The Anesthesia Provider's Role in the Opioid Crisis:

Opioid-Minimizing and Opioid-Free Anesthesia

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DNP Scholarly Project Final Approval Form

Initial Examination of the DNP Scholarly Project Proposal
Review Council Determination

Doctoral Candidate Name: Brooke Huffman

DNP Scholarly Project Proposal Title: The Anesthesia Provider's Role in the Opioid Crisis: Opioid Minimizing and Opioid-Free Anesthesia

DNP Scholarly Project Review Council Members: Drs. Mueller, Clark, King, Osborne, and Lown

Date of Oral Presentation and Review: November 14, 2019

1. *Approved*. The proposal is approved with no required modifications. The candidate may begin implementation of the project.

2. *Approval following review and acceptance of required modifications*. The Scholarly Project Review Council requires the candidate to resubmit the proposal once the candidate has completed the required modifications. The project will be *approved* provided the modifications to the proposal meet to the expectations of the Review Council.

3. *Not Approved*. Significant gaps and or errors in the proposal are identified by the Scholarly Project Review Council that will prohibit the candidate from completing the course.

Abstract

Opioid abuse has been devastating communities across the United States, with overdose deaths now reaching epidemic proportions (Centers for Disease Control, 2017). The majority of chronic opioid dependence in the country has resulted from legal opioid prescriptions, initially prescribed to treat acute perioperative pain (Sun, Darnell, & Mackey, 2016). Anesthesia providers are in a unique position to provide solutions to the overuse of opioids perioperatively, while still maintaining adequate analgesia. Opioid monotherapy is currently the treatment of choice for perioperative analgesia, despite the side effects and potential for abuse of opioid medications. Opioid-minimizing, multimodal analgesic techniques have been shown to decrease the negative side effects of opioids while maintaining adequate analgesia. This project was an educational intervention that aimed to increase knowledge among Certified Registered Nurse Anesthetists (CRNAs) in Indiana regarding the opioid epidemic and anesthetic techniques to decrease opioid use perioperatively.

Executive Summary

Americans consume the majority of the world's opioids, and 130 of them die each day from an opioid overdose (Centers for Disease Control, n.d.). Opioid use disorder (OUD) and opioid overdose deaths have reached epidemic proportions, prompting a federal response to decrease the amount of opioid consumption (Centers for Disease Control, 2017). Many of the opioid-related deaths and chronic opioid dependence in the country appear to have resulted from legal opioid prescriptions, initially prescribed to treat acute perioperative pain (Sun, Darnell, & Mackey, 2016). The Centers for Disease Control and Prevention (2016) estimate that the economic burden of prescription opioid misuse in the United States is approximately $78.5 billion a year.

In Indiana, drug overdoses have been on the rise for the last two decades. From 2016-2017, Indiana's rate of drug overdose deaths increased at the third highest rate in the nation (IN.gov, 2016). The Centers for Disease Control and Prevention announced more than $900 million in funding for a three-year agreement with states to further the understanding of the opioid epidemic and to increase prevention efforts. In addition, the U.S. Department of Health and Human Services has awarded $18 million in federal to Indiana to help combat the opioid epidemic in the state (Health and Human Services, 2019).

The research question for this project, developed using PICO format, is: For practicing anesthesia providers (P), does receiving education on the opioid crisis and current practices regarding multimodal, opioid-minimizing anesthetic techniques (I) compared with a baseline of not receiving the education (C) increase knowledge and likelihood of use among certified registered nurse anesthetists (CRNAs) in Indiana (O)?

The intent of this project was to present the existing evidence to Indiana CRNAs in an online presentation format in order to increase knowledge on the subject. The intervention plan includes delivering the PowerPoint to the CRNAs with an Indiana Association of Nurse Anesthetists (INANA) membership via their email chain.

The participants were expected to take a short ten question pre-test prior to viewing the presentation. After viewing the PowerPoint presentation, the participants will be asked to complete the same test that was taken pre-intervention, including one question regarding likelihood of use. The pre-and post-tests will be delivered electronically along with the PowerPoint.

Chapter 1: Introduction

Problem

Americans consume the majority of the world's opioids, and 130 of them die each day from an opioid overdose (Centers for Disease Control, n.d.). Opioid overdose deaths have reached epidemic proportions, prompting a federal response to decrease the amount of opioid consumption (Centers for Disease Control, 2017). Many of the chronic opioid dependencies and opioid-related deaths in the country appear to have resulted from legal opioid prescriptions, initially prescribed to treat perioperative pain (Sun, Darnell, & Mackey, 2016). The Centers for Disease Control and Prevention (2016) estimate that the national economic burden of prescription opioid misuse is approximately $78.5 billion a year.

The role of the anesthesia provider includes ensuring adequate perioperative pain control, which has historically been accomplished primarily via administration of opioid medications (Frauenknecht et al., 2019; Sultana, Torres, & Schumann, 2017). Current practice guidelines published by the American Society of Anesthesiologists recommend a multimodal approach to pain management (Apfelbaum et al., 2012). Multimodal techniques utilize medications that exert their effects on multiple target receptors to synergistically improve analgesia, while decreasing side effects of opioid medications. Multimodal techniques have been shown to improve postoperative analgesia and decrease opioid consumption (Apfelbaum et al., 2012). The current literature demonstrates that opioid-minimizing and opioid-free anesthetic (OFA) techniques can provide adequate perioperative analgesia while maintaining a superior side effect profile compared with

opioid-inclusive techniques (Frauenknecht et al., 2019; Sultana, Torres, & Schumann, 2017).

Needs Assessment

In Indiana, drug overdoses have increased over the last two decades. Between 2016-2017, Indiana's number of drug overdose deaths rose at the third highest rate in the nation (Indiana State Department of Health, n.d.). The rate has been steadily increasing since the nineties, with overdose deaths involving prescription opioids being five times higher in 2017 than in 1999 (Centers for Disease Control, 2018). The Centers for Disease Control and Prevention have announced that states will receive a total of more than $900 million in funding will be provided to states to further the understanding of the opioid epidemic and to increase prevention efforts. $18 million in federal monies have been granted to Indiana to help combat the opioid epidemic within the state (United States Department of Health and Human Services, 2019).

For approximately 51 million Americans who undergo inpatient surgery annually, opioids remain the primary modality for achieving postoperative analgesia. Surgical patients are routinely prescribed the very opioid medications consistently linked to opioid overdose and physical dependence (Hah, Bateman, Ratliff, Curtin, & Sun, 2017). Fecho, Lunney, Boysen, Rock & Norfleet (2008) noted a correlation between persistent perioperative opioid use following surgical procedures and mortality. Perioperative opioid use can lead to chronic opioid use in patients, regardless of whether or not they are opioid-tolerant, or have ever been exposed to opioids in the past (Hah, Bateman, Ratliff, Curtin, & Sun, 2017; Sultana, Torres, & Schumann, 2017). Opioids prescribed for low-

pain outpatient procedures, even at low doses, have been associated with opioid use years later (Alam, Gomes, Zheng, Mamdani, Juurlink, & Bell, 2012).

The adverse effects of opioids are well documented and include tolerance, hyperalgesia, physical dependence, postoperative nausea and vomiting (PONV), immunosuppression, opioid-induced endocrinopathy, respiratory depression, myocardial depression, decreased gastrointestinal motility, and oversedation (Hah, Bateman, Ratliff, Curtin, & Sun, 2017). Additional side effects specific to perioperative opioid use include postoperative ileus, postoperative cognitive dysfunction, opioid-induced hyperalgesia, and postoperative respiratory depression (Angst & Clark, 2006; Crosby, Culley, & Dexter, 2014; Gan et al., 2015; Frauenknecht et al., 2019). These side effects are so significant that opioid abuse is now listed as a postoperative complication (Sultana, Torres, & Schumann, 2017).

Anesthesia providers are uniquely qualified to develop, implement, and coordinate a comprehensive perioperative analgesic plan, which should begin with the preoperative assessment and continue throughout the perioperative period (Vetter & Kain, 2017). The anesthesia provider's choice to minimize opioids by utilizing a multimodal analgesic technique may have a profound effect on patient outcome by minimizing the side effects associated with opioid use.

Kehlet and Dahl introduced the term multimodal analgesia in 1993 (Kehlet & Dahl, 1993). The aim of multimodal analgesia is to decrease postoperative pain, perioperative opioid requirements, and subsequently, opioid-related adverse effects by utilizing multiple agents that work synergistically to decrease the reliance on one medication (Beloeil et al., 2017). Simultaneously targeting multiple nociceptive

receptors is key to successful multimodal anesthesia (Brown, Pavone, & Naranjo, 2018). Nonopioid adjuvants are chosen and combined based on their ability to synergistically modulate pain pathways, centrally and peripherally, improving analgesia and decreasing opioid requirements intra- and postoperatively. Utilizing multimodal techniques will require a change amongst anesthesia providers that have traditionally been trained to utilize opioid monotherapy to treat perioperative pain (Kumar, Kirksey, Duong, & Wu, 2017).

The American Association of Nurse Anesthetists (AANA) has developed a code of ethics that serves as a guide for the nurse anesthesia profession. One of its ethical principles, principle 1.3, states that the CRNA should protect patients from harm and be an advocate for patient welfare (American Association of Nurse Anesthetists, 2013). As increasing amounts of evidence demonstrate harm related to opioid misuse, CRNAs have an ethical responsibility to minimize risks related to perioperative opioid use. However, the concept of minimizing opioids is still in its infancy within the profession of anesthesia, and requires a significant change in culture and mindset before it is likely to be widely accepted and utilized in practice.

The question for this evidence-based educational intervention, developed using PICO format, is: For practicing certified registered nurse anesthetists (CRNAs) in Indiana (P), does receiving education on the opioid crisis and current practices regarding multimodal, opioid-minimizing anesthetic techniques (I) compared with not receiving the education (C) increase knowledge and likelihood of use among CRNAs in Indiana (O)?

DNP Project Overview

Best practice guidelines state that multimodal analgesic approaches should be utilized in the perioperative period when feasible and appropriate (Apfelbaum et al., 2012). The intent of this project is to increase knowledge on the subject as well as increase the likelihood of implementing these anesthetic techniques across the state. The President of the Indiana Association of Nurse Anesthetists (INANA), which represents the 412 CRNAs in the state of Indiana, has granted support for the project.

This Doctor of Nursing Practice (DNP) project is an evidence-based practice project with an educational intervention. An evidence-based practice project consists of a systematic approach that utilizes a review of the best available scientific evidence and combines it with clinical expertise to guide care delivery (Melynk & Fineout-Overhold, 2015). The educational intervention consists of a PowerPoint presentation, developed by the Team Leader, which was delivered to practicing CRNAs who are members of the INANA in January 2020.

The curriculum for this project includes an overview of the opioid crisis, the role of anesthesia and surgery in the opioid epidemic, and an overview of opioid-minimizing and opioid-free anesthetic techniques. Any knowledge gained by CRNAs completing the intervention will be assessed via a pre-post test, which will be delivered via Survey Monkey. The likelihood that CRNAs who complete the intervention will implement these techniques into practice will be assessed via an additional Likert scale question on the same test delivered via Survey Monkey.

The learning objectives for this educational intervention are as follows:

- Upon reviewing the presentation, the anesthesia provider will be able to correctly answer:
    - two questions regarding the role of surgery in the opioid crisis.
    - three questions regarding opioid-minimizing (multimodal) anesthetic techniques.
    - two questions regarding opioid-free anesthetic techniques.

Participant inclusion criteria include CRNAs who are INANA members and who receive emails from the organization. There are approximately 412 Indiana CRNAs within the INANA membership pool. The exclusion criterion is any CRNA member who does not receive emails from the INANA. Delivery of the educational intervention will occur via email, delivered by the association's management group, Corydon Management Group. The participants will be asked to complete a short ten question pre-test, which they must answer prior to viewing the presentation. After viewing the PowerPoint presentation, the participants will be asked to take the same test, with one additional question regarding likelihood of use. The presentation consists of 17 content slides. The time expectation from participants is thirty minutes to one hour.

The DNP Project Team includes Dr. Carla Mueller, PhD, project advisor and Brooke Huffman, student and team leader. Key stakeholders for this project include the president of the INANA, Gregory Louck, MSNA, CRNA, Kim Williams, vice president of Corydon Management group, and program director Dr. Lisa Osborne DNP, CRNA. The practice mentor for this project was Dr. Marquessa Fisher, DNP, CRNA. Jason McLott, CRNA, a practice expert, has lent support and advice to the team leader throughout

development. Jacob Carlson, chief CRNA at Associated Anesthesiologists in Fort Wayne, acted as a community partner by encouraging staff CRNAs to complete the presentation. Subject matter experts for this project include the Society for Opioid-Free Anesthesia (SOFA), a CRNA-founded national professional organization dedicated to the topic. SOFA has pledged its support for this project via email. The organization has been informed of the intent, and will be provided with the educational intervention for further dissemination. The email is included under Appendix B.

Using the state association for this project dissemination allowed its educational material to reach a wide variety of providers across the state. However, it was possible that members may not have been motivated to participate in an emailed educational intervention. To encourage members to complete the survey, reminder emails were sent bi-weekly during project implementation. The president of the organization encouraged members to participate, while the team leader encouraged participation from CRNAs at clinical sites and requested that fellow classmates do so as well.

Budget and resources

The cost of this project was minimal. The cost of the SPSS software and Survey Monkey membership totaled $300 and were covered as an in-kind cost by the team leader. The educational intervention was delivered and returned via email, incurring no cost for delivery. Because of the electronic format of this intervention, there will be no equipment or facilities costs. Members may only complete the intervention during leisure time, incurring no cost to their respective institutions.

The team leader has created the intervention; the time spent creating the intervention has been provided in-kind. Gregory Louck, MSNA, CRNA, and Kim Williams from Corydon Management are donating their time assisting with the project in-kind as well.

Process and outcomes

After achieving the required Institutional Review Board (IRB) approval from the University of Saint Francis in Fall 2019, implementation of this project occurred from January 2020 to February 2020. Implementation consisted of the delivery of an email containing the pre-post test and intervention, which participants were given one month to complete. Evaluation occurred once the intervention was complete, in March-April 2020. Ongoing meetings and conversations with primary stakeholders occurred throughout the project preparation, implementation, and evaluation phases.

There were three aims of this educational intervention:

- Increase knowledge among practicing anesthesia providers regarding the opioid crisis.
- Increase knowledge among practicing anesthesia providers regarding opioid-minimizing and opioid-free anesthetic techniques.
- Improve anesthesia providers' likelihood of implementing opioid-minimizing techniques.

The proposed outcomes aligned with the project aims, and included:

- Anesthesia providers' knowledge of the opioid crisis will increase by 30% after receiving the education compared with not receiving it within a two-month period.

- Anesthesia providers' knowledge of opioid-minimizing and opioid-free anesthetic techniques will increase by 30% after receiving the education compared with not receiving it within a two-month period.
- More than 30% of CRNAs completing the survey will respond that they are either "likely" or "somewhat likely" to implement these techniques into practice after completing the intervention.

Risk analysis

This project is an educational intervention. There are no known immediate or long-term risks to participants, who agreed to complete the pre-post test and intervention and provided implied consent. Participants received no compensation for participating, and had the option to opt out at any time. Confidential provider, patient, or hospital data was not obtained. Potential benefits included gaining knowledge regarding modern anesthetic techniques, and increasing the likelihood of use as encouraged by best practice guidelines. There is no association between the participants and SurveyMonkey, and returned pre-post tests were anonymous.

This statement was included in the survey instructions: "Completion of this survey for the DNP Project of Brooke Huffman, SRNA at University of Saint Francis is voluntary. You may choose not to participate or withdraw at any time. Your responses will be confidential and I am not collecting identifying information such as your name, e-mail address or IP address. If you have questions about this DNP Project, please contact Brooke Huffman, SRNA, DNP-NAP student at the following number (number included). Completion of this online survey will serve as consent to participate." Instructions also

noted that the study had been approved by the University of Saint Francis Institutional Research Board.

Chapter 2: Synthesis of Supporting Evidence/Literature and Project Framework

Relevant theories and concepts

When the project was in its infancy, the project team chose the Iowa Model of Evidence-Based Practice to guide this evidence-based practice project. This model is a pragmatic, heuristic model developed primarily by nurses that has been widely used for implementing evidence-based practice projects (Steelman, 2015).

For the first step of the Iowa Model, a problem must be identified (Iowa Model Collaborative et al., 2017). The problem identified for this project is that the United States is experiencing an opioid epidemic, and perioperative opioids have been indicated as a contributing factor (Sultana, Torres, & Schumann, 2017). Best practice guidelines state that multimodal analgesia, which minimizes the use of opioids, should be utilized whenever appropriate and feasible (Apfelbaum et. al, 2012).

The second step is to identify and form a team. The team members for this project were chosen based on requirements, as well as their willingness and ability to contribute to the project. The team for this project consists of the previously stated members.

The third step of the model is to review the existing evidence (Iowa Model Collaborative et al., 2017). Exhaustive literature reviews are a synthesis of all available literature on a topic. To truly synthesize evidence, all findings (even diverse and conflicting findings) must be evaluated and combined to form an overview of the subject (Pan, 2017). The resources that have been used for the literature review include those available at The University of Saint Francis' library through Interlibrary Loan Requests

or otherwise, in anesthesia textbooks, and those provided by the Society of Opioid-Free Anesthesia (SOFA).

Literature review

Managing postoperative pain should begin during the preoperative period (Chou et al., 2016; Griffis, Giron, & Darna, 2017; Kumar, Kirksey, Duong, & Wu, 2017). The role of the anesthesia provider includes providing adequate perioperative pain control, which has historically been accomplished primarily via administration of opioid medications. Current literature, however, suggests a shift in the paradigm. Opioid-free anesthetic (OFA) techniques are showing promise in providing adequate perioperative analgesia while minimizing the use of opioid medications while maintaining a superior side effect profile compared with opioid medications (Sultana, Torres, & Schumann, 2017). The purpose of this literature review is to conduct an exhaustive search for the existing literature regarding minimizing opioids in anesthesia.

Literature search.

Databases searched included: American Association of Nurse Anesthetists, Campbell Collaboration (C2) Library of Systematic Reviews, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews (DARE), Dynamed, Essential Evidence Plus, Evidence Based Summaries, Joanna Briggs Institute Systematic Review Library, EBSCO's Nursing Reference Center Evidence Based Summaries, TRIP Database (USF Library), National Guideline Clearinghouse, National Institute of Health and Clinical Excellence (NICE), Registered Nurses' of Ontario, CINAHL Plus, EBSCO Open Dissertations, Emcare (Ovid), ERIC (Education Resources Information Center), Google Scholar, Health Business, Proquest Nursing and Allied Health, Proquest

Dissertations & Theses Global, PsycInfo, PsycEXTRA, PubMed (Medline), Directory of Open Access Journals, ASU DNP Final Project Collection, DNP Scholarly Project Repository, University of San Francisco Open Access DNP Scholarly Project Repository, George Washington University DNP Project Repository, and Sigma Theta Tau Virginia Henderson e-Repository. Search words included: opioid-minimizing techniques, opioid free anesthesia, opioids, anesthesia, certified registered nurse anesthetists, analgesics AND adverse effects, chronic pain drug therapy, postoperative pain, perioperative pain, adjuvants AND anesthesia, opioid dependence, opioid dependence AND anesthesia, opioid dependence AND treatment, opioid sparing, multimodal pain management techniques, multimodal pain AND anesthesia, multimodal pain, balanced anesthesia, intraoperative analgesia, intraoperative opioids, postoperative opioids, addiction. The remaining literature review will be organized first into guiding frameworks followed by the body of evidence, and will conclude with a summary.

Body of review.

Opioids cause the majority of drug overdose deaths in the United States (Centers for Disease Control, 2018). As of October 16, 2017, the United States Government declared the opioid epidemic a public health emergency, with President Donald Trump requesting a national call to action to combat the crisis (The White House, n.d.). Overdoses are increasing at alarming rates, growing by twenty percent from 2015-2016 (Jones, Viswanath, Peck, Kaye, Gill, & Simopoulos, 2018). Indiana is one of 23 states that experienced a statistically significant increase in the amount of overdose deaths between 2016-2017. The rate has been steadily increasing since the nineties, with overdose deaths involving prescription opioids being five times higher in 2017 than in

1999 (Centers for Disease Control, 2018). The rise in deaths is related to a similar rise in opioid prescription rates, which have quadrupled over the past 15 years of level I evidence for the long-term efficacy and safety of chronic opioid use (Jones, Viswanath, Peck, Kaye, Gill, & Simopoulos, 2018).

The dramatic increase in opioid prescriptions began as a result of a culture change that occurred in the 1990s when Dr. Mitchell Max, then president of the American Pain Society, strongly promoted the idea that all pain needed to be treated, and that it was even inhumane not to do so. He is credited with the notion that the therapeutic use of opioids rarely promotes drug addiction (Max, 1990). The American Pain Society adopted pain as the "fifth vital sign" in 1995. In 2000, The Joint Commission issued their standards for pain management, which included adequately abolishing patients' pain, creating financial incentives for organizations and physicians to attempt to eliminate pain (Jones, Viswanath, Peck, Kaye, Gill, & Simopoulos, 2018).

Meanwhile, pharmaceutical companies increased sales approaches specifically targeted to physicians, marketing opioids as non-addictive and "humane" treatment options for pain (Dhalla, Persaud, & Jurrlink, 2011; Jones, Viswanath, Peck, Kaye, Gill, & Simopoulos, 2018). In 2007, Purdue Pharmaceuticals pleaded guilty to federal charges related to the misbranding of OxyContin, which allegations stated was branded as a non-addictive alternative to morphine (Jones, Viswanath, Peck, Kaye, Gill, & Simopoulos, 2018).

The role of surgery in the opioid epidemic.

For the approximately 51 million Americans who undergo inpatient surgery annually, opioids remain the primary modality for achieving postoperative analgesia.

Despite evidence that multimodal techniques decrease opioid use and provide adequate analgesia, surgical patients are still routinely prescribed opioid monotherapy with the very medications linked to overdose and physical dependence (Fecho, Lunney, Boysen, Rock & Norfleet, 2008; Hah, Bateman, Ratliff, Curtin, & Sun, 2017; Sultana, Torres, & Schumann, 2017).

Chronic opioid dependence can develop even in patients who were not taking opioids before surgery (Sultana, Torres, & Schumann, 2017). Intra- and postoperative opioids have been linked to chronic opioid use, regardless of a patients' prior opioid exposure or surgical procedure, although patients undergoing total knee arthroplasty are at highest risk (Alam, Gomes, Zheng, Mamdani, Juurlink, & Bell, 2012; Hah, Bateman, Ratliff, Curtin, & Sun, 2017; Sultana, Torres, & Schumann, 2017; Sun, Darnell, Baker, & Mackey, 2016). Risk factors for chronic opioid use after surgery among opioid-naive patients include: male gender, age >50 years, preoperative use of benzodiazepines, preoperative use of antidepressants, depression history, alcohol abuse history, lower socioeconomic status, preoperative tobacco use, medical comorbidities, and drug abuse history (Brummett et al., 2017; Sun, Darnell, Baker, & Mackey, 2016).

Anesthesia providers are required to develop, implement, and coordinate a comprehensive perioperative analgesic plan, which begins with the preoperative assessment and continues throughout the perioperative period (Apfelbaum et al., 2020; Griffis, Giron, & Darna, 2017; Vetter & Kain, 2017). A tailored analgesic plan within each anesthetic plan should take into account the patient's current amount of pain tolerance and opioid use.

Side effects of opioids.

The adverse effects of opioids are well documented and include: tolerance, hyperalgesia, physical dependence, postoperative nausea and vomiting (PONV), immunosuppression, opioid-induced endocrinopathy, opioid-induced hyperalgesia, respiratory depression, myocardial depression, decreased gastrointestinal motility, and oversedation (Atcheson & Lambert, 1994; Crosby, Culley, & Dexter, 2014; Gan et al., 2015; Hah, Bateman, Ratliff, Curtin, & Sun, 2017; Krenk et al., 2014; Woolf, 2011). These side effects are so severe that chronic opioid abuse is now defined as a postoperative complication (Sultana, Torres, & Schumann, 2017).

Postoperative hypoxia is frequently caused by respiratory depression in the postanesthesia care unit (PACU). Respiratory depression is an expected effect of opioids, and the residual effect of opioids plays a major role in arterial hypoxia in PACU. Opioid-induced respiratory depression occurs due to the depression of brainstem ventilation centers via mu-2 receptor agonism (Atcheson & Lambert, 1994). Postoperative opioid-induced respiratory depression is a potential cause of brain damage and death in surgical patients (Beloeil et al., 2017).

Postoperative ileus (POI) is one of the most frequently occurring side effects of opioids. One study found that, in certain surgical procedures, the incidence of postoperative ileus (POI) in patients treated with opioids to be as high as 10.3% (Gan et al., 2015). The incidence of POI is already increased after gastrointestinal, pelvic and some non-abdominal surgeries (i.e, spine), resulting in significant morbidity. The development and consequences of POI following abdominal surgery is further complicated by the use of opioids (Beloeil et al., 2018).

Opioids are also indicated as one of the risk factors for the development of postoperative cognitive dysfunction. Postoperative cognitive dysfunction (POCD) and delirium occur most often in geriatric surgical patients after major joint replacement or other types of major surgery. POCD and postoperative delirium (POD) are associated with prolonged inpatient stays, cognitive decline, and dementia. One study found that patients receiving opioids via a patient-controlled analgesic device were at significantly higher risk of developing POCD (Crosby, Culley, & Dexter, 2014). In one study, multimodal opioid-minimizing analgesia was associated with a decrease in POD rates after hip and knee arthroplasty in geriatric patients (Krenk et al., 2014).

Opioid-induced hyperalgesia refers to increased sensitivity to painful stimuli in patients taking opioids, which may be the result of upregulation of compensatory pronociceptive pathways (Angst & Clark, 2006; Frauenknecht et al., 2019). Two controlled studies reported higher postoperative pain ratings in patients receiving high compared with low doses of intraoperative systemic opioids (Chia, Liu, Want, Kuo, & Ho, 1999; Guignard et. al., 2000). An additional study of women undergoing spinal anesthesia for cesarean section with intrathecal opioids versus a saline placebo found that women consumed higher amounts of postoperative opioids if intrathecal opioids were used (Cooper, Lindsay Ryall, Kokri, El Dabe, & Lear, 1997). Acute opioid-induced hyperalgesia is most common with remifentanil infusions and/or long cases involving systemic opioid administration, making postoperative opioids less effective (Lirk & Rathmell, 2019). A reduction in opioid-induced hyperalgesia has been found with opioid-free anesthetic techniques (Alam, Gomes, Zheng, Mamdani, Juurlink, & Bell, 2012).

Opioid-dependent patients pose a significant challenge for anesthetists. These patients generally require higher perioperative opioid doses over extended periods, compounding the risks of opioid misuse, relapse, and overdose, while increasing inpatient mortality (Hah, Bateman, Ratliff, Curtin, & Sun, 2017; Menendez, Ring, & Bateman, 2015). As the opioid epidemic generates an increasing numbers of patients dependent on opioids, anesthetic techniques must be tailored to minimize these complications. Optimization of these patients' opioid use preoperatively has been suggested as a potentially important, underutilized way to improve outcomes in these patients, much like optimizing cardiac and respiratory function preoperatively (Kumar, Kirksey, Duong, & Wu, 2017).

Obese patients may be more sensitive to the respiratory depressant effect of opioid medications. Obese patients are more likely to have obstructive sleep apnea and decreased functional residual capacity, increasing their risk for arterial hypoxemia during opioid-induced respiratory depression (Feld, Laurito, Beckerman, Vinvent, & Hoffman, 2003). In one study, in which 30 obese patients undergoing gastric bypass surgery via open laparotomy incision were randomized to a sevoflurane and fentanyl group versus an opioid-free technique, the patients in the non-opioid group were less sedated in PACU, used less morphine postoperatively, reported similar pain scores, and reported higher patient satisfaction scores (Feld, Laurito, Beckerman, Vinvent, & Hoffman, 2003). In a prospective observational case series of 30 obese patients scheduled for a laparoscopic sleeve gastrectomy, a combination of multimodal anesthesia, including local anesthetic infiltration decreased the amount of opioids required for rescue analgesia in PACU and decreased the amount of postoperative opioid consumption (Lam & Mui, 2016).

Patients rank PONV as one of the top outcomes to avoid from anesthesia (Macario, Weinger, Carney, & Kim, 1999). PONV leads to increased length of stay, decreased patient satisfaction, and increased cost of care. In a meta-analysis of 23 randomized controlled trials comparing opioid-inclusive to opioid-free anesthesia, postoperative nausea and vomiting was found to be decreased by 20% in the opioid-exclusive group, highlighting the fact that intraoperative opioid use can contribute to PONV. The authors suggest using an opioid-free anesthetic technique in patients at high-risk for PONV (Frauenknecht et al., 2019). In one prospective, randomized study of 119 patients undergoing bariatric surgery, assigned to either general anesthesia with volatile anesthetic and opioids or total intravenous anesthetic with propofol, ketamine, and dexmedetomidine, the absolute risk reduction for PONV was 17.3%, and the severity of nausea was statistically lower in the opioid-free group (Ziemann-Gimmel, Goldfarb, Koppman, & Marema, 2014).

Based on the current available literature, it is reasonable to suggest that optimal perioperative analgesia would not only provide reduced pain scores but also promote early mobilization, faster discharge, decreased amounts of opioid-related side effects, and improved patient satisfaction. Opioid-free and opioid-minimizing anesthesia has the potential to achieve these goals.

Opioid-free anesthesia.

Opioid-free anesthesia (OFA) is a multimodal anesthetic technique in which intravenous and/or intrathecal opioids are not used for analgesia or anesthesia. Opioid-minimizing techniques use similar principles but allow the use of a modest amount of opioid (Sultana, Torres, & Schumann, 2017). Opioid-free and opioid-minimizing

anesthesia typically involve a combination of either regional or neuraxial blockade and/or multimodal analgesic techniques including *N*-methyl-D-aspartate antagonists, alpha-2 agonists, nonsteroidal anti-inflammatories, steroids, acetaminophen, anticonvulsants, and local anesthetics (Brown, Pavone, & Naranjo, 208; Beloeil et al., 2017; Kamdar, Hoftman, Rahman, & Cannesson, 2017). These techniques are important components of Enhanced Recovery After Surgery (ERAS) protocols, which promote early discharge and decreased opioid use. An OFA strategy within ERAS provides an opportunity to decrease potential opioid dependence and minimize the side effects of opioid medications while increasing long- and short-term benefits for patients (Kamdar, Hoftman, Rahman, & Cannesson, 2017).

Kehlet and Dahl introduced the term *multimodal analgesia* in 1993 (Kehlet & Dahl, 1993). The aim of multimodal analgesia is to decrease postoperative pain, perioperative opioid requirements, and subsequently, opioid-related adverse effects by utilizing multiple agents that work synergistically by targeting multiple nociceptive receptors to decrease the reliance on one medication (Beloeil et al., 2017; Brown, Pavone, & Naranjo, 2018; Choul et al., 2016). Nonopioid adjuvants are chosen and combined based on their ability to synergistically modulate pain pathways, centrally and peripherally, improving analgesia and decreasing opioid requirements intra- and postoperatively (Kumar, Kirksey, Duong, & Wu, 2017).

Regional Anesthesia.

Regional blocks have become important components of multimodal analgesia in opioid-free anesthetic techniques (Chakravarthy, 2018; Kumar, Kirksey, Duong, & Wu, 2017; Piegeler, Hollmann, Borgeat, & Lirk, 2016). Preventative or preemptive

analgesia suggests that nerve blockade can prevent the transition from acute to chronic pain by directly blocking transmission of pain impulses during the perioperative period, preventing central sensitization (Dahl & Moinche, 2004; Hah, Bateman, Ratliff, Curtin, & Sun, 2017).

In an observational study, an opioid-free anesthetic technique was utilized for 24 patients undergoing modified radical mastectomy with axillary dissection via a combination of ultrasound guided pectoral blocks (achieved with 0.25% bupivacaine and dexmedetomidine 1 mcg/kg, 30 mL) compared to 24 patients undergoing opioid anesthesia for the same procedure. Recovery room time, PONV, pain scores, and postoperative opioid requirements were all significantly less in the nonopioid group (Tripathy et al., 2018).

A Cochrane systematic review of 15 randomized controlled trials comparing postoperative epidural anesthesia and analgesia to systemic opioids in patients undergoing open abdominal aortic surgery found that those treated with epidural anesthesia (and/or analgesia) had a decreased risk of postoperative myocardial infarction, decreased pain scores, decreased postoperative respiratory failure, decreased time to extubation, and decreased time in the intensive care unit (Guay & Kopp, 2016).

Continuous local infusions of local anesthetic may be of clinical benefit as well. In one randomized controlled trial in which 62 subjects were randomly assigned to either continuous femoral analgesia (CFA) or systemic opioids following neuraxial anesthesia for total knee replacement, CFA for 24 hours following discontinuation of epidural analgesia was associated with lower pain scores, greater compliance with physical therapy, increased range of motion, reduced opioid analgesia use, and greater patient

satisfaction during hospitalization. The increased flexion of the operated joint was still evident at 1 month postoperatively (Nader, Kendall, Wixon, Chung, Polakow, & McCarthy, 2012).

***Multimodal analgesics*:**

Ketamine.

Ketamine works primarily by *N*-methyl-D-aspartate (NMDA) receptor antagonism. Ketamine also has monamine, muscarinic, opioid, and voltage-gated calcium channel effects (Laulin, Maurette, Corcuff, Rivat, Chauvin, & Simonnet, 2002). It is a dissociative anesthetic agent, with potent analgesic properties due to inhibition of *N*-methyl-D-aspartate receptors in the central nervous system. NMDA receptors are involved in central sensitization in the dorsal horn, and therefore, ketamine is especially useful for patients with chronic pain and opioid dependence, or in preventing this condition (Woolf, 2011; Kremer & Griffis, 2018). Intraoperative ketamine has been associated with decreased postoperative opioid consumption, particularly in opioid-dependent patients (Loftus et al., 2010).

There is evidence to support ketamine's preventive effects on analgesia. Employing non-opioid medications as preventive analgesics has been shown to decrease postoperative opioid use (Laulin, Maurette, Corcuff, Rivat, Chauvin, & Simonnet, 2002; Ramaswamy, Wilson, & Colvin, 2013). In one systematic review, ketamine was found to have lasting effects on analgesia long after its duration of action (McCartney, Sinha, & Katz, 2004). In one clinical investigation of patients undergoing back surgery, patients who received ketamine on induction (0.5 mg/kg) and a maintenance infusion (10

mcg/kg/min) received significantly less opioid and reported less pain six weeks postoperatively (Loftus et al., 2010).

Local anesthetics.

Lidocaine has analgesic, anti-inflammatory, and antihyperalgesic properties. Additionally, because intravenous lidocaine has been used historically to treat cardiac arrhythmias, therapeutic plasma levels of the drug are well established. (Boysen, Philip, Pappas, & Evans, 2018). The effect of intravenous (IV) lidocaine on opioid consumption is thought to occur via the blockade of proinflammatory responses to surgery (Dunn & Durieux, 2017; Weibel, et al., 2018). Subanesthetic doses of lidocaine block ectopic nerve discharge, but not conduction (Boysen, Philip, Pappas, & Evans, 2018).

According to one recent systematic review, the effects of lidocaine on postoperative pain are uncertain. It remains unclear whether IV lidocaine, when compared to placebo or no treatment, has a beneficial impact on pain scores and opioid consumption, gastrointestinal recovery, or PONV in the early postoperative period (Weibel, et al., 2018). Intravenous lidocaine has been associated with decreased opioid consumption in the immediate perioperative period for some surgeries, although the literature suggested no benefit in others (Dunn & Durieux, 2017).

There is a concern of overdosing a patient on local anesthetics during surgical procedures when the combination of intravenous lidocaine with concomitant injection of liposomal bupivacaine (Boysen, Philip, Pappas, & Evans, 2018). Liposomal bupivacaine is encapsulated bupivacaine hydrochloride, consisting of multiple lipid bilayers, offering sustained-release analgesia. A Cochrane systematic review found that using liposomal

bupivacaine at the surgical site decreases pain scores compared to placebo, with no reported serious adverse events (Hamilton et al., 2017).

Dexamethasone.

Dexamethasone is a glucocorticoid used for its anti-inflammatory effects. Dexamethasone inhibits phospholipase A_2, decreasing prostaglandin production (Kremer & Griffis, 2018). Historically used for its ability to decrease airway inflammation and cerebral edema, recent evidence suggests a systemic analgesic effect of dexamethasone. A systematic review of 45 randomized controlled trials found that a single dose of intraoperative dexamethasone (ranging from 1.2-20 mg) led to less morphine-equivalent consumption postoperatively (at 2 and 24 hours), and resulted in less breakthrough pain in PACU. Although blood glucose levels were initially higher postoperatively, there was no significant increase in wound infections in patients receiving intraoperative dexamethasone. Diabetic patients were not excluded from trials (Waldron, Jones, Gan, Allen, & Habib, 2013).

Nonsteroidal anti-inflammatories.

Nonsteroidal anti-inflammatory drugs (NSAIDs) exert their analgesic effect by inhibiting prostaglandin production via inhibition of the key enzymes cyclooxygenase 1 and 2 (COX-1 and COX-2) in the arachidonic acid pathway (Kremer & Griffis, 2018). Ketorolac, a nonselective COX inhibitor with strong analgesic properties, has been extensively evaluated, and consistently demonstrates analgesic efficacy and opioid-sparing effects in surgical patients (Chidambaran et al., 2018; Munro et al., 2002; Cepeda et al., 2005).

Ketorolac was approved for intraoperative analgesic use in 1989, the first parenteral NSAID available in the United States (Vadivelu et al., 2015). The availability of an intravenous NSAID has increased the use of NSAIDs for perioperative pain management. Ketorolac is commonly administered as a 15-30 mg intravenous dose to adults with no contraindications (Kremer & Griffis, 2018). The recommended dosage for patients > 65 years old is half that of younger patients (Vadivelu et al., 2015). Single dose intraoperative ketorolac as an adjunct in multimodal regimens has been shown to decrease postoperative pain while decreasing postoperative nausea and vomiting. The 60 mg dose offered significant benefits over the 30 mg dose (De Oliveira, Agarwal, & Benzon, 2012). A beneficial effect of a single dose of postoperative ketorolac has been shown to be beneficial in the treatment of moderate to severe postoperative pain in a quantitative review (Smith, Carroll, Edwards, Moore, & McQuay, 2000).

Common side effects of NSAIDs include platelet inhibition, gastrointestinal ulceration, decreases in renal perfusion, and an increased incidence of serious cardiovascular events such as myocardial infarction (Kremer & Griffis, 2018). Ketorolac has been associated with an enhanced risk of renal insufficiency in patients with chronic kidney disease when used long-term (Boyer, McDonald, & Zoetis, 2010). The reversible platelet inhibition that occurs with ketorolac can lead to increased bleeding, which is of particular concern in surgical patients. The overall risk of gastrointestinal or operative site bleeding was found to only be slightly higher than that with opioids, according to a large, retrospective study of 20,000 patients. The study demonstrated that the adverse effects may be reduced by restricting the use of ketorolac to five days or less and using it only in patients younger than 65 years old (Strom et al., 1996).

Magnesium.

Magnesium is an important ion in the body and plays a role in multiple physiological processes. Magnesium is a cofactor in adenosine triphosphate production, it inhibits catecholamine release, and it antagonizes NMDA receptors (George, Condrey, & Wilson, 2018). The mechanism of action by which magnesium promotes analgesia is by noncompetititve NMDA antagonism of hippocampal presynaptic calcium channels that participate in the release of glutamate (George, Condrey, & Wilson, 2018). Magnesium has been shown to decrease hyperalgesia in animal models (McCarthy, Kroin, Truman, Penn, & Ivankovich, 1998). Magnesium sulfate has been shown to reduce opioid consumption postoperatively without any serious adverse effects (Albrecht, Kirkham, Liu, & Brull, 2013; Sousa, Giovanna, Neto, Guimarares, Gabriel, & Ashmawi, 2016; Tramer, Schneider, Jurg, Marti, & Rifat, 1996). Numerous studies have demonstrated improved postoperative analgesia with magnesium, but the dosing was highly variable (Elsery, Metyas, Elfeky, & Hassan, 2017; Kara, Sahin, Ulusan, & Aydog, 2002; Levaux, Bonhomme, Dewandre, Brichant, & Hans, 2003).

Many studies have produced conflicting results regarding magnesium's usefulness intraoperatively. Studies have demonstrated no difference in pain scores postoperatively when using intraoperative magnesium; dosing varied widely between studies, and some took place in the setting of concomitant epidural anesthesia (Ko, Lim, Kim, Han, Choe, & Song, 2001; Wilder-Smith, Knopfli, Wilder-Smith, 1997). One meta-analysis of fourteen randomized controlled trials concluded that, while the mechanism of potential analgesia is promising, the trials did not provide enough evidence to suggest that

magnesium improves postoperative pain intensity and analgesic requirements (Lyaskowski, Dumont, Czarnetzki, & Tramer, 2007).

Alpha-2 agonists.

The mechanism by which alpha-2 agonists decrease pain is postulated to be the stimulation of central pre and postsynaptic alpha-2 receptors. Dexmedetomidine enhances descending inhibition of nociceptive input in the dorsal horn (Brown, Pavone, & Naranjo, 2018). Commonly used alpha-2 agonists in anesthesia are clonidine and dexmedetomidine. Dexmedetomidine is a highly selective, centrally acting alpha-2 agonist with analgesic and anxiolytic properties (Kremer & Griffis, 2018). First approved in 1999 for short-term use as an analgesic and sedative, dexmedetomidine causes anxiolysis, analgesia, and sedation without the respiratory depression of opioids (Ingersoll-Weng & Greene, 2018). Dexmedetomidine blunts central sympathetic responses when used as an infusion of 0.2-0.7 mcg/kg/hr during surgery (Kremer & Griffis, 2018). An infusion rate of 0.2 mcg/kg/hr minimizes the cardiovascular effects of bradycardia and hypotension (Tufanogullari et al., 2008). In numerous studies, dexmedetomidine has been found to decrease postoperative opioid requirements (Lee, Yoon, Jin, & Hwang, 2018; Fan et al., 2017; Gurbet, Basagan-Mogol, Turker, Ugun, & Ozcan, 2006) and lower postoperative pain scores (Lee, Yoon, Jin, & Hwang, 2018; Fan et al., 2017). In addition, dexmedetomidine infusion was also found to decrease volatile anesthetic requirements, PONV, length of stay in the postanesthesia care unit, and rescue fentanyl administration (Tufanogullari et al., 2008).

A systematic review of 30 randomized controlled trials found that both clonidine and dexmedetomidine reduce opioid consumption after surgery. With dexmedetomidine,

a statistically significant decrease in opioid consumption was observed at hours 2 and 24 postoperatively; with clonidine, the decrease was at hours 12 and 24 postoperatively. Clonidine increased the risk of intra- and postoperative arterial hypotension, while dexmedetomidine increased the risk of intraoperative hypertension. None of the trials reported on major adverse outcomes. The review also found that dexmedetomidine and clonidine also reduced the incidence of early postoperative nausea. There was no evidence that alpha-2 agonists lengthened recovery times (Blandszun, Lysakowski, & Elia, 2012).

A Cochrane systematic review examined 7 randomized controlled trials (RCTs) with 422 patients and concluded that dexmedetomidine (with a 0.5–1 mcg/kg bolus ± infusion) resulted in decreased breakthrough pain and opioid consumption in the first 24 hours. The review found no significant reduction in pain scores (Jessen, Korvenius, & Moller, 2016).

Acetaminophen.

Acetaminophen is a popular non-opioid analgesic with a well-tolerated side effect profile (Kremer & Griffis, 2018). The mechanism of action of acetaminophen is unclear; it does produce weak action on COX-1 and COX-2. Ofirmev, the intravenous form of acetaminophen, has been available in the United States since 2010. Ofirmev is given as 1,000 mg for patients weighing over 50 kg, generally given on induction (Kremer & Griffis, 2018). The intravenous form has an opioid-sparing effect compared to the oral formulation, perhaps due to its ability to bypass first-pass metabolism (Wong, St. John-Green, & Walker, 2013).

Acetaminophen has been shown to provide superior postoperative analgesia when part of a multimodal anesthetic regimen (Song-bo et al., 2018; Murata-Ooiwa, Tsukada, & Wakui, 2017), and has been shown to decrease postoperative opioid requirements (Song-bo et al., 2018). Acetaminophen is particularly effective at decreasing postoperative opioid consumption following orthopedic surgery (Sinatra, Jahr, & Reynolds, 2005).

Opioid-free anesthetic techniques.

In a prospective, randomized, double-blind study, the combination of dexmedetomidine and lidocaine with propofol compared with propofol and remifentanil infusions led to decreased postoperative consumption of fentanyl, decreased pain scores, and decreased nausea and vomiting in patients undergoing laparoscopic cholecystectomy (Bakan et al., 2015). A similar technique is to administer a continuous infusion of lidocaine and dexmedetomidine and supplement with a low dose of a volatile anesthetic agent and intermittent dosing of acetaminophen, ketamine, ibuprofen, and ketorolac (Boysen, Philip, Pappas, & Evans, 2018).

An opioid-free anesthetic "prescription" proposed by Boysen, Philip, Pappas, & Evans (2018), and demonstrated successfully in two case studies included administering 1,000 mg of acetaminophen on induction, while starting a lidocaine infusion at 0.03 mg/kg/min, along with a dexmedetomidine infusion at 0.5 mcg/kg/hr. Inhalational agent was started and maintained at 0.5-1.0 MAC, as tolerated. The dexmedetomidine infusion was decreased to 0.25 mcg/kg/hr with 2 hours left of the case, and discontinued 30 minutes prior to emergence. Ondansetron and dexamethasone were given. Lidocaine

infusion was continued into the PACU, at a decreased rate of 0.015 mg/kg/min. Intravenous NSAIDs were the first choice for an analgesic in the PACU.

In one randomized controlled trial involving 30 obese patients receiving either opioid-inclusive or opioid-free anesthesia for gastric bypass via open laparotomy, the opioid-free group received sevoflurane for anesthesia and a combination of intravenous lidocaine on induction as well as an infusion (100 mg on induction and an infusion maintained at 4 mg/min for the first hour, 3 mg/min for the second hour, and 2 mg/min for the remainder of the case), ketorolac (30 mg), intravenous clonidine (300-500 mcg as blood pressure tolerated, within the first hour of anesthesia), a ketamine infusion (0.17 mg/kg/hr), magnesium sulfate (80 mg/kg), and methylprednisone (60 mg) for analgesia. The opioid group received an average of 331 mcg of fentanyl during the case, which lasted 3.3 hours on average. The patients in the non-opioid group were less sedated in PACU, used less morphine postoperatively, reported similar pain scores, and reported higher patient satisfaction scores. (Feld, Laurito, Beckerman, Vinvent, & Hoffman, 2003).

Gaps in the literature.

Although there is an abundance of studies available on this topic since opioids are a currently trending subject in anesthesia, there remain some gaps in the research. These gaps include the need for more randomized, controlled, double-blind studies on specific opioid-free anesthetic techniques versus opioid-inclusive techniques, and additional systematic reviews and meta-analyses comparing the techniques for various outcomes, including side effects, postoperative opioid requirements, analgesic ratings, and patient satisfaction.

Summary of literature.

The opioid epidemic presents an opportunity for anesthesia providers to implement alternative, multimodal analgesic strategies to treat perioperative pain. Opioid-free anesthesia is a technique in which regional and multimodal techniques are utilized to prevent the use of opioids to treat perioperative pain. When achieved by utilizing multimodal analgesia, opioid-free anesthesia has been shown to achieve adequate analgesia with decreased side effects compared to opioid medications. Opioid-free anesthesia, as well as opioid-minimizing techniques, can be successfully achieved via the utilization of a combination of either regional or general anesthesia and medications such as NSAIDs, acetaminophen, *N*-methyl-D-aspartate antagonists, alpha-2 agonists, steroids, and local anesthetics in a variety of different populations and surgical procedures.

Chapter 3: Project Design

Methodology

This project is an evidence-based practice project that includes an educational intervention. The intent of the project was to provide an educational intervention to practicing anesthesia providers in order to increase knowledge on opioid-sparing anesthetic techniques and to improve care delivery for patients in the perioperative period.

The team leader developed the curriculum and created the presentation. Project implementation occurred in January 2020. The completed PowerPoint presentation, and the pre-post survey links, were delivered to Corydon Management Group which dispersed the educational intervention to all members of the INANA via email from Corydon Management Group. The pre-post test was created using SurveyMonkey, and was dispersed in the intervention email. The email consisted of a set of instructions, which directed the participants were instructed to complete the pre-test prior to viewing the educational intervention. After viewing the intervention, the participants to complete the post-test. The intervention was available for one month. Kim Williams, the vice president of the management firm, sent bi-weekly reminders via email to complete the intervention.

Evaluation of project aims occurred via pre-test-post-test. A pre-test was administered to evaluate existing knowledge on opioid-minimizing and opioid-free anesthetic techniques. The same test was administered after the intervention to assess knowledge gained. Likelihood of implementation into practice was assessed, using a Likert scale question, before and after the intervention as well.

Ethical considerations

Institutional Review Board (IRB) Approval from the University of Saint Francis was granted for this project after a full review. A letter of approval is included in Appendix C. The approval process consisted of completing the University of Saint Francis' (USF) IRB application form and providing an Executive Summary outlining the project methodology and timeline. Collaborative Institutional Training Initiative (CITI) training was required prior to completing the application. Certificates of completion are included in Appendix D. There are no other known ethical considerations for this educational intervention.

Project timeline

The timeline for this project is included in Appendix E, and includes the project's steps through the evaluation phase. Project implementation occurred in January 2020 and ended in February 2020. In March-April 2020, data was organized, cleaned, and analyzed. The project will be presented and defended to USF Faculty in June 2020.

Implementation methods

The first steps in the implementation of this project were to develop the learning objectives, curriculum, and presentation. The teaching plan was to present a short PowerPoint presentation of the synthesis of current literature related to opioid-free anesthesia. The presentation consists of 17 PowerPoint content slides, covering content regarding the opioid crisis and opioid-free and opioid-minimizing anesthesia. The PowerPoint presentation slides are included in Appendix G. The written content was submitted to the project advisor and primary stakeholder for feedback and approval

multiple times prior to completion. There were no protocols or procedures to follow for this project. The content addresses three main learning objectives:

- Upon reviewing the presentation, the provider will be able to correctly answer two questions regarding the anesthesia provider's role in the opioid crisis.
- Upon reviewing the presentation, the anesthesia provider will be able to correctly answer three questions regarding opioid-minimizing (multimodal) anesthetic techniques.
- Upon reviewing the presentation, the anesthesia provider will be able to correctly answer two questions regarding opioid-free anesthetic techniques.

The measurement tool to assess whether these learning objectives were met was the pre-post test survey in Appendix F. No published tools were available that aligned with the topic of this project. The pre-post test required participants to answer questions directly related to learning objectives to assess knowledge gained from the intervention.

An email including the presentation and pre-post test was distributed to all INANA members by Kim Williams, the vice president of Corydon Management Group. The email included links to the pre-post test with instructions for participants to complete the pre-test first, then complete the educational intervention, and then complete the post-test. Two different surveys were created to keep pre-post data separate for evaluation. Kim Williams sent bi-weekly emails to remind members of the content in the intervention and to encourage members to complete the survey. Participants had one month to complete all portions of the survey. The estimated time commitment from participants was between 30 minutes and one hour.

Evaluation plan

The results of the project were evaluated in March 2020. The source of the data for the evaluation was the pre-post tests completed by participants in the intervention. Based on previous surveys administered by the INANA, the anticipated survey response was 10-20% (Greg Louck, personal communication). The data was collected and securely stored in Survey Monkey, and imported into SPSS by the team leader. The answers remained anonymous. Outcomes for measurement align with the project aims, and include:

- Anesthesia providers' knowledge of the opioid crisis will increase by 30% after receiving the education compared with not receiving it within a two-month period.
- Anesthesia providers' knowledge of opioid-minimizing and opioid-free anesthetic techniques will increase 30% after receiving the education compared with not receiving it within a two-month period.
- The likelihood that practicing anesthesia providers will implement opioid-minimizing or opioid-free anesthetic techniques will increase by 30%.

Analysis of the data included evaluating overall participant responses to each of the ten questions on the pre-post test to assess knowledge gained from the intervention. The results were entered into SPSS software and evaluated for statistical significance using a paired-samples *t*-test. There was an additional Likert scale question regarding likelihood of implementation of opioid-free or opioid-minimizing techniques into practice included on the post-test to evaluate whether the intervention affected participants' likelihood of

using these techniques. Responses to this question were also evaluated for statistical significance using a paired samples *t*-test, using SPSS software.

Dissemination plan

The dissemination plan for this project included a completed written proposal that will be submitted to faculty for review and approval. A written executive summary was included within the proposal, and was available for colleagues and students. A formal project presentation was presented to USF faculty, colleagues, and invited students. The presentation includes a visual aid with content including project results and analysis of outcomes, a discussion on the leadership and management of the project, overall project discussion, and conclusions.

Chapter 4: Results and Outcomes Analysis

Data Collection Techniques

Data collection was accomplished using the SurveyMonkey platform.. Ninety-seven percent of the pre-post test response volume occurred in the first two days after project implementation. The reminder email sent two weeks after initial project implementation garnered an additional two responses. After project implementation was complete, the data was imported into IBM's SPSS Version 25 software from Survey Monkey, and a paired-samples *t*-test was completed using SPSS software. A previously completed power analysis determined a necessary sample size of 45 to determine statistical significance ($p < .05$). Fifty-five people completed the pre-test, but only 40 participants completed both the pre- and post-tests, and thus could be used for analysis.

Measures/Indicators

This project was evaluated on the ability to achieve learning objectives and project outcomes. The goal of this project was to achieve three learning objectives, as well achieve three proposed outcomes. The scores on the pre-post-tests were used to evaluate the project's success in achieving the desired learning objectives and outcomes. The learning objectives for the project were:

- Upon reviewing the presentation, the anesthesia provider will be able to appropriately answer two questions regarding the role of surgery in the opioid crisis.
- Upon reviewing the presentation, the anesthesia provider will be able to correctly answer three questions regarding opioid-minimizing (multimodal) anesthetic techniques.

- Upon reviewing the presentation, the anesthesia provider will be able to correctly answer two questions regarding opioid-free anesthetic techniques.

The proposed outcomes for this project were:

- Anesthesia providers' knowledge of the opioid crisis will increase by 30% after receiving the education compared with not receiving it.
- Anesthesia providers' knowledge of opioid-minimizing and opioid-free anesthetic techniques will increase by 30% after receiving the education compared with not receiving it.
- More than 30% of CRNAs completing the survey will respond that they are either "likely" or "somewhat likely" to implement these techniques into practice after completing the intervention.

There were ten questions on the pre- and post-tests. Each question was designed to measure one of the three learning objectives. The first three questions on the pre-post test addressed the first learning objective, that the anesthesia provider will be able to appropriately answer two questions regarding the role of surgery in the opioid crisis. The first three questions on the pre-post test addressed the opioid crisis(the correct answers are highlighted):

- Question 1: Chronic opioid use has been linked to which of the following?
  - Legal prescriptions used to treat perioperative pain
  - Seeking illegal narcotics
  - Opioid administration intraoperatively
- Question 2: The highest rate of chronic opioid dependence after surgery is linked to which procedure?

  - Lumbar fusion
  - Hysterectomy
  - Total knee arthroplasty

- Question 3: Opioid-induced hyperalgesia can occur after how many doses of an opioid?
  - Ten
  - Five
  - One

Pre-Post Test Results for Learning Objective 1		
	Pre-Test	**Post-Test**
Question 1	52%	82%
Question 2	29.8%	97.3%
Question 3	58%	100%

Question 1 was answered correctly on the pre-test by 52% of respondents; this increased to 82% on the post-test. The second question was answered correctly by 29.8% of respondents, and was the most missed question, as well as the question with the largest increase in correct answers. Question 2 was answered correctly by 97.3% of respondents on the post-test (a 69.3% increase). Question 3 was answered correctly by 58% of respondents on the pre-test, and 100% of respondents on the post-test (a 72.4% increase). Because the majority of respondents answered the first three questions correctly on the post-test, and the increase in knowledge for both questions was greater than 30%, the first learning objective and first proposed outcome were met.

Providers' knowledge on opioid-minimizing techniques was assessed by questions 4, 5, and 7 on the pre-post-tests. The questions on the test were:

- Question 4: The key to successful multimodal analgesia is:
    - Choosing agents based on cost
    - Choosing agents based on ability to target different nociceptive receptors and work synergistically to modulate pain pathways
    - The timing of administration of chosen agents
- Question 5: An advantage of using ketamine as part of an opioid-minimizing technique includes:
    - Its dissociative anesthetic effect
    - Its preemptive effects on analgesia
    - Ketamine's agonist effect at monoaminergic receptors
- Question 7: What is the primary mechanism by which ketamine prevents central sensitization?
    - By antagonizing NMDA receptors and decreasing glutamate release
    - By providing sedation, which decreases pain perception
    - By acting on receptors in the locus ceruleus, inhibiting nociceptive neurotransmission through the posterior dorsal horn

Pre-Post Test Results for Learning Objective 2

	Pre-Test	Post-Test
Question 4	96.3%	100%
Question 5	38.6%	78.9%
Question 7	78.9%	97.3%

Question 4 was answered correctly by 96% of respondents, Question 5 was answered correctly by 38.6%, and Question 7 was answered correctly by 78.9%on the pre-test. On the post-test, 100%, 78.9%, and 97.3% of respondents answered the same

questions correctly, respectively. Question 4 had a 4% increase in correct answers on the post-test compared with the pre-test. Question 5 had a 40.3% increase in correct responses, and Question 7 had an 18.4% increase. Because all three questions demonstrated an increase in correct responses on the post-test, Learning Objective Two was achieved. However, questions 4 and 7 did not achieve the goal of a 30% improvement in responses, so the second proposed outcome for the project was not achieved.

The third learning objective regarding providers' knowledge on opioid-free anesthetic techniques was assessed by questions 6, 8, and 9. This learning objective addressed the second proposed outcome of the project. The questions on the test were:

The third learning objective regarding provider's knowledge on opioid-free anesthetic techniques were assessed by questions 6, 8, and 9 on the pre- and post-tests. This learning objective addressed the second proposed outcome of the project. The questions on the test were the following, with the correct answer highlighted:

- Question 6: What is true about the benefits of regional nerve blockade in OFA techniques?
    - The benefit of the block lasts only for the duration of the block, but it decreases opioid use.
    - It prevents the perception of pain throughout the entire postoperative period.
    - It prevents the release of chemical mediators that lead to peripheral sensitization and postoperative hyperalgesia.

- Question 8: How does opioid-free anesthesia contribute to combatting the opioid epidemic?
    - By preventing central sensitization, postoperative opioids are more effective and patients require less.
    - By preventing the total amount of opioid used intraoperatively.
    - It doesn't if surgeons don't change their prescriptive practices.
- Question 9: Opioid-free anesthetic techniques prohibit the use of opioid medications perioperatively:
    - True
    - False

Pre-Post Test Results for Learning Objective 3		
	Pre-Test	**Post-Test**
Question 6	73.2%	94.7%
Question 8	71.9%	86.8%
Question 9	78.9%	86.8%

Question 6 was answered correctly on the pre-test by 73.2% of respondents, Question 8 was answered correctly by 71.9%, and Question 9 was answered correctly by 78.9% . On the post-test, the same questions were answered correctly by 94.7%, 86.8%, and 86.8% of respondents, respectively. Question 6 had a 22.7% increase in correct answers on the post-test compared with the pre-test. Question 8 had a 20.7% increase in correct responses, and Question 9 had a 10% increase. Because all three questions demonstrated an increase in correct responses on the post-test, Learning Objective Three was likely achieved. However, questions 6, 8, and 9 did not achieve the goal of a 30%

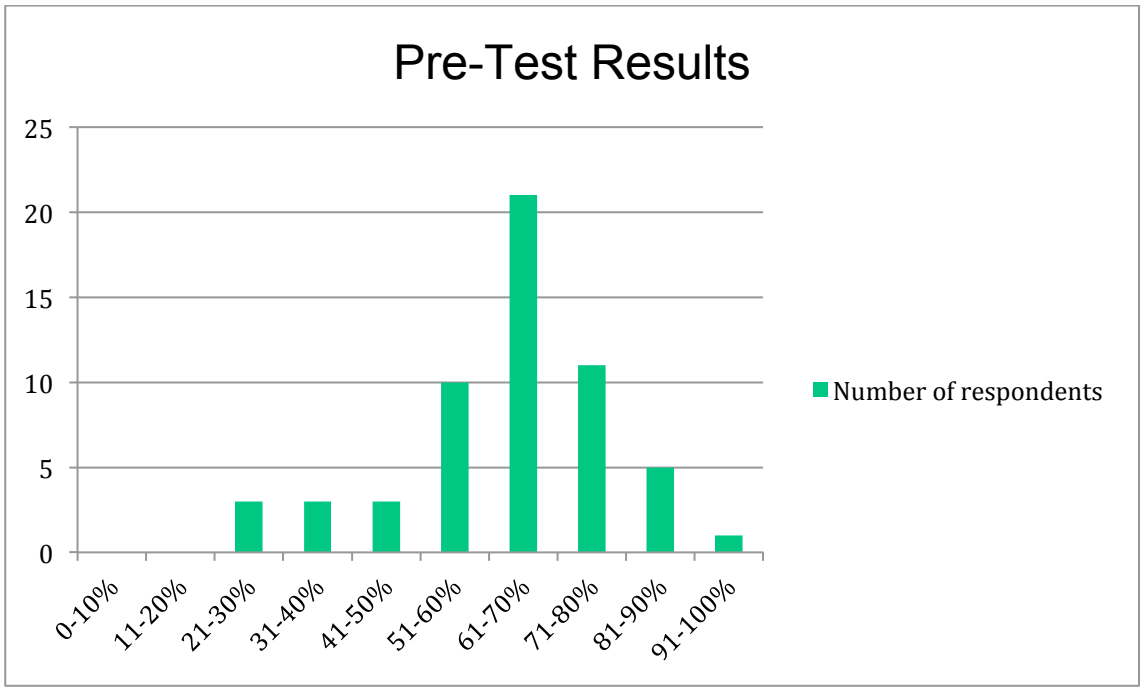
improvement in responses; the second proposed outcome for the project was not achieved.

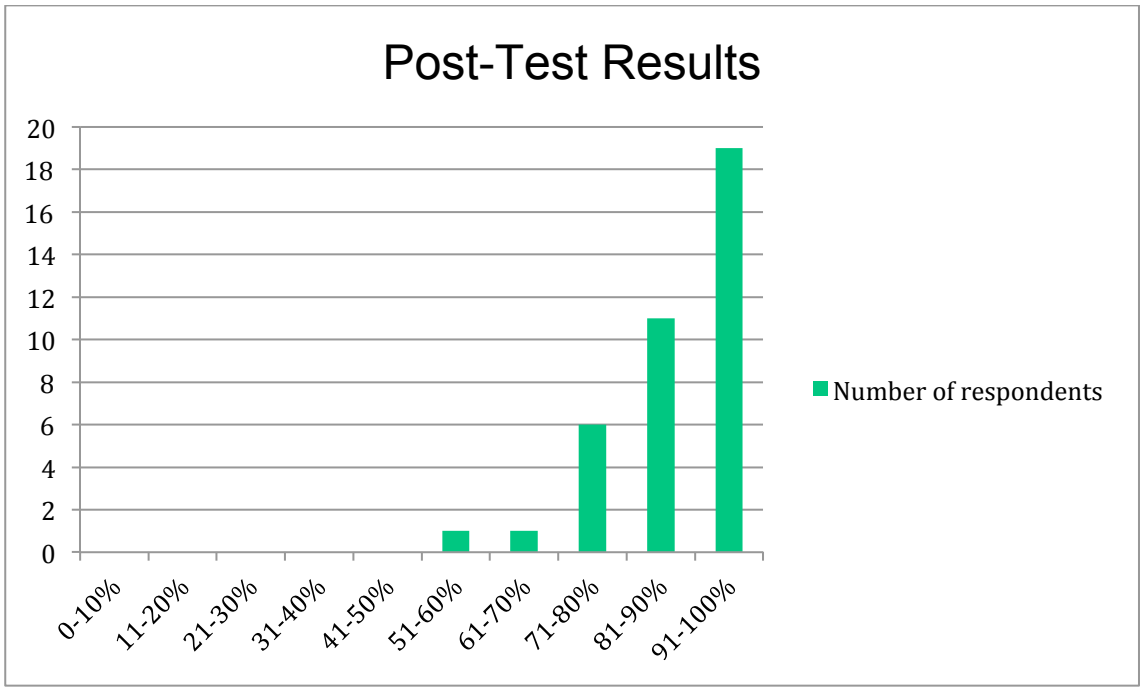
Question 10 was a Likert-scale question assessing the likelihood of implementation of these techniques. The question was asked pre and post-intervention. The question had a comment box in which respondents could leave comments on either the pre- or the post-test. The answer options included: very likely, somewhat likely, undecided, somewhat unlikely, and very unlikely. On the pre-test, the majority of respondents (54.4%) answered "very likely" to implement these practices. Around a fourth (26%) of respondents answered "somewhat likely," 14% answered "undecided," 3.75% answered "somewhat unlikely," and 1.85% answered "very unlikely." On the post-test, 60.53% of respondents answered "very likely" (a 10.1% increase); 31.6% of respondents answered "somewhat likely" (a 17.7% increase); 5.3% of respondents answered "undecided" (a 62% decrease); and 2.63% of respondents answered "somewhat unlikely" (a 29.9% decrease). Overall, the percentage of respondents who are likely to implement opioid-sparing anesthetic techniques into practice increased. Because the proposed outcome was that 30% of respondents would be likely to implement these techniques into practice after the intervention, the proposed outcome was achieved.

Data Analysis Inferences

The mean for the ten-question pre-test was 64%, an average of 5.8 out of 9 points. The majority of the respondents scored between 61-70% on the pre-test ($N = 21$). The lowest score was 22% ($N = 2$), the mean was 64% (SD=17%), and the highest score was 100% ($N = 1$). The most often missed question was Question 2 (a question regarding the operation most associated with opioid dependency), and the question most commonly

answered correctly on the pretest was Question 4. In comparison, the average score for the post-test was 91%, or an average score of 8.2/9 points. The majority of respondents scored between 91-100% ($N = 19$) on the post-test. The lowest score was 56% ($N = 1$), the mean was 91% (SD 11%), and the highest score was 100% ($N = 10$). The most missed question was Question 5, and the questions most likely to be answered correctly were Question 4 and Question 3.





A paired samples dependent *t*-test was used to analyze the scores of the pre-post test. The mean difference increase between pre- and post-test scores was 28.55, with a confidence level of 0.05, stretching from a lower bound of 21.94 to an upper bound of 35.15. There is a statistically significant difference between the pre-test and post-test scores ($p < .05$, t-8.74, df 39). The paired sample statistics box and paired sample test box are located in Appendix H.

Gaps

A noted gap in this analysis is the small sample size. Although 78 people viewed the PowerPoint presentation, and 57 respondents completed the pre-test, only 40 respondents completed both the pre- and post-tests, and could be analyzed with a paired samples *t*-test. The recommended sample size to achieve a statistically significant result with an alpha level of 0.05 was 45, according to GPower software calculations. Although

statistical significance was achieved with a sample size of 40, the small sample size should be taken into account when reviewing these results.

Unanticipated Consequences

One unanticipated consequence was that not all respondents for the pre-test completed the post-test. More emphasis should have been placed on the importance of completing the post-test in the initial email and reminder email. Otherwise, no unanticipated consequences were noted.

Expenditures

A required expenditure for the data analysis portion of this project included the cost of the SPSS software and the Survey Monkey membership, for a total of $200. These costs were covered by the team leader and are considered in-kind costs necessary for the analysis portion of this project.

Chapter 5: Leadership and Management of the Project

Organizational Culture

This project was implemented electronically through the INANA. The INANA is a professional state-run organization representing CRNAs in the state of Indiana. A Strengths, Weaknesses, Opportunities, and Threats Analysis (SWOT) was performed for the INANA to assess fit for this project. This type of analysis provides a template for analyzing an organization's culture prior to project implementation in order to identify what would best be used for advantage of the project and to mitigate risk (Mind Tools, n.d.). In addition, an Open Systems Model was utilized to assess the organizational culture of the INANA.

The results of the SWOT analysis revealed more strengths and opportunities than weaknesses and threats. Strengths of this organization in relation to this project include its membership rate, supportive leadership with its current president, and a history of email communication among its members. Its weaknesses include never having supported doctoral students through a scholarly project and being unaware of the requirements needed. Opportunities include just that: paving the way for this organization to accommodate scholarly projects in the future was mutually beneficial for the organization and the team leader. Threats to the organization include the Indiana Society of Anesthesiologists (ISA), an ever-present opposing force, and potential changing attitudes toward email communication amongst members.

Organizational culture is the foundation upon which an organization operates and abides. Culture provides the language for the operating system. Organizational culture varies in stability as a result of the length of the organization's' history (Schein, 2010).

An Open Systems Model views the organization as a process-oriented system that exists within the organizational culture itself, and is open to and dependent upon external environmental influences for survival (Breckenridge Institute, n.d.). The INANA organization functions as an open system, constantly receiving feedback from members that promotes change. The mission of the INANA is to protect and defend the right to practice as a CRNA, advocate for CRNAs and the profession of Nurse Anesthesia, and to advance the practice of CRNAs in the state. The organization is in constant communication with the external environment of healthcare and policy.

The vision of this state association is to have a highly engaged and cohesive membership, an effective voice and visibility within the healthcare community and Indiana legislature, and a government relations infrastructure that demands respect and a seat at the legislative table (Indiana Association of Nurse Anesthetists, n.d.). The culture at the INANA is to support Student Registered Nurse Anesthetists (SRNAs) completing doctoral projects. Because there have only recently been CRNA students in Indiana, the association has not had the opportunity to support many educational intervention doctoral projects. This project will serve as the first of its kind to be disseminated to the membership. The positivity and support the team leader received from the INANA president and Corydon Management Group reflects the vision and mission of the organization to advocate for the profession of nurse anesthesia.

Change Strategy

Kurt Lewin's classic theory of change is a three-phase change model that views change as a balance of forces; forces that are restrictive to change and those driving towards change work in opposition within an organization (White, Dudley-Brown, &

Terhaar, 2016). In his classic original work, "Field Theory in Social Science", Lewin (1951) describes the concept of "re-education" as a necessary component to lasting change. The concept of minimizing opioids in the perioperative period is still in its infancy within the profession of anesthesia, and requires a significant change in mindset before being widely accepted and utilized in practice.

The first of Lewin's three phases within the model is the *unfreezing* phase. Organizations must first "unfreeze" the situation by either increasing the driving forces toward change or decreasing the restricting forces inhibiting change; this is done by altering the perception of certain practices as counterproductive or not beneficial (White, Dudley-Brown, & Terhaar, 2016). This stage is a necessary first component of change (Cummings, Bridgman, & Brown, 2016). The focus of this project is within the unfreezing stage, as anesthesia and analgesia move away from primary opioid monotherapy to one of multimodal, opioid-sparing techniques.

The second of the three phases is the *change* phase, or the *moving* phase (White, Dudley-Brown, & Terhaar, 2016). This phase involves a process of change in thoughts, feelings, or behaviors that provide more benefit, or are more productive (Shirey, 2013). The intent of the project is to *unfreeze* anesthesia providers' attitudes regarding the opioid crisis and the role of anesthesia in order to move forward into the actual *change* phase.

The third phase is the *refreezing* phase. The refreezing stage requires establishing the change as the new normal, so that it now becomes standard practice. This final stage solidifies the change, and prevents reverting back to the old way of doing things (Shirey, 2013).

Lewin describes that change not only requires re-education and progression through the three-phase model, but also a change in culture. Re-education must occur within the culture of a group; the anesthesia profession is an example of such a group (Lewin, 1945). Individual practitioners may be more likely to adopt a change in practice if it is a change the professional group is adopting also.

Leadership Style

Transformational leadership in nursing has been associated with better outcomes and higher satisfaction rates (Sfantou, Laliotis, Patelarou, Sifaki-Pistolla, Matalliotakis, & Patelarou, 2017). The team leader has made every attempt to adopt a transformational leadership style. Transformational leaders inspire and motivate change without micromanaging (White, 2017). This project aimed to lead CRNAs in Indiana toward practice change by providing an engaging educational intervention. Since the intervention was provided via email, the providers were allowed to complete the intervention autonomously and voluntarily. Information was provided objectively, allowing providers to come to their own conclusions about the topic.

The DNP graduate must strive to improve patient and healthcare outcomes via strong organizational and systems leadership. The DNP graduate should be prepared to assume leadership roles in interprofessional teams (AACN, 2006). Effective leadership has been essential in the development and implementation of this project. The team leader has assumed a leadership role throughout its entirety, with support and assistance from collaborators and followers. The INANA has never supported a scholarly project in this fashion. The team leader had to lead the organization as it navigated this new process.

The transformational leadership currently at the INANA supported this scholarly project. The current president, Gregory Louck, CRNA, inspires and motivates change amongst his members while supporting their right to function as autonomous, independent practitioners. His unrelenting support of this project assisted the team leader in creating the first partnership between the organization and a doctoral student.

Interprofessional Collaboration

Interprofessional collaboration is critical in improving outcomes in healthcare (D'Amour, Ferrada-Videla, Rodriguez, & Beaulieu, 2005). Doctorally-prepared nurses are expected to assume leadership roles and participate in establishing interprofessional teams (AACN, 2006). Effective interprofessional teams are dynamic and capable of fluidity in adapting to the unique needs of the patient or project (AACN, 2006). The team leader for this project established an interprofessional DNP project team, including the project advisor, a PhD-prepared faculty member, the practice mentor, a doctorally-prepared CRNA, stakeholders which include practicing CRNAs and faculty members, and community partners, including CRNAs and members of a professional organization.

Interprofessional collaboration has been essential throughout the development of this project. Collaboration began in the project's initial stages as the team leader and the project advisor met frequently, either in-person or over the phone, to discuss the scholarly content, impact, and feasibility of the project. As the team leader advanced through clinical rotations and experienced issues within the clinical realm, the content of the educational intervention evolved to better fit the perceived need in Indiana. The project advisor provided crucial expertise regarding feasibility of the project as it developed.

The practice mentor was also instrumental in development of this project. The team leader collaborated with the practice mentor on many occasions at the university and while in clinical rotation. Because the practice mentor is an actively practicing CRNA and doctorally-prepared nurse, she was instrumental in providing guidance in identifying gaps in practice and connecting them to the available literature. She is also a proponent of opioid-free anesthesia and guided the team leader by demonstrating the benefits of this anesthetic technique.

Once the project entered into the development phase, community partners were sought to provide additional information and guidance. The community partner assisted the team leader by providing feedback on the project in its initial stages; specifically, they suggested narrowing the scope of the project when the amount of education the team leader wanted to provide was overwhelming. The project advisor and practice mentor supported this change, and the project scope was narrowed as a result. The community partner provided additional resources that the team leader otherwise would have been unable to access.

Subject matter experts were also sought to provide guidance. One subject matter expert was instrumental in this project development. Because he has pioneered his own technique for opioid-free anesthesia, developed his own educational website, and presented at conferences throughout the country, he is regarded as an expert in this new and emerging anesthetic field and was consulted many times throughout the project. He provided his own personal PowerPoint presentations to the team leader to use as a reference, but encouraged her to create a new, unique educational intervention best suited

to learners who are not regularly using this technique. This guidance was very helpful and influenced the final project greatly.

Collaboration occurred throughout project implementation via communication with the management group and the president of the INANA. Discussions were had regarding how the project should be implemented, what its objectives were, and how to best reach the membership. Croydon's vice president and the team leader decided together that email would be the best dissemination method, that bi-weekly reminders would be sent, and what the instruction email should state.

Continued collaboration occurred in the project development and implementation phases between the team leader and the project advisor, as well as the stakeholders in the project. The team leader was in contact regularly with community partners and subject matter experts throughout the development and implementation of this project, receiving feedback regarding new techniques in the field and how to best reach CRNAs in the state. These collaborators provided continued guidance, expertise, resources, and support.

Conflict Management

Throughout project development and implementation, the team leader has received overwhelming support. However, the project incurred its share of inevitable conflict. It was crucial for the team leader to view the conflict as an opportunity, however, since it directly led to the creation of a much stronger end product.

After the initial stages of project development, a site was selected for implementation at a regional hospital in southern Indiana. At the time, the team leader had full support for the project from the chief anesthesiologist and chief CRNA at the site. The team leader discussed the project with hospital administration, and plans were

made to implement the project pending approval. However, conflict ensued when the facility began losing CRNAs and employing more locum tenens CRNAs. The team leader had concerns that locum providers may not have as much motivation to complete the intervention, and could not be required to do so. Therefore, the sample size for the project would have likely been too low to evaluate whether or not the project met its goals. In addition, the chief CRNA experienced health issues, which prevented her from fulfilling her commitment to seeing the project through implementation.

Eventually, the decision was made, later than preferred for the project timeline, to change the site of implementation in order to have an adequate sample size and the necessary support for success. Changing sites required notifying the hospital that the project would no longer occur at the facility, and networking to quickly find another site. The team leader's request to implement at a tertiary care hospital in the region was declined. The project advisor suggested working with Gregory Louck, CRNA, a professor at the University of St. Francis as well as president of the INANA. This strategy proved successful, after he received confirmation from his management group that a project would be supported.

This conflict changed the entire course of the project, as changing sites also required a change in mode of delivery from an in-person presentation to an electronic presentation. Changing the format required the team leader to completely revise the presentation to engage learners electronically. Ultimately, this conflict strengthened the project, improved the sample size, and proved to be proactive, as the anesthesia group at the previous hospital lost the contract, and the project would not have been able to

continue. Creating the presentation in this manner also allowed it to be reused and downloaded amongst members.

Effective conflict resolution strategies are necessary for all nurses to possess in order to deliver quality care in the current complex healthcare system. For the doctorally-prepared nurse specifically, conflict management is essential in roles of leadership and collaboration. Constructive conflict management requires mutual respect and professionalism among all parties involved. Effective conflict management encompasses mastering leadership and interprofessional communication skills to solve problems and find new solutions (Siu, Spence Lashinger, & Finegan, 2008).

Chapter 6: Discussion

Impact of Project

The intent of this project was to provide education that would initiate change in anesthesia practice in Indiana. The learning objectives for this educational intervention were achieved. The proposed outcomes were not achieved as initially stated, but progress was made on each. Overall, the CRNAs who viewed the presentation and took the pre-post tests demonstrated an increase in knowledge and in likelihood of implementing of opioid-minimizing techniques into their practice. Providers who viewed the presentation without taking the tests may have gained knowledge as well. The intent is for the CRNAs who gained knowledge via the presentation to spread this information throughout their various practices throughout the state, widening the impact of this project.

One major impact of this project is its demonstration that educational interventions for CRNAs can be effectively disseminated via email through the state organization in Indiana and lead to a gain in knowledge. This project was the first to be disseminated electronically through the INANA; it paves the way for future scholarly projects, which could potentially serve as continuing education credits. The project's content and delivery have implications for future DNP projects, as well as state-led, anesthesia-related educational campaigns.

Decisions and Recommendations

The electronic format of this project provided flexibility for the CRNAs viewing the presentation to complete on their own time, and may have improved response rate. In comparison with the initial project design, which was to present information to CRNAs in-person, the response rate from sending the information electronically through the state

organization was perhaps higher and is recommended for future replications of this project.

A recommendation for anyone seeking to replicate this project is to reach out to the national organization, the American Association of Nurse Anesthetists (AANA), for electronic delivery. Reaching CRNAs on a national level would likely increase the response rate and greatly influence the impact of this project. An additional recommendation to increase the response rate is to apply for continuing education certification, so that respondents could obtain credits toward their mandatory annual certification requirements for completing the pre- and post-tests. Receiving credit for participation would also likely increase the number of respondents completing the post-test.

Limitations of the Project

A limitation of this project includes a small sample size. There are 412 CRNA members of the INANA in the state of Indiana. There were 56 participants who viewed the presentation, but only 40 completed both the pre- and post-test. Having a decreased number of respondents for the post-test compared to the pre-test was a limitation, since the overall results of exam performance with the total number of viewers could not be adequately analyzed.

The electronic format could be considered an advantage or a limitation depending on perspective. The format may not have effectively taught auditory learners. It is also possible that viewers were distracted during the presentation, and may not have gained as much knowledge as they would have with an auditory lecture or in-person presentation.

Application to Other Settings

The format of this presentation can be applied to other settings. Although utilizing PowerPoint presentations for education is common, distributing education through email via a state organization membership is an uncommon but effective way to disseminate information. Because the information is in PowerPoint format, it can be easily downloaded and used to educate anesthesia providers in different settings, such as departmental meetings, state and national conferences, and classroom settings. The presentation can also be useful for other medical professionals to whom it would be applicable, like registered nurses in the postanesthesia care unit (PACU).

Strategies for Maintaining and Sustaining

This project will be dispersed through the INANA once during implementation. It will not be a sustained project. However, because this project is electronic, it can be downloaded to various devices and referenced or used in other settings. The team leader will submit the presentation to The Society of Opioid Free Anesthesia for utilization by its membership. The project is also easily replicable with different content. The project manuscript and presentation will be available to future cohorts of the University of Saint Francis Nurse Anesthesia Program.

Lessons Learned

A lesson learned during this project was to utilize SurveyMonkey's free membership instead of purchasing an annual membership. The survey results could easily have been input into SPSS; an additional $170 was paid by the team leader in-kind for this feature, and it was largely unnecessary.

Another important lesson learned with this project is to require participants to complete the post-test. Having pre- and post-test results for each participant could have been most effectively achieved by applying for continuing education credits, and requiring completion of the post-test to receive those credits. Completion could also have been encouraged by including one or two sentences detailing the importance of completing both tests for the successful analysis of the project.

Chapter 7: Conclusion

Potential Project Impact on Health Outcomes Beyond Implementation Site

The opioid epidemic has had a devastating impact on public health in Indiana. The potential of this project to decrease the amount of perioperative opioids used will likely have a positive impact on health outcomes in the state. The majority of illegal opioid use has been linked to initial legal prescriptions (Sun, Darnell, & Mackey, 2016), the majority of which are consumed by surgical patients. By educating anesthesia professionals about alternative anesthetic techniques, "The Anesthesia Provider's Role in the Opioid Crisis" may result in more providers choosing to minimize opioid use, and therefore has the potential to lessen the impact of the opioid epidemic in the future.

This project has the potential to change attitudes towards perioperative opioid use. The United States currently consumes 80% of the world's opioids; a change in attitudes toward the role of providers in the opioid epidemic and how providers treat pain is an initial step toward decreasing the amount of opioids consumed in the United States. The long-held approach of opioid monotherapy to surgical analgesia cannot continue in the face of the current opioid epidemic. Change is necessary to improve the public health of the state and the nation.

This project has the potential to be expanded upon by future cohorts. The presentation was a simple, brief overview of a highly complex topic. Multimodal analgesia, central desensitization, regional anesthesia, and opioid-free anesthesia could all easily be topics for another project. This project could also be used as a reference for developing future projects on the topic of opioid-minimizing anesthesia.

Health Policy Implications of Project

The impact of nursing on health policy will likely increase as scholarly projects are implemented throughout the state of Indiana. CRNAs have been fighting for the freedom to practice independently in the state for decades. In light of the current opioid epidemic, CRNA-driven initiatives have provided solutions. For example, the Society of Opioid Free Anesthesia is a CRNA-founded professional organization providing resources to health professionals and policy makers regarding the role of anesthesia providers in combatting the opioid crisis.

As the healthcare industry continues the move toward value-based care, reimbursement from federal agencies has become tied to quality metrics. The Centers for Medicaid and Medicare Services may begin placing restrictions on opioid use, or tie reimbursement to multimodal analgesic techniques. This project would be particularly useful as an educational intervention for providers if such restrictions do eventually occur. Because the project is in electronic format, it can be easily downloaded, viewed, and updated to reflect changes.

Proposed Future Direction for Practice

This project is the beginning of a long process of change that must occur within the field of anesthesia. As the opioid epidemic ravishes the United States, changes must occur in perioperative pain management. Anesthesia providers must understand the role that they play in this crisis in order to provide the solutions they are uniquely qualified to implement. This project is an initial step toward changing attitudes among providers in Indiana.

By utilizing regional anesthetic techniques, multimodal analgesic principles, and opioid-free anesthesia whenever feasible and appropriate, anesthesia providers can help decrease perioperative opioid use. Decreased intraoperative opioids impact the opioid epidemic by increasing the efficacy and decreasing the requirement of postoperative opioids. Utilizing these strategies is often more labor-intensive, and requires additional education of the anesthesia professional. The hope is that this project will provide education to CRNAs regarding the importance of going the extra step to utilize these techniques.

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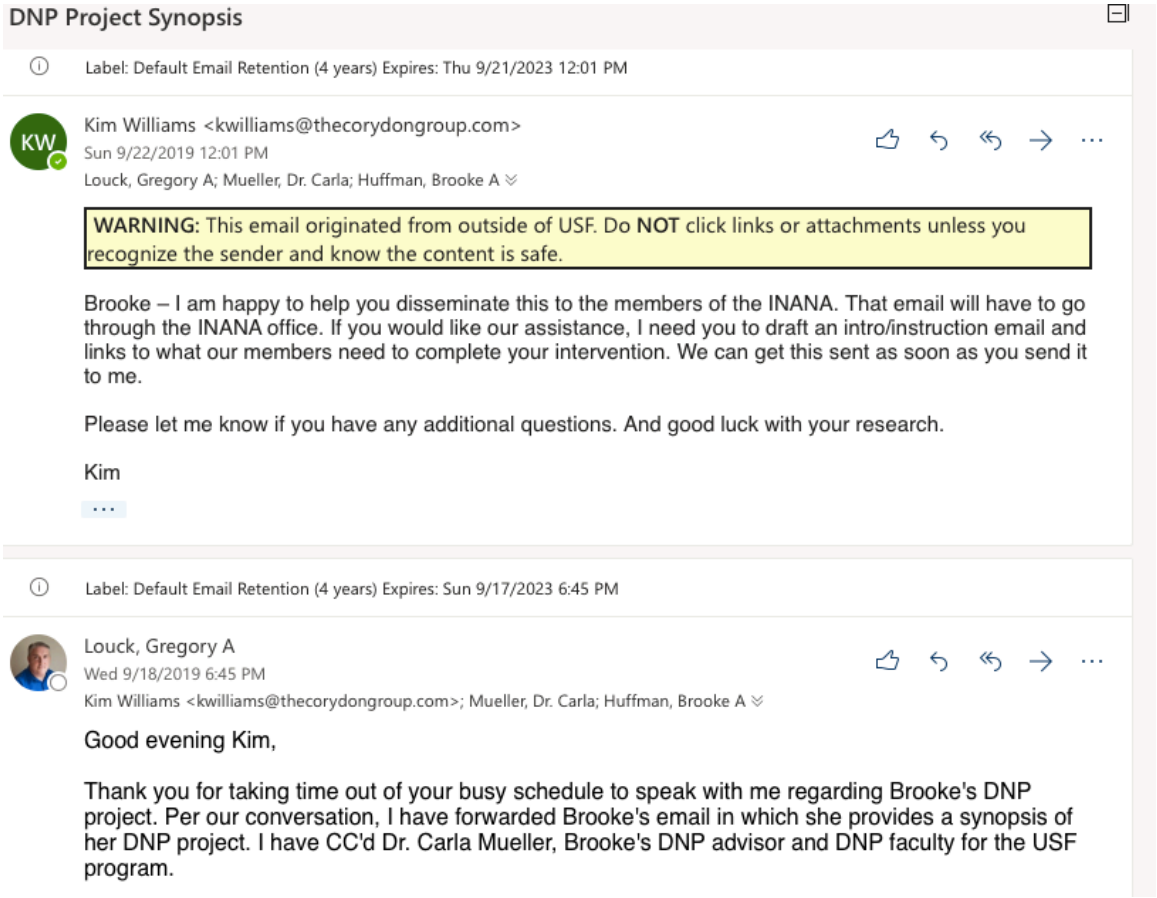
Appendix A

Project Approval Letter from INANA



DNP Project Synopsis

Label: Default Email Retention (4 years) Expires: Thu 9/21/2023 12:01 PM

KW

Kim Williams <kwilliams@thecorydongroup.com>
Sun 9/22/2019 12:01 PM
Louck, Gregory A; Mueller, Dr. Carla; Huffman, Brooke A

WARNING: This email originated from outside of USF. Do **NOT** click links or attachments unless you recognize the sender and know the content is safe.

Brooke – I am happy to help you disseminate this to the members of the INANA. That email will have to go through the INANA office. If you would like our assistance, I need you to draft an intro/instruction email and links to what our members need to complete your intervention. We can get this sent as soon as you send it to me.

Please let me know if you have any additional questions. And good luck with your research.

Kim

Label: Default Email Retention (4 years) Expires: Sun 9/17/2023 6:45 PM

Louck, Gregory A
Wed 9/18/2019 6:45 PM
Kim Williams <kwilliams@thecorydongroup.com>; Mueller, Dr. Carla; Huffman, Brooke A

Good evening Kim,

Thank you for taking time out of your busy schedule to speak with me regarding Brooke's DNP project. Per our conversation, I have forwarded Brooke's email in which she provides a synopsis of her DNP project. I have CC'd Dr. Carla Mueller, Brooke's DNP advisor and DNP faculty for the USF program.

Appendix B

Letter of Support from the Society of Opioid Free Anesthesia

Society for Opioid Free Anesthesia <info@goopioidfree.com>

Tue 10/15/2019 10:27 AM

Huffman, Brooke A

Brooke,

My apologies in not responding sooner. I was going back through old emails in preparation for the SOFA Congress and came across yours that got lost in the shuffle of my personal emails.

In short, a SRNA partnership gains you full access to the SOFA Membership side of the website for 1 year which includes all of the resources, references, discussion boards, etc. This is in exchange for a copy of your final project to share with the other SOFA members via the SOFA website.

If you think this would help you, I would encourage you to utilize this resource.

If that is agreeable to you, please let me know, and I can have our webmaster set you up with access.

Thanks!

Craig

craig@goopioidfree.com

SOFA
The Society for Opioid Free Anesthesia

Website
GoOpioidFree.com

Email Address
info@GoOpioidFree.com

Social Media
@GoOpioidFree

Appendix C

IRB Approval Form

University of Saint Francis
Institutional Review Board
Human Subjects Review Committee/ACUC/IBC
Institutional Review Board Approval Form

Protocol Number: 1569954-HSRC

Review by (underline one): HSRC ACUC IBC

Date Reviewed: 10/09/2019
Principal Investigator: Brooke Huffman
Faculty Advisor: Dr. Carla Mueller
Protocol Title: The Anesthesia Provider's Role in the Opioid Crisis: Opioid-minimizing & Opioid-free Anesthesia
Study Site(s): Indiana Association of Nurse Anesthetists

Items submitted for review:
- ☒CITI Certificate
- ☒Initial protocol
- ☐Abstract
- ☒Informed Consent Form (if applicable)
- ☐Approval letter from outside institution
- ☐Other – explain:

Type of Review:
- ☒Full Review
- ☐Expedited Review
- ☐Exempt Review

Approval:
- ☒Approval granted on 10/09/2019
- ☐Approval granted on _____ for a period of one year.
- ☐Conditional approval* granted on _____ for a period of one year.
- ☐Not approved*
- ☐Other

*Comments: _____

The committee performing this review is duly constituted and operates in accordance and compliance with local and federal regulations and guidelines.

Stephanie Oetting	*Stephanie Oetting*	10/14/2019
Printed Name (Chair or designee)	Signature	Date

IRB Committee Approval Form sjo 10/15/2019

Appendix D

CITI Training Certifications

CITI PROGRAM

This is to certify that:

Brooke Huffman

Has completed the following CITI Program course:

Public Health Research (Curriculum Group)
Public Health Research (Course Learner Group)
1 - Basic (Stage)

Under requirements set by:

University of Saint Francis

Completion Date 03-Aug-2019
Expiration Date 02-Aug-2022
Record ID 32619828

CITI
Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 31-Jul-2019
Expiration Date 30-Jul-2022
Record ID 32619827

This is to certify that:

Brooke Huffman

Has completed the following CITI Program course:

GCP – Social and Behavioral Research Best Practices for Clinical Research (Curriculum Group)
GCP – Social and Behavioral Research Best Practices for Clinical Research (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of Saint Francis

CITI
Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 31-Jul-2019
Expiration Date 30-Jul-2022
Record ID 32619827

This is to certify that:

Brooke Huffman

Has completed the following CITI Program course:

GCP – Social and Behavioral Research Best Practices for Clinical Research (Curriculum Group)
GCP – Social and Behavioral Research Best Practices for Clinical Research (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of Saint Francis

CITI
Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 03-Aug-2019
Expiration Date 02-Aug-2022
Record ID 32619826

This is to certify that:

Brooke Huffman

Has completed the following CITI Program course:

Social and Behavioral Responsible Conduct of Research (Curriculum Group)
Social and Behavioral Responsible Conduct of Research (Course Learner Group)
1 - RCR (Stage)

Under requirements set by:

University of Saint Francis

CITI
Collaborative Institutional Training Initiative

Completion Date 03-Aug-2019
Expiration Date N/A
Record ID 32619825

This is to certify that:

Brooke Huffman

Has completed the following CITI Program course:

Information Privacy Security (IPS) (Curriculum Group)
Researchers (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of Saint Francis

Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 03-Aug-2019
Expiration Date 02-Aug-2022
Record ID 32619824

This is to certify that:

Brooke Huffman

Has completed the following CITI Program course:

Social & Behavioral Research - Basic/Refresher (Curriculum Group)
Social & Behavioral Research (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of Saint Francis

CITI
Collaborative Institutional Training Initiative

Appendix E

Project Timeline

Tasks	Jul 19	Aug 19	Sept 19	Oct 19	Nov 19 *	Dec 19	Jan 20	Feb 20	Mar 20	Apr 20	May 20	Jun 20	Jul 20	Aug 20
Literature Review	x	x												
Gap Analysis	x													
Organizational assessment / SWOT Analysis	x													
CITI training	x													
Budget Development	X													
Pre-post test development			X											
Meetings with Project Advisor		x	x	x	x	x	x	x	X	x	x	x	x	x
Meeting or phone conversations with Primary Stakeholder		x	X	x	X	x	X	x	X	x	X	x	X	x
IRB approval			x	x										
Curriculum			x	x	x	X								

Development														
Implement							X	X	X					
Analyze results									X	X				
Enter data into SPSS									X	X				
Draft chapter 1,2,3				X	X	x	x							
Proposal Presentation					X									
Defend project at USF												x		

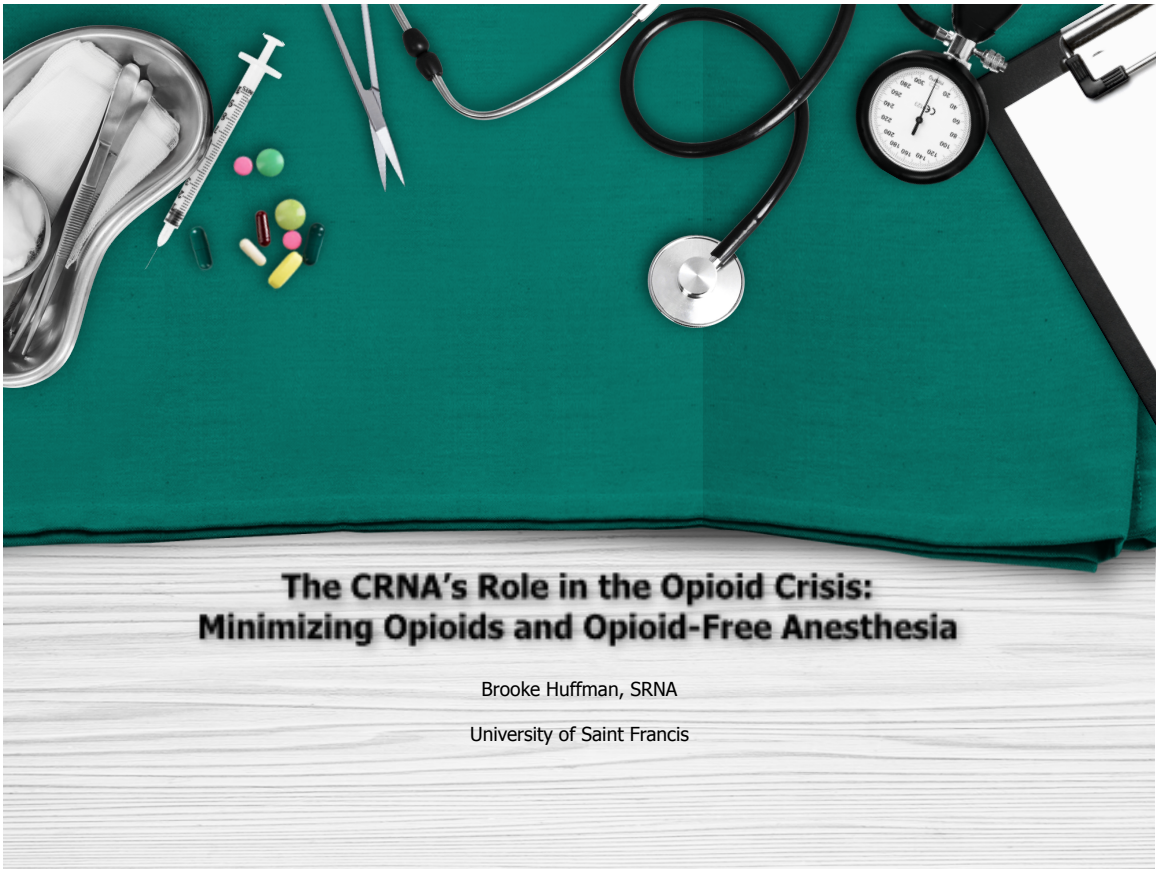
Appendix F

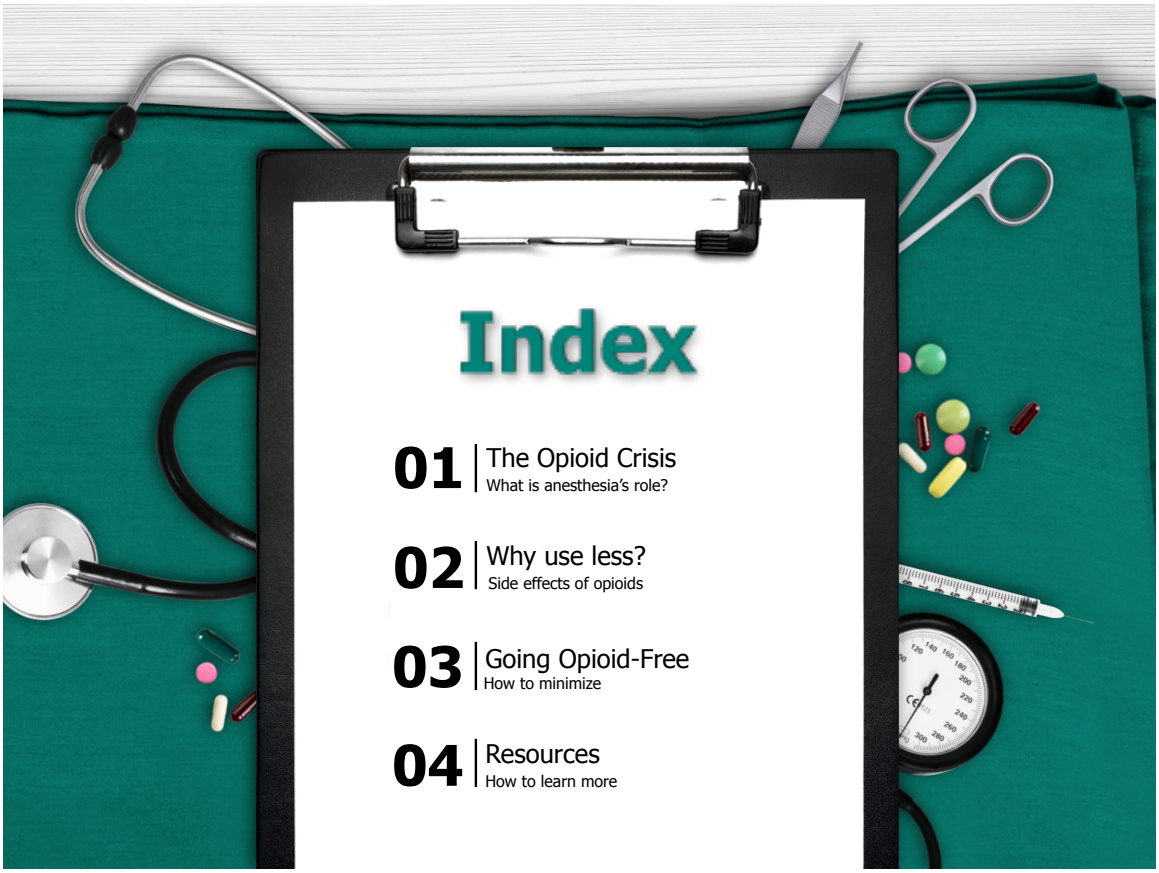
Pre-post Test link:

https://www.surveymonkey.com/r/DMTYRCL

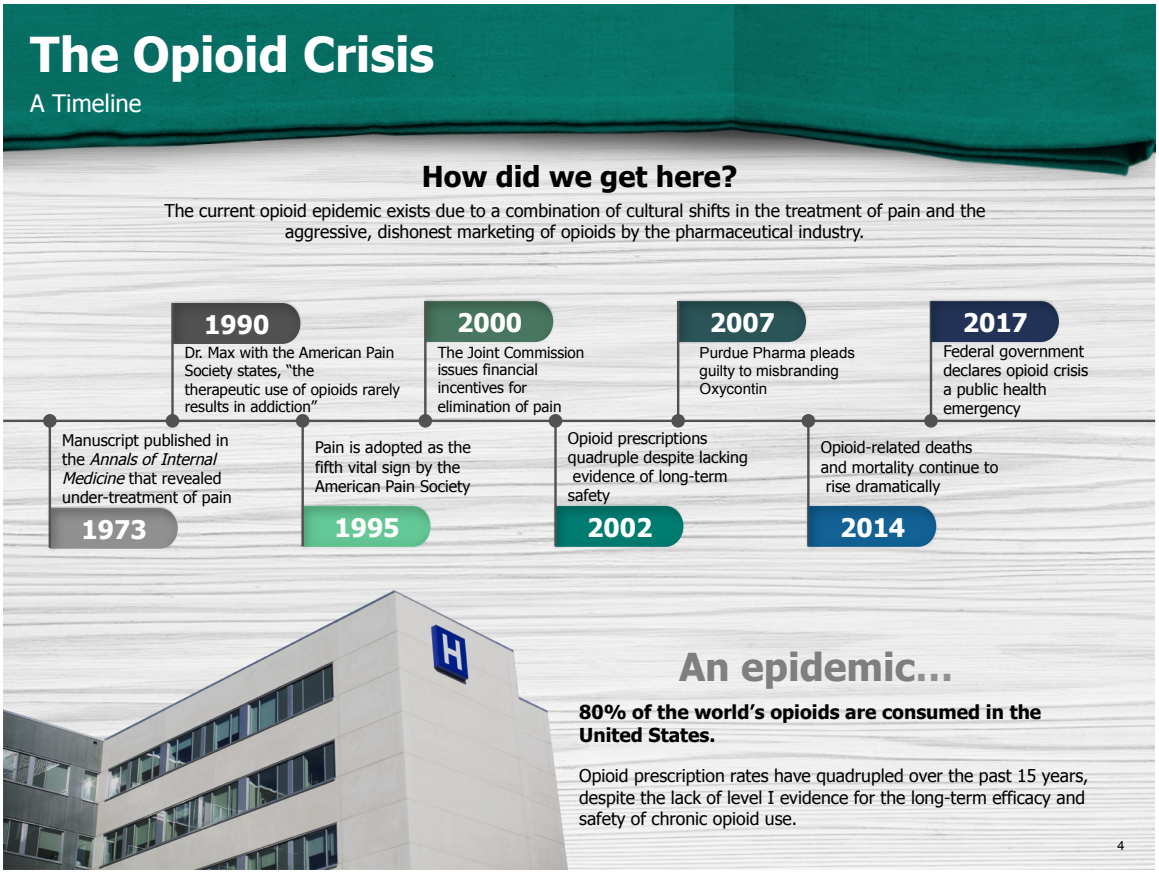
Appendix G

PowerPoint Presentation




Index
01 The Opioid Crisis
What is anesthesia's role?
02 Why use less?
Side effects of opioids
03 Going Opioid-Free
How to minimize
04 Resources
How to learn more

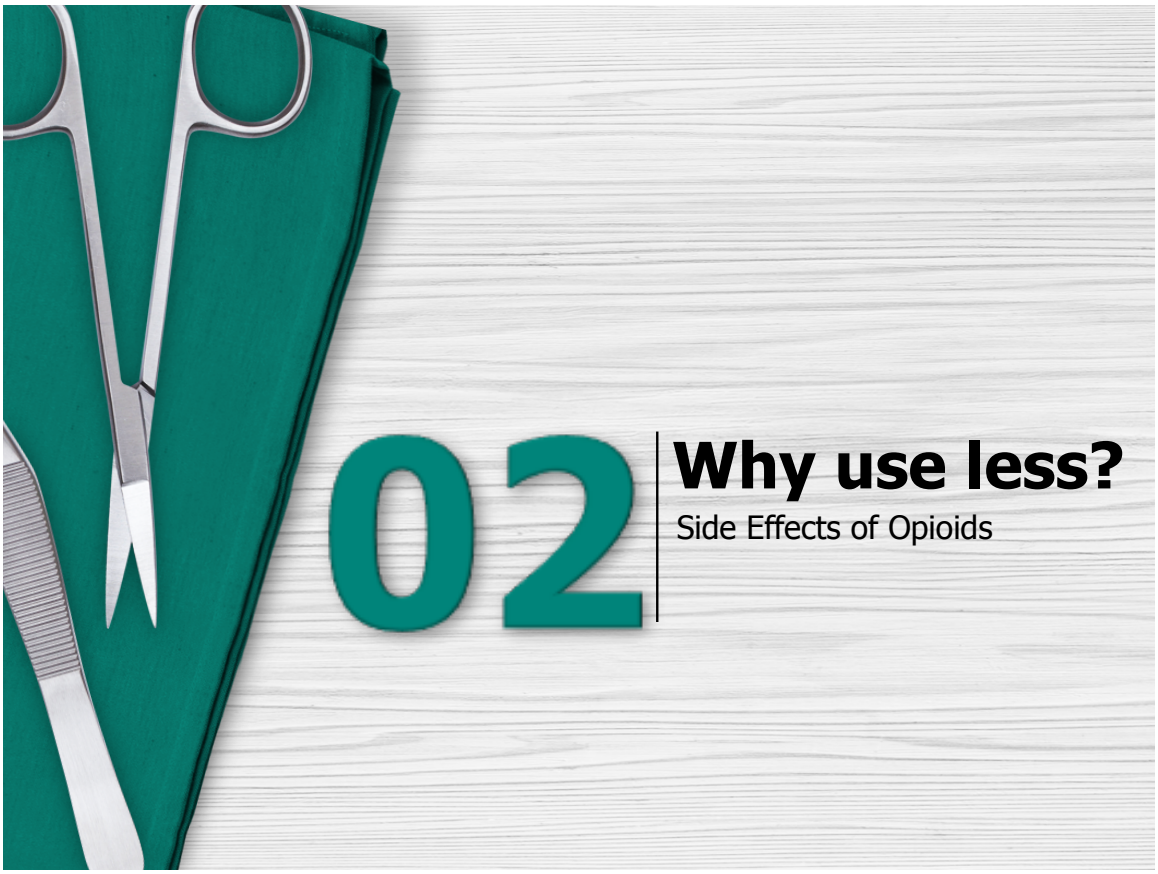

01
The Opioid Crisis
& The Role of Anesthesia

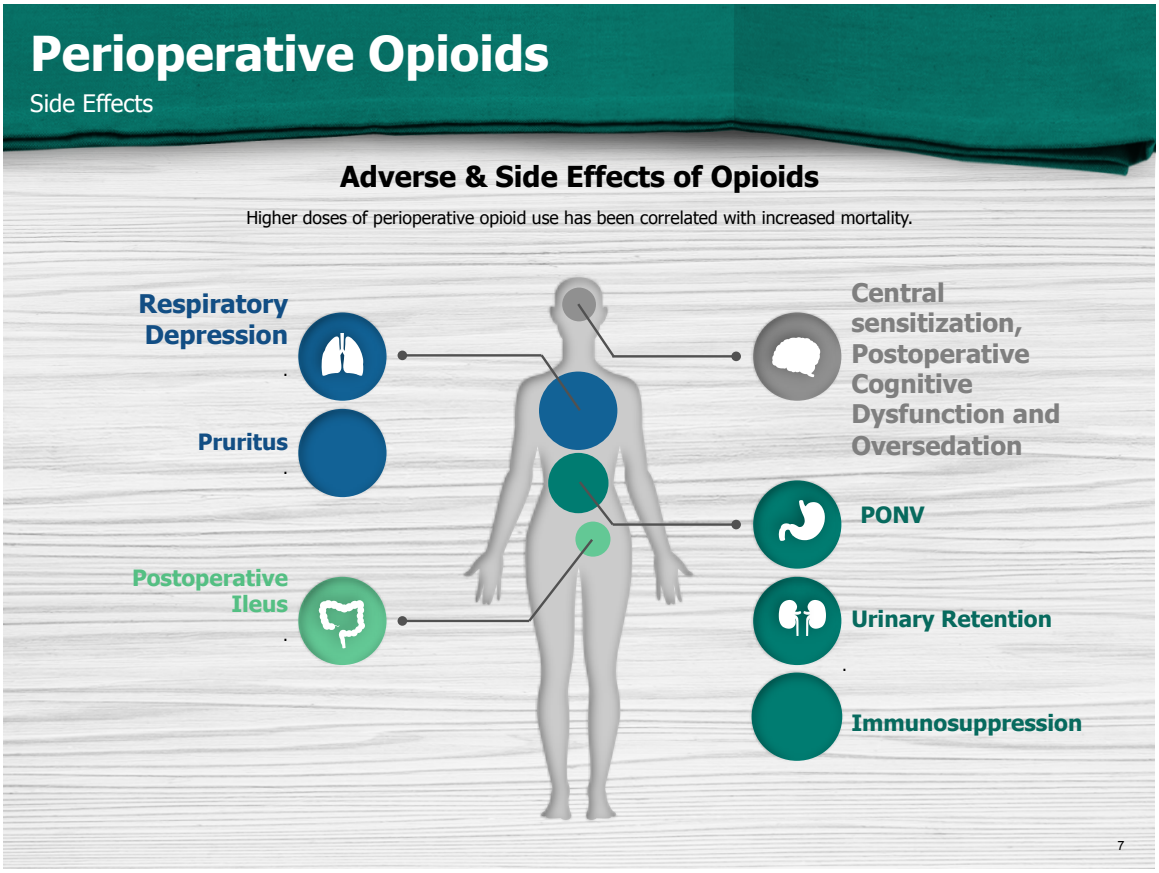

The Opioid Crisis
A Timeline
How did we get here?
The current opioid epidemic exists due to a combination of cultural shifts in the treatment of pain and the aggressive, dishonest marketing of opioids by the pharmaceutical industry.
1973
Manuscript published in the Annals of Internal Medicine that revealed under-treatment of pain
1990
Dr. Max with the American Pain Society states, "the therapeutic use of opioids rarely results in addiction"
1995
Pain is adopted as the fifth vital sign by the American Pain Society
2000
The Joint Commission issues financial incentives for elimination of pain
2002
Opioid prescriptions quadruple despite lacking evidence of long-term safety
2007
Purdue Pharma pleads guilty to misbranding Oxycontin
2014
Opioid-related deaths and mortality continue to rise dramatically
2017
Federal government declares opioid crisis a public health emergency
An epidemic…
80% of the world's opioids are consumed in the United States.
Opioid prescription rates have quadrupled over the past 15 years, despite the lack of level I evidence for the long-term efficacy and safety of chronic opioid use.
4

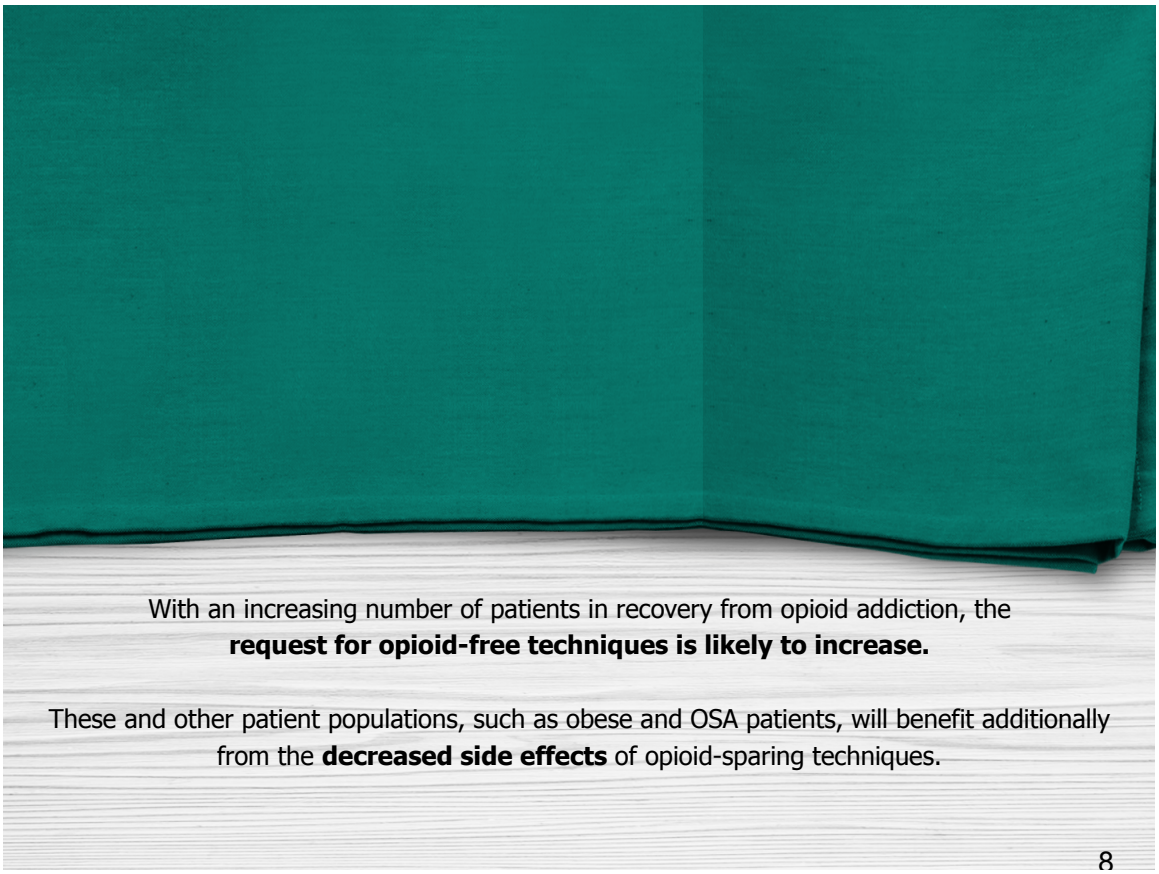
Surgery & The Opioid Crisis

What is anesthesia's role?

- The majority of chronic opioid dependence in the U.S. has resulted from **legal perioperative opioid use**.
- Opioid-induced hyperalgesia can occur after a **single intraoperative dose** of an opioid.
- Chronic opioid dependence can occur even in opioid-naïve patients.
- Certain procedures carry a higher risk for chronic postoperative opioid dependence, with Total Knee Arthroplasty (TKA) being the highest risk.
- Despite the known complications associated with opioids, **opioid monotherapy is still a common analgesic regimen** in surgical patients.


02
Why use less?
Side Effects of Opioids

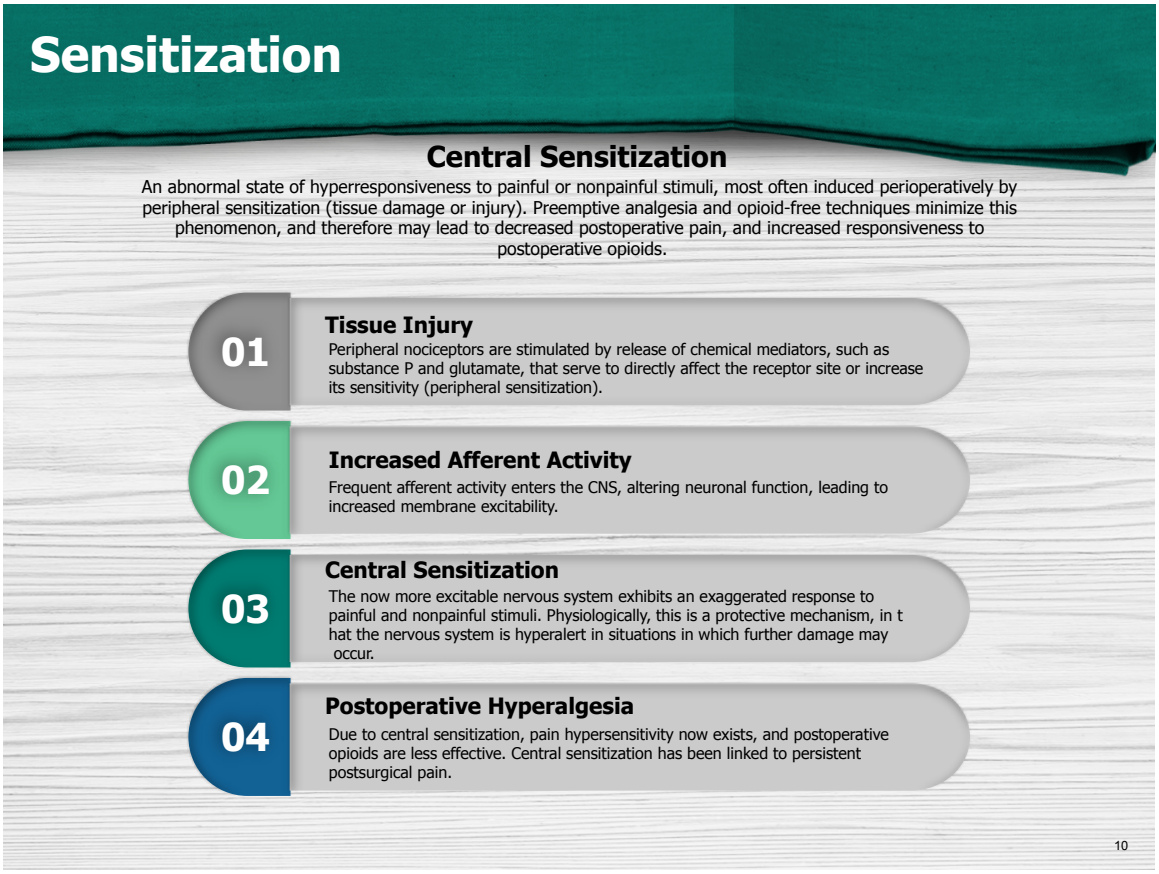

Perioperative Opioids
Side Effects
Adverse & Side Effects of Opioids
Higher doses of perioperative opioid use has been correlated with increased mortality.
Respiratory Depression
Pruritus
Postoperative Ileus
Central sensitization, Postoperative Cognitive Dysfunction and Oversedation
PONV
Urinary Retention
Immunosuppression
7


With an increasing number of patients in recovery from opioid addiction, the **request for opioid-free techniques is likely to increase.**
These and other patient populations, such as obese and OSA patients, will benefit additionally from the **decreased side effects** of opioid-sparing techniques.
8

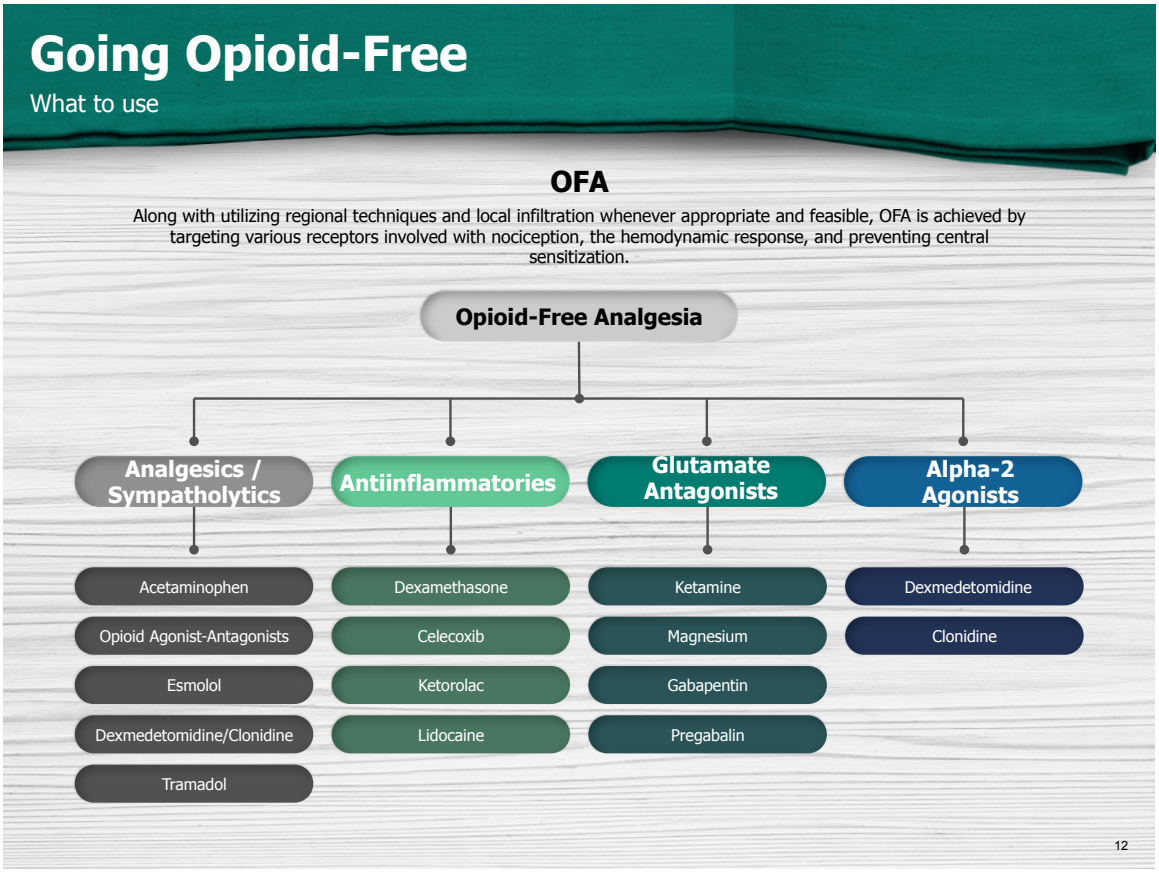
Enhanced Recovery After Surgery (ERAS)

& Minimizing perioperative narcotic use

- ERAS is an evidence-based, multimodal, multidisciplinary perioperative care pathway that strives to **accelerate patient recovery** after surgery, while minimizing complications.
- Utilizing **multimodal analgesia** to minimize opioids is a **key component** of ERAS protocols, along with preoperative education, reducing fasting time, and goal-directed fluid management.
- Implementation of ERAS protocols has resulted in decreased postoperative surgical complications, decreased hospital length of stay, and decreased opioid usage.


Sensitization
Central Sensitization
An abnormal state of hyperresponsiveness to painful or nonpainful stimuli, most often induced perioperatively by peripheral sensitization (tissue damage or injury). Preemptive analgesia and opioid-free techniques minimize this phenomenon, and therefore may lead to decreased postoperative pain, and increased responsiveness to postoperative opioids.
01
Tissue Injury
Peripheral nociceptors are stimulated by release of chemical mediators, such as substance P and glutamate, that serve to directly affect the receptor site or increase its sensitivity (peripheral sensitization).
02
Increased Afferent Activity
Frequent afferent activity enters the CNS, altering neuronal function, leading to increased membrane excitability.
03
Central Sensitization
The now more excitable nervous system exhibits an exaggerated response to painful and nonpainful stimuli. Physiologically, this is a protective mechanism, in t hat the nervous system is hyperalert in situations in which further damage may occur.
04
Postoperative Hyperalgesia
Due to central sensitization, pain hypersensitivity now exists, and postoperative opioids are less effective. Central sensitization has been linked to persistent postsurgical pain.
10

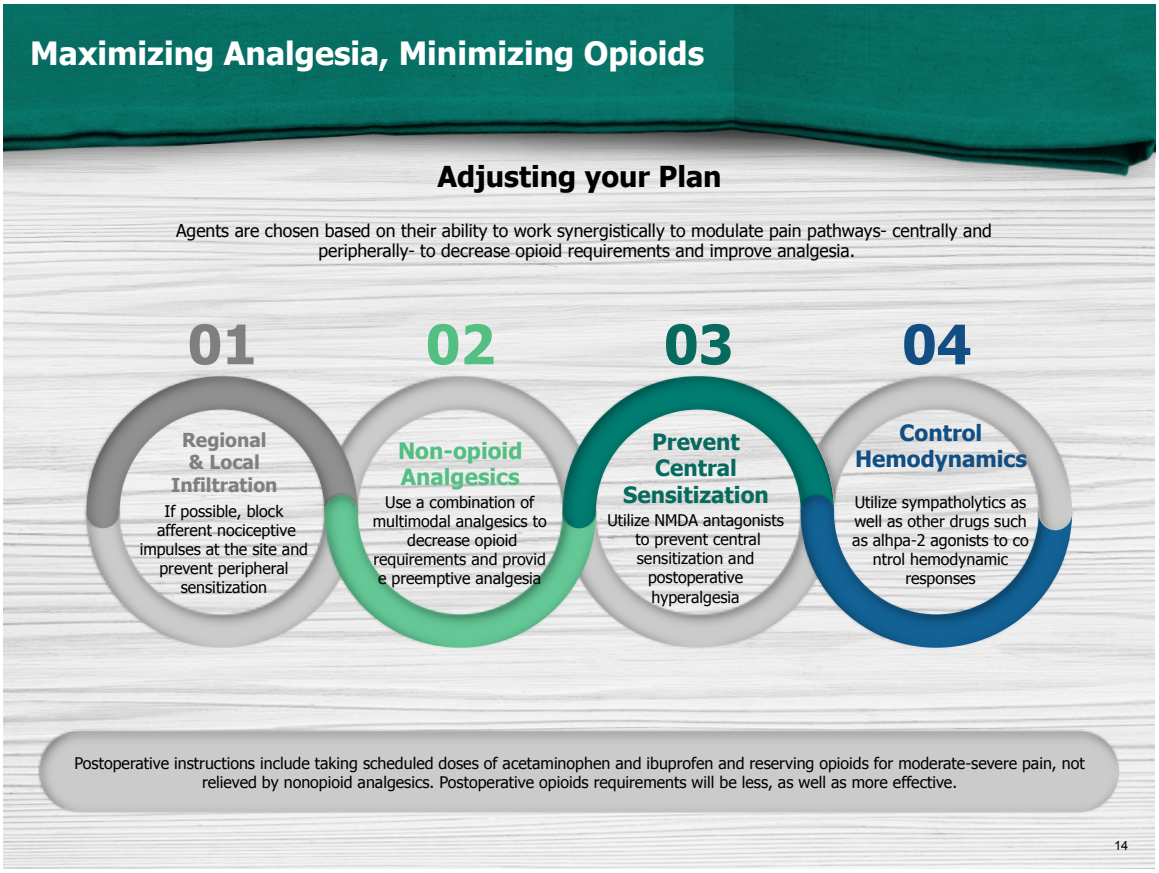

03
Going Opioid-Free
How to Minimize


Going Opioid-Free
What to use
OFA
Along with utilizing regional techniques and local infiltration whenever appropriate and feasible, OFA is achieved by targeting various receptors involved with nociception, the hemodynamic response, and preventing central sensitization.
Opioid-Free Analgesia
Analgesics / Sympatholytics
Antiinflammatories
Glutamate Antagonists
Alpha-2 Agonists
Acetaminophen
Opioid Agonist-Antagonists
Esmolol
Dexmedetomidine/Clonidine
Tramadol
Dexamethasone
Celecoxib
Ketorolac
Lidocaine
Ketamine
Magnesium
Gabapentin
Pregabalin
Dexmedetomidine
Clonidine
12

New Balanced Anesthesia

- New Balanced Anesthesia refers to using **targeted, receptor-directed drug combinations**
  - Targeted to pain, the stress response, or inflammation
  - May replace (or minimize) opioid use in a balanced anesthetic technique
- Using **regional anesthesia whenever feasible** as well as receptor-directed, targeted drug combinations are important concepts of Opioid-Free Anesthesia**.**
- Drug combinations include alpha-2 agonists, NMDA antagonists, antiinflammatories, sympatholytics, and non opioid analgesics.

13


Maximizing Analgesia, Minimizing Opioids
Adjusting your Plan
Agents are chosen based on their ability to work synergistically to modulate pain pathways- centrally and peripherally- to decrease opioid requirements and improve analgesia.
01
Regional & Local Infiltration
If possible, block afferent nociceptive impulses at the site and prevent peripheral sensitization
02
Non-opioid Analgesics
Use a combination of multimodal analgesics to decrease opioid requirements and provid e preemptive analgesia
03
Prevent Central Sensitization
Utilize NMDA antagonists to prevent central sensitization and postoperative hyperalgesia
04
Control Hemodynamics
Utilize sympatholytics as well as other drugs such as alhpa-2 agonists to co ntrol hemodynamic responses
Postoperative instructions include taking scheduled doses of acetaminophen and ibuprofen and reserving opioids for moderate-severe pain, not relieved by nonopioid analgesics. Postoperative opioids requirements will be less, as well as more effective.
14


04
Resources
How to learn more

Society for Opioid Free Anesthesia

SOFA

- The Society for Opioid Free Anesthesia (SOFA) is a professional organization founded by Tom Baribeault, CRNA in 2017 in order to educate anesthesia providers on OFA and to promote research in the field.
- Yearly membership provides access to various helpful resources, including "recipes", printable cards, research articles, and assistance.
- You can hear Tom Baribeault speak on the society and OFA on "From the Head of the Bed," the anesthesia podcast created by Jon Lowrance, CRNA here: https://www.fromtheheadofthebed.com/episode42/

McLott Mix

"An Easier Way to do Opioid-Free Anesthesia"

- Jason McLott, CRNA, has created a website with "recipes" for OFA, as well as postoperative handouts for patients. These are accessible to all at no charge.
- It contains OFA drug dosage calculators, presentations, and step-by-step "recipes" for successfully implementing this technique.
- You can find the link here: **http://mclottmix.com**

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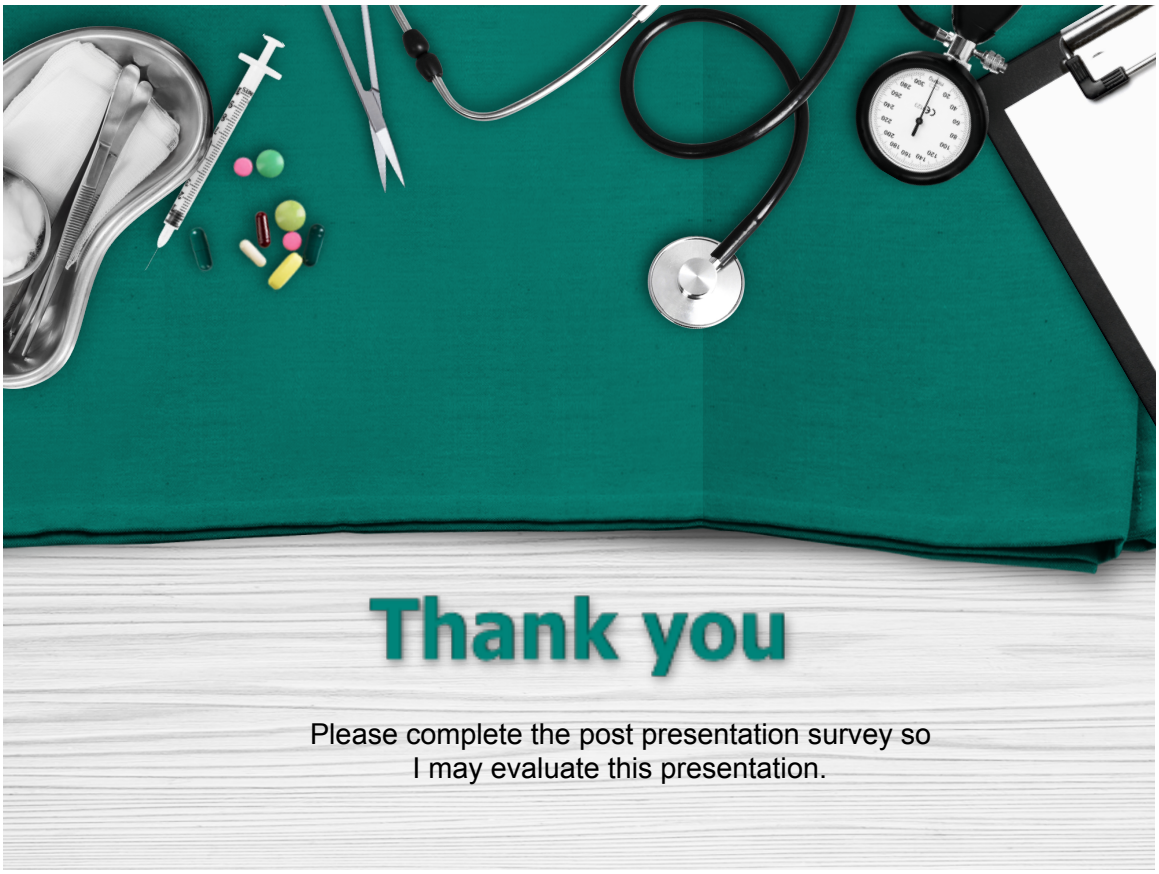
Thank you
Please complete the post presentation survey so
I may evaluate this presentation.

Appendix H

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PretestScore	62.3750	40	18.38992	2.90770
	PosttestScore	90.9250	40	10.82587	1.71172

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PretestScore & PosttestScore	40	.073	.655

Paired Samples Test

		Paired Differences				
					95% Confidence Interva of the Difference	
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper
Pair 1	PretestScore - PosttestScore	-28.55000	20.64964	3.26499	-35.15408	-21.9459

Paired Samples Test

		df	Sig. (2-tailed)
Pair 1	PretestScore - PosttestScore	39	