Efficacy of a Multimedia Educational Module on Best Practices of Anesthesia Patient Safety for Intraoperative Lidocaine Infusions

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Author Note

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This paper is based on data from the DNP Project completed as partial fulfilment of the Doctor of Nursing Practice degree with the guidance and supervision of the following:

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Abstract

Since the opioid epidemic was declared a public health emergency in the United States in 2017, it is important to continually update anesthesia practice with evidence-based recommendations to lower opioid consumption and improve the safety of the surgical patient. Multimodal anesthetic techniques utilize non-opioid medications to replace opioid monotherapy and lower opioid consumption. Intraoperative lidocaine infusions have been shown to reduce opioid consumption and decrease the negative side effects associated with opioid administration. Increasing the usage of intraoperative lidocaine infusions can improve patient outcomes and safety. The purpose of this project was to educate anesthesia providers on intraoperative lidocaine infusions and create a willingness for providers to make a practice change. To provide this education, a virtual educational module and robust simulation scenario on topics of anesthesia patient safety were created. Especially during the COVID-19 pandemic where face-to-face learning was difficult and providers faced busy schedules, the virtual format provided a convenient and effective learning platform. Assessment of provider knowledge acquisition and willingness to incorporate lidocaine into practice was measured using pre/post surveys. Although statistical significance was not possible, the results were clinically significant as they can create a lasting positive impact on anesthesia patient safety and outcomes.

Keywords: lidocaine, education, anesthesia, safety, multimodal, opioid

Title

Effectiveness of a Multimedia Educational Module on Best Practices of Anesthesia Patient Safety for Intraoperative Lidocaine Infusions

Population, Intervention, Control, Outcome (PICO) Question

In anesthesia providers, does a multimedia simulation-based educational intervention increase knowledge about current best practice for patient safety, monitoring and administering medications in accordance with evidence-based practice guidance?

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Chapter I

Evidence-based practices (EBPs) is a leading means of clinical innovation and decision-making in the healthcare setting. The integration of evidence-based findings into practice will improve patient outcomes and safety in addition to increasing providers' level of knowledge and skills (Young et al., 2014; Walczak et al. 2010). During anesthesia administration, it is essential to keep patient safety a top priority. Since anesthesiology is considered one of the leaders in patient safety, it is crucial to continually update patient safety standards with EBP recommendations (Botney, 2008).

In the field of anesthesia, opioids are routinely administered to control intraoperative and postoperative pain. Although opioids have powerful analgesic properties, they possess a variety of unwanted side effects and the possibility of substance abuse. Currently, the United States consumes a large percentage of the world's opioids in an ongoing opioid crisis (Rose, 2017). It is important for anesthesia providers to utilize EBP recommendations for multimodal anesthetic techniques to combat the opioid epidemic. Intraoperative lidocaine infusions have evidence to reduce perioperative opioid requirements and improve patient outcomes (Eipe, Gupta, & Penning, 2016).

Background and Significance

An estimated 130 people die each day from a drug overdose related to opioids (CDC, 2020). A 2018 statistic showed that 10.3 million people misused prescription opioids, and approximately 47,600 people died from overdosing on opioids that year in the United States (CDC, 2020). Along with devastating health consequences, the opioid epidemic in the United States creates an economic burden on the country. Costs associated with healthcare assistance, criminal justice support, family assistance, and untimely death that are tied to the opioid

epidemic have exponentially increased over the past several years (Neville & Foley, 2020). The United States makes up an estimated 4.4% of the world's population and consumes approximately 80% of the world's opioids (Rose, 2017). The opioid crisis became so problematic in the United States that President Donald Trump declared the opioid epidemic a public health emergency in 2017 (CDC, 2020).

Opioid use during and after surgery is one of the biggest contributors to the opioid crisis in the United States and throughout the world (Egan, 2019). Opioids, although powerful analgesic agents, come with burdensome side effects. Side effects such as constipation, pruritus, nausea, vomiting, and respiratory depression are often seen with administration of opioids (Nagelhout & Elisha, 2018). The most concerning drawback of opioids is the possibility of physical dependence and addiction that may result from their administration (Nagelhout & Elisha, 2018). In attempt for anesthesia providers to better combat the opioid crisis, multimodal anesthetic techniques have begun to replace monotherapy of opioids in the operative setting (Kandarian, Elkassabany, Tamboli, & Mariano, 2019.

Multimodal techniques during the operative phase utilize non-opioid drugs to control patient pain levels during surgery without sole reliance on opioids. Advances in such techniques by anesthesia providers aim to better control patient operative pain, increase positive patient outcomes, and reduce the adverse effects of opioids (Kandarian, Elkassabany, Tamboli, & Mariano, 2019). Intravenous (IV) lidocaine has been studied and is currently being further explored to better understand its use and expand its purpose within multimodal anesthesia (Eipe, Gupta, & Penning, 2016).

Balanced anesthetic techniques that utilize alternative drugs to minimize opioid use is a core concept to opioid stewardship. It is important for anesthesia provider participation in this

process to control the opioid epidemic and public health emergency (Egan, 2019). As part of the fight to the opioid epidemic, the Centers for Medicare and Medicaid Services (CMS) has released a roadmap in collaboration with President Trump's public health emergency declaration. The key areas of this directive are prevention, treatment, and data. The prevention branch of the plan focuses on pain control methods that rely less on prescription opioids and better utilize alternative medications (Ongoing, 2020). This branch most closely relates to anesthesia providers and their intraoperative analgesic choices.

Anesthesia providers are considered leaders in patient safety, therefore continual improvement and innovation within the profession are essential to maintain patient safety (Botney, 2008). The translation of EBP in anesthesia delivery can help to improve the safety profile of the process and improve patient outcomes of those undergoing any surgical intervention (Botney, 2008). The Institute of Medicine (IOM) has highlighted the importance of incorporating EBP into the clinical arena. While considering the importance of patient safety and clinical innovation that is supported by evidence, the IOM has set a goal that 90% of clinical decisions made by providers are backed by research and evidenced-based findings (Lehane et al., 2019). Although the benefits of incorporating EBP findings into practice are apparent, many barriers exist that will challenge its translation (Shayan, Kiwanuka, & Nakaye, 2019). Being aware of both the benefits and barriers when attempting to incorporate EBP findings offers the best opportunity of achieving the IOM's goal for evidence-based innovation (Lehane et al., 2019).

EBP recommendations strongly support the use of intraoperative lidocaine infusions for multimodal anesthetic purposes (Eipe, Gupta, & Penning, 2016). IV lidocaine is an inexpensive, widely available drug that can improve acute and postoperative pain when administered

intraoperatively. This medication is an amide local anesthetic that exhibits anti-inflammatory, anti-hyperalgesic, and pro-peristaltic properties (Eipe, Gupta, & Penning, 2016). Along with reducing sensitivity of neurons in the spinal cord, IV lidocaine also exhibits action on *N*-methyl-d-aspartate (NMDA) receptors to decrease depolarization. IV lidocaine can have a significant role in multimodal anesthesia and fighting the opioid epidemic when utilized by anesthesia providers (Eipe, Gupta, & Penning, 2016). Lidocaine allows anesthesia providers to use less opioids and ultimately increase patient safety. By using this alternative method, anesthesia providers can contribute to the prevention aspect of the roadmap to fight the opioid epidemic (Eipe, Gupta, & Penning, 2016; Ongoing, 2020).

To translate EBP recommendations for intraoperative lidocaine infusions into practice, a coalition between researchers and clinicians must be formed (Rosswurm & Larrabee, 1999). It is also important to utilize a proper learning platform that maintains both effectiveness and convenience when educating anesthesia providers (Chu et al., 2020). A recent study found that more than 50% of anesthesia providers have never read or referenced an education article, citing an insufficient amount of spare time as the reason (Castanelli et al., 2015). The COVID-19 worldwide pandemic has greatly impacted the teaching and learning environment for all groups and demographics. Shifting to a virtual platform and away from face-to-face instruction has become more common during the COVID-19 pandemic. This modality can prevent the spread of infection and increase convenience for the learners. Virtual learning sessions have been shown to be both effective and enjoyable for those who are unable to attend educational sessions in-person (Agarwal & Kaushik, 2020).

The nursing field itself has a history of successful use of e-learning platforms. Surveys show that nursing learners are both satisfied with virtual learning and find it an effective means

of education (Rouleau et al., 2019). This is especially reassuring during the COVID-19 worldwide pandemic where in-person instruction may not be possible or feasible. It may also preserve the ability to translate EBP into the clinical setting during a challenging period (Agarwal & Kaushik, 2020).

The original Doctor of Nursing Practice (DNP) project was designed to address the importance of multimodal use of intraoperative lidocaine infusions at a specific clinical site. However, the COVID-19 pandemic prevented the ability for DNP projects to be carried out at a singular clinical site. Understanding that intraoperative lidocaine infusions are important to patient safety and combating the opioid epidemic, it is still important to continue to educate anesthesia providers about how they can increase patient safety using this technique. Especially in times of pandemic, disseminating evidence-based information that can increase patient safety in a virtual format will ensure that best practices are continued even in unique and difficult times when face-to-face learning is not possible.

To accomplish education of anesthesia providers on patient safety topics, a group of senior student registered nurse anesthetists (SRNAs) have collaborated to create a virtual educational module and simulation scenario that would incorporate education on multiple topics and be delivered in an online format. This virtual approach has the potential to increase the number of participants since it is not limited by geography or singular clinical site. It also provides an effective and convenient means to provide education on multimodal intraoperative lidocaine infusions.

Problem Statement

Effective pain management in an opioid epidemic should be a priority of all anesthesia providers. There are multiple studies to support the use of IV lidocaine infusions intraoperatively

for multimodal anesthetic purposes (Eipe, Gupta, & Penning, 2016). However, many anesthesia providers are unaware of the benefits of this technique and fail to utilize intraoperative lidocaine infusions despite the data to support its use for multimodal use and ability to increase patient safety profiles. The usage of IV lidocaine can be of great benefit for pain management, increasing patient safety profiles, and confronting the opioid epidemic. A PICO question was developed to increase the utilization of lidocaine infusions by educating anesthesia providers through a multimedia simulation-based educational: In anesthesia providers, does a multimedia simulation-based educational intervention increase knowledge about current best practice for patient safety, monitoring and administering medications in accordance with evidence-based practice guidance?

System and Population Impact

With the opioid epidemic prevalent in the United States and throughout the whole world, education on opioid-sparing techniques is crucial for anesthesia providers to increase patient safety and outcomes. One of the barriers for this education is the COVID-19 pandemic where face-to-face education is limited. Virtual education and simulation scenarios will provide anesthesiologists, certified registered nurse anesthetists (CRNAs), and SRNAs the best opportunity to conveniently and effectively learn the use of intraoperative lidocaine infusions for multimodal purposes.

Increasing the usage of intraoperative lidocaine infusions by anesthesia providers will have profound effects on the surgical patient population. Lidocaine infusions can decrease the perioperative opioid requirements and combat the opioid epidemic in the United. With increased usage of lidocaine infusions, patients can also experience a reduction in the negative side effects that are associated with opioid administration States (Eipe, Gupta, & Penning, 2016). Lidocaine

can also help anesthesia providers better address the addiction and mental health issues that are present in society (Egan, 2019). This medication offers patients a safer and more pleasant surgical experience when compared to opioid monotherapy (Eipe, Gupta, & Penning, 2016).

Purpose, Objectives, and Goals

The purpose of this project is to increase anesthesia provider knowledge of IV lidocaine, elicit a practice change by providing virtual education and a robust simulation scenario on the usage of lidocaine infusions, and show the clinical significance of the practice change. Knowledge of lidocaine infusions was measured using pre- and post-educational surveys. These surveys determined whether anesthesia providers' knowledge and willingness to change clinical practice was modified after the educational module.

There were multiple objectives with this project. The main objective was to educate anesthesia providers on the importance of lidocaine infusions as a multimodal technique to combat the current opioid crisis. Another objective was to educate anesthesia providers on how lidocaine infusions can help increase patient safety. The last objective was to determine if a multimedia simulation-based educational intervention increases knowledge on lidocaine infusions and persuades anesthesia providers to make a practice change. A goal was established to have at least 50% of the participants who viewed the module report a willingness to make a practice change on the post-survey.

Chapter II

Search Methodology

A literature review was completed to identify relevant information on intraoperative lidocaine infusions and their role within anesthesia patient safety. Research that contained evidence which supports the use of EBP educational video modules to disseminate practice recommendations was also researched to demonstrate the efficacy of virtual education on anesthesia providers. The Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCO host, Oxford University Press, Google Scholar, Wiley, ScienceDirect, Ovid, PubMed, SAGE Journal, and the Cochrane library databases were all utilized. The results were filtered to only include contemporary works, and they were then sorted by relevance.

The terms inserted into the database search engines for multimedia EBP education were *e-learning, video, modules, EBP,* and *guidelines*. To gather information for intraoperative lidocaine infusion investigation, the keywords *lidocaine, infusions, intraoperative, anesthesia, multimodal,* and *opioid-sparing* were searched. Although results were filtered by relevance and date, landmark studies were also considered if applicable to the PICO question. Pieces that failed to answer the PICO question or did not provide supporting background evidence were excluded. All products of the search results were critiqued and appraised. Upon final review of the search results after appraisal, a total of approximately 30 articles were selected to support the project.

Available Knowledge

The collaboration between practitioners and researchers is what makes it possible to translate evidence-based findings into use for the improvement of healthcare practices (Rosswurm & Larrabee, 1999). By utilizing convenient and effective methods to educate today's anesthesia clinicians during pandemic times, it is the hope to connect the gap that exists for

anesthesia providers between evidence and clinical practice to increase patient safety. Education is a crucial step towards the integration of new standards and techniques in the clinical setting for providers to utilize and incorporate into their practice (Plemmons et al., 2019).

E-learning is a platform that incorporates the use of multimedia platforms such as videos and animations into the translation of information (Rouleau et al., 2019). Although it is a relatively newer field within the nursing profession, it has been shown that learners who utilize it are satisfied with its platform and agree that it increases their knowledge and confidence (Rouleau et al., 2019). E-learning can prove to be an effective way of translating EBP findings into current practice for both new and experienced providers (Elkman, 2018). Since the COVID-19 pandemic has decreased in-person instruction and often made it impossible, virtual learning is an effective and enjoyable approach to present information in a safe and convenient way (Agarwal & Kaushik, 2020).

Intraoperative Lidocaine Infusions

IV lidocaine infusions used during the intraoperative period can be beneficial when used as an adjunct to general anesthesia for multimodal purposes, increasing positive patient outcomes, and decreasing opioid requirements. Lidocaine is a simple medication that has a broad safety profile for intraoperative use by anesthesia providers (Weibel et al., 2016). Pain is regarded as one of the most unwelcomed consequences of surgical procedures. Over the past twenty years, adjunctive agents such as lidocaine have been further studied to understand their benefit for controlling operative pain and decrease intraoperative opioid requirements. Research supports the use of IV lidocaine for pain control (Eipe, Gupta, & Penning, 2016). Meta-analysis of randomized controlled trials (RCTs) offers data that lidocaine infusions decrease postoperative pain scores and opioid requirements (Li et al., 2018). As much as a 50% decrease

in morphine requirements were experienced with patients receiving IV lidocaine (Eipe, Gupta, & Penning, 2016).

Acute surgical pain is not the only task an anesthesia provider must treat. Often, a difficult part of operative analgesia is pain control in patients who have chronic pain. IV lidocaine infusions have been used to control pain in this patient population and decrease opioid requirements (Bailey, Corcoran, Schug, & Toner, 2018). The medication also serves to reduce the development of chronic postsurgical pain (Bailey, Corcoran, Schug, & Toner, 2018).

Constipation is a common side effect associated with administration of opioids (Nagelhout & Elisha, 2018). Evidence supports the use of IV lidocaine infusions to improve this problem. Since lidocaine will decrease overall opioid requirements, patients will experience the first bowel movement more quickly after surgery and return to normal bowel function in a timelier manner (Moeen & Moeen, 2019). IV lidocaine is associated with quicker return of normal bowel sounds, first flatus, return to regular diet, and first defecation after surgery when compared to control groups who did not receive opioids and relied primarily on opioids for pain control. Differences on average of 10% improvement were experienced for each category (Moeen & Moeen, 2019). For example, in colorectal surgery patients, an average first bowel movement was 9.54 hours sooner with patients who received IV lidocaine infusions when compared to a control group receiving alternatives (Cooke et al., 2019).

In addition, IV lidocaine improves several other unwanted side effects of opioids such as nausea and vomiting, ileus, and pruritis (Li et al., 2018). Each of these side effects are secondary problems in the operative setting when compared to pain, but they can create a negative experience for the patient. When effects such as these are eliminated or decreased, the patient

can progress in a timelier fashion and recovery is more efficient. Adverse patient effects such as aspiration can also be avoided (Li et al., 2018).

With the ability to decrease pain scores, opioids requirements, and negative side effects associated with opioid administration, IV lidocaine creates a multidimensional tool for anesthesia providers when used in the intraoperative period (Ventham et al, 2015). When these factors are taken into consideration, lidocaine infusions are associated with a decrease in length of stay of combined procedures by an average of 1.1 days (Eipe, Gupta, & Penning, 2016). It can be also inferred that when patients are able to leave the hospital earlier and maintain higher levels of comfort in terms of pain, satisfaction scores will increase and it will translate to overall savings in money for the hospital (Eipe, Gupta, & Penning, 2016).

Despite its benefits for outcomes, anesthesia providers must still remain vigilant when using lidocaine infusions to keep patients safe and prevent toxicity. To best understand the safety profile of lidocaine, serum levels of the drug must be assessed in subjects' blood. A safety profile defines the pharmacology, therapeutic effects, and adverse effects of a drug (Nagelhout & Elisa, 2018). When serum lidocaine levels rise above 5 mcg/mL, toxic levels may appear. A toxic level of lidocaine can bring forth harmful effects. The first signs of toxicity typically experienced are neurological symptoms such as tinnitus or metallic taste in the mouth. Advanced toxic symptoms associated with higher serum levels of lidocaine are cardiovascular symptoms, seizures, coma, and even death (Eipe, Gupta, & Penning, 2016).

To assess serum lidocaine levels, a study was performed in bariatric surgery patients when patients' blood was assessed after receiving a 1.5 mg/kg lidocaine bolus followed by an infusion of 2 mg/kg/hr intraoperatively based on ideal body weight (IBW). After skin closure, the infusion was decreased to 1 mg/kg/hr IBW and continued postoperatively. No patients

experienced toxic levels of serum lidocaine in this study. The median serum concentration was 1.45 mcg/mL. The highest value from the studied categories was at the end of the 2 mg/kg/hr IBW infusion, which was 1.96 mcg/mL. The drug is considered safe when the recommendations for usage are followed (Carabalona et al., 2020).

Literature Conclusion and Limitations

Intraoperative lidocaine infusions are an important part of multimodal anesthetic usage to lower total opioid requirement, improve patient outcomes, and increase patient safety profiles (Eipe, Gupta, & Penning, 2016). To translate these EBP recommendations into practice, researchers and providers must collaborate via educational intervention to exchange information (Rosswurm & Larrabee, 1999). During the COVID-19 pandemic, virtual learning and education has become more widely used. E-learning has been reported by learners as being both an enjoyable and effective means of knowledge acquisition (Agarwal & Kaushik, 2020).

Although convincing evidence exists on the benefits of intraoperative lidocaine infusions and virtual education, literature limitations exist. The biggest limitations surround the process of getting experienced providers with a busy schedule to make a practice change. The literature did not include information on providers' willingness to incorporate new ideas into an established practice. Information on virtual learning included only individuals who are currently in an established schooling system such as a university. The literature failed to address people who are not full-time students. To combat the literature limitations surrounding provider willingness to incorporate new techniques, the project presented convincing information and EBP recommendations in combination with a convenient learning platform to offer the best chance at anesthesia provider integration of the findings for clinical innovation.

Chapter III

Theoretical Framework

In a technology-driven era, the rapid advances in technology and accessibility enable the development of a broad range of instructional multimedia (Rudolph, 2017). Instructional designers, multimedia designers, and instructors are challenged with finding a balance between the technology and multimedia that fosters meaningful learning (Mayer, 2005; Rudolph, 2017). The Cognitive Theory of Multimedia Learning (CTML) is a theoretical framework that helps to create meaningful learning by structuring multimedia "in light of how the human mind works (Mayer, 2005)."

The three major assumptions of how the human mind work in CTML are: dual channels, limited capacity, and active processing (Mayer, 2005; Rudolph, 2017). Mayer (2005) noted that humans process information presented in dual channels as auditory/verbal channels and a visual/ pictorial channel. With this information, the learner integrates the new information into working memory (Rudolph, 2017). Since these channels' capacity is limited, learners are forced to allocate their cognitive resources to build connections between pieces of new information and existing knowledge (Mayer, 2005). Active learning involves selecting, organizing, and incorporating information with previous experience as well as filtering extraneous details not relevant to core materials presented. Through active processing, people learn and convey information more efficiently from a combination of words, animations, audio, and pictures than words alone (Mayer, 2005; Rudolph, 2017).

To build an effective multimedia module, it is essential to balance the visual and verbal information to engage the learner and minimize extraneous distractions (Rudolph, 2017). The presented material should have a coherent structure and reflect guidance for the learner on

building the structure (Mayer, 2005). Learning outcomes can be measured through retention, recall of information presented, and the ability to understand the information presented to solve new problems (Mayer, 2005). The combination of words and images forms the theoretical basis for CTML because it captures the learners' interest, engages memory, prevents cognitive overload, and stimulates reflection (Rudolph, 2017). The goal of CTML is to demonstrate how words and pictures contribute to a meaningful learning experience.

Relationship of Theory/Framework of Theory

This project incorporated the principles of CTML into the design of the multimedia educational module and outcome assessment. The content was delivered in a format that encompassed the dual-channel processing system of the human mind by combining animation, sounds, images, and words (multimedia principles) (a) to reduce cognitive loads and (b) to make the four evidence-based topics presented clearly understandable to anesthesia providers. The educational module was designed to capture anesthesia providers' attention focused on the four topics and engage them in cognitive processing while integrating it with prior knowledge activated from long-term memory.

The presentation incorporated the fundamental principles of effective instructional multimedia elements, such as (1) redundancy, (2) signaling, (3) segmentation, (4) animation vs. static images, (5) control, (6) interactivity, and (7) engagement/feedback (Rudolph, 2017). The information was succinctly presented to avoid redundancy and was segmented into individual patient safety topics. Signaling was used to highlight key points to help facilitate the learner's allocation of cognitive resources. Patient safety points were animated to facilitate a mental representation of the content (Rudolph, 2017). The control element was incorporated by allowing the viewer to go back, pause, and advance to the next topic at their own pace. Participants were

also asked to answer questions related to key points and advance to the next topic to incorporate the elements of interactivity and engagement. The integration of content into a patient scenario was used to help the learner build a coherent example of topics that would be experienced within clinical practice. The outcomes assessment was employed to evaluate the learner's retention and transfer of information presented in the module to demonstrate the effectiveness of a multimedia educational module on best practices of anesthesia patient safety.

With recent studies showing cohesive moderate-to-large-effect sizes, each of these principles has been shown to have a significant impact on knowledge and willingness to adopt evidence-based findings (Shanim, 2018; Unk & Brasington, 2014). Because of its foundation in fostering meaningful learning, CTML principles were used as a heuristic guide for the simulation-based education module.

Chapter IV

Project Design

A project to increase the usage of multimodal intraoperative lidocaine infusions was initially intended to be carried out at a clinical site where the stakeholders were supportive. The stakeholders included the Chair of the Anesthesia Department, the Chief CRNA, and staff CRNAs who voiced interest in learning about this technique. The Chair of the Anesthesia Department and Chief CRNA indicated that the anesthesia providers at the site were not utilizing lidocaine infusions per anecdotal conversations and lack of infusion documentation in the intraoperative electronic medical record (EMR). The original project was to develop an educational intervention for anesthesia providers about the dangers of the opioid epidemic, the benefits of multimodal lidocaine infusions, and recommendations for intraoperative lidocaine infusion usage. However, due to the COVID-19 pandemic, this made DNP projects difficult to be implemented at clinical sites.

Acknowledging that education about intraoperative lidocaine was still important for anesthesia providers, this DNP project was then transitioned as a virtual platform with other senior SRNAs at Cedar Crest College. A simulation-based educational module was created to incorporate the original DNP projects of the SRNAs from other respective clinical sites. In this module, each SRNA provided a solo recorded educational discussion on his individual topic. The benefits, recommendations, contraindications, and miscellaneous facts were portrayed about intraoperative lidocaine infusions in this video segment, in addition to discussion on the impact of the opioid epidemic. After the educational discussions, a robust simulation scenario was performed and recorded on camera to demonstrate the uses and importance of each SRNA DNP

topic. A comprehensive video module was then compiled for anesthesia providers to view for the goal of increasing knowledge and creating practice changes.

Once the video module was recorded on a handheld camera, Davinci Resolve 16 software was used for film creation. This software allowed for video trimming, editing, and ability to create the comprehensive educational module. A WIX website was then created to act as the main site for the educational module. The WIX website contained the educational film, pre-survey, post-survey, instructions for project participation, contact information for the authors, and other miscellaneous information. Miscellaneous information included anonymity proclamation and the option to opt out of the project at any time up until submission of the post-survey. Pre/post-surveys were created via the SurveyMonkey platform. At no time during participation were participants asked to input identifiable information, thus guaranteeing anonymity. Participants were e-mailed a recruitment letter that contained the link to the WIX website along with instructions for participation. The educational module and website were reviewed and approved by DNP faculty and CRNA project chairs.

Each DNP student from the module completed Collaborative Institutional Training Initiative (CITI) training. Expedited institutional review board (IRB) approval was requested from Cedar Crest College on May 28, 2020. Approval was granted by the DNP committee. The project creation was then started on August 26, 2020.

Implementation Plan

An evidence-based approach enables healthcare professionals to close the gap between basic research and its translation into clinical practice to optimize patient outcomes. Without translational research, existing practice becomes obsolete and may negatively impact patient outcomes. The implementation of processes and procedures is broken down into four phases: (1)

creating awareness and interest, (2) building knowledge and commitment, (3) promoting action and adoption, and (4) pursuing integration and sustained use (Iowa Model Collaboration, 2017; Cullen et al., 2018).

Creating awareness and interest is also known as pre-planning phase because it involves cultivating a spirit of inquiry, identifying clinical problems/conducting a needs assessment, and collecting and appraising the best evidence that supports a practice change. These three subphases were operationalized pre-COVID-19 within each DNP student's clinical site. The needs assessment was conducted by anecdotal conversations with key stakeholders and EMR documentation evaluation by stakeholders. To overcome barriers in implementing the practice change, the DNP students employed change agents and champions to spread the word about the EBP's advantages and its impact on healthcare. Utilizing this strategy helped highlight the institution's unique culture and incentive for change among key stakeholders, organizational leaders, and clinicians (Cullen et al., 2018). Lastly, the investigation into utilizing knowledge brokers (Chief Anesthesiologists and Chief CRNAs) at each clinical site helped highlight the institution's support for EBP, available resources, institutional barriers, and the necessary partnerships required to bring about a sustainable institutional change.

After the awareness and interest phase has been established, the second phase of implementation began. Building knowledge and personal commitment were operationalized via teamwork after a gap analysis was conducted and an action plan was developed. For this phase, the pinnacle accolade was the delivery of education via a multimedia simulation-based module and dissemination of credible evidence with a clear implication for clinical practice. The educational module was designed to obtain clinician input and inform today's clinicians on contemporary evidence-based practice recommendations that were not implemented within the

DNP students' clinical settings. Since the clinical problem and needs assessment was conducted at the DNP students' primary clinical sites, it was concluded that anesthesia providers at each of those clinical sites should be invited to participate in the module. Adopting this approach helped secure buy-in, stimulate commitment, promote action and adoption, and provide an essential foundation for optimizing knowledge synthesis on the four DNP topics.

After building knowledge and personal commitment, the third phase of implementation (promoting action and adoption) started. Given this research project's design, it limits the number of interventions that can be operationalized to promote action and adoption within the clinical setting without developing a protocol or purchasing required monitors. However, it is imperative to adopt implementation strategies that promote action and adoption of the evidence-based recommendations. The educational module offered proof and evidence-based data for providers to support the recommendations on the four DNP topics and convince providers to make a practice change. Implementation strategies also adopted to promote action and adoption included the DNP students functioning as role models at various clinical sites, advocating for practice change, reporting updates on the study findings, and e-mailing educational handouts to providers. These strategies created awareness, promoted adoption and enthusiasm, and garnered support for the practice change (Melnyk, & Fineout-Overholt, 2018).

The final phase of the implementation processes and procedures included pursuing integration and harnessing the sustained use of evidence-based practices. To promote sustained integration of the practice change, the post-survey included questions related to the participants' willingness to change their practice. Due to the project's methodology, it was not feasible to determine whether the participants definitively made a practice change, given those findings would be outside this project's scope. Despite this, it was still imperative to provide information

about the project and the clinical practice recommendations to all stakeholders. The DNP students functioned as peer influencers and transformational leaders throughout the project's development to deter providers from falling back into old ways or avoiding EBP recommendations. To promote integration and sustained use, educational handouts were included on the website for future reference to supplement the educational module.

Data Collection Tool

The pre-survey and post-survey were used to collect data from the module since surveys are a dependable means to assess knowledge acquisition (Polit & Beck, 2017). Melnyk and Fineout-Overholt's (2018) principles for creating reliable and valid measurement tools were followed to ensure a legitimate tool was created. These surveys were also submitted during the Cedar Crest College IRB proposal. They received approval from the IRB panel and DNP project chairs.

The pre-survey and post-survey both consisted of 10 questions (Appendix A). The pre-survey consisted of two demographic questions to determine participant title (anesthesiologist, CRNA, or SRNA) and experience level. Two questions per module were then asked to quantify baseline knowledge on the topics. In the post-survey, questions were asked to determine knowledge acquisition and likelihood of a practice change after module completion. A conclusion was able to be made from the surveys on whether providers gained knowledge on intraoperative lidocaine infusions and if they will utilize them in their practice during the intraoperative period for multimodal purposes.

Resources Needed

To carry out this project, several resources were required to research, create, implement, and disseminate the information on lidocaine infusions. Research was completed on a personal

laptop computer and with Cedar Crest College resources. Online databases, librarians, and library facilities from the Cressman Library were responsible for providing the scholarly information presented in the project. Computer applications such as Microsoft Office, Outlook e-mail, and Microsoft TEAMS allowed for project presentation and processing. Virtual meetings on Microsoft TEAMS were especially important during the COVID-19 pandemic.

Many high-fidelity simulation assets were utilized from Cedar Crest College. The simulation center at the college, which included all necessary equipment for demonstration of intraoperative usage of lidocaine infusions, was used for filming. Materials included at the simulation center included mannequins, patient monitoring equipment, simulation medications, and anesthesia equipment. The simulation director and simulation technician were also utilized and consulted for simulation center reservation and utilization needs.

The filming and editing required additional technological resources. Along with the high-technological equipment found at the Cedar Crest College simulation center, filming of the module was done on a handheld camera and with SIM-IQ. SIM-IQ is a college resource that allows for overview filming of an entire simulation experience. The combination of the handheld camera and SIM-IQ technology allowed for a multiangle filming process of the robust simulation scenario.

Once the module was recorded, Davinci Resolve 16 was used to edit and create the film to be distributed to anesthesia providers. Davinci Resolve 16 is a video editing application that allows for color correction and video trimming. This platform allowed for video selection, combination, and cutting of video scenes provided by the handheld camera and SIM-IQ technology. After the video was created, a WIX website was created to house the video, pre/post surveys, and educational materials on the topics.

Budget Justification

Many materials and resources such as the simulation center, simulation equipment, academic databases, and library services were provided by Cedar Crest College and were included in student tuition. Materials for filming and editing such as the handheld camera and personal laptop were previously owned from personal expenses. Personnel such as DNP committees, DNP project chairs, and simulation staff did not require personal compensation as they were Cedar Crest College staff.

Some items and resources required purchase to carry out the project. The WIX website required an upgraded annual subscription of $114.48 to fulfill the needs of the project. To disseminate the findings, a poster presentation of the module was created and disseminated at Cedar Crest College and the Eastern Nursing Research Society (ENRS) scientific session in the Spring of 2021. ENRS membership cost $75 and registration for the conference came with a $175 fee.

Chapter V

Implementation Procedures and Processes

The implementation of this project took place via e-mail recruitment of prospective anesthesia professionals (i.e., anesthesiologist, CRNA, SRNA) from established clinical sites and a peer-network of professional contacts. The recruitment e-mail (Appendix C), with transmittal heading of *"Evidence Based Practices of Anesthesia Patient Safety,"* contained a brief description of the project, informed consent to participate in the project, instructions to complete the SurveyMonkey© pre/post-surveys, a link to the educational module website, and contact information for the project's authors. Participants were notified that their participation in the project was anonymous. The educational module website was available to participants for a two-week period and participants had the option to decline participation in the project until the final submission of the post-survey.

The educational module was delivered in an online on-demand format with an estimated completion time of one hour. The module consisted of introduction, four 10-minute EBP presentations on each topic of anesthesia patient safety, a 12-minute high fidelity simulation scenario, and a conclusion. Participants were instructed to view each of the four EBP topics prior to viewing the simulation. Materials for each topic were available for download from the educational module website to supplement the content delivered in the module and for future reference.

After completion of the educational module, participants were instructed to complete the post-survey. Data collected from the pre/post-surveys were tracked via SurveyMonkey©. Statistical Package for the Social Sciences (SPSS) v.17 was used to further analyze the data and acquire statistics. A descriptive statistic was used to measure the change in

knowledge by comparing each participant's pre-survey and post-survey. SPSS v.17 was also used for knowledge-based question and comprehensive module data.

Chapter VI

The project had an implementation period that spanned two weeks from January 23, 2021 to February 5, 2021 to acquire data to answer the project's PICO question. This two-week period allowed for adequate time for participants to view the education modules and robust simulation scenario and answer pre/post surveys. Although contact information for the principal investigators was listed in the recruitment e-mail and project website, no questions or concerns were raised by participants at any time during the implementation period.

Demographics

The recruitment e-mail was sent to 40 anesthesia providers. Of the 40 providers who were invited, 24 providers (60%) were full participants in the project. Two questions on the pre-survey were participant demographic questions to determine position (anesthesiologist, CRNA, or SRNA) and years of experience. It was discovered that four participants were anesthesiologists (16.67%), 12 were SRNAs (50%), and 8 were CRNAs (33.33%) (Appendix D). The pre-survey data also indicated that 16 providers had an average of 0 – 5 years of experience (66.67%), five had 6 – 10 years of experience (20.83%), and three had 11 – 15 years of experience (12.50%) within the anesthesia field (Appendix E).

Evaluation

To evaluate the efficacy of the multimedia module, a comparison was made on the pre/post surveys (Appendices A and B) to determine whether the anesthesia providers acquired knowledge and indicated a willingness to institute a practice change after module participation. A question on the pre-survey was asked to identify the number of providers who were currently utilizing intraoperative lidocaine infusions. A knowledge-based question on the pre-survey the asked, "What is the recommended infusion rate for multimodal intraoperative lidocaine

infusions?" This same question was then asked on the post-survey for comparison to the pre-survey to determine if providers gained knowledge from the education and were able to identify the correct recommended infusion rate from literature for intraoperative lidocaine infusions. Another question on the post-survey asked, "Are you willing to change your practice based on the information you were presented about multimodal intraoperative lidocaine infusions?" This question provided a measurement for the possibility of anesthesia providers incorporating the information from the module on intraoperative lidocaine infusions into their practice for multimodal use.

Outcomes

Of the 24 participants, 8 providers (33.33%) indicated that they used intraoperative lidocaine infusions in their practice prior to participating in the module (Appendix G). After viewing and participating in the module, all 24 participants (100%) indicated that they would be willing to utilize the presented information and make a practice change based on the education received (Appendix F). On the pre-survey, 12 participants (50%) were able to properly identify the correct recommended infusion rate for intraoperative lidocaine infusions. After the educational module, all 24 participants (100%) were able to answer the post-survey question correctly on the recommended infusion rate for intraoperative lidocaine infusions.

To further analyze pre/post survey data acquired for lidocaine infusions, McNemar's test was performed with SPSS v.17. There were 8 correct (33.33%) answers on the pre-survey and 24 correct (100%) on the post-survey that measured knowledge acquisition on recommended intraoperative lidocaine infusion rates. Analysis (Appendix H) with McNemar's test claims statistical significance with $p < 0.001$.

To better analyze comprehensive data for all topics of anesthesia patient safety, statistics were performed on all knowledge-based questions from the module to help determine efficacy of the module as an educational platform (Appendix I). A total of 6 questions were determined to be knowledge-based questions from the combined modules of anesthesia patient safety: corneal abrasion prevention, timing and dosing of reversal agents, quantitative neuromuscular monitoring, and intraoperative lidocaine infusions. There was a total of 90 (62.5%) correct answers and 54 (37.5%) incorrect answers on the pre-survey. There was a total of 128 (88.9%) correct answers and 16 (11.1%) incorrect answers on the post-survey. Odds ratio statistics from SPSS v.17 show a value of 4.800 (95% CI [2.538-8.919]) for pre-survey to post-survey data (Appendix J). A paired t-test was used to evaluate the collective correct responses in pre/post survey of knowledge-based question pairs. Sample mean for pre-survey = 14; sample mean for post-survey = 21.33. Observed difference of 7.33 was tested and resulted a $p = 0.0218$.

Comprehensive data was also gathered for the entire module on willingness to create a practice change. Post-survey questions 1, 4, and 7 (Appendix B) asked about willingness to incorporate information from the educational module into practice. With 24 participants, a total of 72 questions on willingness to make a practice change was asked on the post-surveys. Participants answered “yes” all 72 times. There was a 100% reported willingness to make a practice change based on information presented in the module for anesthesia providers.

Discussion

With the opioid epidemic greatly harming the world’s population and opioid administration during the intraoperative period contributing to the problem, education on multimodal intraoperative lidocaine infusions is needed for anesthesia providers to increase patient safety (CDC, 2020; Egan, 2019). Since virtual learning sessions have been reported as

both effective and enjoyable, a multimedia educational module was created to increase anesthesia provider knowledge and help institute a practice change for the incorporation of intraoperative lidocaine infusions (Agarwal & Kaushik, 2020). The virtual platform proved to be invaluable during the COVID-19 pandemic as in-person instruction was not possible. Data was gathered during the project implementation period to determine whether the module was effective for achieving those two objectives.

It was concluded that the educational module was effective for both increasing provider knowledge and creating a practice change. During the pre-survey, 12 out of 24 (50%) module participants were able to correctly answer the knowledge-based question of intraoperative lidocaine infusions. On the post-survey, 24 out of 24 (100%) of participants were able to correctly answer the knowledge-based lidocaine question after receiving completing the educational module and simulation videos. Although 8 out of 24 (33%) of participants claimed to use intraoperative lidocaine infusions in their practice prior to module participants, 24 out of 24 (100%) noted on the post-survey to be willing to incorporate the information presented on lidocaine infusions into their anesthesia practice. This data is indicated of both knowledge acquisition and willingness to institute a practice change for lidocaine infusions.

When looking at comprehensive data, the average score of correct answers on the pre-survey knowledge-based questions for all topics of anesthesia patient safety was 62.5%. On the post-survey, the average score of correct answers was 88.9% for all knowledge-based questions. Odds ratio statistics (Appendix J) showed a 4.8 times greater probability of a participant choosing the correct answer on the post-survey after receiving education. 100% of participants reported a willingness to institute a practice change for all the patient safety topics. This was also indicative that the module successfully provided education and instituted practice changes for all

topics of anesthesia patient safety. Although SPSS v.17 provided statistics on the data using McNemar's test and odds ratio, statistical significance was not possible due to a small convenience sample size being used. However, clinical significance was possible with the conclusion from the data that providers were able to increase knowledge and showed a willingness to make a practice change. Clinical significance is crucial within anesthesia and healthcare since the EBP recommendations can be inferred to increase positive patient outcomes (Polit & Beck, 2017).

The module proved to be successful in achieving its goal set prior to the implementation period of having at least 50% of participants indicate the willingness to make a practice change for intraoperative lidocaine infusions on the post-survey after completing the module. Since intraoperative lidocaine infusions have evidence to improve patient outcomes and reduce opioid usage and requirements, it can be inferred that this module was effective to combat the opioid epidemic and educate anesthesia providers on lidocaine infusions. This project was also able to reach and educate a convenience sample of anesthesia providers. The providers indicated a willingness to incorporate the education into practice.

Although this process was implemented smoothly, improvements could be made if the process were to be repeated. Additional knowledge-based questions could be added for each topic of anesthesia patient safety to better assess the module's ability to educate providers. A scaled level of measurement for willingness could also be used to measured practice incorporation instead of "yes" or "no" to better assess degree of educational impact. Despite improvements being possible, the knowledge bestowed by the virtual module during pandemic times will help participants improve anesthesia patient safety and keep anesthesiology one of the leaders in the patient safety realm (Botney, 2008).

Chapter VII

Implications for Practice

Advanced nursing providers including CRNAs and SRNAs along with anesthesiologists can utilize the education received from the module to improve patient outcomes and safety. Intraoperative lidocaine infusions have been shown to increase positive patient outcomes by lowering opioid requirements, decreasing pain scores, and decreasing side effects of opioid administration (Eipe, Gupta, & Penning, 2016). Participation in this educational module will broaden anesthesia providers' knowledge of IV lidocaine and encourage the providers to incorporate IV lidocaine into practice, thus improving patient care. The findings from the project concluded that anesthesia providers who participated in the educational presentation showed a willingness to incorporate lidocaine infusions into practice.

Since the IOM has set a goal to have 90% of clinical decisions made by providers backed by research and evidenced-based findings, this DNP project helps the healthcare field work towards that goal (Lehane et al., 2019). The premise behind this project was to insert evidence-based findings into practice to improve outcomes and show clinical significance. Since intraoperative lidocaine infusions are positively supported by research, the technique assists in reaching the IOM goal. Clinical decisions by providers that are supported by evidence-based findings will be safer and more effective for patients (Lehane et al., 2019).

With the United States consuming a large percentage of the world's opioids and experiencing an opioid epidemic, careful consideration during opioid administration is paramount for anesthesia providers (CDC, 2020; Rose, 2017). IV lidocaine infusions can spare opioid use and decrease the negative sides effects and possibility of opioid addiction when compared to opioid monotherapy (Eipe, Gupta, & Penning, 2016). Participation in the

educational module by anesthesia providers will encourage the usage of lidocaine infusions for multimodal purposes. This will lead to a safer, more balanced anesthetic technique that relies less on opioids for pain control. This will allow anesthesia providers to play a major role in combating the opioid epidemic.

Strengths and Limitations of the Project

A major strength of this project was the convenience and accessibility of the virtual education module. During the COVID-19 pandemic, providers faced incredible stress and busy schedules. Face-to-face learning was also not possible. The virtual learning platform allowed education to continue during the COVID-19 pandemic and at the convenience of the provider.

Another strength of the project was the accommodation of different learning styles. The WIX website provided verbal instruction, a realistic simulation scenario, and information written as text on the topics of anesthesia patient safety. These multiple platforms provided different routes to address the preferences of how an individual learns and retains information to allow for the best opportunity for the material to be translated into practice. The WIX website also allows for topic information to be stored and disseminated to providers in the future.

Since anesthesia patient safety is important, it is crucial to reach anesthesia providers of all types and experience levels. Another strength of this project was being able to accomplish this and reach a diverse group of anesthesia providers. Every type of provider (anesthesiologist, CRNA, and SRNA) and experience level (0 – 15 years) participated in the educational module. The module created a strong platform that was able to encourage a practice change for all providers and levels of experience.

Although the project possessed strengths, there were also weaknesses. One weakness was the small convenience sample for data collection. Due to this limitation, it is not possible to generalize the findings of the DNP project or obtain statistical significance.

Since the module was virtual and recorded, participants were unable to ask questions in real-time. Although none of the DNP authors were contacted about questions at any time, participants may have failed to ask questions or raise concerns due to a lack of convenience or inaccessibility of the authors. Questions may have been more likely if instruction was held in-person and authors were readily available.

Finally, the implementation period only spanned two weeks. Two weeks gave providers time to participate, however a longer period may have encouraged more participants. More participants could have led to a larger clinical impact.

Linkage to DNP Essentials

The DNP Essentials (Appendix K) aim to guide DNP education and practice. These essentials are critical for the advancement of the profession. Therefore, it is important to incorporate the essentials when instituting EBP recommendations (AACN, 2006). The DNP project used these essentials as guidance throughout planning, implementation, and evaluation. DNP essentials I through VIII were referenced throughout this process.

- Essential I – Scientific Underpinnings for Practice: Contemporary research and literature were used to support and recommend practice methods for intraoperative lidocaine infusion usage. Safe and effective dosages of IV lidocaine were supplied from evidence-based research, and a compelling reason for a practice change was given to providers through data from literature.

- Essential II – Organizational and Systems Leadership for Quality Improvement and Systems Thinking: Recommending EBP changes to anesthesia practice to increase patient safety was a premise behind this project. By considering the needs of the target population and providers who care for them, providing a pathway to increase the usage of intraoperative lidocaine infusions will lead to quality improvement during the perioperative period.
- Essential III – Clinical Scholarship and Analytical Methods for Evidence-based Practice: This project connected providers to a new technique to improve patient outcomes. The application of the evidence-based findings for lidocaine infusions into practice allows for problems to be solved and health outcomes to improve for patients.
- Essential IV – Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care: The virtual learning system employed by this project created a technological means of education for anesthesia providers. The web-based educational module and robust simulation scenario utilized technology as a convenient means to translate EBP and improve patient outcomes.
- Essential V – Health Care Policy for Advocacy in Health Care: Educating providers on the usage of lidocaine infusions for anesthesia patient safety provided the opportunity to advocate for health policy. Increasing knowledge and eliciting practice changes on topics of anesthesia patient safety influences patient care and foster positive patient outcomes.
- Essential VI – Interprofessional Collaboration for Improving Patient and Population Health Outcomes: The unification of all providers of anesthesia allowed this project to effectively collaborate interprofessional efforts for the improvement of patient safety. This project was able to educate anesthesiologists, CRNAs, and SRNAs on the

importance of lidocaine infusions to spare opioid usage, improve patient outcomes, and increase anesthesia patient safety.

- Essential VII – Clinical Prevention and Population Health for Improving the Nation's Health: Increasing the usage of intraoperative lidocaine infusions promotes risk reduction from the side effects of opioids and possible mental health drawbacks of substance addiction. Since lidocaine is an alternative drug that can assist in combating the opioid epidemic, increased usage during the intraoperative period can improve the health outcomes of the surgical patient and prevent/decrease opioid side effects.
- Essential VIII – Advanced Nursing Practice: Utilization of new evidence-based findings allows for provider growth and improved practice. The premise behind this project was to create clinically significant education for anesthesia providers to acquire new knowledge and incorporate lidocaine infusions into their practice to enhance patient outcomes.

Chapter VIII

Summary and Conclusions

With the United States facing an opioid crisis, multimodal anesthetic techniques such as intraoperative lidocaine infusions have been used to reduce opioid consumption and decrease the negative side effects associated with opioid administration (CDC, 2020; Eipe, Gupta, & Penning, 2016). The translation of EBP findings related to IV lidocaine into practice will increase patient safety and outcomes by educating providers on best practices (Young et al., 2014; Walczak et al. 2010). Multimedia e-learning is an effective and convenient educational platform to translate EBP recommendations into practice (Rouleau et al., 2019). Anesthesia provider education and incorporation of intraoperative lidocaine infusions into practice can increase patient safety, lower opioid consumption, and improve patient outcomes (Eipe, Gupta, & Penning, 2016).

The purpose of this DNP project was to educate providers on the benefits of intraoperative lidocaine infusions based on EBP recommendations for patient safety. It was also the hope to increase provider willingness to incorporate IV lidocaine into practice. The goals of this project were accomplished by utilizing the CTML framework and providing a virtual education module based on how the human mind best learns (Mayer, 2005). Based on pre/post survey analysis and statistics, the project was successful in achieving its goal of educating anesthesia providers and creating a willingness to make a practice change for intraoperative lidocaine infusions. It can be then inferred that this project was clinically significant and helped to increase anesthesia patient safety.

Dissemination

The DNP project was disseminated to multiple audiences to best publicize its results. On March 25th, 2021 – March 26th, 2021, the project was disseminated at the Eastern Nursing

Research Society's (ENRS) 33rd Annual Scientific Sessions conference via virtual poster presentation (Appendix L). The poster won 3rd place among DNP posters at the ENRS conference. On April 15th, 2021, the project was also disseminated to students and faculty at Cedar Crest College.

Future Ideas

It is recognized that provider education on EBP recommendations can bring forth practice changes (Rosswurm & Larrabee, 1999). The field of anesthesia will need to be continually updated with evidence-based recommendations to ensure patient safety and positive outcomes (Botney, 2008). Expanding on the use of lidocaine infusions can bring forth additional positive patient outcomes. Continuing IV lidocaine infusions from the intraoperative period to the postoperative period can additionally lower opioid consumption when compared to the intraoperative period alone (Carabalona et al., 2020). A future project idea to expand the use of intraoperative lidocaine infusions and continue their use into the postoperative period can lead to improved patient safety and additional positive outcomes.

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Appendix A

Pre-Survey Questions

1. What is your primary role?
- a. Anesthesiologist
- b. Certified Registered Nurse Anesthetist
- c. Student Registered Nurse Anesthetist

2. How many years have you been practicing?
- a. 0 - 5 years
- b. 6 – 10 years
- c. 11 – 15 years
- d. 16 – 20 years
- e. ≥ 21 years

3. What is your current methodology to assess neuromuscular paralysis? (select all that apply)
- a. Qualitative techniques (i.e. PNS)
- b. Quantitative techniques (i.e. AMG, EMG, KMG)
- c. Physical Assessment
- d. No monitoring

4. What degree of paralysis is present when 4/4 twitches are elicited with a peripheral nerve stimulator?
- a. 90%
- b. 70%
- c. 50%
- d. 30%

5. Do you implement eye protection to patient's corneal prior to or post mask ventilation/laryngoscopy?
- a. Prior to mask ventilation
- b. Post mask ventilation

6. What is the appropriate dose of Neostigmine to reverse a TOFr of 0.5 in a patient who weighs TBW:100kg and IBW:70kg?
- a. 20mcg/TBW
- b. 20mcg/IBW
- c. 40mcg/TBW
- d. 40mcg/IBW

7. What is the ideal TOFr to achieve prior to extubation?
- a. TOFr 0.1
- b. TOFr 0.9
- c. TOFr 0.8
- d. TOFr 0.7

8. What is the recommended infusion rate for multimodal intraoperative lidocaine infusions?
- a. 0 – 1 mg/kg/hr IBW
- b. 1 – 2 mg/kg/hr IBW
- c. 2 – 3 mg/kg/hr IBW

d. Not sure

9. Do you currently use multimodal intraoperative lidocaine infusions in your practice?

a. Yes
b. No

10. Which of the following is not a risk factor for corneal abrasion?

a. Dangling ID badge
b. Pulse oximeter on the index finger
c. Incomplete eyelid closure
d. Taping the eyelid after induction

Appendix B

Post-Survey Questions

1. Are you willing to change your practice based on the information you were presented about corneal abrasion prevention?

a. Yes, I will make changes based on the highlighted evidence-based recommendations
b. No, I will not make any changes

2. Based on the simulation, when is the best time to initiate eye protection?

a. Prior to intubation
b. After induction

3. What is the recommended infusion rate for multimodal intraoperative lidocaine infusions?

a. 0 – 1 mg/kg/hr IBW
b. 1 – 2 mg/kg/hr IBW
c. 2 – 3 mg/kg/hr IBW
d. Not sure

4. Are you willing to change your practice based on the information you were presented about multimodal intraoperative lidocaine infusions?

a. Yes
b. No

5. What is the appropriate dose of Neostigmine to reverse a TOFr of 0.5 in a patient who weighs TBW:100kg and IBW:70kg?

a. 20mcg/TBW
b. 20mcg/IBW
c. 40mcg/TBW
d. 40mcg/IBW

6. What is the ideal TOFr to achieve prior to extubation?

a. TOFr 0.1
b. TOFr 0.9
c. TOFr 0.8
d. TOFr 0.7

7. Are you willing to make a change in your practice based on the information you were presented about timing and dosing of reversal agents?

a. Yes
b. No

8. What degree of paralysis is present when 4/4 twitches are elicited with a peripheral nerve stimulator?

a. 90%
b. 70%
c. 50%
d. 30%

9. What modality is the MOST accurate at depicting the depth of neuromuscular paralysis?

a. Qualitative techniques (i.e. PNS)
b. Quantitative techniques (i.e. AMG, EMG, KMG)
c. Physical Assessment (i.e. HR, Vt, RR, etc.)

d. Sustained head lift for 5 seconds

10. Which of the following is not a risk factor for corneal abrasion?

a. Dangling ID badge
b. Pulse oximeter on the index finger
c. Incomplete eyelid closure
d. Taping the eyelid after induction

Appendix C

Recruitment E-mail

Dear Participant,

One behalf of the Cedar Crest College: School of Nursing and Nurse Anesthesia Program, we are cordially inviting you to participate in a doctoral project proposed by four student registered nurse anesthetists. Our project was unfortunately transitioned from a clinical setting-based implementation to a virtual platform due to today's unprecedented times amidst the COVID-19 pandemic. We ask that you participate in our project to help continuously advocate for implementing evidence-based practice into the clinical setting in order to improve upon anesthesia patient safety practices.

If you choose to voluntarily participate, you can follow the link below to our custom website for our project. Here, there will be a simple 3-step process to follow for participation. **Step 1** will consist of a brief 10-question pre-survey. After completion of the pre-survey, **Step 2** will be to watch our educational module on best practices of anesthesia patient safety. This module consists of four individual topic presentations that are approximately 10 minutes each. After the presentation segment, a robust simulation scenario will be performed. The entire duration of the module is approximately 1 hour. After viewing the module, you can proceed to **Step 3** of participation. Here, a 10-question post-survey will be administered to help us gather pertinent data on this doctoral project. Although this is 100% voluntary, completion and submission of the online survey is an indication of your consent to participate within the project. You can stop participation at any time up until submission of the post-survey during Step 3.

Institutional review board (IRB) approval was obtained prior to the project's implementation. Each DNP student author from the module completed Collaborative Institutional Training Initiative (CITI) training. It is anticipated that participants will be at no physical, psychological, or emotional risk at any time during this research. We assure that all survey data is anonymous and will be collected and stored on an encrypted and password protected electronic device.

Your participation is crucial to the implementation of this project and would be greatly appreciated! Provided below is a link to the website. We hope that you are as interested as we are in advocating for the improvement of evidence-based practices on anesthesia patient safety.

Please feel free to contact any of us with any question, comments, or concerns regarding this project.

WEBSITE LINK:

https://athernan2.wixsite.com/website

Sincerely,

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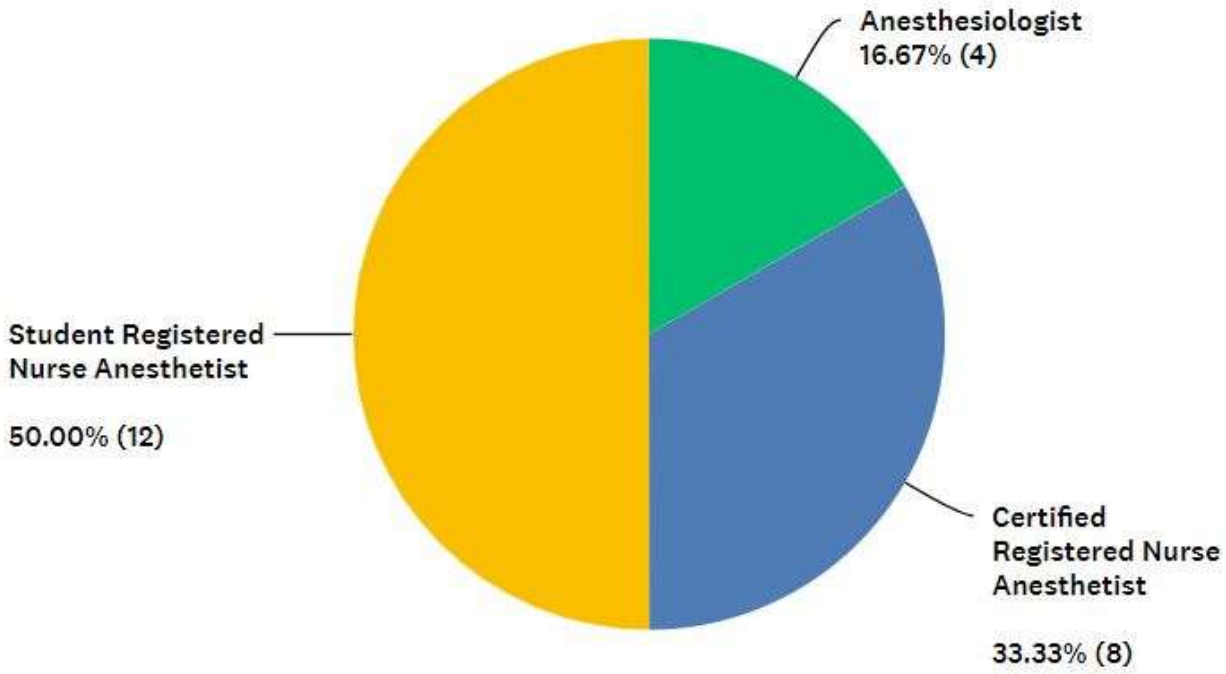
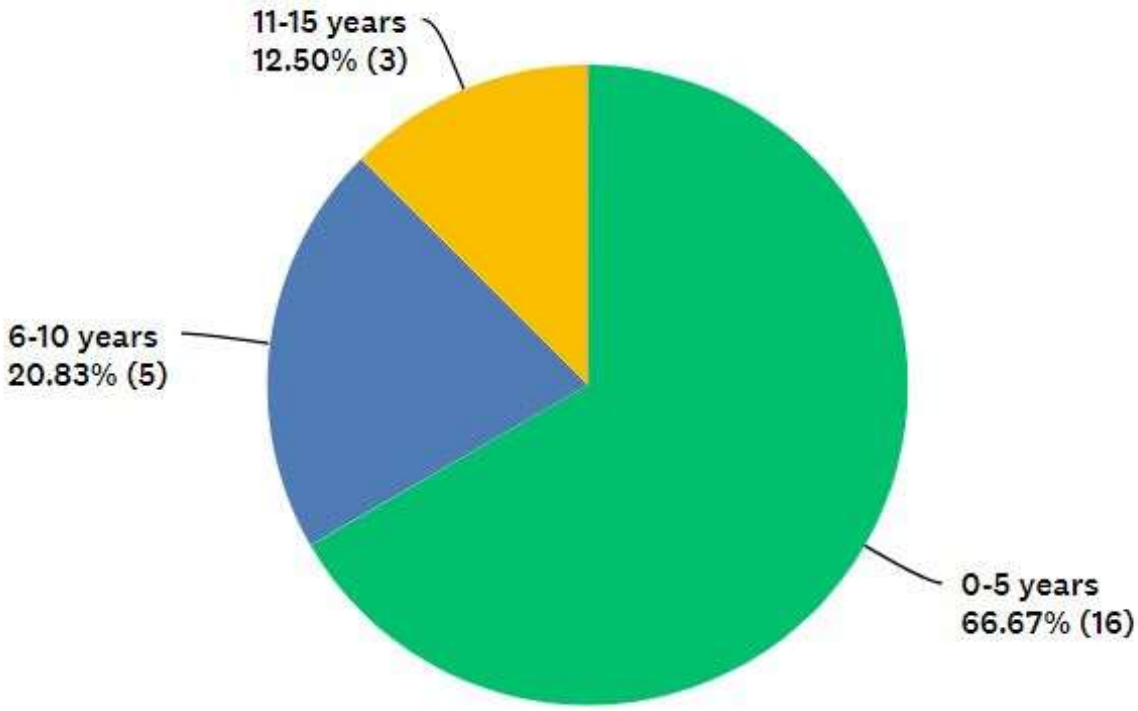
Appendix D

Project Participant Position



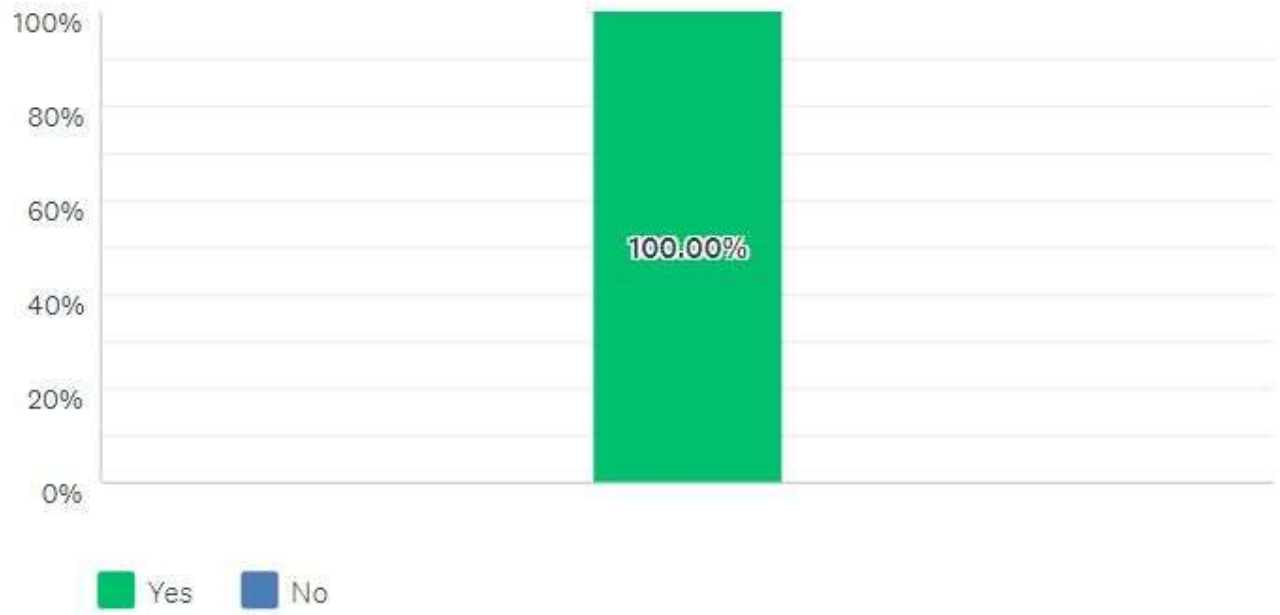
Appendix E

Experience Level of Project Participants



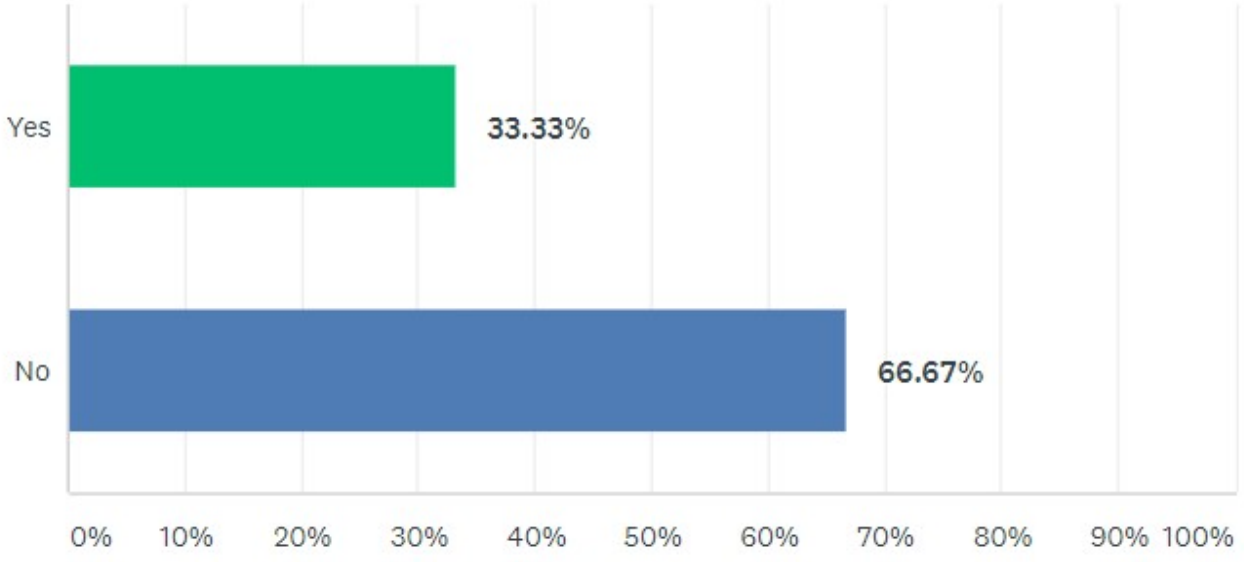
Appendix F

Anesthesia providers who reported a willingness to make a practice change based on information received from the module on intraoperative lidocaine infusions



Appendix G

Number of anesthesia providers who utilize intraoperative lidocaine infusions prior to module participation



Appendix H

SPSS v.17 of knowledge-based lidocaine question: McNemar's test

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
PretestQ8 * PosttestQ3	24	100.0%	0	0.0%	24	100.0%

PretestQ8 * PosttestQ3 Crosstabulation

			PosttestQ3 Correct	Total
PretestQ8	Incorrect	Count	12	12
		% within PretestQ8	100.0%	100.0%
		% within PosttestQ3	50.0%	50.0%
		% of Total	50.0%	50.0%
	Correct	Count	12	12
		% within PretestQ8	100.0%	100.0%
		% within PosttestQ3	50.0%	50.0%
		% of Total	50.0%	50.0%
Total		Count	24	24
		% within PretestQ8	100.0%	100.0%
		% within PosttestQ3	100.0%	100.0%
		% of Total	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
McNemar-Bowker Test	.	.	.[a]
N of Valid Cases	24		

a. Computed only for a PxP table, where P must be greater than 1.

Appendix I

Statistics for comprehensive knowledge-based questions

	Pretest	Posttest
1	.7083	.7500
2	.6250	.9167
3	.3333	.7917
4	.9167	.9583
5	.5000	1.0000
6	.6667	.9583

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	.625000	6	.1972210	.0805151
	Posttest	.895833	6	.1011943	.0413124

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pretest & Posttest	6	.261	.618

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Posttest	-.2708333	.1967818	.0803358	-.4773431	-.0643235	-3.371	5	.020

Paired Samples Effect Sizes

			Standardizer[a]	Point Estimate	95% Confidence Interval Lower	Upper
Pair 1	Pretest - Posttest	Cohen's d	.1967818	-1.376	-2.498	-.196
		Hedges' correction	.2132568	-1.270	-2.305	-.180

Appendix J

Odds ratio for comprehensive module statistics

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Test * Condition	288	100.0%	0	0.0%	288	100.0%

Test * Condition Crosstabulation

			Condition		
			Correct	Incorre	Total
Test	Postest	Count	128	16	144
		% within Test	88.9%	11.1%	100.0%
	Pretest	Count	90	54	144
		% within Test	62.5%	37.5%	100.0%
Total		Count	218	70	288
		% within Test	75.7%	24.3%	100.0%

Chi-Square Tests

	Value	Exact Sig. (2-sided)
McNemar Test		.[a]
N of Valid Cases	288	

a. Both variables must have identical values of categories.

Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Test (Postest / Pretest)	4.800	2.583	8.919
For cohort Condition = Correct	1.422	1.238	1.634
For cohort Condition = Incorre	.296	.178	.492
N of Valid Cases	288		

Appendix K

DNP Essentials (AACN, 2006)

DNP Essentials

1. Scientific underpinnings for practice
2. Organizational & systems leadership for quality improvement & system thinking
3. Clinical scholarship & analytical methods for evidence-based practice
4. Technology & information for the improvement & transformation of patient-centered health care
5. Health care policy for advocacy in health care
6. Interprofessional collaboration for improving patient & population health outcomes
7. Clinical prevention & population health for improving the nation's health
8. Advanced nursing practice for improving the delivery of patient care

Appendix L

DNP Poster Presentation