Stage 1 - Biomedical Investigators

- Report ID: 20632322
- Completion Date: 28-Aug-2016
- Expiration Date: 28-Aug-2019
- Minimum Passing: 80
- Reported Score*: 95

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Avoiding Group Harms - U.S. Research Perspectives (ID: 14080)	28-Aug-2016	3/3 (100%)
Recognizing and Reporting Unanticipated Problems Involving Risks to Subjects or Others In Biomedical Research (ID: 14777)	28-Aug-2016	5/5 (100%)
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16690)	28-Aug-2016	4/5 (80%)
Module for Non-DoD Personnel Conducting Research Involving Human Subjects Supported by the DoD (ID: 16769)	28-Aug-2016	No Quiz
History and Ethics of Human Subjects Research (ID: 498)	28-Aug-2016	7/7 (100%)
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)	28-Aug-2016	5/5 (100%)
Informed Consent (ID: 3)	28-Aug-2016	5/5 (100%)
Social and Behavioral Research (SBR) for Biomedical Researchers (ID: 4)	28-Aug-2016	4/4 (100%)
Records-Based Research (ID: 5)	28-Aug-2016	3/3 (100%)
Genetic Research in Human Populations (ID: 6)	28-Aug-2016	5/5 (100%)
Vulnerable Subjects - Research Involving Children (ID: 9)	28-Aug-2016	3/3 (100%)
Vulnerable Subjects - Research Involving Pregnant Women, Human Fetuses, and Neonates (ID: 10)	28-Aug-2016	3/3 (100%)
FDA-Regulated Research (ID: 12)	28-Aug-2016	4/5 (80%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	28-Aug-2016	4/5 (80%)
Office of the Under Secretary of Defense (Personnel and Readiness) (ID: 912)	28-Aug-2016	No Quiz
The Federal Regulations - SBE (ID: 502)	28-Aug-2016	5/5 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

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COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)**COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS***

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

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- Curriculum Group: OUSD P&R Human Research
- Course Learner Group: Biomedical Investigators and Research Study Team
- Stage: Stage 1 - Biomedical Investigators

- Report ID: 20622880
- Completion Date: 28-Aug-2016
- Expiration Date: 28-Aug-2019
- Minimum Passing: 80
- Reported Score*: 92

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Avoiding Group Harms - U.S. Research Perspectives (ID: 14060)	27-Aug-2016	3/3 (100%)
Recognizing and Reporting Unanticipated Problems Involving Risks to Subjects or Others in Biomedical Research (ID: 14777)	27-Aug-2016	4/5 (80%)
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)	27-Aug-2016	4/5 (80%)
Module for Non-DoD Personnel Conducting Research Involving Human Subjects Supported by the DoD (ID: 16769)	27-Aug-2016	No Quiz
History and Ethics of Human Subjects Research (ID: 498)	27-Aug-2016	7/7 (100%)
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)	27-Aug-2016	4/5 (80%)
Informed Consent (ID: 3)	28-Aug-2016	5/5 (100%)
Social and Behavioral Research (SBR) for Biomedical Researchers (ID: 4)	28-Aug-2016	4/4 (100%)
Records-Based Research (ID: 5)	28-Aug-2016	3/3 (100%)
Genetic Research in Human Populations (ID: 6)	28-Aug-2016	5/5 (100%)
Vulnerable Subjects - Research Involving Children (ID: 9)	28-Aug-2016	3/3 (100%)
Vulnerable Subjects - Research Involving Pregnant Women, Human Fetuses, and Neonates (ID: 10)	28-Aug-2016	3/3 (100%)
FDA-Regulated Research (ID: 12)	28-Aug-2016	5/5 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	28-Aug-2016	5/5 (100%)
Office of the Under Secretary of Defense (Personnel and Readiness) (ID: 912)	28-Aug-2016	No Quiz
Cultural Competence in Research (ID: 15166)	28-Aug-2016	3/5 (60%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

Verify at: <https://www.citi-program.org/verify/725515335-cbd5-4ae9-8b7c-eb15263752df>

CITI Program
 Email: support@citi-program.org
 Phone: 888-529-5929
 Web: <https://www.citi-program.org>

**USUHS FORM 3202N
DANIEL K. INOUE GRADUATE SCHOOL OF NURSING
EVIDENCE-BASED PRACTICE/PERFORMANCE IMPROVEMENT PROPOSAL**

VPR Date Stamp

Project Number: GSN-61-10264 (VPR will assign)
Project Title: MH Training with Cognitive Aid

SECTION A: STUDENT POC INFORMATION	
1. Name (Last, First, MI): <u>Hennen, Bryan, T</u>	Student E-mail: <u>bryan.hennen@usuhs.edu</u>
2. Home Address: <u>[REDACTED]</u>	
SECTION B: COMMITTEE CHAIR/ SENIOR MENTOR INFORMATION	
3. Name (Last, First, MI): <u>Litchfield, John, N</u>	
4. Telephone: <u>301-295-1213</u> Fax: _____	E-mail: <u>john.litchfield@usuhs.edu</u>
5. USUHS Building/ Room No.: <u>E-1025</u>	
SECTION C: PROJECT INFORMATION	
6. Attach the Abstract for the proposal, including the following sections: Site Location of the Project, Title, Authors, Background or Problem/Issue, Clinical Question/Purpose, Project Design, Anticipated Organizational Impact/Implications for Practice and also include the Proposed Timeline. Single space the abstract and use Times New Roman font, size 12.	
7. Is this proposal related to an active research project of the Chair/Senior Mentor identified in Section B? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, complete below; if no, proceed to Part 8. Project Number: _____ Project Title: _____ Project Start Date: _____ Project End Date: _____	
8. Anticipated period of performance: Project Start Date: <u>2/1/2018</u> Project End Date: <u>5/1/2019</u>	
9. Performance Site(s): <u>Fort Meade</u>	
10. Does this project involve any classified information? (Contact the USUHS Security Office for guidance) <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
11. Do you have a funding source for this project? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> NA If yes, specify the funding agency and the amount provided:	
SECTION D: SIGNATURES	
The following signatures attest to the validity of the above information:	
<u>[REDACTED]</u> Student (Project Point of Contact for the Group) (Signature and Date)	<u>[REDACTED]</u> Chair/Senior Mentor (Signature and Date)
<u>[REDACTED]</u> Chair/Program Director (Signature and Date)	<u>[REDACTED]</u> Chair/Program Director (Signature and Date)
<u>[REDACTED]</u> DNP Project Director or PhD Director (Signature and Date)	<u>[REDACTED]</u> Associate Dean for Academic Affairs, GSN (Signature and Date)
<u>[REDACTED]</u> Associate Dean for Research, GSN (Signature and Date)	<u>[REDACTED]</u> Dean, DKJ Graduate School of Nursing (Signature and Date)
In light of the above signatures, the project is approved.	
<u>[REDACTED]</u> USUHS Vice President for Research	<u>22 Feb 2019</u> Date

Walter Reed National Military Medical Center
Department of Research Programs
8901 Wisconsin Avenue
Bethesda, MD 20889-5600

February 28, 2018

MEMORANDUM FOR Hennen, Bryan Timothy

SUBJECT: WRNMMC DRP Determinations Review of Project WRNMMC-EDO-2018-0141,
Malignant Hyperthermia training program utilizing cognitive aid

REFERENCE #: 902362

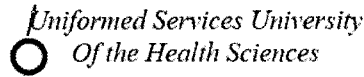
ACTION: DETERMINATION OF NOT RESEARCH

DECISION DATE: 02/28/2018

1. Thank you for your submission of this project and supporting materials. This project does not meet the definition of research in accordance with 32 Code of Federal Regulation 219.102 and DODI 3216.02.
2. You must register your project with the WRNMMC Quality Management Division. Please contact Mr. Victor Mosley at victor.c.mosley.civ@mail.mil.
3. Any changes to this project must be reviewed by the WRNMMC DRP Determinations Official to ensure that the changes do not impact this determination.
4. You are reminded that all information collection surveys must comply with DoDI 1100.13, "DoD Surveys".
5. Any publication arising from this work must be cleared through the publication clearance process.
6. The point of contact for this memorandum, Sanjur Brooks, can be reached 301-400-1237 or william.g.danchanko.mil@mail.mil.



CDR William Danchanko, PhD
Determination Official



Manuscript/Presentation Approval or Clearance (Student)

Initiator

1. USU Principal Author/Presenter: Elizabeth Gallegos, LT, NC, USN; Bryan Hennen, LT, NC, USN
2. Academic Title: Students, Nurse Anesthesia Program
3. School/Department/Center: Daniel K. Inouye Graduate School of Nursing
4. Phone: (320)-250-6731
5. Type of clearance: Paper ___ Article ___ Book ___ Poster X Presentation X Workshops Abstract ___ Other ___
6. Title: Malignant Hyperthermia Crisis Preparedness
7. Intended publication/meeting: USU Research Days (Poster, and Presentation), final report, abstract/impact statement for USU Archives
8. "Required by" Date: ASAP
9. Date of submission for USU approval: 02 April 2019

Public Affairs Officer Kimbrough Ambulatory Care Center

1. Name: Chuck Yang
2. Date: 3 April 2019

**Note: It is DoD policy that clearance of information or material shall be granted if classified areas are not jeopardized, and the author accurately portrays official policy, even if the author takes issue with that policy. Material officially representing the view or position of the University, DoD, or the Government is subject to editing or modification by the appropriate approving authority.*

4/10/2019



Chuck Yang
 Public Affairs Officer
 Signed by: YANG.CHUL.HO.1042887214

Demographics

1. Job title: _____

2. Years of practice: 0-4; 5-9; 10-14; 15-19; >20

1. have you ever used a cognitive aid/emergency manual during a medical emergency? If so, please answer question 2 & 3

Yes or No

2. What type of manual/aid did you use? i.e. ACLS card, Stanford emergency manual, ect.

3. Did you find the cognitive aid helpful?

Yes or No

4. Do you feel cognitive aids are helpful in emergency situations?

Not helpful 1 2 3 4 5 Very helpful

5. Do you feel the use of cognitive aids/emergency manuals have a negative stereotype associated with their use

Negative stereotype 1 2 3 4 5 Positive stereotype

6. How practical is the use of a cognitive aid in the treatment of Malignant Hyperthermia?

Not practical at all 1 2 3 4 5 Very practical

7. Have you ever received training on the use of cognitive aids? If yes, please answer question 7

Yes or No

8. How was the training delivered? Classroom/presentation, simulation, ect.

9. Are you likely to use a cognitive aid in the treatment of Malignant Hyperthermia?

Not very likely 1 2 3 4 5 Very likely

10. Are you likely to use a cognitive aid in the treatment of other operating room emergencies?

Not very likely 1 2 3 4 5 Very likely

11. What barriers do you see to cognitive aid use?

12. What benefits do you see to cognitive aid use?

Demographics

1. Job title: _____

2. Years of practice: 0-4; 5-9; 10-14; 15-19; >20

1. After completing this training, are you more likely to use a cognitive aid in the treatment of Malignant Hyperthermia? Not more likely 1 2 3 4 5 Way more likely

2. After completing this training, are you more likely to use a cognitive aid in the treatment of other operating room emergencies? Not more likely 1 2 3 4 5 Way more likely

3. Do you feel cognitive aids are helpful in emergency situations? Not helpful 1 2 3 4 5 Very helpful

4. Do you feel the use of cognitive aids/emergency manuals have a negative stereotype associated with their use? Negative stereotype 1 2 3 4 5 Positive stereotype

5. Was this training beneficial on for the treatment of Malignant Hyperthermia? Yes or No

6. Yes or No: Was this training beneficial on the use of cognitive aids in operating room emergencies? Yes or No

7. How practical is the use of a cognitive aid in the treatment of Malignant Hyperthermia? Not practical 1 2 3 4 5 Very practical

8. What barriers did you encounter to cognitive aid use during the simulation _____

9. What, if any benefits did you see to cognitive aid use during the simulation? _____

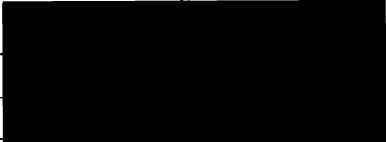
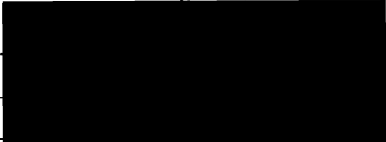


Appendix G: Daniel K. Inouye Graduate School of Nursing
DNP Project Completion Verification Form

**DOCTOR OF NURSING PRACTICE PROJECT
Completion Verification Form**

The DNP Project titled: Malignant Hyperthermia Crisis Preparedness


was completed at Kimbrough Ambulatory Care Center Fort Meade Maryland by the following student(s):

<i>(type student name)</i>	<i>(signature)</i>	<i>(date)</i>
<u>Elizabeth Galleogos</u>		<u>29 APR 2019</u>
<u>Bryan Hennen</u>		<u>29 APR 2019</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

The DNP Practice Project Team verifies that the following components of the DNP project, accomplished by the above students, is of sufficient rigor and demonstrates doctoral level scholarship to meet the requirements for USUHS GSN graduation:

- Presentation of DNP project to the leadership/stakeholders at the Phase II Site,
- Abstract/Impact Statement (*Appendix F*), and
- DNP Project written report.

Verified by:

<i>(type name)</i>	<i>(signature)</i>	<i>(date)</i>
_____		_____
		Senior Mentor
_____	_____	_____
		Team Mentor
_____	_____	_____
		Team Mentor
_____	_____	_____
		Team Mentor & Phase II Site Director

For RNA Students only - add the following additional signature for final verification of project completion:

<u>CDR Kennett Radford, PhD, CRNA</u>		<u>4/30/2019</u>
RNA Project Director <i>(type name)</i>	<i>(Signature)</i>	<i>(Date)</i>