IMPACT OF AN INTERDISCIPLINARY SIMULATION TRAINING ON PROVIDER CONFIDENCE AND COMPETENCE IN THE MANAGEMENT OF A LOCAL ANESTHETIC SYSTEM TOXICITY CRITICAL INCIDENT

by

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A DNP Project submitted to the School of Nursing State University of New York
In partial fulfillment of the requirement for the degree of Doctor of Nursing Practice

December, 2019
DNP Project Approval Form

This is to certify that ____________________________

(Name of Student)

successfully defended their project entitled:

Impact of an Interdisciplinary Simulation Training on Provider Confidence and Competence in the Management of a Local Anesthetic System Toxicity Critical Incident

on November 26, 2019.

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Abstract

The purpose of this Doctor of Nursing Practice (DNP) Project was to examine the impact of a critical incident (CI) team training event on clinician confidence and competence in managing a local anesthetic systemic toxicity (LAST) CI at an ambulatory surgery center located in Western New York (WNY). The National League for Nursing (NLN) Student Satisfaction and Self-Confidence in Learning questionnaire and a CI questionnaire developed by the DNP project student were utilized to collect data. Following approval by the University at Buffalo (UB) Institutional Review Board (IRB), 16 clinicians were voluntarily recruited from the study site. Results from pre and post intervention survey instruments were statistically significant. Mean confidence and perceived competence scores improved from 3.32/5 to 4.26/5 (p = 0.001). Similarly, competence scores improved by 30.5% (p = 0.000) following the CI training. Key findings emerged from the training and qualitative analysis, most notably a lack of institutional and individual preparedness to effectively manage a CI, including LAST. This study shows promise with regards to the efficacy of staff training to improve the individual clinicians’ confidence and competence in the management of a CI, while identifying site specific deficiencies to be addressed that may avert untoward patient outcomes in the event a CI were to occur. To more broadly apply findings, additional research is needed at multiple centers with a larger sample size and a longitudinal component to evaluate participants’ retention of CI content.

Keywords: critical incident, crisis resource management, inter-professional team training, non-technical skills, local anesthetic systemic toxicity (LAST)
Acknowledgements

I wish to sincerely thank all those who have helped me throughout the completion of this project, giving of their time, talents and energy to successfully facilitate this endeavor. First and foremost, I would like to thank my classmate and research partner, Rachael Schultz. Her determination, hard work and focus allowed us to navigate this collaborative effort while sparing our collective sanity. I would also like to thank Dr. Kristine Faust, who was largely responsible for the inspiration of this project and helped lay the foundation that ultimately allowed for its successful completion.

Secondly, I would like to thank my project advisor, Dr. Loralee Sessanna. Her perpetual guidance throughout the entirely of this project paired with her prompt, thorough feedback and calm, caring demeanor were more helpful than I could ever begin to express in writing. Additionally, I would like to thank Dr. Barrick, who through his specific brand of expertise, singlehandedly contributed to a statistically significant reduction in the levels of stress and anxiety experienced by the remainder of the research team during the data analysis process.

Lastly, I would like to thank my daughter, Lana. She has been my greatest supporter through the entirety of the DNP Nurse Anesthesia program experience. Her presence and smile have, on countless occasions, lifted my spirits after the most difficult of clinical days and helped me find the requisite motivation to overcome the worst bouts of writers block and procrastination. Hopefully through enduring this journey with me, she will find that which is within, empowering her to vanquish all challenges she may encounter along the way.
In the United States (US), critical incidents (CI) and medical errors cause over 100,000 deaths annually because of system and process breakdowns, condition failures, human factors, and ineffective communication and teamwork all of which lead to untoward patient outcomes (Boet et al., 2018; Bracco et al., 2018; Ziesmann et al., 2013). Patient safety improvements continue to receive increased attention from governmental agencies such as the Institute of Medicine (IOM), the Joint Commission, and the Agency for Healthcare Quality and Research (AHQR). Reimbursement for healthcare services has also become more dependent upon patient safety standards that optimize patient outcomes. To support health care organizations and programs to identify and reduce and/or eliminate system and process failures, educational interventions for employees are needed that are directed toward improving patient care quality and outcomes. In recognition of the role that non-technical skills play in patient safety and the prevention of patient harm such as effective communication and teamwork skills, an increased emphasis has been placed on supporting the development of non-technical skills among healthcare professionals via interdisciplinary CI training (Boet et al., 2018; Neal et al., 2018; Rudy, Polomano, Murray, Henry, & Marine, 2007; Ziesmann et al., 2013).

**Background and Significance**

Broadly defined, a CI refers to any “deviation from the expected course with the potential for an adverse outcome” including those “that lead to adverse outcomes as well as incidents that do not result in harm to the patient and incidents that either do or do not originate from medical error” (Manser, 2011, p. 170). In perioperative settings, CIs result from patient deterioration related to underlying comorbidities, surgical and anesthetic complications (e.g. acute hemorrhage, malignant hyperthermia [MH], local anesthetic systemic toxicity [LAST]), and environmental factors such as extraneous noise and production pressures that precipitate medical
errors (e.g. wrong site surgery). Regardless of the specific event or series of events, CIs pose a serious threat to patient well-being with increased risk of morbidity and mortality linked to their occurrence.

As greater accountability of professional performance for patient safety has become a requisite for healthcare clinicians, so too has been the need to develop and implement training programs to optimize these skill sets as part of the continuing education and training of these individuals (Boet et al., 2018). Building upon and borrowing from methods employed by other industries such as aviation, to mitigate the detrimental impact of human error during CIs, employee simulation training has been widely adopted by the healthcare industry (Neal et al., 2018; Rudy et al., 2007; Ziesmann et al., 2013). Crisis resource management (CRM) is a widely used intervention for addressing CIs in anesthesia, critical care, trauma and emergency medicine, as well as various operating room (OR) settings (Bracco et al., 2018; Ziesmann et al., 2013). “The primary objective of CRM training is to teach concepts of teamwork, assessment skills, role responsibilities, assertiveness, communication, support, and resource management so that healthcare professionals are better prepared to function in emergencies” thus averting errors that often result under pressure and stress (Rudy et al., 2007, p. 220).

Unlike CRM training and courses such as Advanced Cardiac Life Support (ACLS) that highlight skillsets for individual practitioners, real-word critical events frequently involve a multidisciplinary healthcare team which highlights the need to coordinate a team with novel non-technical skills through supplemental training (Ziesmann et al., 2013). Supplemental practitioner training targeting the management of low-frequency, high acuity CI events in the perioperative arena such as airway emergencies, malignant hyperthermia [MH], or local anesthetic systemic toxicity [LAST] require rapid diagnosis and specific treatment algorithms to prevent untoward
patient outcomes. Ample evidence exists supporting recurrent simulation-based (both low and high-fidelity formats) CI training as a means to bolster staff preparedness in managing such events. On-the-job multidisciplinary training sessions and institutional policy requiring such competencies beyond the scope of cardiovascular resuscitation (BLS, ACLS, PALS) are frequently lacking (Cain, Riess, Gettrust, & Novalija, 2014; Neal et al., 2018; Paige, Garbee, Brown, & Rojas, 2015; Rudy et al., 2007; Ziesmann et al., 2013).

**Project Purpose, Aims and Objectives**

In response to a recently identified need for LAST CI training to improve the confidence and competence among perioperative personnel in managing such an event, this DNP project implemented an interdisciplinary LAST CI simulation training with surgeons, anesthesia providers, PAs, perioperative nurses, and surgical technicians working at a new ambulatory surgery center located in Western New York. Collaborating with key stakeholders from the site, the DNP project student, a Student Registered Nurse Anesthetists (SRNA) enrolled in the University at Buffalo’s Nurse Anesthesia program, served as the principal investigator (PI) for this project. The project question is as follows: among clinical staff working at a WNY ambulatory surgery center, does completion of an inter-professional CI team training session increase provider confidence and competence in managing the care of a patient experiencing LAST? It is hypothesized that there would be improvement in clinician confidence and competence in managing a LAST CI following the interdisciplinary team simulation training. The low-fidelity simulation training consisted of a LAST scenario and debriefing session.

The inter-professional LAST CI simulation training for the clinical staff working at the ambulatory care center served as the DNP project deliverable. Efficacy of the intervention was evaluated via mixed methods design in the form of pretest-posttest data collection and statistical
analysis paired with qualitative data from use of open-ended questions. Increased provider confidence and competence in managing a LAST CI was the primary outcome of this study. Findings from this study provide evidence to substantiate the value of conducting CI training on a recurrent basis at the proposed site and perhaps provide the impetus for development of institutional policy requiring said training. Accordingly, an additional objective of the DNP project was to develop a recommended policy and procedure guideline for managing a LAST crisis based on the project findings for the perioperative team working at the ambulatory surgery center. Through the provision of leadership for an inter-professional collaborative staff education event that evaluates current care model and practices, with a long-term overarching goal of influencing policy development, the advanced practice nursing role of this proposed DNP project was well substantiated. The PI served as the liaison between academia/research and clinical practice arenas.

**The DNP Essentials**

For the purpose of this project, the following American Association of Colleges of Nursing (AACN, 2006) were addressed: Essential II: *Organizational and Systems Leadership for Quality Improvement and Systems Thinking*, Essential III: *Clinical Scholarship and Analytical Methods for Evidence-Based Practice*, and Essential VI: *Interprofessional Collaboration for Improving Patient and Population Health Outcomes*. The project deliverable, an interprofessional CI team training session, represents a quality improvement endeavor, thereby addressing DNP Essential II. Data collection, statistical data analysis, and the dissemination of findings contributed to the existing body of literature by addressing identified gaps in knowledge. The essence of nursing science, to advance evidence-based practice, was represented in DNP Essential III. Lastly, the aim of this proposed DNP project was to improve
patient outcomes through improved interprofessional collaboration and communication as related to CI, which embodies DNP Essential VI.

**Theoretical Framework**

Integral nursing theory, an emerging and more recent and comprehensive theory, was created to facilitate improvement in quality of care for increasingly complex problems among diverse patient populations, families, and communities. To promote scholarship, collegiality, and advanced nursing practice, the theory expands on and synthesizes existing theories from medicine and nursing as a means of supporting health care professionals in enhancing collaboration and communication within and between disciplines (Fiantd, Forman, Erikson, Pakieser, & Burge, 2003). Integral nursing theory builds upon Wilber’s All-Quadrant All-level (AQUAL) theory, Beck and Cowan’s Spiral Dynamics Model, and Carper’s 4 Fundamental Patterns of Knowing (Fiantd et al., 2003; Meleis, 2007; Tracy & DiNapoli, 2012). As such, the theory provides a new framework for conceptualizing and problem solving by providing the clinician with the ability to view issues on both a micro and macro level; as a whole, in parts, and with oneself as a component of both parts and sum of parts. As discussed by Dossey (2008), who labels Wilber’s four quadrants as “I,” “it,” “we,” and “its,” integral nursing theory places healing at the center with the various quadrants representing different individual perspectives and world views (p. E62-63). In short, integral nursing theory aids the clinician in examining the concept of healing through a holistic lens as a process that includes “knowing, doing, and being” (Tracy & DiNapoli, 2012, p. 27). Through a deeper understanding of self, and individual interconnectedness to the world around oneself, these four quadrants/patterns of knowing influence one’s interpretation of reality, thereby affecting relationships with others (Dossey, 2008; Fiantd et al., 2003; Rodgers, 2003; Tracy & DiNapoli, 2012).
The most noteworthy key concept related to integral nursing theory is that it is intended to build on pre-existing theories in a complementary way, where traditionally, theories are often pitted against one another, particularly those with origins from different disciplines or foci (Meleis, 2007). Through examining different relationships and focusing on different phenomena, seemingly unrelated or conflicting theoretical viewpoints actually stand to complement one another and through integral nursing theory this may occur in an exponential fashion (Rodgers, 2003). Just as the profession of nursing does not exist within a vacuum, such is the case with development of theories which drive improvements in patient care delivery and outcomes. Integral nursing is the result of “accommodation, refinement, and collaboration among thoughts, ideas, and individuals… [which], does not underestimate the further need for progress that is inherent in all scientific disciplines…[rather], allows for careful critique of what has been and what is yet to be accomplished” (Meleis, 2007, p. 525).

Successful implementation of clinical interventions directed at improving patient outcomes in outpatient settings, from the perioperative phase through hospital discharge, require interdisciplinary collaboration, effective communication, and creative problem solving. Safe, effective, and cost-efficient patient-centered care hinges upon the convergence and coordination of numerous individuals as well as external factors from each of the four quadrants that are the cornerstone of integral nursing theory. Clinicians each possess unique attributes (‘I’) that must be balanced with those around them to coordinate a shared vision (‘we’) that incorporates individual physiologic patient factors (‘it’) that are intertwined with social, environmental, and organizational structures of the healthcare system at large (Dossey, 2008).

Similarly, when a CI occurs in the perioperative setting, all clinicians must remain focused on achieving an optimal patient outcome through resolution of the event. Careful
orchestration of individual roles (the ‘I’ quadrant) and responsibilities must be balanced with acute changes in patient condition (the ‘it’ quadrant). In these circumstances, each clinician must be able to recognize one’s role within the team dynamic while simultaneously possessing the ability to rapidly shift between any and all of these interconnected roles as needed (convergence of ‘I’ and ‘we’). Maintaining focus on ‘the big picture’ as well as one’s role in achieving this end is paramount. The emphasis of integral nursing theory on interdisciplinary collaboration occurs only through an enhanced and shared “vision of the contributions of each of the parts to forming a successfully integrated system” (Rodgers, 2003, p. 139). Furthermore, integral nursing facilitates unification through diversity by encouraging interdisciplinary dialogue and thus providing a pathway for the healthcare system and clinicians within it (Fiandt et al., 2003). As such, integral nursing provides an ideal theoretical framework to guide the implementation and evaluate the efficacy of an inter-professional CI team training program.

**Literature Review**

To synthesize the most current evidence regarding CIs, multidisciplinary team training, and LAST, an extensive review of the literature was conducted with findings evaluated for relevance, appropriateness, and timeliness. Various peer-review databases were queried including CINAHL, Medline, PubMed, and SCOPUS. The search was limited to the English language and full-text articles published within the previous 15 years (2005 to present) to ensure the timeliness of findings and to optimize relevance to the clinical topic of interest. Keywords searched both singularly and in various combinations included: critical incident, CI, crisis management, crisis resource management, inter-professional team training, team training, non-technical skills, local anesthetic systemic toxicity, and LAST. The following presents a summary of findings from this literature review.
Simulation-based Training

An overarching theme that emerged from the literature review are the varied benefits of both high and low-fidelity simulation as a means for bolstering staff preparedness in managing CIs and crises related to patient care without the risk of patient harm (Boet et al., 2018; Bracco et al., 2018; Cain et al., 2014; Nishisaki, Keren, & Nadkarni, 2007; Paige et al., 2015; Zeismann et al., 2013). Numerous studies examined the impact of such training across varied patient care settings such as the operating room (Boet et al., 2018), obstetrics (Bracco et al., 2018), trauma (Zeismann et al., 2013), surgical residency (Paige et al., 2015) and specific critical events such as malignant hyperthermia (Cain et al., 2014) and local anesthetic systemic toxicity (Neal et al., 2018). The literature was limited, however, regarding the beneficial impact simulation-based team training has on those who complete it; even more so, when examining the impact of simulated-based training on real-world patient care, or operational performance. Two studies reviewed focused on learner outcomes derived from completion of simulated CI training (Nishisak et al., 2007; Rudy et al., 2007). Both studies highlighted the difficulty in measuring the ability to translate skills emphasized and acquired during such training to real-world patient care outcomes “because with a small number of poor outcomes at baseline, a large number of subjects (trainees) is necessary to show a difference in patient outcome” (Nishisak et al., 2007, p. 232). Due to the low-frequency and high-acuity nature of critical events paired with the vast array of patient circumstances that precipitate such an event, demonstration of a statistical correlation between the CI training one receives with a reduction in patient harm/improved outcome is not feasible on a large enough scale for study (Rudy et al., 2007). Therefore, learner outcomes from simulation based team training, such as crisis resource management, are frequently measured using a combination of subjective (e.g. participant survey) and objective
(e.g. participant observation). With regard to participant confidence and competence, Rudy et al. (2007) reported statistically significant improvement in these domains following simulation-based crisis resource management training, as well as perceived benefit in managing real-world critical events following the training.

Similarly, a systematic review by Nishisak, Keren, and Nadkarni (2007) found that simulation training can improve individual provider as well as team confidence, self-efficacy and competence in managing crisis situations on mannequins. The authors further noted ample evidence in support of the benefit of simulation training on improving operational performance, or real-world skill sets, such as more rapid management of a difficult airway with fiberoptic bronchoscope. However, such a correlation has yet to be demonstrated between simulation training for crisis resource management training and improved team operational performance within the clinical setting (Nishisaki et al., 2007).

**Technology to Enhance Team Performance**

Due to the nature of critical events, technology serves a pivotal role in providing opportunity for learning to manage crises without risk of patient harm. Healthcare is unique from other industries, such as the military, aviation, and nuclear power, in that teams working in the healthcare setting are not fixed, but rather, ad hoc: changing from day to day and shift to shift, often developing based on available resources (White et al., 2015). When combined with the high acuity nature of a crises situation, the ad hoc nature of healthcare teams becomes even less concrete with team member roles (leadership in particular) shifting between providers from various backgrounds. Accordingly, the design of educational interventions to improve team performance during critical events within the healthcare setting must focus on the simultaneous development of both individual and whole-team competencies (White et al., 2015). A commonly
cited barrier to CI team training in healthcare is the inability, or limited availability, to gather all
team members together at the same time, particularly in smaller patient care settings such as the
Post Anesthesia Care Unit (PACU) or ambulatory surgery centers (White et al., 2015). A novel
approach to these factors is to employ technology in the form of virtual humans (VHs), remotely
operated clinician displayed on computer monitor (as with telemedicine), as part of a CI team
training program (White et al., 2015). White and colleagues (2015) examined the performance
(specifically communication and teamwork principles) of 43 PACU nurses during an evolving
medical crisis (acute myocardial infarction) through use of VHs (serving the role of anesthetist
and charge nurse). Of the participants in the study, 87% missed a fatal drug error (incorrect drug
dose), 37% failed to communicate critical patient information (history of cardiac stents), and
38% failed to consistently employ closed loop communication (White et al., 2015). While this
study highlighted the novel use of technology to overcome common barriers to team training in
healthcare, it also demonstrated potential for further research and adaptation in the form of
allowing participants to take turns functioning in each individual role within the team. Of note
was the use of dichotomous variables (performed/not performed) to assess participant
performance during the evolving medical crisis, which the authors emphasized as integral to
team-based critical event training (White et al., 2015).

Checklists and Evaluation Tools

The most widely discussed theme within the literature was the array of assessment tools
that may be employed as a means of both evaluating participant performance during CI training
as well as serving as a reference/guide during an actual (real world) patient care related crisis
situation. Three studies focused primarily on validity and reliability evaluation of three
assessment tools commonly used for simulation training including the Anaesthetists’ Non-
Technical Skills (ANTS), Ottawa Global Rating Scale (GRS), and the Mayo High Performance Teamwork Scale (MHPTS) (Hamilton et al., 2009; Jirativanont et al., 2017; Stocker et al., 2013). Recommendations and proposed modification/adaptation of these instruments for optimal use in specific CRM simulation settings were included in study findings. Another three studies focused largely on methods and metrics concerning course and learner objectives for a variety of simulation and team-based training programs, as well as recommendations for improvement in future program design, which exemplifies a significant area for future research preceding implementation to clinical practice (Andersen et al., 2010; Bracco et al., 2018; Rego, Walker, Thompson, & Wren, 2008).

Overall, current literature review findings revealed that commonly used assessment tools of non-technical skills and team-performance in simulation training had a high degree of validity and inter-rater reliability, which are improved when binary rating scales (present/absent; observed/not-observed) are implemented (Hamilton et al., 2009; Stocker et al., 2013; White et al., 2015); a concept also addressed in one recent outcome evaluation (Bracco et al., 2018). A common theme emerging from all three psychometric studies was the importance of tailoring the assessment tool for the given audience. For instance, Jirativanont et al. (2017) found similar validity and reliability for both ANTS and Ottawa GRS, but noted the ANTS to be superior for evaluation and debriefing sessions amongst anesthesia providers specifically (due to very context specific elements focused on anesthesia); while the GRS was more user friendly and widely applicable to a more diverse group of clinicians. The assessment tool should be tailored to best fit the intended audience and through context-based modification, validated assessment instruments may help optimize desired performance behaviors in simulation, and ideally by extension clinical practice (Jirativanont et al., 2017; Stocker et al., 2013). Furthermore,
Hamilton et al. (2009) noted that such a tool can serve as mental checklist to enhance individual simulation performance while allowing for rapid assessment of team performance by faculty and improved debriefing/feedback; a concept which White and colleagues (2015) further supported.

Sufficient evidence exists supporting the use of Likert style pre- and post-course survey along with semi-structured interviews (at various time intervals) as a means to assess learner attitudes, non-technical skills, and behavioral and course outcomes as part of CI team training across a variety of settings including ambulatory surgery, obstetrics (OB), ALS, and clinical disciplines (Andersen et al., 2010; Bracco et al., 2018; Rego et al., 2008). Andersen et al. (2010), discussed barriers and facilitators to use of non-technical skills during interdisciplinary team training noting that optimal team performance may not exist in static, mutually exclusive domains and that often clinical scenarios may progress adversely as a direct result of a would be beneficial attribute (e.g. strong MD leadership directs team down wrong path while inadequate team communication prevents correct course of action). This elucidated an important caveat: to beware of evidence from homogenous sources (all MD) that may overvalue certain elements (leadership) at the expense of other non-technical skills (communication). A study by Bracco et al. (2018) emphasized the significance of employing behaviorally anchored rating scales (BARS), Likert style scale anchored with example of effective and ineffective behaviors. The authors highlighted the tremendous utility such tools offer when applied to simulation training; particularly, enhancing metacognition of participants and improved debriefing when learners serve in both roles of evaluator and participant (Bracco et al., 2018). Similarly, Rego et al. (2008), noted the importance of direct feedback from simulation participants, in particular, longitudinal feedback, via follow-up interviews and surveys especially in regard to the application of learning outcomes in clinical practice to guide ongoing program development for
optimal use when needed at the point of care. These studies demonstrate the potential clinical benefits that can be generated through use of sound evaluation methods, which warrant further exploration.

**Design, Methods, and Analysis**

To evaluate the efficacy of an inter-professional LAST CI simulation team training program and associated outcomes, a combination of various methods were utilized to assess participant confidence and competence, and ultimately determine the extent to which these endpoints were realized. A mixed method design is more comprehensive as it reveals different aspects and perspectives, thereby yielding more insightful results and a deeper understanding of central issues (Celik, Abma, Klinge, & Widdershoven, 2012). Ultimately, such a design bolsters the ability to apply findings from the CI training more broadly within other academic healthcare training environments and patient care settings.

Perioperative clinicians were informed of and recruited for the CI training two weeks prior to the event utilizing informative flyers (Appendix C). The flyers were posted in both male and female locker rooms and the lunch room which is shared by all perioperative staff at the surgery center. Per University at Buffalo IRB guidelines, verbal consent was obtained from all participating clinicians (Appendix D). Information about the CI training session was conveyed to all potential perioperative staff members. Sufficient time was allowed for subjects to consider the process and ask all necessary questions.

Four surveys (two pre- and two post-intervention) served as the data collection instruments (Appendices A and B). Questionnaire responses remained anonymous with matched numeric identifiers pairing the pre- and post- responses. Specifically, the questionnaires
examined confidence and competence of participants as related to the management of CIs, including LAST.

After completion of the two pre-intervention surveys, subjects participated in a mock LAST CI, to which they were blinded. Following a scripted scenario (Appendix E) led by the PI, participants collaborated to effectively manage the LAST crisis, reflecting the course that would occur based on clinical presentation under real-world circumstances. Facility-owned supplies to manage LAST were utilized (to maintain staff familiarity with equipment), with the exception of expired lipid emulsion provided by the PI. All participants had the opportunity to administer lipid therapy while verbalizing appropriate weight-based bolus and infusion dosing. Role assignment cards utilized during mock critical events were provided by the PI, with random assignment (pick from hat) by participants. Following the mock LAST crisis, participants completed the post-training questionnaires, which assisted in answering the clinical question of interest: whether completion of the inter-professional CI training improves provider confidence and competence in the management of a LAST crisis.

Two assessment instruments were utilized to collect data regarding the perceived confidence and competence of perioperative personnel in the management of a LAST crisis before and after the inter-professional CI training session: The National League for Nursing (NLN) Student Satisfaction and Self-Confidence in Learning questionnaire (NLN, 2005), modified for LAST (Appendix A) and a CI questionnaire developed by the DNP project student (Appendix B). The NLN Student Satisfaction and Self-Confidence in Learning questionnaire was utilized post-intervention as a validated instrument to assess self-confidence. The NLN questionnaire is a five-point Likert scale to assess user satisfaction and self-confidence based on
participant self-reports to 13 statements with responses ranging from “strongly agree” to “strongly disagree” (NLN, 2005).

A Critical Incident questionnaire (Appendix B) developed by the DNP project student and served as the source for mixed methods data collection. This questionnaire consisted of multiple choice, short-answer open-ended, and Likert-scale questions, which assessed provider competence, perceived competence, and confidence in managing a LAST event. Competency was measured using questions such as “what is the appropriate weight-based bolus dose of lipid emulsion?”, “what is the continuous infusion dosing (weight-based) of lipid emulsion?”, “commonly used ACLS drugs to be avoided during cardiac arrest for a patient experiencing LAST include which of the following (select all that apply)?”, “what drug should be avoided when treating seizures in a patient experiencing LAST?”. Perceived competence and confidence were assessed via 5-point Likert scale, with participants self-report responses on a spectrum between “strongly agree” and “strongly disagree.” Sample assessment statements for perceived confidence include “I feel confident in dosing and administering lipid emulsion during a LAST event”, “I feel confident in managing cardiac arrest during a LAST event”, and “I am confident during a LAST crisis.” Perceived competence was assessed through statements such as “I know initial steps in managing a LAST event until lipid emulsion is administered”, “I know the weight-based bolus and infusion dosages of lipid emulsion therapy for treating LAST”, “I know common ACLS medications to avoid during concurrent cardiac arrest and LAST”, “I am confident in my ability to recognize initial signs and symptoms based on patient presentation during LAST”, and “I know what to do to manage a patient experiencing LAST.” Similarly themed questions to additional critical incidents (e.g. cardiac arrest, malignant hyperthermia)
were also included, in part so as to not reveal in pre-survey the specific mock event to be implemented as part of the training.

Pre- and post-CI training questionnaire results were analyzed using descriptive statistics, including measures of central tendency and variability. Data from the NLN questionnaires were analyzed via paired t-tests in order to determine what, if any, statistically significant differences between mean results pre- and post-intervention. Results from both instruments were analyzed using Statistical Package for Social Sciences (SPSS) software.

**Human Subject Rights and Ethical Considerations**

University at Buffalo (UB) Institutional Review Board (IRB) approval was obtained prior to project implementation (Appendix F). All efforts were taken to protect the rights and personal information of project participants. The PI ensured security of all data collected. Source data was originally collected on paper in the form of anonymously completed questionnaires. Paper documents remain securely in the possession of the PI once completed and were stored in a locked file cabinet that only the PI had key access to. Data was subsequently transferred from paper to electronic platform in Microsoft Excel, and then SPSS. The computer that housed electronic data was password protected, with only members of the DNP project team having access. Paper documents were securely shredded and destroyed once transcribed to electronic format. Anonymous paper documentation were stored for a period of four weeks, allowing adequate time for electronic transcription. Electronic data will be securely retained for a period of three years at which point it will be deleted. Access to study data was limited to authorized members of the DNP project team, including the PI, the DNP Project Faculty Advisor, and a quantitative methods expert on faculty in the UB School of Nursing. Paper questionnaires
collected from study participants at the WNY ambulatory surgical center remained safeguarded in a locked file cabinet at the PI’s personal residence.

All subjects who wished to voluntarily participate were provided informed consent (Appendix D). Furthermore, information regarding the CI training session as well as any potential risks incurred were provided to all perioperative personnel at the ambulatory surgical center. Adequate time was provided for potential candidates to contemplate participation and to ask relevant questions prior to consenting to participate in the project. A verbal consent form was used to obtain subjects’ consent (Appendix D). Participants were explicitly informed of their right to leave the study at any point in time as well as their right to refuse to answer any survey question for any reason. As this was a small, unfunded study with validated instruments not available in other languages, non-English speaking perioperative staff were not able to participate; however, all other efforts were made to optimize cultural sensitivity. Given the specific population being surveyed along with the research methodology primarily survey based, the anticipated ethical and cultural considerations were minimal, and reasonably understood based on the clinical and academic background of participants.

**Results**

A total of sixteen (N=16) individuals participated in the CI team training event. Survey data examining descriptive statistics were collected (Appendix B, Part I). Of the participants, 1 was male and 15 female. The majority of participants were Registered Nurses (n=9), the remainder of the sample being Surgical Technicians (n=5) as well as two Physician (MD) anesthesiologists. Participant age was divided into eight categories: 24 and younger, 25-29, 30-24, 35-39, 40-44, 45-49, 50-54, and 55 and older; with the greatest percentage (25%) of participants falling in the 25-29 years of age group. The average (mean) duration of clinician
experience was 9.25 years, with the greatest percentage (18.8%) of participants being in the 11-15 years of clinical practice group. As the overall sample size was small, and relatively homogenous, descriptive statistics between groups were not analyzed, rather survey results from all participants were lumped in one sample with two variables: one pre- and one post-intervention respectively.

Results from the pre-post intervention surveys support the PI’s hypothesis that participation in a multidisciplinary CI team training event improves clinician confidence, perceived competence, and competence in the management of a LAST CI. Confidence and perceived competence were assessed via Likert scale survey items (Appendix B, Part II) scored from 1 (strongly disagree) to 5 (strongly agree) for 16 questions with a maximum total score of 80 (16x5). Mean confidence and perceived competence scores improved from 3.32/5 (52.9/80 total) pre-intervention to 4.26/5 (68.1/80 total) following the CI training (Figure 1). Paired T-test analysis demonstrates statistically significant improvement in provider confidence and perceived competence following the CI training, t(15) = -3.9, p = 0.001.

Similarly, competence was assessed pre and post intervention via a series of short answer and multiple choice questions (Appendix B, Part III) with partial credit awarded to multi-part questions (e.g. list 3 signs and symptoms of a patient experiencing LAST). Participants’ mean competence scores increased from 63.7% on the pre-test to 94.2% on the post-test; a 30.5% improvement (Figure 2). Paired t-test analysis also revealed statistically significant improvement in clinician competence following the LAST CI, t(15) = -7.9, p = 0.000.

Paired samples correlation tests were analyzed pre and post CI training. Results were statistically significant (p = 0.009) for confidence and perceived competence, indicating those participants who scored highly in these domains pre-intervention also did so on the post-test. In
regards to competence, results were not statistically significant ($p = 0.144$), which indicates a less consistent improvement of individual participants’ scores from pre-test to post-test.

The NLN Student Satisfaction and Self Confidence in Learning Tool (Appendix A) was utilized as a validated instrument to evaluate the overall efficacy of the CI training, while simultaneously providing additional quantitative data with regard to participant self-confidence and satisfaction following the intervention. The 13 item Likert scale instrument is scored based on participant responses ranging from 1 (strongly disagree) to 5 (strongly agree) with a maximum total score of 65. The mean score from the NLN tool was 61.87, with an average per-item rating of 4.7/5, indicating a high degree of learner self-confidence following the training as well as overall satisfaction with the educational methodology employed by the PI to conduct the CI event (Figure 3).

With regard to qualitative data, insufficient and inconsistent responses on both the pre- and post CI surveys were provided by participants to conduct a meaningful statistical analysis (Appendix B, Part IV). Fewer than 40% of participants responded to the majority of these questions on the pre-test, with only a slightly higher response rate (44%) to 3 of 7 items on the post-test; 3 of 7 questions had no response from any participants on both tests. Additionally, 3 participants who did respond to items regarding prior participation in CI training (Appendix B, Part IV, Question 2A) and prior involvement with CI during patient care (Appendix B, Part IV, Question 3A) had inconsistent answers between pre and post-tests. This may indicate a change in individual perception of what constitutes a CI following the training. However, this cannot be confirmed with any degree of confidence as no response was provided by these participants to the question regarding one’s own definition of a CI (Appendix B, Part IV, Question 1).
Discussion

This pilot study examined the impact of an interdisciplinary CI team training event on the confidence and competence of participants’ in managing a LAST event shows promise. As hypothesized by the PI, quantitative data demonstrated statistically significant improvement in clinician confidence, perceived competence, and competence following completion of CI training event. While qualitative data from the study were inadequate to conduct a meaningful analysis, themes that emerged from those participants who did respond to qualitative survey items paired with participant feedback and observations from the research team during CI training and simulation debriefing highlight noteworthy points to be addressed at the research site as well as future research.

While participants responded positively to the CI training event as well as methods of instruction, some institutional and individual deficiencies were noted. Perhaps most notably, was a lack of institutional preparedness to manage CI including LAST. This became apparent throughout the CI training as staff worked efficiently to identify and respond to the scripted CI scenarios. As a free-standing ambulatory surgery center, the study site lacks many of the supplies requisite to manage more critical situations that arise during high-acuity low-frequency CI, or as a CI unfolds (e.g. complicated by cardiac arrest requiring prolonged resuscitation and subsequent hospitalization). Basic supplies were readily available in a single cart to manage the LAST scenario. However, it took nearly three minutes for staff to get this cart to the OR during the simulation as lack of knowledge regarding location of the key to open the cart prolonged arrival of supplies to the patient. Once the LAST cart arrived in the room, study participants realized the algorithm for managing LAST was not on the cart, rather posted on the wall above where the cart is stored in the pre-op area; this of course prohibited participants from utilizing the
algorithm as a reference to guide clinical management of the event. Furthermore, not a single intravenous (IV) pump was available in the facility, which certainly prohibited the ability to run a continuous IV infusion of rescue medication (e.g. lipid emulsion, Dantrolene, vasoactive drugs). Point of care (POC) testing supplies to analyze patient blood gas and other lab values as well as invasive lines (arterial/central lines) are also not stocked at the site. In the event a patient needed to be transferred to a nearby hospital with cardiopulmonary bypass capabilities (as may be the case with prolonged LAST resuscitation), the study site would be grossly underprepared to adequately manage the patient until transport arrives. Of note, staff who participated were unable to appropriately identify nearby facilities that would be capable of accepting such a patient transfer. When paired with quantitative results, these findings support the value of simulation-based interdisciplinary CI team training as a means to prepare clinical staff to better manage a real-word CI including LAST while simultaneously highlighting areas for improvement and immediate practice change and policy development.

**Strengths and Limitations**

Positive feedback from study participants regarding the benefit of the CI training as well as instructional methods paired with a high degree of clinician satisfaction and self-confidence as assessed by the NLN tool (Appendix A) highlight the strengths of this study. Statistically significant improvements in the domains of confidence, perceived competence and competence following the CI training further support the value of the study intervention to better prepare clinical staff in the management of a LAST CI if one were to occur during the course of real-world patient care. Identified institutional and individual deficiencies that emerged from the CI training may on the surface appear to be weak points. However, in the context of research, these actually represent key areas for immediate improvement, practice change, and policy
development that will be disseminated to the study site (Appendix G), and as such are highlighted as strengths of the study.

A larger, more diverse sample size may have yielded more meaningful results. In particular, ANOVA tests examining survey data within and between groups may elucidate deficiencies in clinician confidence and/or competence amongst a more specific sub-population and thus pave the way for more targeted intervention and training (e.g. RN educated at the Associates Degree level with less than 5 years of experience may exhibit lower competence compared to MD with 20 years of experience). Institutional policy could then be tailored to address these findings. For instance, this may include mandatory CI training/Simulation annually for all employees, while incorporating additional CI training as part of the orientation process for new employees and those with less than 10 years of experience in one’s professional role. Furthermore, study design could be modified to incorporate a longitudinal component, whereby follow-up survey data collected at a pre-determined time interval (e.g. 6 months) after the CI event could evaluate retention of content from the initial training as well as any impact of elapsed time on participant confidence and competence. Findings from such a study design might better shape recurrent training emphasizing means to improve retention and clinical applicability of didactic content incorporated as part of the CI simulations. Additionally, more robust qualitative data and thematic analysis would likely highlight areas for improvement to the structure of the CI training event based on participant feedback (e.g. what worked/didn’t, what would help make training more meaningful, etc.) that could guide future interventions or increase participation amongst staff who chose not to participate.

**Future Implications**

Although this study demonstrated significant improvement in clinicians’ confidence and
competence in managing a LAST event following completion of a CI team training session, these results were generated from a small sample size at a single ambulatory surgery center in WNY. Future research should include a larger more diverse sample size at multiple centers with a longitudinal component evaluating participants’ retention of CI content to more broadly apply the findings. Additionally, a more robust analysis of qualitative data examining the same endpoints as this study is warranted. A focus group, semi-structured interview design or simply recording the simulation and debriefing sessions (for thematic analysis) as conducted under this protocol might suffice. As previously mentioned, adequate qualitative data may reveal areas for improvement or highlight weak points in the implemented study design and methodology that are lacking from the largely quantitative findings.

Conclusion

In summary, this DNP project sought to answer the question: among clinical staff at an ambulatory surgery center, does completion of an inter-professional team training session increase provider confidence and competence (as measured by pre-post intervention Likert scale scores) in managing the care of a patient experiencing LAST? The project deliverable consisted of a LAST CI simulation training for perioperative personnel at an ambulatory surgery center in WNY. Statistically significant improvements in the domains of clinician confidence, perceived competence, and competence in managing a CI were found based on pre and post intervention survey data. Project findings may serve as the impetus for practice change and/or policy development at the project site, whereby CI training could be implemented on a recurring basis, and at a minimum, identified institutional deficiencies are rectified thereby mitigating patient detriment were a CI to occur. Ultimately, such training could better prepare staff in managing
LAST CIs given the occurrence during real-world patient care and by extension generate improved patient outcomes.
References


Figure 1. Display of Confidence and Perceived Competence Survey Results

Confidence and Perceived Competence

Figure 1. Confidence and perceived competence survey results pre- and post-intervention. Participant scores from Likert-scale survey instruments are displayed as blue (pre-test) and orange (post intervention) lines. Individual participants are represented by anonymous numerical identifiers (horizontal axis) with their total score out of 80 possible points (vertical axis).
Figure 2. Display of Competence Survey Results

*Figure 2.* Competence survey results pre- and post-intervention. Participant scores from multiple choice and short answer survey instruments are displayed as blue (pre-test) and orange (post-test) lines. Individual participants are represented by anonymous numerical identifiers (horizontal axis) with their total score out of 100 possible points (vertical axis).
Figure 3. Display of NLN Survey Results

Figure 3. Results from the National League for Nursing (NLN) Student Satisfaction and Self-Confidence in Learning Tool completed by study participants post-intervention. Participant scores from the previously validated NLN tool are displayed as a blue line. Individual participants are represented by anonymous numerical identifiers (horizontal axis) with their total score out of 65 possible points (vertical axis).
Appendix A

**Student Satisfaction and Self-Confidence in Learning**

**Instructions:** This questionnaire is a series of statements about your personal attitudes about the instruction you receive during your simulation activity. Each item represents a statement about your attitude toward your satisfaction with learning and self-confidence in obtaining the instruction you need. There are no right or wrong answers. You will probably agree with some of the statements and disagree with others. Please indicate your own personal feelings about each statement below by marking the numbers that best describe your attitude or beliefs. Please be truthful and describe your attitude as it really is, not what you would like for it to be. This is anonymous with the results being compiled as a group, not individually.

Mark:
1 = STRONGLY DISAGREE with the statement
2 = DISAGREE with the statement
3 = UNDECIDED - you neither agree or disagree with the statement
4 = AGREE with the statement
5 = STRONGLY AGREE with the statement

<table>
<thead>
<tr>
<th>Satisfaction with Current Learning</th>
<th>SD</th>
<th>D</th>
<th>UN</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The teaching methods used in this simulation were helpful and effective.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>2. The simulation provided me with a variety of learning materials and activities to promote my learning the medical surgical curriculum.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>3. I enjoyed how my instructor taught the simulation.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>4. The teaching materials used in this simulation were motivating and helped me to learn.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>5. The way my instructor(s) taught the simulation was suitable to the way I learn.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Self-confidence in Learning</th>
<th>SD</th>
<th>D</th>
<th>UN</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I am confident that I am mastering the content of the simulation activity that my instructors presented to me.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>7. I am confident that this simulation covered critical content necessary for the mastery of medical surgical curriculum.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>8. I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform necessary tasks in a clinical setting</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>9. My instructors used helpful resources to teach the simulation.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>10. It is my responsibility as the student to learn what I need to know from this simulation activity.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>11. I know how to get help when I do not understand the concepts covered in the simulation.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>12. I know how to use simulation activities to learn critical aspects of these skills.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
<tr>
<td>13. It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time.</td>
<td>O1</td>
<td>O2</td>
<td>O3</td>
<td>O4</td>
<td>O5</td>
</tr>
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Appendix B
Critical Incident Perceptions, Confidence, and Confidence Instrument

Part I

1. What is your age?
   24 or younger____ 25-29____ 30-34____ 35-39____
   40-44____ 45-49____ 50-54____ 55 or older____

2. Gender: Male_____ Female_____ Prefer not to answer_____

3. In what role/capacity do you practice (e.g. MD, CRNA, RN)? _____

4. Number of years practicing in this role? _____

5. What is the highest level of education you have completed, your degree?
   AD/Certificate_____ BA/BS_____ Masters_____ Doctorate_____

Part II

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

<table>
<thead>
<tr>
<th>Questions</th>
<th>SD</th>
<th>D</th>
<th>UN</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel confident in my skills as a provider during a crisis involving direct patient care.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Why or why not?</td>
<td></td>
<td></td>
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<tr>
<td>2. I feel confident in managing the care of a patient in cardiac arrest.</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Why or why not?</td>
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<tr>
<td>3. I feel confident in managing the care of a patient experiencing an airway emergency (e.g. cannot ventilate or intubate).</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Why or why not?</td>
<td></td>
<td></td>
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</table>

Why or why not?

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

<table>
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<tr>
<th>Questions</th>
<th>SD</th>
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<th>UN</th>
<th>A</th>
<th>SA</th>
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<tbody>
<tr>
<td>Why or why not?</td>
<td></td>
<td></td>
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5. I know the initial interventions required during an MH crisis.

Why or why not?


Why or why not?

7. I feel confident in my ability to reconstitute dantrolene.

Why or why not?

8. I am confident in my ability to recognize initial signs and symptoms based on patient presentation during MH.

Why or why not?

9. I know what my roles and responsibilities would be during an MH crisis.

Why or why not?

10. I feel confident in how to coordinate patient transfer to a hospital.

Why or why not?
<table>
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<tr>
<th>Questions</th>
<th>SD</th>
<th>D</th>
<th>UN</th>
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<th>SA</th>
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<tbody>
<tr>
<td>11. I know initial steps in managing a LAST event until lipid emulsion is administered.</td>
<td></td>
<td></td>
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<tr>
<td>12. I feel confident in dosing and administering lipid emulsion during a LAST event.</td>
<td></td>
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<tr>
<td>13. I am confident in my ability to recognize initial signs and symptoms based on patient presentation during LAST.</td>
<td></td>
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<tr>
<td>14. I know the weight-based bolus and infusion dosages of lipid emulsion therapy for treating LAST.</td>
<td></td>
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<tr>
<td>15. I feel confident in managing cardiac arrest during a LAST event.</td>
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<td></td>
<td></td>
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<tr>
<td>16. I know common ACLS medications to avoid during concurrent cardiac arrest and LAST.</td>
<td></td>
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</table>

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

1. What are 3 patient signs or symptoms of MH?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. What are three interventions required during MH crisis management?

________________________________________________________________________
________________________________________________________________________

3. What is the first step the team should take in caring for a patient with MH?
   a. Call for a stat chest x-ray
   b. Apply heating pads to the patient
   c. Discontinue all anesthetic agents and administer 100% oxygen
   d. Continue with the surgery

4. If a patient has had anesthesia in the past without complication, it’s safe to assume that the patient will not develop MH:
   True or False

5. What volume of sterile water is required to dilute one 20 mg vial of dantrolene?

________________________

6. Which medication is NOT an MH triggering agent? (circle your answer):
   Sevoflurane    Succinylcholine    Nitrous Oxide

7. Where could you find the number for the Malignant Hyperthermia Association of the United States?

________________________________________________________________________
8. When applying ice packs for surface cooling of the patient, what are three areas on which you would apply them?
   a. Groin, axillae, and neck
   b. Abdomen, popliteal area, and feet
   c. Hips, back, and palms

9. What is the dose of dantrolene for initial treatment?

10. Bolus and infusion dosages of lipid emulsion therapy for patients less than 70kg are?

    Bolus and infusion dosages of lipid emulsion therapy for patients over 70kg are?

    Maximum total weight based dosage of lipid emulsion therapy is?

11. List 3 common signs or symptoms of a patient experiencing LAST.

12. During a LAST crisis involving cardiac arrest, epinephrine doses should be reduced to______.

13. What are three common resuscitation medications to avoid in a patient experiencing a LAST crisis?

14. The preferred medication to treat seizures in a patient experiencing a LAST crisis is? (Circle your answer).

    Atenolol    Propofol    Midazolam    Haldol    Vasopressin
Part IV

1. In your own words, please define a critical incident (CI)

2. Have you ever participated in a CI training session before today? YES____ NO____
   
   *If yes, please offer a brief description of the training. If no, why not?*

3. Have you ever been involved in a critical incident during your professional practice providing direct patient care? YES____ NO____

   *If yes, did you feel adequately prepared to serve in your role during the event? Why or why not?*

   *If no, would you feel prepared to serve in your role if a CI were to occur? If no, why not?*

4. What do you hope to learn as a result of participation in this CI Team Training Course (pre survey)? OR What did you learn as a result of participation in this CI Team Training Course (post survey)?

5. What impact (application), if any, do you feel this CI Team Training Course will have on your professional practice in the provision of direct patient care?
Appendix C

Critical Incident Training

**Who:** All perioperative staff including but not limited to preoperative, OR, and PACU nurses, surgical technicians, anesthesiologists, CRNAs, SRNAs, nurse managers, surgeons, physician assistants, surgical residents, and ancillary staff are invited to participate.

**What:** All perioperative staff are invited to participate in a research study directed by two of UB’s senior nurse anesthetist students. Participants will partake in an interdisciplinary critical incident training, working as a team to manage potential critical incidents in the operating room. Participants will have the opportunity to practice, enhance, and develop skills using evidence based practice related to critical incidents in the OR. Written surveys will be given to participants before and after the Critical Incident Training.

**When & Where:**
If you’re interested in participating, please meet in Southtowns Surgery Center’s Pre-Operative Unit at **12:00pm Monday November 4, 2019**. Training is expected to require between 2 and 4 hours.
Southtowns Surgery Center
5959 Big Tree Road, Suite 100
Orchard Park, NY 14127

**For More Information:**
Please contact:
Jeffrey Gaulrapp SRNA ([jgaulrap@buffo.edu](mailto:jgaulrap@buffo.edu)) or Rachael Schultz SRNA ([rmb33@buffalo.edu](mailto:rmb33@buffalo.edu))
School of Nursing
University at Buffalo
304C Wende Hall
Buffalo, NY 14214

Lunch will be provided to all participants!
Appendix D

University at Buffalo Institutional Review Board (UBIRB)
Office of Research Compliance | Clinical and Translational Research Center Room 5018
875 Ellicott St. | Buffalo, NY 14203
UB Federalwide Assurance ID#: FWA00008824

Adult Consent to Participate in a Research Study

**Title of research study:** Impact of an Interdisciplinary Simulation Training on Provider Confidence and Competence in the Management of a Local Anesthetic System Toxicity Critical Incident.

**Version Date:** Version #1.0: September, 2019.

**Investigator:** Jeffrey Gaulrapp.

**Key Information:** The following is a short summary of this study to help you decide whether or not to be a part of this study. More detailed information is listed later on in this form.

**Why am I being invited to take part in a research study?**
You are being invited to take part in a research study because you are a staff member involved in the provision of direct patient care at the clinical site of interest where the study is being conducted. Study participation is open to staff employed at Southtowns Surgery Center including: Pre-operative nurses, Intraoperative nurses, Post-anesthesia care unit (PACU) nurses, Nurse manager, Charge nurse, Anesthesiologists, Certified registered nurse anesthetists (CRNAs), Student registered nurse anesthetists, Surgeons, Physician Assistants (PAs), Surgical residents, and Ancillary staff.

**What should I know about a research study?**
- Someone will explain this research study to you.
- Whether or not you take part is up to you.
- You can choose not to take part.
- Your participation will have no possible effect on your job because your employer will never know whether or not you participated and will not be given access to identifiable data.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

**Why is this research being done?**
In the United States, over 100,000 deaths annually are the result of critical incidents (CI) and medical errors. In recognition of the role non-technical skills hold in the prevention of patient harm, especially during critical incidents, an increased emphasis is being placed on supporting the development of these skill sets amongst healthcare professionals via interdisciplinary critical incident training. Simulation-based CI training is a means to bolster staff preparedness in
managing such events, yet on-the-job multidisciplinary training sessions are frequently lacking. The intent of this study is to improve the confidence and competence of perioperative personnel in managing such events through participation in an interdisciplinary CI training event.

**How long will the research last and what will I need to do?**

We expect that you will be in this research study for 2-4 hours. You will be asked to complete a written pre-survey questionnaire. Upon collection of surveys, perioperative staff will then participate in two case studies involving simulated crises in the perioperative setting. During the case studies, staff will need to participate alongside perioperative colleagues to manage a critical event. Following the two case studies, participants will complete the written post-training survey questionnaire.

More detailed information about the study procedures can be found under “**What happens if I say yes, I want to be in this research?**”

**Is there any way being in this study could be bad for me?**

The known risks related to this procedure include the following:

As a part of the critical incident simulation procedure, participants will be working with needles and risk a needle stick causing possible infection. This Physical/Medical risk is usually a Non-Serious situation. The chance that this will occur is Rare (<1%). Although an infection may cause permanent infection, although highly unlikely, most needle sticks do not and only cause minimal pain for 5-10 minutes.

More detailed information about the risks of this study can be found under “**Is there any way being in this study could be bad for me? (Detailed Risks)**”

**Will being in this study help me in any way?**

We cannot promise any benefits to you or others from your taking part in this research. However, possible benefits include improved confidence and competence in the management of critical incidents.

**What happens if I do not want to be in this research?**

Participation in research is completely voluntary. You may choose not to enroll in this study. Your alternative to participating in this research study is to not participate.

**Detailed Information:** The following is more detailed information about this study in addition to the information listed above.

**Who can I talk to?**

If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at 315-420-6093 or jgaulrap@buffalo.edu. You may also contact the research participant advocate at 716-888-4845 or researchadvocate@buffalo.edu.

This research has been reviewed and approved by an Institutional Review Board (“IRB”). An IRB is a committee that provides ethical and regulatory oversight of research that involves human subjects. You may talk to them at (716) 888-4888 or email ub-irb@buffalo.edu if:
• You have questions about your rights as a participant in this research
  Your questions, concerns, or complaints are not being answered by the research team.
  You cannot reach the research team.
  You want to talk to someone besides the research team.
  You want to get information or provide input about this research.

**How many people will be studied?**
We expect about 20-25 people here will be in this research study.

**What happens if I say yes, I want to be in this research?**
Participation will be required over a 2-4 hour period at Souhtowns Surgery Center. Perioperative clinicians will receive written pre-surveys intended to gauge clinician confidence and competency in managing critical incidents (CI) prior to the CI training. Surveys will not ask for any identifying information. Surveys are expected to take between 10 and 20 minutes to complete. Upon completion, clinicians will partake in two case studies. One will occur in the operating room (OR) and the other will occur in the preoperative unit. During each case study, staff will follow a scripted scenario led by the project investigator (PI) during which a mock critical incident will occur. Perioperative staff will collaborate with colleagues to effectively manage the critical incident. Role assignment cards will be utilized during mock critical incidents to randomly assign tasks to participants. Responsibilities during the case studies include team interventions which are applicable to crises in the OR, including preparing medication, retrieving life-saving equipment, and interpreting vital signs. Each case study is estimated to take 1 hour, for a total of 2 hours. Following the two case studies, participants will complete the written post-training questions, estimated to take between 10 and 20 minutes to complete. Participants will interact with their perioperative colleagues and Project Investigators.

**What are my responsibilities if I take part in this research?**
If you take part in this research, you will be responsible to: complete a written pre-survey where no identifying information will be collected. Upon collection of surveys, perioperative staff will then participate in two case studies involving crises in the operating room. Responsibilities during the case studies include team interventions which are applicable to crises in the OR, including preparing medication, retrieving life-saving equipment, and interpreting vital signs. Each case study is estimated to take 1 hour, for a total of 2 hours. Following the two case studies, participants will complete the written post-training questions.

**What happens if I say yes, but I change my mind later?**
You can leave the research at any time it will not be held against you. Any data collected to the point of your withdrawal will be destroyed and not included in the study.

**Is there any way being in this study could be bad for me? (Detailed Risks)**
The known risks related to this procedure include the following:
As a part of the critical incident simulation procedure, participants will be working with needles and risk a needle stick causing possible infection. This Physical/Medical risk is usually a Non-
Serious situation. The chance that this will occur is Rare (<1%). Although an infection may cause permanent infection, although highly unlikely, most needle sticks do not and only cause minimal pain for 5-10 minutes.

**What happens to the information collected for the research?**

Efforts will be made to limit the use and disclosure of your personal information, including research study and medical or education records, to people who have a need to review this information. We cannot promise complete secrecy. Organizations that may inspect and copy your information include the IRB and other representatives of this organization.

Your information or samples that are collected as part of this research will not be used or distributed for future research studies, even if all of your identifiers are removed.

**Will I get paid for my participation in this research?**

You will not be paid for participating in this study.

**Verbal Consent for Capable Adult**

Before the study begins, the researcher will ask you to respond to the following questions:

1. Have you had a chance to read the consent information sheet?
2. Do you have any questions?
3. May we begin?
Appendix E

LAST Case Study Mock Crisis Scenario

A 33-year old 79Kg very fit male patient with no significant past medical history presents for right knee arthroscopy and ACL reconstruction. He denies any allergies, alcohol, tobacco, or illicit drug use. On pre-operative assessment, cardiovascular exam is benign with regular rate, rhythm and absence of any murmurs. Respiratory, abdominal and neurological exams are also unremarkable; remaining review of systems are within normal limits. The anesthetic plan includes general anesthesia with LMA and adductor canal block (ACB) for post-operative pain management. Just prior to placement of ACB vital signs are: BP 112/70, HR 82 bpm, RR 16/min, SpO2 100% on room air and temperature 37.0 Celsius.

Prior to local anesthetic injection, 2mg Midazolam is administered IV. Under continuous ultrasound guidance the femoral artery is identified deep to the Sartorius muscle and just proximal to the mid-thigh. A skin wheal is placed using 1% lidocaine prior to insertion of the block needle. The block needle is visualized under ultrasound and advanced toward the femoral artery via in-plane technique; visualization of the needle tip is maintained at all times during injection of LA distant from the femoral artery. After negative aspiration, a total of 30mL 0.5% bupivacaine is injected in 5 mL increments with LA spread seen around the artery. The patient remains awake and responsive throughout the administration of local anesthetic, denying ringing in his ears, metallic taste, pain or paresthesia. Vital signs remain stable throughout placement of the ACB.

Following placement of the block, the patient is immediately transported to the operating room, ASA monitors are applied along with supplemental O2 and general anesthesia is induced with 100 mcg fentanyl, 80mg lidocaine and 200mg Propofol all administered intravenously. Immediately following induction, the patient begins having seizure activity, cardiac monitor shows bradycardia which rapidly progresses to pulseless electrical activity (PEA). A blood pressure reading is cycled with NIBP 60/40 mmHg.

Work as a team in assigned roles to effectively manage the care of this patient.

Role Cards (number of individuals per role will depend on staff attendance at CI training)

Surgical team: surgeon and assistants (PA, RNFA, Resident), scrub technician (2 person minimum, 4 maximum).

Anesthesia team: attending anesthesiologist, CRNA, SRNA, relief/backup anesthetists (2 person minimum, 5 maximum).

Nursing staff: circulator in OR, charge nurse, pre-op nurse, PACU nurse (2 person minimum, 6 maximum).

PI will facilitate the mock crisis: use of American Society of Regional Anesthesia (ASRA) LAST Checklist to guide staff interventions during CI training as necessary. Print outs to be made available to study participants for debriefing and future reference.
**AMERICAN SOCIETY OF REGIONAL ANESTHESIA AND PAIN MEDICINE**

**CHECKLIST FOR TREATMENT OF LOCAL ANESTHETIC SYSTEMIC TOXICITY (LAST)**

---

**The Pharmacologic Treatment of LAST is Different from Other Cardiac Arrest Scenarios**

- **Reduce** individual epinephrine boluses to \( \leq 1 \text{ mcg/} \text{kg} \)
- **Avoid** vasopressin, calcium channel blockers, beta blockers, or other local anesthetics

- Stop injecting local anesthetic
- Get help
  - Consider lipid emulsion therapy at the first sign of a serious LAST event
  - Call for the LAST Rescue Kit
  - Alert the nearest cardiopulmonary bypass team - resuscitation may be prolonged
- Airway management
  - Ventilate with 100% oxygen / avoid hyperventilation / advanced airway device if necessary
- Control seizures
  - Benzodiazepines preferred
  - Avoid large doses of propofol, especially in hemodynamically unstable patients
- Treat hypotension and bradycardia – **If pulseless, start CPR**

### Lipid Emulsion 20%

(Precise volume and flow rate are not crucial)

<table>
<thead>
<tr>
<th>Greater than 70 kg patient</th>
<th>Less than 70 kg patient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolus 100 mL Lipid Emulsion 20% rapidly over 2-3 minutes</strong></td>
<td><strong>Bolus 1.5 mL/kg Lipid Emulsion 20% rapidly over 2-3 minutes</strong></td>
</tr>
<tr>
<td>• Lipid emulsion infusion 200-250 mL over 15-20 minutes</td>
<td>• Lipid emulsion infusion (~0.25 \text{ mL/kg/min}) (ideal body weight)</td>
</tr>
</tbody>
</table>

**If patient remains unstable:**

- Re-bolus once or twice at the same dose and double infusion rate; be aware of dosing limit (12mL/kg)
- Total volume of lipid emulsion can approach 1 L in a prolonged resuscitation (e.g., \( \geq 30 \text{ minutes} \))

- Continue monitoring
  - At least 4-6 hours after a cardiovascular event
  - Or, at least 2 hours after a limited CNS event
- Do not exceed 12 mL/kg lipid emulsion (particularly important in the small adult or child)
  - Much smaller doses are typically needed for LAST treatment
- See reverse side of this checklist for further details

---

**ASPA**
Risk Reduction (Be sensible)

- Use the least dose of local anesthetic necessary to achieve the desired extent and duration of block.
- Local anesthetic blood levels are influenced by site of injection and dose. It is important to identify patients at increased risk of LAST prior to using local anesthetics, e.g., infants <6 months old, small patient size, advanced age and frailty, heart failure, ischemic heart disease, conduction abnormalities, or rhythm disorders, metabolic (e.g., mitochondrial) disease, liver disease, low plasma protein concentration, acidosis, and medications that inhibit sodium channels. Patients with very low ejection fraction are more sensitive to LAST and may be especially prone to elevated local anesthetic levels associated with “stacked” injections.
- Consider using a pharmacologic marker and/or test dose, e.g., epinephrine 2.5 to 5 mcg/mL (total 10-15 mcg). Know the expected response, onset, duration, and limitations of a “test dose” in identifying intravascular injection.
- Aspirate the syringe prior to each injection while observing for blood in the syringe or tubing
- Inject incrementally, while observing for signs and inquiring for symptoms of toxicity between each injection
- Consider discussing local anesthetic dose as part of the pre-procedural or pre-surgical pause (“time out”).

Detection (Be vigilant)

- Monitor the patient during and after completing injection. Clinical toxicity can be delayed 30 minutes or longer.
- Use standard American Society of Anesthesiologists (ASA) monitors.
- Communicate frequently with the patient to query for symptoms of toxicity.
- Consider LAST in any patient with altered mental status, neurological symptoms or signs of cardiovascular instability after a regional anesthetic (e.g., change in HR, BP, ECG). Consider LAST even when the local anesthetic doses is 1) small (susceptible patient), 2) atypically administered (subcutaneous, mucosal, topical), 3) administered by the surgeon, or 4) after recent tourniquet deflation.
- Central nervous system signs (may be subtle, atypical, or absent)
  - Excitation (agitation, confusion, vocalization, muscle twitching, seizure)
  - Depression (drowsiness, obtundation, coma, or apnea)
  - Non-specific (metallic taste, circumoral numbness, diplopia, tinnitus, dizziness)
  - Cardiovascular signs (occasionally the only manifestation of severe LAST)
    - Initially may be hyperdynamic (hypertension, tachycardia, ventricular arrhythmias), then
      - Progressive hypotension
      - Conduction block, bradycardia or asystole
      - Ventricular arrhythmia (ventricular tachycardia, Torsades de Pointes, ventricular fibrillation or asystole)
- Sedation may abolish the patient’s ability to recognize or report LAST-related symptoms.

Treatment

**Suggested components of a “LAST Rescue Kit”**

- 1 L (total) lipid emulsion 20%
- Several large syringes and needles for administration
- Standard IV tubing
- ASRA LAST Checklist

- Administer lipid emulsion at the first sign of a serious LAST event.
- Lipid emulsion can be used to treat LAST caused by any local anesthetic.
- Standard dose epinephrine (1 mg) can impair resuscitation from LAST and reduce the efficacy of lipid rescue. Use smaller doses than typical for ACLS, e.g., ≤1 mcg/kg boluses, or for treating hypotension.
- Propofol should not be used when there are signs of cardiovascular instability.
- Prolonged monitoring (2-6 hours) is recommended after any signs of LAST, since cardiovascular depression due to local anesthetics can persist or recur after treatment.
  - If LAST event is short-lived and without signs of cardiovascular instability, one may consider proceeding with surgery after an uneventful ~30 minute interval of monitoring.

Please report LAST events to www.lipidrescue.org


The ASRA LAST™ smart phone app can be purchased from
The Apple App Store or Google Play

ASRA hereby grants practitioners the right to reproduce this document as a tool for the care of patients who receive potentially toxic doses of local anesthetics. Publication of these recommendations requires permission from ASRA.
October 19, 2019

Dear Jeffrey Gaulrapp,

On 10/19/2019, the University at Buffalo IRB reviewed the following submission:

<table>
<thead>
<tr>
<th>Type of Review:</th>
<th>Initial Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title of Study:</td>
<td>Impact of Interdisciplinary Training on Provider Confidence and Competence in the Management of Critical Incidents</td>
</tr>
<tr>
<td>Investigator:</td>
<td>Jeffrey Gaulrapp</td>
</tr>
<tr>
<td>IRB ID:</td>
<td>STUDY00003782</td>
</tr>
<tr>
<td>Funding:</td>
<td>None</td>
</tr>
<tr>
<td>Grant ID:</td>
<td>None</td>
</tr>
<tr>
<td>IND, IDE, or HDE:</td>
<td>None</td>
</tr>
<tr>
<td>Documents Reviewed:</td>
<td>• Gaulrapp LAST Case Study Appendix E.docx, Category: Other;</td>
</tr>
<tr>
<td></td>
<td>• Gaulrapp DNP Project Appendices AB.docx, Category: Surveys/Questionnaires;</td>
</tr>
<tr>
<td></td>
<td>• CI Training Recruitment Flyer.pdf, Category: Recruitment Materials;</td>
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<tr>
<td></td>
<td>• Gaulrapp.HRP 503 Protocol.docx, Category: IRB Protocol;</td>
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<td></td>
<td>• Gaulrapp.HRP502 Consent Document.pdf, Category: Consent Form;</td>
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<tr>
<td></td>
<td>• Gaulrapp NGC 799 Final DNP Project Proposal.docx, Category: Other;</td>
</tr>
<tr>
<td></td>
<td>• Scientific Review Form.pdf, Category: Other;</td>
</tr>
</tbody>
</table>

The University at Buffalo Institutional Review Board has considered the submission for the project referenced above on 10/19/2019 and determined it to be Exempt.

In conducting this study, you are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the Click system.
UBIRB exemption is given with the understanding that the most recently approved procedures will be followed and the most recently approved consenting documents will be used. If modifications are needed that may change the exemption determination, please contact the UB IRB Office. Also, see the Worksheet: Exempt Determination (HRP-312) for information on exemption criteria and categories.

As principal investigator for this study involving human participants, you have responsibilities to the SUNY University at Buffalo IRB (UBIRB) as follows:

1. Ensuring that no subjects are enrolled prior to the IRB approval date.

2. Ensuring that the UBIRB is notified of:
   - All Reportable Information in accordance with the Reportable New Information Smart Form.
   - Project closure/completion by submitting a Continuing Review/Modification/Study Closure Smart Form in Click.

3. Ensuring that the protocol is followed as approved by UBIRB unless minor changes that do not impact the exempt determination are made.

4. Ensuring that the study is conducted in compliance with all UBIRB decisions, conditions, and requirements.

5. Bearing responsibility for all actions of the staff and sub-investigators with regard to the protocol.

6. Bearing responsibility for securing any other required approvals before research begins.

If you have any questions, please contact the UBIRB at 716-888-4888 or ub-irb@buffalo.edu.
Appendix G

Executive Summary and Recommendations: Critical Incident Training on 11/4/2019

This study shows promise with regards to the efficacy of staff training to improve the individual clinicians’ confidence and competence in the management of a CI, while identifying site specific deficiencies to be addressed that may avert untoward patient outcomes in the event a CI were to occur.

Results from pre-post intervention surveys completed by study participants support the hypothesis that participation in a multidisciplinary CI team training event improves clinician confidence, perceived competence, and competence in the management of a CI.

Mean confidence and perceived competence scores improved from 3.32/5 (52.9/80 total) pre-intervention to 4.26/5 (68.1/80 total) following the CI training; statistically significant results: t(15) = -3.9, p = 0.001. Similarly, mean competence scores increased from 63.7% on the pre-test to 94.2% on the post-test, a 30.5% improvement; statistically significant: t(15) = -7.9, p = 0.000.

Mean score from the NLN Student Satisfaction and Self Confidence in Learning Tool was 61.87, with an average per-item rating of 4.7/5, indicating a high degree of learner self-confidence following the training as well as overall satisfaction with the educational methodology employed by the PIs to conduct the CI event.

Recommendations based on observations and participant feedback, from the CI training:

- Institution did not possess:
  - Means for sterile reconstitution of dantrolene
  - i-Stat/Point of Care device for intraoperative lab work processing
  - Intravenous pumps for medication infusions required for hospital transfer
  - Arterial line kit
  - Central line kit
  - Charcoal filters for anesthesia machine
Strongly recommend addition of these equipment and supplies to facility stock:
- Means for sterile reconstitution of dantrolene (sterile basin or sterile water vials)
- Means for intraoperative lab work processing (i-Stat or Point of Care device)
- Charcoal filters for anesthesia machine
- Intravenous pumps for medication infusions required during hospital transfer

Moderately recommend addition of these equipment and supplies to facility stock:
- Arterial line kit
- Central line kit

- MH cart lacked medications (vials of sterile water, Calcium Chloride, Albuterol, and Lasix), sterile basins (if not using sterile water vials), and charcoal filters. Recommend addition of these medications and supplies to MH cart.

- Staff were delayed in retrieving LAST cart key: needed to ask multiple people, required 3 minutes to bring LAST supplies to OR. Recommend availability of multiple keys at designated locations within the facility, pre-op/block area, OR, PACU; educate staff regarding these locations.

- LAST algorithm poster on wall above cart rather than on portable cart. Recommend placement on cart or in OR (as with MH poster) to guide clinician during use once cart has been moved from its storage location.

- Staff unable to unanimously identify which hospital (Buffalo General Hospital) patient would be transferred to during prolonged resuscitation. Recommend posting this location and contact information on both LAST and MH carts.
IMPACT OF AN INTERDISCIPLINARY SIMULATION TRAINING ON PROVIDER CONFIDENCE AND COMPETENCE IN THE MANAGEMENT OF A LOCAL ANESTHETIC SYSTEM TOXICITY CRITICAL INCIDENT

Presented by:
Jeffrey Gambrad RN, DNP-c
University at Buffalo, School of Nursing

Background

- A critical incident (CI) refers to any "event or deviation from the expected course with the potential for adverse outcome" including those that lead to adverse outcomes as well as incidents that do not result in harm to the patient and incidents that either do or do not mitigate from medical error. (p. 17)
- A CI can range from patient dissatisfaction and surgical or anesthetic complications (e.g., wrong level, wrong site) to serious unexpected events (e.g., anaphylaxis, disseminated intravascular coagulation, and ischemia). A CI can be due to medical error, (p. 17)
- CI poses a serious threat to patient and public health with increased risk of morbidity and mortality related to their occurrence.

Significance

- Building upon methods from other industries, simulation training has been widely adopted by the healthcare industry to train personnel. (p. 17)
- CIM is widely implemented as a tool for improving patient care and patient outcomes through implementation and continuous improvement. (p. 17)
- The Critical Incident Management (CIM) approach is widely implemented in healthcare organizations. (p. 17)
- Low-priority CI events (e.g., patient satisfaction) require rapid diagnosis and solution. (p. 17)
- Evidence supports the use of CI training as a means to better identify staff preparation in managing such events. (p. 17)
- This study and institutional policy maintains requiring such circumstances are lacking. (p. 17)

Theoretical Framework

- Integral nursing facilitates the improvement in quality of care by equipping nursing staff with knowledge of patient care and the need for effective communication and collaboration. (p. 17)
- Integral framework borrows from the theories of Sies and Cowan’s Carter-Dossey in the framework of a fundamental pattern of knowledge. (p. 17)
- Integral framework provides a new framework for conceptualizing and providing care by presenting the concept of care within a holistic view of health and illness as a whole, in parts, and with oneself as a component of both parts. (p. 17)
- Dossey (2010) elaborates Wilber’s four quadrants—"I, II, "and "III" places holding at the center with various quadrants representing different individual perspectives and world views. (p. 17)

Theoretical Framework continued

- The emphasis of integral theory is for interdisciplinary collaboration occurring through an ongoing and shared "vision of the contributors of each of the parts" that make up a whole. (p. 17)
- Integration and collaboration are achieved through the concept of a whole that is not the sum of its parts. (p. 17)
- Integral nursing theories promote diversity and collaboration among multidisciplinary teams. (p. 17)
- Integral theory encourages nurses to be open to new ideas and to embrace change as a part of growth and development. (p. 17)
Literature Review
- Peer-reviewed databases were queried including CINahl, MEDLINE, PESUMED, and ESCOPUS.
- Search results were limited to English language, full-text articles published within the previous 5 years (2015 to present).
- Keywords searched both singularly and in various combinations included: critical incident, crisis management, crisis resource management, interdisciplinary team training, team training, non-technical skills, local emergency systems toxicity, IAST.
- Common themes that emerged from the literature review include:
  - Simulation-based training
  - Evaluation of team performance
  - Checklists and evaluation tools
- A discussion of thematic findings from this literature review is summarized on the 5536546974 page 358.

Simulation-based Training
- Numerous studies examined the impact of simulation training across varied patient care settings, such as operating room (Lobo et al., 2016), anesthesia (Adams and others, 2015), trauma (Lubman et al., 2015), surgical residency (Page et al., 2015), and specific clinical events such as malignant hypotension (Lee et al., 2014) and blood iso-volume toxicity (Hsu et al., 2019).
- Two studies highlighted the efficacy in increasing the ability to recognize errors identified and acquired during simulation training at improved patient care outcomes (because with a small number of poor outcomes at baseline, a larger number of patients trained is necessary to show a difference in patient outcomes) (Hsu et al., 2017, p. 23).
- Learner outcomes are frequently measured using a combination of subjective (e.g., participant anxiety, and objective, e.g., participant knowledge).
- Study (2017), statistical significant improvement in confidence, communication, perceived benefit in managing real-world critical events following simulation training.
- Vahdati, Kanner, and Hazou (2019); simulation training can improve, individual patient and team confidence, self-efficacy and competence in managing crisis situations, improved operational skill set.

Technology to Enhance Team Performance
- The design of educational interventions to improve team performance during critical events within the healthcare setting must focus on the simultaneous development of individual and team competencies (White et al., 2016).
- A common feature of critical incident training is the ability to gather as team members at the same time (White et al., 2014).
- A novel approach to this feature is to employ virtual human (VH), virtual reality synchronized, telepresence, or computer-based training methods, which are used to simulate team training (Muller et al., 2016).
- White et al. (2016) examined the performance communication and teamwork principles of critical incident training (CIT) using VH (addressing the role of leadership and change) and VH (addressing the role of leadership and change), 81% of participants reported a real-time feel, 87% failed to communicate patient information, and 59% failed to effectively complete closed loop communication.
- Potential for further research and development of protocols by White et al. (2016) by defining participants' roles from team members to team leaders and vice versa.

Checklists and Evaluation Tools
- Assessment tools may be employed to evaluate participant performance during CIT training and serve as a reference guide during an actual event; patient care varies from situation to situation.
- Commonly used assessment tools have a high degree of variability and non-standardized scoring, which are improved when scoring is based on standard observation forms and are then reinforced with a pre- and post-training assessment (Becker et al., 2015; Harrison et al., 2014; Stocker et al., 2015; White et al., 2014).
- Assessment tools should be tailored to fit the intended audience through context-based modification: validated assessment instruments optimize desired performance behaviors in simulation and clinical practice by extension (Stocker et al., 2015; Stocker et al., 2013).
- Literature supports Likert style pre-post survey and semi-structured interviews to assess teamwork, non-technical skills, leadership, and collaborative outcomes as part of CIT training in various settings and specific disciplines (Branco et al., 2014; Stocker et al., 2011; Stocker et al., 2008).
- Branco et al. (2015) behaviorally anchored rating scale (BARS) enhance recognition of participants and improved debriefing when rated same in both roles of evaluator and participant.

Project Methods and Design
- A combination of various methods were utilized to evaluate the efficacy of the interprofessional CIT training program and to assess participant confidence and competence in the management of a crisis.
- A mixed method design was more comprehensive as it entails efficient aspects and perspectives, thereby gaining more insights into a deeper understanding of critical incident (Cradle, 2018; Cradle, 2006).
- Such a design produces the ability to apply findings from the CIT training more broadly within other academic healthcare training environments and patient care settings.

Human Subject Rights and Ethical Considerations
- While conducting the CIT training program, efforts were taken to protect the rights and personal information of the participants.
- Source data was collected on paper in the form of anonymous survey forms, not recorded in a manner that could be associated with the participants by any means.
- Data were transferred from paper to password-protected computer with only one copy of the data on the computer, and electronic data were saved in an archive for a period of 30 years, while electronic data was saved for a period of 6 months.
- All subjects who agreed to participate were provided informed consent.
- Information regarding CIT training session and any potential risks involved were provided to all potential candidates with adequate time provided for all volunteers.
- Participants were instructed of the right to refuse the study at any point in time and as such no consent was necessary to perform any test or interview questions for any reason. As this was a small, uncontrolled study with validated instruments not available in other languages, no attempt was made to participate, however, at another institution.
- Consent was obtained from the participants to participate in the research methodology. All participants were informed about the confidentiality of the data and that it would not be used for any other purpose. Any data collected was stored in a secure location and access was limited to the research team.
- Consent was obtained from the participants to participate in the research methodology. All participants were informed about the confidentiality of the data and that it would not be used for any other purpose. Any data collected was stored in a secure location and access was limited to the research team.
Data Collection and Analysis

- After completion of the pre-post intervention surveys, participants were asked for the first time to complete a model LAST checklist, designed to determine the level of performance in the management of a LAST crisis event.

- Following the model LAST checklist, participants completed a post training questions response, which included the following questions: (a) the checklist improved management of a LAST crisis event.

Results

- Results from the pre-post intervention surveys supported the hypothesis that participation in a multi-disciplinary CI training event improves clinical confidence, perceived competence, and performance in the management of a LAST crisis event. Significant improvements were observed in the post intervention surveys, with participants demonstrating higher levels of clinical confidence and perceived competence following the intervention.

Results Continued

- Participation in the multi-disciplinary CI training event was associated with significant improvements in clinical confidence and perceived competence. Participants who participated in the intervention showed a marked improvement in their confidence and perceived competence, with a significant increase in their ability to manage a LAST crisis event.

Data Collection cont'd.

- Two assessment instruments were utilized to collect data regarding the level of confidence and perceived competence of participants following the intervention. These instruments were the LAST checklist, which assesses the level of confidence and perceived competence of participants in the management of a LAST crisis event, and the post training questions response, which assesses the level of confidence and perceived competence in managing a LAST crisis event.

- The LAST checklist and post training questions response were administered prior to and following the intervention, allowing for the assessment of changes in confidence and perceived competence.

Results Continued

- The results from the LAST checklist and post training questions response indicated a significant improvement in clinical confidence and perceived competence following the intervention. Participants demonstrated an increase in their confidence and perceived competence in managing a LAST crisis event, with a marked improvement in their ability to identify and manage a LAST crisis event effectively.

Data Collection Analysis continued

- A CI checklist consisting of multiple choice, short answer, open-ended, and likert scale questions, was administered to assess clinical confidence, perceived competence, and performance in the management of a LAST crisis event. The checklist was designed to evaluate the level of confidence and perceived competence of participants in the management of a LAST crisis event.

- The results from the checklist indicated a significant improvement in clinical confidence and perceived competence following the intervention. Participants demonstrated higher levels of clinical confidence and perceived competence in the management of a LAST crisis event following the intervention.
Discussion

- Quantitative data demonstrated statistically significant improvement in decision-making, problem-solving, and communication skills among CI trainees.
- Qualitative data from the study were positive overall, with participants expressing a need for more structured feedback and opportunities for peer review.
- Limitations include a lack of control group and potential for bias due to the self-reported nature of the data.

Strengths, Limitations, Future Implications

- Strengths include the use of a randomized control trial design, which allowed for a high level of internal validity.
- Limitations include the lack of long-term follow-up and the potential for selection bias.
- Future implications suggest the need for further research to validate the findings and explore the potential for integrating this model into routine practice.

Limitations and Future Implications Cont.

- Findings from such a study design might better capture the benefits of training in a more realistic setting, with external validity.
- Future research could also include the use of objective performance measures to supplement self-reported outcomes.

Conclusion

- In summary, the CI training program shows promise in improving clinical decision-making and communication skills among CI trainees.
- Further research is needed to evaluate the long-term impact of this training on patient outcomes.

References
