Anesthesia for Patients Who Use Marijuana

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Abstract

Marijuana is a complex chemical substance that has been known for centuries for its effects on the human body. In recent years, changes in legislation have led to an increase in the number of patients who use marijuana (both medicinal and recreational). Healthcare providers including anesthesia providers need to be cognizant of the specific precautions needed when caring for these patients. A literature search performed on the topic yielded crucial information that can expand the anesthesia providers' understanding of how to safely care for the patients who use marijuana. This Doctor of Nursing Practice (DNP) project disseminated the available information through education with the use of a cognitive aid to the anesthesia providers in the Operating Room (OR) Suites at Lehigh Valley Health Network (LVHN). The project utilizes the RE-AIM framework to achieve this result. The objective of the project is to improve the OR approach for patients who use marijuana, by educating providers on the specific needs of the patients who use marijuana and causing a change in their clinical practice to incorporate this knowledge in the care of these patients. This goal is evaluated through surveys of the anesthesia providers who participated in the educational series.

Keywords: Anesthetic implications of marijuana, RE-AIM, cognitive aid, education, practice change.

Chapter One: Introduction and Overview of the Problem of Interest

Marijuana or cannabis, a plant used for centuries for its medicinal properties, is a complex plant that contains chemical substances, such as cannabinoids, which elicit effects on the cardiovascular, respiratory, neuropsychiatric, gastrointestinal, and other systems of the body. While cannabinoids are the biologically active substances that produce most of the physiological effects of the plant (Teitel & Bozimowski, 2020), there are hundreds of other compounds in the cannabis plant that also produce effects on the body. The human body possesses cannabinoid receptors in all body tissues as a part of the endogenous cannabinoid system. The receptors are specifically abundant in the cardiovascular, immune, adrenal, ocular, gastrointestinal, and central nervous systems (Teitel & Bozimowski, 2020). The effects of the plant on the organism are varied and not thoroughly researched, those pertinent to the anesthesia providers can include arrhythmias, hemodynamic changes, altered sensory perception, increased risk of chronic lung diseases, anxiety, paranoia, interaction with multiple medications. Historically, research on marijuana was illegal, but recent changes on the state level have led to the initiation of marijuana as a legal medicine prescribed by healthcare practitioners for specific maladies. Additionally, legislation has allowed the research of the potential medicinal properties of marijuana. Consequently, there has been an increase in the population that utilizes marijuana.

Healthcare providers are coming in contact with patients who use marijuana regularly and need to be mindful of the specific pharmacodynamics and risks of adverse effects that these patients bring to practice. Anesthesia providers particularly must be aware of marijuana use since they administer multiple drugs in a short period of time to a patient to achieve an appropriate level of anesthesia. There is a risk of interactions between marijuana and many of the medicines utilized by the anesthesia providers. Additionally, the use of marijuana per se also increases the risks of adverse invents.

This DNP project focuses on the development of a cognitive aid to disseminate current scientific evidence available to the anesthesia providers in the health care network on the perioperative management of patients who use marijuana with the ultimate goal of quality improvement (Stanford Medicine, 2021).

Background and Significance

There has been an increase in the use of marijuana in the past few years, both medicinal and recreational, which is partly due to the recent legalization of marijuana. In 2013 approximately 7% of the US population was using marijuana. For comparison, in 2016 approximately 13% of the population was using it (Horvath et al., 2019). A federal survey released in 2015 estimated that approximately 33 million people in the US use cannabis, which is just slightly less than the approximately 38 million people in the US who use tobacco products (Horvath et al., 2019).

There is an interesting caveat with the "legality" of marijuana. Marijuana remains a Schedule I substance on the federal level (Russell, 2019). According to the Federal Controlled Substance Act of 1970, a Schedule I substance can have no use in medical practice, is highly addictive, and is completely forbidden to possess or utilize (Russell, 2019). Consequently, until very recently, conducting any research on marijuana was illegal on the Federal level. In 2016, the DEA denied a petition to reschedule marijuana as a Schedule II substance, but they did acknowledge that there was a lack of research on marijuana's medicinal properties. As a result, some restrictions were lifted, specifically, for FDA-authorized research purposes. Since then, research on marijuana has been conducted with a growing body of evidence being collected regarding its potential uses on a medicinal level as well as potential risks of its use.

Even though on a federal level, marijuana use remains illegal, medicinal marijuana use is legal on a state level in 35 states and its recreational use is legal in 14 states (National Council of State Boards of Nursing [NCSBN], 2018). The majority of the changes to the legal use of marijuana have occurred since 2016. Whether the federal government decides to prosecute medicinal marijuana prescribers and/or patients is dictated by the Rohrabacher-Farr amendment (signed into law in 2014) which prevents the federal enforcement of the prohibition in states where medicinal marijuana has been legalized (Russell, 2019). This amendment, however, does not protect recreational use.

Marijuana consumption is growing, and healthcare providers, including anesthesia, are faced with patients who are using marijuana for medicinal and/or recreational purposes regularly. When a patient undergoes general anesthesia, they are exposed to a variety of medications (inhalational gases, intravenous, and epidural medications) in a relatively short time, which have the potential to interact with the chemicals found in marijuana. Interactions between the anesthetic drugs and the patients' regular medications (antihypertensives, psychiatric medication, etc.) are well known to the anesthesia providers. The choice of anesthetics is carefully selected for each case after reviewing the patient's medications and pathologies to avoid adverse effects.

The same considerations exist for all substances that the patient may consume, such as alcohol, heroin, tobacco, marijuana, etc. However, the possible effects and/or interactions of some of these substances with anesthetic medications are less well known because fewer studies are conducted with illicit substances by virtue of the legal difficulties this would represent. Since regulations surrounding marijuana research have changed, data is now being collected regarding the possible effects and/or interactions that this substance may have with anesthetic agents. This knowledge is essential for anesthesia providers to consider, as it can significantly alter the

selection of medications chosen to provide anesthesia safely. Marijuana may alter the dosages and affect the monitoring of a patients' anesthesia depth. For example, patients who use marijuana require higher dosages of induction agents, narcotic analgesics, anesthetic gases. Additionally, some medications (anticholinergics and sympathomimetics) should be avoided if possible due to the possibility of toxic synergy. Furthermore, the use of marijuana brings its own inherent risks, of particular interest is five times higher rates of myocardial infarction within one hour of use even in relatively young otherwise healthy patients) (Goel et al., 2020)

PICO Question Guiding Inquiry

Despite a recently growing population of patients who use marijuana, there is a gap in knowledge among anesthesia providers on how to best care for these patients. Current data exists that highlights the precautions that anesthesia providers should take when caring for the patients who use marijuana, but it is not widely implemented because this data is still relatively new. A PICO question was formulated to guide this DNP Project: Among anesthesia providers, does a brief educational session and addition of a cognitive aid in the clinical setting improve the understanding of risks and perioperative anesthesia management of patients who use marijuana?

This Doctor of Nursing Practice (DNP) project aims to use a quality improvement approach by disseminating relevant evidence-based information in the form of a cognitive aid regarding anesthesia care for perioperative patients who use marijuana to the anesthesia providers in the Lehigh Valley Health Network (LVHN).

Organizational "Gap" Analysis of Project Site

A basic needs assessment was performed at the site of the project before initiation of planning using the Agency for Health Care Research and Quality [AHRQ] Guide. An important step in determining needs is to identify the current status of the organization's knowledge in the

area (AHRQ, 2014). After discussing the project with clinical managers at different sites of the health network and discussions with the clinical educator of the anesthesia department it became apparent that no education is available on this topic and no such initiatives have been pursued in the past in the organization. Even though this topic development is fairly new, there is a growing body of evidence that can help guide the safe administration of anesthesia. Healthcare organizations need to be up to date with the recent emerging data. The knowledge gap is apparent and the need for such an educational project is evident.

System and Population Impact

As a quality improvement project, the ultimate potential impact of this work is to educate the anesthesia providers on the topic of the perioperative management of the patients who use marijuana, to achieve safer and more effective care. The health system where this project was carried out is being entrusted by the patients with their wellbeing, hence, the system is interested in providing the best care possible to validate the patient's trust. This project's impact aims at a positive change in the anesthesia delivery to a growing group of at-risk individuals and reflects the most evidence-based approach to their healthcare.

On a population level, several critical points must be taken into account. It is crucial for the anesthesia providers to accurately identify the perioperative risks each patient possesses. Some risks are easier to identify than others (i.e. arrhythmia) others are dependent on the strength of the patient-provider relationship build during the clinical encounter, for example, the desire to disclose the use of drugs such as marijuana. Hence, it is essential that the anesthesia providers approach this part of the patient's personal history in a non-threatening and non-judgmental manner. The emphasis should be made on confidentiality and the fact that nondisclosure may lead to adverse events that can potentially result in discomfort, and/or

disability, and/or death. Although it is impossible to quantify the potential financial implications that may arise from preventable complications in patients who choose to not disclose marijuana use, in healthcare all involved parties (patients, providers, healthcare systems) are invested in avoiding difficulties when possible.

Goals, Objectives, and Expected Outcomes

The goal of this DNP project is to educate anesthesia providers regarding the evidence-based anesthesia management of patients who use marijuana. This is achieved through a brief educational session and the use of a cognitive aid in the clinical setting. The main expected outcome of this project is to improve the understanding of risks and perioperative management by anesthesia providers for patients who use marijuana. The motivation for the project is to improve anesthesia practices through the dissemination of evidence-based practice information.

The Specific, Measurable, Assignable, Realistic, and Time-specific (SMART) Objectives are:

1. Anesthesia providers will become more knowledgeable about the risks and management when providing anesthesia to the patients who use marijuana. This objective is measured through the pretest and posttest surveys administered by the DNP student. The objective is to increase the response mean by 30% for items “I am aware of perioperative risk factors in patients who use marijuana” and “The treatment plan in the perioperative period should be altered for patients who use marijuana” (items one and two on the posttest survey as compared to items two and three on the pretest survey) (Appendix A).

2. Anesthesia providers will self-report that their perioperative management of patients who use marijuana follows the evidence-based recommendations disseminated by the DNP student at the educational session. The timeframe for this goal is one month after the educational

session presented by the DNP student (Fall 2021). This objective is measured by the DNP student with item two on the one-month survey "The perioperative care I provide to patients who use marijuana has changed as a result of the education I received on the topic" (Appendix A).

3. Anesthesia providers will self-report that the use of the cognitive aid prompted them to alter their perioperative management of patients who use marijuana. This objective is measured by item three on the one-month survey "The cognitive aid mnemonic (CANNABIS) prompted me to modify my anesthesia administration practices" (Appendix A).

Chapter Two: Review of the Literature

Search Methodology

A literature search was initiated in Google Scholar, as this search engine gives a broad amount of literature that can then be narrowed down according to the needs. PubMed and EBSCOhost (CINAHL) were also utilized. Full access versions of some of the articles found previously on Google Scholar were located in these search engines.

In Google Scholar the keywords contained "anesthesia marijuana use." The desired published date exclusion for the articles was set from 2017 to the present. The search produced approximately 28,000 results. After this initial process, the titles of the articles were reviewed, paying attention to the date of publication (newer articles were given preference) and the type of research (experimental studies were given preference), and the site of publication (peer-reviewed scientific publishers were preferred). The articles that seemed related to the PICO question were skimmed through, reading initially the abstract and conclusions. This provided an idea of the research and information contained in the study and the determination was made whether it was of use to the PICO question. The only exclusion criterion in the Google Scholar search was the date. No specific inclusion criteria aside from the keywords were utilized.

In EBSCOhost CINAHL the advanced search link was selected. The search terms were the same: “anesthesia marijuana use.” Smart Text Searching was enabled; the search was further limited by date (2017 to present) and to availability of full-text articles. Additionally, the search was expanded by selecting the checkboxes of “Apply equivalent subjects”, “Apply related words” and “Also search within the full text of articles.” The results were 2125 articles. The method of screening and selection utilized in Google Scholar was repeated.

In PubMed, under “Advanced search”, the search was built as follows: In the first line the keywords “anesthesia marijuana use” were utilized applying it to “All Fields.” The second search line “AND” was selected as “Date - Publication” from 2017 to date. This produced 57 results and when the filter of “free full text” was added the yield was only 28 articles. The exclusion criteria in the search were the date and availability of free full text. No specific inclusion criteria aside from the keywords were used.

Additionally, several articles that were found in Google Scholar offered only an abbreviated version. The full versions were found through EBSCOhost CINAHL as mentioned earlier. After these searches were conducted in all three search engines, approximately 20 articles were gathered that were directly and indirectly related to the PICO question. A thorough reading of all the pieces of literature was performed, selecting the articles that were instrumental to answering the question. The fourteen articles that were finally selected are directly related to the PICO question. The search is schematically depicted in a PRISMA Diagram (Appendix B).

Following is a synthetized review of the overall characteristics of the selected studies as well as their main points. This information has been summarized in an evidence review table (see Appendix C).

Findings and Limitations

The strength of the evidence was evaluated according to the Melnyk and Fineout-Overholt Levels of Evidence (Arbor, 2019). The articles range from Level II to Level IV. There is a paucity of randomized controlled trials (RCTs) performed in the recent research on marijuana. One of the RCTs was performed in Israel and evaluates the accuracy of bi-spectral index (BIS) monitoring in the patients who use marijuana (Ibera et al., 2018) and the other RCT is a landmark study that evaluated the dosages of Propofol needed for successful intubation of the patients (Flisberg et al., 2009). Aside from this older landmark study the rest of the evidence is fairly recent (from 2017 to date). The majority of articles represent retrospective chart analysis or cohort studies and literature reviews. There is an article included from a professional society, the American Association of Nurse Anesthetists [AANA], which represents their practice recommendations regarding patients who use marijuana for anesthesia providers (AANA, 2019).

The quality of the studies was also examined utilizing the John Hopkins Evidence Level and Quality Guide (Johns Hopkins Medicine, n.d.). All studies are either good or high quality for their strength level. This means that they present reasonably consistent results, are controlled, and provide fairly definitive conclusions (Johns Hopkins Medicine, n.d.).

Overview of the Studies

The experimental and retrospective studies aimed at studying if the consumption of marijuana has effects on pain perception, dosages of medications needed for induction and maintenance of anesthesia, and differences in intraoperative monitoring techniques, rate of postoperative complications. To assess this, the investigators compared cohorts of patients who use marijuana vs those, who do not. The results in all the studies showed that patients who use

marijuana have significant differences in their operative risks and needs. The main findings of these studies are that this project aims to disseminate consist of the following:

- Higher doses of sedative medications are needed for induction and maintenance of anesthesia (Flisberg et al., 2009; Twardowski et al., 2019).
- Higher dosages needed of inhalation agents (Holmen, 2020).
- Higher perception of self-identified pain which leads to higher dosage needs of analgesic medications (including opioids) (Salottolo et al., 2018; Liu et al., 2019).
- Inaccurate intra-operative readings by BIS monitoring (Ibera et al., 2018).
- Higher rates of complications (five times higher rates of myocardial infarction within one hour of use) (Goel et al., 2020).

The literature review shows that the care of patients who use marijuana should be modified to accommodate specific needs in medication dosages, pain control, and risk mitigation. The main findings of these studies consist of the following:

- Link between marijuana and gastrointestinal dysmotility, potential need to utilize rapid sequence intubation (RSI) (Camilleri, 2018).
- Higher rates of perioperative complications, cardiovascular (tachycardia, hypotension), cerebrovascular, airway hyperreactivity, psychiatric manifestations, hypothermia (Alexander & Joshi, 2019; American Association of Nurse Anesthetists [AANA], 2019; Echeverria-Villalobos et al., 2019; Horvath et al., 2019; Jouanjus, 2017; Ladha et al., 2019).

As discussed above, all studies agree that the use of marijuana has a direct impact on the metabolism of the patients. This translates into:

- potential interactions with anesthetic and other medications

- limitations in the intra-operative modalities utilized in the operating room (BIS monitoring)
- increased perceptions of acute pain and, hence, increased doses of analgesic medications (opioids)
- increased doses of intravenous hypnotics (Propofol)
- increased doses of inhalational gases
- increased rates of intra-, and postoperative complications.

All of these findings are crucial to the everyday work of anesthesia providers and can directly impact the care of patients who use marijuana. The need to deliver this information to the anesthesia providers in a way that they can easily refer to is imperative for a safe operating environment for the growing population of patients who use marijuana.

Evidence-Based Practice

Based on the current literature, this project aims to use a cognitive aid to reinforce the specific changes to anesthesia care that should be made when caring for patients who use marijuana. The main focus is on the increased rate of complications (neurologic, cardiovascular, respiratory, gastrointestinal); differences in pain perception; increased needs of analgesic medications, sedatives, and inhalational agents and differences in monitoring modalities (inaccuracy of the BIS monitoring).

Chapter Three: Organizational Framework of Theory

Conceptual Definitions of Theory or Framework

The framework selected is the RE-AIM framework (Reach, Effectiveness, Adoption, Implementation, and Maintenance) (Appendix D) (RE-AIM, 2021). The RE-AIM framework is a reliable tool for the translation of research into practice. This model provides a functional

starting point for understanding the impact of change implementation for organizations and staff who intend to implement clinical practice guidelines or to deliver evidence-based information with fidelity (Sweet et al., 2014). The DNP Project approach follows the Reach, Effectiveness, Adoption, Implementation, and Maintenance format.

Relationship of Theory/ Framework to Scholarly project

For the Reach stage, the educational information regarding the differences in anesthesia care for patients who use marijuana was disseminated with the use of a cognitive aid through a presentation to highlight the specific needs of these patients. It is crucial to build a relationship with the stakeholders to engage audiences and recruit volunteers who will further spread the message. Handout materials that contain the cognitive aid can help in the process (Martinelli et al, 2019). Information dissemination materials are being used as well (such as posters) (RE-AIM, 2021).

During Effectiveness stage, the impact of the education was assessed. It is important to deliver the information clearly and concisely. Another strategy to be utilized was the use of a pretest survey to assess the base knowledge on the topic and an immediate posttest survey. This data assessed the impact that the educational session achieved (RE-AIM, 2021).

The Adoption stage is a key step as it implies the motivation that the stakeholders have towards the program. It is imperative to show the potential value of the proposed change. To achieve this, the key is the motivation of the stakeholders which will be sought through the provision of accurate scientific data that demonstrates the reach and effectiveness of the program (RE-AIM, 2021). Other tools included the strategic placement of educational materials (such as posters) in high-traffic areas.

The Implementation stage reflects how closely the staff members follow the program that was initially proposed, serves to ensure fidelity, and includes consistency of delivery as intended. Involvement and motivation remain key, and the participation process enhances the level of commitment and acceptance by those who will be delivering the protocol (RE-AIM, 2021).

The Maintenance stage is the step of the framework that looks at the long-term effectiveness, sustainability, and adaptation of the program (Schillinger, 2010). Once the educational program is instituted and in practice, the ultimate goal should be for it to become part of the routine organizational practice and policies. To achieve this, informational resources (cognitive aid) should continue to be easily accessible and reusable (RE-AIM, 2021). This step was monitored by an additional online survey to be performed one month after the completion of the education. This assessed if the anesthesia providers have modified their clinical practice according to the evidence-based data provided to them.

Chapter Four: Project Design

Project Design

After a gap analysis was performed, as described in Chapter One. A need was identified in the education of anesthesia providers in the care of patients who use marihuana. A meeting with the educational department leaders of the project site confirmed this need and solidified the buy-in from the stakeholders into the project. A quality improvement pre-post design was used for the DNP project. An educational session, entitled “Perioperative Management of Patients Who Use Marijuana” was provided to the Lehigh Valley Health Network (LVHN) anesthesia providers. The project does not aim to develop or to contribute to generalized knowledge but to provide clinical reminders so that providers are following evidence-based practice recommendations.

Institutional Review Board (IRB) Approval

Before the initiation of the project, it was submitted for the IRB review for both the project site (LVHN) and the student's school (Cedar Crest College). The initial application was to the project site (LVHN) which was submitted in August 2021. The proposal was reviewed by the institution's Human Subject Research Determination Board (HSRD), who determined that the project does not meet the regulatory requirements for human subject research as defined by 45 CFR 26.102(d) (Appendix E). After this, the proposal was submitted for the student's school IRB review, in September 2021. The determination was that the project proposal met the requirements for a Category 2 Exemption and, thus, was not subject to further review by the committee as long as there were no significant changes in the overall procedures (Appendix F). Securing both IRB clearances, the implementation phase was initiated.

Project Site and Population

The DNP project was disseminated to anesthesia providers at three different clinical sites of LVHN which includes: Lehigh Valley Hospital-Cedar Crest, a Level I Trauma Center, Allentown, PA; Lehigh Valley Hospital - 17th Street, an Ambulatory Surgical Center, Allentown, PA; and Lehigh Valley Hospital - Muhlenberg, a Level II Trauma Center, Bethlehem, PA. All three sites offer extensive surgical services and consequently have a robust anesthesia presence. The three sites are all within the Lehigh Valley in Pennsylvania. The Lehigh Valley is home to a population of approximately 840,000 people of diverse ethnic, cultural, and economic backgrounds (United States Census Bureau, 2021) and LVHN is one of the largest employers in the area (Lehigh Valley Economic Development, 2021).

Nonprobability purposeful convenience sampling (i.e., the target is a selected sample of individuals from a specific profession who will make good informants, are articulate and

reflective) was used (Polit, & Beck, 2017). The target population was anesthesia providers employed at one of the three clinical sites mentioned above. The sample size was expected to be around 40-45 participants. This was an approximation based on the number of anesthesia providers used for daily operating room function in the three campuses, the actual number was 36 participants.

The stakeholders of the project are the management of the institution, the clinical educators of the anesthesia department, the anesthesia providers, and ultimately, though indirectly, the patients. A possible barrier to project implementation was theorized to be the clinical practices of the anesthesia providers who might be reluctant to change their current ways. This potential difficulty was addressed by providing robust evidence-based information that justified the need for change in practice (Martinelli et al, 2019).

Project Implementation (Methods)

As mentioned above the project intended to improve quality by educating the anesthesia providers on the most up-to-date evidence-based information on the perioperative management of patients who use marijuana. For this purpose, a literature search was conducted and specific considerations that anesthesia providers should use when caring for these patients were synthesized. From these findings, the educational session and cognitive aid (acronym) were developed. On behalf of the DNP student, an invitation e-mail was sent by Jill Hanisak, DNP, CRNA, to the secure LVHN email addresses of anesthesia department members (anesthesiologists and CRNA's) inviting them to attend the educational session. This email informed the participants of the project's aims as well as implied consent upon participation (Appendix G).

The session was a 30-minute PowerPoint lecture (Appendix H) presented in-person at the LVHN- Cedar Crest site by the DNP student on September 17th, 2021 and broadcasted in real-time to the other clinical sites using LVHN's video-conferencing capabilities. The presentation included the use of a mnemonic cognitive aid in the form of the acronym: CANNABIS (Appendix I). The mnemonic addressed the following aspects of caring for the patient who uses marijuana: C- cardiovascular, A- airway (respiratory), N-neurological, N- narcotics (medication adjustment), A- aspiration precautions, BIS- monitoring adjustments. The cognitive aid was made available in posters strategically placed in high-traffic areas of the anesthesia departments of all the participating facilities.

Measurement Instruments and Data Collection Procedures

To assess knowledge acquisition and change in practice, a Pretest Survey, Posttest Survey, and One-month Survey were used. In educational-type projects, surveys represent a dependable and frequently used tool in assessing the effectiveness and impact that the project achieved (Nayak & Narayan, 2019). The Pretest and Posttest Surveys that collected no personal data, were developed by the DNP student, and were delivered on paper. The Pretest Survey (Appendix A) was three questions and intended to measure the baseline knowledge on the topic. There was also one demographic-based question that assessed years of experience of the anesthesia providers. This information was collected to describe the participant's years of experience. The Posttest Survey (Appendix A) was four questions and assessed the participant's knowledge acquisition of the topic. The One-Month Survey (Appendix A) was three questions and was administered at one-month after the presentation. This survey assessed if the providers incorporated the content of the educational session and cognitive aid in their daily practice. The collected data is quantitative, with nominal yes or no and Likert-scaled responses. The aim is for

the questions to follow a logical structured sequence. The questions are appropriate, intelligible, unambiguous, and unbiased (Yaddanapudi & Yaddanapudi, 2019).

The DNP student placed the paper surveys in a sealable envelope and delivered them to the designated clinical educators/ managers of the different clinical sites before the presentation. Upon arrival, all providers signed into the educational session using a standard departmental sign-up sheet. The clinical educators/managers handed the surveys to the participants upon arrival at the session. Prior to the presentation, the participants were asked to complete the Pretest Survey, which was printed on green paper. At the conclusion of the presentation, anesthesia providers were asked to complete the Posttest Survey (printed on pink paper) and leave them at their desks for collecting after the lecture. The participants were informed that they would receive an email in one month which would include the One-Month Posttest Survey. This survey was administered using SurveyMonkey software. The sign-in sheet utilized during the educational session provided the email contact information for the educational coordinator, Jill Hanisak, DNP, CRNA, to invite participants to complete the One-Month Survey.

The total time required to complete this DNP presentation was approximately 30 minutes. Agreement to participate included attendance at the educational session and response to all three surveys. Although this was 100% voluntary, completion and submission of the surveys was an indication of implied consent to participate in the project. Participation could be stopped at any time up until the submission of the One-Month Survey.

There were no anticipated risks to the participants as a result of their involvement in this project. If the participants felt uncomfortable or upset when answering any questions, they could stop and discontinue their participation. No direct benefit from participation in this project was

offered. The benefits of this project include the advancement of knowledge and evidence-based practice.

All data collected in this project was anonymous. Participants' names were never linked to the data. All data is being kept confidential and will only be used for the project purposes. All data is being stored on an encrypted and password-protected electronic device. This data will be destroyed at the completion of the project. The findings of this project may be included in a publication; however, participants' names will never be used.

Participation in this project was voluntary. The anesthesia providers had the right not to participate and could choose not to complete the surveys. They could end their involvement at any time without personal or professional penalty or consequence. The submission of the survey was an indication of implied consent to allow the responses to be used for this project. Once the responses were submitted it is not possible to remove them. The survey data is deidentified and analyzed as an aggregate.

Data Analysis

The data was grouped into three separate data samples based on the survey administered. Microsoft Excel and/or SPSS software was used to create a data set and descriptive statistics (i.e., mean, median, mode, standard deviation, sample variance, skewness, and confidence level of 95%) were computed. Contingency tables were created, and the differences were tested between the Pretest, Posttest, and One-Month Surveys to analyze the percentage of providers who understand the need for the change of their practice due to the education. The statistical analysis includes images and/or graphs for its schematic representation.

Cost-Benefit Analysis/Budget

Being a purely educational project that aims to cooperate with the educational department of a large health network, this project's costs were minimal to none for the hosting institution. The DNP student provided all of the education and created the handout materials and surveys. The educational presentation was created using Microsoft PowerPoint software and did not incur any expenses. The handout materials and posters were created using Microsoft PowerPoint software as well and printed on colorful paper (approximate cost $10, provided by the DNP student) at Cedar Crest College utilizing the DNP student's printing allowance for the semester. The DNP student analyzed the data and described the pertinent results. The organization did not need to provide financial assistance to the project creation, implementation, or analysis. The informative presentation was incorporated into the already existing educational series of the anesthesia department of the institution and utilized their infrastructure and information technology services as needed. No specific studies have been conducted that evaluate the potential economic benefits of providing evidence-based anesthesia care to patients who use marijuana. Potentially, the organization that strives for quality improvement will provide safer and more effective care of the patients who put their health in the hands of the institution.

Chapter Five: Implementation Procedures and Processes

This project was designed to be completed over several semesters (a complete timeline table is attached in Appendix J). In the spring of 2021, the DNP student performed a needs assessment, and several potential topics were analyzed for the project. A literature review was performed on the several topics to identify anesthesia pertinent evidence-based information available on them. After the selection of the project's topic and fulfilling the student's school requirements for the formal DNP project proposal, the next step was to secure support from as many stakeholders as possible. In the case of this project, the anesthesia educational department

of the selected health network was involved, through several meetings between the DNP student and the educational coordinators. The participants were selected to be the anesthesia providers of the health network. No further inclusion or exclusion criteria were in place. Support from the stakeholders is crucial for successful project implementation (Siegelaub, 2005).

The next step was the development of the implementation plan. Following the RE-AIM framework (see Chapter 4), the implementation plan was formed around an educational session. An initial survey was to be administered prior to the education to obtain an assessment of the baseline knowledge of the anesthesia providers on the topic. This was to be followed by a formal presentation. Immediately after the educational session, another survey was collected to obtain the degree of information comprehension and short-term retention. This was followed by a period of one month where the information was made available in high-traffic areas of the health network's anesthesia department to serve as visual reminders. After the one-month period was completed the third survey was to be collected to assess long-term knowledge retention and implementation. This was the skeleton plan developed as an informal guide around which the details were to be filled in.

In the summer of 2021, the DNP student undertook the creation of the educational material. A succinct (30 minute) PowerPoint presentation was developed that contained the evidence-based information that was to be disseminated. The most practical points of the information were organized into a mnemonic cognitive aid that served as a visual reminder for the providers. Then, the DNP student created the surveys, considering their length and tying them to the desired goals of the project. After these materials were created, the project was submitted to the health network's IRB for review. The approval was obtained deeming the project a quality improvement initiative (Appendix E). Then the student's school IRB approval

was procured (Appendix F). The IRB approvals of both institutions were obtained before the implementation of the project as this is an essential step.

In the fall of 2021, through coordination with the anesthesia's educational department a date was settled for the implementation phase, initiating with the presentation of the educational session. An email inviting the anesthesia providers of the health network to the educational lecture was sent out by the anesthesia educational coordinator (Appendix G). The email contained information regarding the project and implied consent. Due to the earlier work of securing support from the stakeholders, the conference was integrated into the existing anesthesia department's continuous education program and the securing of date, location, attendance of anesthesia providers, and technological support was streamlined. The project was presented by the DNP student as proposed on September 17th, 2021, in the health networks facilities with the use of their technological support. Two surveys were collected on-site, on paper, as planned. One pre and the other immediately post-presentation by the education coordinators. Immediately after the presentation, the cognitive aid was made available in the departments, by the DNP student, placed in high traffic areas to serve as a visual reminder. The cognitive aid will remain in place per the discretion of the anesthesia's education coordinator. A period of one month was allowed to transpire and the third and final survey was sent out by the educational coordinator on October 18th, 2021, through email utilizing a free online survey tool (Survey Monkey). The data collection period was finalized at the end of October 2021. The data (possesses no personal identifiers) of all three surveys were gathered and are stored securely in a password-protected file for further analysis by the DNP student. The DNP student solely possesses access to the data. The data was utilized in the spring of 2022 (see timeline Appendix

J) for statistical analysis of the DNP project and will be destroyed after the DNP project's completion (please see invitation email for further details Appendix G).

Chapter Six: Evaluation and Outcomes

This DNP project set out to answer the following PICO question: Among anesthesia providers, does a brief educational session and addition of a cognitive aid in the clinical setting improve the understanding of risks and perioperative anesthesia management of patients who use marijuana? This was formulated based on the needs assessment performed at the LVHN that showed a gap in the knowledge and the available education for the CRNA's on the topic in the institution. As such, the main goal of the project was to educate anesthesia providers regarding the evidence-based anesthesia management of patients who use marijuana resulting in a change in practice in the CRNA population of the LVHN. This goal was assessed utilizing surveys. Immediate pre- and post-intervention surveys were employed to assess baseline knowledge and immediate knowledge retention. Additionally, a one-month post-intervention survey was administered to measure self-reported practice change. For a thorough discussion of the collection process and the surveys themselves (please see Chapter 4).

The population of this DNP project is the CRNA's at the LVHN which is approximately 120 providers. The implementation lecture was attended by 36 providers (30% of the DNP project population), which makes the sample size statistically significant and provides confidence towards the generalization of the results. A total of 36 initial surveys (immediate pre- and post-intervention) were collected and a total of 16 surveys were collected at one-month post-intervention. All of the surveyed respondents were CRNA's with roughly bimodal (two peaks) distribution in terms of years of experience (less than five years and more than twenty-one years) (Table 17).

After collection the data was utilized to perform statistical analysis, the data was analyzed as an aggregate. Nonprobability purposeful convenience sampling (i.e., the target is a selected sample of individuals from a specific profession who will make good informants, are articulate and reflective) was used. Since the sample is a good representation of the population, inferences can be made with confidence about the population from the sample data results.

The data were grouped into three separate data samples based on the survey administered. Microsoft Excel and SPSS software were used to create a data set and descriptive statistics (i.e., mean, median, mode, standard deviation, sample variance, skewness) were computed. Contingency tables were created (see Tables 1-20), and the difference was tested between the pre-intervention, post-intervention, and one-month surveys to analyze the percentage of providers who understand the need for the change of their practice due to the education. The statistical analysis includes graphs for a schematic representation of the data (Tables 1-20).

The main expected outcome of this project was to improve the understanding of risks and perioperative management by anesthesia providers for patients who use marijuana. This goal was achieved with a brief educational session and a cognitive aid presented to the CRNA's at LVHN. This outcome was further broken down into three Specific, Measurable, Assignable, Realistic, and Time-specific (SMART) Objectives.

SMART Objective 1. Anesthesia providers will become more knowledgeable about the risks and management of providing anesthesia to the patients who use marijuana. This objective was measured through the pre-intervention and post-intervention surveys. The goal was to increase the response mean by 30% for questions one and two on the post-intervention survey as compared to questions two and three on the pre-intervention survey (Appendix A).

The first question that evaluated this objective was: “I am aware of perioperative risk factors in patients who use marijuana.” The mean response on the pre-intervention survey (pretest question #2) was 3.67 and on the post-intervention survey (posttest question #1) the mean was 4.44 (Table 5). The mean change was 15.4%. Although this did not achieve a 30% increase, there was a significant change in the strongly positive answers. In the pre-intervention survey combined 55.4% of the surveyed CRNA’s answered “agree” or “strongly agree” to the question (Tables 1, 2). In contrast, in the post-intervention survey combined 97% of surveyed respondents answered “agree” and “strongly agree”, meaning that they are aware of perioperative risk factors in patients who use marijuana as a result of the education they received (Tables 3, 4). Additionally, in the pre-intervention survey, 41.6% of surveyed CRNA’s answered “neutral”, but on the post-intervention survey there were no neutral answers to the same question (Tables 1, 3). This change in the survey answers represents that the anesthesia providers were educated, through the session presented by the DNP student, about the risks of peri-operative anesthesia care of patients who use marijuana. This is one of the objectives of the project and it ties back to the PICO question: an educational session for the anesthesia providers improves the understanding of risks and perioperative anesthesia management of patients who use marijuana.

The second question (pretest question #3 and posttest question #2) that evaluated this objective was “The treatment plan in the perioperative period should be altered for patients who use marijuana” (Appendix A). Both in the pre- and post-intervention surveys 94.4% of the surveyed respondents answered “yes” (Tables 6, 7; 8, 9). So, effectively, there was no mean change (Table 10). In comparing responses to both questions, however, even though most CRNA’s knew that the anesthesia perioperative treatment plan for patients who use marijuana

should be altered (94.4% positive answers on the pretest question #3), only 13.8% of them were confident on how to alter the treatment plan according to the risks of these patients ("strongly agree" answer on the pretest question # 2) (Tables 6, 1).

SMART Objective 2. Anesthesia providers self-reported that their perioperative management of patients who use marijuana follows the evidence-based recommendations disseminated by the DNP student at the educational session. This objective was measured by question # 2 on the one-month survey ("The perioperative care I provide to patients who use marijuana has changed as a result of the education I received on the topic") (Appendix A). The data shows that 87.5% responded yes to this question (Tables 11, 12, 13). This number means that the majority of CRNA's who attended the lecture and answered the one-month survey have undergone a change in practice as a result of this DNP project. This also shows that the ultimate goal of the project, education that leads to practice change, was achieved by this DNP project.

SMART Objective 3. Anesthesia providers self-reported that the use of the cognitive aid prompted them to alter their perioperative management of patients who use marijuana. This objective is measured by question #3 on the one-month survey (Appendix A). The data shows that 75% responded yes to this question (Tables 14, 15, 16). Again, this number shows that the majority of the CRNA's who attended the lecture and answered the one-month survey have found the cognitive aid (CANNABIS mnemonic) (Appendix I) helpful in their clinical work prompting them to change their day-to-day work when dealing with patients who use marijuana in order to proceed according to the latest evidence-based knowledge available on the topic.

Other data has been gathered through surveys that are not directly related to the SMART objectives. Interestingly, the one-month post-intervention survey showed that 75% of respondents had taken care (in a period of one month) of patients who use marijuana (Table 18).

This confirms the prevalence of patients who use marijuana and the need for anesthesia providers to be well versed in their care. Additionally, some data aids to answer the PICO question. Questions #3 and #4 in the post-intervention survey (Appendix A) are particularly helpful in this. Posttest question # 3 ("I will apply the concepts I learned about today in my clinical practice") reveals that combined 94.4% of the CRNA's who attended the lecture will apply the concepts learned on the lecture in their daily practice of anesthesia (Table 19). Posttest question # 4 (Appendix A) reveals that combined -88.9% of the CRNA's who attended the lecture felt that the mnemonic will result in a direct modification of their practice as anesthesia providers (Table 20).

The survey responses demonstrate that an educational session with the use of a cognitive aid among anesthesia providers improves the understanding of risks and perioperative anesthesia management of patients who use marijuana. Some of the conclusions learned from this project are that the CRNA's who participated in this project, overall, keep up to date with the currently available data (as manifested by the pre-intervention survey answers). CRNA's are receptive to educational material that is pertinent to their practice and are willing to incorporate new knowledge in their day-to-day work. There is a need for CRNA's to be aware of how to manage patients who use marijuana safely. Given the busy nature of the practice of anesthesia, participation in quality improvement projects needs to be encouraged in some way for the participants, educational projects do well with continuous education credits. In addition, cognitive aids at the point of care are a useful way of simplifying and improving the retention of complex material.

Some of the changes that could be made are related to the CRNA's survey participation and long-term education on the topic. Ideally, all the CRNA's of the health network should be exposed to the educational material (online module), making it available as part of the CRNA's

yearly continuous educational material would be an option. Additionally, the participation in the one-month post-intervention survey was limited (a little over one-third of the initial participants), so this could be an area for improvement, either by tying the continuous education credits received by the provider to this survey or other encouragement could be offered to improve survey completion. Another option would be to extend the follow-up survey period beyond one month, which would more accurately show long-term retention of the information and incorporation to the CRNA's practice.

Chapter Seven: Implications for Practice

There are two aspects of this project that impact nursing practice. The first one is the actual EBP recommendations for CRNA's on how to best deliver anesthesia to patients who use marijuana. Special precautions must be implemented when caring for this subset of patients. The choices and dosages of medications should be modified. Monitoring techniques may have inaccurate results. Specific possible adverse events must be anticipated, and preparations should be made to avoid them or face them safely should they occur. These recommendations have ample implications for the safe practice of anesthesia. The CRNA's that attended the educational session of this DNP project were directly affected by the EBP recommendations disseminated and self-reported a change in practice as a result of the education they received. The care these professionals will provide to their patients who use marijuana will follow the latest evidence-based recommendations. The second aspect of how this project impacts nursing practice is the development and implementation of the project itself. This project utilized the RE-AIM theoretical framework as the underpinning guide for its development, proving it to be an effective tool for this kind of design. The project also proved that an educational session with

the use of a cognitive aid is an effective way to achieve practice change and individuals who aim to achieve this may utilize this type of design for their project.

Strengths of the Project

This project set out with the goal to disseminate evidence-based information regarding the implications of marijuana use for patients undergoing anesthesia. The main strength of this project is that it has accomplished its goal. The surveys collected as part of the evaluation of the project demonstrate so. Additional strengths of the project are that the design is straightforward and allows for ease of execution and that the topic selected is very pertinent to today's anesthesia practice making it interesting to anesthesia providers, ensuring buy-in, and a willingness to change practices. Early collaboration with the network's education department guaranteed support from the institution which allowed for easy coordination regarding the delivery of the educational session and obtaining data for evaluation. The development of a catchy cognitive aid that allows for complex information to be delivered in a simple way helped the project as well.

Limitations of the Project

This DNP project has several areas that can be improved for future reference. The number of providers that were involved in the project (initial sample of 36) is one of the areas that can be improved. Even though this number represents a good percentage of the total population of the project, still it is a relatively small sample. This project was carried out in one health network, and although it is a large multi-center health network, still it is only one organization. It would be beneficial to expand the project to several organizations achieving, thus, a wider impact on CRNA's. Another limitation is the number of providers that completed the one-month surveys (16 out of 36). Unfortunately, without motivation, it is hard to achieve a

higher number of survey completion later. Another limitation is that the project only evaluated "self-reported" change in practice as a result of the education received. It would be hard to assess the actual change of practice by chart review in this type of project. The recommendations for practice made by the project are not easily traceable in the chart. For example, it is impossible to tell whether an anesthesia provider gave a specific amount of analgesic to a patient because this is the usual practice or because the provider anticipated higher pain perception in the patient due to marijuana use. This type of study would require a control group, and this escapes the purpose of a DNP project. An additional limitation is a time constraint. The project finalized data collection with a one-month survey. It would be beneficial for future DNP projects or researchers to see if any long-term information retention or long-term practice change has occurred. Lastly, the data available on marijuana itself represents a limitation. Because marijuana is still, technically, illegal on a federal level, very few, high quality, studies of its effects in general have been performed and even less so specifically in the area of anesthesia.

Linkage to DNP Essentials

The eight DNP Essentials are the foundational outcome competencies deemed essential for all graduates of a DNP program regardless of specialty or functional focus (American Association of Colleges of Nursing, 2006). This DNP project relates to all eight DNP essentials.

Essential I

Scientific Underpinnings for Practice. This DNP project links complex scientific data regarding a chemical substance (marijuana) to the effects it has on the human body and translates this information to the practice of anesthesia, disseminating this information to other anesthesia providers.

Essential II

Organizational and Systems Leadership for Quality Improvement and Systems Thinking. The goal of this project, quality improvement, is directly related to this essential. The ultimate objective is to achieve safe anesthesia practices for all patients, thus eliminating health disparities and promoting patient safety and excellence in practice.

Essential III

Clinical Scholarship and Analytical Methods for Evidence-Based Practice. This DNP project links to this essential through its completion by translating research into practice and disseminating and integrating new knowledge to other healthcare providers.

Essential IV

Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care. This DNP project utilizes information systems and technology for its completion, through data gathering, delivery of information, and gathering of outcomes.

Essential V

Health Care Policy for Advocacy in Health Care. It would probably be premature, but not impossible to imagine the development of policies that pertain to the care of patients who use marijuana. This project advocates for the safe delivery of anesthesia to a subset of patients in healthcare.

Essential VI

Interprofessional Collaboration for Improving Patient and Population Health Outcomes. Healthcare is a complex science, where many things depend on the relationships created between healthcare providers and the patient. If a patient has previous negative experiences when they disclosed high-risk behaviors, this may translate into patients not feeling comfortable revealing

parts of their personal story. The healthcare providers not having a complete and accurate picture of the health of the patient will not be able to provide the best possible care to each specific person. This project addresses the particular anesthetic needs of the patients who use marijuana. Healthcare providers need to know if their patient uses marijuana to be able to provide the appropriate anesthetic care. If the patient does not disclose this, the project is of no practical value. The interdisciplinary collaborative opportunities for this project arise from these dynamics. If all the healthcare team (nurses, surgeons, anesthesia, etc.) provides a safe non-judgmental environment for the patient while obtaining a thorough social history, this will lead to honest answers and allow the anesthesia provider to deliver adequate care to the patients who use marijuana.

Essential VII

Clinical Prevention and Population Health for Improving the Nation's Health. This DNP project focuses on a specific growing population, patients who use marijuana. As such the project aims to ensure the adequate peri-operative care of this subset of patients.

Essential VIII

Advanced Nursing Practice. This DNP project is specialized in the practice of a nurse anesthetist within the larger domain of nursing practice. Practicing advanced nursing allows for this DNP project to achieve its objectives.

Chapter Eight: Summary of Project

Summary and Conclusions

With the recent changes in legislation surrounding marijuana, an increase in patients who use marijuana has occurred in all healthcare areas. Marijuana has the potential for side effects, medication interactions, and elevated risks, of which anesthesia providers must be aware. This is

a quality improvement educational project on the perioperative management of patients who use marijuana. The project consisted of the delivery of scientific evidence to anesthesia providers by way of an educational session with the use of a cognitive aid. The end goal was to improve anesthesia delivery to the patients who use marijuana based on current evidence-based practices. The project utilized pre-, and post-educational surveys to assess the effects of the effort. The surveys demonstrated an increase in knowledge in the anesthesia providers as a result of the educational session, as well as a self-reported change in practice as a result of the education received on the topic. The main learning points of this project were directed towards the need for evidence-based education of anesthesia providers on the peri-operative implications of marijuana use by patients. Anesthesia providers demonstrated receptiveness to education and practice modification when presented with sound scientific data supporting the need for change. A cognitive aid (in this case a mnemonic) proved to be an effective tool for education delivery.

Dissemination Plans and Future Ideas

This project will be presented in two separate events. The first event is the 34th Annual Scientific Session of the Eastern Nursing Research Society which will be held in Providence, RI in March of 2022. The second presentation took place at the Cedar Crest College, School of Nursing in April of 2022 as well. The aim of these presentations is to disseminate a doctoral nursing science project that promotes clinical excellency, patient safety, diversity, health equity, and inclusion. As the scientific evidence of the health benefits of marijuana and the medical indications for the use of marijuana expand, so will the patient population that utilizes this substance. The patients that utilize marijuana whether for recreational or medical purposes are increasing and require the anesthesia clinicians to be prepared to deliver quality patient care.

As mentioned in previous chapters, this project has the potential for expansion. A multi-organizational education session, such as the dissemination of the information at a scientific meeting, would be an interesting enterprise. A broader outreach effort to reach more providers and have a wider clinical effect can be pursued, resulting in a larger impact of the project on the anesthesia clinicians and hence on the population. Long-term follow-up with the providers to evaluate durable practice changes could be pursued as well.

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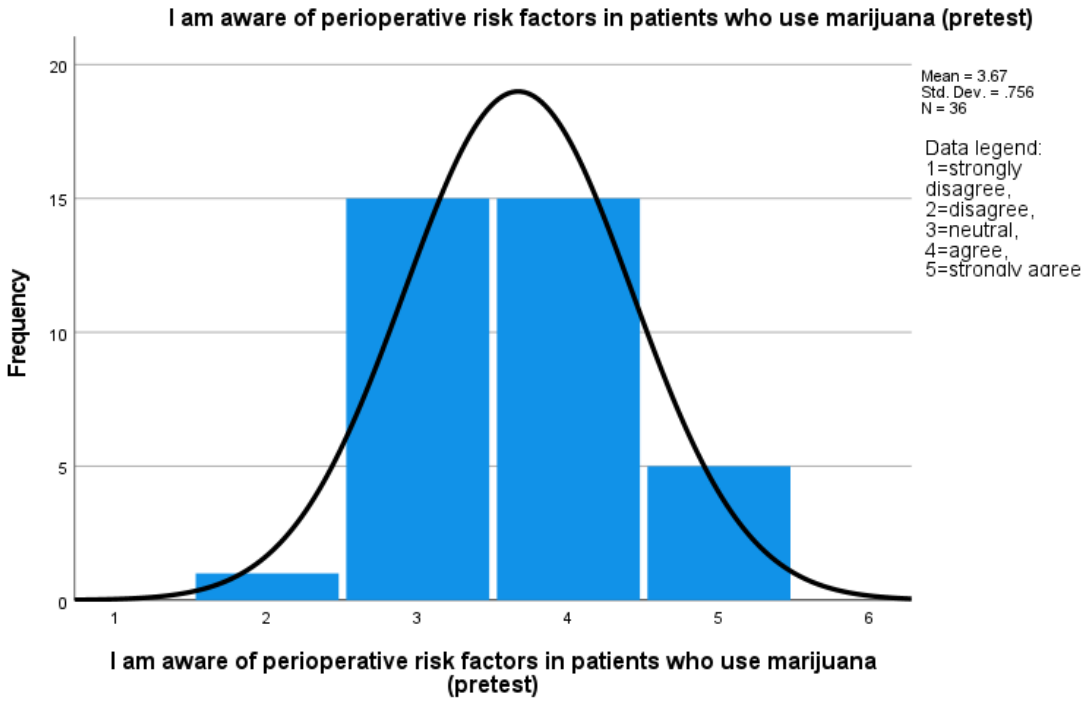
Table 1. Frequency Pretest question #2.

I am aware of perioperative risk factors in patients who use marijuana (pretest)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	1	2.8	2.8	2.8
	neutral	15	41.7	41.7	44.4
	agree	15	41.7	41.7	86.1
	strongly agree	5	13.9	13.9	100.0
	Total	36	100.0	100.0	

(SPSS, 2022).

Table 2. Histogram Pretest question #2.



(SPSS, 2022).

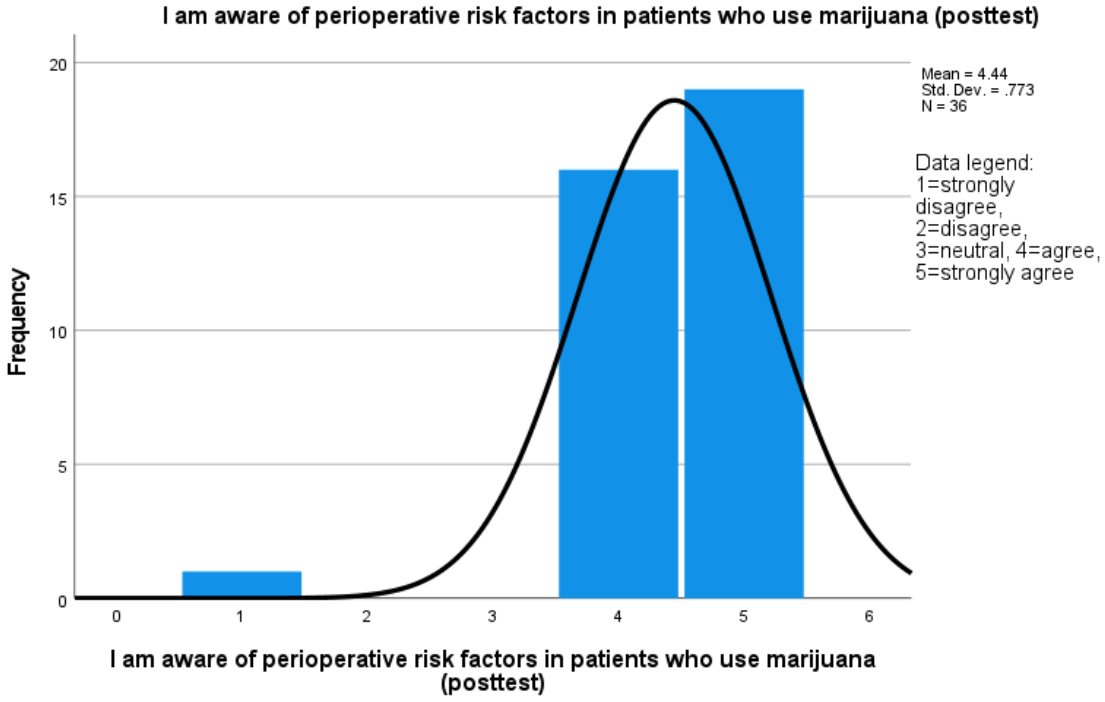
Table 3. Frequency Posttest Question #1.

I am aware of perioperative risk factors in patients who use marijuana (posttest)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	1	2.8	2.8	2.8
	agree	16	44.4	44.4	47.2
	strongly agree	19	52.8	52.8	100.0
	Total	36	100.0	100.0	

(SPSS, 2022).

Table 4. Histogram Posttest Question #1.



(SPSS, 2022).

Table 5. Descriptive Statistics for Pretest Question #2 and Posttest Question #1.

Statistics

		I am aware of perioperative risk factors in patients who use marijuana (pretest)	I am aware of perioperative risk factors in patients who use marijuana (posttest)
N	Valid	36	36
	Missing	0	0
Mean		3.67	4.44
Std. Error of Mean		.126	.129
Median		4.00	5.00
Mode		3[a]	5
Std. Deviation		.756	.773
Variance		.571	.597
Skewness		.233	-2.560
Std. Error of Skewness		.393	.393
Kurtosis		-.505	10.360
Std. Error of Kurtosis		.768	.768
Range		3	4
Sum		132	160

a. Data legend: 1=strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree

(SPSS, 2022).

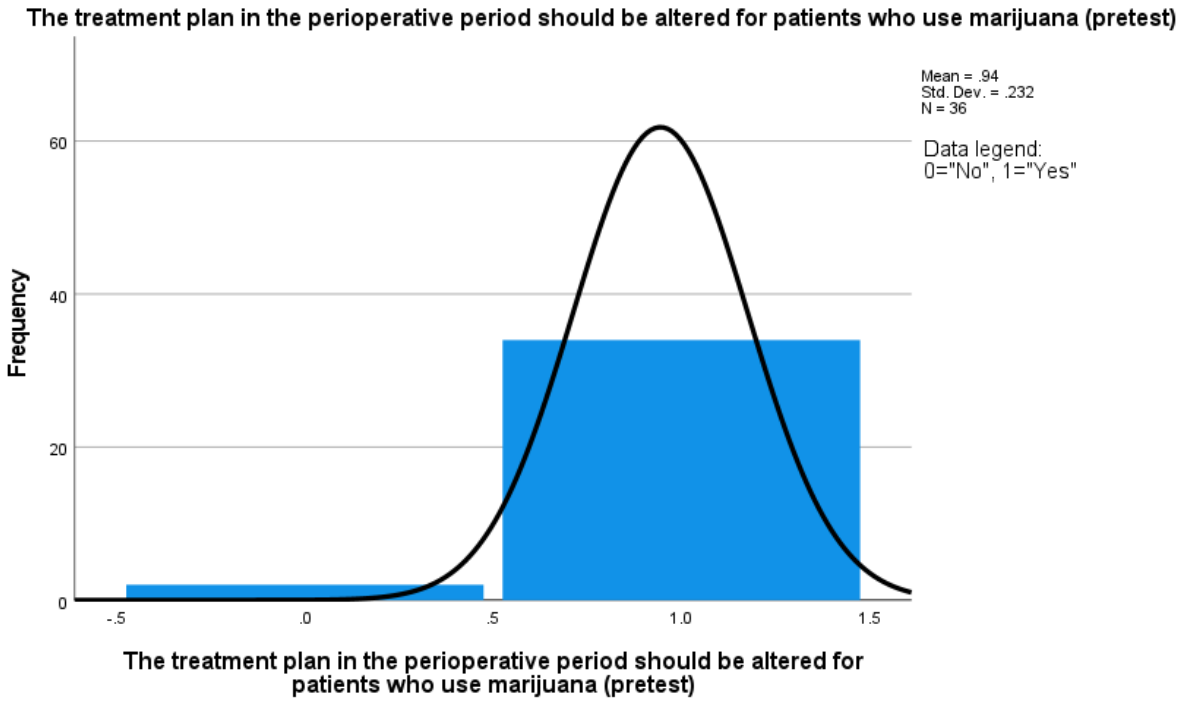
Table 6. Frequency Pretest Question #3.

The treatment plan in the perioperative period should be altered for patients who use marijuana (pretest)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	2	5.6	5.6	5.6
	yes	34	94.4	94.4	100.0
	Total	36	100.0	100.0	

(SPSS, 2022).

Table 7. Histogram Pretest Question #3.



(SPSS, 2022).

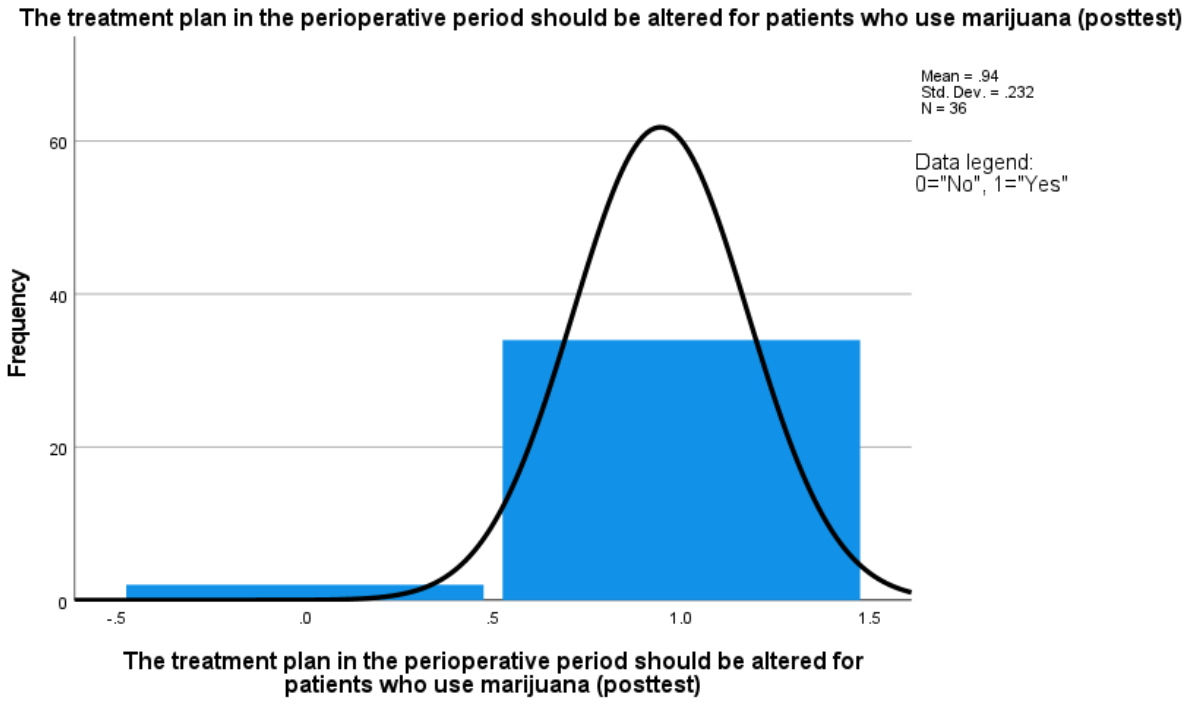
Table 8. Frequency Posttest Question #2.

The treatment plan in the perioperative period should be altered for patients who use marijuana (posttest)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	2	5.6	5.6	5.6
	yes	34	94.4	94.4	100.0
	Total	36	100.0	100.0	

(SPSS, 2022).

Table 9. Histogram Posttest Question #2.



(SPSS, 2022).

Table 10. Descriptive Statistics for Pretest Question #3 and Posttest Question #2.

Statistics

		The treatment plan in the perioperative period should be altered for patients who use marijuana (pretest)[b]	The treatment plan in the perioperative period should be altered for patients who use marijuana (posttest)
N	Valid	36	36
	Missing	0	0
Mean		.94	.94
Std. Error of Mean		.039	.039
Median		1.00	1.00
Mode		1	1
Std. Deviation		.232	.232
Variance		.054	.054
Skewness		-4.051	-4.051
Std. Error of Skewness		.393	.393
Kurtosis		15.260	15.260
Std. Error of Kurtosis		.768	.768
Range		1	1

b. Data legend: 0="No", 1="Yes"

(SPSS, 2022).

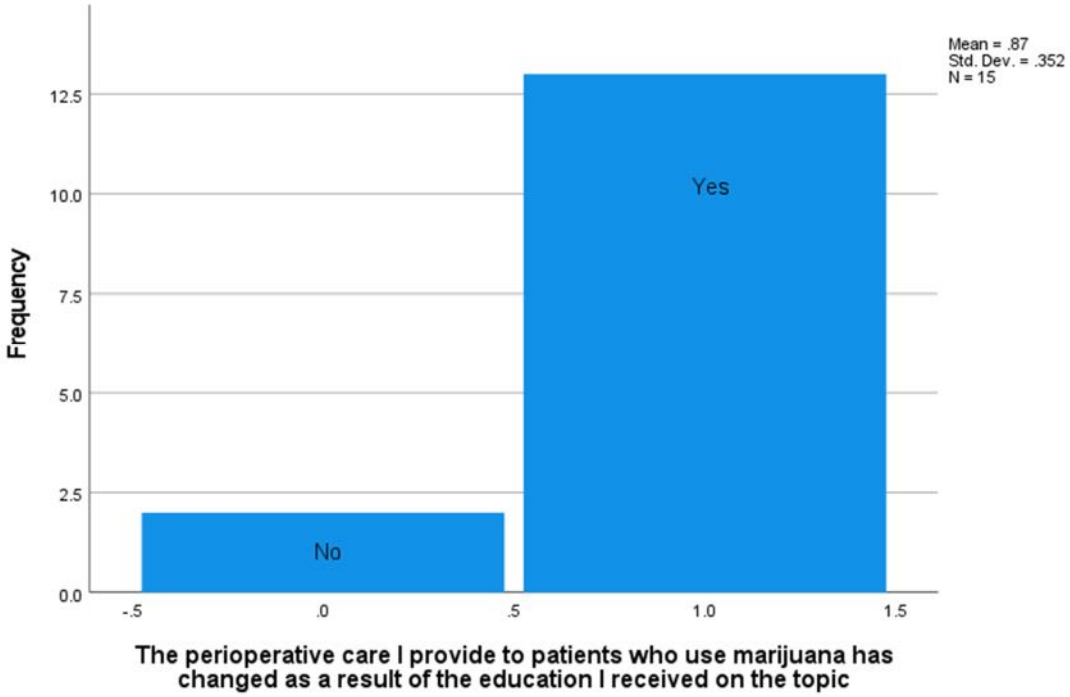
Table 11. Frequency One-month Survey Question #2.

The perioperative care I provide to patients who use marijuana has changed as a result of the education I received on the topic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	2	12.5	12.5	12.5
	yes	14	87.5	87.5	100.0
	Total	16	100.0	100.0	

(SPSS, 2022).

Table 12. Histogram One-month Survey Question #2.



(SPSS, 2022).

Table 13. Descriptive Statistics One-month Survey Question #2.

Statistics

The perioperative care I provide to patients who use marijuana has changed as a result of the education I received on the topic

N	Valid	16
	Missing	0
Mean		.88
Median		.88[a]
Mode		1
Std. Deviation		.342
Variance		.117
Skewness		-2.509
Std. Error of Skewness		.564
Kurtosis		4.898
Std. Error of Kurtosis		1.091
Minimum		0
Maximum		1

a. Calculated from grouped data.

(SPSS, 2022).

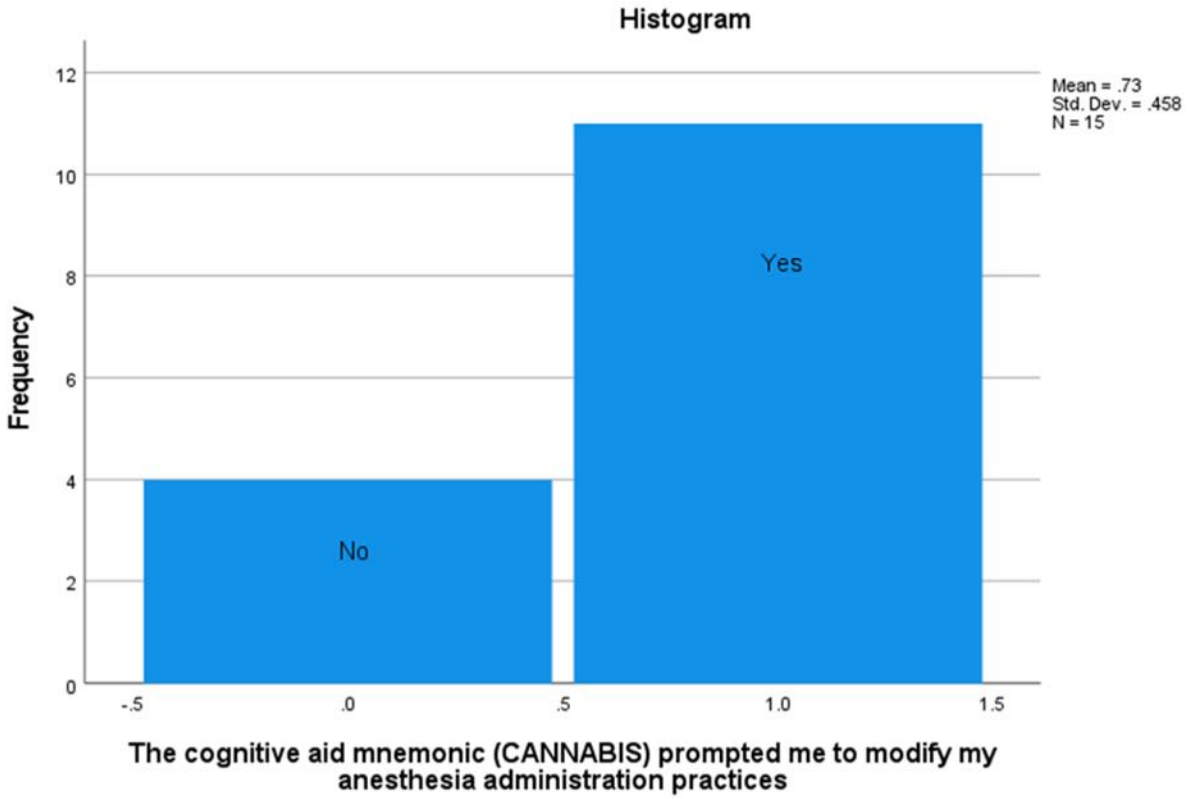
Table 14. One-month Survey Question # 3

The cognitive aid mnemonic (CANNABIS) prompted me to modify my anesthesia administration practices

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	4	25.0	25.0	25.0
	yes	12	75.0	75.0	100.0
	Total	16	100.0	100.0	

(SPSS, 2022).

Table 15. Histogram One-month Survey Question # 3



(SPSS, 2022).

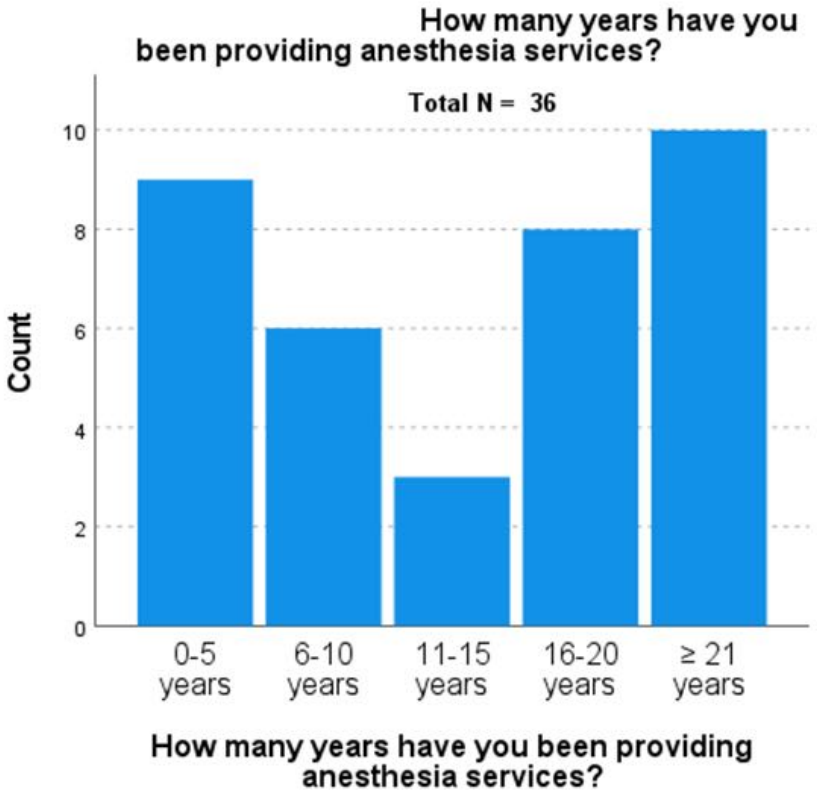
Table 16. Descriptive Statistics One-month Survey Question #3

The cognitive aid mnemonic (CANNABIS) prompted me to modify my anesthesia administration practices

N	Valid	16
	Missing	0
Mean		.75
Median		.75[a]
Mode		1
Std. Deviation		.447
Variance		.200
Skewness		-1.278
Std. Error of Skewness		.564
Kurtosis		-.440
Std. Error of Kurtosis		1.091
Minimum		0
Maximum		1

(SPSS, 2022).

Table 17. Histogram Pretest Question #1.



(SPSS, 2022).

Table 18. Frequency One-month Survey Question #1.

Have you had a chance to take care of a patient who uses marijuana since you attended the educational session on marijuana?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	4	25.0	25.0	25.0
	yes	12	75.0	75.0	100.0
	Total	16	100.0	100.0	

(SPSS, 2022).

Table 19. Frequency Posttest Question #3.

I will apply the concepts I learned about today in my clinical practice (posttest)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	1	2.8	2.8	2.8
	neutral	1	2.8	2.8	5.6
	agree	17	47.2	47.2	52.8
	strongly agree	17	47.2	47.2	100.0
	Total	36	100.0	100.0	

(SPSS, 2022).

Table 20. Frequency Posttest Question #4

The cognitive aid mnemonic (CANNABIS) will prompt me to modify my anesthesia administration practices (posttest)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	1	2.8	2.8	2.8
	disagree	1	2.8	2.8	5.6
	neutral	2	5.6	5.6	11.1
	agree	19	52.8	52.8	63.9
	strongly agree	13	36.1	36.1	100.0
	Total	36	100.0	100.0	

(SPSS, 2022).

Appendix A

Pretest Survey

1. How many years have you been providing anesthesia services?				
0-5 years	6-10 years	11-15 years	16-20 years	≥21 years
2. I am aware of perioperative risk factors in patients who use marijuana.				
1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3. The treatment plan in the perioperative period should be altered for patients who use marijuana.				
YES		NO		

Posttest Survey

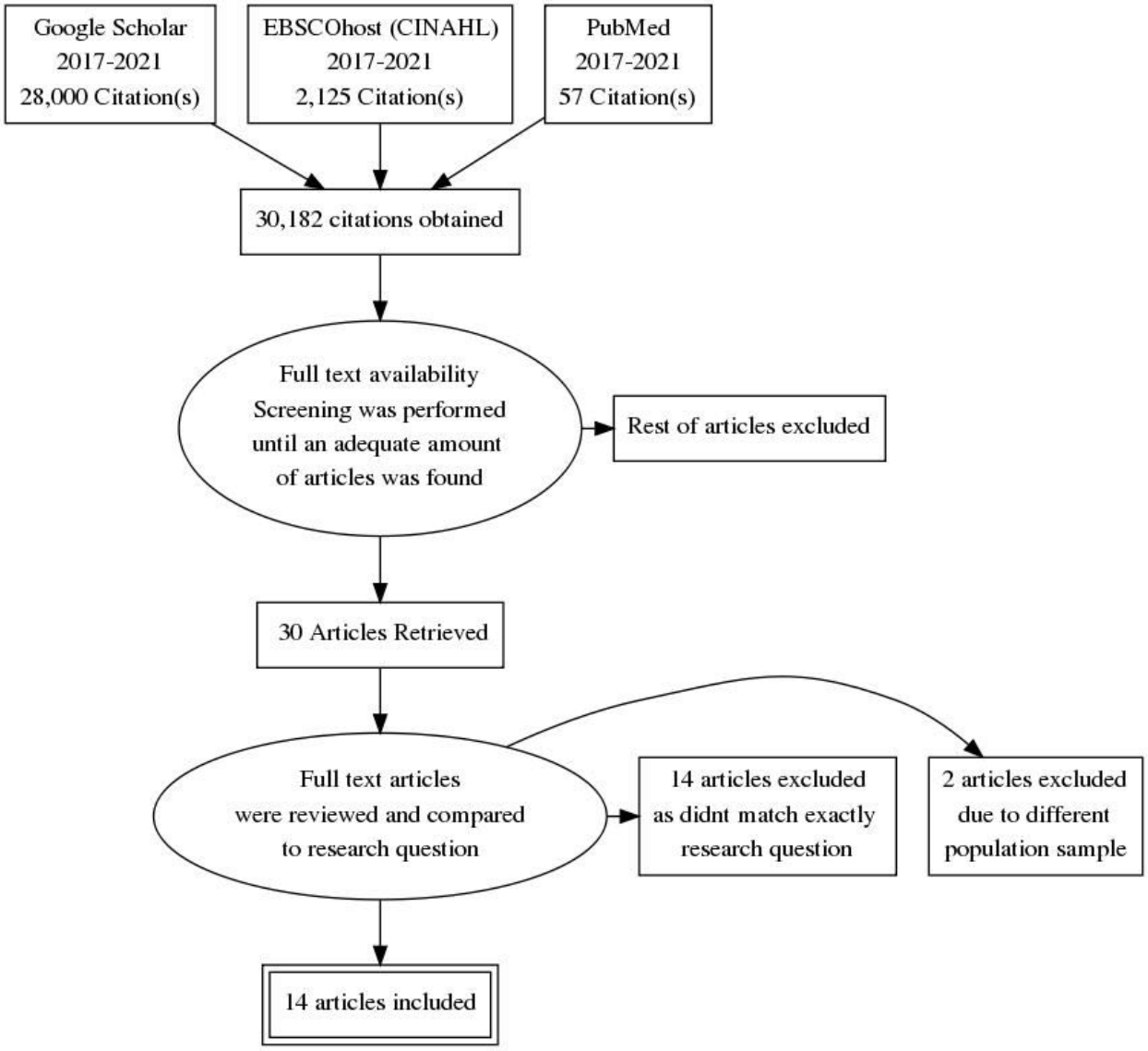
1. I am aware of perioperative risk factors in patients who use marijuana.				
1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2. The treatment plan in the perioperative period should be altered for patients who use marijuana.				
YES		NO		
3. I will apply the concepts I learned about today in my clinical practice.				
1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4. The cognitive aid mnemonic (CANNABIS) will prompt me to modify my anesthesia administration practices.				
1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

One-month Survey

1. Have you had a chance to take care of a patient who uses marijuana since you attended the educational session on marijuana? YES NO
2. The perioperative care I provide to patients who use marijuana has changed as a result of the education I received on the topic. YES NO
3. The cognitive aid mnemonic (CANNABIS) prompted me to modify my anesthesia administration practices. YES NO

Appendix B

PRISMA Diagram



Appendix C

Evidence Synthesis Table

Author & Date	Aim & Research Design	Sample Size, Population & Setting	Methods	Measures & Outcomes	Study Findings that Answer the PICO	Limitations	Evidence Rating	
							Level	Quality
1. Twardowski et al., (2019).	• Determine whether cannabis use has effect on medication dose needed for sedation during endoscopic procedures • Cohort Study	• 250 patients • Patients undergoing endoscopic procedures • Level III hospital, Colorado	• Retrospective medical record review	• Primary outcome: dose of sedative medications needed to complete endoscopic procedures in those who use cannabis vs those who do not • A statistically significant difference existed in the amounts of the 3 types of sedation (fentanyl, midazolam, and propofol) used in procedures for cannabis consumers in comparison with non-consumers	• There is a need to anticipate greater dosages of sedatives for cannabis consumers.	• Retrospective study • Not experimental • Relatively small sample size • Specific setting one institution (endoscopic procedures only)	Level IV (Arbor, 2019).	Good Quality (Johns Hopkins Medicine, n.d.).

2. Salottolo et al., (2018).	• Determine if there is an association between marijuana use and pain response following a traumatic injury • Cohort Study	• 261 patients • Patients admitted to four hospitals in Taxes and Colorado after a trauma (motor vehicle crashes)	• Multi-institutional retrospective chart review	• Differences, by marijuana status, in total daily opioid analgesics consumed and average daily pain scores • The primary findings suggest that marijuana use significantly affects acute pain management and results in increased consumption of opioid analgesics and greater self-reported pain following traumatic injury	• Anesthesia providers need to anticipate greater pain scores, and increased usage of pain medication for acute pain treatment in patients who use marijuana	• Retrospective not experimental study • A specific subset of the population (trauma patients) • Relatively small sample size	Level IV (Arbor, 2019).	Good Quality (Johns Hopkins Medicine, n.d.).
3. Ibera et al., (2018).	• Examine the effect of preoperative administration of cannabis extract on obtained BIS value relative to the concentration of anesthetic gases	• 27 patients • Patients hospitalized for a surgical procedure at an Israeli hospital	• Double-blinded randomized controlled study with four population groups	• Patients were randomly allocated to four trial regimes (high dose cannabis, low dose cannabis, active placebo, and placebo) and were monitored during surgery	• Anesthesia providers need to be cognizant that BIS monitoring may be inaccurate in patients who use marijuana	• Small sample size • International setting (Israel)	Level II (Arbor, 2019).	Good Quality (Johns Hopkins Medicine, n.d.).

	• Randomized control trial			using a BIS monitor. • Evidence suggests that cannabinoids may affect the BIS. • Cannot rely on the BIS monitoring to determine the patient sedative state.				
4. Flisberg et al., (2009).	• Investigate whether patients who regularly use cannabis have higher propofol requirements at induction • Prospective randomized, single-blind study	• 60 male patients • Patients admitted for same-day surgical procedure in a hospital in Australia	• Prospective randomized single-blind study	• Patients randomly allocated to different doses of propofol for induction and monitored for anesthesia depth • Regular cannabis consumption shows a more variable response to induction of anesthesia with propofol and higher doses of propofol may be required to	• Anesthesia providers should be aware that higher doses of propofol may be needed for induction to achieve jaw relaxation for successful laryngeal mask insertion	• Older study but landmark in the topic • Small sample size • A specific subset of the population (male patients) • International setting (Australia)	Level II (Arbor, 2019).	Good Quality (Johns Hopkins Medicine, n.d.).

				achieve both loss of consciousness and adequate jaw relaxation and depression of airway reflexes for insertion of a laryngeal mask				
5. Goel et al., (2020).	• Determine whether patients with an active cannabis use disorder have an elevated risk of postoperative complications • Retrospective population-based cohort analysis	• 27206 patients • Hospitalized surgical patients across the USA	• Retrospective population-based cohort analysis	• The primary composite outcome is clinically relevant postoperative complications, including myocardial infarction, stroke, sepsis, deep vein thrombosis/pulmonary embolus, acute kidney injury requiring dialysis, respiratory failure, and in-hospital mortality. • Patients with a cannabis use disorder were more likely to experience a	• Increased risk of postoperative cardiovascular complications prompts cautious monitoring of the postoperative period	• Retrospective review, not experimental	Level IV (Arbor, 2019).	Good Quality (Johns Hopkins Medicine, n.d.).

				postoperative acute MI than their counterparts without a cannabis use disorder. A reported active cannabis use disorder may also be associated with higher adjusted odds of suffering a postoperative acute cerebrovascular accident, although this result was not statistically significant after Bonferroni adjustment.				
6. Liu et al., (2019).	• Examine the impact of preoperative cannabinoid use on postoperative pain scores and pain-related outcomes in patients undergoing	• 3793 initial patients, 310 matched patients for propensity-matched cohort analysis • Patients admitted for orthopedic surgery in	• The retrospective propensity-matched cohort study	• The intensity of pain with movement in the early postoperative period (defined as up to 36 hours after surgery) was the primary outcome of this study. The secondary	• Increased postoperative pain scores in patients who use marijuana in the immediate postoperative study	• Retrospective review, not experimental • A specific subset of patients (orthopedic surgery) • International setting (Canada)	Level IV (Arbor, 2019).	Good Quality (Johns Hopkins Medicine, n.d.).

	major orthopedic surgery • Retrospective cohort study with propensity matching	Ontario, Canada		outcomes (in the early postoperative period) were pain at rest, opioid consumption, the incidence of pruritus, nausea and vomiting, sedation, delirium, constipation, impairment of sleep and physical activity, patient satisfaction with analgesia, and the length of Acute Pain Service follow-up • Cannabinoid use was associated with higher pain scores and a poorer quality of sleep in the early postoperative period				
7. Camilleri, (2018).	• Increase the awareness of gastroenterologists to the	N/A	• Review of pharmacological effect of cannabinoids	• Discusses cannabinoids' role in causing	• Anesthesia providers need to take into account	• Literature review, not experimental study	Level V (Arbor, 2019).	High Quality (Johns Hopkins Medicine, n.d.).

	effects of cannabinoids on gastrointestinal motility • Review article		on the organism	gastrointestinal dysmotility • Cannabinoids are linked with inhibition of motility which increases the risk for cyclic vomiting syndrome, hyperemesis, chronic constipation, and delayed gastric emptying	the possibility of delayed gastric emptying and adjust their intubation/induction approach (i.e. Rapid Sequence Intubation) as well as a possible longer NPO period to prevent pulmonary aspiration of gastric content.			
8. Jouanjus, (2017).	• Examine the published evidence on the cardiovascular risk related to the use of cannabis-based products by performing a systematic review of recent literature	• 81 case reports, 29 observational studies, 3 clinical trials, and 2 experimental studies • Subjects using cannabis-based products and suffering from any	• Systematic literature review	• Large literature review of potential complications in the perioperative period for patients who use marijuana. • Based on the currently available data, suggests that cannabis use may contribute to cardiovascular	• Increased risk of postoperative complication CVA	• Literature review, not experimental study	Level V (Arbor, 2019).	High Quality (Johns Hopkins Medicine, n.d.).

	• Systematic literature review	cardiovascular disease		and cerebrovascular diseases.				
9. Holmen, (2020).	• Assess the preoperative cannabis impact on intraoperative anesthetic delivery • Retrospective review study	• 118 patients • Patients admitted for orthopedic surgery in a Colorado hospital	• Retrospective review study	• Evaluation of anesthetic medication usage through the surgery • Demonstrates increased delivery of inhaled anesthetic among preoperative cannabis consumers	• Anesthesia providers should anticipate a greater need for inhalational anesthetics throughout the surgery	• Retrospective review not experimental study • Relatively small sample size • A specific subset of patients (orthopedics)	Level IV (Arbor, 2019).	Good Quality (Johns Hopkins Medicine, n.d.).
10. Alexander & Joshi, (2019).	• Review the known physiologic effects of marijuana in humans, discuss potential implications of marijuana use that the anesthesiologist should consider at each phase of the perioperative period	N/A	• Current literature review	• Review of knowledge regarding the effects of marijuana as related to the perioperative period • Considerations for the provider: elevated risk of myocardial infarction, airway hyperreactivity, anxiety/paranoia, psychosis, tolerance to induction	• Practical considerations for the anesthesia provider in the perioperative period	• Literature review, not experimental study	Level V (Arbor, 2019).	High Quality (Johns Hopkins Medicine, n.d.).

	• Current literature review			medications, elevated BIS, possible heightened pain perception, withdrawal				
11. Ladha et al., (2019).	• Summarize the available evidence regarding marijuana usage in the perioperative setting • Scoping review study design	• A total of 27 articles, 13 articles were randomized control trials, two articles were animal studies, eight were cohort studies, and five were case reports • Articles related to marijuana usage in the perioperative setting	• Scoping review study design	• Literature review yielding information regarding patients who use marijuana in the perioperative period: may be beneficial to continue perioperative use for habitual consumers to avoid withdrawal syndrome; anesthetic induction and maintenance is more challenging; cardiovascular lability may be anticipated; slowed gastric emptying is to be anticipated; higher pain scores and poor	• General considerations for the anesthesia provider in the perioperative period for habitual marijuana consumers	• Literature review not experimental study	Level V (Arbor, 2019).	High Quality (Johns Hopkins Medicine, n.d.).

				sleep postoperatively				
12. Horvath et al., (2019).	• Provide a history of marijuana use, the current laws and regulations, the pharmacology of marijuana, and best evidence-based practices related to anesthetic care of the patients who use marijuana • Literature review	N/A	• Literature review	• Comprehensive literature review of marijuana physiologic effects and considerations on the perioperative period • Surgical patients should be advised to avoid consuming or inhaling cannabis for as long as possible before surgery because cannabis can be found in the bloodstream more than 30 hours after consumption and interactions with anesthetic drugs and adjuvant drugs administered during an anesthetic are not reliably predictable; if consumption has	• General considerations for the anesthesia provider in the perioperative period for habitual marijuana consumers	• Literature review, not experimental study	Level V (Arbor, 2019).	High Quality (Johns Hopkins Medicine, n.d.).

				occurred, anesthetic care should be planned to treat or avoid side effects.				
13. Echeverria-Villalobos et al., (2019).	• highlight the most important pharmacological aspects and pathophysiological effects that should be considered by the anesthesiologists during the perioperative management of chronic cannabis/cannabinoids consumers • Systematic literature review	• Total of 147 articles • Articles discussing cannabis pharmacology and perioperative considerations for naive and chronic patients	• Systematic literature review	• Literature review addressing major perioperative physiologic findings in patients who use marijuana • Low doses of cannabinoids have been associated with increased sympathetic response (tachycardia, hypertension, and increased contractility) • High doses enhance parasympathetic tone leading to dose-dependent bradycardia and hypotension • Severe vascular complications: malignant	• General considerations for the anesthesia provider in the perioperative period for patients who use marijuana	• Literature review, not experimental study	Level V (Arbor, 2019).	High Quality (Johns Hopkins Medicine, n.d.).

				arrhythmias, coronary spasm, sudden death, cerebral hypoperfusion, and stroke • Bronchial hyperreactivity and upper airway obstruction are commonly reported • Postoperative hypothermia, shivering, and increased platelet aggregation				
14. American Association of Nurse Anesthetists [AANA], (2019).	• Offer practice considerations for the anesthesia professional to provide safe care of the patient with substance use disorder, whether alcohol or drugs from the American Association	• Patients who utilize substances, drugs (including marijuana), and alcohol who will undergo anesthesia care	• Practice considerations from a professional society	• Review of different substances (including marijuana) physiological effects as they pertain to the anesthesia department and practical recommendations for anesthesia providers when treating marijuana	• Professional society (AANA) practice recommendations regarding patients who use marijuana for anesthesia providers	• Literature review, not experimental study	Level V (Arbor, 2019).	High Quality (Johns Hopkins Medicine, n.d.).

	of Nurse Anesthetists • Practice Considerations			patients in the OR setting • Maintain airway due to potential for airway obstruction; consider dexamethasone to minimize airway edema, increased propofol dose may be required for induction, avoid drugs known to affect heart rate (e.g., ketamine, atropine, epinephrine)				

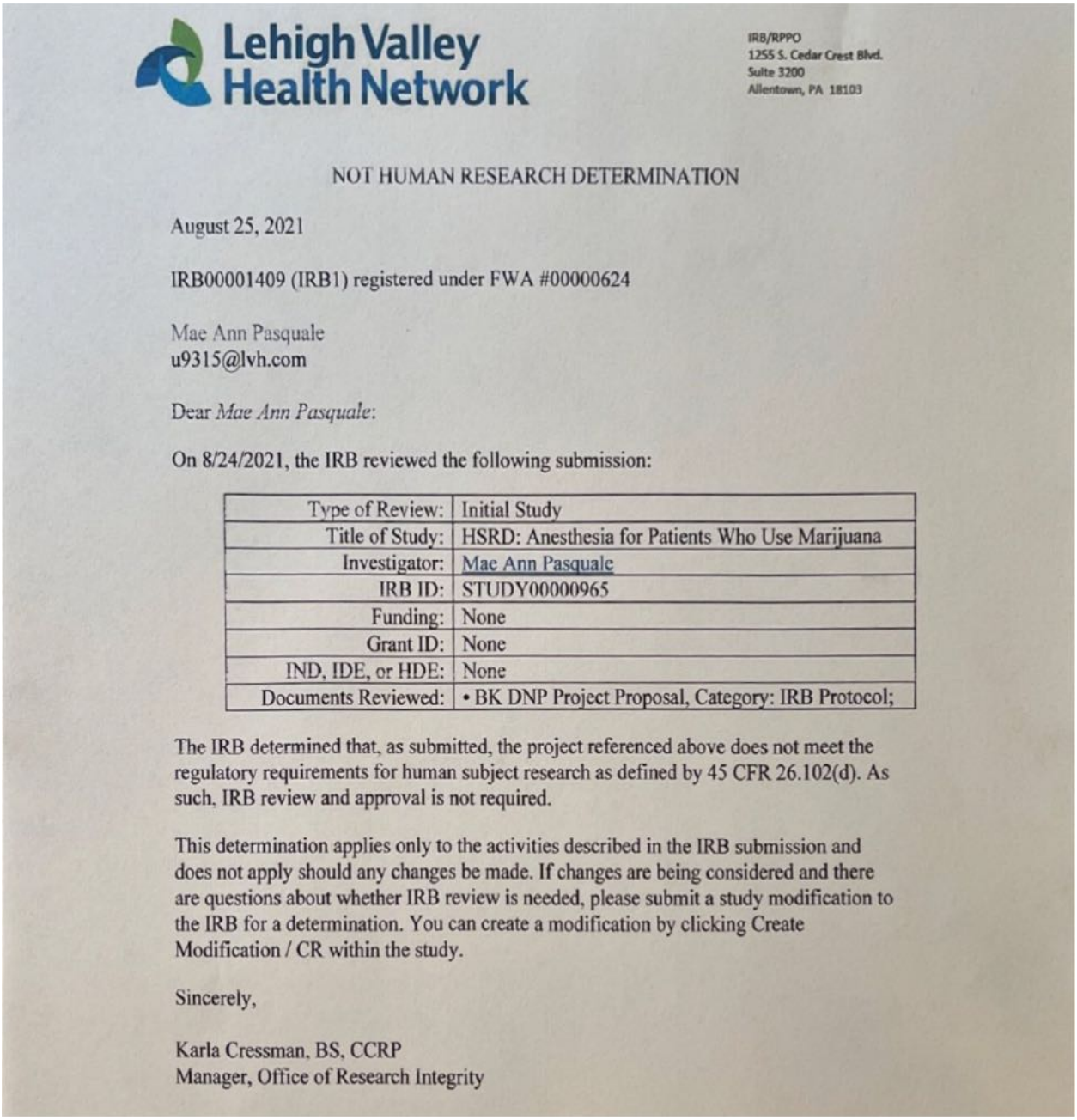
Appendix D

Diagram RE-AIM

(Ory et al., 2015)

Appendix E

LVHN IRB Approval



Lehigh Valley Health Network

IRB/RPPO
1255 S. Cedar Crest Blvd.
Suite 3200
Allentown, PA 18103

NOT HUMAN RESEARCH DETERMINATION

August 25, 2021

IRB00001409 (IRB1) registered under FWA #00000624

Mae Ann Pasquale
u9315@lvh.com

Dear *Mae Ann Pasquale*:

On 8/24/2021, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	HSRD: Anesthesia for Patients Who Use Marijuana
Investigator:	Mae Ann Pasquale
IRB ID:	STUDY00000965
Funding:	None
Grant ID:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• BK DNP Project Proposal, Category: IRB Protocol;

The IRB determined that, as submitted, the project referenced above does not meet the regulatory requirements for human subject research as defined by 45 CFR 26.102(d). As such, IRB review and approval is not required.

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are being considered and there are questions about whether IRB review is needed, please submit a study modification to the IRB for a determination. You can create a modification by clicking Create Modification / CR within the study.

Sincerely,

Karla Cressman, BS, CCRP
Manager, Office of Research Integrity

Appendix F

Cedar Crest College IRB Approval

APPROVED - Anesthesia for Patients Who Use Marijuana - IRB Request Number 364

DocuWare Notification <noreply@docuware.cloud>
Mon 9/13/2021 10:45 AM
To: Bohdan Khromenko <BKhrome@cedarcrest.edu>
Cc: DocuWare Service Account <DocuWare@cedarcrest.edu>

1 attachments (1 MB)
Anesthesia for Patients Who Use Marijuana.zip;

Your IRB Request has been Approved by the Project Advisor/Supervisor and the Committee Chair. This is the final Approval.

Attached you'll find the IRB Request Form for this request, including any notes added by the reviewer.

If additional files were submitted the request form and additional files will be delivered together in a zipped file.

COMPLETE BY DATE: 9/13/2022

Notes: It has been determined that your proposal meets the requirements for a Category 2 Exemption and, thus, is not subject to further review by this committee as long as there are no significant changes in your overall procedures.

IRB Request Number: 364

Title of Research: Anesthesia for Patients Who Use Marijuana

Review Type: EXEMPT REVIEW

Lead Researcher: Bohdan Khromenko

Project Advisor/Supervisor: Catherine Zurawski, David Holland

Date Submitted: 8/31/2021

Appendix G

Recruitment E-mail

Dear Anesthesia Provider,

You are invited to participate in a Doctor of Nursing Practice project entitled "Anesthesia for the Patients Who Use Marijuana." The purpose of the project is to educate anesthesia providers regarding evidence-based perioperative anesthesia management of patients who use marijuana. You are invited to participate because you are an anesthesia provider at LVHN. Agreement to participate includes attendance at the educational session by the DNP student and response to three surveys on the topic. The first two surveys will be administered on paper during the educational session; the third and last survey will be administered via SurveyMonkey through your secure LVHN e-mail, which will be sent by Jill Hanisak, DNP, CRNA, the education coordinator for the anesthesia department. Although this is 100% voluntary, completion and submission of the surveys are an indication of your consent to participate in the project. You can stop participation at any time up until the submission of the final survey, which will occur one month after the educational presentation. The total time required to participate in this DNP project is approximately 30 minutes.

LVHN and Cedar Crest College's Institutional Review Board reviewed this project and granted approval for it to be carried out. There are no anticipated risks to you as a result of your participation in this project. However, if you feel uncomfortable or upset when answering any questions, you can stop and discontinue your participation. You will not receive any direct benefit from participation in this project. The benefits of this project include the advancement of knowledge and evidence-based practice.

All data collected in this project will be anonymous; your name will never be linked to the data. All data will be kept confidential and will only be used for project purposes. All data will be stored on an encrypted and password-protected electronic device. This data will be destroyed at the completion of the project. The findings of this project may be included in a publication, but your name will never be used.

Participation in this project is voluntary. You have the right not to participate and you may choose not to complete the survey. You may end your involvement at any time without personal or professional penalty or consequence. Your submission of the survey is an indication of your implied consent to allow your responses to be used for the purposes of this project. Once your responses are collected it is not possible to remove them.

If you have any questions about this project or want to discuss any concerns, you may contact the DNP student at any time. I would greatly appreciate your participation as it is crucial to the successful implementation of this project. Thank you for your consideration and time.

Sincerely yours,

Bohdan Khromenko, BSN, RN, SRNA

Doctor of Nursing Practice Student

Cedar Crest College School of Nursing, Nurse Anesthesia Program

Email: BKhrome@cedarcrest.edu

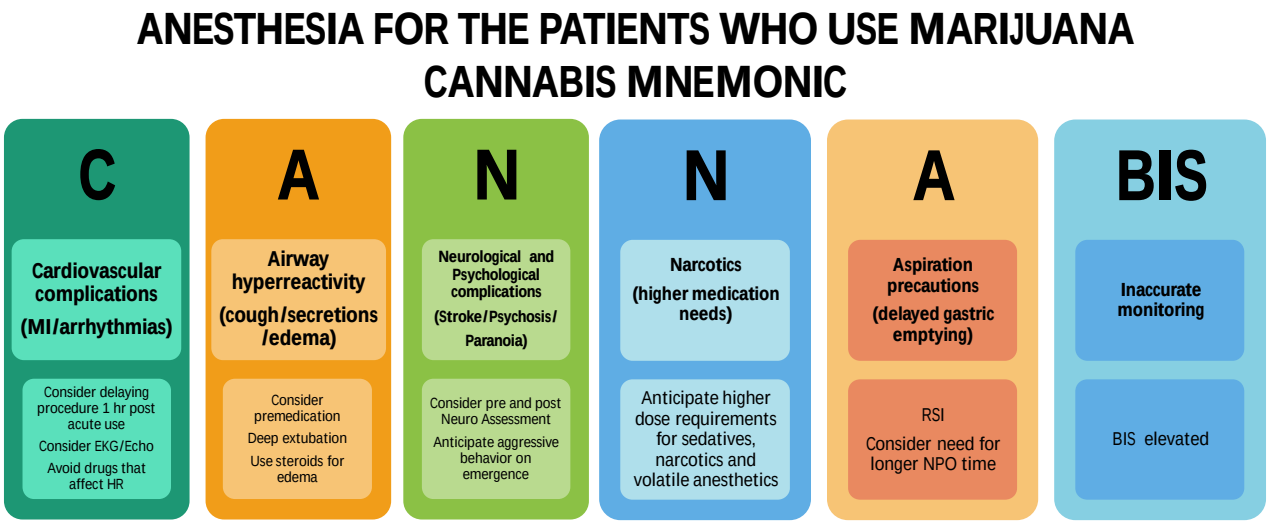
Appendix H

PowerPoint Presentation

Please, double click on the image below to access the PowerPoint presentation.

Appendix I

Cognitive Aid



- Obtain history: with higher use the likelihood of complications increases
- Evaluate mental status in acute use, consider obtaining a proxy consent
- Consider obtaining a PT/INR prior to neuroaxial and regional blocks
- Anticipate potential difficulty voiding post procedure
- Consider Sevoflurane as the gas of choice

Appendix J

DNP Project Timeline

Timeline Goal	**Task**	**Completed**	**Notes**
April 2021 NUR 850	DNP Project Proposal		
Apr 2021 NUR 850	Revisions to Project Proposal		Complete at least 2 weeks prior to formal presentation
Apr 2021 NUR 850	Formal Project Proposal Presentation to Chairs and DNP Committee		Possible approval vs revisions
May - July 2021	Revisions to IRB		May extend process 2-3 weeks
July 2021	Final DNP Project draft submission to Team for review and feedback		2-3 weeks for review/revisions

August 2021	IRB Application submission to CCC and LVHN		Expect 4-6 weeks for approval *IRB approval needed prior to NUR 851
September 2021 NUR 851	Pre-Implementation preparation		The final development of presentations, handout material. Schedule presentation dates at sites.
September 2021 NUR 851	Implementation of the DNP Project		Begins at the beginning of NUR 851. *IRB must be approved before any initiation of the project. Ongoing literature review.
September- October 2021 NUR 851	Data collection		Ongoing throughout the semester, meet

			with chairs/committee if any issues
Jan-Feb 2022 NUR 852	Analysis of collected data		Project evaluation, statistical analysis of data, implications for future practice
Spring 2022 NUR 852	Dissemination of DNP Project		Formal written paper and oral presentation, poster presentation, publication
Spring 2022 NUR 852	Manuscript preparation, oral defense development, poster development		
Spring 2022 NUR 852	Final Project draft		
Spring 2022 NUR 852	Final Project submission		
Spring 2022 NUR 852	Revisions to Final Project submission		If needed