IMPROVING PERIOPERATIVE STAFF CONFIDENCE AS EMERGENCY MANUAL READERS DURING OPERATING ROOM EMERGENCIES

by

Sarah Elizabeth Boisen

A DNP Project Submitted to the Faculty of the

COLLEGE OF NURSING

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF NURSING PRACTICE

In the Graduate College

THE UNIVERSITY OF ARIZONA

2 0 2 5

THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Sarah Elizabeth Boisen, titled Improving Perioperative Staff Confidence as Emergency Manual Readers During Operating Room Emergencies, and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

Reggie Elam (Feb 27, 2025 13:04 MST) Date: Feb 27, 2025
Reggie Elam, PhD, DNAP, CRNA

Kristie J Hoch Date: Feb 27, 2025
Kristie Hoch, DNP, CRNA, MS, RRT, FAANA

Luc Corriveau (Feb 27, 2025 15:26 EST) Date: Feb 27, 2025
Luc G. Corriveau, DNP, APRN, CRNA

Final approval and acceptance of this DNP project are contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

Reggie Elam (Feb 27, 2025 13:04 MST) Date: Feb 27, 2025
Reggie Elam, PhD, DNAP, CRNA
DNP Project Committee Chair
College of Nursing

ACKNOWLEDGMENTS

I would like to thank my committee chair Dr. Reggie Elam and my committee members Dr. Luc Corriveau and Dr. Kristie Hoch for imparting their guidance through the development of this project. I would also like to thank my family and my partner for their unwavering support as I've plunged headfirst into the highs and lows of this journey. Each step forward has felt bolstered by your relentless encouragement, and I couldn't feel more fortunate.

LAND ACKNOWLEDGEMENT

We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. The University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

DEDICATION

I dedicate this project to the multidisciplinary individuals that each play an integral role in ensuring that our patients are seen safely through their time in the operating room. In the face of the unexpected, the strength of the team is each individual member, and the strength of each member is the team. My hope is that, when facing the unexpected, this project empowers all those working within the perioperative setting to feel confident as active participants in effective emergency response.

TABLE OF CONTENTS

TABLE OF CONTENTS – Continued

TABLE OF CONTENTS – Continued

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Purpose: This quality improvement (QI) project aimed to evaluate changes in the perceived confidence of multidisciplinary perioperative staff in assuming the role of emergency manual (EM) reader during intraoperative emergencies following an educational training session.

Background: Intraoperative emergencies are stressful events that magnify the impact of human factors on clinical performance leading to a deterioration in cognitive function and an elevated risk of error, ultimately deviating from established standards of care (Schild et al., 2019). Emergency manual cognitive aids (EMs) serve as evidence-based, context-specific adjuncts aimed at reducing human error and enhancing team performance during emergencies or crises in the OR (Hepner et al., 2017). Central to the successful application of EMs is the EM “reader” who triggers the manual’s use, guides the intraoperative team through navigating the crisis checklist, and promotes the delivery of best practices by leveraging key non-technical skills such as interpersonal communication and team coordination (Saravana-Bawan et al., 2019). Despite ongoing efforts to familiarize perioperative staff with EM navigation and application, there exists a lack of consensus on the ideal individual to assume the reader role.

Methods: A pre-recorded, educational training video detailing EM purpose, navigation, implementation, and role of the reader was provided to perioperative staff at a critical access hospital. Pre- and post-intervention surveys assessed changes in participant baseline knowledge, intent to use, and confidence in assuming the EM role.

Results: Of the 17 participants, 57% had never received formal EM training and 41% were unaware that any perioperative team member could assume the reader role. Following training, reported confidence in assuming this role increased from 38% to 81%. The likelihood of utilizing an EM during an emergency rose from 35% to 71% and intent to trigger EM use increased from 24% to 71%.

Conclusion: This project supports using a multidisciplinary educational intervention to reinforce EM importance, enhance confidence in its use, and increase the likelihood of perioperative team members assuming the reader role. While the value of EMs is widely recognized, multi-step implementation initiatives are essential for creating a culture of confidence that results in an intent to use when emergencies do arise.

INTRODUCTION

Operating room (OR) emergencies are stressful, high-risk events that demand focused, dynamic decision-making and immediate action by perioperative staff. While rare, the inherent urgency of these events imposes a significant cognitive burden upon responders that has been documented to negatively impact memory, therefore increasing the potential omission of key steps (Goldhaber-Fiebert et al., 2020). Failure to ensure that best practices are adhered to during the management of perioperative emergencies is associated with adverse patient outcomes, including delayed treatment and diagnostic error which are three times that of surgical error (Koers et al., 2020). Emergency manual cognitive aids (EMs), also known as crisis checklists or cognitive aids, serve as evidence-based, context-specific adjuncts aimed at reducing human error and enhancing team performance during emergencies or crises in the OR (Hepner et al., 2017). By providing structured guidance for managing common OR emergencies, EMs not only facilitate the correct performance of critical interventions but promote the delivery of best practices during crisis management by leveraging key non-technical skills such as interpersonal communication and team coordination across perioperative staff (Saravana-Bawan et al., 2019). Central to the successful use of EMs is the EM “reader” who triggers the manual’s use and guides the team through navigating the crisis checklist (Goldhaber-Fiebert et al., 2020). While the team leader, typically an anesthesia provider or surgeon, often faces cognitive overload during emergencies, the EM reader plays a crucial role in supporting its optimal utilization, enhancing team dynamics, and ensuring adherence to critical action steps (Hardy et al., 2018; Huang et al., 2019).

Adherence to lifesaving steps is four to six times greater with the use of an EM compared to without, and training that supports clinicians in triggering their use improves effective application during time-sensitive, critical events (Simmons & Huang, 2019). Despite ongoing efforts to familiarize perioperative staff with EM navigation and application, there remains a lack of consensus on the ideal individual to assume the role of EM reader. This implementation gap highlights the need for further investigation into effective strategies for training EM readers. This project aimed to address this gap by assessing the confidence of multidisciplinary perioperative staff in assuming the role of EM reader following an educational intervention.

Background Knowledge and Significance

Surgical complications represent a substantial portion of the global burden of disease, accounting for 28-32% of the worldwide burden, with approximately 313 million surgical procedures performed annually, including 50 million in the United States (US) alone (Cutti et al., 2020; Dobson, 2020). Despite significant advancements in patient safety during surgery, there persists an annual global mortality rate of 8 million resulting from complications (Dobson, 2020). As the world's population ages, with an estimated 16% expected to be older than 65 years by 2050, accompanied by an increase in chronic comorbidities, the demand for surgical intervention is anticipated to rise, posing greater complexity for healthcare systems (Cutti et al., 2020).

In the US, defining and delivering quality healthcare is a paramount focus of the healthcare community, with postoperative outcome measures carrying significant implications due to performance models that utilize clinical outcomes to determine reimbursement and reputation (Mullen et al., 2017). This focus on patient safety and quality outcomes is underscored by the pervasive nature of errors and near misses in healthcare, which incur substantial financial costs and have lasting negative impacts on providers and patients (Goldberg et al., 2015). Annually, an estimated 100,000 deaths are attributed to medical errors, with the operating room serving as a high-acuity environment where emergent patient safety events occur more frequently compared to other care settings (Alidina et al., 2018; Saravana-Bawan et al., 2019). Many of these errors stem not from a lack of medical knowledge, but from deficiencies in non-technical skills such as communication, fatigue, and challenges navigating complex equipment design (Hepner et al., 2017; Saravana-Bawan et al., 2019).

High-stakes situations, such as emergencies, magnify the impact of human factors on clinical performance leading to a deterioration in cognitive function and an elevated risk of error, ultimately deviating from established standards of care (Schild et al., 2019). Intraoperative emergencies, though infrequent, represent critical events that demand quick decision-making and immediate action from perioperative teams, often in scenarios they rarely encounter. The cognitive burden induced by stress during these events not only compromises clinician's judgement, decision making abilities and memory retention, but also fosters fixation on incorrect problems and undermines effective team communication (Alidina et al., 2018). Together, these stressors contribute to a failure of teams to adhere to best practices during perioperative emergencies, resulting in heightened patient morbidity and mortality rates (Koers et al., 2020).

Emergency Manual Cognitive Aids

Emergency manual cognitive aids (EMs), alternatively known as crisis checklists, were adopted into the healthcare setting to address opportunities for human error and mitigate adverse patient events (Hepner et al., 2017). The integration of decision aids into crisis resource management initially evolved within safety-critical industries such as aviation, nuclear power, and space flight (Greig et al., 2023). These industries recognized the challenges in improving human performance during high-reliability situations, identifying lapses in communication, team functioning, and critical action omission during time-sensitive events as primary concerns (Hepner et al., 2017). A notable success story in the healthcare sector is the globally adopted *World Health Organization (WHO) Surgical Safety Checklist,* which has significantly improved postoperative patient outcomes reducing rates of morbidity and mortality by over 50% and shifting attitudes towards safety (Greig et al., 2023; Saxena et al., 2020; Simmons & Huang, 2019). The success demonstrated by these implementation strategies set the stage for the further development of checklists intended to increase clinician confidence and supplement access to critical information during perioperative emergencies (Greig et al., 2023). Building upon these successes, EMs tailored to perioperative emergencies have gained traction, with groups like the Stanford Anesthesia Cognitive Aid Group, Ariadne Lab, and the Society for Pediatric Anesthesia's Quality and Safety Committee offering cost-free cognitive aid manuals and resources online that include a broad range of intraoperative events with examples such as malignant hyperthermia, bronchospasm, local anesthetic systemic toxicity (LAST) and asystole (Goldhaber-Fiebert & Macrae, 2018).

Research on EM use is burgeoning, with current evidence underscoring its value in perioperative settings, showing a reduction in errors and improved efficiency during the management of critical events compared to without (Alidina et al., 2018). A systematic review on stress and decision-making in resuscitation found that cognitive aids not only decrease stress but improve the technical and non-technical performance of teams (Groombridge et al., 2019).

Simulation-based studies corroborate these findings, demonstrating a significant increase in the delivery of critical action items during emergencies and a decrease in omission errors by 75% with EM use (Goldhaber-Fiebert et al., 2020). It is essential to note that while EMs serve as valuable tools to supplement decision-making during crisis management, they are not intended to replace clinical judgment. Instead, they aim to offset the cognitive load and support clinicians in delivering crucial actions during high-stress situations (Urman et al., 2021).

Benefits and Challenges

The integration of emergency manual cognitive aids (EMs) into perioperative settings aligns with key principles of crisis resource management, emphasizing the optimization of non-technical skills such as team dynamics and interpersonal communication (Saravana-Bawan et al., 2019). Effective team performance is fundamental in emergency management as deficiencies in teamwork may lead to increased morbidity and mortality for patients (Boet et al., 2019). EMs facilitate a culture of teamwork by clearly outlining interventional priorities and supporting dynamic verbal communication, thereby establishing a shared mental model between the team and the team leader (Goldhaber-Fiebert et al., 2020).

However, team leaders have reported challenges in adhering to EMs while simultaneously synthesizing clinical information, assigning roles, and communicating team action items (Urman et al., 2021). Some studies indicate that, in the face of task saturation, EMs may have the potential to slow down team leaders, presenting an additional workload that redirects their focus of attention and increases the occurrence of perceptual errors (Greig et al., 2023; Urman et al., 2021). To mitigate this, the role of the EM "reader" has emerged, broadening the shared mental model by acting as a liaison between the team, the team leader, and the cognitive aid. The primary role of the EM reader is to navigate to the appropriate crisis response page within the EM and verbalize critical action items in tandem with the team leader. Literature has shown that a dedicated EM reader significantly increases the completion of critical steps during an intraoperative crisis by relieving the team leader of cognitive burden and establishing a shared mental model for the perioperative team (Goldhaber-Fiebert et al., 2020).

In the event of an intraoperative crisis, the role of the reader may either be delegated to a perioperative team member by the team leader, or it may be assumed by one who volunteers (Goldhaber-Fiebert et al., 2020). Currently, there is little consensus on the ideal individual to assume this role, however, it has been consistently identified as a subtheme in EM studies, suggesting potential clinical translation through training additional perioperative team members to trigger EM use (Goldhaber-Fiebert et al., 2020). Assigning the EM reader to a clinician already in a leadership role has been suggested, but training is still necessary for the clinician to attain competence in effective navigation (Hepner et al., 2017). Moreover, the sustainable application of EMs during perioperative emergencies relies on prior training to instill confidence in both appropriate navigation and application of cognitive aid. If a reader fails to be designated or lacks the confidence to volunteer, EMs may not be triggered or presented as a supplement during an intraoperative crisis (Urman et al., 2021).

As pioneers in crisis checklist implementation, the aviation industry has identified that routine training, simulation, and application are required for the integration of checklists to be considered standard workflow (Hepner et al., 2017). Now, the culture around cognitive aid use within the aviation industry has become so strong that it is the expectation that memory should not be relied upon alone (Simmons & Huang, 2019). Organizations like the Emergency Manuals

Implementation Collaborative (EMIC) offer comprehensive online resources developed by leaders in cognitive aid research to support EM implementation efforts globally (Agarwala et al., 2019). While printing and placing EMs in accessible locations within operating rooms are essential initial steps, this is often insufficient for sustainability efforts as it fails to support staff use through training that facilitates competent and confident navigation (Goldhaber-Fiebert et al., 2015). Aligning implementation with sustainment efforts is crucial for creating intrinsic value among clinicians that support continued training and meaningful EM use (Goldhaber-Fiebert et al., 2023).

Significance

Integral to developing intrinsic value in implementation science is collaborative action that supports broadening perceptions of meaningful use. Emerging literature suggests that comprehensive emergency manual (EM) training for all perioperative staff holds significant value, not only in increasing familiarity with EM application and navigation but also in boosting confidence to initiate triggering their use (Goldhaber-Fiebert et al., 2015). Simmons and Huang (2019) highlight this in their definition of EMs as "a tool made to command all resources at hand to provide a care plan in concert with members of the anesthesia care team and operating room personnel in the aid of dynamic decision making" (p. 1). Comprehensive familiarization, training, and testing for all perioperative staff have been shown to positively impact practice with 80-95% of users reporting improvements in team dynamics, delivery of critical interventions, and sustained interest in EM use following training sessions (Alidina et al., 2018). Indeed, a multi-step implementation that involves all perioperative team members in navigating and reading from EMs has been shown to mitigate 90-100% of harmful oversights (Simmons &

Huang, 2019). A study on EM implementation revealed that multiple clinical specialties expressed eagerness for additional training opportunities on EM use, highlighting an unmet need for broader clinician education on team-based clinical management during emergencies (Goldhaber-Fiebert et al., 2015). In response, safety initiatives, such as EMs that are aimed at improving the culture of safety in the perioperative environment should encompass a range of clinical perspectives to maximize their impact (Bass & Hose, 2023).

Local Problem

A study assessing factors associated with the use of emergency manual cognitive aids (EMs) in operating room (OR) crises across the US revealed that the facility significantly influences the acceptance of innovation (Alidina et al., 2018). Smaller facilities, such as critical access hospitals, were found to facilitate greater implementation success compared to larger facilities, due to the strength of relationships, increased face-to-face communication, enhanced ownership, and ability to adapt the cognitive aid to the local context (Alidina et al., 2018) Critical access hospitals (CAH) were introduced by the Federal government in 1997 as a part of the Medicare Rural Hospital Flexibility Program to improve care access to rural hospitals and their communities (Hopper et al., 2022). Studies show that surgical volume is associated with increased profitability for many hospitals, and a positive correlation exists between the diversity of surgical services offered at critical access hospitals, their operating margin and net income (Hoskins et al., 2021). In a survey of CAH, 81% of administrators reported that surgical capabilities were very important to their hospital's viability, emphasizing the importance of ensuring that adequate safety mechanisms are in place that support perioperative staff in delivering safe, quality surgical care (Hoskins et al., 2021). Enhancing the confidence of perioperative staff at CAH to actively engage in EM navigation and application during perioperative emergencies is crucial for successful implementation. This quality improvement (QI) project aimed to assess this relationship by organizing an educational session on Emergency Manual Cognitive Aids for multidisciplinary perioperative staff at a CAH. The goal was to improve participant confidence in assuming the role of EM reader during operating room emergencies.

Androscoggin Valley Hospital, a 25-bed critical access hospital located in northern New Hampshire (NH) with three operating rooms, presents with a need for implementation improvement in its efforts to educate perioperative staff regarding the appropriate application of EMs. Dr. Luc Corriveau, DNP, MBA, CRNA, the lead CRNA at Androscoggin Valley Hospital underscores the value of comprehensive staff training due to strong team relationships and seasoned experience across all roles (L. Corriveau, personal communication, June 27, 2023). However, the lack of continued training poses a challenge to leveraging EMs during perioperative emergencies. While EMs were previously printed, laminated, and placed in visible locations in each OR for use during emergencies, there remains a gap in comprehensive staff training on their utilization. Despite one fire drill training for nursing staff, other staff have not been trained on their use, and EMs have not been utilized during actual emergencies, as these are rare. With approximately 2-26 surgical cases managed daily by teams consisting of a surgeon, Certified Registered Nurse Anesthesiologist (CRNA), and nursing staff, there is an opportunity to improve multidisciplinary staff confidence and competence in EM navigation and application.

A central tenet of implementation science is that implementation strategies are more effective when they are aligned with the culture of the healthcare system, they aim to improve

(Leeman et al., 2021). Therefore, this project aims to support a high percentage of multidisciplinary perioperative staff in receiving EM training to foster familiarity and promote a positive shift in the hospital's culture of safety and quality care.

Intended Improvement

Project Purpose

The purpose of this quality improvement project (QI) was to improve multidisciplinary perioperative staff confidence in assuming the role of emergency manual (EM) reader during operating room emergencies. A secondary purpose was to determine whether training on the role of the reader would increase perioperative staff intent to trigger EM use during emergencies.

Project Question

For multidisciplinary perioperative staff, will an educational session on emergency manual cognitive aids improve confidence in assuming the role of a reader during an operating room emergency?

Project Objectives

The primary objectives of this quality improvement (QI) project included developing and implementing an educational session for perioperative staff on the use of emergency manuals (EMs) to bolster confidence in assuming the role of reader during operating room emergencies. Although EMs have been introduced to this facility through accessible printouts in each of the three operating rooms, reinforced education on appropriate use is lacking. This intervention aligns with the multi-step implementation process recommended for successful emergency manual cognitive aid integration into an existing perioperative setting, aimed at optimizing timely critical action delivery and improving team functioning (Alidina et al., 2018).

EM training materials were sourced from the Emergency Manuals Implementation Collaborative (EMIC), a free, online resource endorsed by the Anesthesia Patient Safety Foundation (APSF) and the Council on Surgical and Perioperative Safety (CSPS). The training session encompassed an overview of EM use, navigation, and role delineation, including the reader's role, and featured examples of applications demonstrated in recorded simulations. A discussion on the benefits, challenges, and unique applications within a critical access setting was also included. Delivery of the training session involved a pre-recorded lecture sent via e-mail. Before viewing the training video, perioperative staff completed a pre-survey in Qualtrics. Following completion of the training video, a post-survey with the same questions was administered to assess for changes in knowledge, confidence, and intent to use. The goal was for at least 75% of the perioperative staff at Androscoggin Valley Hospital to watch the training video, complete both surveys and report improved confidence in assuming the role of reader during operating room emergencies.

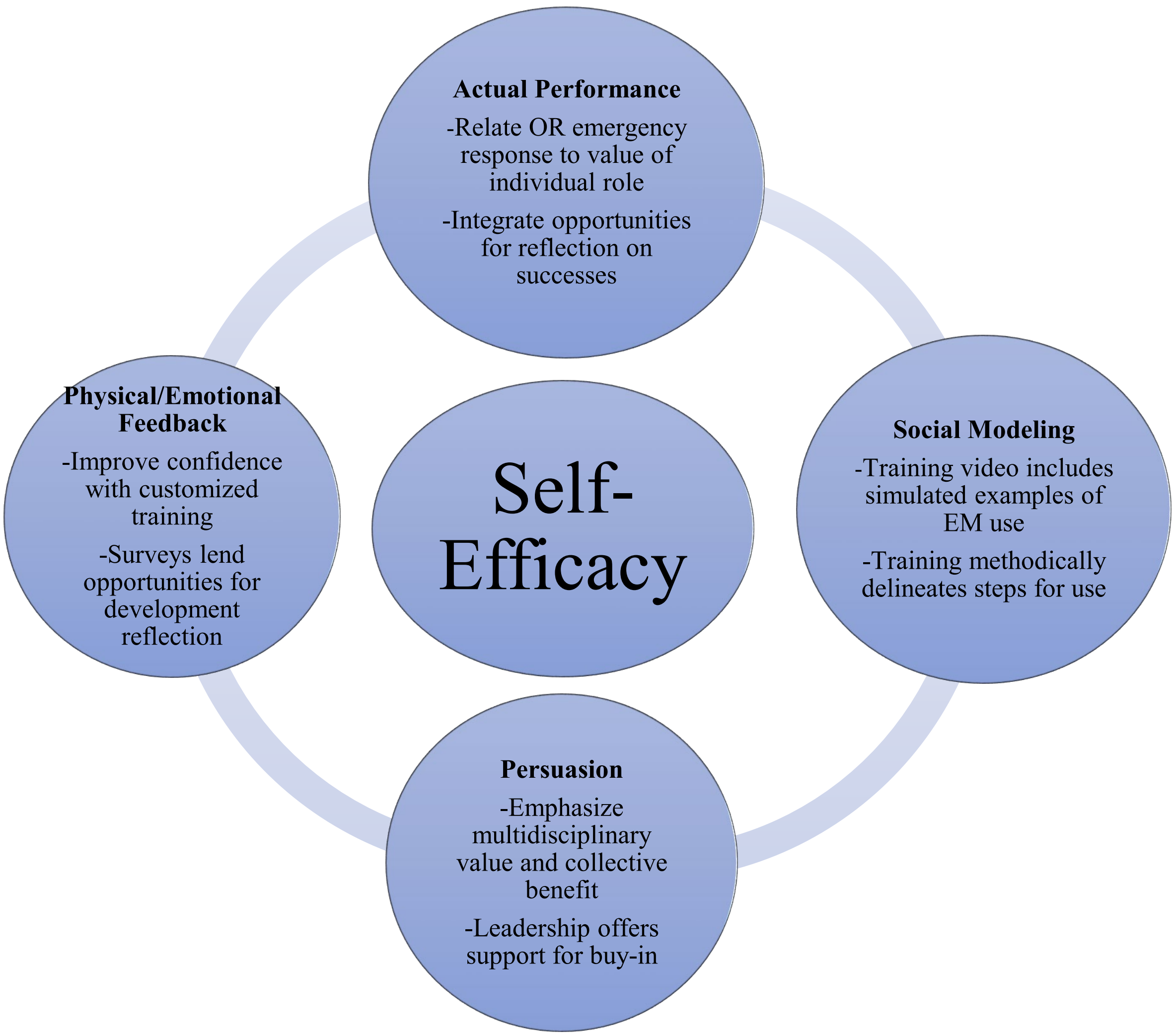
Theoretical Framework

Alfred Bandura's social cognitive theory (SCT), initially developed in 1986, offers valuable insights into understanding human functioning and motivation, particularly through the lens of self-efficacy. Self-efficacy, a central construct in this theory, refers to an individual's belief in their capability to successfully perform a specific task or behavior (Schunk & DiBenedetto, 2021). This perception of self-efficacy plays a crucial role in motivating individuals to engage in learning and behavior at various levels. The SCT suggests that self-efficacy is specifically influenced by various interdependent factors within the categories of actual performance, physiological and emotional feedback, social modeling via observation of others, and persuasion or encouragement from others (Artino, 2012). As a result, self-efficacy and the pillars that construct it can be considered key motivational factors that affect choice, effort, persistence, and achievement (Schunk & DiBenedetto, 2021). As self-efficacy is considered a motivational process, it has often been described as an influential component in contextual learning that joins both skills and efficacy beliefs to facilitate successful functioning. Individuals with high self-efficacy for engaging in a specific task are more likely to participate whereas those with low self-efficacy are more likely to remain averse to participating (Artino, 2012). In the context of this project, SCT offers a framework for understanding how shifts in perceived self-efficacy can occur through education and training interventions shaped around the pillars of actual performance, physiological and emotional feedback, social modeling, and persuasion.

Conceptual frameworks for effective clinical implementation of EMs further align with the SCT by emphasizing participant familiarization, training, and integration into local culture (Goldhaber-Fiebert & Macrae, 2018). The development of self-efficacy across these key realms is context-specific, meaning that perceived capabilities may vary depending on the task and environment (Artino, 2012). Therefore, assessing perceived self-efficacy in the specific context of EM use is essential for understanding motivational processes and barriers to engagement. Given that widespread adoption of EMs within the perioperative setting is still emerging, acknowledging this cultural variation is key for sustainment efforts that emphasize contextual self-efficacy as a method to improve engagement. The SCT also suggests that achieving self-efficacy is associated with increased motivation and persistence in pursuing desired outcomes (Schunk & DiBenedetto, 2021). Educational interventions aimed at enhancing self-efficacy can lead to greater confidence in translating knowledge into practice, particularly when individuals perceive value in the expected outcomes. This inclination to persist is a key motivational outcome that arises alongside increases in self-efficacy and is a component of sustainability that may be developed by facilitating continued opportunities for skill development within the specific context of EM use and multi-step educational initiatives. Social Cognitive Theory (SCT) additionally supports the importance of multi-step, continuing education initiatives that have been tailored to fit the contextual domain of EM use as a reflection of value creation. The predictive power of individual self-efficacy on motivational learning has been well-demonstrated and has led to an emphasis on the value of collective self-efficacy, or teamwork in facilitating persistence (Schunk & DiBenedetto, 2021) Success in cognitive aid implementation has been attributed to supportive organizational contexts, intentional staff training and emphasis on quality improvement processes (Alidina et al., 2018). To supplement educational initiatives, high-fidelity simulation is a well-documented training technique that utilizes a hands-on approach to cement concepts (Agarwala et al., 2019). Experiencing EM use, whether simulated or clinically, has been described as powerful for demonstrating their value and understanding how to best use them, further developing individual and collective self-efficacy (Goldhaber-Fiebert et al., 2020).

Figure 1

Alfred Bandura's Social Cognitive Theory, Adapted to the Concept of Self Efficacy for Emergency Manual (EM) Education



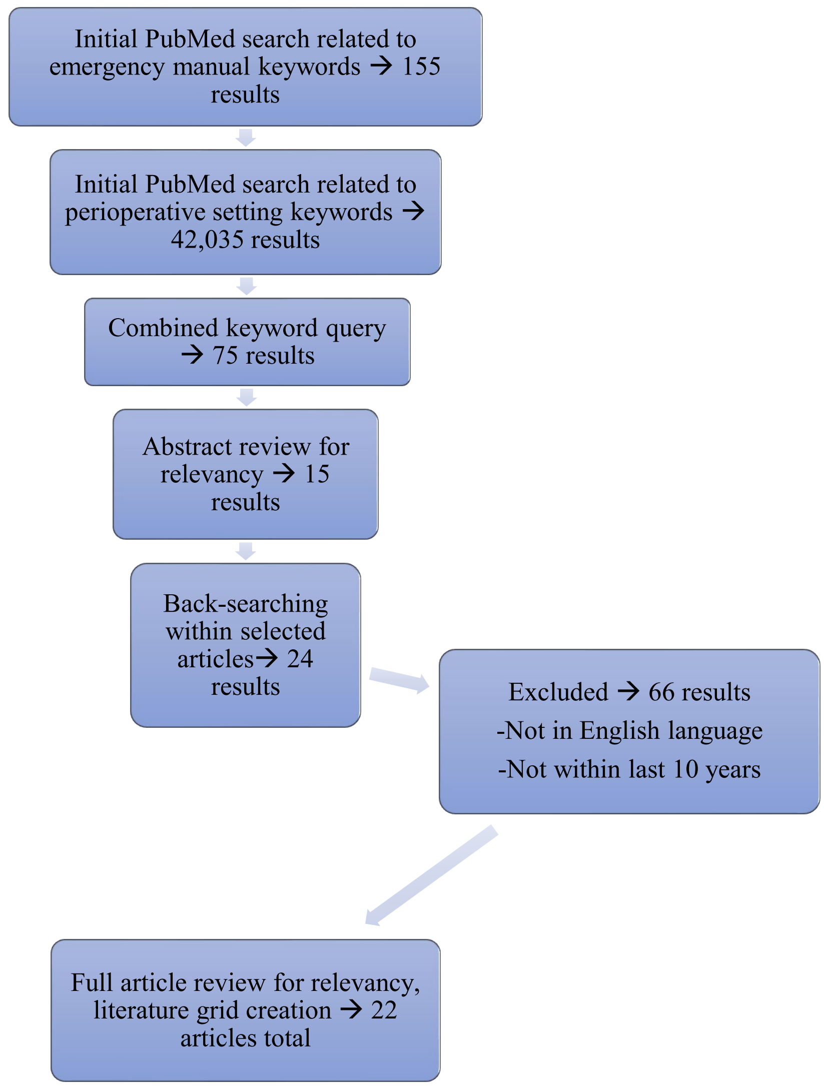
Literature Synthesis

Evidence Search

For this quality improvement (QI) project, a systematic literature search was conducted using the PubMed search engine to access articles from the National Library of Medicine's Medline database. Additionally, the reference lists of relevant articles were back-searched to identify additional sources. The search process commenced with individual searches using the terms ‘emergency manual,’ ‘cognitive aid,’ and ‘emergency manual cognitive aid’ in the MeSH database, but these searches yielded no results. Subsequently, a search using the term, ‘emergency manual cognitive aids’ in the comprehensive database yielded 23 results, six of which were deemed pertinent to the project. Further exploration via a back search within these relevant articles identified an additional 13 potentially relevant articles. To broaden the search, additional queries were formulated by combining the keywords ‘emergency manual,’ ‘emergency manual cognitive aids,’ *or* ‘crisis checklist,’ yielding 155 articles. A similar search combining keywords ‘perioperative,’ ‘intraoperative,’ *or* ‘operating rooms,’ resulted in 41,035 articles. The results from both sets of queries were consolidated using the Boolean operator “AND,” resulting in 75 articles. From this combined list, nine articles were identified as relevant to the project. A subsequent back-search within these articles yielded an additional 11 articles for preliminary inclusion. A total of 39 articles were identified for further evaluation. Each article’s abstract and full text were reviewed to assess their relevance to the project’s objectives, specifically focusing on content related to EM facilitators and barriers, improvements in critical action delivery and teamwork, implementation strategies, and the role of the “reader.” After careful evaluation, 22 articles were deemed appropriate for inclusion in the final selection. (Appendix G)

Figure 2

Evidence Search Flow Diagram



Comprehensive Appraisal of Evidence

This quality improvement (QI) project primarily focused on the utilization of emergency manuals (EMs) in the intraoperative setting. The inclusion criteria were broadened to encompass studies examining EM utilization in non-operating room settings such as emergency departments

(EDs), intensive care units (ICUs), or other hospital wards. To ensure the incorporation of the most current evidence, articles selected for inclusion were limited to those published within the past 10 years and written in English. This selection criteria prioritized high-quality evidence, including meta-analysis, randomized controlled trials (RCTs), systematic reviews, and case reports, and broadened inclusion as the review progressed. This literature synthesis encompassed a range of study designs with the final selection including five reviews of literature and randomized controlled trials respectively, three case reports, two implementation studies, and mixed-methods studies respectively, one each of a prospective retrospective, quantitative, qualitative, descriptive, and cross-sectional study.

Emergency Manuals Improve Critical Action Delivery and Reduce Human Error

Emergency manual cognitive aids (EMs) represent a burgeoning patient safety tool, increasingly recognized for their capacity to enhance critical action delivery, mitigate human error and consequently, improve patient safety. With an annual global mortality rate of 8 million people attributed to surgical complications, half of which are potentially preventable, the need for interventions like EMs is paramount (Dobson, 2020). Randomized controlled trials (RCTs) investigating EM utilization consistently demonstrate significant improvements in adhering to best practices and delivering critical actions (Hardy et al., 2018; Koers et al., 2020; Sellmann et al., 2022) all found that EMs facilitate the successful completion of key steps and reduce errors by preventing omissions. In one study, crisis management was found to assume a more systematic approach when an EM was available, permitting a greater adherence to best-practice guidelines and supporting a faster time to critical intervention delivery (Hardy et al., 2018). Sellman et al. (2022) conducted a prospective, randomized single-blind study to assess risk reduction of essential working steps during simulated emergencies and found that EM use led to 9% absolute and 15% relative risk reduction of failure to adhere to guideline-adherent critical process steps (Sellmann et al., 2022). A high-fidelity simulation study by Koers et al. (2019) observed a 70% improvement in the omission of critical management steps during intraoperative emergencies with EM utilization (Koers et al., 2020).

Emergency manuals not only improve adherence to best practices but also bolster non-technical skills by alleviating cognitive load during high-stress scenarios. This stress-induced cognitive burden, a known barrier to knowledge retrieval, is effectively mitigated by EMs, as evidenced by studies that highlight significant reductions in stress burdens (Greig et al., 2023; Hardy et al., 2018). The negative consequences of stress-induced limitations on cognitive processing are well-documented, affecting ease of recall and resultant omissions (Hepner et al., 2017). EMs serve as an effective adjunct to critical thinking during crises, offering relief from working off memory alone. Multiple systematic reviews of the literature confirm this multifaceted reduction of stress-induced burden and subsequent error when EMs are incorporated into crisis management (Greig et al., 2023; Saxena et al., 2020; Simmons & Huang, 2019).

Emergency Manuals Improve Team Dynamics During Intraoperative Emergencies

Emergency manuals (EMs) not only enhance critical action delivery but also foster improvements in clinical team dynamics and communication. Systematic reviews, such as those by Grieg et al. (2023) and Saxena et al. (2020), consistently highlight the positive impact of cognitive aids on teamwork, citing enhancements in clinical teamwork skills, conflict resolution scores, and overall team performance (Greig et al., 2023; Saxena et al., 2020). Sellman et al.

(2022) conducted a large, prospective, randomized single-blind study, revealing that teams performed significantly better ($p<0.05$) during simulated emergencies when EMs were available. Additionally, qualitative studies assessing anesthesia provider perceptions, reported that EMs supported effective clinical team functioning through mechanisms like role delegation and the establishment of a shared mental model (Bereknyei Merrell et al., 2018; Goldhaber-Fiebert et al., 2020). These findings align with a systematic review of literature by Saxena et al. (2020) which noted that 92% of studies reported improved team performance with the use of cognitive aids, indicating an alignment of the team member's mental models. In contrast, some studies cautioned that the addition of EMs could potentially slow teams down, serving as a distractor that necessitates additional focus, or attention redirection (Goldhaber-Fiebert et al., 2020; Greig et al., 2023). A randomized controlled trial found that while the use of EMs, when available, was generally positive, teams were found to struggle with integrating them into patient care processes meaningfully and as a result, they did not significantly impact team performance compared to without (Urman et al., 2021).

Multi-Step, Multidisciplinary Emergency Manual Training Facilitates Intent to Use

Effective and sustainable use of emergency manuals (EMs) in operating room (OR) emergencies hinges on multi-step, multidisciplinary training initiatives. It is noted that the "print and plunk" method of simply placing EMs in ORs, with little to no training, improves accessibility alone, yet fails to create a culture of confidence that results in an intent to use when emergencies do arise (Agarwala et al., 2019). As OR emergencies are rare, implementation studies emphasize customized, consistent staff familiarization and underscore the importance of these training frameworks in ensuring sustained EM utilization in the event of an intraoperative crisis (Agarwala et al., 2019; Goldhaber-Fiebert & Macrae, 2018). A systematic review by Simmons and Huang (2019) revealed that adherence to lifesaving processes of care is four to six times higher with EM use compared to without, highlighting the necessity of focused training efforts to foster familiarity and cultural acceptance. Frequent educational reviews, coupled with simulation exercises exploring EM utilization in team dynamics, role delineation, and engagement reinforcement, play crucial roles in maintaining staff intent to use (Clebone et al., 2017). Goldhaber-Fiebert et al. (2015) conducted a study involving brief, targeted training sessions with multidisciplinary OR staff on EM use and navigation, leading to notable increases in EM awareness ($p<0.01$), familiarity ($p<0.01$), willingness and intention to use during critical events (<0.01). Similarly, a case report by Huang et al. (2020) attributed successful EM utilization during an actual intraoperative crisis to regular training sessions focusing on both EM use and the empowerment of multidisciplinary team members. A cross-sectional study by Alidina et al. (2018) identified factors associated with EM use during OR crisis with 90% of respondents expressing interest in using EMs utilization. Facilitators included a multi-step implementation process incorporating continuing education initiatives to maintain a receptive implementation climate and foster stakeholder ownership. Adapting EMs to fit local contexts further enhances staff buy-in and promotes a broader intent to use intent to use (Alidina et al., 2018; Goldhaber-Fiebert & Macrae, 2018; Goldhaber-Fiebert et al., 2016; Huang et al., 2020).

The Emergency Manual Reader Plays a Critical Role in Triggering Use

Developing the role of the emergency manual (EM) reader is a subtheme that was identified as a pivotal component of successful EM utilization that necessitates further refinement to optimize its effectiveness. A systematic review of literature highlighted that the integration of the reader role either through delegation from a leader, via pre-assignment, or through volunteer assumption, was integral to completing critical actions during a crisis (Hardy et al., 2018). In a randomized controlled trial featuring high-fidelity simulations of intraoperative emergencies, the introduction of a designated reader significantly reduced the leader's workload, enhancing team performance and communication (Hardy et al., 2018). Aligned with these findings, another systematic review by Simmons and Huang (2019) revealed that integrating a dedicated EM reader into the care team nearly doubled the quality of decision-making and the completion of tasks according to protocol. Additionally, a prospective randomized controlled trial by Urman et al. (2021) involving 304 anesthesia providers, identified the failure to designate an EM reader as a pitfall to effective use, leading to role clarity breakdown and incomplete task assignments as the EM was circulated without its contents being presented. While assigning the reader role is crucial, its effectiveness depends on the individual's ability to effectively verbalize EM content and consistently engage with the team (Urman et al., 2021). Survey-based studies assessing perioperative staff perceptions of EM use underscored the benefits of having a designated reader to establish a shared mental model (Bereknyei Merrell et al., 2018; Goldhaber-Fiebert et al., 2016; Huang et al., 2019). Goldhaber-Fiebert et al. (2018) presented a conceptual framework for EM implementation emphasizing the inclusion of a designated reader role as one of four key elements enabling effective implementation. While the ideal individual to assume this role was not explicitly identified, a systematic review by Hardy et al. (2017) suggested that prior experience with the role is essential, whether as a leader or through prior training and experience. Given the task and attention saturation often experienced by team leaders during critical events, training a subset of interdisciplinary perioperative staff as effective EM readers may enhance familiarity and subsequent triggering (Goldhaber-Fiebert et al., 2015). A multidisciplinary implementation study that trained OR staff including nurses and surgical technicians on EM awareness found that the session significantly increased intention to use during critical events (<0.01), emphasizing components that facilitate triggering such as increasing awareness, familiarity, cultural acceptance and routinization (Goldhaber-Fiebert et al., 2015).

Strengths of Evidence

This literature review encompasses a diverse range of evidence levels that reflect the varying types of inquiry into the use of emergency manuals (EMs). Included in the review are five randomized controlled trials, which represent high-quality studies supporting the efficacy of EMs in improving critical action delivery and reducing the omission of critical management steps (Hardy et al., 2018; Koers et al., 2020; Saravana-Bawan et al., 2019; Sellmann et al., 2022; Urman et al., 2021) . Among these trials, two specifically identify the designation of a reader as a beneficial contributor to meaningful EM application (Hardy et al., 2018; Urman et al., 2021). Additionally, five systematic reviews of the literature were included, providing a synthesis of evidence regarding the benefits of EMs in enhancing team adherence to lifesaving processes and improving patient safety by reducing human error (Clebone et al., 2017; Goldhaber-Fiebert & Macrae, 2018; Greig et al., 2023; Saxena et al., 2020; Simmons & Huang, 2019). These reviews also underscore the importance of structured, multi-step implementation processes that support continued familiarization and training for all team members in translating EM knowledge into practice (Clebone et al., 2017; Goldhaber-Fiebert & Macrae, 2018; Saxena et al., 2020; Simmons & Huang, 2019). Notably, three of these articles specifically discuss role delineation, emphasizing the identification of a dedicated EM reader as a key implementation component (Clebone et al., 2017; Goldhaber-Fiebert & Macrae, 2018; Simmons & Huang, 2019). Descriptive studies incorporating both quantitative and qualitative data contribute to the evidence base by highlighting EMs as a significant contributor to risk reduction during intraoperative emergencies. These studies report that sustained EM use relies on a multi-step implementation process ensuring consistent, customized training, with two studies specifically noting the critical role of assigning the reader in triggering EM use following training (Goldhaber-Fiebert et al., 2016; Huang et al., 2019).

Weaknesses of Evidence

A notable weakness in this evidence is the inherent difficulty in studying the effects of emergency manual (EM) application during actual intraoperative crises. These events are rare and occur unexpectedly, making it challenging to conduct controlled studied in real-time settings. Consequently, much of the evidence regarding EM implementation and use is derived from simulated scenarios rather than real-life emergency situations. While high-fidelity simulations provide valuable insights into team dynamics and skill development, they may not fully capture or be reflective of the complexities of actual crisis. In addition, the reliance on lower-quality evidence such as case reports to provide anecdotal evidence of EM application may serve as another limitation, as they lack the generalizability of other study designs and pose challenges in drawing broad conclusions from the findings of individual cases. As selected studies primarily focus on the intraoperative setting, with a few exceptions, it may be challenging to extrapolate findings to other healthcare contexts that present their own unique facilitators and barriers to cognitive aid implementation. Opportunities for future research may address these weaknesses by incorporating real-time or retrospective data collection during actual intraoperative emergencies.

Gaps and Limitations

The primary limitation of this project lies in the rarity of intraoperative emergencies, which may hinder the ability to assess the effectiveness of emergency manual (EM) training in real-world crisis situations. While the project aims to improve multidisciplinary confidence and readiness to use EMs during emergencies, the infrequency of these events may limit opportunities for staff to apply their training in practice. Another challenge is the potential difficulty in generalizing project findings to other healthcare institutions due to variability in institutional contexts, including size, staffing, resources, and patient populations. Efforts have been made to tailor EM training to the specific context of AVH, yet the extent to which these can be extrapolated to other settings is uncertain. Limitations related to staff changes and training sustainability may present as a challenge due to factors such as locums hires, rotating trainees, and overall staff turnover. As a result, maintaining the momentum of training initiatives and ensuring ongoing competency among staff may prove challenging and impact the long-term effectiveness of this specific intervention. Assessing the long-term impact may present challenges as the training may demonstrate immediate improvements in staff confidence and intent to use EMs during emergencies, however measuring the sustained or tapering effects requires longitudinal follow-up and data collection. Specific to data collection, there may be limitations faced due to participant dropout. While the initial recruitment e-mail suggests allotting a 15-minute window for participants to complete the surveys and educational video, there is still the potential for incomplete surveys to be submitted. Given the small participant sample size, an incomplete survey has the potential to significantly impact results.

METHODS

Project Design

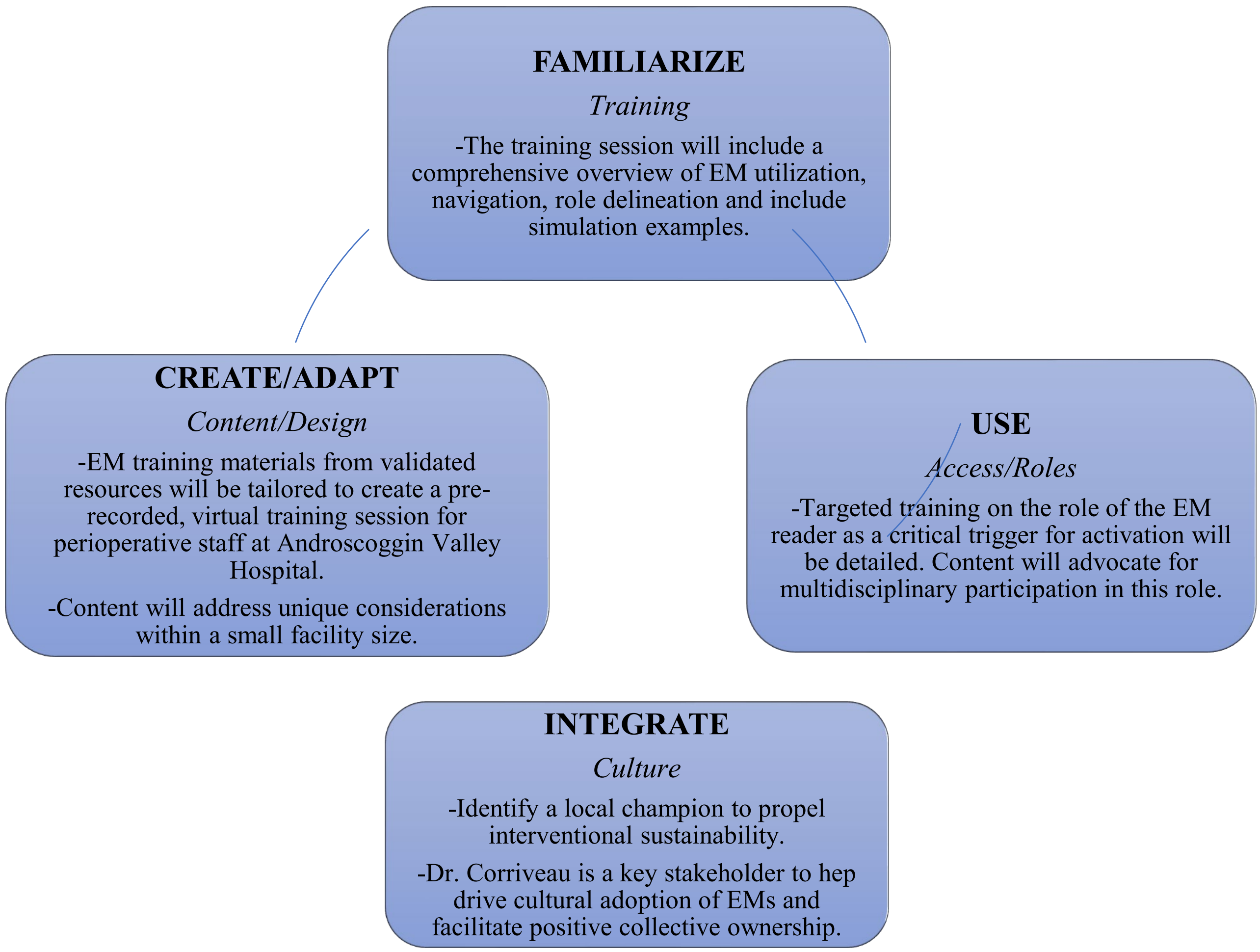
Emergency manual cognitive aids (EM) serve as valuable educational and clinical tools designed to facilitate rapid critical action delivery and enhance team functioning during high-stress operating room (OR) emergencies (Goldhaber-Fiebert & Macrae, 2018). Of note, successful clinical implementation extends beyond the mere availability of EMs in ORs; it necessitates supporting perioperative staff in acquiring the confidence and knowledge required to effectively utilize them. This quality improvement (QI) project seeks to enhance multidisciplinary perioperative staff confidence in assuming the role of EM reader and their subsequent intent to trigger EM use during OR emergencies through an educational training session. The focus of this intervention will consist of a pre-recorded, educational training video that comprehensively details the purpose, navigation, and steps for successful EM implementation that has been broadened to accommodate multidisciplinary perioperative staff (Appendix E). Participants will be administered a pre-survey before viewing the educational video, to assess baseline knowledge and intent to use (Appendix D). Following the training video, a post-survey will then be administered to assess for changes in participant responses (Appendix D). The primary outcome of this project will assess whether perioperative staff report an improvement in confidence to assume the role of EM reader during intraoperative emergencies following the educational training video. Additionally, a secondary outcome will evaluate whether training on the role of EM reader increased perioperative staff intent to trigger EM use during OR emergencies.

Model for Implementation

While their approach may differ, implementation science and quality improvement science are becoming increasingly aligned, as both aim to produce knowledge that can guide the improvement of healthcare services and outcomes (Leeman et al., 2021). While implementation science primarily focuses on optimizing the utilization of evidence-based interventions, improvement science centers on measuring and enhancing care processes (Leeman et al., 2021). Goldhaber-Fiebert et al. (2018) introduced a conceptual framework that integrates elements from both implementation science and quality improvement to support the development, testing, and systematic integration of emergency manual cognitive aids in perioperative settings. This model will be adapted for this project and delineates four key non-linear elements that are crucial for effective implementation: Create/Adapt, Familiarize, Use, and Integrate (Figure 2) (Goldhaber-Fiebert & Macrae, 2018). These elements mirror the iterative nature of the Plan-Do-Study-Act (PDSA) cycles advocated for by the Institute for Healthcare Improvement (IHI) as a framework for guiding quality improvement initiatives (Burke & Marang-van de Mheen, 2021). The Plan and Create elements both focus on intervention development, the Familiarize and Do elements support training, the Use and Study elements support role development and the Integrate and Act elements promote facilitating ownership.

Figure 3

Conceptual Framework for Emergency Manual Implementation



(Figure adapted from the four vital elements for implementing emergency manuals (Goldhaber & Macrae, 2018))

Create/Adapt

During the Create/Adapt phase, emergency manual (EM) content will be customized to suit the context of local implementation. This tailored approach aims to enhance buy-in during implementation and promote local ownership in tool development, increasing the likelihood that it will be integrated into practice by end-users. To achieve this, EM training materials will be sourced from the Emergency Manuals Implementation Collaborative (EMIC), an online platform supported by leaders in EM adoption and endorsed organizations such as the Anesthesia Patient Safety Foundation (APSF) and the Council on Surgical and Perioperative Safety (CSPS). These materials will then be modified to create a pre-recorded, virtual training session tailored for perioperative staff at Androscoggin Valley Hospital (AVH) (Appendix E). Additionally, a concise project invitation detailing the "What, Why, When, Where, and How" of the quality improvement (QI) project will be formulated and disseminated via e-mail to multidisciplinary perioperative staff, ensuring clear communication of the project's objectives and processes (Appendix C).

Familiarize

Familiarizing end-users in the effective clinical use of emergency manuals (EMs) can be facilitated through educational initiatives that review key information and effective integration into patient care (Goldhaber-Fiebert & Macrae, 2018). While EMs were already printed out, laminated, and placed in visible locations in each of the operating rooms at AVH, familiarity with their content was limited to a single drill for nursing staff. To address this, the training session will be tailored to provide a comprehensive overview of EM utilization, including navigation guidance and delineation of roles that will be broadened to include all perioperative staff roles. Additionally, the session will feature examples of effective applications demonstrated in recorded simulations, allowing participants to observe scenarios where EMs were successfully employed. A discussion on the facilitators, barriers and unique application within a smaller facility size will also be included to contextualize the training to the specific needs of AVH. Hosting subsequent educational training sessions for perioperative staff is aligned with multi-step implementation processes advocated for by Alidina et al. (2018), that support including continuing education and simulation for all perioperative staff to continue increasing awareness, familiarity with and intention to use (Alidina et al., 2018).

Use

While actual operating room emergencies are infrequent, the effective utilization of emergency manuals (EMs) during such high-stakes events relies on both accessibility and the optimization of team-based interactions through role delineation and clinical translation (Goldhaber-Fiebert & Macrae, 2018). Training will seek to bolster the confidence of multidisciplinary perioperative staff in assuming the role of reader during intraoperative emergencies. To facilitate this, the training session will include content that highlights the role of the EM reader, identifying it as a critical trigger for EM activation. Content will differentiate this role as distinct from that of the team leader and one that can be assumed by any staff member. It will further highlight the reader's integral responsibility of initiating the appropriate response protocols outlined in the EM.

Integrate

The Integrate phase will focus on embedding the use of EMs into the local culture and professional practice, fostering a sense of collective ownership. Research suggests that small facility size positively influences the cultural acceptance of implementation initiatives, with critical access hospitals found to facilitate components of EM implementation with greater success compared to larger facilities (Alidina et al., 2018). This success is attributed to factors such as the strength of relationships, increased face-to-face communication, enhanced ownership, and the ability to adapt the cognitive aid to the local context (Alidina et al., 2018). Identifying local champions who are well-respected in the professional setting and motivated to propel the sustainability of the intervention are integral to this. Dr. Corriveau, the lead CRNA at AVH has been identified as a key stakeholder that can support driving the cultural adoption of EMs. Dr. Corriveau who has been involved in the project from its inception, has, and will continue to provide valuable insights and guidance to ensure that the intervention aligns with the hospital's professional and quality improvement goals. By engaging local champions such as Dr. Corriveau to help foster a sense of collective ownership among staff, this project aims to integrate EMs in a sustainable manner that will continue to enhance patient safety outcomes.

Setting and Stakeholders

This project was implemented at Androscoggin Valley Hospital (AVH), a 25-bed private, non-profit, critical access hospital (CAH) located in Berlin, New Hampshire (NH), a town with a population of 9,500 (U.S. Census, n.d.). AVH has three operating rooms (OR) that handle anywhere from 2-26 cases per day and include a wide variety of surgical specialties such as urology, ear nose, and throat (ENT), orthopedics, general surgery, and pain sedation. These surgical procedures are managed by multidisciplinary perioperative teams consisting of a surgeon, CRNA, OR nursing staff, and at times, a pain specialist. The patient population seeking surgical care at AVH is primarily from a rural setting and includes all age ranges. The primary stakeholders are the multidisciplinary staff that will be involved in the project and include anesthesia providers, surgeons, OR nurses, and pain specialists. Downstream effects of this quality improvement project will benefit patients and their families within the community of Berlin, AVH administration, AVH management and the greater healthcare community.

Planning the Intervention

A digital, pre-recorded educational training presentation was developed utilizing evidence-based material sourced from the open-access Emergency Manuals Implementation Collaborative (EMIC) (Appendix E). The presentation detailed various aspects of Emergency Manual (EM) utilization, including an overview of its use, navigation, role delineation, effective triggering, and exemplification of successful application through a recorded simulation video. It additionally addressed the specific benefits, challenges, and unique considerations within a critical access setting, and emphasized the importance of multidisciplinary involvement and the role of the EM reader. To assess the impact of the educational training, a pre- and post-survey was designed using Qualtrics software (Appendix D). This survey aimed to gather quantitative data regarding changes in perioperative staff knowledge, confidence, and intent to use following the educational intervention. A concise summary invitation was created, providing essential details about the QI project objectives and methods, and was delivered via e-mail to multidisciplinary perioperative staff with instructions for participation (Appendix C). These instructions outlined the steps for completing the pre-survey, accessing the educational training video, and subsequently completing the post-survey. To permit time for staff involvement and data collection, a participation window of two weeks was delineated to provide a timeframe intended to accommodate schedules. Following completion of the intervention and data collection, the final data synthesis was completed within Qualtrics software.

Participants and Recruitment

All multidisciplinary perioperative staff at AVH were invited to participate in this quality improvement project. Inclusion criteria comprised individuals working within a perioperative setting at the hospital, including six surgeons, four certified registered nurse anesthetists, 13 nursing staff, five pain specialists, and one student registered nurse anesthetist. Given the relatively small size of the facility, the project aimed to secure participation from 22 multidisciplinary perioperative staff members, representing a targeted response rate of 75%. This sample size provides sufficient power to detect meaningful differences in participants' responses representing the effects of the educational intervention. A level of significance of 0.05 was utilized as a threshold to determine the statistical significance of observed differences between pre- and post-survey responses. The only exclusion criteria for participation were refusal by individual staff members. Recruitment was completed through an e-mail sent to perioperative staff by Dr. Corriveau. In total, two e-mails were sent over the two-week-long data collection timespan, one e-mail at the commencement of the project and a subsequent e-mail one week in. This e-mail invitation included a concise summary of the objectives and methodologies for project completion (Appendix C). Additionally, detailed instructions for participation encompassing the steps and links to the surveys and educational content were provided. For transparency, a disclosure form was included in the e-mail stipulating that consent is implied through voluntary participation and that no financial compensation would be provided (Appendix B). Each participant had an equal opportunity to be entered into an anonymous raffle to receive one of two, $20 coffee shop gift cards.

Consent and Ethical Considerations

Before project implementation, written site approval was obtained from Dr. Luc Corriveau (Appendix A), and the Human Subjects Institutional Review Board (IRB) project approval was received through the University of Arizona (Appendix A). A consent and disclosure form were distributed to staff as a part of the project recruitment e-mail (Appendix B). Aligned with the ethical principle of beneficence, this e-mail comprehensively detailed components of the project for full participant transparency (Haddad & Geiger, 2024). This included a statement that no financial benefit was to be offered for participation and noted that participation in the project was both voluntary and anonymous, aligned with the ethical principle of justice that promotes fair and equal treatment (Haddad & Geiger, 2024). Participation was defined to imply that participants agreed to have their responses used for the project and were offered the option to withdraw at any time. This is aligned with the ethical principle of autonomy that supports an individual's right to make their own decisions based on their beliefs and values and their right to refuse participation (Haddad & Geiger, 2024).

Data Collection

Survey data will be collected anonymously utilizing Qualtrics software. Participants will receive detailed instructions via email outlining the required steps for project participation (Appendix C). First, participants will be directed to click on a private, anonymous link provided to complete the pre-training survey on Qualtrics (Appendix D). Following this, participants will be instructed to view the pre-recorded educational training session that will cover essential content on emergency manual cognitive aids (Appendix E). Lastly, participants will be prompted to click on another private, anonymous link to complete the post-training survey on Qualtrics, reflecting any changes in their perceptions or confidence level following the educational training (Appendix D). To accommodate schedules, participants will be given a 2-week window from October 28, 2024, through November 11, 2024, to complete their participation. Additionally, a follow-up reminder will be sent out to all staff one week after the initial recruitment e-mail to encourage participation and ensure that none miss out on the opportunity to contribute.

Data Analysis

The pre- and post-survey consisted of primarily Likert-style questions designed to gauge participants' confidence levels, the likelihood of utilization, and perceptions of importance (Appendix D). Additionally, multiple dichotomous questions were included to capture baseline data on participant experience and characteristics. Response data was collected through Qualtrics software upon completion of both surveys. Results were analyzed to assess for changes in intent to use, knowledge base, and perceived confidence. Quantitative questions included questions 6, 7, 10, 11, and 12 and results were assigned values of 1-5 with the most negative responses (extremely unlikely, not at all important, not confident) given the value of '1' and the most positive responses (extremely likely, extremely important, extremely confident) given the value of '5.' Each question was compared between the pre- and post-survey results via mean, standard deviation, and a one-tailed t-test to determine if the training had a positive impact on post-survey results. T-tests were completed at the 95% confidence level with an Alpha of 0.05. A Cohen's d test was completed for all quantitative questions to assess for effect size.

RESULTS

Outcomes

An invitation to participate in this quality improvement (QI) project was sent to all 29 members of the perioperative staff department at Androscoggin Valley Hospital by Dr. Luc Corriveau. Of the perioperative team members, the participation rate was 58.6% (n=17) for both the pre- and post-training survey. For the pre-training survey alone, participation was 79.3%

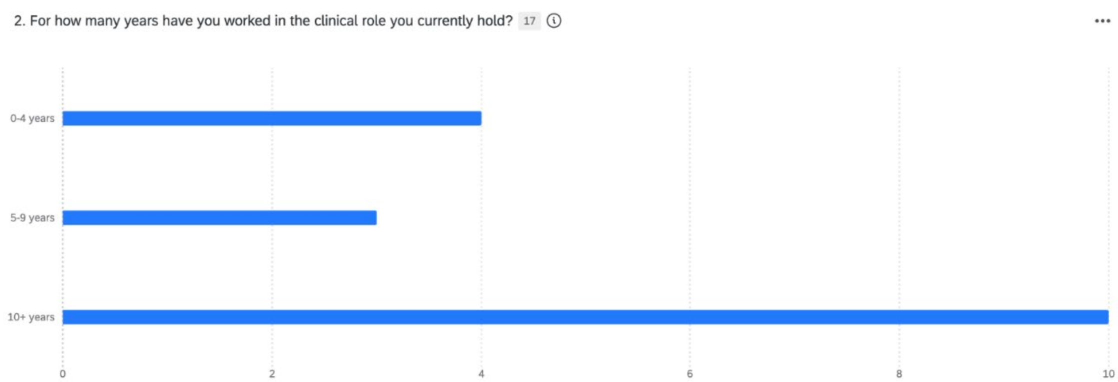
(n=23), as six individuals completed the pre-training survey, but did not complete the post-training survey following the educational video. To be considered full participants in this quality improvement (QI) project, participants were required to complete a pre-training survey, view an educational training session on the use of emergency manual cognitive aids, and then complete a post-training survey featuring the same questions. Responses for participants were linked between the pre- and post-survey using a 4-digit anonymous identifier and a total of 17 pre- and post-survey responses were included for analysis. As six participants completed solely the pre-survey without completing the post-survey, their answers were cross-referenced with a 4-digit anonymous identifier and omitted from the final analysis.

Participant Demographics

Participant demographics reflect the total number of participants who completed both the pre- and post-survey (n=17) and initiated participation in this quality improvement (QI) project. The clinical roles of participants included medical assistants (n=2), nurses (n=10), a resident registered nurse anesthetist (n=1), certified registered nurse anesthetists (CRNA) (n=3), and a surgeon (n=1). Participants experience ranged from 0-4 years (n=4), 5-9 years (n=3) and greater than 10 years (n=10).

Figure 4

Pre-Survey, Question 2



All but one participant reported having experienced a patient emergency while working in the operating room in the past (n=17). Less than half (47%) of participants (n=8) report never having received formal training on the utilization of emergency manual cognitive aids, compared to 53% (n=9) who have. In the operating room setting, 41% (n=7) had previously observed the utilization of an emergency manual cognitive aid during an operating room emergency while 59% (n=10) had not.

Figure 5

Pre-Survey, Question 3

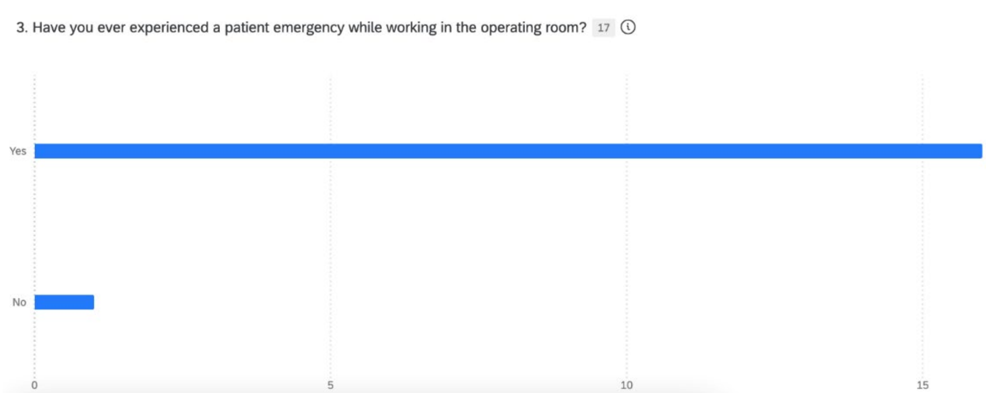


Figure 6

Pre-Survey, Question 4

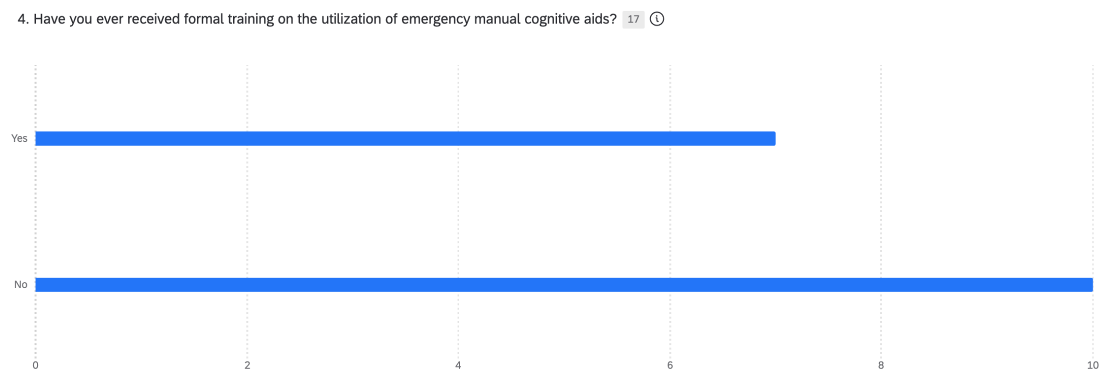
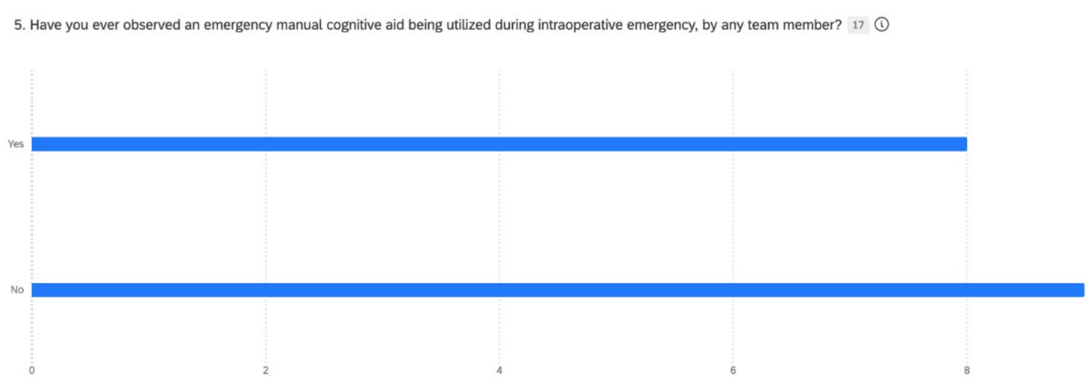


Figure 7

Pre-Survey, Question 5



Quantitative Analysis

Tables 1 and 2 show the mean and standard deviation for the pre- and post-survey results. All quantitative questions showed more positive responses following the educational training. Question 7 was not significant following the t-test, with a p-value of 0.055. Questions 6, 10, 11, and 12 were all significant following the t-test, with Question 6 resulting in the lowest confidence at a p-value of 0.026. Questions 10, 11, and 12 all had p-values of less than 0.01, indicating a greater than 99% confidence that the training had a positive impact on participant responses between the pre- and post-survey.

Question 7 had the highest mean and lowest standard deviation in both the pre- and post-survey results, conveying that providers understand the importance of utilizing emergency manuals (EM) during emergencies. Question 6 had the second highest mean during both the pre- and post-survey results, however pre-survey standard deviation was the highest amongst all questions assessing whether a provider is extremely likely to use or extremely unlikely to use. Together, this may indicate that participants recognize the importance of EMs, but actual intent to use during intraoperative emergencies is non-standardized.

Question 10 dealt with how likely someone was to trigger the use of a manual, while Questions 11 and 12 dealt with how confident respondents were with navigating the EM, either in general or as the reader. All questions saw improvements of almost a full confidence level, reduced standard deviation, and p-values of <0.01. This indicates that the training provided was significant enough to improve provider confidence in the use and navigation of EMs as well as intent to use, as demonstrated by improvement in Question 6 post-survey results. This saw an almost full confidence level improvement and the steepest drop in standard deviation among questions, demonstrating an overall improvement in the likelihood of use by participants.

Given the smaller sample size, a Cohen's d test was completed to assess for effect size between the two groups signifying overlap in the means and standard deviation across data sets. According to Cohen, the larger the effect size, the greater the degree to which the phenomenon under the study is manifested (Cohen, 1977). For this project, a large effect size was considered a d >/=0.8, and a moderate effect size was considered a d=(0.5-0.8). For quantitative results, the effect size was large for Question 10 (d=0.97), Question 11 (d=1.19), and Question 12 (d=0.83), suggesting that the intervention in question had a strong impact with a meaningful, significant difference. For Question 6 (d=0.77) the effect size was moderate to large, and moderate for Question 7 (d=0.51) suggesting the intervention may still indicate value depending on the clinical setting.

Table 1

Pre-Survey Results

Pre-Survey Results					
Question	Question 6	Question 7	Question 10	Question 11	Question 12
Mean	3.706	4.294	3.647	2.706	3.294
Standard Deviation	1.448	0.849	1.169	1.047	1.105

Table 2

Post-Survey Results

Post-Survey Results					
Question	Question 6	Question 7	Question 10	Question 11	Question 12
Mean	4.588	4.647	4.588	3.941	4.176
Standard Deviation	0.712	0.493	0.712	1.029	1.015

Intent to Use

Question 6: How likely are you to use an emergency manual cognitive aid during an intraoperative emergency, if it is readily available?

Following the educational training session, the number of participants that reported they would be “extremely likely” to use an emergency manual cognitive aid (EM) during an intraoperative emergency doubled, with an increase from 35% (n=6) to 71% (n=12). Six participants (35%) reported being “somewhat likely” on the pre-survey compared to three participants (18%) on the post-survey. Two participants (12%) reported being "neither likely or unlikely" on both the pre- and post-survey. On the pre-survey, 18% (n=3) of participants reported they would be "extremely unlikely" to utilize an EM during an interoperative emergency and none reported being unlikely to use an EM on the post-survey. Clinical roles of the three participants that reported being "extremely unlikely" to use an EM on the pre-survey included a medical assistant and two nurses. On the post-survey, all three of these participants reported being "extremely likely" to use an EM.

Figure 8

Pre-Survey, Question 6

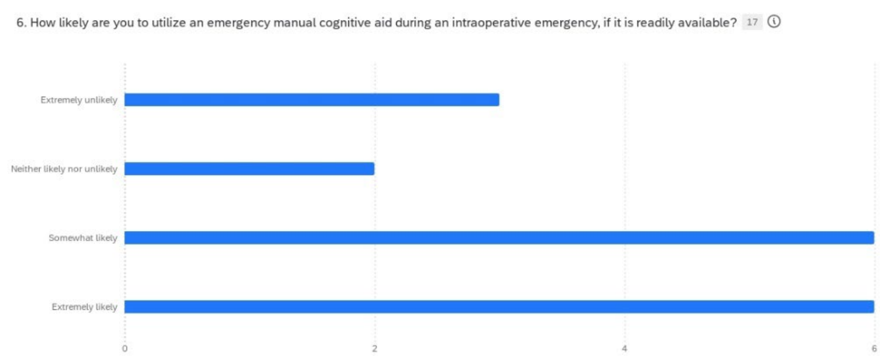
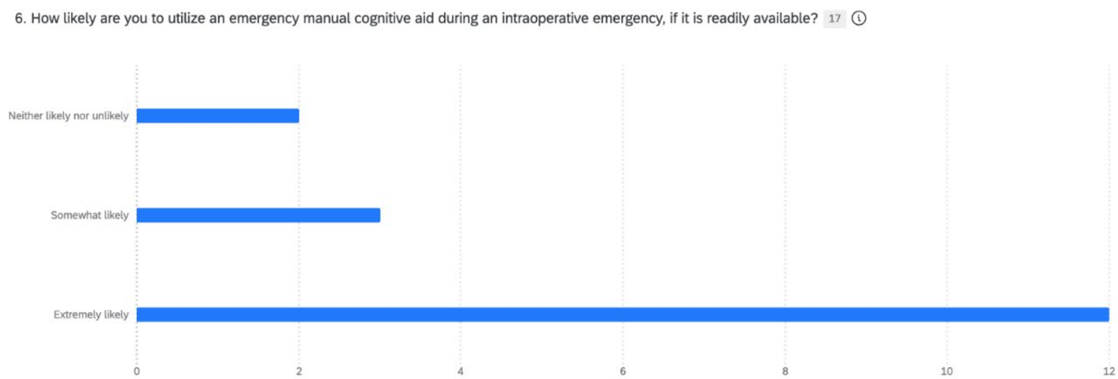


Figure 9

Post-Survey, Question 6



Question 10: How likely are you to trigger the use of the emergency manual, without prompting, during an intraoperative emergency?

The number of participants who reported being "extremely likely" to trigger EM use without prompting during an intraoperative emergency increased from 24% (n=4) to 71% (n=12). Those who reported being "somewhat likely" decreased from 41% to (n=7) to 18% (n=3), while those who reported "neither likely or unlikely" decreased from 18% (n=3) to 12% (n=2). Twelve percent (n=2) of participants reported "somewhat unlikely" and 6% (n=1) reported "extremely unlikely" on the pre-survey, while no participants reported either of these values on the post-survey. Clinical roles of participants who reported "somewhat unlikely" or "extremely unlikely" included a medical assistant (MA), a registered nurse (RN), and a certified registered nurse anesthetist (CRNA). Post-survey responses for the MA and RN changed to report "neither likely, or unlikely", while that of the CRNA changed to report "extremely likely."

Figure 10

Pre-Survey, Question 10

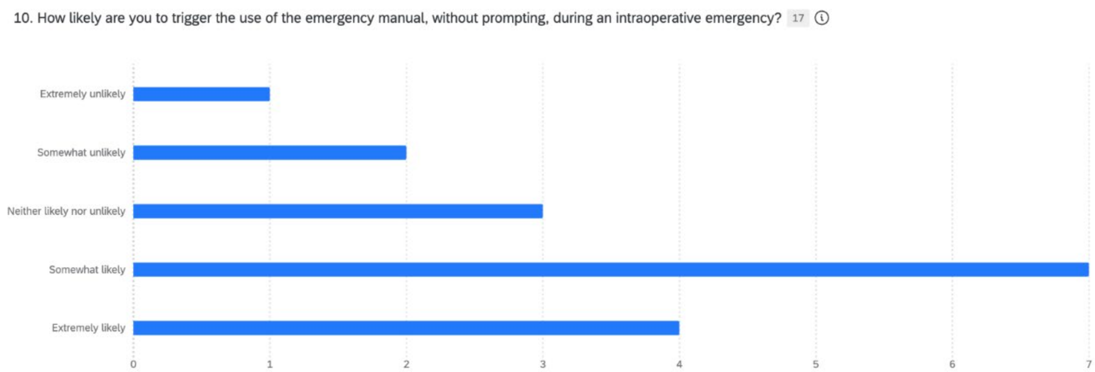
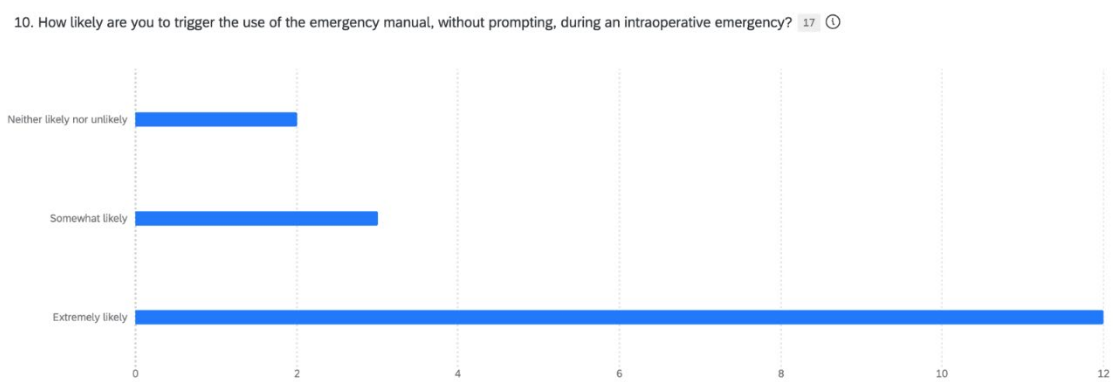


Figure 11

Post-Survey, Question 10



Perceived Importance

Question 7: How important do you believe the utilization of emergency manuals are for improving patient safety during intraoperative emergencies?

Prior to the educational training session, participants expressed a broader range of perceived value of emergency manual utilization for improving patient safety during intraoperative emergencies. Forty-seven percent (n=8) reported them as being “extremely important”, 41% (n=7) reported “very important,” and 6% (n=1) respectively reported "moderately important," and "slightly important." In the post-survey these values shifted to 65% (n=11) reporting emergency manuals are "extremely important" and 35% (n=6) reporting "very important" for improving patient safety during intraoperative emergencies.

Figure 12

Pre-Survey, Question 7

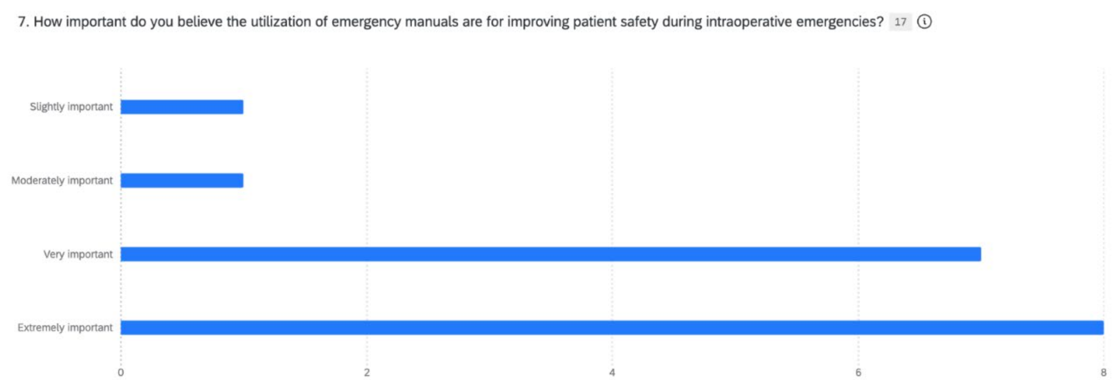
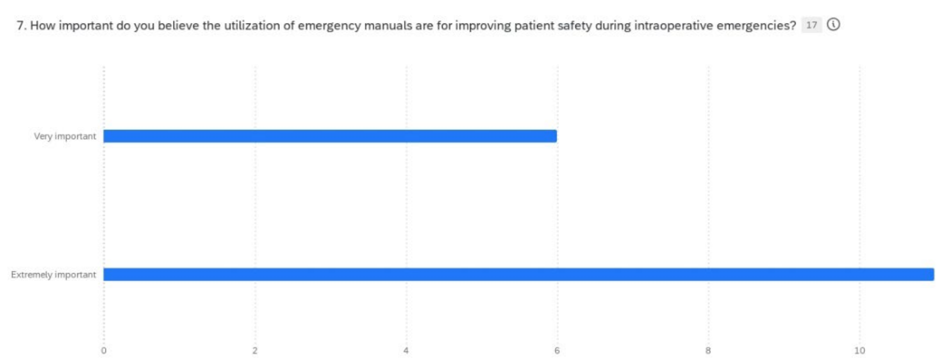


Figure 13

Post-Survey, Question 7



Knowledge Base

Question 8: During an intraoperative emergency, which staff member is in charge of obtaining the emergency manual?

Reported knowledge of role responsibilities related to triggering emergency manual use during intraoperative emergencies differed following the educational training session. In the Pre-survey, 53% (n=9) reported “all of the above” to include the surgeon, anesthesia provider, circulating nurse, scrub nurse and surgical technician. Forty-one percent (n=7) reported the “circulating nurse” and 6% (n=1) reported the “anesthesia provider.” On the post-survey, 100% of participants reported “all of the above” as overseeing obtaining the emergency manual.

Figure 14

Pre-Survey, Question 8

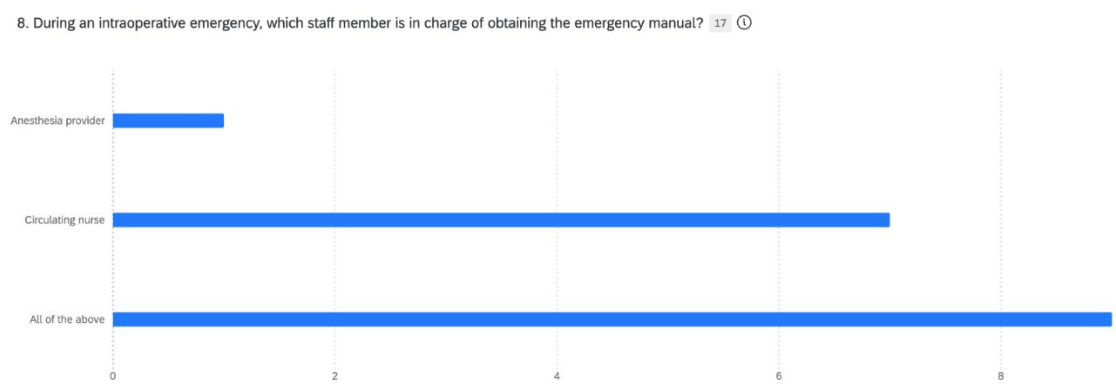
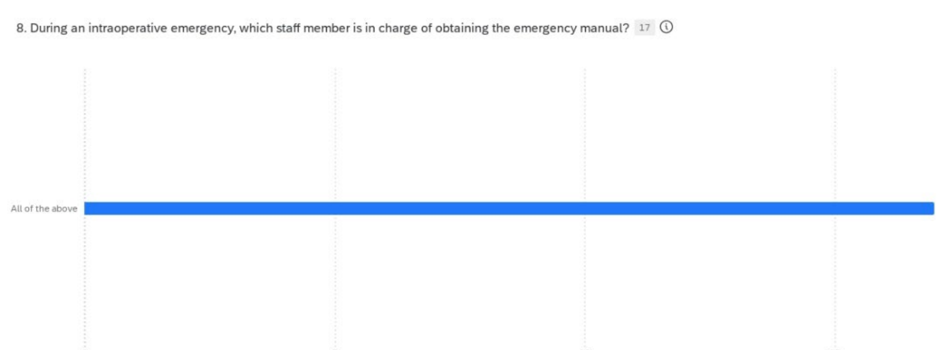


Figure 15

Post-Survey, Question 8



Question 9: During an intraoperative emergency, which staff member can be the emergency manual reader?

Reported knowledge of responsibilities related to assuming the role of emergency manual reader during intraoperative emergencies differed following the educational training session. In the pre-survey, 59% (n=10) reported “all of the above,” 18% (n=3) reported the “circulating nurse,” 12% (n=2) reported the “scrub nurse,” and 12% (n=2) reported the “anesthesia provider. In the post-survey, 94% (n=16) reported “all of the above,” and 6% (n=1), whose clinical role is a certified registered nurse anesthetist (CRNA), reported the “anesthesia provider.”

Figure 16

Pre-Survey, Question 9

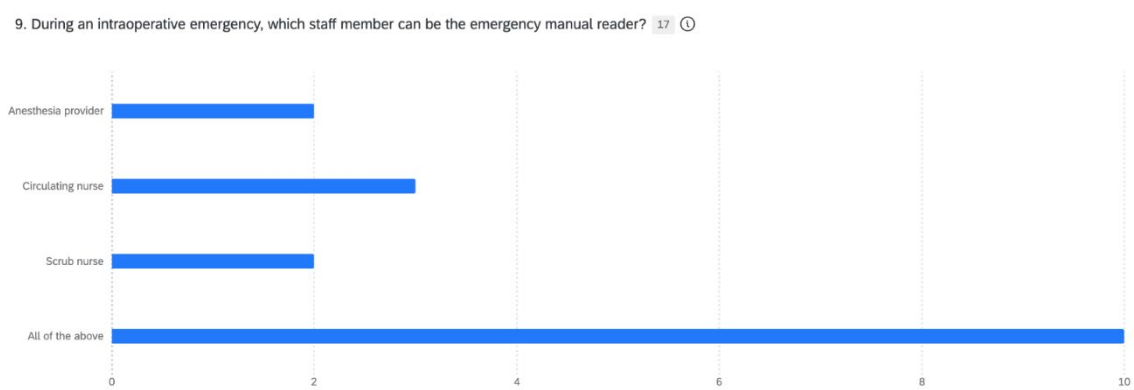
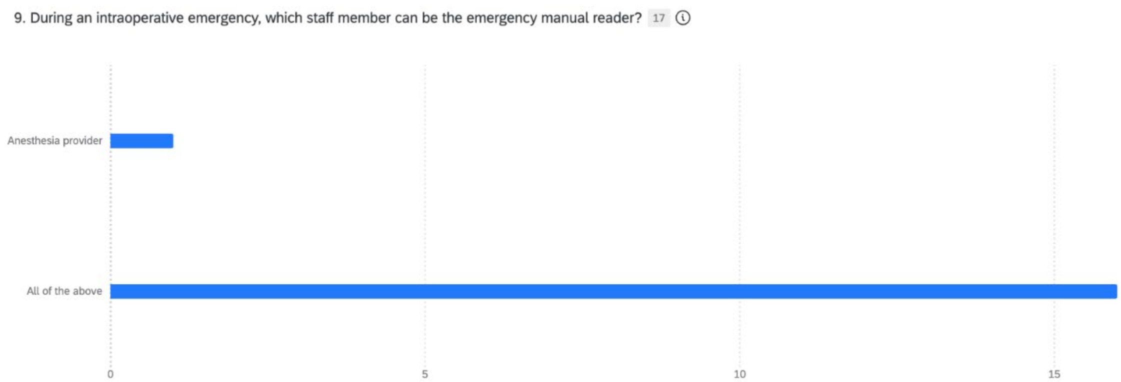


Figure 17

Post-Survey, Question 9



Perceived Confidence

Question 11: How confident are you in navigating the emergency manual during an intraoperative emergency?

In an assessment of perceived confidence related to the navigation of an emergency manual (EM) during a perioperative emergency, participant confidence levels across all clinical roles were improved following the educational training session. In the pre-survey, only 18% of participants reported feeling any level of confidence in navigating EMs during an intraoperative emergency. One participant who is a CRNA reported feeling "extremely confident" while two participants who included an RRNA and an MA reported feeling "very confident." The remaining 82% of participants reported feeling "neither confident nor unconfident" (n=7) "somewhat confident" (n=5) or "not confident" (n=2). On the post-survey, 70% of participants reported feeling "extremely confident" (n=6) or "very confident" (n=6) following the educational training session. Eighteen percent (n=3), all of whom were RNs, reported "neither confident not unconfident" and 12% (n=2), including an RN and an MA, reported "somewhat confident."

Figure 18

Pre-Survey, Question 11

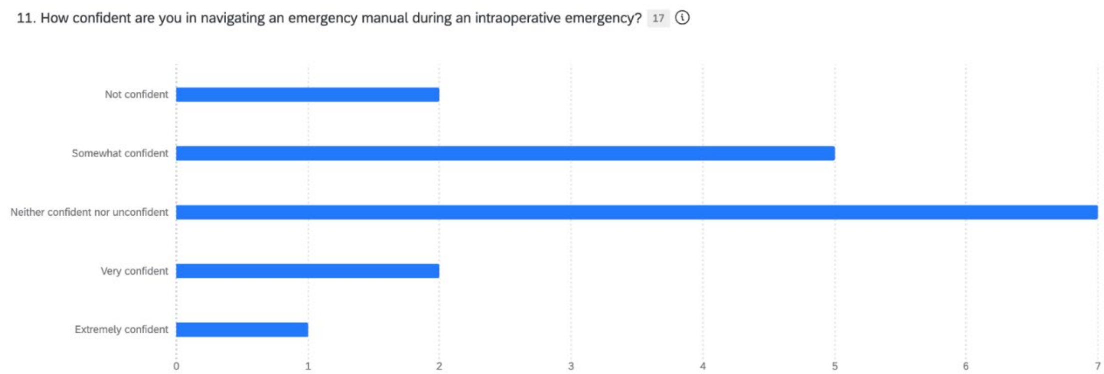
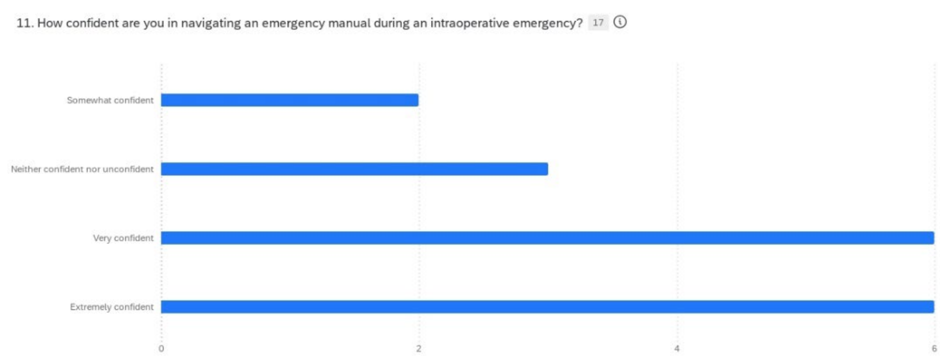


Figure 19

Post-Survey, Question 11



Confidence in Assuming the Role of Reader

Question 12: How confident are you in assuming the role of emergency manual reader during an intraoperative emergency?

Perceived confidence related to assuming the role of emergency manual (EM) reader during an intraoperative emergency also improved across all clinical roles following the educational training session. One participant completed the pre-survey response to this question, but left the post-survey question blank, therefore their results were omitted from this question's analysis for the pre-survey. Pre-survey results showed 38% reporting feeling “extremely confident” (n=3) or “very confident” (n=3) in assuming the role of EM reader. Forty-four percent (n=7), including CRNAs and RNs, reported feeling “neither confident nor unconfident,” 13% (n=2), both RNs reported feeling “somewhat confident” and 6% (n=1), a MA reported feeling “not confident.” post-survey results were more than doubled related to perceived confidence, with 44% (n=7), including all clinical roles, reporting feeling “extremely confident” assuming the role of EM reader and 38% (n=6), including CRNAs and RNs reporting feeling “very confident”. One participant, an RN, reported feeling “neither confident nor unconfident” and two participants (13%), an RN and a MA reported feeling “somewhat confident.”

Figure 20

Pre-Survey, Question 12

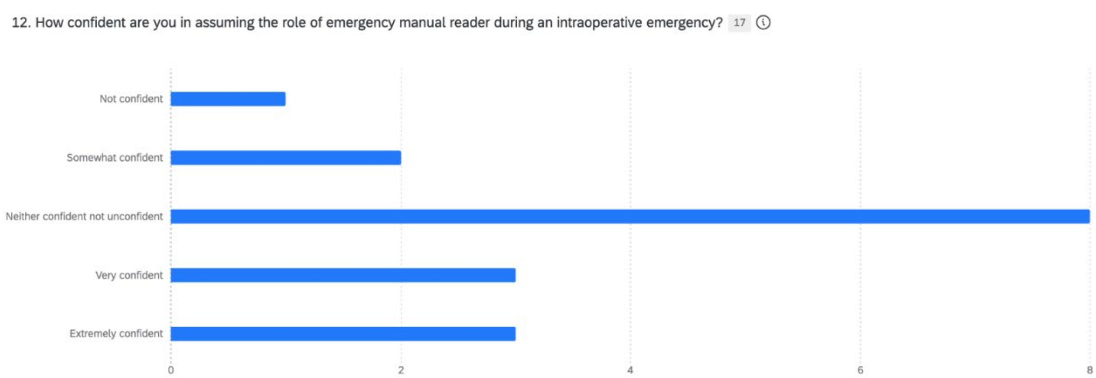
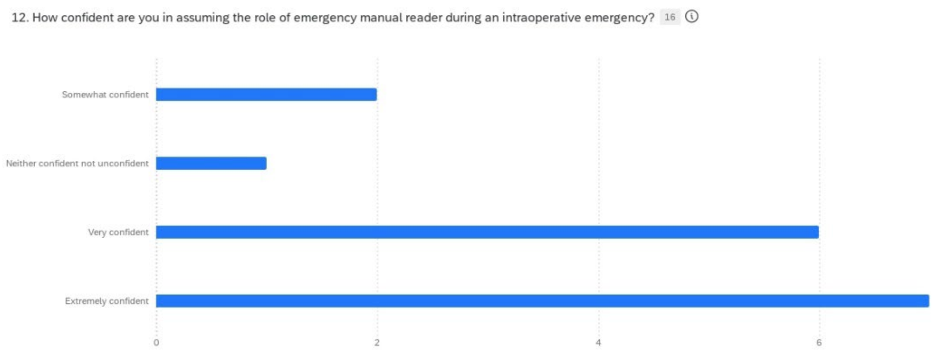


Figure 21

Post-Survey, Question 12



DISCUSSION

Summary

This quality improvement project sought to assess changes in the perceived confidence of multidisciplinary perioperative staff in assuming the role of emergency manual cognitive aid (EMs) reader during an intraoperative emergency following an educational training session. Results following an educational training session, detailing the purpose, navigation, and steps for successful EM implementation and the role of the reader, show that participants all recognize the importance of EMs, but low confidence in their use may prevent their initiation and utilization during intraoperative emergencies. Results suggest that training, such as the one utilized for this project, may help to improve the confidence of select clinicians, reinforce the EM's importance and increase the likelihood that participants will step up to assume the role of EM reader during an intraoperative emergency. The EM reader has been identified as a critical role that promotes successful manual use and is one that greatly improves quality decision-making and the completion of critical tasks according to protocol during an intraoperative emergency. Following the training, the number of participants who reported improvements in confidence assuming the role of reader more than doubled, with increases from six (38%) to 13 (81%) reporting feeling "very confident" or "extremely confident." While the reader plays a key role in triggering EM use and integration into crisis response, the ideal clinician to assume this role has not yet been explicitly identified. A pre-survey baseline knowledge assessment identified that 41% of participants were unaware that any perioperative team member could assume the role of EM reader, compared to 94%, following the educational training session.

Additional improvements were seen related to participant intent to use an EM, with participants reporting "extremely likely" increasing from six (35%) to 12 (71%) to use an EM during an intraoperative emergency if readily available. The likelihood of participants to trigger EM use was also improved, with those reporting "extremely likely" increasing from four (24%) to 12 (71%). Of note, all but one participant reported having experienced an intraoperative emergency in the past, over half (57%) of participants reported having never received formal training on EM use, and only nine (39%) had previously observed the use of an EM for an intraoperative emergency. For many participants, this quality improvement project served as an initial introduction to EM education and use, and improvements related to confidence in assuming the role of the reader and the likelihood of triggering the EM were observed across all participating clinical roles. This suggests a benefit to leveraging multidisciplinary training to improve both familiarity with and confidence in assuming the role of EM reader to support intraoperative crisis response.

Interpretation

Multidisciplinary, multi-step educational training on Emergency Manual (EM) use for perioperative emergencies improves clinician knowledge base, intent to use, and confidence in assuming the role of EM reader. While printing and placing EMs in operating rooms is a necessary first step towards improving accessibility for perioperative staff, the absence of focused training on their navigation and application fails to create a culture of confidence that results in an intent to use when emergencies do arise. The results of this quality improvement project indicate this form of education and training is a valuable tool for achieving the intended objectives.

Implications (Practice, Education, Research and Policy)

This quality improvement project demonstrated that over half of the perioperative staff at Androscoggin Valley Hospital improved their confidence in navigating and utilizing emergency manuals (EMs) following a structured, formalized training process. These findings highlight the critical importance of implementing multi-step, multidisciplinary educational initiatives to enhance staff preparedness for crises. In clinical practice, these outcomes underscore the necessity of fostering a culture of continuous learning and preparedness and due to limited resources and infrequent exposure to high-stakes emergencies, critical access hospitals face unique challenges. The success of this quality improvement project is aligned with current research that supports multi-step, multi-disciplinary educational initiatives and may be adapted to larger healthcare systems. Further education efforts should include hands-on simulation-based training that goes beyond theoretical instruction and permits participants to practice emergency response skills in a controlled environment followed by structured debriefings to reflect on performance. Future research that evaluates the long-term impact of similar training program son staff confidence, retention of knowledge and patient outcomes may be of value, including comparative studies between critical access hospitals and larger institutions that may reflect the scalability and adaptability of these training models. At a policy level, this project underscores the importance of ensuring that emergency response training is multidisciplinary and that all staff are prepared to be confidently involved in emergencies.

Limitations

Limitations of this project include a participation rate of 59%, with 17 of the 29 eligible perioperative staff completing both the pre- and post-surveys. Despite an initial participation rate of 79.3% (n=23), six participants were excluded from the results due to incomplete data, as they completed the pre-survey alone. This reduced sample size limits the robustness of the findings and may introduce response bias as those who completed both surveys may have a greater interest or engagement in the training compared to those who did not complete it. As a result, despite the large effect size, the study may still be underpowered due to the small sample size, limiting the true statistical significance. The small facility size and the unique characteristics of a critical access hospital present challenges to the generalizability of the results to larger healthcare organizations or facilities with different staffing levels or resources. The smaller, tight-knit nature of staff may have facilitated higher levels of engagement which may not be easily replicated in larger, more fragmented care settings. Lastly, the reliance on self-reported confidence measures as the primary outcome introduces the potential for subjective bias and may not directly correlate with actual performance during emergencies. Future studies should incorporate objective measures such as simulation exercises to provide broader data.

DNP Essentials Addressed

The American Association of Colleges of Nursing (AACN) outlines a comprehensive educational framework comprising of curricular elements and competencies that are foundational to the Doctor of Nursing Practice (DNP) degree (AACN, 2006). This quality improvement (QI) project aligns with seven of the eight DNP Essentials, which are integral to the DNP curriculum and critical for preparing graduates to lead in clinical practice and systems improvement.

Essential I: Scientific Underpinnings for Practice

DNP Essential I emphasizes the importance of a robust scientific foundation to translate knowledge into practice, addressing current and emerging healthcare challenges. This QI project leverages evidence-based research to design and implement a multidisciplinary emergency manual (EM) training session aimed at improving perioperative staff confidence in EM utilization during operating room emergencies. A conceptual framework integrating principles of implementation science and quality improvement was adapted to guide this project. Specifically, the Plan-Do-Study-Act (PDSA) cycle, as advocated for by the Institute of Healthcare Improvement (IHI), served as the foundation for the iterative refinement of the intervention.

Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking

DNP Essential II highlights the importance of organizational and systems leadership in driving sustainable practice improvements and promoting patient safety. This QI project exemplifies systems thinking by collaborating with anesthesia leadership to identify a critical gap in current practices: the underutilization of EMs by perioperative staff despite the availability of laminated manuals on site. Addressing this system gap aligns with the principles of quality improvement and fosters a culture of safety within the perioperative setting.

Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

DNP Essential III emphasizes the importance of translating, disseminating, and integrating research knowledge into practice to advance the discipline. A systematic appraisal of evidence-based literature was conducted to synthesize current data on EM usage and the role of the EM reader—an identified gap in existing research. These findings informed the design, implementation, and evaluation of a multidisciplinary educational training session tailored for a critical access hospital. This approach not only addressed a scientific practice gap but also contributed to building a foundation for continued evidence-based improvements in patient safety during operating room emergencies.

Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

DNP Essential IV emphasizes the role of DNP graduates in leveraging information systems and technology to enhance patient care, evaluate outcomes, and lead healthcare transformation. This QI project addressed this Essential through the development of an educational training video incorporating multimodal approaches to reinforce information effectively. Additionally, Qualtrics, a data-collection platform was utilized to administer pre-and post-training surveys. This allowed for real-time collection and analysis of data related to perceived changes in staff confidence and knowledge following the training session. By integrating technology into both education and evaluation processes, this project demonstrated the effective use of patient care technology to drive measurable improvements in practice.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

DNP Essential VI underscores the importance of interprofessional collaboration in addressing the complexities of today's healthcare environment. This QI project embraced the multidisciplinary nature of perioperative emergency response by actively engaging perioperative staff from diverse clinical backgrounds. By fostering teamwork and sharing learning among professionals, the project emphasized the critical role of interprofessional collaboration in improving emergency manual utilization and ultimately, enhancing patient safety.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health

DNP Essential VII emphasizes clinical prevention to promote health and reduce risks for individuals and families while also addressing population health at the community level. This QI project aligns with this Essential by promoting intraoperative risk reduction through the improved use of EMs. By strengthening staff confidence and preparedness, this project directly benefits individuals undergoing surgical procedures at Androscoggin Valley Hospital. As a critical access hospital, these improvements extend beyond individual care to provide broader benefits for the tight-knit community it serves, fostering safer surgical team practices.

Essential VIII: Advanced Nursing Practice

DNP Essential VIII focuses on advancing nursing practice through the refinement of assessment skills and practice based on applying biophysical, psychosocial, behavioral, sociopolitical, cultural, economic, and nursing science within a specialty field. This QI project exemplified advanced nursing practice by developing, implementing, and evaluating a training intervention. By enhancing the preparedness and performance of perioperative staff, this project contributes to improved patient safety outcomes and demonstrates the application of advanced clinical knowledge to address a critical practice need.

Conclusions

Plan for Sustainability

Effective and sustainable use of emergency manuals (EM) in operating room (OR) emergencies has been shown to benefit from structured, multi-step and multidisciplinary training initiatives. While simply printing and placing EMs in ORs improves accessibility, this alone does not support a culture of confidence or ensure consistent utilization during high-stress emergencies. A key challenge for sustainability is the infrequent, yet life-threatening nature of intraoperative emergencies. This issue is particularly pronounced in critical access hospitals, where perioperative staff experience lower case volumes and acuity levels compared to large academic medical centers. However, the rarity of emergencies does not diminish their critical importance making ongoing training essential for preparedness.

Sustainability efforts must prioritize continuous engagement with EM content to reinforce knowledge and build confidence over time. This quality improvement project served as initial exposure to EMs for many participants, highlighting the need for ongoing educational reinforcement. Notably, over half of the participants (57%) reported never having received formal training on EM use and only nine (39%) had previously observed EM use during an intraoperative emergency. The results underscore the value of targeted training: following the educational session, the number of participants reporting that they were “extremely likely” to use an EM during an intraoperative emergency doubled. Additionally, the percentage of participants "extremely likely" to trigger EM use increased dramatically from 25% (n=4) to 71% (n=12). These findings demonstrate the significant impact of formalized training on staff confidence and intent to use EMs.

To ensure long-term sustainability, ongoing training opportunities should be offered at AVH that include simulations, drills, and case-based reviews to maintain familiarity and confidence with hands-on use. For continuity in material engagement, emergency manuals should be integrated into practice through incorporation into all perioperative staff onboarding processes and annual competencies. Staff were receptive to leadership involvement and encouragement of participation in this QI project, therefore operating room and anesthesia leadership should continue to champion EM use. Quarterly crisis simulation exercises should be offered by educational leadership, that engage multidisciplinary perioperative team members in responding to a variety of intraoperative emergencies included in the emergency manuals. This hands-on training should permit perioperative staff members of varied clinical backgrounds to participate as the manual reader and simulation host. To encourage multidisciplinary involvement, each perioperative specialty should be supported in helping to facilitate the simulation, alternating in as hosts when quarterly exercises are scheduled. Lastly, as operating room emergencies are rare, emergency manuals may be overlooked by staff during crisis response, therefore incorporating acknowledgment of its accessibility into pre-operative time-outs needs to be encouraged, and can serve as a collective reminder of its availability.

Plan for Dissemination

The educational content created for this project will remain available to all staff at Androscoggin Valley Hospital for continued emergency management training initiatives for perioperative team members. Communication with leadership in the surgical services department have proposed future content engagement via simulation exercises that provide staff with a multi-step approach to refining their knowledge base. This project will be disseminated via poster presentation at the Arizona Association of Nurse Anesthesiology (AZANA) annual educational meeting in April 2025.

APPENDIX A

SITE APPROVAL/THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD AUTHORIZATION LETTER

NCH north country healthcare | Androscoggin Valley Hospital

April 27, 2024

University of Arizona Institutional Review Board
c/o Office of Human Subjects
1618 E Helen St
Tucson, AZ 85721

To Whom It May Concern:

Please note that Ms. Sarah Boisen, UA Nurse Anesthesiology Doctor of Nursing Practice student, has permission of the Androscoggin Valley Hospital to conduct a quality improvement project at our facility for her project titled, "Improving the Confidence of Perioperative Staff As Emergency Manual Readers During Intraoperative Crisis Management."

Ms. Boisen will conduct an educational session and collect survey data from health care providers at Androscoggin Valley Hospital. She will be recruiting providers through e-mail that will provide a thorough description of the project, what participants will be asked to do, and the time commitment involved. This e-mail will include a link to the online educational session and survey and include participant consent. Ms. Boisen's activities will be completed by 12/01/2024.

Ms. Boisen has agreed to provide me with a copy of the University of Arizona Determination before she recruits participants and will provide me with her aggregate results.

If there are any questions, please contact my office.

Signed,

Luc G. Corriveau DNP, MBA, APRN, CRNA
Chief Nurse Anesthetist
Androscoggin Valley Hospital
59 Page Hill Road
Berlin, NH 03570
603.752.2200
luc.corriveau@northcountryhealth.org

THE UNIVERSITY OF ARIZONA
Research
Innovation & Impact

University of Arizona IRB
845 N Park Ave., Suite 537A
Tucson, AZ 85719
Fax: 520-621-9810
VPR-IRB@arizona.edu

NOT HUMAN RESEARCH

July 11, 2024

Dear Sarah Boisen:

On 7/11/2024, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title:	Improving Perioperative Staff Confidence as Emergency Manual Readers During Operating Room Emergencies
Investigator:	Sarah Boisen
IRB Submission ID:	STUDY00004909
Sponsor:	None
Prime Sponsor:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• Advisor Attestation.pdf, Category: Institutional Approval; • Boisen_DNP Consent_Disclosure.doc, Category: Consent Form; • Boisen_DNP Recruitment E-mail.docx, Category: Recruitment Materials; • Boisen_DNP Site Authorization Letter.pdf, Category: External Site Authorization; • Educational Training, Category: Participant Material; • IRB Protocol for Determination of Human Research v2023-12.docx, Category: IRB Protocol; • Survey Questions, Category: Data Collection Tool;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these

APPENDIX B

CONSENT DOCUMENT (DISCLOSURE AND CONSENT FORM)

Voluntary Disclosure Consent Document

Improving Perioperative Staff Confidence as Emergency Manual Readers During Operating Room Emergencies
Principal Investigator: Sarah Boisen, MSN, RN – DNP Nurse Anesthesiology Candidate, 2025

Instructions—please read carefully.

The purpose of this project is to provide an educational training session for all perioperative staff at Androscoggin Valley Hospital on emergency manual cognitive aids. The goal is to evaluate changes in the knowledge, confidence, and intent to use emergency manuals during operating room emergencies.

Participation in this project should be completed in one sitting—please allot yourself 15 minutes. If you voluntarily choose to participate in this project, you will be asked to:

1. First, complete a brief, 12-question, multiple-choice survey before viewing the educational training video.
2. Second, view a short (<10 minute), pre-recorded educational training video on emergency manual cognitive aids.
3. Third, complete a brief, 12-question, multiple-choice survey after viewing the educational training video.

There are no foreseeable risks associated with participating in this project and you will receive no immediate financial benefit from your participation. Your survey responses are anonymous, non-identifiable, and your name will not be collected or linked to your answers.

If you choose to participate in this project, your participation is voluntary, and refusal will involve no penalty or loss of benefits to which you are otherwise entitled. Participation implies that you agree to have your responses used for this project. You may withdraw at any time from the project. In addition, you may skip any question that you choose not to answer. By participating, you do not give up any personal legal rights you may have as a participant in this project.

For questions, concerns, or complaints about the project, you may contact:

Sarah Boisen, MSN, RN
DNP Nurse Anesthesiology Candidate, 2025
The University of Arizona
Mobile: 907-830-1425
E-mail: boisens@arizona.edu

APPENDIX C

RECRUITMENT MATERIAL (RECRUITMENT FLYER AND EMAIL)

Educational Training Invitation – Recruitment E-mail

Who: All perioperative staff at Androscoggin Valley Hospital
What: A DNP Project Training Session by Sarah Boisen, RRNA - Improving Perioperative Staff Confidence as Emergency Manual Readers During Operating Room Emergencies
Where: A Prerecorded Training Video
When: October 28th-November 11th, 2024

Recruitment E-mail

Hello,

You are invited to participate in a Doctor of Nursing Practice (DNP) project that is investigating perioperative staff confidence in utilizing emergency manual cognitive aids during operating room emergencies.

Project participation involves:

- Viewing a pre-recorded educational training session on emergency manual cognitive aids, how they work, how to navigate them and how to effectively use them during operating room emergencies. There will also be content describing how all perioperative staff members can help support their use to provide safer patient care.
- You will be asked to take a brief, multiple-choice pre- and Post-Survey to assess any changes following the educational video.
- Participants may choose to be entered to win one of two, $20 coffee shop gift cards. Following completion of the steps below, email boisens@arizona.edu to be entered to win.

The steps below should be completed in one sitting and cannot be accessed multiple times—please allot yourself 15 minutes.

To participate, please follow the steps in the order below:

1. First, complete the **pre-training** survey, please follow this link or QR code
    a. https://uarizona.co1.qualtrics.com/jfe/form/SV_51J7N23zbXlW0Fo
    b.

2. Secondly, view the pre-recorded, educational training video, please follow this link: https://1drv.ms/p/s!AlH6A20iKS6qhTVflEmcbpB56p2y
3. Lastly, complete the **post-training** survey, please follow this link or QR code:
    a. https://uarizona.co1.qualtrics.com/jfe/form/SV_5nAscP8RtJyT1Zk
    b.

The project will run from 10/28/2024 to 11/11/2024 and will be open for your participation during this two-week window. As participation is completely voluntary, we are not able to offer any financial compensation, however we would be deeply grateful to have the opportunity to learn from your perspective.

Thank you for your time and consideration,

Sarah E. Boisen, MSN, RN
DNP Nurse Anesthesiology Candidate, 2025
The University of Arizona
Mobile: 907-830-1425
E-mail: boisens@arizona.edu

APPENDIX D

EVALUATION INSTRUMENTS (PRE-TRAINING AND POST-TRAINING SURVEYS)

Pre- and Post-Training Survey

Question 1

1. What is your clinical role?

Question 2

2. For how many years have you worked in the clinical role you currently hold?

- 0-4 years
- 5-9 years
- 10+ years

Question 3

3. Have you ever experienced a patient emergency while working in the operating room?

- Yes
- No

Question 4

4. Have you ever received formal training on the utilization of emergency manual cognitive aids?

- Yes
- No

Page Break

Question 5

5. Have you ever observed an emergency manual cognitive aid being utilized during intraoperative emergency, by any team member?

- Yes
- No

Question 6

6. How likely are you to utilize an emergency manual cognitive aid during an intraoperative emergency, if it is readily available?

- Extremely unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely
- Extremely likely

Question 7

7. How important do you believe the utilization of emergency manuals are for improving patient safety during intraoperative emergencies?

- Not at all important
- Slightly important
- Moderately important
- Very important
- Extremely important

Question 8

8. During an intraoperative emergency, which staff member is in charge of obtaining the emergency manual?

- ○ Surgeon
- ○ Anesthesia provider
- ○ Circulating nurse
- ○ Scrub nurse
- ○ Surgical technician
- ○ All of the above

Question 9

9. During an intraoperative emergency, which staff member can be the emergency manual reader?

- ○ Surgeon
- ○ Anesthesia provider
- ○ Circulating nurse
- ○ Scrub nurse
- ○ Surgical technician
- ○ All of the above

Question 10

10. How likely are you to trigger the use of the emergency manual, without prompting, during an intraoperative emergency?

- ○ Extremely unlikely
- ○ Somewhat unlikely
- ○ Neither likely nor unlikely
- ○ Somewhat likely
- ○ Extremely likely

Question 11

11. How confident are you in *navigating* an emergency manual during an intraoperative emergency?

- ○ Not confident
- ○ Somewhat confident
- ○ Neither confident nor unconfident
- ○ Very confident
- ○ Extremely confident

Question 12

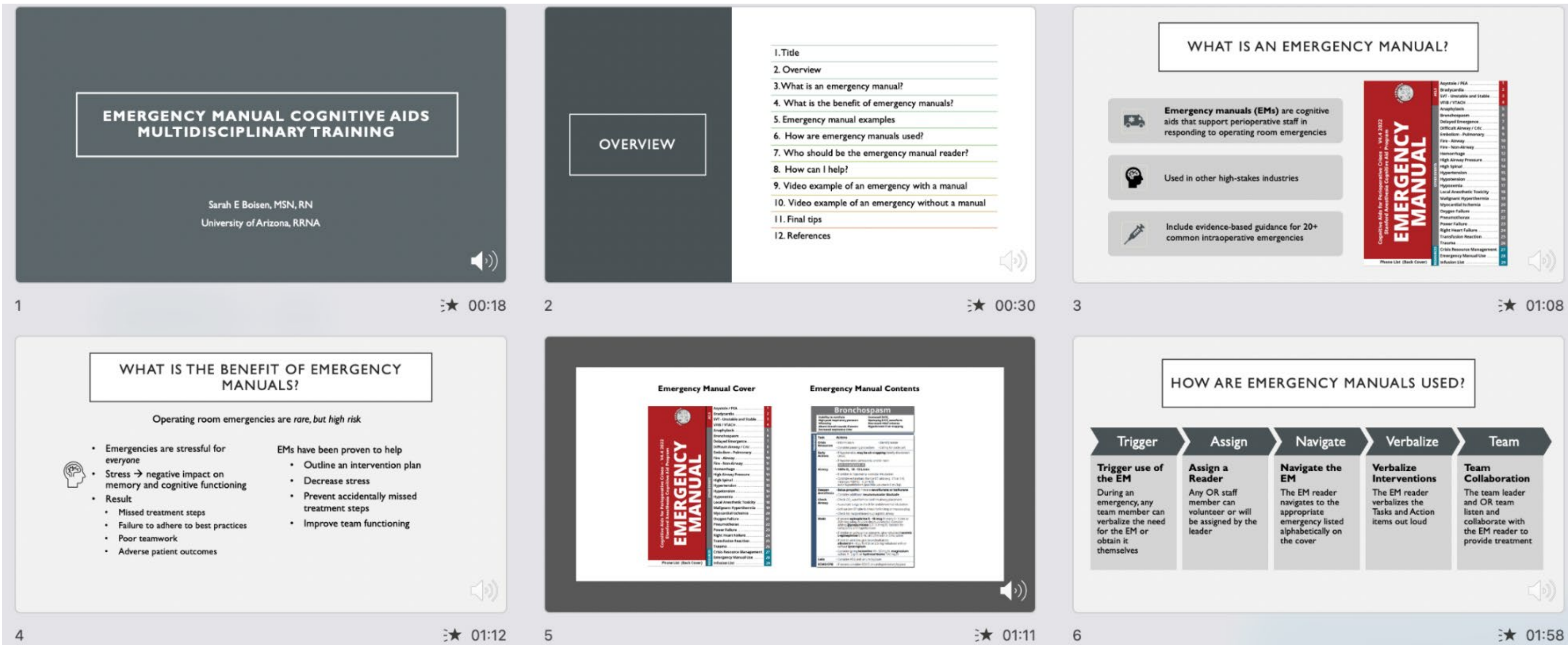
12. How confident are you in assuming the role of emergency manual *reader* during an intraoperative emergency?

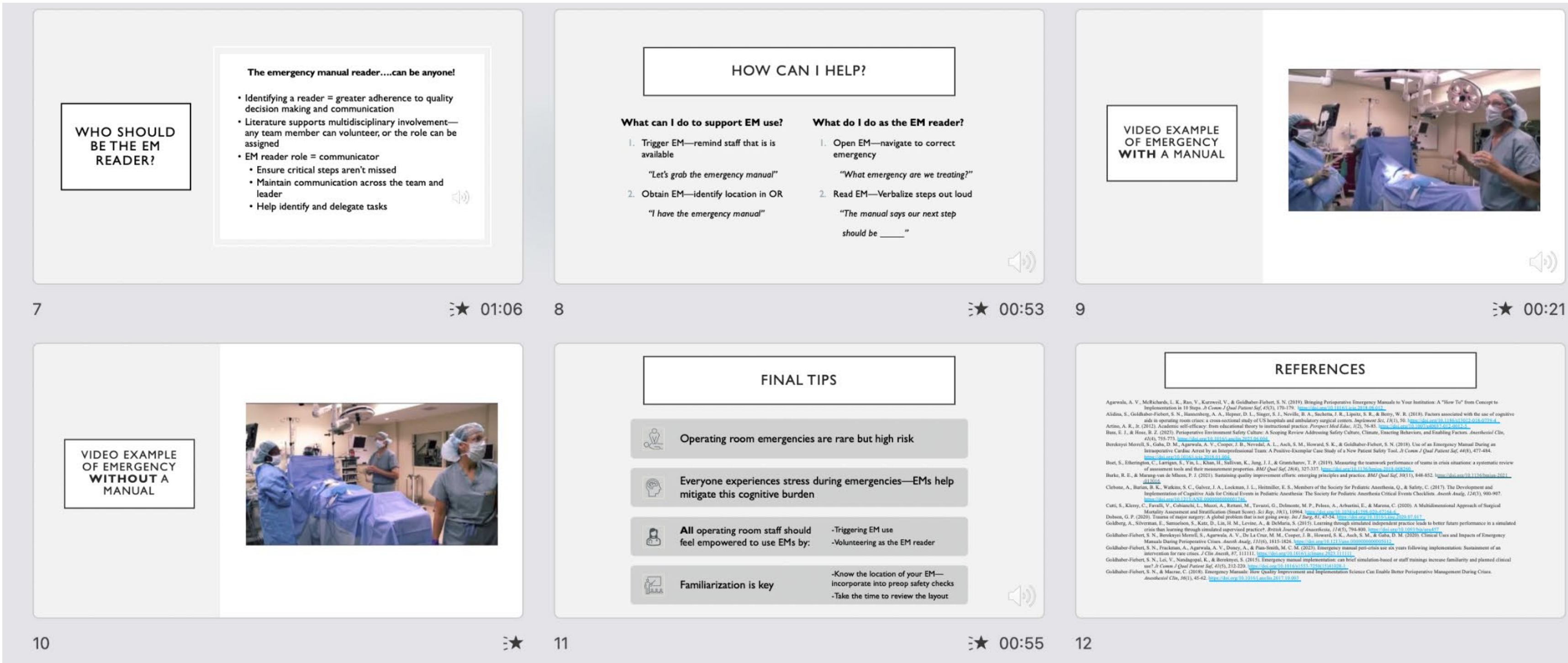
- ○ Not confident
- ○ Somewhat confident
- ○ Neither confident not unconfident
- ○ Very confident
- ○ Extremely confident

APPENDIX E

PARTICIPANT MATERIAL (PRE-RECORDED EDUCATIONAL TRAINING VIDEO)

Pre-recorded Educational Training Video Link: https://1drv.ms/p/s!AlH6A20iKS6qhTVflEmcbpB56p2y




WHO SHOULD BE THE EM READER?
The emergency manual reader….can be anyone!
• Identifying a reader = greater adherence to quality decision making and communication
• Literature supports multidisciplinary involvement—any team member can volunteer, or the role can be assigned
• EM reader role = communicator
• Ensure critical steps aren't missed
• Maintain communication across the team and leader
• Help identify and delegate tasks
7
01:06
HOW CAN I HELP?
What can I do to support EM use?
1. Trigger EM—remind staff that is is available
"Let's grab the emergency manual"
2. Obtain EM—identify location in OR
"I have the emergency manual"
What do I do as the EM reader?
1. Open EM—navigate to correct emergency
"What emergency are we treating?"
2. Read EM—Verbalize steps out loud
"The manual says our next step should be ____"
8
00:53
VIDEO EXAMPLE OF EMERGENCY WITH A MANUAL
9
00:21
VIDEO EXAMPLE OF EMERGENCY WITHOUT A MANUAL
10
FINAL TIPS
Operating room emergencies are rare but high risk
Everyone experiences stress during emergencies—EMs help mitigate this cognitive burden
All operating room staff should feel empowered to use EMs by:
-Triggering EM use
-Volunteering as the EM reader
Familiarization is key
-Know the location of your EM—incorporate into preop safety checks
-Take the time to review the layout
11
00:55
REFERENCES
12

APPENDIX F

PROJECT TIMELINE

Completion Date	Planning	Pre-implementation	Implementation	Evaluation
03/25/2024	Create pre-recorded educational video			
03/27/2024	Create pre-and post-Qualtrics surveys to measure outcomes			
06/17/2024		Defend DNP project proposal to project committee		
07/05/2024		Submit to IRB		
07/11/2024		IRB approval received		
10/28/2024			Project implementation start date, data collection begins	
11/08/2024			Project implementation end date, data collection ends	
12/03/2024				Data analysis completed
01/14/2025				Final paper completed and submitted to committee chair for review
02/27/2025				Oral defense completed with passing score

APPENDIX G

LITERATURE REVIEW GRID

Project Question: For multidisciplinary perioperative staff, will an educational session on emergency manual cognitive aids improve confidence in assuming the role of a reader during an operating room emergency?

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
Agarwala et al., 2019	Bringing perioperative emergency manuals to your institution: A "how to" from concept to implementation in 10 steps	Case report Implementation study	Presents a framework and detailed description of steps a large academic institution followed in successfully implementing the Stanford Emergency Manual Cognitive Aid. This was accomplished in 10 steps across four distinct phases. During the first six months following implementation, a total of 282 clinicians from various specialties reported on EM use with 67% reporting using the manual, 24.1% reporting using it for clinical care and 9.2% reporting using it during a critical event.	This article includes delineated implementation steps that focus on developing an education and training plan to help familiarize staff and create interprofessional engagement in the use of EMs beyond printing and placing in the OR.
Alidina et al., 2018	Factors associated with the use of cognitive aids in operating room crises: a cross-sectional study of US hospitals and ambulatory surgical centers	Cross-sectional study Reports survey data on 368 respondents from US hospitals and ambulatory surgical centers. N=368	Successful implementation of cognitive aids in operating rooms (ORs) was associated with a supportive leadership organizational context ($p<0.0001$) and dedicated time to train staff ($p<0.0189$). Multivariable logistic regression showed that small facility size was associated with a fourfold increase in the odds of the facility reporting a more successful implementation $p=0.0092$). 90% of respondents expressed	A multi-step implementation process that includes dedicated training time and adapts the aid and training to fit the local context is important for sustainability. This lends insights into factors that facilitate the continued use of cognitive aids and notes the specific success seen in smaller facilities.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			interest in wanting to use cognitive aids during OR crisis, regardless of if facilities were currently successful in implementing the tool. Recommendations for sustainability include adapting the cognitive aid and training to fit facility size, building leadership support, making time available for training, enhancing staff willingness to use OR cognitive aids and following a multi-step implementation process.	
Bereknyei Merrell et al., 2018	Use of an emergency manual during intraoperative cardiac arrest by an interprofessional team: A positive-exemplar case study of a new patient safety tool	Qualitative Structured interviews N=6	An EM was used during a cardiac arrest at a tertiary care hospital that had systematically implemented perioperative EMs. Semi-structured interviews with clinicians present during the event reported perceptions of effective team functioning, stress reduction, fostering a calm work environment and improving teamwork and communication.	The surgical resident obtained the EM and read aloud as the "reader," which was reported to enhance participant's shared mental model, help guide focused communication and ensure team members remained on the same page.
Clebone et al., 2017	The development and implementation of cognitive aids for critical events in pediatric anesthesia: The Society for Pediatric Anesthesia	Review of literature	The development and successful implementation of critical event checklists for perioperative use involves content creation, incorporation of human-factors elements and	Checklist use requires consistent training to achieve buy in from participants, identify knowledge gaps and reinforce team roles. Training will include a focus on team interactions and optimizing role delineation.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
	Critical Events Checklists		validation through frequent review and simulation. A key principle of implementation includes exploring the checklist use relative to team interactions, including specifying who is leading and who is reading through training.	
Dobson, 2020	Trauma of major surgery: A global problem that is not going away	Perspective, peer reviewed	Around 40 to 50 million surgeries are performed annually in the United States, with around 310 million globally. An annual global mortality of around 8 million places major surgery as comparable with the leading causes of death. Reducing preventable deaths would save billions of dollars in healthcare costs, especially as studies have found that over 50% of adverse events were potentially preventable, marking a large opportunity to reduce surgical morbidity.	Major focus on the consequences of surgical stress and the potential adverse events that may result. This data supports the need for continued, focused improvement efforts such as emergency manuals that are aimed at reducing surgical deaths that result from preventable adverse effects.
Gallegos et al., 2022	Malignant hyperthermia preparedness training: Using cognitive aids and emergency checklists in the perioperative setting	Evidence-based practice improvement project N=13	Conducting an in-service for multidisciplinary perioperative staff on emergency manual cognitive aid tool use followed by a simulation exercise improved staff perception of use during emergencies. Participants were multidisciplinary and included RNs, CRNAs and	This study presents improvements in the perception of cognitive aid use for multidisciplinary perioperative staff and highlights the value in utilizing continuing education sessions to reinforce application.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			OR technicians all with practice experience ranging from <4 years to >20 years. Seven out of thirteen participants had received prior training on cognitive aid use however improved perception of use increased across all experience levels following an educational session on their use.	
Goldhaber-Fiebert et al., 2023	Emergency manual peri-crisis use six years following implementation: Sustainment of an intervention for rare crises	Prospective, observational study N=75,000 all patients undergoing anesthesia during the entire study period	Questions regarding the use of EMs were presented at close of each anesthetic case and assessed in intervals that included at initial implementation, one-year later and six-years post-implementation. For more than 24,000 cases in a 6-month study period, EMs were used peri-crisis in 145 cases initially, 42 cases one years later and 57 cases six-years post-implementation. Peri-crisis EM use dropped 0.38% from initial to one-year implementation but after that, use did not differ significantly from one-year to six-years post-implementation, showing sustainment.	The sustained use of EMs may be related to cultural acceptance of EMs. However, the potential positive impact of EM use during relevant clinical crisis is substantial. Decreases in EM use is driven by decrease in general use such as teaching and self-review, demonstrating the value for continued, multi-step educational implementation projects.
Goldhaber-Fiebert & Macrae, 2020	Clinical uses and impacts of emergency manuals	Mixed-methods qualitative/quantitative	Emergency manual (EM) use impacted clinician team members by decreasing stress (95%), enabling teamwork	Subthemes identified from this study that warrant further exploration are the expanding adoption of the role of the reader, who was perceived as

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
	during perioperative crisis	Semi-structured interviews N=53 anesthesia providers	(73%), and calming the atmosphere (46%). Impacts on patient care included action improvements such as catching errors of omission (59%) and process improvements (41%). In 8% of crisis EM use was associated with potential distractions.	being helpful and supportive. Results suggest benefits in expanding interprofessional team training to support triggering EM use during intraoperative crisis.
Goldhaber-Fiebert & Macrae, 2018	Emergency manuals: How quality improvement and implementation science can enable better perioperative management during crisis	Review of literature	The Emergency Manuals Implementation Collaborative (EMIC) offers a free central repository for implementation and training resources to help disseminate emergency manuals for use during rare intraoperative events. A conceptual structure for implementing these EMs was presented that delineated key elements that enable effective implementation. These include: 1.) Create: Refine EM content for implementation 2.) Familiarize: Train clinicians on use, including why, when and how to apply it 3.) Use clinically: Ensure accessibility in locations, support team interactions such as triggering use and enabling a "reader" role 4.) Integrate: Embed EM use into local culture and professional practice	Offers comprehensive tools and materials for emergency manual training and optimization that will be used to develop the training session. Further emphasizes the importance of optimal clinical application that supports team interactions and establishing the role of "reader" to trigger use.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
Goldhaber-Fiebert et al., 2016	Emergency manual uses during actual critical events and changes in safety culture from the perspective of anesthesia residents: A pilot study	Retrospective study Pilot study Mixed-methods qualitative/quantitative survey N=19	Surveys with quantitative and qualitative data were used to assess clinical adoption of EMs in the OR. Post-implementation, of respondents, 45% had used an EM during a critical event and of all respondents who had used an EM, 100% reported that "EMs in operating rooms improves patient care". Post-implementation, 69% of respondents also answered that an EM would be helpful "during an event, once there were enough people that someone could be reading it out loud for the team," indicating the perceived value in a reader role. Immersive simulations and self-review of EMs were identified as facilitators that most positively influenced EM use while barriers were attributed to remembering to trigger use, limited time, and cultural acceptance.	Integrating an EM reader into event management was perceived as a potential facilitator in EM use during critical events. Focusing on this role may also help mitigate a perceived barrier of remembering to trigger EM use.
Goldhaber-Fiebert et al., 2015	Emergency manual implementation: Can brief simulation-based OR staff trainings increase familiarity and planned clinical use?	Implementation study N= 126 staff members	Nine 50-minute training sessions were held with OR staff to include OR nurses and surgical technologist on why and how to use EMs, familiarization with their format, simulated scenarios of critical events and	Facilitating team-based clinical management during rare critical events can be enhanced by training a high percentage of OR staff and can result in a positive shift in organizational culture. Team leaders can be task and attention saturated during fast-paced critical events and

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			debriefings. A retrospective pre-post survey found that all staff reported increases in awareness of the EM (p<.01), familiarity (p<.01), willingness to use for educational review (p<.01) and intention to use during critical events (p<.01). Implementing institutions should not only place EMs in accessible places but incorporate training mechanisms to increase clinician's familiarity, acceptable and planned clinical use.	training a subset of OR staff as effective EM readers was found to have a positive impact on familiarity and triggering effective clinical use.
Grieg et al., 2023	Cognitive aids in the management of clinical emergencies: A systematic review	Systematic review of literature N=13 RCTs	Systematic review evaluating the usefulness of cognitive aids in clinical emergencies with a primary outcome of completeness of care delivered to the patient. Cognitive aids were associated with a reduction in incidence of missed steps from 43.3% to 11% (RR (96% CI) 0.29 (0.15-0.16; p<0.001). The use of cognitive aids was related to a decrease in the incidence of errors, increases in the rate of correctly performed steps, improvements in clinical teamwork skill scores, non-technical skill scores,	It is important that cognitive aids be tested before deployment with appropriate training in their use to avoid a potential additional burden necessitating a shift in focus of attention. This supports the value in establishing an alternative staff member as an EM reader to help alleviate the potential to slow teams down.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			subjective conflict resolution scores and global assessment of team performance. Challenges found are that cognitive aids may have the potential to slow teams down by adding an additional focus of attention.	
Hardy et al., 2017	The use of a checklist improves anaesthesiologists' technical and non-technical performance for simulated malignant hyperthermia management	Randomized controlled trial High fidelity simulation N= 24	Anesthesiologist were allocated to a checklist and a control group and their technical performance and non-technical performance were assessed during a simulated intra-operative crisis. Anesthesiologists in the checklist group had higher technical performance scores, and non-technical skills scores, faster time to critical intervention and greater adherence to guidelines than the control group. The introduction of a designated reader proved beneficial to team performance and communication during simulation. Despite availability of the checklist only 75% of participants were aware of its existence it was noted that checklist usability warranted improvements.	Deficits in usability and knowledge of availability demonstrate a need for increased awareness and training on EM use to improve successful integration into clinical practice. A reader was identified as a facilitator for improved team performance and communication.
Huang et al., 2020	Use of an emergency manual during an intraoperative	Case report	During an intraoperative crisis, the Stanford Emergency Manual Cognitive	Repeat simulation training and drills permits prompt action by teams during intraoperative crisis. Case

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
	pulmonary arterial rupture, hypoxemia and bradycardia		Aid was immediately activated and use during emergency response facilitated a smooth, successful team-based response. Regular training on emergency manual use was accomplished through trainings, drills and simulation, utilizing different team members to assume different roles.	reports provide evidence that EMs are effective, especially if familiarity with the manual content, roles, and optimal communication are reinforced.
Huang et al., 2019	Best location and reader role in usage of emergency manuals during critical events: Experienced emergency manual users' opinion	Quantitative survey N=114 anesthesia providers at seven hospitals	Of participants, 47.7% reporting reviewing the EM at least once in the last year and 90% used an EM during a critical event in the last year with anaphylaxis (16.3%), hemorrhage (13%), cardiac arrest (12%) and bronchospasm (12%) as the most common event types. The EM reader during critical events was either a senior physician (57.8%), junior physician (23.6%), CRNA (11.4%) or OR nurse (7%). Careful assignment of the reader role to a team member who is also a leader was noted as being critical due to the impact on the process of positive EM usage and consequences of negative use.	This study found a range of individuals assumed the role of reader and noted that the role may be best suited to an individual in an existing leadership role. As a result, role experience may be a factor in supporting EM use in the absence of continued training.
Koers et al., 2019	Effect of cognitive aids on adherence to	Randomized clinical trial	The trial tested the effectiveness of cognitive aids	Cognitive aids improve adherence to best practice in the management of

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
	best practice in the treatment of deteriorating surgical patients a randomized clinical trial in a simulation setting	High fidelity simulation N=150 case simulations	on adherence to best practice in the management of deteriorating surgical patients during high-fidelity simulation. Fifty surgical teams were randomized to using a cognitive aid or control group in a simulated surgical deterioration. Cognitive aid use resulted in a reduction of omitted critical management steps from 33% to 10% which is a 70% improvement (P<.001) and overall usability of the cognitive aids was scored at a median of 8.7/10.	postoperative complications, including failure to rescue emphasizing that their application has broad use in managing surgery-related complications.
Sanchez et al., 2020	Use of emergency manuals to treat intraoperative supraventricular tachycardia and hypotension during exploratory laparotomy	Case report	The Stanford Emergency Manual was activated to guide treatment of intraoperative supraventricular tachycardia with narrow, irregular QRS complexes and refractory hypotension and permitted rapid selection of the appropriate pharmacologic agent. This permitted prompt, efficient response by the perioperative team during intraoperative crisis.	Care reports lend valuable evidence that support the benefits of ensuring the availability of and training on EMs to improve patient safety during intraoperative crisis.
Saravana-Bawan et al., 2019	Evaluating best methods for crisis resource management education	Randomized simulated trial	Multidisciplinary preclinical students were split into two groups and taught crisis resource management (CRM) either through traditional lecture or low-fidelity	This study highlights the need for continuing education and opportunities to practice skills to improve retention. It further emphasizes the value of varied approaches to reinforcing training.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			simulation consisting of non-contextual active learning. Noncontextual active learning of CRM using low-fidelity simulation results in improved performance compared with didactic teaching, however they did not appear to be sustained after one educational session.	
Saxena et al., 2019	Anaesthesia-specific checklists: A systematic review of impact	Systematic review N=25	Most (92%) studies showed that checklist use in anesthesia can decrease human error, improve patient safety and teamwork and increase quality of care. All studies supported an improvement in performance associated with checklist use. The use of checklists in anaesthesia, whether in routine or emergency situations, has the potential to improve anaesthesia process and may decrease perioperative morbidity and mortality.	Checklists hold value in helping increase the quality of care delivered by teams to help improve patient outcomes. Lack of team training and poor integration into existing workflows can act as barriers, further supporting the value in continuing training.
Sellman et al., 2022	Simulation-based randomized trial of medical emergency cognitive aids	Prospective, randomized, single-blind study N=240 simulated emergencies	Eighty teams with 520 total participants were randomly assigned to manage a simulated medical emergency with or without a cognitive aid, with the primary outcome as risk reduction of essential working steps. Cognitive aids led to 9% absolute and 15%	Cognitive aids could be used as teaching aids to avoid potentially fatal misinterpretations in an emergency. Future implementation recommendations suggest prioritizing selecting the correct cognitive aid for a specific critical incident.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
			relative risk reduction and were judged as being helpful by 94% of the participants. Teams performed significantly better when cognitive aids were available ($p<0.05$) for successful completion of critical steps. Stress reduction when using the EM was more likely in medical than perioperative subspecialties.	
Simmons & Huang, 2019	Operating room emergency manuals improve patient safety: A systematic review	Systematic review	Adhering to lifesaving processes of care is 4-6 times higher with EM use compared to without EM use. Skills learned in simulation training can additionally transfer to clinical settings and lead to improved patient outcomes. When a dedicated EM "reader" is integrated as part of the care team, quality decision making and the number of performed tasks completed with adherence to proper protocol was almost doubled.	Emergency manuals help teams adhere to best practices to improve patient outcomes and integrating a dedicated "reader" serves to further enhance their capabilities.
Urman et al., 2020	The effect of emergency manuals on team performance during two different simulated perioperative crises: A prospective,	Prospective randomized controlled trial N=304	Main findings identified that whether an EM was available or not had little effect on performance scores in simulated emergencies. Use of EMs when available was generally positive, however many teams struggled to	Areas for future investigation propose studies of how EM readers should best engage with navigating and applying the EM.

Pub. Year; Author's Last Name	Title of Publication	Type of Study	Main Outcomes of Findings	Support for and or Link to Project
	randomized controlled trial		integrated it into patient care process meaningfully. Pitfalls found were related to fixation on an incorrect diagnosis or treatment, EM overuse for competing diagnosis and the failure to designate a reader. If a reader is not designated, the EM may be passed around as a 'hot potato' and its contents never presented. If task assignment and role clarity are not maintained the EM can take a critical team member out of commission. Or, if the reader cannot be heard or fails to engage with the team the EM becomes less effective.	

REFERENCES

Agarwala, A. V., McRichards, L. K., Rao, V., Kurzweil, V., & Goldhaber-Fiebert, S. N. (2019). Bringing perioperative emergency manuals to your institution: A "how to" from concept to implementation in 10 steps. *Jt Comm J Qual Patient Saf*, *45*(3), 170-179. https://doi.org/10.1016/j.jcjq.2018.08.012

Alidina, S., Goldhaber-Fiebert, S. N., Hannenberg, A. A., Hepner, D. L., Singer, S. J., Neville, B. A., Sachetta, J. R., Lipsitz, S. R., & Berry, W. R. (2018). Factors associated with the use of cognitive aids in operating room crises: A cross-sectional study of US hospitals and ambulatory surgical centers. *Implement Sci*, *13*(1), 50. https://doi.org/10.1186/s13012-018-0739-4

Artino, A. R., Jr. (2012). Academic self-efficacy: From educational theory to instructional practice. *Perspect Med Educ*, *1*(2), 76-85. https://doi.org/10.1007/s40037-012-0012-5

Bass, E. J., & Hose, B. Z. (2023). Perioperative environment safety culture: A scoping review addressing safety culture, climate, enacting behaviors, and enabling factors. *Anesthesiol Clin*, *41*(4), 755-773. https://doi.org/10.1016/j.anclin.2023.06.004

Bereknyei Merrell, S., Gaba, D. M., Agarwala, A. V., Cooper, J. B., Nevedal, A. L., Asch, S. M., Howard, S. K., & Goldhaber-Fiebert, S. N. (2018). Use of an emergency manual during an intraoperative cardiac arrest by an interprofessional team: A positive-exemplar case study of a new patient safety tool. *Jt Comm J Qual Patient Saf*, *44*(8), 477-484. https://doi.org/10.1016/j.jcjq.2018.01.004

Boet, S., Etherington, C., Larrigan, S., Yin, L., Khan, H., Sullivan, K., Jung, J. J., & Grantcharov, T. P. (2019). Measuring the teamwork performance of teams in crisis situations: A systematic review of assessment tools and their measurement properties. *BMJ Qual Saf*, *28*(4), 327-337. https://doi.org/10.1136/bmjqs-2018-008260

Burke, R. E., & Marang-van de Mheen, P. J. (2021). Sustaining quality improvement efforts: Emerging principles and practice. *BMJ Qual Saf*, *30*(11), 848-852. https://doi.org/10.1136/bmjqs-2021-013016

Clebone, A., Burian, B. K., Watkins, S. C., Galvez, J. A., Lockman, J. L., Heitmiller, E. S., Members of the Society for Pediatric Anesthesia, Q., & Safety, C. (2017). The development and implementation of cognitive aids for critical events in pediatric anesthesia: The Society for Pediatric Anesthesia Critical Events Checklists. *Anesth Analg*, *124*(3), 900-907. https://doi.org/10.1213/ANE.0000000000001746

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. Elsevier Science & Technology. http://ebookcentral.proquest.com/lib/uaz/detail.action?docID=1882849

Cutti, S., Klersy, C., Favalli, V., Cobianchi, L., Muzzi, A., Rettani, M., Tavazzi, G., Delmonte, M. P., Peloso, A., Arbustini, E., & Marena, C. (2020). A multidimensional approach of surgical mortality assessment and stratification (Smatt Score). *Sci Rep*, *10*(1), 10964. https://doi.org/10.1038/s41598-020-67164-6

Dobson, G. P. (2020). Trauma of major surgery: A global problem that is not going away. *Int J Surg*, *81*, 47-54. https://doi.org/10.1016/j.ijsu.2020.07.017

Goldberg, A., Silverman, E., Samuelson, S., Katz, D., Lin, H. M., Levine, A., & DeMaria, S. (2015). Learning through simulated independent practice leads to better future performance in a simulated crisis than learning through simulated supervised practice. *British Journal of Anaesthesia*, *114*(5), 794-800. https://doi.org/10.1093/bja/aeu457

Goldhaber-Fiebert, S. N., Bereknyei Merrell, S., Agarwala, A. V., De La Cruz, M. M., Cooper, J. B., Howard, S. K., Asch, S. M., & Gaba, D. M. (2020). Clinical uses and impacts of emergency manuals during perioperative crises. *Anesth Analg*, *131*(6), 1815-1826. https://doi.org/10.1213/ane.0000000000005012

Goldhaber-Fiebert, S. N., Frackman, A., Agarwala, A. V., Doney, A., & Pian-Smith, M. C. M. (2023). Emergency manual peri-crisis use six years following implementation: Sustainment of an intervention for rare crises. *J Clin Anesth*, *87*, 111111. https://doi.org/10.1016/j.jclinane.2023.111111

Goldhaber-Fiebert, S. N., Lei, V., Nandagopal, K., & Bereknyei, S. (2015). Emergency manual implementation: can brief simulation-based or staff trainings increase familiarity and planned clinical use? *Jt Comm J Qual Patient Saf*, *41*(5), 212-220. https://doi.org/10.1016/s1553-7250(15)41028-1

Goldhaber-Fiebert, S. N., & Macrae, C. (2018). Emergency manuals: How quality improvement and implementation science can enable better perioperative management during crises. *Anesthesiol Clin*, *36*(1), 45-62. https://doi.org/10.1016/j.anclin.2017.10.003

Goldhaber-Fiebert, S. N., Pollock, J., Howard, S. K., & Bereknyei Merrell, S. (2016). Emergency manual uses during actual critical events and changes in safety culture from the perspective of anesthesia residents: A pilot study. *Anesth Analg*, *123*(3), 641-649. https://doi.org/10.1213/ane.0000000000001445

Greig, P. R., Zolger, D., Onwochei, D. N., Thurley, N., Higham, H., & Desai, N. (2023). Cognitive aids in the management of clinical emergencies: A systematic review. *Anaesthesia*, *78*(3), 343-355. https://doi.org/10.1111/anae.15939

Groombridge, C. J., Kim, Y., Maini, A., Smit, V., & Fitzgerald, M. C. (2019). Stress and decision-making in resuscitation: A systematic review. *Resuscitation*, *144*, 115-122. https://doi.org/10.1016/j.resuscitation.2019.09.023

Haddad, L. M., & Geiger, R. A. (2024). Nursing ethical considerations. In *StatPearls*. https://www.ncbi.nlm.nih.gov/pubmed/30252310

Hardy, J. B., Gouin, A., Damm, C., Compère, V., Veber, B., & Dureuil, B. (2018). The use of a checklist improves anaesthesiologists' technical and non-technical performance for simulated malignant hyperthermia management. *Anaesth Crit Care Pain Med*, *37*(1), 17-23. https://doi.org/10.1016/j.accpm.2017.07.009

Hepner, D. L., Arriaga, A. F., Cooper, J. B., Goldhaber-Fiebert, S. N., Gaba, D. M., Berry, W. R., Boorman, D. J., & Bader, A. M. (2017). Operating room crisis checklists and emergency manuals. *Anesthesiology*, *127*(2), 384-392. https://doi.org/10.1097/aln.0000000000001731

Hopper, W., Zeller, R., Burke, R., & Lindsey, T. (2022). The association between operating margin and surgical diversity at critical access hospitals. *Journal of Osteopathic Medicine*, *122*(7). https://doi.org/doi.org/10.1515/jom-2022-0028

Hoskins, N. N., Cunicelli, M. A., Hopper, W., Zeller, R., Cheng, N., & Lindsey, T. (2021). The value surgical services bring to critical access hospitals. *Cureus*, *13*(4), e14367. https://doi.org/10.7759/cureus.14367

Huang, J., Huang, X., Guan, Y., Wang, X., & Mishra, S. (2020). Use of an emergency manual during an intraoperative pulmonary arterial rupture, hypoxemia, and bradycardia. *Cureus*, *12*(2), e6838. https://doi.org/10.7759/cureus.6838

Huang, J., Sanchez, K., Wu, J., & Suprun, A. (2019). Best location and reader role in usage of emergency manuals during critical events: Experienced emergency manual users' opinion. *Cureus*. https://doi.org/10.7759/cureus.4505

Koers, L., van Haperen, M., Meijer, C. G. F., van Wandelen, S. B. E., Waller, E., Dongelmans, D., Boermeester, M. A., Hermanides, J., & Preckel, B. (2020). Effect of cognitive aids on adherence to best practice in the treatment of deteriorating surgical patients: A randomized clinical trial in a simulation setting. *JAMA Surg*, *155*(1), e194704. https://doi.org/10.1001/jamasurg.2019.4704

Leeman, J., Rohweder, C., Lee, M., Brenner, A., Dwyer, A., Ko, L. K., O'Leary, M. C., Ryan, G., Vu, T., & Ramanadhan, S. (2021). Aligning implementation science with improvement practice: A call to action. *Implement Sci Commun*, *2*(1), 99. https://doi.org/10.1186/s43058-021-00201-1

Mullen, M. G., Michaels, A. D., & Mehaffey, J. H. (2017). Risk associated with complications and mortality after urgent surgery vs elective and emergency surgery implications for defining "quality" and reporting outcomes for urgent surgery. *JAMA Surgery*, *152*(8), 768-774. https://doi.org/10.1001/jamasurg.2017.0918

Saravana-Bawan, B. B., Fulton, C., Riley, B., Katulka, J., King, S., Paton-Gay, D., & Widder, S. (2019). Evaluating best methods for crisis resource management education: Didactic teaching or noncontextual active learning. *Simul Healthc*, *14*(6), 366-371. https://doi.org/10.1097/sih.0000000000000388

Saxena, S., Krombach, J. W., Nahrwold, D. A., & Pirracchio, R. (2020). Anaesthesia-specific checklists: A systematic review of impact. *Anaesth Crit Care Pain Med*, *39*(1), 65-73. https://doi.org/10.1016/j.accpm.2019.07.011

Schild, S., Sedlmayr, B., Schumacher, A. K., Sedlmayr, M., Prokosch, H. U., & St Pierre, M. (2019). A digital cognitive aid for anesthesia to support intraoperative crisis management: Results of the user-centered design process. *JMIR Mhealth Uhealth*, *7*(4), e13226. https://doi.org/10.2196/13226

Schunk, D. H., & DiBenedetto, M. K. (2021). Chapter four - Self-efficacy and human motivation. In A. J. Elliot (Ed.), *Advances in motivation science* (Vol. 8, pp. 153-179). Elsevier. https://doi.org/https://doi.org/10.1016/bs.adms.2020.10.001

Sellmann, T., Alchab, S., Wetzchewald, D., Meyer, J., Rassaf, T., Thal, S. C., Burisch, C., Marsch, S., & Breuckmann, F. (2022). Simulation-based randomized trial of medical emergency cognitive aids. *Scand J Trauma Resusc Emerg Med*, *30*(1), 45. https://doi.org/10.1186/s13049-022-01028-y

Simmons, W. R., & Huang, J. (2019). Operating room emergency manuals improve patient safety: A systemic review. *Cureus*, *11*(6), e4888. https://doi.org/10.7759/cureus.4888

Urman, R. D., August, D. A., Chung, S., Jiddou, A. H., Buckley, C., Fields, K. G., Morrison, J. B., Palaganas, J. C., & Raemer, D. (2021). The effect of emergency manuals on team performance during two different simulated perioperative crises: A prospective, randomized controlled trial. *J Clin Anesth*, *68*, 110080. https://doi.org/10.1016/j.jclinane.2020.110080