Preventing Surgical Fires During High Risk Surgeries: A CRNA Quality Improvement Project

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Notes from the Author

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Abstract

Although uncommon, operating room fires may occur during surgical procedures, especially high-risk procedures above the xiphoid process, and place patients at risk for preventable injuries and death. The fire triad, also referred to as the fire triangle, contains three elements – fuel, ignition, and oxygen source. Of those, Certified Registered Nurse Anesthetists (CRNAs) play a key role in controlling the oxygen source. The purpose of this Doctor of Nursing Practice project was to develop, implement, and evaluate the perceived adequacy of a perioperative fire prevention guide made specifically for CRNAs and designed to improve fire prevention practices in a medical facility located in southeastern North Carolina. Five CRNA participants were given the tool in an electronic format, as well as an informational video with instructions, to utilize in clinical practice for two weeks. Analysis of pre- and post-assessment questionnaire responses indicated an improvement in participants' confidence and on knowledge regarding perioperative fire prevention, improvement on overall confidence in their ability to identify high-risk procedures, and that the majority felt an easily accessible guide would provide support in decision making.

Keywords: CRNAs, surgical, fire, prevention, guide

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Section I. Introduction

Background

Fires occurring during surgical procedures, either within the surgical field or adjacent areas, can result in injury to patients, especially if on the skin, trachea, and respiratory tract (Fisher, 2015; Kezze et al., 2018). Patients undergoing a surgical procedure above the xiphoid process are at increased risk, especially when there is an oxygen source (Fisher, 2015; Tola et al., 2018). The fire triad, also referred to as the fire triangle, consists of a fuel, ignition, and oxygen source, which all must be present for a fire to occur during surgery (Putnam, 2015; Tola et al., 2018). Extra precautions should be taken to limit the fire risk for those undergoing a high-risk surgical procedure, which first must be done by examining the individual components of the fire triad on a case by case basis.

Of the three components encompassed by the fire triangle, Certified Registered Nurse Anesthetists (CRNAs) have the most control over the oxygen source. Surgical fires frequently occur when there is an increase in oxygen concentration at the surgical site or near the patients' airway, as oxygen increases the flammability and the rate at which injury occurs (Jones et al., 2019). Putnam (2015) noted that fires occur more readily in an oxygen enriched environment than one that only contains room air. This is particularly important to consider in surgeries involving the lungs, as there is a high probability of having an oxygen rich environment during those procedures. Jones et al. (2019) noted multiple interventions CRNAs can implement to decrease the chance of a surgical fire occurring during lung surgeries. The primary suggestions are to "minimize or discontinue (when appropriate) oxygen one minute prior to energy device use" and "utilize cuffed ETT [endotracheal tube] for airway surgery" (p. 493). Both suggestions are further supported by Kezze et al. (2018). In addition, CRNAs should reduce the fraction of

inspired oxygen (FiO2) to the lowest concentration possible, preferably keeping the oxygen concentration at less than 30% to reduce the risk of surgical fires (Kezze et al., 2018; Jones et al., 2019).

Although the oxygen source is where CRNAs contribute most to surgical fires, regard for the ignition and fuel sources is equally important. Surgeons control the electrosurgery units, such as the Bovie, which are leading ignition sources common to surgical fires (Jones et al., 2019; Putnam, 2015). CRNAs have an obligation to their patients to notify the surgeon when this equipment is being used inappropriately. Furthermore, in regard to the fuel source, alcohol skin preps require adequate time to dry, specifically at least three minutes, to decrease the fire risk potential (Kezze et al., 2018; Jones et al., 2019). All of these specific recommendations within the fire triad components can serve as educational starting pieces for development of a quality improvement (QI) tool for CRNAs that focuses on recommended considerations to keep in mind during high risk surgeries.

Healthy People 2030, the fifth iteration of the initiative developed by the Department of Health and Human Services, includes new and improved objectives on a variety of topics (Healthy People 2030, n.d.). From the core objectives, the goal of improving health care was directly addressed by this QI project, as the overarching aim of this project was to improve health care practices in the operating room (Healthy People 2030, n.d.). This project also addressed the Triple Aim of the Institute for Healthcare Improvement (IHI), a framework consisting of three components aimed at enhancing health system performance (IHI, 2020). The components of this framework include “improving the patient experience, improving the health of populations, and reducing the per capita cost of health care” (IHI, 2020, para. 1). Providing

this intervention aimed at reducing the risk of fire during high-risk surgeries addressed each of these aims.

Many professional anesthesia organizations express overwhelming support for education on surgical fire prevention. The American Association of Nurse Anesthetists (AANA) conveys the importance of CRNAs being knowledgeable on what can cause a surgical fire to occur, how to prevent them from occurring, and steps to take when attempting to extinguish a surgical fire (AANA, n.d.). They strongly encourage participation in a fire risk assessment at the beginning of each surgical procedure and continuous team communication during all steps of the procedure. Additionally, the Anesthesia Patient Safety Foundation (APSF) released an 18-minute video titled "Prevention and Management of Operating Room Fires" for operating room staff to utilize as a resource (APSF, 2018). This video has contributed to a 44% drop in reported intraoperative fires in the state of Pennsylvania since 2011.

Organizational Needs Statement

Surgical fires put healthcare facilities at risk for legal action. Choudhry et al. (2017) conducted a retrospective review of 40,000 closed malpractice claims to understand the repercussions associated with surgical fires and what led to their occurrence. They found 38% of cases had a verdict in favor of the individual filing the claim, which on average led to settlements that cost the facilities $215,000 per case. This can bring a tremendous financial burden to medical facilities. In addition, Choudhry et al. (2017) noted that up to 5% of operating room fires "cause serious harm or death" (p. 562). Short term morbidity occurs after superficial burns, but mortality is more likely when the patients' airway is affected after severe burns to this area, such as the oropharynx (Choudhry et al., 2017). Considering the partnering medical facility in southeastern North Carolina conducts high risk surgeries on a regular basis, they are at risk for

these legal penalties and, more importantly, placing patients at risk of unnecessary harm. Therefore, partnering together to maximize patient safety during these surgeries is vital.

There is currently no national benchmark data for these "never events" (National Quality Forum, 2011). However, guidelines do exist that include recommendations to help medical facilities prevent operating room fires from occurring. The AANA has collaborated with the Food and Drug Administration (FDA) to increase awareness and encourage interprofessional collaboration between operating room staff members to help prevent the risk of fires (FDA, 2011). They recommend the following guidelines:

- Carefully evaluate if the patient needs extra oxygen.
- Prevent alcohol-based antiseptics from pooling during skin preparation.
- Ensure that alcohol-based antiseptics applied to the skin are completely dry before draping the patient.
- When not in use, place potential ignition sources (such as electrosurgical tools) in a holster and not on the patient or drapes.
- Ensure good communication among all members of the surgical team.
- Practice fire drills so that everyone is aware of roles and responsibilities in the event of a surgical fire (para. 19).

Furthermore, the current organizational policy does not include a specific section anesthesia personnel can quickly reference during high risk cases. Considering how operating room fires put the patient at risk for increased hospital stays, lifelong injuries, and death, a perioperative fire prevention guide focused specifically on the needs of anesthesia providers has the potential to assist the partnering organization in further lowering risk of fires occurring during surgical procedures. It was anticipated that a specifically focused guide could support not

only better patient care and safety, but also provide increased protection for the medical facility and CRNA staff.

Problem Statement

Although operating room fires are not common, when they do occur they can result in permanent injury to the patient, increased medical costs, and legal consequences for the medical facility. In the partnering organization, CRNAs are responsible for the majority of anesthesia provided during surgical cases and are positioned to recognize unsafe practices, as well as contribute to the prevention of surgical fires based on their role with the oxidizing agent. Though a basic fire risk checklist is completed by the operating room nurse, a specific perioperative fire prevention guide for anesthesia providers is not available.

Purpose Statement

The purpose of this Doctor of Nursing Practice (DNP) quality improvement project was to develop, implement, and evaluate the perceived adequacy of a perioperative fire prevention guide designed specifically for anesthesia providers for improving awareness of fire prevention practices among a group of CRNAs practicing in a medical facility located in southeastern North Carolina.

Section II. Evidence

Literature Review

A literature review focused on prevention of surgical fires was conducted in September and October of 2020 utilizing multiple databases, search engines, and professional websites, including Cumulative Index to Nursing and Allied Health literature (CINAHL), PubMed, East Carolina University Libraries' OneSearch, and Google Scholar. As noted in Appendix A, primary keywords and subject headings utilized included, but were not limited to, fires, safety, operating room, and surgical. Limiters applied, based on the availability within each source, included publication within the past five years, written in English language, and peer reviewed status. Specific search strategies are available in Appendix B. After review of titles and abstracts, as well as an exclusion of duplicates, approximately 27 publications were identified as pertinent for full-text review. Additional publications were identified after exploration of websites of related organizations and Google searches. Of the publications reviewed at full-text level, six were identified as providing evidence to support this project. See the literature matrix in Appendix C.

Melnyk and Fineout-Overholt (2018) describe placing evidence into various hierarchical categories based on the strength the evidence provides as this is important to consider when making clinical decisions that can influence or change practice. Applying this level of evidence model, studies reviewed were from Levels II, V, and VI, which include randomized controlled trials, systematic review of qualitative or descriptive studies, and qualitative and descriptive studies, respectively. Additionally, several quality improvement projects were reviewed. Although multiple studies applicable to this project are not considered strong as they are lower in

the hierarchy, Melnyk and Fineout-Overholt (2018) note evidence in nursing is primarily found in descriptive or qualitative studies; therefore, items kept are within the acceptable range.

Current State of Knowledge

The literature review identified a significant volume of information on guidelines and recommendations health care providers can implement to prevent surgical fires; however, little information was specific to CRNAs. In addition, only a few research or quality improvement-based studies focused on fire risk interventions for CRNAs that had been delivered virtually. Identified recommendations were broad and inclusive of not only the anesthesia role, but also the surgeon and nursing staff roles during all surgery types.

Current Approaches to Solving Population Problem

Several approaches have been implemented to confront this problem. Tola et al. (2018) implemented a quality improvement project which aimed to "improve knowledge and awareness of surgical fire risk and increase practitioners' use of a fire risk assessment tool during the surgical safety communication process" (p. 335) by implementing a fire risk assessment into the surgical time out done before the start of the case. Findings showed the importance of each team member knowing their role in how to prevent surgical fires from occurring. In addition, multiple participants showed evidence of improved knowledge during the posttest self-assessment survey.

One unique approach presented by Keane and Pawlowski (2019) included the use of in-person simulation as an effective training method for health care providers to utilize in order to learn what to do if a surgical fire was to occur. This method may be the most realistic as surgical fires are rare and cannot ethically be intentionally produced during actual surgical cases simply for the purpose of research. Several studies assessed the impact of a variety of simulation scenarios among medical professionals. Findings revealed improved competency and

performance, as well as an increase in confidence and use of skills during these high-risk events (Kishiki et al., 2019; Wunder et al., 2020).

Using a more practical approach, Lee et al. (2018) implemented a randomized controlled trial aimed at examining the usefulness of an online approach for education on fire prevention provided to healthcare workers. A questionnaire was given to participants before and after the intervention video training. Findings showed an increase in knowledge in fire prevention with this method, and the delivery was demonstrated as useful for this specific training program. Additionally, Fisher (2015) conducted a pilot study where there was a 26.8% increase in test scores after the completion of an education model, which indicated improved competence for surgical fire prevention.

Evidence to Support the Intervention

Due to the current challenges brought about by COVID-19, the partnering organization needed a personalized approach that avoided holding large educational staff meetings with CRNAs; therefore, approaches to solving the problem such as in-person simulations were not feasible during the timeline of this project. Collaborating virtually was the safest and most appropriate way identified to deliver and assess the perceived adequacy of this perioperative fire prevention guide for improving fire safety awareness and practices.

Taking into consideration the scheduling conflicts that could arise with participants is important. Lee et al. (2018) noted the importance of having an education method tailored to the busy lives of hospital staff. CRNAs are no exception. Furthermore, they concluded: "participation in an on-line fire training program by watching educational video [sic] can effectively improve healthcare workers' knowledge of fire prevention" (p. 13). Additionally, a total of 84.4% of participants preferred this method of delivery and the scores of the intervention

group significantly improved, showing participants indeed had an increase in knowledge on fire prevention.

Further supporting this method of intervention, Tola et al. (2018) reported an 11% increase in the number of participants who reported "using fire prevention strategies in their practice since the intervention" (p. 342) upon follow-up posttest after implementation of a quality improvement project in an ambulatory surgical center. Another consideration to bear in mind when developing interventions is the need for continued reinforcement of positive changes to practice that occur after a tool is implemented (Tola et al., 2018). Current evidence supports the need for an intervention specifically targeted to CRNAs, delivered virtually, quickly accessible, and designed in a way that is useful in the clinical setting for the purpose of reducing the risk of surgical fires during high-risk surgeries. The goal of this quality improvement project was to assess the perceived adequacy of such an intervention.

Evidence-Based Practice Framework

Identification of the Framework

Solberg's conceptual framework on improving medical practice is relevant to operating room fire prevention in various ways. Solberg (2007) discussed the use of three conceptual components that can be used to improve practice and ultimately yield quality improvement. These components include "priority, change process capability, and care process content" (Solberg, 2007, p. 254). If these concepts were addressed to their fullest degree, the partnering medical facility would be able to "develop, implement, and sustain improved care quality for its patients, measurable by both improved services and improved patient outcomes" (Solberg, 2007, p. 254).

Priority ensures the need to address the current problem is strongly desired by all of those involved and there are adequate resources allocated to support the change taking place (Solberg, 2007). Solberg (2007) explained that the change process capability includes various factors, one of which is "individual accountability" (p. 254). CRNAs play a major role during surgical cases in creating and preventing surgical fires from occurring. Knowing this, CRNAs have a high degree of accountability and are constantly evolving to improve their practice and prevent these sentinel events. Lastly, Solberg (2007) noted that the care process content involves changes in practice environment. For CRNAs to make these changes, they need tools that assist them in improving practice and patient care. This project aimed to create and assess the perceived adequacy of one such tool.

When aiming to implement quality improvement processes in the clinical setting, facilitators and barriers may impact the success of the three conceptual components utilized. Examples of internal or external facilitators impacting each of the three components are: focus placed on the mission, adequate resources, and the existence of support for patient-centeredness (Solberg, 2007). When these facilitators are not present during the implementation process, practice will not be improved. Ultimately, the absence of these facilitators will turn them into barriers, which will prevent change from occurring (Solberg, 2007). The perioperative fire prevention guide was designed and served to support the three components of change.

Ethical Consideration & Protection of Human subjects

This quality improvement project met criteria approved by the University and Medical Center Institutional Review Board (IRB) and the participating organization as a quality improvement project and was not subject to full review; see Appendix D. Furthermore, to prepare for the following project, the lead investigator completed the Collaborative Institutional

Training Initiative (CITI) modules for the following basic courses: Human Research, All Biomedical Investigators and Key Personnel and Responsible Conduct of Research.

Ethical considerations included rights to respect and privacy of participants in this quality improvement project. The purpose of this project was fully disclosed to participants as it did not interfere with the results. Those who did not wish to participate were not required to as there is a right to voluntary participation. No personal information was obtained from participants in order to maintain confidentiality and anonymity. The intervention was equal for those involved and there was no foreseeable potential harm to the target population other than the minimal risk for some added stress, as education on this topic fell within the usual practice organizations often utilize. There was no involvement of patients nor was any identifiable personal medical information collected for use.

Section III: Project Design

Project Site and Population

Description of the Setting

The partnering organization for this quality improvement project was a level one trauma center located in southeastern, North Carolina. This facility has approximately 900 beds and offers a wide variety of services for the areas' diverse patient population. Each operating room can accommodate anywhere from one to five cases per eight-hour shift, sometimes more depending on turn-around times. Special interest was placed on this facility based on the many surgical procedures performed, including surgeries at high risk for surgical fires. The large number of surgeries performed on a daily basis had the potential to serve not only as a facilitator, as more data could be collected, but also as a barrier to the performance of this QI project as CRNAs have busy schedules with limited time to devote to data collection.

Description of the Population

Participants in this quality improvement project were CRNAs who provide direct anesthesia services for patients receiving care in the partnering facility. They are advanced practice providers who deliver anesthesia to a variety of patient populations during surgical cases, including those at high risk for fire occurrence. At the partnering organization, CRNAs provide most of the anesthesia during each surgical case and are very busy during their scheduled work shifts with minimal time to commit to data collection. Recognizing this potential barrier, the project was designed to utilize a virtual data collection method that was quick and easily accessible on any electronic device. Additionally, the commitment CRNAs would have towards keeping patients safe during surgery was perceived as a facilitator that would further

motivate their desire to participate in a quality improvement project with potential to minimize the risk of harm to the patient.

Project Team

The team implementing this quality improvement project was made up of a student registered nurse anesthetist (SRNA), a clinical CRNA faculty member, a CRNA faculty member who served as the project chair and content specialist, and the site manager. The CRNA program director served as general advisor, and an additional faculty member coordinated the projects' development and implementation. Additionally, initial development of the project was accomplished in cooperation with three additional students addressing the same clinical issue. The primary SRNA took the lead in regard to implementing the educational tool, administering questionnaires, assessing participant perceptions, and analyzing the questionnaire data.

Project Goals and Outcome Measures

Description of the Methods and Measurement

This quality improvement project focused on understanding the perceptions of participants before and after implementation of a virtual perioperative fire prevention guide specific to anesthesia providers. The Plan Do Study Act (PDSA) model was used to guide the development of this project as evidenced in the *plan* stage as we reviewed the literature and worked as a group to develop intervention and assessment tools (Institute for Healthcare Improvement, n.d.). Additionally, the *do* stage was addressed during the implementation phase of this QI project, while the *study* stage consisted of the analysis of data. The *act* stage is exemplified in the change making process. The pre-test/post-test methodology used an electronically delivered Qualtrics questionnaire before and after implementation of a perioperative fire prevention guide designed specifically for anesthesia providers. The purpose of

the questionnaires was to gather data with which to assess the usefulness and adequacy of the guide.

The perioperative fire prevention guide consisted of a single, visually appealing and information dense page that encompassed recommended guidelines for a variety of high-risk surgical procedures above the xiphoid process. In addition, a Prezi video explaining the importance of the guide was created and shared. Material for the guide was obtained from highly regarded anesthesia organizations, such as the AANA, and publications from reputable journals like The American Journal of Surgery. No data gathered through the questionnaires contained identifying information and confidentiality was maintained as the links were anonymous. The project was approved as quality improvement through a special process acceptable to the university IRB office and the partnering institution as noted in Appendix D.

Pre-assessment questions included those that provided insight into how much education participating CRNAs had received on fire prevention, their access to surgical fire educational resources, and their subjective level of confidence on the topic. The post-assessment questionnaire included questions that provided participants the opportunity to evaluate the usefulness and accessibility of the tool. Questions utilized included simple yes/no, Likert-scale type, multiple choice, and free response. This variety of questions provided nominal and ordinal quantitative, as well as some qualitative, data for analysis. The perioperative fire prevention guide, questionnaires, and Prezi video were shared with participants through their work emails. They are available in Appendices E, F, and G, respectively.

Discussion of the Data Collection Process

The clinical CRNA faculty member assisted in recruitment of participants by sharing information about the project with the CRNAs working in the clinical setting of interest. The

names and email addresses of those interested in participating were then shared with the project lead SRNA to be used for project implementation and data collection. An email was sent that included a PDF version of the perioperative fire prevention guide, video explaining the tool and process, and the Qualtrics pre-assessment questionnaire link to collect initial data.

Implementation Plan

After receiving the first email with aforementioned materials, participants had time to utilize the tool in clinical practice for two weeks. They were asked to consider the adequacy and usefulness of the tool when caring for those undergoing high-risk surgical procedures. At the end of the allotted two weeks, they received a second email with the link to the Qualtrics post-assessment questionnaire which was used to then gather data regarding their perceptions of the tool.

Timeline

A project timeline, available in Appendix H, includes the significant steps undertaken during the implementation of this project. Exploration of the topic and literature began in May of 2019 and continued through May of 2020. The literature review was conducted in the fall of 2020. In October of 2020 the assessment tool and questionnaires were developed and they were finalized in January of 2021. Project implementation and data collection occurred in April of 2021. Data analysis was completed in the summer of 2021. Project results were shared publicly via an in-person poster presentation to a group of faculty and students from the nurse anesthesia program in November of 2021. The presentation was made available remotely via Zoom to additional invited students, project participants, and other stakeholders. The project team worked collaboratively throughout every event in the timeline.

Section IV. Results and Findings

Results

CRNA participants received an email that included a pre-assessment questionnaire link used to collect initial data. The questionnaire consisted of nine questions, as noted in Appendix F, that assessed: previous education, confidence on perioperative fire identification and prevention, high-risk procedure participation, perioperative fire experiences, and availability/desire for quickly accessible perioperative fire prevention guidelines that provide support in decision making. After completing the pre-assessment questionnaire, participants had an allotted time of two weeks for using the perioperative fire prevention guide in clinical practice. After two weeks they were sent the post-assessment questionnaire for completion.

Post-assessment questionnaire questions assessed high-risk fire participation, accessibility and usefulness of the tool, how much time the tool saved participants, as well as any additional recommendations they suggested for improvement (see Appendix F). Results showed the majority of CRNAs participated in nine or more procedures that qualified as high-risk for fire over the allotted two-week time period. Additionally, the tool was perceived as useful, easily accessible, and visually appealing. Overall, participants reported that time was saved when accessing the tool in comparison to outside reference material, confidence increased, and there were no recommendations for improvement. Total data collection spanned four weeks as participants started and ended the two-week period at different intervals due to vacation time and sick leave.

Analysis

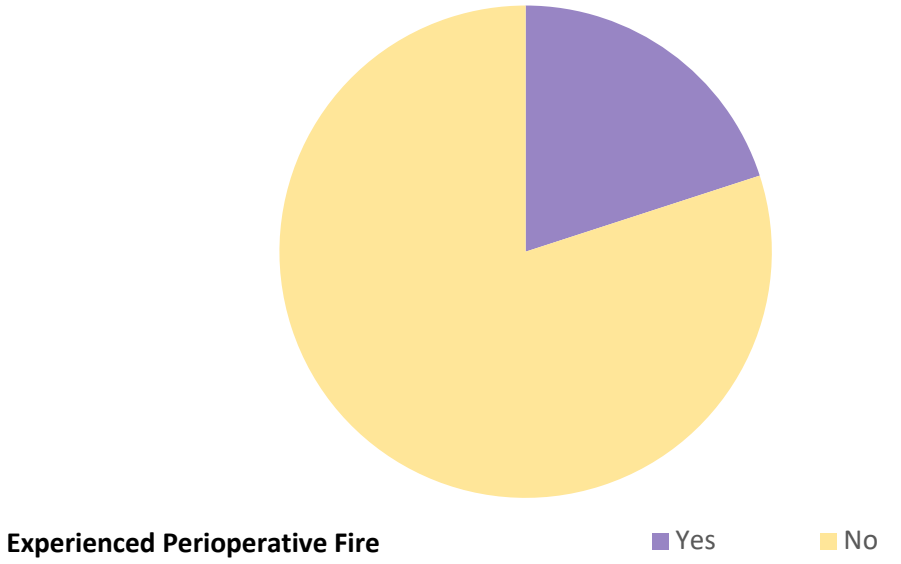
The pre-assessment questionnaire gave insightful information on CRNA perspectives. All five CRNA participants had received education, including continuing education, on perioperative

fire prevention. Additionally, one question assessed how confident participants were in their knowledge on perioperative fire prevention. Participants had the choice to select between options 1-5. Option 1 indicated that the participant was not at all confident while option 5 indicated they were very confident. Three participants selected option 5, one selected option 4, and the last selected option 3. This question was followed up in the post-assessment questionnaire. Results showed that three participants selected option 5 (very confident) and two selected option 4, showing a slight improvement in at least one participants' confidence on knowledge regarding perioperative fire prevention.

Using the same scale, four of five CRNA participants selected option 5 (very confident) when assessing their ability to identify a surgical procedure that had a high risk of fire, while the fifth participant selected option 4. This showed that they were overall confident in their ability to identify high-risk procedures. No participants indicated that the partnering organization currently had quickly accessible guidelines available for use while at work. With the exception of one participant, responses indicated that an easily accessible guide would provide support in decision making. These results demonstrated a need and desire for an easily accessible perioperative fire prevention guide. Additionally, as noted in Figure 1, the majority of participants have not experienced a perioperative fire. Therefore, rapidly recalling information on perioperative fire prevention methods may be more efficient with a quickly accessible reference guide on hand.

Figure 1

CRNAs Who Have Experienced a Perioperative Fire

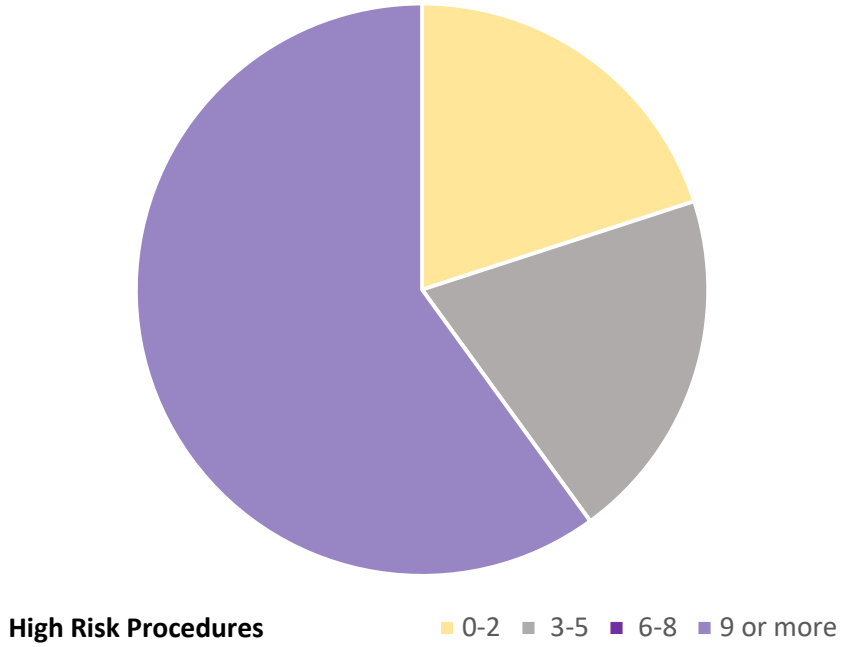


Note. N=5. Displayed is the number of CRNA participants that have experienced a perioperative fire in the clinical area per post-assessment questionnaire results.

As noted in Figure 2, post-assessment questionnaire results showed that three CRNAs who partook in this project participated in nine or more high risk procedures over the two-week time period, one participated in between three and five, and another two or fewer. Results support the need for a perioperative fire prevention guide as the majority participate in at least one high-risk procedure a day. Results show that the guide was perceived as useful to participants. All rated the guide as easily accessible and visually appealing, and had no recommendations for improvement. Interestingly, despite positive perceptions of the tool, only two of five participants reported they would use the reference guide in their practice.

Figure 2

High Risk Procedure Participation by CRNA Participants Over Two Weeks

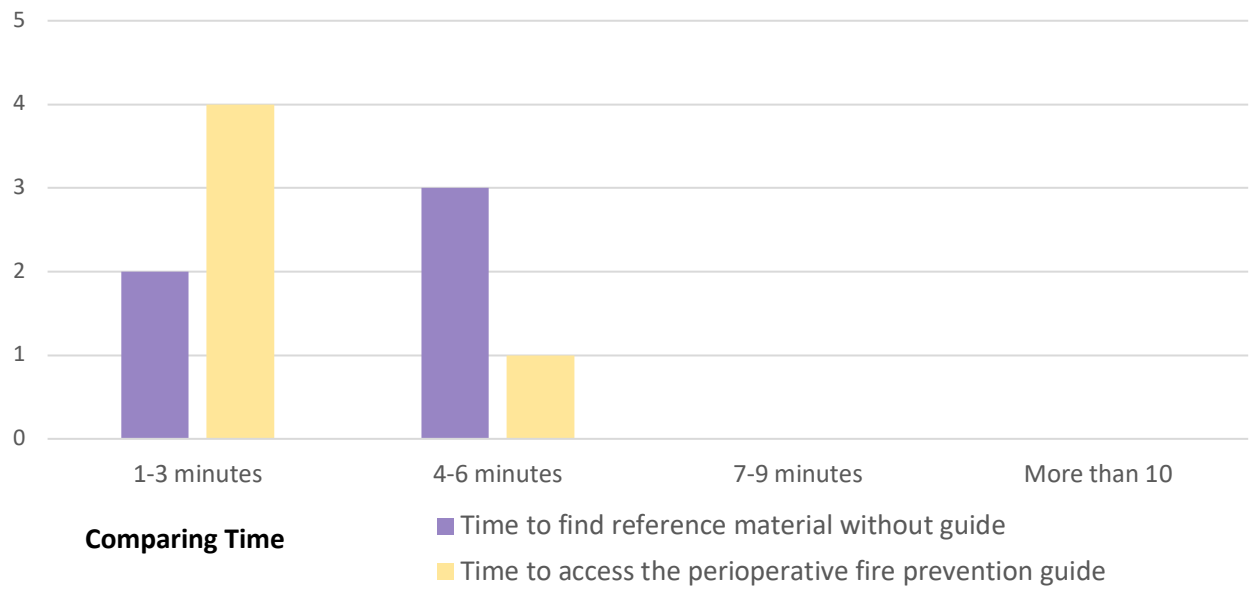


Note. N=5.

An interesting finding was that three of the five CRNA participants indicated the reference guide did not save them time. However, when comparing responses on how long it took to access the perioperative fire prevention guide versus the time it would take to find reference material without the guide, results show a reduction in time when using the guide. This can be seen in Figure 3.

Figure 3

Comparing the Difference in Time Spent Accessing Information



In conclusion, the perioperative fire prevention guide produced a slight increase in confidence regarding knowledge on perioperative fire prevention and a reduction in the time it takes to electronically access the perioperative prevention guide when compared to not having any quickly accessible guidelines.

Section V. Interpretation and Implications

Cost Benefit Analysis

Settlement costs for medical facilities in the rare event that a fire occurs range from $82,000-$518,100 (Choudhry et al., 2017). Fortunately, implementing this perioperative fire prevention guide into clinical practice is relatively free and has the potential to reduce the already low risk of perioperative fires, potentially saving the organization thousands of dollars per prevented event. The perioperative fire prevention guide was designed as a PDF document that can be opened on almost any electronic device. As it is already created, cost of employee time to produce the tool and cost of supplies is eliminated. It can be shared online via email or through a mobile device. Time efficiency is improved, while workload is decreased as CRNAs do not have to take the time to access outside reference material. The organization would only need to budget a couple hours per quarter to update the material based on current evidence. With a wage of $140 allowed for two hours of time allotted every three months, this would cost the facility approximately $560 a year.

Due to the low cost, ease of use, and potential reduction in perioperative fire risk, the partnering organization would have a good return on their minimal investment if adopting this guide as perioperative fires produce an enormous financial burden on the facility. These may include costs related to repairing damaged equipment or care areas, additional patient care or legal representation required due to fire-related injuries or deaths of patients and/or staff, and lost revenues associated with negative public perceptions of the organization.

Resource Management

The primary non-financial resource needed to support this intervention is access to devices allowing viewing. CRNAs working in the partnering organization have access to

computers throughout the entire operating room area. Additionally, most CRNAs maintain access to their own mobile devices while working in clinical areas, allowing for easy and quick access to the perioperative fire prevention guide while on shift. This availability added to the successful implementation of this project which required having CRNAs utilize the guide in the clinical area. A potential barrier that can occur is occur is a lack of cellular reception in the surgical suites. This would create issues with internet access in cases where CRNAs wished to use the fire prevention guide, but did not have it saved in a format not requiring internet access. This could be avoided by educating CRNAs on the importance of saving the guide as a photograph to avoid the need for cell reception.

Implications of Findings

There is currently no national benchmark data for these "never events," but there are guidelines that include recommendations to help medical facilities prevent operating room fires from occurring. Guidelines by the AANA and FDA collaboration discussed earlier are clearly incorporated into the perioperative fire prevention guide (FDA, 2011). Recall that the AANA conveys the importance of CRNAs being knowledgeable on perioperative fire causes and prevention, and findings from the data showed that there was an improvement in confidence regarding perioperative fire prevention (AANA, n.d.). Derived from the Healthy People 2030, the overarching aim of this project was to improve health care practices, in this case practices associated with fire risk in the operating room (Healthy People 2030, n.d.). This was accomplished as evidenced by findings shared in the data analysis, such as an increase in the level of confidence associated with knowledge in perioperative fire prevention.

Tola et al. (2018) noted that multiple participants in their QI project aimed to improve knowledge and awareness of surgical fire showed improved knowledge in their posttest self-

assessment survey. Data analysis for this QI project showed similar results. This increase in knowledge and confidence was also noted by Kishiki et al. (2019) and Wunder et al. (2020) in their simulation training findings that involved medical professionals. Recall that Solberg's conceptual framework discussed the use of three conceptual components that can be used to improve practice and ultimately yield quality improvement (i.e., priority, change process capability, and care process content). When relating Solberg's conceptual framework to the results of this QI project, it should be noted that priority was evidenced by CRNA participants showing a strong desire to prevent perioperative fires from occurring, as the majority indicated a guide would provide them support and was strongly desired. Due to the positive responses to this QI project, it is suggested that any future implementation efforts continue to utilize electronic versions of any perioperative fire prevention tools.

Implications for Patients

Patients benefit from having a quickly accessible, evidence-based perioperative fire prevention guide for CRNAs as it has potential to reduce the risk of fire occurrence which will ultimately improve patient care delivery and patient outcomes. Perioperative fires are avoidable if proper guidelines are set in place and utilized appropriately. Having this tool available to CRNA staff delivering direct patient care, especially during cases with elevated fire risk, provides extra support for delivery of safe, evidence-based patient care.

Implications for Nursing Practice

Nurses strive to provide safe and competent care for all patient populations. This is embedded into the practice as a whole. Having fire safety information quickly available in an easy to access format provides nurse anesthetists an added layer of support in providing safe

care. Utilization of best practice literature and accepted guidelines further elevates nursing practice and improves the profession as well as patient care.

Impact for Healthcare System

Healthcare systems aim to serve their communities by providing exemplary physical and emotional care that improves the health status of the population. Patients deserve to have proper guidelines in place to assure their safety and well-being is taken into consideration through all parts of the healthcare system and prioritized by the individuals partaking in their care. This perioperative fire prevention guide takes this all into account as its primary focus is to reduce harm and increase knowledge in the clinical setting.

Sustainability

Implementation of this quality improvement project involved no financial and few resource costs for the organization. As the tool is accessed electronically with distribution costs and efforts being quite minimal, continued utilization of this tool by CRNAs within the organization should be easily sustainable. Once sent to the entire CRNA staffing pool, all will have access to the tool from almost any electronic device, allowing for ongoing use in clinical practice.

Dissemination Plan

The dissemination plan for sharing the findings of this QI project included the creation of a poster that included the highlights of the project, such as the methods, data collection results, and discussion of findings. A presentation of this poster was delivered both in person and via Zoom to the East Carolina University nurse anesthesia faculty and students, as well as interested project participants. Additionally, the QI project dissertation was uploaded to The ScholarShip, a digital archive for scholarly output from the East Carolina University community.

Section VI. Conclusion

Limitations

The primary limitation in this study was the time limit of two weeks placed on utilization of the tool. This time period did not consider any potential vacation time that could be taken by the CRNAs. Additionally, as this project was implemented during a global pandemic, excess absences of participants from work may have played a role in limiting the data collected. Responses requiring the participants to consider their past two weeks of work experience may have been skewed if participants had taken vacation or sick leave during the two-week intervention period. In addition, with such a small sample size results are not generalizable to other populations.

Recommendations for Others

In any future implementation of this or a similar project, it is recommended that the tool continue to be made accessible electronically as it reduces cost for organizations and saves time when accessing it. Any time taken off by participants during the implementation phase should be taken into consideration as it can prolong data collection and skew results. Use of in person or email reminders to encourage completion of surveys is also recommended. Qualtrics can send reminders while maintaining anonymity, although that capability was not utilized in this project implementation. The final recommendation is assuring a greater sample size to allow for more generalizable results.

Recommendations for Further Study

For future success, it may be important to investigate if there is a difference between continuing this tool electronically or having printable versions in every operating room by the anesthesia machine. Although it will increase cost to produce, it may increase use as it eliminates

the need of requiring an electronic device for access. CRNAs can simply look at the side of the anesthesia machine and take note of the information. Additionally, a print version would be consistently available to locums or part time staff working in the organization even if they did not have access to the electronic copy.

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Appendix A

Literature Search Strategies

	Concept	
	Fires	Operating Room
Keywords	Fires Fire Safety	Operating Room Surgical
PubMed MeSH	Fires Safety	Operating Rooms Surgical Procedures, Operative
CINAHL Subject Headings	Fires Safety Fire Safety	Operating Rooms Surgery, Operative

Note. Various combinations of the provided keywords, PubMed MeSH terms, and CINAHL subject headings were used to conduct literature searches in PubMed, CINAHL, ProQuest Search, East Carolina University Libraries' OneSearch, and Google Scholar. Boolean operators were used in different combinations to yield reported search results.

Appendix B

Search Strategy

Search Date	Database/ Search Engine	Search Strategy	Limits Applied	Number of Results	Number Reviewed	Number Kept
10/2020	PubMed	Fires AND Operating Room	Last 5 year (2015-2020) English	137	137	7
10/2020	ProQuest	(Surgical Fire) AND (Prevention)	Last 5 years (2015-2020) Scholarly Journals Peer Reviewed	1,549	100	2
9/2020	CINAHL	Surgical Fires	Last 5 years (2015-2020) English "Prevention and Control/PC"	51	51	10
9/2020	East Carolina University OneSearch	(Surgical Fires) AND (CRNA)	Last 5 years (2015-2020) English	118	50	5
9/2020	Google Scholar	(Operating Room) AND (Fire Safety)	Last 4 years (2016-2020)	44,300	50	3

Appendix C

Literature Matrix

Citation	Level of Evidence	Data/Evidence Findings	Conclusions	Use of Evidence in EBP Project Plan
Coletto, K., Tariman, J. D., Lee, Y., & Kapanke, K. (2018). Perceived knowledge and attitudes of certified registered nurse anesthetists and student registered nurse anesthetists on fire risk assessment during time-out in the operating room. AANA Journal, 86(2), 99-108.	VI	"CRNAs and SRNAs perceived a lack of knowledge about new ideas for disseminating fire risk assessment during time-outs" (p. 105).	Perceived knowledge deficits can hinder the need for additional fire risk assessment implementations. This could deter us from improving and increasing patient safety. Therefore, education is vital.	Not directly applicable as we are not assessing the knowledge of CRNAs or implementing an additional fire risk assessment.

Fisher, M. (2015). Prevention of surgical fires: A certification course for healthcare providers. AANA Journal, 83(4), 271-274.	VI	A certification course can improve knowledge on surgical fire prevention.	"Results indicated that this course can remediate gaps in surgical fire prevention knowledge of providers" (p. 273).	Significant increase in knowledge can occur after completing an education module on fire prevention. Thus, providing CRNAs with a tool to remind them of prevention methods can decrease the risk of surgical fires from occurring.
Kezze, I., Zoremba, N., Rieg, A., Coburn, M., & Schalte, G. (2018). Risks and prevention of surgical fires. Der Anaesthesist, 67, 426-447.	I	Highlighted the use of a cuffed ETT for airway surgery and the need to titrate oxygen down to lowest amount possible.	The impact each fire triad component was extensively evaluated, providing necessary education on their individual role.	Each component of the fire triangle and their involvement in operating room fires explained in great detail adds value to background section.
Lee, P. H., Fu, B., Cai, W., Chen, J., Yuan, Z., Zhang, L., & Ying, X. (2018). The effectiveness of an on-line training program for improving knowledge of fire prevention and evacuation of healthcare workers: A randomized controlled trial. PLOS ONE, 13(7), 1-15.	II	A total of 84.4% of participants preferred an online method of delivery and the scores of the intervention group significantly improved, showing an increase in knowledge of fire prevention.	Increased knowledge on fire prevention and evacuation occurred after delivering an education video and online fire training program.	Provided support for the use of an online delivery method and acknowledged the time conflicts with in person training.

Putnam, K. (2015). A tailored approach to fire safety in the OR. AORN Journal, 102(4), P7-P9.	VII	The importance of OR personnel being familiar with prevention measures and responding quickly to OR fires.	Even though surgical fires are rare, if elements of the fire triad exist the risk is present.	Provided insight on the risk associated with a given oxygen concentration.
Tola, D. H., Jillson, I. A., & Graling, P. (2018). Surgical fire safety: An ambulatory surgical center quality improvement project. AORN Journal, 107, 335-344.	QI	After implementing a fire risk assessment tool during surgical time outs, 11% of participants implemented the learned fire prevention strategies.	Findings showed an increase in those who use fire prevention strategies, as well as an increase in knowledge.	Illustrates the value a quality improvement project can bring to the clinical setting in regards to fire prevention.

Appendix D

Approval Process

Center for Research & Grants

[redacted]

Quality Assurance/Quality Improvement Project vs. Human Research Study (Requiring IRB approval) Determination Form

This worksheet is a guide to help the submitter to determine if a project or study is a quality assurance/quality improvement (QA/QI) project or research study and is involving human subjects or their individually identifiable information and requires IRB approval as defined by the Health and Human Services (HHS) or Food and Drug Administration (FDA). Once completed, please email the form to the [redacted] Center for Research and Grants [redacted] CRG.Quality@[redacted].com. A CRG team member will contact you with the results of their review and may request additional information to assist with their determination. The determination will be made in conjunction with the UMCIRB office.

Please contact the [redacted] with any questions at 252-847-1177 or CRG.Quality@[redacted].com.

For more guidance about whether the activity meets the definition of Human Subjects Research see https://rede.ecu.edu/umcirb/irb-faqs/definitions/ or https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html#c1

Project Title: Assessing anesthesia providers' perceptions of adequacy of operating room fire prevention		
Funding Source: None		
Project Leader Name: Genesis Guzman/Angela Ciuca	☐ Ed.D. ☐ J.D. ☐ M.D. ☐ Ph.D. ☐ Pharm.D. ■ R.N. ☐ Other(specify):	
Job Title: ECU SRNA/ECU CRNA Faculty	**Phone:** [redacted]	**Email:** [redacted]
	Primary Contact (If different from Project Leader): Genesis Guzman, SRNA	
	Phone: [redacted]	**Email:** [redacted]

Key Personnel/ Project Team members:

Name and Degree:	Department: (Affiliation if other than Vidant)	Email:
Genesis Guzman, SRNA	ECU Nurse Anesthesia Program	[redacted]
Angela Ciuca, DNAP, CRNA	ECU Nurse Anesthesia Program	
Dr. McAuliffe, PhD, CRNA	ECU Nurse Anesthesia Program	

QI/QA Assessment Checklist:

Consideration	Question	Yes	No
PURPOSE	Is the PRIMARY purpose of the project/study to: • IMPROVE care right now for the next patient? OR • IMPROVE operations outcomes, efficiency, cost, patient/staff satisfaction, etc.?	✓	
RATIONALE 1	The project/study falls under well-accepted care practices/guidelines or is there sufficient evidence for this mode or approach to support implementing this activity or to create practice change, based on: • literature • consensus statements, or consensus among clinician team	✓	
RATIONALE 2	The project/study would be carried out even if there was no possibility of publication in a journal or presentation at an academic meeting. (**Please note that answering "Yes" to this statement does not preclude publication of a quality activity.)	✓	
METHODS 1	Are the proposed methods flexible and customizable, and do they incorporate rapid evaluation, feedback and incremental changes?	✓	
METHODS 2	Are patients/subjects randomized into different intervention groups in order to enhance confidence in differences that might be obscured by nonrandom selection? (Control group, Randomization, Fixed protocol Methods)		✓
METHODS 3	Will there be delayed or ineffective feedback of data from monitoring the implementation of changes? (For example to avoid biasing the interpretation of data)		✓
METHODS 4	Is the Protocol fixed with fixed goal, methodology, population, and time period?		✓
RISK	The project/study involves no more than minimal risk procedures meaning the probability and magnitude of harm or discomfort anticipated are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.	✓	
PARTICIPANTS	Will the project/study only involve patients/subjects who are ordinarily seen, cared for, or work in the setting where the activity will take place?	✓	
FUNDING	Is the project/study funded by any of the following? • An outside organization with an interest in the results • A manufacturer with an interest in the outcome of the project relevant to its products • A non-profit foundation that typically funds research, or by internal research accounts		✓

If all of the check marks are inside the shaded gray boxes, then the project/study is very likely QI and not human subject research. Projects that are not human subject research do not need review by the IRB.

-

In order to assess whether your project meets the definition of human subject research requiring IRB review or may qualify as a quality improvement/assurance activity, please provide the following information:

1. **Project or Study Summary:**
   As a separate attachment, please provide a **summary of the purpose and procedures** as well address all of the following:
   a) The project question/hypothesis.
   b) The project design.
   c) Any interaction or intervention with humans.
   d) A description of the methods that will be used and if they are standard or untested.
   e) Specify where the data will come from and your methods for obtaining this data -please specify who/where (i.e. CRG will provide you with the data, or someone from a specific department will provide you with the data, or you will pull it yourself).
   f) Specify what data will be used and any dates associated with when that data was originally collected (i.e Patient Name, Diagnosis, Age, Sex). *If applicable, please attach your data collection sheet.*
   g) Where will the data (paper and electronic) for your project be stored? Please specify how it will be secured to protect privacy and maintain confidentiality. For paper data, please provide physical location such as building name and room number and that it will be kept behind double lock and key. For electronic data, please provide the file path and folder name network drive where data will be stored and specify that it is secure/encrypted/password protected. If using other storage location, please provide specific details.
   h) Please specify how long data will be stored after the study is complete? (Keep in mind that data collected/generated during the course of the project that includes protected health information (PHI) should have identifiers removed at the earliest opportunity.)
   i) Please specify how the collected data will be used (internal/external reports, publishing, posters, etc.).

   Please attach a summary and/or any other additional documentation describing your project

2. **If the Primary purpose of your project/study is for QA/QI, have you obtained approval from the operational leader within your department or health system:**
   ■ **Yes** [Please specify here whom and obtain their signature in the signature section below [redacted]
   ☐ **No** [Contact the appropriate operational leader for approval.]

Please note:

- By submitting your proposed project/study for QA/QI determination you are certifying that if the project/study is established to qualify as QA/QI project, you and your Department would be comfortable with the following statement in any publications regarding this project: "This project was reviewed and determined to qualify as quality improvement by the [redacted] for Research and Grants."
- If you are submitting a Poster to Media Services for printing, you will need to also submit this Quality Improvement Worksheet or proof of your IRB Application and IRB Approval.
- If the [redacted] determines the activity is not human subject research, then any presentation, publication, etc. should not refer to the activity as "human subject research," "exempt research," or "expedited research."
- If you would like the [redacted] to verify that a project/study is not human subject research, please provide this form completed with the summary of your activity and any additional information to the [redacted] at CRG.Quality@[redacted].com and the following will be completed and returned to you for your records.

NHSR vs. HSR Determination:

☒ **Not Human Subject Research:** The [redacted] has determined that based on the description of the project/study, approval by the IRB is not necessary. Any changes or modifications to this project may be discussed with the [redacted] at that time to ensure those changes do not elevate the project to human research that would need IRB approval.

☐ **Human Subject Research:** This project/study requires review by the IRB prior to initiation. An application in the electronic IRB submission system should be submitted.

Approval Signatures:

Department (Site) Manager: [redacted] **Date:** 2-25-2021

[redacted] **Reviewer:** [redacted] **Date:** _____

UMCIRB Office Staff Reviewer: [redacted] **Date:** 3-10-21

Appendix E

Perioperative Fire Prevention Guide

ECU

Case Specific Tips

Monitored Anesthesia Care

- Avoid supplemental O_2[6,7,8]
- Do not deliver 100% FiO_2[6,8]
- Use O_2 blender or CGO to deliver O_2 ≤ 30%[6,8]
- Consider ETT/LMA in high-risk cases requiring ≥ 30% FiO_2[6,8]
- Position drapes and forced air warming equipment to prevent tenting and trapping of O_2[8,9]
- Suction the zone around the head to limit O_2 and N_2O gases in the area[9]

Head and Neck Surgery

- Scavenge oropharynx with suction during oral cases[9]
- Discuss O_2 delivery with surgeon during case[10]
- Ask the surgeon to announce intent to use an ignition source[10]
- Saline available if surgery in oral cavity[10]

Airway and Lung Surgery

- Stop N_2O, decrease O_2 to ≤30% for 1-5 minutes before activating ignition source in airway[9]
- Ensure no air leak from ETT[3]
- Consider suctioning ipsilateral lumen of DLT to decrease O_2 near electrocautery[3]

Laser Surgery/ENT

- Use appropriate laser resistant ETT[9]
- Fill ETT cuff with saline and indicator dye[9]

Other

- Check anesthesia circuit for leaks[5]
- Ensure O_2 off after every case[5]

Surgical Fires

Anesthesia is primarily responsible for managing the oxidizer component of the fire triad (O_2 and N_2O)[1]

O_2 was the oxidizer in 95% of electrocautery-induced OR fires and 100% of fires with other ignition sources[2]

Standard ETT is combustive when O_2 >25%[3]

Silverstein Fire Risk Assessment[4]

Score one point for each item below	
Open oxygen source	
Presence of an ignition source	
Surgery at/above the xiphoid	
	Total ____

Scoring

0-1: Low risk

2: Intermediate risk

3: High risk

Communicate fire risk with all staff[5]

[1]Ahmed OI, Girshin M. Fire safety in the operating room. *APSF.* 2013; 28(1):17. [2]Mehta SP, Bhananker SM, Posner KL, Domino KB. Operating room fires: A closed claim analysis. *Anesthesiology.* 2013; 118(5): 1133-1139. [3]Bansal A, Bhama JK, Varga JM, Toyoda Y. Airway fire during double-lung transplantation. *Interact Cardiovasc Thorac Surg.* 2013; 17(6):1059-1060. [4]Mathias JM. (2006). Scoring fire risk for surgical patients. *OR Mgr.* 2006; 22(1): 1-3. [5]Spruce L. Back to basics: Preventing surgical fires. *AORN J.* 2016; 104(3): 217-224.e2. [6]Jones TS, Black DI, Robinson TN, Jones EL. Operating room fires. *Anesthesiology.* 2019; 131(3): 492-501. [7](2003). Sentinel event alert: Preventing surgical fires. The Joint Commission. https://www.jointcommission.org/-/media/tjc/documents/resources/patient-safety-topics/sentinel-event/sea_29.pdf. Published 2003. Accessed November 3, 2020. [8]USFDA. Recommendations to reduce surgical fires and related patient injury: FDA safety communication. https://www.fda.gov/medical-devices/safety-communications/recommendations-reduce-surgical-fires-and-related-patient-injury-fda-safety-communication. Published 2018. Accessed November 3, 2020. [9]ASA. Practice advisory for the prevention and management of operating room fires: An updated report by the ASA task force on operating room fires. *Anesthesiology.* 2013; 118(2):1-20. [10]Di Pasquale L, Fernetti EM. Fire Safety for the Oral and Maxillofacial Surgeon and Surgical Staff. *Oral Maxillofac Surg Clin North Am.* 2017; 29(2): 179-187.

Appendix F

Qualtrics Pre- and Post-assessment Questionnaires

Pre-assessment Questionnaire

1. Have you **ever** received education on perioperative fire prevention?
   Yes/No
2. Have you received continuing education on perioperative fire prevention?
   Yes/No
3. How confident are you in your knowledge about perioperative fire prevention?
   Not at all confident 1 2 3 4 5 Very confident
4. Have you participated in a procedure where all the elements of the fire triad were present?
   Yes/No
5. Have you ever experienced a perioperative fire?
   Yes/No
6. How confident are you in your ability to identify a surgical procedure that has a high risk of fire?
   Not at all confident 1 2 3 4 5 Very confident
7. Do you currently have perioperative fire prevention guidelines that you can quickly access while at work?
   Yes/No
8. If you had a question about perioperative fire prevention, approximately how long do you think it would take you to find reference material to answer the question?
   1-3 minutes 4-6 minutes 7-9 minutes More than 10 minutes
9. Would an easily accessible reference guide provide you support in decision making regarding high fire risk procedures?
   Yes/No

Post-assessment Questionnaire

1. Approximately how many procedures did you participate in over the last two weeks that qualified as high-risk for fire?
   0-2 3-5 6-8 9 or more
2. What is your perception of the usefulness of this reference guide for an anesthesia department?
   Not at all useful 1 2 3 4 5 Very useful
3. Was this reference guide easily accessible in the clinical setting?
   Yes/No
4. Did you find this reference guide visually appealing?
   Yes/No
5. Did this reference guide save you time?
   Yes/No
6. If saved to your mobile phone or work computer, how long would it take you to access this reference guide?
   1-3 minutes 4-6 minutes 7-9 minutes More than 10 minutes
7. Do you think you will use this reference guide in your practice as a CRNA?
   Yes/No
8. After reviewing this reference material, how confident are you in your knowledge about perioperative fire prevention?
   Not at all confident 1 2 3 4 5 Very confident
9. Do you have any recommendations to improve the reference guide? (i.e. is there something missing).
   Open ended response

Appendix G

Prezi Video Link

https://nam02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fprezi.com%2Fv%2Fqc-l_u954_li%2F&data=04%7C01%7Cparraguzmang13%40students.ecu.edu%7Cb8875163220444 0b29f908d8e0177bcc%7C17143cbb385c4c45a36ac65b72e3eae8%7C0%7C0%7C63750573874 8582173%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLC JBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=Zo%2Ba5VspG7wv8eDcr6qZmIb1lmL BE%2FVGoLu%2FSVWHHl4%3D&reserved=0

Appendix H

Project Timeline

Date	Tasks
May 2019	Explore project topic
June 2019	Explore literature on topic
May 2020	Define project topic
August 2020	Submit initial draft of Section I
September 2020	Submit initial Literature Matrix
September 2020	Submit revised Literature Matrix
September 2020	Submit revised Section 1 and initial draft of section II
October 2020	Develop assessment tool
October 2020	Develop pre- and post-assessment questionnaires
November 2020	Submit revised section I and II and initial draft of section III
November 2020	Submit reviews of sections I-III.
December 2020	Write script for Prezi video explaining assessment tool
January 2021	Work on intervention and email script
January 2021	Finalize pre- and post-assessment questionnaires
January 2021	Finalize intervention tool
January 2021	Submit edited version of sections I-III after Chair feedback
February 2021	Record voice over Prezi to send out to target audience
April 2021	Submit edited version of sections I-III after finalizing materials
May 2021	Introduce the tool to the target audience via video and email
May 2021	Allow two weeks before sending follow-up email
May 2021	Have participants assess adequacy and usefulness of tool
June 2021	Perform data analysis
July 2021	Submit versions IV-VI
August 2021	Submit edited version of sections IV-VI
August 2021	Finalize Sections I-VI per chair feedback
October 2021	Submit poster presentation for feedback
November 2021	Submit final poster presentation
November 2021	Present poster and project to faculty, participants, and students
November 2021	Submit final paper to The ScholarShip