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An Education Module for the Utilization of the Perioperative Quadratus Lumborum Block to Improve Postoperative Cesarean Section Pain

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An Education Module for the Utilization of the Perioperative Quadratus Lumborum Block to
Improve Postoperative Cesarean Section Pain

A DNP Project Presented to the Faculty of the
Nicole Wertheim College of Nursing and Health Sciences
Florida International University

In partial fulfillment of the requirements
For the Degree of Doctor of Nursing Practice

By

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ABSTRACT

Background: Pain management for cesarean section patients postoperatively mainly involves oral analgesics, especially opioids. Between the ongoing opioid epidemic and innovations in pain management techniques, further exploration is needed to discover the copious benefits of the quadratus lumborum (QL) block in obstetrics and create recommendations for its use.

Objectives: The systematic review aimed to assess the most current randomized controlled trials (RCTs) regarding the efficacy of the QL block given for postoperative cesarean section pain management and introduce recommendations for anesthesia professionals to utilize the block to lessen postoperative pain and opioid consumption. Additionally, the information and results from the systematic review will be presented in an education module to Certified Registered Nurse Anesthetists (CRNAs).

Data Sources: Investigators used CINAHL, MedLine, EMBASE, and Pubmed databases to answer the PICO (i.e., population, intervention, comparison, outcome) question: *In patients undergoing cesarean section (P), does the use of an ultrasound-guided perioperative quadratus lumborum block (I) compared to an ultrasound-guided perioperative transversus abdominis plane block (C) improve postoperative pain management (O)?*

Methodology: Ten RCTs were included in this systematic review and incorporated in the education module to CRNAs. Inclusion criteria included: RCTs in English, published 2015-present, abdominal surgeries with patients who received either a QL block or transversus abdominis plane (TAP) block, and outcomes including lowered pain scores and reduced opioid consumption. The 10 RCTs had a combined sample size of 2606 patients. Six RCTs analyzed a QL and TAP block, two analyzed QL blocks versus a placebo, and the remaining two examined TAP blocks versus a placebo. All studies found the block group to have superior pain management and less opioid consumption. The six studies that compared the QL and TAP block found the QL block to be superior in both pain management and reducing opioid consumption. The education module containing a pre- and post-test and a voiced-over PowerPoint was presented to a group of CRNAs.

Results: Statistical analysis using SPSS revealed a statistically significant knowledge increase from the pre- to post-test, and increased likelihood of recommending the QL block.

Conclusions: The empirical evidence shows the QL block to provide a longer-lasting reduction in pain and opioid consumption. Implementing an evidence-based QL block leads to positive patient outcomes, increased patient satisfaction, and reduced opioid consumption. Lastly, CRNA providers benefit from an educational module presenting evidence-based information on the newest regional block techniques. The knowledge increase also led to providers being more likely to recommend the use of the QL block.

Keywords: quadratus lumborum block, obstetrics, parturients, transversus abdominis plane block, cesarean section, c-section, TAP block

INTRODUCTION

Description of the Problem

In the United States, undergoing a cesarean section (CS) is a fairly common practice and represents 31.9% of all deliveries; however, undertreating postoperative pain is a continual problem. CS scored in the top 20 of 179 surgical procedures as most painful.¹ CS is identified as major abdominal surgery. The American College of Obstetricians and Gynecologists (ACOG) recognizes that a multimodal approach to managing postoperative pain from a cesarean birth is imperative.² Unfortunately, women continue to report high pain scores and state a lack of receiving any opioid medication and a wish for more analgesics.¹ On average, patients provided intravenous medication asked for an equivalent of 30mg of morphine in the first 24 hours after surgery.¹ When compared with hysterectomies, CS patients reported significantly higher pain scores, a willingness to accept pain medication to treat the discomfort, and a lack of providers willing to prescribe opioids.¹ The magnitude of surgical trauma does not always directly correlate to postoperative pain scores because pain is multifactorial, including the type of tissue damage, lesions of neural structures, or inflammation, which all contribute significantly to reported pain levels. One enormous contributing factor to CS patients' commonly undertreated pain is the ongoing opioid crisis that plagues the United States. Historically the United States is known for frequently prescribing and overprescribing opioids for various conditions and surgical procedures. Overprescribing opioids raises the question of why so many patients report undertreated pain postoperatively since opioids are readily prescribed and available to all patients.

In 2016, more people died from opioid overdoses than traffic accidents (42,000 vs. 37,461).³ Opioid overdoses have increased in both the United States and Europe; however, this increase is much more dramatic within the United States, which led to a public health emergency declaration in October of 2017.³ Of all the deaths in the United States in 2016, 40% of them involved prescription opioids.³ To understand the origin of the opioid crisis, it is imperative to understand the history of pain management. In the 1990s, patient advocacy groups, professional

pain societies, and the US government emphasized adequately treating pain.³ Pain became the fifth vital sign, and its treatment became a patient ‘right.’³ Initially, education promoted the use of opioids as it was believed that using opioids would not result in addiction; however, many studies since the 1990s have demonstrated this assumption to be incorrect.³ It is now widely accepted that healthcare provider prescriptions are a substantial contributor to the opioid crisis and deaths in the U.S. due to opioid overdose. A unique consideration is the treatment of postoperative CS pain, as this surgical procedure is commonly the first encounter with opioids for young women to treat acute surgical pain. Doctors who prescribe unnecessary or excessive opioids contribute to long-term misuse of opioids by the mother or another family member because of easy access to leftover pain pills.³ Treating postoperative pain remains a priority, and alternative treatment modalities should be considered. Utilizing regional anesthesia techniques provides excellent analgesia and serves as suitable alternatives to opioid administration for pain relief. Additionally, many factors contribute to patients’ self-reported pain levels.³ ACOG recommends using a multimodal approach to treating pain in the CS population and notes that patient education is a vital adjunct.

Background

The ACOG states that neuraxial opioids provide the most analgesia, but frequently women will experience pain as neuraxial opioid potency diminishes over time.² Oral and parenteral analgesics, including acetaminophen along with nonsteroidal anti-inflammatory drugs (NSAIDs), and opioids, can be used in a multimodal pain management technique along with local anesthetic wound infiltration via transversus abdominis plane (TAP) block. The TAP block is not widely used across the United States, nor is it standard policy to offer this pain management method to every woman receiving a cesarean section. Many facilities and doctors are sometimes hesitant to prescribe opioids because of the risk of chronic use and the exposure to adverse effects.⁴ Regional anesthesia utilizing the TAP block or the newer quadratus lumborum (QL) block provides the opportunity to reduce opioid consumption and postoperative pain.⁴ While TAP

blocks have demonstrated adequate postoperative analgesia and reduced the use of opioids, the QL block may provide superior pain relief.⁵

The TAP blockade is limited to somatic anesthesia of the abdominal wall and is dependent on interfascial spread.⁶ Newer techniques have been proposed, including the QL block that enhances pain relief. The QL block has a wider and longer sensory blockade compared to the TAP block.⁶ The TAP block is performed under ultrasound by identifying the rectus abdominis muscle and its posterior rectus sheath.⁶ The transversus abdominus muscle is deep to the posterior rectus sheath. The TAP block targets the fascial plane between the posterior rectus sheath and the transversus abdominis muscle.⁶ There are three common approaches the lateral, anterior, and posterior TAP block. Regardless of the approach, the target remains the same. The needle is inserted above the rectus abdominus, and the endpoint of injection is between the posterior rectus sheath and the anterior margin of the transversus abdominis muscle.⁶

The transmuscular QL block is also performed with the assistance of ultrasound but uses a curved array transducer instead of a linear transducer.⁶ The curved array transducer is placed in the axial plane on the patient's flank just cranial to the iliac crest.⁶ The landmarks of the QL block include L4 transverse process, the erector spinae muscle, and the psoas major muscle, which form as a "shamrock" on ultrasound images.⁶ The target for the QL block injection is the fascial plane between the psoas major muscles and the QL.⁶ The local anesthetic is injected between the QL and psoas major muscles to spread to the thoracic paravertebral space.⁶ Ultimately, this block aims to accomplish segmental somatic and visceral analgesia from T4 to L1.⁶ There are two other identified methods to the QL block. Type 1 and type 2 differ from the transmuscular QL block in needle approach. Type 1 provides analgesia only from T12 to L1, while type 2 provides similar analgesia to the transmuscular QL block but with faster onset and a mechanism of action that is not well understood.⁶

Scope of the problem

The Center for Disease Control and Prevention (CDC) reports that in the United States, nearly one-third of all women (31.9%) who delivered a baby underwent a cesarean section in 2018.⁷ Compared to the national statistics, the state of Florida reported 36.8% of women undergoing a CS in the same year.⁸ Additionally, south Florida counties of Miami-Dade and Broward report a significantly higher number of CS than the national average of 31.9%.⁸ In 2018, CS represented 48% of all births in Miami-Dade, and in Broward county, CS represented 41.5% of all deliveries.⁸ CS rates vary dramatically among states, countries, and medical treatment facilities. The issue of undertreated postoperative cesarean pain affects millions of women every year. These women undergo major abdominal surgery and are frequently prescribed opioids during the recovery period.

Consequences of the problem

Opioids, while effective at treating postoperative pain, also cause dose-dependent respiratory depression, itching, gastrointestinal upset, urinary retention, nausea, vomiting, and hypotension.^{4,9} Additionally, many women who undergo a cesarean section are opioid naïve. A study conducted on 80,000 opioid naïve women found that the risk of becoming a persistent opioid user after cesarean delivery is approximately 1 in 300.¹⁰ Out of 1.3 million cesarean deliveries each year, this risk contributes to a large number of new chronic opioid users each year. On the opposing side are women who wish to have adequate pain relief after a CS but do not wish to take opioids. One study, including 720 women, identified that 105 participants (14.5%) did not fill a prescription for opioids even though they were prescribed.¹¹ These women reported not needing, not wanting, or not liking how they felt while taking the opioids.¹¹ The women have previously experienced side effects from opioids and wished to avoid taking them.¹¹

Knowledge gap

The issue surrounding postoperative CS pain management is complex. Adequately managing postoperative pain, meeting patient expectations for pain management, and combating

the opioid crisis can be difficult. While the ACOG acknowledges the need to utilize multimodal pain management techniques, opioids continue to be widely prescribed as a central component of postoperative pain management.² Unfortunately, a lack of widespread education and practitioner experience utilizing TAP blocks or the newer QL block prevents women across the United States from receiving the most effective evidence-based multimodal pain management techniques.

Proposed solution

Elective and emergent cesarean sections are frequent; however, they result in moderate to severe pain that frequently requires opioid administration. Enhancing the mother's recovery process is enhanced by minimizing postoperative pain and reducing opioid consumption.¹² A variety of regional anesthesia techniques have been employed to mitigate immense pain postoperatively; however, the most effective regional anesthesia technique remains elusive. Determining whether the TAP block or the QL block is the most effective regional anesthesia technique will allow the parturient to receive the most current evidence-based regional anesthesia pain relief technique available. It is imperative to adequately relieve postoperative pain, reduce opioid consumption, and enhance the crucial mother-to-child bonding in the first hours after birth.

Additionally, relaying these research results to Certified Registered Nurse Anesthetists (CRNAs) via a formal education module is crucial for future mitigation and relief from the current postoperative pain encountered by CS patients. A pre-test and post-test format for evaluating educational enhancement will be the method of choice for this educational module. The participants will initially receive a pre-test not longer than ten questions before the educational module narrated PowerPoint. Then the participants will watch an auditory and visual presentation via PowerPoint. This interactive educational module will compare the QL block to the TAP block, emphasizing the impact of CRNAs' knowledge about better managing postoperative pain in the CS patient. A pre-test will be given to the participants immediately before the educational module, followed by the educational module. Then a post-test will be provided upon the conclusion of the educational module. The *National Journal of Physiology*,

Pharmacy and Pharmacology published a research article that examined medical students' teaching and learning methodology via pre and post-test study designs.¹³ The study concluded that immediate pre-testing before the educational module presentation helped students focus better during the presentation, pick out the essential parts of the presentation, and ultimately score higher on a post-test.¹³ Scheduling a pre and post-test immediately before and after the educational module assesses the participants' baseline knowledge and post-education knowledge.¹³

PICO

In patients undergoing cesarean section (P), does the use of an ultrasound-guided perioperative quadratus lumborum block (I) compared to an ultrasound-guided perioperative transversus abdominus plane block (C) improve postoperative pain management (O)? This systematic review aims to gather the most current evidence-based information regarding the QL block and the TAP block, which will then be compiled into an educational module to present to current CRNAs. The goal of the educational module is to give updated and new information to CRNAs about regional anesthesia techniques that are not currently utilized. The purpose is to increase provider knowledge and create a practice change to positively benefit the CS patients by reducing opioid consumption while maintaining adequate pain relief.

METHODOLOGY OF LITERATURE REVIEW

Search Strategy and Sources

A literature search of online databases was conducted utilizing PubMed electronic database, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Excerpta Medica Database (EMBASE), and MEDLINE (ProQuest) database. Search terminology included the following: *TAP blocks* OR *transversus abdominis plane block* AND *quadratus lumborum block*, *TAP block* OR *transversus abdominis plane block* OR *quadratus lumborum block* AND *obstetric**, *TAP block* AND *quadratus lumborum block*, *TAP block* OR *quadratus lumborum block*, *TAP block* OR *quadratus lumborum block* AND *obstetric**, *Transversus abdominis plane*

block AND quadratus lumborum block AND cesarean section, quadratus lumborum block AND cesarean. The CINAHL, MEDLINE (ProQuest), EMBASE, and PubMed databases produced 30, 230, 57, and 34 results, respectively. After removing duplicates, 327 articles were left for appraisal. The literature search was current as of October 2020. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist was used to help guide and format the literature review. The literature review aims to provide the current evidence-based research on the TAP block and QL block, identify inconsistencies, provide a foundational knowledge for using these regional techniques, and isolate the most effective regional block to reduce opioid consumption. Table 1 provides the search criteria, and table 2 encompasses the inclusion and exclusion criteria. Appendix L displays the PRISMA flow diagram that details each phase of the literature review screening process.

Study Selection and Screening of Evidence

Search Criteria Table 1.

Concepts/ Topics	TAP block or transversus abdominus plane block	Quadratus lumborum block	Obstetric	Filters Applied
CINAHL	("TAP blocks") OR ("transversus abdominis plane block")	AND ("quadratus lumborum block")		<ul style="list-style-type: none"> • Peer-reviewed, years 2016-2020, and human filter applied, and 13 results found
	("TAP block") OR ("Transversus abdominis plane block")	OR ("quadratus lumborum block")	AND ("Obstetric *")	<ul style="list-style-type: none"> • Peer-reviewed, years 2010-2020, English, and cesarean section filters applied, and 17 results found

MEDLINE (ProQuest)	(TAP block)	AND (quadratus lumborum block)		<ul style="list-style-type: none"> • Peer-reviewed, 2016-2020 resulted in 4 results
	(TAP block)	OR (quadratus lumborum block)		<ul style="list-style-type: none"> • Peer-reviewed, 2016-2020 resulted in 182 results
	(TAP block)	OR (quadratus lumborum block)	AND (Obstetric*)	<ul style="list-style-type: none"> • Peer-reviewed, 2010-2020 resulted in 44 results
EMBASE	‘TAP block’	AND ‘quadratus lumborum block’		<ul style="list-style-type: none"> • 2010-2020 gave 36 results
	‘Transversus abdominis plane block’	AND ‘quadratus lumborum block’	AND ‘cesarean section’	<ul style="list-style-type: none"> • 2010-2020 gave 21 results
PubMed		quadratus lumborum block	Cesarean	<ul style="list-style-type: none"> • 2015-2020 gave 34 results

Table 2. Inclusion and Exclusion Criteria	
Inclusion	Exclusion
Population: <ul style="list-style-type: none"> • Female • Obstetric (OB) • Abdominal surgery • Male Type of procedure: <ul style="list-style-type: none"> • TAP block for cesarean delivery • QL block for cesarean delivery • TAP block or QL block for abdominal surgery Intervention: <ul style="list-style-type: none"> • Studies that performed a TAP/QL block to manage postoperative pain Primary outcomes: <ul style="list-style-type: none"> • TAP block reduced pain levels compared to patients who did not receive a TAP block • QL block reduced pain levels compared to patients who did not receive a TAP block • QL block provided better analgesia than TAP blocks across all abdominal surgeries Type of study: <ul style="list-style-type: none"> • English language • Randomized controlled trials • Publication date 2015-Present 	Population: <ul style="list-style-type: none"> • Children (<18 years old) Type of procedure: <ul style="list-style-type: none"> • Anything surgery that didn't involve a TAP block or QL block for any type of abdominal surgery Intervention: <ul style="list-style-type: none"> • Studies that did not exclusively examine the effectiveness of the TAP/QL block Outcomes: <ul style="list-style-type: none"> • Anything other than TAP/QL block being effective analgesia Type of study: <ul style="list-style-type: none"> • Non-English • Publication date pre-2010 • Systematic reviews • Meta-analysis • Questionnaire • Dissertations/theses

RESULTS OF LITERATURE REVIEW

Study Selection

A total of 351 articles resulted from the four databases after initial searches. Twenty-four duplicates were removed, and a total of 327 articles remained. A further review examining the titles and abstracts of the articles allowed 299 articles to be excluded. A total of 28 articles were assessed for eligibility. Investigators conducted a full-text analysis based on strict inclusion and exclusion criteria. Ultimately, 18 full-text articles were excluded for many reasons, including outcomes other than reducing opioid consumption, interventions other than single-dose local anesthetic injection, no full-text research study available, opinion letters, and language other than English. Additionally, a manual assessment of the search result's reference list was completed, which did not identify additional RCTs that met the criteria for this systematic review.

Ultimately, ten studies were selected and included in this systematic qualitative review that answered the PICO question: In patients undergoing cesarean section (P), does the use of an ultrasound-guided perioperative quadratus lumborum block (I) compared to an ultrasound-guided perioperative transversus abdominus plane block (C) improve postoperative pain management (O)?

TAP Block Versus QL Block

Yousef¹⁴ piloted a six-month randomized prospective control trial in a hospital setting with 60 adult female participants to study the comparison of a TAP block to a QL block for patients undergoing a total abdominal hysterectomy. The participants were ASA I or II patients aged 45 to 60 years old, and 30 participants received the TAP block while the other 30 received the QL block.¹⁴ The visual analog scale (VAS) was used to report pain scores, with 0 being no pain and 10 being maximum pain. Pain scores were assessed at 30 mins, 2, 4, 6, 12, and 24 hours postoperatively.¹⁴ The mean amount of morphine used per patient postoperatively was significantly higher in the TAP group than the QL group at each measured time postoperatively. The duration of postoperative analgesia was longer in the QL group than in the TAP group. The number of patients who requested additional analgesia was lower in the QL group than in the TAP group.¹⁴ Lastly, no serious complications were noted in either group. Patients who underwent a total hysterectomy and received the QL block received more significant pain relief, received less intraoperative fentanyl, had lowered VAS scores postoperatively, needed less analgesia after surgery, and had less postoperative morphine consumption compared with the bilateral TAP block. The TAP block showed a shorter duration of postoperative analgesia.

Wang et al.¹⁵ evaluated the effects of the TAP block and the QL block in the postoperative analgesia by searching online databases including MEDLINE, EMBASE, Cochrane Library, Web of Science, CNKI, and Wanfang and QVIP to collect the RCTs from inception to December 9th, 2019 to create a meta-analysis of RCTs.¹⁵ Twenty-two studies contained 777 patients in the TAP block group and 783 in the QL block.¹⁵ Overall results showed that the QL

block provided more effective analgesia than the TAP block regarding morphine consumption, fentanyl consumption, VAS score at 24 hours postoperatively, the number of patients requiring analgesia postoperatively, and the incidence of dizziness.¹⁵ Morphine consumption (mg), fentanyl consumption (mcg), VAS score at 24 hours postoperatively, number of patients requiring analgesia postoperatively, and the incidence of dizziness were all higher in the TAPB group than the QLB group.¹⁵ No significant differences were noted between the two groups regarding the operative time, duration of anesthesia, duration of postoperative analgesia, and nausea and vomiting. Conclusively, the QL block performed better than the TAP block in all areas of review. The QL block and the TAP block were comparable with operative time, duration of anesthesia, and the incidence of nausea and vomiting.

Liu et al.¹⁶ directed a systematic review and meta-analysis of randomized controlled trials. A comprehensive database search of PubMed, EMBASE, EBSCO, the Cochrane Library, Web of Science, and CNKI for RCTs were searched for QL blocks and TAP blocks for pain management in patients undergoing abdominal surgery.¹⁶ A total of 8 RCTs involving 564 patients were included. The meta-analysis of the 8 RCTs showed that pain scores at 2, 4, 6, 12, and 24 hours were significantly lower in the QL group than in the TAP group.¹⁶ The amount of postoperative morphine consumption was lower with the QL block than the TAP block. The duration of postoperative analgesia was longer in the QL group than in the TAP group. There was no difference noted in PONV.

Kumar et al.¹⁷ in 2018, performed a prospective double-blinded study that compared the efficacy of the TAP block versus the QL block for providing postoperative analgesia for lower abdominal surgeries. Seventy adult patients were randomly allocated into two groups.¹⁷ Group A received a TAP block with 20ml of 0.25% ropivacaine on each side (n=35), while group B got the QL block with 20ml of 0.25% ropivacaine on each side (n=35).¹⁷ The time of block, duration of surgery, numerical pain intensity scale (NPIS) score at the 1st, 2nd, 4th, 8th, 12th, 16th, and 24th postoperative hours, and the total analgesic drug requirements were compared between the two

groups.¹⁷ The QL block would be a better option for providing postoperative analgesia during abdominal surgeries. The duration for the requirement of the first rescue analgesic was longer, the patients had a better pain score at rest, and the total opioid analgesic consumption was less. These factors contribute to faster postoperative recovery and earlier mobilization of the patient.

Verma et al.⁹ in 2019 conducted a randomized clinical trial to compare the analgesic efficacy of the QL block and TAP block after a cesarean section. There were 60 ASA I or II singleton pregnancy patients with gestation of at least 37 weeks scheduled for an elective cesarean section between December 2018 and January 2019 randomized into the TAP block group or the QL block group.⁹ Each group contained 30 participants who received bilateral injections with 0.2% ropivacaine postoperatively in either the TAP block or the QL block group.⁹ There were no statistical differences among either group in operative time, right or left procedure, and presence or absence of related viscera visibility (uterus, urinary bladder).⁹ Time for rescue analgesic requirement was significantly longer in the QL block group than the TAP block group. Only 13 patients needed a single dose of analgesic in the QL block group, while 17 required none.⁹ In the TAP block group, one patient required six doses of analgesic, 19 needed seven doses, and ten patients needed eight doses.⁹ In the QL block group, the amount of analgesic required over 72 hours was significantly less than the TAP block group. VAS was significantly lower in the QL block group than the TAP block group both at rest and with movement at all times postoperatively.

Wei et al.¹⁸ in 2019, directed a randomized controlled trial comparing the QL block method with the TAP block for postoperative pain management in patients undergoing laparoscopic colorectal surgery. There were 74 ASA I or II patients between 18 and 70 included in the study scheduled for laparoscopic colorectal surgery.¹⁸ The patients were randomly assigned into two different groups, either the TAPB or QLB group. The blocks were administered postoperatively bilaterally, and each side received 20ml of 0.375% ropivacaine. All patients received sufentanil via patient-controlled intravenous analgesia (PCIA).¹⁸ At 2, 4, 6, 24, and 48

hours postoperatively, the patient's resting and moving numeric rating scale (NRS) were assessed.¹⁸ The study did have an attrition rate of six because six patients withdrew before completing the study. The QLB group used significantly less sufentanil at 24 and 48 hours, while no significant difference was noted at six hours postoperatively.¹⁸ Additionally, there was no significant difference in NRS results between the two groups at rest or during movement. The incidence of dizziness in the QLB group was lower than in the TAPB.¹⁸ Pruritus, nausea, and vomiting were not significantly different between the two groups. This was the first prospective, randomized, double-blind, controlled study comparing the QLB and TAPB for pain relief in patients undergoing laparoscopic colorectal surgery.¹⁸ The QLB is an effective, reliable, and safe analgesic procedure with no adverse reactions. Significantly less sufentanil was consumed in the QLB group compared to the TAPB; therefore, the QLB block is superior to the TAPB in postoperative pain management.

QL Block

Krohg et al.⁵ in 2018 piloted a randomized control trial to evaluate the efficacy of the QL block after c-section delivery. Forty parturients who underwent a CS received a bilateral ultrasound-guided QL block with either 2mg/ml ropivacaine or saline postoperatively.⁵ Patients who received the QL block with ropivacaine used less ketobemidone at 12 and 24 hours compared to the control group; however, there were no statistically significant differences noted at 36 or 48 hours.⁵ Fatigue and nausea levels were similar in both groups, while the control group could stand 13.5 hours after the placebo block and the QL block group could stand 14.5 hours later.⁵ Ultimately, the ropivacaine ultrasound-guided QL block reduced postoperative ketobemidone consumption and pain after c-section; however, further studies are needed to determine the ideal dose, volume, and injection site.

Blanco et al.¹⁹ also conducted a double-blinded randomized control trial to evaluate the analgesic efficacy of the QL block after cesarean section. There were 50 ASA I and II singleton pregnancy patients at least 37 weeks gestation selected and randomly assigned into one of the two

groups.¹⁹ Two patients delivered their babies before the planned CS, so only 23 patients ended up in the control group. The QL block group contained 25 patients, and the control group included 23 patients. The patients who received the QL block used less morphine at 6 and 12 hours postoperatively but not at 24 and 48 hours postoperatively; however, the QL block group had significantly fewer morphine demands at all time intervals than the control group.¹⁹ The VAS scores were less in the QL block group than the control group at all times at rest except for 24 hours postoperatively and for all time with movement.¹⁹ The QL block performed after CS was effective and provided satisfactory analgesia combined with a typical postoperative analgesic regimen. Proper implementation of the technique can significantly decrease opioid use after cesarean sections.

TAP Block

In 2016, Omur et al.²⁰ evaluated the analgesic efficacy of an ultrasound-guided TAP block on postoperative pain and morphine consumption in varicocelectomy. A prospective, double-blind, randomized placebo-controlled clinical study where 40 males who were scheduled for elective varicocele operations were randomized into the control or treatment group.²⁰ The treatment group received a TAP block using 20ml 0.25% bupivacaine on the operation side, whereas the control group received 20ml 0.9%NaCl.²⁰ Ultimately, only 34 patients were included in the analysis, 18 in the treatment group and 16 in the control group²⁰. As part of a multimodal analgesic regime for Ivanissevich varicocelectomy operations, 20ml 0.25% bupivacaine administered by ultrasound TAP block provided adequate analgesia in the postop period. It reduced the need for opioid consumption compared to the control group.²⁰ In the first 24 hours postop, the pain was significantly less at rest and with coughing. Additionally, the request for morphine was lower in the treatment group compared to the control group.

A randomized control trial aimed to evaluate the analgesic effects of the TAPB in patients undergoing cesarean section was performed by Kupiec et al.²¹ in 2018. This study assessed the analgesic efficiency of the TAP block in 88 women undergoing elective cesarean

section with spinal anesthesia. The women were prospectively randomized into two groups. The first group received an ultrasound-guided TAPB performed using 40ml of 0.25% bupivacaine.²¹ The second group did not receive a regional nerve block. Both groups received standard analgesia protocol with intravenous paracetamol given every 6 hours and intravenous tramadol on demand given via patient-controlled analgesia (PCA).²¹ Of the 88 participants, 46 underwent TAP block, and 42 received IV analgesia.²¹ There were no statistically significant differences in height, weight, BMI, or amount of hyperbaric bupivacaine used for subarachnoid analgesia between the two groups.²¹ The TAP block group received less on-demand tramadol, had lower visual analog scores (VAS) 3, 6, and 12 hours postoperatively.²¹ Three patients in the treatment group reported vomiting, nausea, and dizziness, while in the control group, two patients were nauseous, and one was dizzy. Ultimately, the addition of morphine to the subarachnoid labor analgesia results in a less marked TAPB effect. Patients did not receive any opioids into the subarachnoid space due to lack of postoperative monitoring capabilities.

Table 3 provides a summary of all the studies included in the systematic review.^{5,9,14-21}

Table 3. Studies Included in the Appraisal		
Author (Year) & Level of Evidence	Study, Participants, Interventions, & Setting	Findings in QL and TAP block groups
Yousef (2018) Level 1 Quality B	60 ASA 1-2 pts 45-60 years old undergoing total abdominal hysterectomy divided into 2 groups-30 patients per group. No placebo group	Overall morphine used/patient (mg) for TAP blocks 14.46 +/- 3.4, QL block 10.06 +/-3.8 with a P value of 0.001. VAS pain score results for 30 min, 2,4,6,12,24hr in that order for TAP block 3.5+/-0.67, 4.1+/-0.68, 3.8+/-0.69, 4.6+/-0.85, 3.5+/-0.62, 3.2+/-0.43. For QL block 2.0+/-0.63, 2.4+/-0.67, 2.6+/- 0.61, 2.5+/- 0.50, 1.8 +/-0.46, 1.9 +/-0.32. P values for every time interval was 0.001. The dose of fentanyl used/patient (mcg) for TAP group 110.6+/-22.4 for QL group 43.16+/-19.5 with a P value of 0.001. The duration of postoperative analgesia (hours) for TAP group was 8.33 +/-4, for QL group 15.1 +/-2.12 with a P value of 0.001. The Number

		of patients needed analgesia postoperatively (%) TAP group 23(77), QL group 8(27) with a P value of 0.017.
Wang,Y, Wang X, Zhang K. (2020). Level 1 Quality A	Meta-analysis of RCTs, 22 studies were included containing 777 patients in the TAPB group and 783 in the QLB group. No placebo group	Morphine consumption (mg), fentanyl consumption (mcg), VAS score at 24 hours postoperatively, number of patients requiring analgesia postoperatively, and the incidence of dizziness were all higher in the TAPB group than the QLB group. No significant differences were noted between the two groups regarding the operative time, duration of anesthesia, duration of postoperative analgesia, and nausea and vomiting.
Liu X, Song T, Chen X, et al. (2020). Level 1 Quality B	8 RCTs included involved 564 patients. Patients received either a QLB or TAPB while undergoing abdominal surgeries. Postoperative pain scores were evaluated at 2,4,6,12 and 24h to compare morphine consumption.	The meta-analysis of 8 RCTs showed that pain scores at 2,4,6,12 and 24h were significantly lower in the QL group than the TAP group. The amount of postoperative morphine consumption was lower with the QL block than the TAP block. Duration of postoperative analgesia was longer in the QL group than in the TAP group. No difference in PONV.
Kumar GD, Gnanasekar N, Kurhekar P, et al. (2018). Level 1 Quality B	A prospective double-blinded study comparing QLB and TAPB for lower abdominal surgeries. 70 adult patients were included, divided into two groups; Group A TAPB received 20ml of 0.25% ropivacaine on each side, Group B QLB got 20ml of 0.25% ropivacaine on each side.	The time for the first analgesic requirement was 243.00+/- 97.36min and 447.00 +/-62.52min, and the total analgesic consumption (morphine in mg) was 6.65+/-1.55 and 3.25+/-0.78 in Group A and B. Both were statistically significant (P<0.01). Statistically significant postoperative pain scores (NPIS scale 0-10) were found at rest, between the two groups, and up to 16 hours. The QL block proves to be favored for the longer time period before the patient needs analgesics, as well as requiring less morphine and having a lower reported NPIS score.

Verma K, Malawat A, Jethava D, et al. (2019) Level 1 Quality B	RCT of 60 patients scheduled for elective c-section, divided into two groups of TAPB or QLB. Each group had 30 patients and received bilateral injections of 0.2% ropivacaine postoperatively. All were ASA I or II, singleton pregnancy, gestation at least 37 weeks.	No statistical differences among either group were noted in operative time, right or left procedure, and presence or absence of related viscera visibility (uterus, urinary bladder). Time for rescue analgesic requirement was significantly longer in the QLB group than in the TAPB group. In the QLB group, only 13 patients needed a single dose of analgesic, while 17 required none. In the TAPB group, one patient required six doses of analgesic, 19 needed seven doses, and ten patients needed eight doses. In the QLB group, the amount of required analgesic over 72hours was significantly less than the TAPB group. VAS was significantly lower in the QLB group than the TAPB group both at rest and with movement at all times postoperatively.
Wei D, Long S, Li M, et al. (2019). Level 1 Quality A	RCT with 74 patients scheduled for laparoscopic colorectal surgery randomly assigned to one of two groups. After surgery, patients received either TAPB or QLB bilaterally. Each side received 20ml of 0.375% ropivacaine, and all patients received sufentanil via PCIA.	QLB group used significantly less sufentanil at 24 and 48hours, and no significant difference was noted at 6hours postoperatively. There was no significant difference in NRS results between the two groups at rest or during movement, and the incidence of dizziness in the QLB group was lower than in the TAPB. Pruritus, nausea, and vomiting were not significantly different between the two groups. The first prospective, randomized, double-blind, controlled study comparing the QLB and TAPB for pain relief in patients undergoing laparoscopic colorectal surgery. QLB is an effective, reliable, and safe analgesic procedure with no adverse reactions. Significantly less sufentanil was consumed in the QLB group compared to the TAPB.
Krohg A, Ullensvang K, Rosseland LA, et al. (2018). Level 1 Quality A	RCT with 40 parturients who received a c-section. Divided into two groups received either ultrasound-guided QLB with 2mg/ml ropivacaine or saline postoperatively.	QLB group had lower ketobemidone consumption at 24 hrs (P=0.04; ratio of means =0.60; 95% CI, 0.37-0.97). at 12hours ketobemidone consumption was lower (P<0.01; ratio of means =0.52; 95% CI, 0.35-0.79). No statistically significant differences at 36 hours (P=0.13; ratio of means = 0.71; 95% CI, 0.45-1.12) or at 48 hours (P=.20; ratio of means = 0.74;

		95% CI, 0.47-1.18). Interactions between time and treatment showed statistically significant group differences in pain intensity at rest ($P<0.1$) and when the patients were coughing ($P<0.01$). 61 patients were considered eligible, then 40 patients were randomly assigned. Patients receiving active QLB used less ketobemidone at 24 hours compared to the control group. Less ketobemidone consumption was used at 12 hours, but no statistically significant differences were noted at 36 or 48 hours. Fatigue and nausea levels were similar. The QLB group could stand 14.5 hours after the block, and the control group stood 13.5 hours after.
Blanco R, Ansari T, Girgis E. (2015). Level 1 Quality A	An RCT with 50 patients randomly assigned into two groups. 23 patients were in the control group (2 had babies before the planned c-section).	QLB group used less morphine at 6, and 12 hours ($P<0.001$), QLB group had significantly fewer morphine demands than the control group ($P<0.001$) at 6, 12, 24, and 48h after c-section. Forty-eight patients were included because two delivered before the planned c-section. Twenty-five were placed in the QLB group and 23 in the control group. No deviations from the protocol. Patients in the QLB group used less morphine than the control group at 6 and 12 hours but not at 24 or 48 hours. VAS was less in the QLB group than control at all times at rest except 24 hours and for all times with movement.
Omur D, Oguzalp H, Kiraz HA, et al. (2016). Level 1 Quality B	Prospective, double-blind RCT with 40 male patients scheduled for elective varicocele operations and randomized into a control or treatment group. The treatment group received TAPB with 20ml 0.25% bupivacaine on the operation side, and the control group received 20ml 0.9% NaCl.	No statistical differences were found in the clinical and demographic variables of the groups. VAS pain scores when coughing and at rest were $P<0.05$ at all measured time points. The treatment group consumed less morphine than the control group at all measured time points except when admitted to PACU. The total morphine dose to the control group was 21.6 \pm 12.4mg and 7.7 \pm 4.0mg for the treatment group. For those who received unilateral repairs, there was a statistically significant difference in morphine consumption between those who received TAPB and those who did not. For those who

		received bilateral repairs, no significant difference between the groups was noted at any time point. The control group needed significantly more diclofenac sodium ($P < 0.001$ at PACU and $P = 0.039$ at the 15 th minute). No differences were noted in hemodynamics between the groups ($P < 0.05$). One patient in each group had nausea and received 10mg metoclopramide IV at the 15 th minute postop in PACU.
Kupiec A, Zwierzchowski J, Kowal-Janicka J, et l. (2018). Level 1 Quality A	Eighty-eight women undergoing elective cesarean section with spinal anesthesia were prospectively randomized into two groups. The first group received an ultrasound-guided TAPB was performed using 40ml of 0.25% bupivacaine. The second group received a regional nerve block. Both groups received standard analgesia protocol with intravenous paracetamol given q6h and intravenous tramadol on demand given via PCA. The study was conducted in the Department and Clinic of Gynaecology, Obstetrics, and Neonatology of the Wroclaw Medical.	One hundred patients were selected, 22 were excluded due to administrative reasons, 46 underwent TAPB, and 42 received IV analgesia. There were no statistically significant differences between the two groups in height, weight, BMI, or amount of hyperbaric bupivacaine used for subarachnoid analgesia. TAPB group were given less on-demand tramadol ($p = 0.005$). They had lower VAS values at 3 ($p = 0.000014$), 6 ($p = 0.015$) and 12 hours ($p = 0.006$) postoperatively. No significant difference in arterial pressure and heart rate between the two groups ($p > 0.05$). Three patients in the treatment group reported vomiting, nausea, and dizziness. In the control group, two patients were nauseous, and one was dizzy.

DISCUSSION OF LITERATURE REVIEW

Summary of the Evidence

Ten RCTs, systematic reviews, and metanalysis of RCTs were included in this literature review.^{5,9,14-21} Many studies were excluded for reasons including outcomes other than reducing opioid consumption (i.e., comparing QL block to intrathecal morphine), interventions other than single-dose local anesthetic injection (i.e., pain catheter left in place for several days), no full-text research study available, opinion letters, and language other than English. The Johns Hopkins' appraisal tool was utilized to help evaluate each article's quality and evidence level. There are three designated evidence levels: "A" or "High" quality stands for reliable, applicable results, a

study of adequate sample size, a control group, and a definitive result; “Good” or “B” quality refers to sufficient sample size, adequate results, and a fairly definitive conclusion that comes from fairly conclusive literature; finally, “C” or “low” quality literature indicates poor evidence with unreliable results, inadequate sample size, and unclear conclusions.²² According to the Johns Hopkins’ appraisal scale, all ten articles were level 1, with five rated as high quality and five as medium quality.²² Only articles with high quality and medium quality were included in this literature review. The results of this systematic review are as summarized below:

- Six studies directly compared the QL block to the TAP block,^{9,14-18} while two studies examined just the QL block^{5,19} and the remaining two studies examined just the TAP block.^{20,21}
- All ten studies found that receiving either a QL block or a TAP block reduced analgesics' consumption, including opioids and synthetic opioids.^{5,9,14-21}
- All six studies comparing QL and TAP blocks found the QL block provided superior pain relief and patients consumed fewer opioids than those who received a TAP block.^{9,14-18}

Limitations of the Systematic Review

The investigators of this systematic review must acknowledge the limitations. Inclusion criteria included solely peer-reviewed articles in English, which potentially limits the conclusion based on language bias. Another limitation is the overall small number of well-conducted research studies about the QL block. Within the studies included, researchers identified that more well-designed research studies are needed to confirm studies. Additionally, several studies did not assess dermatome level. One common theme among the studies was the identified limitation of not knowing the ideal dose of local anesthetic to give as well as lacking knowledge around the actual or potential spread of local anesthetic to the paravertebral space and how that did or did not affect the overall block.

Another limitation is that these studies were performed on a wide variety of patients, and this study format provides the potential for widespread use of the QL block. Still, the results must

be extrapolated to the parturient and used in cesarean sections as not all studies examined this patient population. The types of surgeries included in these studies ranged from cesarean section to varicocele operations and laparoscopic colorectal surgery. Additionally, study participants ranged in age and were both male and female.

Lastly, a few other differences were noted between studies. Investigators used the VAS scale most frequently to monitor pain scores objectively; however, different scales such as the NIPS and NRS scales were also used in some studies. Time intervals for evaluating postoperative pain were not consistent across studies. Yousef et al.¹⁴ used time intervals of 30 minutes and then 2 hours, 4 hours, 6 hours, 12 hours, and 24 hours postoperatively, while Blanco et al.¹⁹ evaluated postoperative pain levels at 6, 12, 24, and 48 hours postoperatively. Regardless of the slight variations in study design, the overall results and conclusions remain consistent between all ten studies.

Recommendations for Future Research

More well-designed studies examining specific local anesthetics, ideal doses, and potential spread to the paravertebral space are needed to determine the best use of QL blocks. Larger scale RCTs with a larger sample size should be conducted to ensure the generalizability of the results. Additionally, these studies should include patients with higher BMIs because obesity should not be an exclusion criterion from receiving a nerve block unless adequate research demonstrates a currently unknown contraindication. Future RCTs should also include high-risk pregnancies since pain is not exclusive to healthy pregnancies. The goal should be to provide a new and better pain management technique to as many patients as possible, ideally the entire obstetric population. Another recommendation is to test varying doses of local anesthetic, including larger versus smaller volumes of local anesthetic, and single versus continual local anesthetic administration via a catheter.

Lastly, no studies examined the cost-benefit of patients receiving a QL or TAP block versus opioid administration and the overall cost savings by preventing chronic opioid

dependency. A cost-benefit analysis was not completed by any of the ten studies. In the larger context of the opioid epidemic, more than 130 people died from an opioid-related drug overdose in 2017.²³ The Kaiser Family Foundation (KFF) reported an increase in opioid treatment costs from \$0.3 billion in 2004 to \$2.6 billion in 2016, but medication-assisted treatment only accounts for a small part of the overall healthcare costs associated with opioids.²³ Additionally, individuals with opioid use disorders are more likely to miss work, commit crimes, have injuries related to intoxication, have babies dependent on opioids, and transmit infectious diseases.²⁴ Further research should include and examine the benefit of reducing opioid consumption in parturients both from a cost-benefit analysis perspective and an overall reduction in patients developing a chronic opioid dependency.

CONCLUSION OF LITERATURE REVIEW

A literature review was conducted, which examined PubMed electronic database, CINAHL, EMBASE, and MEDLINE (ProQuest) database. The search resulted in 351 articles, which were thoroughly reviewed and examined. Ultimately, ten RCTs were included in the literature review. Out of the ten included articles, six compared the QL block to the TAP block, two examined the QL block, and two evaluated the TAP block. All ten studies found that receiving either a QL block or a TAP block reduced analgesics' consumption, including opioids and synthetic opioids.^{5,9,14-21} All six studies comparing the QL and TAP blocks found the QL block provided superior pain relief and patients consumed fewer opioids than those who received a TAP block.^{9,14-18}

METHODOLOGY OF QUALITY IMPROVEMENT

The primary objective of this quality improvement education module project is to assess the baseline knowledge of current CRNAs regarding how to perform the TAP block and QL block and the benefits of these regional anesthesia techniques to reduce postoperative cesarean section pain and opioid consumption. To successfully achieve the goal of this project, a series of actions will be conducted involving a specifically selected group of CRNAs who are currently

practicing at a level 1 trauma center. These CRNAs will voluntarily participate in the intervention portion of this project, specifically the education module, along with a pre-test and post-test. Each of the actions involved in implementing this project will be identified in the following sections, as each section is crucial in determining the study outcome.

Setting and Recruiting Participants

The setting is a hospital system in Broward County, Florida. The hospital system contains four hospitals. Broward Health Coral Springs includes 250 beds. Broward Health Imperial Point holds 204 beds. Broward Health Medical Center consists of 716 beds. Broward Health North contains 409 beds. The Salah Foundation Children's Hospital includes 125 beds. The Nurse Anesthetists and Anesthesiologists are employed by Anesco and not the Broward Healthcare System. The target population consisted of all the Nurse Anesthetists employed by Anesco. Participants were identified via an employee email list supplied by Anesco. All Anesco Nurse Anesthetists were emailed an invitation to participate in the education module.

Project Participants

All Anesco Nurse Anesthetists were eligible to participate in the educational module. All other Broward Hospital employees including but not limited to nurses, physicians, techs, environmental services, secretaries, and security, were excluded from participation in the study. No Broward Health employees participated in this educational module. Only Anesco Nurse Anesthetists participated in the educational module. All Anesco anesthesia employees who met inclusion criteria on the unit were given the opportunity to take the voluntary pre- and post-surveys (see Appendix G).

Intervention

An educational intervention about using the QLB to reduce postoperative cesarean section pain and opioid consumption is essential to gain Nurse Anesthetist buy-in and increase Nurse Anesthetist knowledge and understanding, both necessary to overcome perceived barriers to implementing regional anesthesia techniques. Reducing barriers is critical to motivating

anesthesia staff to change their actual practice behaviors. The education module about the benefits of the TAP block and QL block instructed the staff on proper regional block techniques for these blocks and how implementing these blocks will reduce opioid consumption in post-cesarean section women while better controlling postoperative pain. The education module included a pre-test survey, a voice-over PowerPoint, and a post-test survey. The goal is for nurse anesthetists to understand better the benefits of using a TAP block or a QL block; however, research does indicate that the QL block provides superior analgesia. Regardless, providing as many cesarean section patients either a TAP block or a QL block should become standard of care because the blocks are easy to learn and teach others, and they will help reduce the opioid crisis. The educational session's content is reflective in the pre- and post-test questions to help the learners consolidate the knowledge and skills acquired from the presentation to engage the learner further. The pre-test questions aim to focus the learners on what content is most important. In contrast, the post-test questions ensure the educational module properly taught the information and the learner gained appropriate knowledge.

The primary methodology of the proposed project is to administer an online educational module composed of a narrated PowerPoint along with a pre- and post-test to determine providers' baseline knowledge and knowledge gained after the intervention. The educational module will be distributed using a Qualtrics survey, which will contain the consent form, demographic questions, a pre-test, the narrated PowerPoint, and a post-test (see appendix G and K). The first phase of the project will be composed of the consent form, demographics, and pre-test survey. The participants will review the consent form and be taken to the demographics questionnaire upon agreeing to participate voluntarily. After completing the demographics questions, the participants will then complete a 10-question pre-test. This phase aims to determine the participants' existing knowledge. The data collected in this phase will be compared to the data collected in the post-test to assess the impact of the education module. Upon completion of the pre-test, the participants will move to phase two of the project. Phase two contains the narrated

PowerPoint. The participants will learn about the benefits of the QL block compared to the TAP block to reduce the patient's postoperative pain level and opioid consumption after a cesarean section. The project's final phase contains the post-test survey aimed to identify the learned knowledge of the project participants and how likely the participants are to integrate the use of the QL block into their clinical practice. The data collected from the pre- and post-test provides feedback concerning the impact of the educational intervention and establishes the efficacy of the participants learning. The data collected from the pre- and post-test survey will be analyzed using SPSS to determine the statistical significance of the knowledge gained and the effectiveness of the online intervention.

Procedures

An informational letter was sent via email to all the Nurse Anesthetists employed by Anesco, inviting them to participate in the project. An anonymous link to the educational module was included in the email. The Nurse Anesthetists completed the survey on their mobile devices or computers via the Qualtrics survey platform. A unique code identified was created for the survey, and no personal identifiable information was captured. Following these procedures protected the privacy of those who volunteered to participate in the project, as there was no way to link responses to identifying information. Those who chose to participate in the educational module could listen to and view the PowerPoint education at their leisure, followed by filling out the post-test survey on their mobile phone or computer. The participants were presented with the consent form as the first item after clicking on the link. After agreeing to participate, the participants were then directed to the rest of the educational module phases. There was no penalty if a participant chose to withdraw from the project at any point. Additionally, there were no perceived risks to participating in this study, as participation only requires 10-15 minutes to complete the educational intervention.

Protection of Human Subjects

Participants will be recruited via the email list provided by Anesco. The entire online education module created using Qualtrics will be emailed to participants and accessed by one unique link for each participant. By using unique code identifiers, nurse anesthetists participating in the survey remain anonymous and the data secured. Laptop passwords and spyware protected the digital data collected from the pre-test and post-test surveys, and these protective measures ensured the safety of the data.

Measure and Analysis

For the study, the data was exported from Qualtrics to SPSS, and analysis was conducted using SPSS. Inferential statistics were used to analyze the responses from the pre- and post-test surveys. A paired t-test was conducted to determine if there was a significant change in the nurse anesthetists' knowledge, attitudes, and behaviors after participating in the virtual education module about implementing the QL block to reduce pain and opioid consumption in postoperative cesarean section patients. The pre-test survey will gauge the participants' baseline knowledge and attitudes, while the post-test will determine if the participants have gained knowledge from the educational module. The instrument reliability and validity will be measured in accordance with the intervention and the effectiveness it offered the providers. The data collection is completely anonymous, confidential, and no subject identifiers will be recorded during any study component.

The pre- and post-test surveys consisted of 10 questions directly related to the educational content and five personal questions such as age, gender, ethnicity, level of education, and years of being an anesthesia provider (see appendix G). No information collected could lead to personally-identifying the participant. The ten knowledge-based questions were all multiple-choice questions with four answer options, and two questions reflect the Likert scale with answer options from most likely to most unlikely. Postquestionnaire analysis examined an increase in knowledge-based purely on how many questions the participant got right on the pre-test compared to the number of correct answers on the post-test.

Additionally, the Likert questions were used for analysis about whether or not anesthesia providers would be likely or not likely to adopt alternative pain methods for women undergoing cesarean section and recommend the QL block. Through the statistical analysis, the study results should quickly identify patterns that will then be used to determine the effectiveness of the educational module and how it affects all clinicians' actions and behaviors. Finally, the co-investigator will store all the data on a password-protected laptop.

RESULTS OF QUALITY IMPROVEMENT

Demographics

The participant demographics are displayed in Table 4 below.

Table 4. Demographics

Demographic	n (%)
Total Participants	6 (100.00%)
Gender	
Male	3 (50.00%)
Female	3 (50.00%)
Ethnicity	
White	4 (66.67%)
African American	1 (16.67%)
American Indian	0 (0.00%)
Asian	0 (0.00%)
Other	1 (16.67%)
Age	
18-25	0 (00.00%)
26-40	3 (50.00%)
41-55	3 (50.00%)
>55	0 (00.00%)
Education	
Bachelors	0 (0.00%)
Masters	3 (50.00%)
Doctorate	3 (50.00%)
Other	0 (0.00%)
Years of Experience	
1-2	1 (16.67%)
2-5	0 (0.00%)
5-10	2 (33.33%)
>10	3 (50.00%)

There were 6 participants in the pre-test demographics, and all 6 completed the entire study, both pre- and post-test components. The gender of the participants revealed that 3 (50.00%) were female and 3 (50.00%) were male. There was also a range of ethnicities represented: African American (n=1, 16.67%), White (n=4, 66.67%), and Other (n=1, 16.67%). Information was obtained regarding the participant's highest level of education. It was found that there was an equal mix of those who had received either a master's (n=3, 50.00%) and those who had received a doctorate (n=3, 50.00%). The participants were questioned about the length of time practicing, finding that the practice period ranged: one to two years (n=1, 16.67%), 2 to 5 years (n=0, 0.00%), 5 to 10 years (n=2, 33.33%), >10 years (n=3, 50.00%).

Pre-test and Post-test Sample

Six CRNAs completed both the pre- and post-test surveys. The average overall scores for the pre-test were 2.83 (SD=0.753), and the overall scores for the post-test were 5.50 (SD= 1.87). Out of six participants, the average post-test increased 2.66 points from the pre-test. The results indicate a P value of 0.01, which is well below the statistically significant indicator of 0.05. The paired T-test demonstrates a statistically significant knowledge base increase from the pre-test to the post-test due to the education module provided to the participants (Appendix G).

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PostScore	5.50	6	1.871	.764
	PreScore	2.83	6	.753	.307

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PostScore & PreScore	6	.497	.316

Paired Samples Test								
		Paired Differences			95% Confidence Interval of the Difference			
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df
Pair 1	PostScore - PreScore	2.667	1.633	.667	.953	4.380	4.000	5
							Sig. (2-tailed)	
							.010	

Pre-Test Knowledge

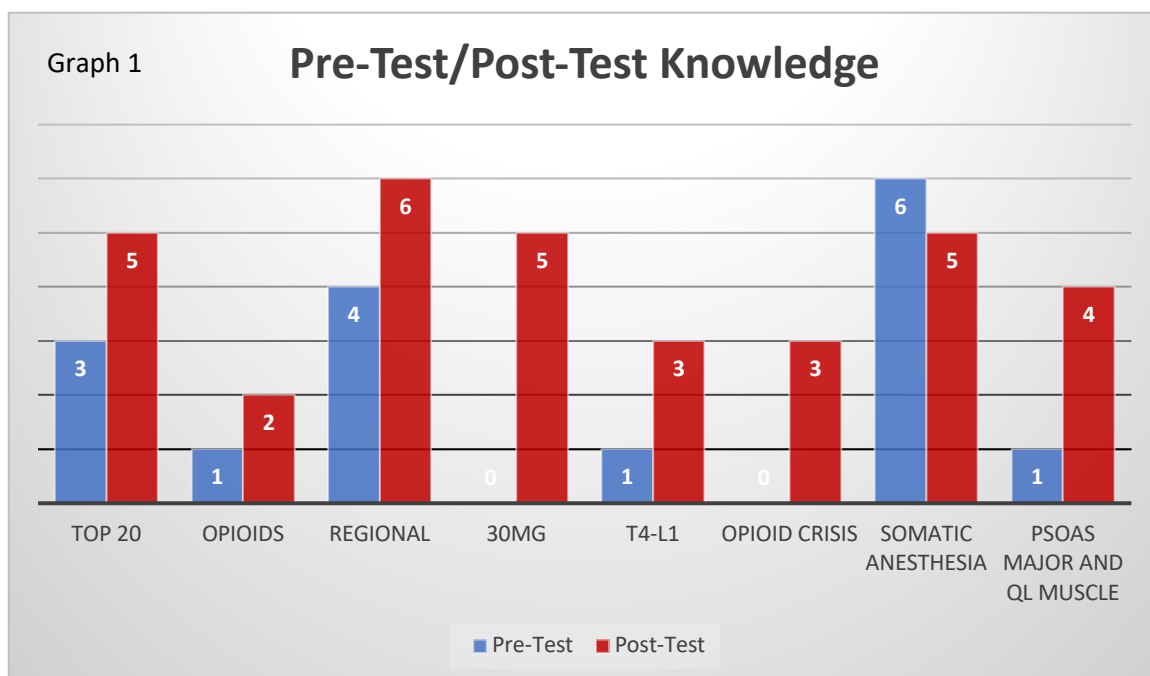
This section contains information regarding the common beliefs about pain management of cesarean section patients and regional anesthetic techniques to address postoperative pain. All participants believed that a cesarean section was either in the top 20 (n=3, 50.00%) or top 5 (n=3, 50.00%) most painful surgical procedures. While all the participants understood the significance of how painful a cesarean section is, the participants did not know the most common postoperative analgesia method. Three of the participants believed regional anesthesia was the most common method of postoperative analgesia; however, opioids are most often prescribed. Additionally, all participants significantly underestimated the amount of morphine equivalent mothers asked for postoperatively. The average morphine equivalent in the first 24 hours postoperatively is 30mg. Four participants (66.67%) believed only 20mg would be needed, and two participants (33.33%) believed mothers only needed 10mg in the first 24 hours. Regarding the QL block, only one participant knew where the target region for the QL block was located, and only one participant knew what dermatome levels were expected to be blocked.

Post-Test Knowledge

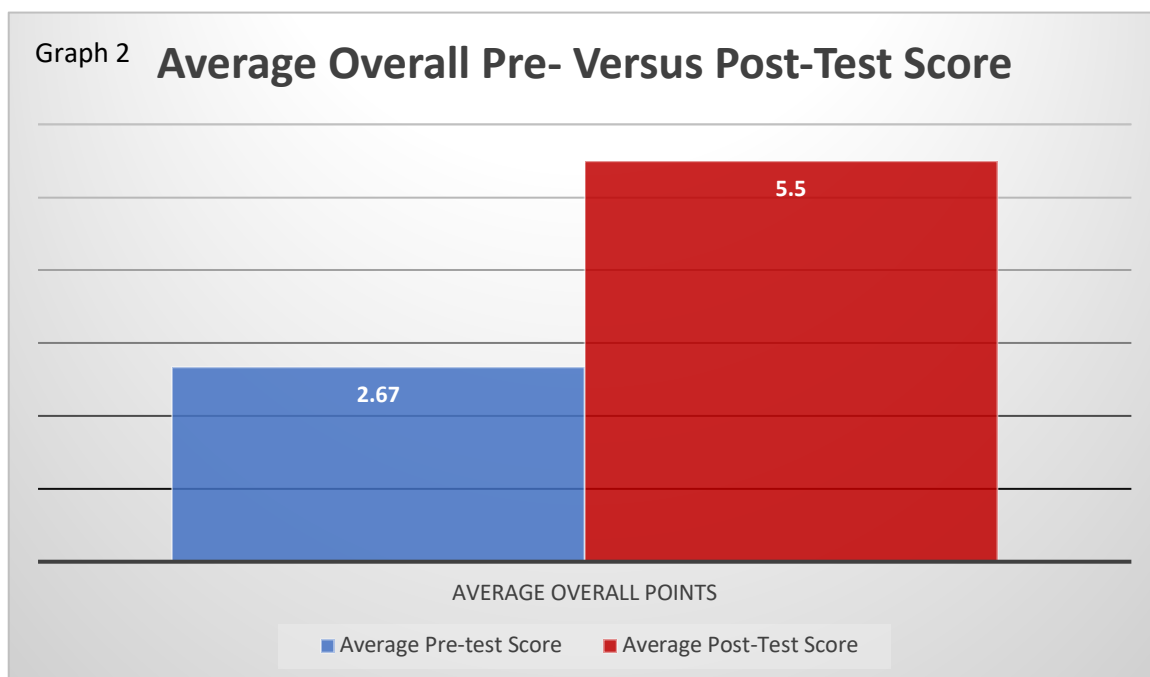
Five of the participants (83.33%) correctly identified that a cesarean section is considered one of the top 20 most painful surgical procedures on the post-test. Only two participants (33.33%) correctly identified opioids as the most common treatment for postoperative cesarean section pain. A greater understanding of morphine equivalent usage in the first 24 hours postoperatively was reached with five participants (83.33%) correctly identifying that 30mg of morphine equivalent are needed. Only three participants (50.00%) could correctly identify the dermatome level expected with the QL block, and four participants (66.67%) could correctly

identify the target area for the QL block. Unfortunately, there was one question where every participant answered the pre-test correctly, but then one participant changed their answer on the post-test to an incorrect answer. As a result, the post-test score decreased from 100% to 83.33%, showing a decrease in knowledge of 16.67%. Since all participants could correctly identify the correct answer in the pre-test, the one participant who changed their response to an incorrect choice on the post-test was done so in haste or by misreading the question. By all six participants choosing the correct answer on the pre-test, it is reasonable to assume that the base knowledge and understanding of a TAP block and how it provides analgesia is present in all participants and changing the answer to an incorrect option on the post-test was simply a mistake. All other questions had at least a 16.67% improvement from the pre-test to the post-test score. Most questions had at least a 33.33% increase, and one question had an 83.33% increase. See Table 5 and Graph 1 for all the differences in responses from the pre- to post-test.

Table 5: Difference in Pre- and Post-Test Findings	Pre-Test	Post-Test	Difference
Out of 179 surgical procedures, a cesarean section is considered to be: in the top 20 most painful surgical procedures	50.00%	83.33%	33.33%
The most common method of pain management for cesarean section is analgesics: opioids	16.67%	33.33%	16.66%
The American College of Obstetricians and Gynecologists (ACOG) states that regional anesthesia blocks provide the most analgesia	66.67%	100.00%	33.33%
On average, patients who were provided intravenous pain medication asked for an equivalent of 30mg of morphine in the first 24 hours after surgery	0.00%	83.33%	83.33%
The goal of the quadratus lumborum block is to create a segmental somatic and visceral analgesia from T4 to L1	16.67%	50.00%	33.33%
One contributing factor to cesarean section patients' commonly undertreated pain is the ongoing opioid crisis in the United States	0.00%	50.00%	50.00%
The transversus abdominus plane block compared to the quadratus lumborum block provides somatic anesthesia of the abdominal wall and is dependent on the interfascial spread	100%	83.33%	-16.67%
The target for the quadratus lumborum block injection site is the fascial plane between the psoas major muscles and the quadratus lumborum muscle	16.67%	66.67%	50.00%



Average overall pre-test versus post-test scores are displayed below in graph 2.



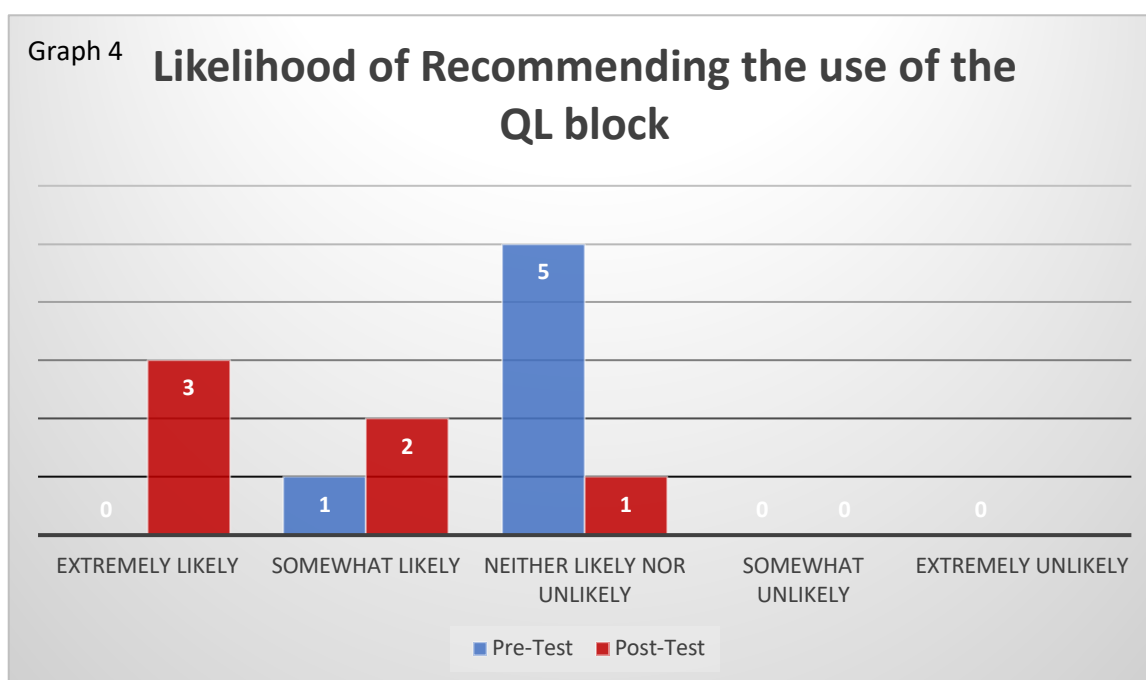
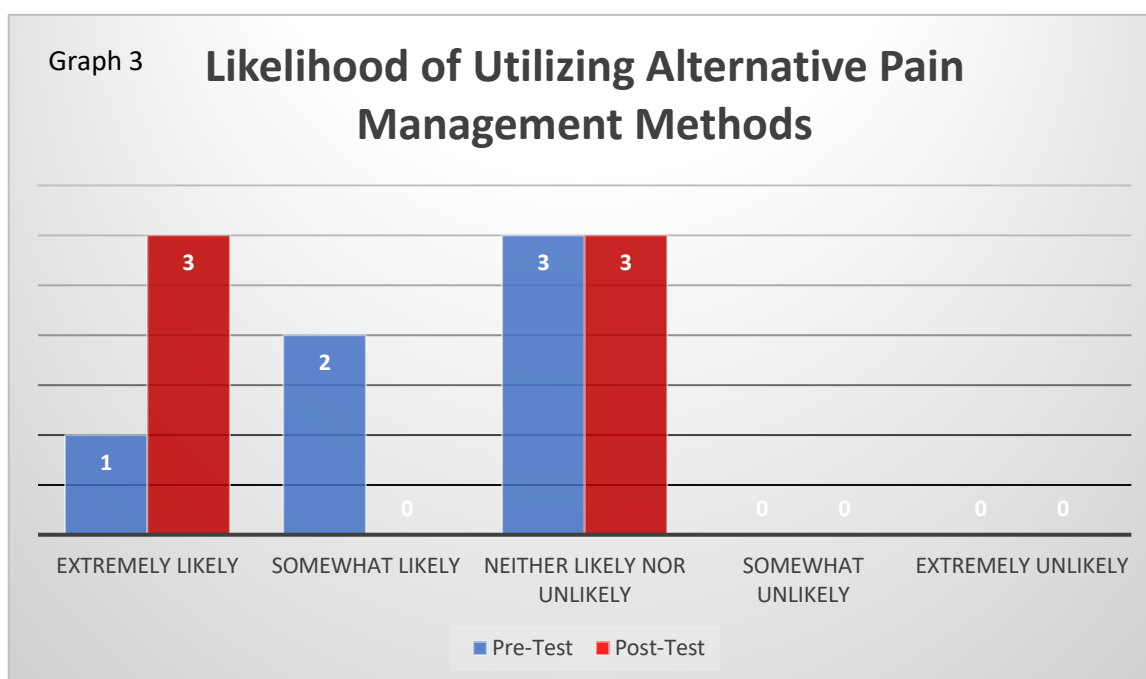
Perspective of Use in Practice

On the pre-test, all six participants identified in either the extremely likely, somewhat likely, or neither likely nor unlikely category. Three participants were neither likely nor unlikely

to utilize alternative pain management methods, while two participants were somewhat likely, and one was extremely likely. After implementing the education module, three participants were still neutral, choosing neither likely nor unlikely category. In comparison, three participants now stated that they were extremely likely to utilize alternative pain management methods for postoperative cesarean section pain. In the final likert question, five participants were neither likely nor unlikely to recommend the usage of the QL block for postoperative cesarean section pain. In contrast, one participant was somewhat likely to recommend the QL block. After the education module, only one participant remained neutral, choosing neither likely nor unlikely to recommend the QL block; however, three participants were now extremely likely to recommend the use of the QL block, and two participants were somewhat likely to recommend its use. As is visually represented in both Graph 3 and Graph 4, while some participants remained neutral on the information presented to them, at least 50% of the participants increased their likelihood of both utilizing alternative pain management methods and recommending the use of the QL block specifically to manage postoperative cesarean section pain.

Table 6 represents the pre- versus the post-test likelihood of participants who are extremely likely to recommend alternative methods to reduce postoperative cesarean section pain and the likelihood of explicitly recommending the QL block. All participants who did not select extremely likely on the post-test chose neither likely nor unlikely; therefore, they remained neutral. No participant selected that they would be somewhat or extremely unlikely to recommend an alternative pain management method or the QL block. The education module successfully demonstrated benefit to women undergoing cesarean section to consider utilizing regional anesthesia and the QL block, shown in Table 6 by having both a 33.33% and a 50.00% increase in the likelihood of providers recommending alternative providers pain management methods, including the QL block.

Table 6: Difference in Pre- and Post-Test Confidence	Pre-test	Post-test	Difference
How likely are you to use alternative methods to reduce postoperative pain in women undergoing cesarean section?	16.67%	50.00%	33.33%
How likely are you to recommend the use of the QL block?	0.00%	50.00%	50.00%



DISCUSSION OF QUALITY IMPROVEMENT

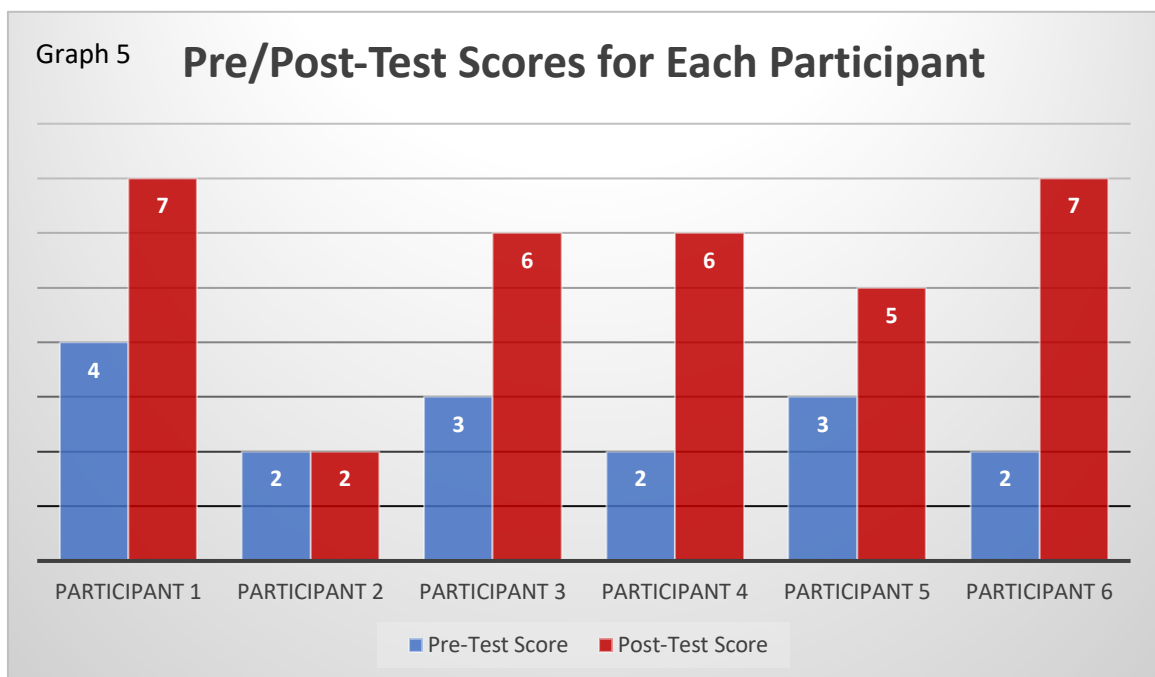
Evidence-based alternative pain management methods for postoperative cesarean section pain, including the QL block, not only provide superior pain relief but significantly reduce the utilization of opioid usage. Providing CRNAs with an education module on the use of alternative pain management techniques for postoperative cesarean section pain demonstrated an overall increase in knowledge and understanding about not only the QL block itself but the benefits of regional anesthesia for reducing postoperative pain and opioid consumption. While not all providers are likely to use or recommend the usage of the QL block, the majority did report an increased likelihood of recommending and using alternative pain management techniques, including the usage of the QL block. Additionally, the knowledge base of the surveyed participants demonstrated a general lack of understanding of the severity of postoperative cesarean section pain and the methods used to treat these patients' pain. The overall average pre-test score was 2.83 points out of 8 scored questions (35.37%). The pre-test consisted of 10 pre-test and post-test questions; however, the final two questions were the likert style questions, which were not scored in the paired T-test. The average post-test score was 5.50 points out of 8 scored questions (68.75%). These scores indicate that the overall knowledge increase was 2.67 points or 33.37%. This knowledge increase is statistically significant as identified by the paired T-test analysis (see Appendix G for the table).

Limitations

Overall there are two main limitations to this study. The first is the small sample size, and the second is that one participant answered the pre-test and the post-test with the same answers, which slightly skews the results. The sample size only had n=6. The participants all came from the Broward Health System and were CRNAs employed by Anesco. This sample population is limited to less than 40 employees, did not always have accurate or up-to-date emails for employees, and recent hires were not included on the list. A larger sample population would

provide greater statistical significance and reduce the sample bias in those who voluntarily chose to participate in this survey and education module.

Additionally, as shown in Graph 5, each participant increased their post-test score from their initial pre-test score except participant number two. Participant number two received a score of 2 (33.33%) on the pre- and post-test, but upon further investigation, this participant selected the same answer for each question on both the pre- and post-test. While there is no definitive answer for why this participant answered the pre- and post-test in this manner, it is reasonable to hypothesize that the participant voluntarily chose to participate in the study but did not wish to put time or effort into the education module. Every participant increased their post-test score from their pre-test score, indicating effort and attentiveness to the education module presented. Unfortunately, participant number two decided to participate voluntarily but simply select random answers while remaining consistent in the pre- and post-test survey selection. This method of participation became apparent upon examining the results of each participant. Participant number two's answers were included in all statistical analyses; however, this participant's method of participation does negatively affect the statistical results because this participant did not show that any knowledge was gained by participating in the education module.



Future Implications for Advanced Nursing Practice

The outcomes of the education module demonstrate the continued need for learning, expanding knowledge base, and empowering providers to follow the most up-to-date evidence-based practices. The education module demonstrated the need for currently practicing CRNAs to expand their foundational knowledge and scope of practice as new evidence-based research provides updated techniques and methods for treating patients. Providing patients with opioids and intravenous analgesics for postoperative cesarean section pain has routinely been provided to patients for years. However, research demonstrates that opioids are overprescribed, including opioid naïve mothers, while regional anesthesia has become widely accepted and more effective at treating post-surgical pain. Unfortunately, current clinical practices are slow to adopt new evidence-based research and change treatment modalities and patient care. The reluctance to evolve into newer and more updated practices is multifactorial; however, implementing education modules, presenting providers with the most up-to-date evidence-based research, and advocating for patients to receive the highest quality of care remains an essential aspect of CRNA practice. The CRNAs who participated in the education module demonstrated a statistically significant knowledge improvement and a greater understanding of postoperative cesarean section pain severity and the most effective regional anesthesia techniques available to address this pain adequately. Implementing more regional anesthesia to manage postoperative cesarean section pain as recommended by the ACOG should become standard of care for CRNAs providing care to obstetrical patients delivering via cesarean section.

CONCLUSION

Ten RCTs were selected and reviewed to evaluate the QL block as a method of regional anesthesia and compared to the TAP block to determine which technique provided superior analgesia and reduced opioid consumption. Collectively the ten RCTs demonstrated that receiving either the QL block or a TAP block significantly reduced the consumption of opioids

and synthetic opioids postoperatively. Additionally, the six RCTs that directly compared the QL block to the TAP block identified that the QL block provided superior pain relief, with patients consuming fewer opioids than those who received a TAP block. The utilization of regional anesthesia for postoperative cesarean section pain is recommended by ACOG as the most effective pain management technique and should be considered the standard of care.

An educational module was created and implemented based on the evidence-based research and most current practice recommendations. The education module received IRB exemption status before being deployed to the CRNAs employed at Broward Health by Anesco. These CRNAs were asked to participate on an entirely voluntary and anonymous basis. Each participant took a pre-test followed by viewing the education module and then finally completing the post-test survey. Both Qualtrics and SPSS were utilized to conduct the education module and run statistics following the participants' survey completion. The results provided conclusive evidence that the provider's knowledge of the severity of postoperative cesarean section pain, along with the most effective regional anesthesia techniques to treat this pain adequately, was lacking. The results also indicated providers' gaining significant knowledge after completing the education module and an increased likelihood of recommending alternative pain management methods, including the QL block. However, further research is needed to solidify the recommendation of utilizing the QL block instead of the TAP block for postoperative cesarean section pain

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APPENDIX A: MATRIX

Citation and Theme of the article	Design/Method	Sample/Setting	Major Variables Studied and Their Definitions	Measurement And Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Yousef NK. Quadratus lumborum block versus transversus abdominis plane block in patients undergoing total abdominal hysterectomy: A randomized prospective controlled trial. <i>Anesthesia, essays and researches</i> . 2018;12(3): 742-747.	Randomized Prospective Control Trial. The study aimed to compare a TAP block to a QL block for patients undergoing total abdominal hysterectomy.	A 6-month study was conducted in a hospital setting on 60 adult female patients ASA status of I or II aged 45 to 60 years old. 30 received a TAP block while the other 30 received a QL block. No patients were excluded from the study and there was no attrition or loss to follow up	Independent variables = standard induction protocol used on each patient, mechanical ventilation to maintain end-tidal CO2 between 34-36mmHg, isoflurane 1-2% with 100% FIO2, blinded anesthesiologist performed assigned block, blocks performed under aseptic technique with ultrasound Dependent variables = overall fentanyl doses, reported VAS pain score, morphine requirements after surgery	Visual Analog scale (VAS) was used to report pain scores with 0 being no pain and 10 being maximum pain. Pain scores were assessed at 30 min, 2,4,6,12, and 24 hours postoperatively. Statistical Package for the social sciences version 20 was used with the independent sample t-test to analyze quantitative data. Qualitative data was analyzed using a Chi-square test. P< 0.05 was considered to be statistically significant.	Overall morphine used/patient (mg) for TAP blocks 14.46 +/- 3.4, QL block 10.06 +/-3.8 with a P value of 0.001. VAS pain score results for 30 min, 2,4,6,12,24hr in that order for TAP block 3.5+/-0.67, 4.1+/-0.68, 3.8+/-0.69, 4.6+/-0.85, 3.5+/-0.62, 3.2+/-0.43. For QL block 2.0+/-0.63, 2.4+/-0.67, 2.6+/-0.61, 2.5+/-0.50, 1.8 +/-0.46, 1.9 +/-0.32. P values for every time interval was 0.001. The dose of fentanyl used/patient (mcg) for TAP group 110.6+/-22.4 for QL group 43.16+/-19.5 with a P value of 0.001. The duration of postoperative analgesia (hours) for TAP group was 8.33 +/-4, for QL group 15.1 +/-2.12 with a P value of 0.001. The Number of patients needed analgesia postoperatively (%) TAP group 23(77), QL group 8(27) with a P value of 0.017.	The mean amount of morphine used per patient postoperatively was significantly higher in the TAP group than the QL group at each measured time postoperatively. Duration of postoperative analgesia was longer in the QL group than the TAP group, and the number of patients who requested additional analgesia was lower in the QL group than the TAP group. Lastly, no serious complications were noted in either group.	Patients who underwent a total hysterectomy and received the QL block received greater pain relief, less intraoperative fentanyl, had lower VAS scores postoperatively, needed less analgesia after surgery, and had less postoperative morphine consumption compared with the bilateral TAP block, which showed shorter duration of postoperative analgesia.	Strengths: consistent with literature and presents the highest level of evidence. Limitations: Dermatoma levels of each block were not assessed. Risks/harm: no risks or harms were identified in this study. Feasibility: QL block and TAP block are not technically difficult. They are easy to teach providers. Level of Evidence: Level I the highest level of evidence because this study is a RCT.

Wang, Y, Wang X, Zhang K. Effects of transversus abdominis plane block versus quadratus lumborum block on postoperative analgesia: A meta-analysis of randomized controlled trials. BMC Anesthesiology. 2020;20(1): 1-9.	Meta-analysis of randomized controlled trials. This study's purpose was to evaluate the effects of TAPB and QLB in postoperative analgesia by searching online databases including MEDLINE, EMBASE, Cochrane Library (&Trail), Web of Science, CNKI, and Wanfang and QVIP were applied to collect the RCTs from inception to Dec 9 th , 2019.	Twenty-two studies were included containing 777 patients in the TAPB group and 783 in the QLB group.	Independent variables = randomization, blinding, withdrawals/dropouts, allocation concealment. Dependent variables = morphine consumption, VAS score at 24 hours postoperatively, number of patients requiring analgesia postoperatively, the incidence of dizziness.	Heterogeneity test was conducted for each indicator and measured by statistics of I^2 , with $I^2 > 50\%$ indicating significant heterogeneity. if $I^2 > 50\%$, a random effects model was used; if $I^2 < 50\%$, the fixed effects model was applied, and the heterogeneity was applied. Software Stata 15.0 was used. Effect index relative risk (RR) as used for enumeration data and weighted mean difference (WMD) for measurement data. $P < 0.05$ was considered statistically significant.	Overall results showed that QLB was more effective analgesia than TAPB in regard to morphine consumption, fentanyl consumption, VAS score at 24 hours postoperatively, the number of patients requiring analgesia postoperatively, and the incidence of dizziness.	Morphine consumption (mg), fentanyl consumption (mcg), VAS score at 24 hours postoperatively, number of patients requiring analgesia postoperatively, and the incidence of dizziness were all higher in the TAPB group than the QLB group. No significant differences were noted between the two groups regarding the operative time, duration of anesthesia, duration of postoperative analgesia, and nausea and vomiting.	QLB performed better than TAPB in all areas of review. QLB and TAPB were comparable with operative time, duration of anesthesia, incidence of nausea and vomiting.	Strengths: high levels of evidence due to format of meta-analysis Limitations: more research with well-designed and adequate sample sizes are required to confirm these findings Risk/harm: no risks/harms found in relation to patients. Level of evidence: Level I, highest level of evidence because it includes more than 1 RCT.
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Liu X, Song T, Chen X, et al. Quadratus lumborum block versus transversus abdominis plane block for postoperative analgesia in patients undergoing abdominal surgeries: A systematic review and meta-analysis of randomized controlled trials. BMC anesthesiology. 2020;20(1).	Systematic review and meta-analysis of randomized controlled trials. A comprehensive database search of PubMed, EMBASE, EBSCO, the Cochrane Library, Web of Science and CNKI for RCTs were searched for QL blocks and TAP blocks for pain management in patients undergoing abdominal surgery.	A total of 8 RCTs involving 564 patients were included.	Independent variables = age, sex, type of surgery, published year. Dependent variables = postoperative pain scores at 2h, 4h, 6h, 12h, and 24h, postoperative morphine consumption at 24h, and duration of postoperative analgesia.	Each study was reviewed by two researchers using the Cochrane Handbook. A third reviewer made a decision in case of any disagreement. Assessment topics were random sequence generation, allocation scheme concealment, blinding, accuracy of data results, freedom from selective reporting and other biases. The quality of outcomes were evaluated by the Grading of Recommendations Assessment, Development and Evaluation (GRADE).	Statistical analysis was conducted using RevMan 5.3. A heterogeneity test on the included studies and calculated the statistics was conducted and when I^2 was <0.5 or p was >0.1 , the level of heterogeneity was low, and a fixed-effects model was applied. Otherwise, a random effects model was used to analyze the sources of heterogeneity. Pain scores at all intervals were statistically significant indicating the QL block provides better pain management. No significant statistical difference between the two groups regarding postoperative nausea and vomiting (PONV).	The meta-analysis of 8 RCTs showed that pain scores at 2, 4, 6, 12, and 24h were significantly lower in the QL group than the TAP group. The amount of postoperative morphine consumption was lower with the QL block than the TAP block. Duration of postoperative analgesia was longer in the QL group than the TAP group. No difference in PONV.	The QL block provides better pain management with less opioid consumption than the TAP block after abdominal surgery. No differences were noted between TAPB and QLB for PONV.	Strengths: high levels of evidence due to format of meta-analysis Limitations: in data extraction some observation indexes in the literature were only reported as the mean and median or in the form of graphics and text. These results could not be included in the analysis. No explicit mention of optimal drug type and concentration for the two trunk plane blocks. Original data was requested via email, but the author did not respond. Further studies are needed to clarify more subtle differences in pain after getting the QLB and TAPB. Risk/harm: no risks or harm were found to these patients in the RCTs. Level of evidence: Level I, highest level of evidence because it includes more than 1 RCT.
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<p>Kumar GD, Gnanasekar N, Kurhekar P, et al. A comparative study of transversus abdominis plane block versus quadratus lumborum block for postoperative analgesia following lower abdominal surgeries: A prospective double-blinded study. Anesthesia, essays and researches. 2018;12(4): 919-923.</p>	<p>Prospective double-blinded study. This study compared the efficacy of TAP blocks versus QL blocks for providing postoperative analgesia for lower abdominal surgeries.</p>	<p>Seventy adult patients were randomly allocated into two groups. Group A received a TAP block with 20ml of 0.25% ropivacaine on each side (n=35), while group B got the QL block with 20ml of 0.25% ropivacaine on each side (n=35). The time of block, duration of surgery, numerical pain intensity scale (NPIS) score at the 1st, 2nd, 4th, 8th, 12th, 16th and 24th postoperative hours, along with the total analgesic drug requirements were compared between the two groups.</p>	<p>Independent variables = randomized, double-blinded study, standard TAPB 20ml of 0.25% ropivacaine on each side, standard QLb with 20ml of 0.25% ropivacaine on each side Dependent variables = time elapsed before requirement of first additional analgesic, dose of morphine required postoperatively, total morphine consumption, NPIS scores.</p>	<p>Data was analyzed with SPSS version 23 with independent t-test and Chi-square test as appropriate. P <0.05 was considered statistically significant.</p>	<p>The time for the first analgesic requirement was 243.00±/ 97.36min and 447.00 ±/62.52min and the total analgesic consumption (morphine in mg) was 6.65±/1.55 and 3.25±/0.78 in Group A and B. Both which were statistically significant (P<0.01). Statistically significant postoperative pain scores (NPIS scale 0-10) were found at rest, between the two groups, and up to 16 hours.</p>	<p>The QL block proves to be favored for the longer time period before the patient needs analgesics, as well as requiring less morphine and had lower reported NPIS score.</p>	<p>The QL block would be a better option for providing postoperative analgesia during abdominal surgeries, for increasing the duration before the 1st rescue analgesic, better pain score at rest, and less total opioid analgesic consumption. These factors contribute to faster postoperative recovery and earlier mobilization of the patient.</p>	<p>Strengths: consistent with literature and presents the highest level of evidence. Limitations: the study failed to identify limitations Risks/harms: no report of infection following the procedure, no other risks/harms were reported. Feasibility: TAPB and QLb are easily taught and reproducible. Level of evidence: Level I, highest level of evidence because it is an RCT.</p>
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Verma K, Malawat A, Jethava D, et al. Comparison of transversus abdominis plane block and quadratus lumborum block for post-caesarean section analgesia: A randomized clinical trial. Indian Journal of Anaesthesia. 2019;63(10): 820-826.	A randomized clinical trial. The study's goal was to compare the analgesic efficacy of QLB and TAPB after a c-section.	60 patients who were scheduled for elective c-section between December 2018 and January 2019 were randomized into either the TAPB group or the QLB group. Each group had 30 patients, received bilateral injections with 0.2% ropivacaine postoperatively. Study was conducted in the obstetrics and gynaecology operation theatre for 2 months. Each patient was ASA status I or II, normal singleton pregnancy with gestation of at least 37 weeks.	Independent variables = elective c-section, 37 weeks gestation, female, ASA I or II. Dependent variables = time for rescue analgesic requirement, total number of analgesic dose required over 72 hours, severity of post-operative pain assessment via visual analogue scale (VAS) score at rest and movement.	Statistical analysis was done with SPSS version 21. The chi-square test and students' t-test were utilized to compare data. Probability of less than 0.05 was considered to be significant. Randomization was used via a computer system to categorize each patient. Then each number was enclosed in an opaque envelope, the patient selected an envelope and gave it to the anesthesiologist, who compared the number to the computer-generated list and thereby assigned the patient to one of the two groups.	No statistical differences among either group were noted in operative time, right or left procedure and presence or absence of related viscera visibility (uterus, urinary bladder). Time for rescue analgesic requirement was significantly longer in the QLB group than the TAPB group. In the QLB group, only 13 patients needed a single dose of analgesic while 17 required none. In the TAPB group, 1 patient needed 6 doses of analgesic, 19 needed 7 doses, and 10 patients needed 8 doses.	In the QLB group the amount of analgesic needed over 72 hours was significantly less than the TAPB group. VAS was significantly lower in the QLB group than the TAPB group both at rest and with movement at all times postoperatively.	This study demonstrates that the QLB block produces long-lasting analgesia compared to the TAP block.	Strengths: consistent with literature and presents the highest level of evidence. Limitations: The study did not evaluate the potential effect of local anesthetic diffusing into the paravertebral space or the motor component of the QLB block. Risks/harm: no risks or harms were identified in this study. Feasibility: QLB block and TAP block are not technically difficult. They are easy to teach providers. Level of Evidence: Level I the highest level of evidence because this study is a RCT.
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<p>Wei D, Long X, Li M, et al.</p> <p>Quadratus lumborum block versus transversus abdominis plane block for postoperative pain management after laparoscopic colorectal surgery: A randomized controlled trial.</p> <p>Medicine.</p> <p>2019;98(52): 1-5.</p>	<p>A randomized controlled trial. This study compared the QLB method with TAPB for management in patients undergoing laparoscopic colorectal surgery.</p>	<p>74 patients that were scheduled for laparoscopic colorectal surgery were randomly assigned into two different groups. After the surgery, patients either received the TAPB or QLB. The blocks are bilateral, and each side got 20ml of 0.375% ropivacaine and all patients received sufentanil via a patient-controlled intravenous analgesia (PCIA). At 2,4,6,24, 48hrs postoperatively the patient's resting and moving numeric rating scale (NRS) were assessed.</p> <p>Attrition rate =6 patients withdrew before the completion of the study</p>	<p>Independent variables = randomized, double blinded study, same general anesthesia with IV propofol and sufentanil.</p> <p>Dependent variables = sufentanil consumption, numeric rating scale scores at rest, numeric rating scale scores with movement, and postoperative side effects.</p>	<p>Sample size calculation was performed via power analysis based on cumulative sufentanil consumption at 48hours post-surgery. Based on pilot study and assuming group means +/- standard deviation of 58.9 +/- 15.4mcg (QLB group) and 71.3+/-19.6mcg (TAPB group), 62 patients were required to achieve a power analysis of 80% and the alpha value of 0.05 to detect differences between the two groups. With 20% dropout rate assumed 74 patients were enrolled. Patients had to be ASA I or II and aged 18-70yr. Excel software was used to randomly assign patients into 2 groups.</p>	<p>QLB group used significantly less sufentanil at 24 and 48hours. No significant difference noted at 6hours postoperatively. No significant difference in NRS results between the 2 groups at rest or during movement, and the incidence of dizziness in the QLB group was lower than in the TAPB. Pruritus, nausea, and vomiting were not significantly different between the 2 groups.</p>	<p>First prospective, randomized, double-blind, controlled study comparing the QLB and TAPB for pain relief in patients undergoing laparoscopic colorectal surgery. QLB is an effective, reliable, and safe analgesic procedure with no adverse reactions. Significantly less sufentanil was consumed in the QLB group compared to the TAPB.</p>	<p>The QLB block is superior to the TAPB in postoperative pain management. QLB reduces sufentanil consumption compared to the TAPB.</p>	<p>Strengths: consistent with literature and presents the highest level of evidence.</p> <p>Limitations: use of multimodal analgesia via parecoxib may have masked some of the benefits of the QLB.</p> <p>Additional studies are needed to explore the mechanism of QLB as well as compare the QLB to the subcostal TAPB in upper abdominal surgeries.</p> <p>Risks/harm: no risks or harms were identified in this study.</p> <p>Feasibility: QL block and TAP block are not technically difficult. They are easy to teach providers.</p> <p>Level of Evidence: Level I the highest level of evidence because this study is a RCT.</p>
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Krohg A, Ullensvang K, Rosseland LA, et al. The analgesic effect of ultrasound-guided quadratus lumborum block after cesarean delivery: A randomized clinical trial. Anesthesia Analgesia. 2018;126(2): 559-565.	A randomized Clinical Trial. The goal of this study was to evaluate the efficacy of the QL block after c-section delivery.	Forty parturients who received a c-section received a bilateral ultrasound-guided QL block with either 2mg/ml ropivacaine or saline postoperatively.	Independent variables= QL block with ropivacaine, spinal anesthesia with bupivacaine and sufentanil and and postoperative pain management with paracetamol, ibuprofen, and ketorolac via patient controlled analgesic pump Dependent variables =ketorolac consumption during 24 hours postoperatively. Pain scores, nausea, fatigue, and total differences in time until patients were able to stand and walk 5min, and the interaction between the effective analgesic score and time.	Statistical analysis was performed using Statistical package for the social sciences version 22. Histograms, box plots, Q-Q plots, and the Kolmogorov-Smirnov test were used to assess whether the variables and the residuals were normally distributed.	QLB group had lower ketorolac consumption at 24 hrs (P=0.04; ratio of means =0.60; 95% CI, 0.37-0.97), and at 12 hours ketorolac consumption was lower (P<0.01; ratio of means =0.52; 95% CI, 0.35-0.79). No statistically significant differences at 36 hours (P=0.13; ratio of means = 0.71; 95% CI, 0.45-1.12) or at 48 hours (P=.20; ratio of means = 0.74; 95% CI, 0.47-1.18). Interactions between time and treatment showed statistically significant differences in pain intensity at rest (P<0.1) and when the patients were coughing (P<0.01).	61 patients were considered eligible, then 40 patients were randomly assigned. Patients receiving active QL block used less ketorolac at 24hours compare to the control group. Less ketorolac consumption was found at 12hours but no statistically significant differences noted at 36 or 48 hours. Fatigue and nausea levels were similar. The QL block group could stand 14.5 hours after the block and the control group stood 13.5 hours after.	Ropivacaine US-guided QL block reduced postoperative ketorolac consumption and pain after c-section. Further studies needed to determine ideal dose, volume, and injection site.	Strengths: consistent with literature and presents the highest level of evidence. Limitations: The study did not assess dermatome level, the optimal dose of local anesthetic is not known, a higher dose of ropivacaine may have improved and prolonged the analgesic effect. Patients with BMI >32 were excluded so we do not know efficacy of QL block in obese patients. Risks/harm: no risks or harms were identified in this study. Feasibility: QL block is easy to teach providers. Level of Evidence: Level I the highest level of evidence because this study is a RCT.
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<p>Blanco R, Ansari T, Girgis E. Quadratus lumborum block for postoperative pain after caesarean section: A randomised controlled trial. Eur J Anaesthesiol. 2015;32(11): 812-818.</p>	<p>A randomized control trial. The purpose of this randomized, controlled, double-blinded study was to evaluate the analgesic efficacy of QLB after c-section.</p>	<p>50 patients were selected for the study and randomly assigned into one of the two groups. Two patients delivered their babies before the planned c-section so only 23 patients ended up in the control group.</p>	<p>Independent variables = randomization, double-blinded, ASA I and II, singleton pregnancy, 37 weeks gestation Dependent variables = morphine demands, and doses delivered by a patient-controlled analgesia system at predetermined intervals (1,2,4,6,12,24, and 48h) after surgery. VAS for pain at rest and with movement, heart rate, blood pressure, pruritis, itching, nausea, vomiting and sedation.</p>	<p>Power analysis showed that 25 patients were needed in each group. Complete descriptive statistics were recorded for each variable including minimum, maximum, range, mean, standard deviation, 95% CI of the mean, median and interquartile range. Comparisons were performed using independent t tests or Mann-Whitney tests. Friedman test was used for repeated measures for nonnormally distributed variables. Box plots, whisker plots and error bar graphs were plotted. The X² test and Fisher exact test were used to evaluate the association between qualitative variables.</p>	<p>QLB group used less morphine at 6 and 12 hours (P<0.001), QLB group had significantly fewer morphine demands than the control group (P<0.001) at 6,12,24, and 48h after c-section.</p>	<p>48 patients were included because 2 delivered before the planned c-section. 25 were placed in the QLB group and 23 in control group. No deviations from protocol. Patients in QLB group used less morphine than the control group at 6 and 12 hours but not at 24 or 48 hours. VAS was less in QLB group than control in all times at rest except 24 hours and for all times with movement.</p>	<p>The QLB after c-section was effective and provided satisfactory analgesia in combination with a typical postoperative analgesic regimen. Proper implementation of the technique can significantly decrease opioid use after cesarean sections.</p>	<p>Strengths: consistent with literature and presents the highest level of evidence. Limitations: more investigation is needed for the local anesthetic dispersion through the paravertebral space. Postoperative dermatomal levels were not assessed. Patients may have been using morphine PCA to treat nonoperative pain. Risks/harm: no risks or harms were identified in this study. Feasibility: QL block is easy to teach providers. Level of Evidence: Level I the highest level of evidence because this study is a RCT.</p>
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Omür D, Oguzalp H, Kiraz HA, et al. The analgesic efficacy of transversus abdominis plane block on postoperative pain and morphine consumption in varicocelelectomy. Saudi medical journal. 2016;37(6): 648-655.	Prospective, double blind, randomized, placebo controlled clinical study. Each patient was evaluated for 24h after surgery using the VAS at rest and while coughing.	40 male patients who were scheduled for elective varicocele operations were randomized into the control or treatment group. The treatment group received a TAPB using 20ml 0.25% bupivacaine on the operation side whereas the control group received 20ml 0.9%NaCl. Ultimately only 34 patients were included in the analysis, 18 in the treatment group and 16 in the control group.	Independent variables = TAPB and placebo both 20ml, males scheduled for elective varicocele operations, randomized, double blinded Dependent variables =VAS pain scores when coughing and at rest, morphine consumption	Statistical analyses were conducted with the Statistical Package for the social sciences version 15.0 for Windows. Descriptive statistics included the mean \pm standard deviation for numerical data. Numbers and percentages were done for numerical data. Kolmogorov-Smirnov test examined normality in data. Mann Whitney test compared the averages of continuous measures such as age, weight, height, VAS, and morphine requirements. Wilcoxon signed rank test compared intragroup repeated measures. Chi-square test compared data that denoted frequency such as gender and ASA risk category. Statistical significance was $p < 0.05$.	No statistical differences were found in the clinical variables of the groups. VAS pain scores when coughing and at rest were $p < 0.05$ at all measured time points. Treatment group consumed less morphine than the control group at all measured time points except when admitted to PACU. Total morphine dose to the control group was 21.6 ± 12.4 mg and 7.7 ± 4.0 mg for the treatment group. For those who received unilateral repairs there was a statistically significant difference in morphine consumption between those who received TAPB and those who did not. For those who received bilateral repairs, no significant difference between the groups was noted at any time point. The control group needed significantly more diclofenac sodium ($p < 0.001$ at PACU and $p = 0.039$ at 15 th minute). No differences were noted in hemodynamics between the groups ($p < 0.05$). One patient in each group had nausea and received 10mg metoclopramide IV at the 15 th minute postop in PACU.	As part of a multimodal analgesic regime for Ivanišević varicocelelectomy operations, 20ml 0.25% bupivacaine administered by ultrasound TAPB provided effective analgesia in the postop period and reduces the need for opioid consumption compared to the control group. In the first 24hours postop, pain was significantly less at rest and with coughing. Additionally, the request for morphine was lower in the treatment group compared to the control group.	Multimodal analgesic using 20ml of 0.25% bupivacaine administered by ultrasound-guided TAPB can provide effective analgesia during the postoperative period and reduce opioid consumption. Ultrasound-guided TAPB may be safe and effective for postop pain control. More studies are needed to determine the most appropriate local anesthetic, concentration, volume, and timing for the TAPB.	Strengths: consistent with literature and presents the highest level of evidence. Limitations: TAPB was performed while the patient was under general anesthesia so a sensory blockade level could not be evaluated. Using a larger volume of local anesthetic may increase success rate but could also lead to increased paravertebral distribution. Risks/harm: no risks or harms were identified in this study. Feasibility: TAP block is easy to teach providers. Level of Evidence: Level I the highest level of evidence because this study is a RCT.
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Kupiec A, Zwierzchowski J, Kowal-Janicka J, et al. The analgesic efficiency of transversus abdominis plane (TAP) block after caesarean delivery. Ginekologia polska. 2018;89(8): 421-424.	A randomized control trial. This study aimed to evaluate the analgesic effects of the TAPB in patients undergoing caesarean section.	88 women undergoing elective caesarean section with spinal anesthesia were prospectively randomized into two groups. The first group received an ultrasound-guided TAPB was performed using 40ml of 0.25% bupivacaine. The second group did not receive a regional nerve block. Both groups received standard analgesia protocol with intravenous paracetamol given q6h and intravenous tramadol on demand given via PCA. Study was conducted in the Department and Clinic of Gynaecology, Obstetrics, and Neonatology of the Wrocław Medical.	Independent variables = TAPB, regional nerve block, women ASA I and II Dependent variables = pain intensity assessed via the VAS directly after the TAPB, 3, 6, and 12h postoperatively. Patient complaints and side-effects during postoperative period.	Results were pre-analyzed using Excel 2010 spreadsheet tools. Quantitative analyses utilized Statistical 10.0 PL software. P values less than 0.05 were considered statistically significant. The W-Shapiro-Wilk test indicated a non-normal distribution of the quantitative data. Non-parametric tests were used to further assess the data between the groups. The U-Mann-Whitney test, chi2 and Friedman test with a post-hoc (test Dunn) analysis were carried out.	100 patients were selected, 22 were excluded due to administrative reasons, 46 underwent TAPB, and 42 received IV analgesia. No statistically significant differences in height, weight, BMI, or amount of hyperbaric bupivacaine used for subarachnoid analgesia between the two groups. TAPB group were given less on-demand tramadol (p=0.005). They had lower VAS values at 3 (p=0.00014), 6 (p=0.0315) and 12 hours (p=0.006) postoperatively. No significant difference in arterial pressure and heart rate between the two groups (p>0.05). Three patients in the treatment group reported vomiting, nausea, and dizziness. In the control group two patients were nauseous and one was dizzy.	The TAPB provides analgesia to the cranial branches of the T10-11 nerve roots so it is a promising adjunctive analgesic therapy for postoperative c-section pain management. The addition of morphine to the subarachnoid labor analgesia results in a less marked TAPB effect and does not reduce pain or use of analgesic drugs. Patients did not receive any opioids into the subarachnoid space due to lack of postoperative monitoring capabilities.	Standard analgesic treatment is frequently inadequate following a c-section. The TAPB provides effective and safe postoperative analgesia, improving patient comfort, and reducing the doses of the administered analgesics.	Strengths: consistent with literature and presents the highest level of evidence. Limitations: The size of the study population and difficulties in carrying out the study protocol in certain patients. The authors plan to carry out further research in order to determine the best serum bupivacaine concentration following a TAPB. Risks/harm: no risks or harms were identified in this study. Feasibility: TAP block is easy to teach providers. It is a simple and safe analgesic technique. Level of Evidence: Level I the highest level of evidence because this study is a RCT.
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Appendix B: Broward IRB Approval



Institutional Review Board - Human Research Protections

Broward Health Medical Center
Broward Health Coral Springs
Broward Health Imperial Point
Broward Health North

Salah Foundation Children's Hospital
Broward Health Weston
Community Health Services
Broward Health Physician Group

DATE: 04/22/2021

TO: Katelyn Reckamp, BSN

FROM: Broward Health Institutional Review Board

RECORD NUMBER: 2021-052

STUDY TITLE: Implementation of the perioperative quadratus lumborum block to improve postoperative cesarean section pain: An evidence-based education module

RE: NOT HUMAN SUBJECT RESEARCH DETERMINATION

Dear Katelyn Reckamp, BSN:

This is to advise you that your project, "Implementation of the perioperative quadratus lumborum block to improve postoperative cesarean section pain: An evidence-based education module" was reviewed on behalf of the Broward Health Institutional Review Board and was declared "not research involving human subjects" based on the definitions provided in the U.S. Department of Health and Human Services Code of Federal Regulations found at 45 CFR 46.102.

Please note, this determination does not absolve the Principal Investigator from complying with other federal, state, or local laws or institutional policies and procedures that may be applicable in the conduct of this project. This determination applies to your project in the form and content as submitted to the IRB for review. Any variations or modifications to this project involving the participation of human subjects must be approved by the IRB prior to implementing such changes. Please maintain a copy of this determination for your records.

Thank you for submitting your project to the IRB for consideration.

The Broward Health Institutional Review Board – FWA00001248 operates in accordance with the Office of Human Research Protections and U.S. Food and Drug Administration (FDA) regulations. The Broward Health Institutional Review Board complies with the ICH guidelines on Good Clinical Practice (GCP) where they are compatible with the FDA and HHS regulations.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Broward Health IRB's records.


Appendix C: FIU IRB Approval



FLORIDA
INTERNATIONAL
UNIVERSITY

Office of Research Integrity
Research Compliance, MARC 414

MEMORANDUM

To: Dr. Yasmine Campbell
CC: Katelyn Reckamp, Valerie Diaz
From: Maria Melendez-Vargas, MIBA, IRB Coordinator 
Date: April 7, 2021
Protocol Title: "Implementation of the perioperative quadratus lumborum block to improve postoperative cesarean section pain: An evidence-based education module"

The Florida International University Office of Research Integrity has reviewed your research study for the use of human subjects and deemed it Exempt via the Exempt Review process.

IRB Protocol Exemption #: IRB-21-0133 **IRB Exemption Date:** 04/07/21
TOPAZ Reference #: 110181

As a requirement of IRB Exemption you are required to:

- 1) Submit an IRB Exempt Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved prior to implementation.
- 2) Promptly submit an IRB Exempt Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
- 3) Submit an IRB Exempt Project Completion Report Form when the study is finished or discontinued.

Special Conditions: N/A

For further information, you may visit the IRB website at <http://research.fiu.edu/irb>.

MMV/em

Appendix D: Anesco Letter of Support



March 1, 2021

Valerie J. Diaz, DNP, CRNA, APRN, CAPT, NC, USN
Assistant Professor
Department of Nurse Anesthetist Practice
Florida International University

Dr. Diaz,

Thank you for inviting Broward Health Medical Center to participate in the Doctor of Nursing Practice (DNP) project conducted by **Katelyn Reckamp** entitled *"Implementation of the perioperative quadratus lumborum block to improve postoperative cesarean section pain: An evidence-based education module"* in the Nicole Wertheim College of Nursing and Health Sciences, Department of Nurse Anesthetist Practice at Florida International University. I have granted the student permission to conduct the project using our providers.

Evidence-based practice's primary aim is to yield the best outcomes for patients by selecting interventions supported by the evidence. This proposed quality improvement project seeks to investigate and synthesize the latest evidence.

We understand that participation in the study is voluntary and carries no overt risk. All Anesthesiology providers are free to participate or withdraw from the study at any time. The educational intervention will be conveyed by a 15-minute virtual PowerPoint presentation, with a pretest and posttest questionnaire delivered by a URL link electronically via Qualtrics, an online survey product. Responses to pretest and posttest surveys are not linked to any participant. The collected information is reported as an aggregate, and there is no monetary compensation for participation. All collected material will be kept confidential, stored in a password encrypted digital cloud, and only be accessible to the investigators of this study: Katelyn Reckamp and Dr. Valerie Diaz.

Once the Institutional Review Board's approval is achieved, this scholarly project's execution will occur over two weeks. Katelyn Reckamp will behave professionally, follow standards of care, and not impede hospital performance. We support the participation of our Anesthesiology providers in this project and look forward to working with you.

March 1, 2021

Edward Punzalan, DNP, CRNA, APRN
Administrative Director of Nurse Anesthesia
Healthcare Performance Anesco
Broward Health

Date

Appendix E: Recruitment Letter



Nicole Wertheim College of Nursing and Health Sciences
Department of Nurse Anesthetist Practice

**Implementation of the perioperative quadratus lumborum block to improve postoperative cesarean
section pain: An evidence-based education module**

Dear Broward Health Anesco Anesthesia Provider:

My name is Katelyn Reckamp and I am a student from the Anesthesiology Nursing Program Department of Nurse Anesthetist Practice at Florida International University. I am writing to invite you to participate in my quality improvement project. The goal of this project is to improve health care provider knowledge on the uses of the quadratus lumborum block to help reduce postoperative pain and opioid consumption in parturients undergoing a cesarean section. You are eligible to take part in this project because you are a member of the Anesthesia Department for Anesco at Broward General.

If you decide to participate in this project, you will be asked to complete and sign a consent form for participation. Next, you will complete a pre-test questionnaire, which is expected to take approximately 5 minutes. You will then be asked to view an approximately 15 minute long educational presentation online. After watching the video, you will be asked to complete the post-test questionnaire, which is expected to take approximately 5 minutes. No compensation will be provided.

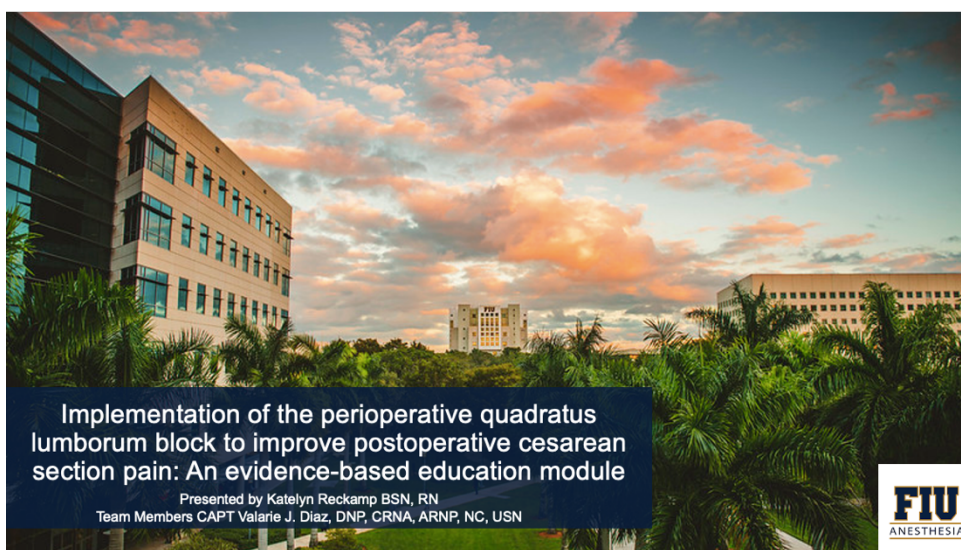
Remember, this is completely voluntary. You can choose to be in the study or not. If you'd like to participate or have any questions about the study, please email or contact me at kmoor075@fiu.edu or 916-806-1616

Thank you very much.

Sincerely,

Katelyn Reckamp, SRNA, BSN, CCRN

Appendix F: Education Module PowerPoint



Learning Goals

After this education you will be able to:

- Recognize the current pain issues and opioid consumption parturients face
- Understand how the TAP block and QL block can benefit patients and reduce opioid consumption
- Discuss why it is important to explore greater use of regional blocks to manage postoperative cesarean section pain

FIU

Background

FIU

Cesarean Sections¹

- 31.9% of deliveries
- Top 20 most painful surgeries

ACOG^{1,2}

- Neuraxial anesthesia provides most analgesia
- On average patients ask for an equivalent of 30mg of morphine

Opioid Crisis³

- Affects how much of a narcotic or if any narcotics are prescribed to manage postoperative pain
- In 2016, more people died from opioid overdoses than traffic accidents

Transversus Abdominis Plane (TAP) Block⁴

The TAP blockade is limited to somatic anesthesia and performed under ultrasound

The TAP block targets the fascial plane between the posterior rectus sheath and the transversus abdominis muscle

There are three common approaches the lateral, anterior, and posterior TAP block

The endpoint of injection being the spread of local anesthetic between the posterior rectus sheath and the anterior margin of the transversus abdominis muscle



FIGURE 7. Patient and transducer position for different TAP nerve block approaches: subcostal (A), lateral (B), anterior (C), and posterior (D).

FLORIDA INTERNATIONAL UNIVERSITY

Quadratus Lumborum (QL) Block⁴



FIGURE 8. Patient and transducer position for Transversus QL Block.

QL block uses a curved array transducer

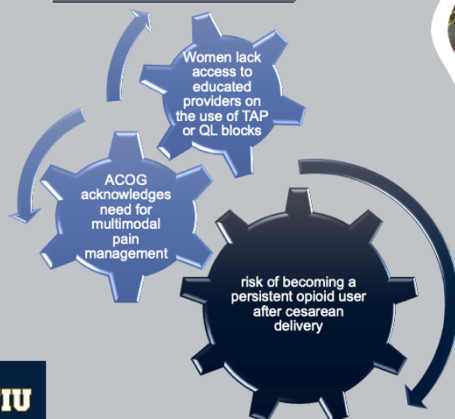
The "shamrock" sign is visualized as the transverse process of vertebra L4 as the stem and the erector spinae posteriorly, QL laterally, and psoas major anteriorly encompass the three leaves of the shamrock

The target for the QL block injection is the fascial plane between the psoas major muscles and the QL.

Ultimately, this block aims to accomplish a segmental somatic and visceral analgesia from T4 to L1

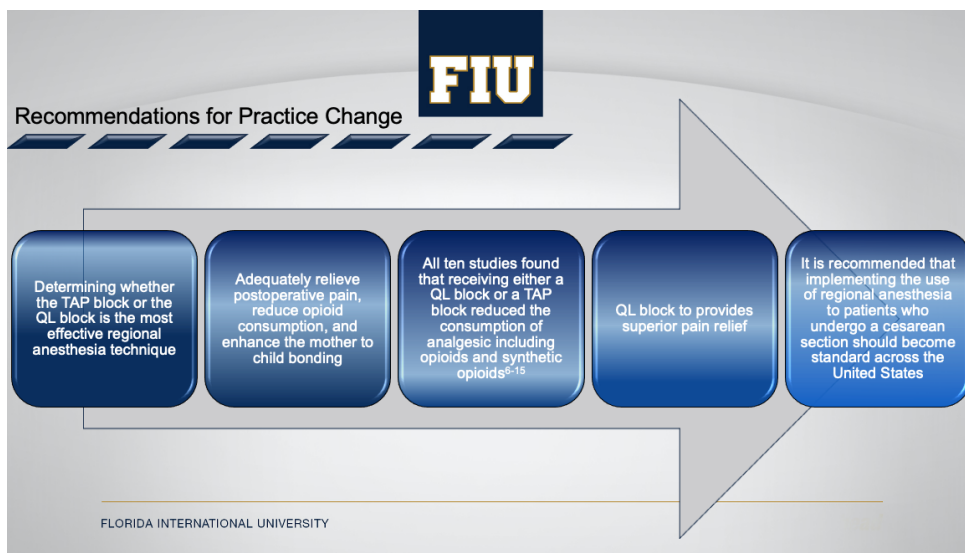
FIU

Consequences of the Problem^{2,5}



FIU





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Appendix G: Pre-Test and Post-Test Questionnaire

PERSONAL INFORMATION

1. **Gender:** Male Female Other _____
2. **Age:** _____
3. **Ethnicity:**
 Hispanic Caucasian African American Asian
 Other _____
4. **Level of Education:** Associates Bachelors Masters
 Other _____
5. How many years have you been an anesthesia provider?
 Over 10 5-10 years 2-5 years 1-2 years

QUESTIONNAIRE:

1. Out of 179 surgical procedures, a cesarean section is considered to be:
 - a. In the top 5 most painful surgical procedures
 - b. In the top 20 most painful surgical procedures
 - c. In the top 40 most painful surgical procedures
 - d. In the top 50 most painful surgical procedures
2. The most common method of pain management for cesarean section is:
 - a. Analgesics: non-opioids
 - b. Analgesics: opioids
 - c. PCA pump
 - d. Regional Anesthesia block

3. The American College of Obstetricians and Gynecologists (ACOG) states that _____ provides the most analgesia?
- a. Analgesics: non-opioids
 - b. Analgesics: opioids
 - c. PCA pump
 - d. Regional Anesthesia block
4. On average patients who were provided intravenous pain medication asked for an equivalent of how much morphine in the first 24 hours after surgery?
- a. 10mg
 - b. 20mg
 - c. 30mg
 - d. 40mg
5. The goal of the Quadratus Lumborum block is to:
- a. Create a segmental somatic and visceral analgesia from T4 to L1
 - b. Create a segmental somatic and visceral analgesia from T6 to L1
 - c. Create a segmental somatic and visceral analgesia from T8 to L2
 - d. Create a segmental somatic and visceral analgesia from T10 to L4

6. One contributing factor to cesarean section patients' commonly undertreated pain is:
 - a. Providers' lack of knowledge about how best to treat this type of pain
 - b. Providers underestimating the pain associated with this type of surgical procedure
 - c. The ongoing opioid crisis in the United States
 - d. A debate about the best approach to pain management

7. The transversus abdominis plane block compared to the quadratus lumborum block
 - a. Is superior in providing analgesia
 - b. Provides a longer and wider sensory blockade
 - c. Is performed with a curved array transducer
 - d. Provides somatic anesthesia of the abdominal wall and is dependent on the interfascial spread

8. The target for the quadratus lumborum block injection site is:
 - a. Between the posterior rectus sheath and anterior margin of the transversus abdominis muscle
 - b. Fascial plane between the psoas major muscles and the quadratus lumborum muscle
 - c. Between the erector spinae muscle and the quadratus lumborum muscle
 - d. Between the transversus abdominis muscle and quadratus lumborum muscle

9. How likely are you to use alternative methods to reduce postoperative pain in women undergoing cesarean section
 - a. Most likely
 - b. Somewhat likely
 - c. Somewhat unlikely
 - d. Most unlikely

10. How likely are you to recommend the use of the QL block

- a. Most likely
- b. Somewhat likely
- c. Somewhat unlikely
- d. Most unlikely

Appendix H: Paired T-test

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PostScore	5.50	6	1.871	.764
	PreScore	2.83	6	.753	.307

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PostScore & PreScore	6	.497	.316

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	PostScore - PreScore	2.667	1.633	.667	.953	4.380	4.000	5	.010

Appendix I: Citi Training Certificate Supervisor

		Completion Date 08-Feb-2020 Expiration Date 07-Feb-2023 Record ID 35312850
This is to certify that:		
Valerie Diaz		
Has completed the following CITI Program course:		
Basic/Refresher Course - Human Subjects Research (Curriculum Group) Biomedical Human Research Course (Course Learner Group) 1 - Basic Course (Stage)		
Under requirements set by:		
Florida International University		
		
Verify at www.citiprogram.org/verify/?w4e8a4763-3494-44c6-9857-91f65cf90d0b-35312850		

Appendix J: Citi Training Certificate Investigator

		Completion Date 09-Oct-2020 Expiration Date 09-Oct-2023 Record ID 38636533
This is to certify that:		
Katelyn Reckamp		
Has completed the following CITI Program course:		
Basic/Refresher Course - Human Subjects Research	(Curriculum Group)	<div>Not valid for renewal of certification through CME. Do not use for TransCelerate mutual recognition (see Completion Report).</div>
Biomedical Human Research Course	(Course Learner Group)	
1 - Basic Course	(Stage)	
Under requirements set by:		
Florida International University		
		 Collaborative Institutional Training Initiative
Verify at www.citiprogram.org/verify/?w9ccb6e4f-3b5f-45ec-bc75-39a9d78dcd05-38636533		

Appendix K: Educational Module Consent Form



CONSENT TO PARTICIPATE IN A QUALITY IMPROVEMENT PROJECT **Implementation of the perioperative quadratus lumborum block to improve postoperative cesarean section pain: An evidence-based education module**

PURPOSE OF THE PROJECT

You are being asked to be in a quality improvement project. The goal of this project is to educate anesthesia providers' about the benefits of using a quadratus lumborum block to reduce pain and opioid consumption postoperatively in women undergoing cesarean section.

DURATION OF THE PROJECT

Your participation will require about 20 minutes of your time.

PROCEDURES

If you agree to be in the project, we will ask you to do the following things:

RISKS AND/OR DISCOMFORTS

There are no foreseeable risks with you for participating in this project.

BENEFITS

The following benefits may be associated with your participation in this project: An increase in cholesterol management knowledge, which will help you to better assess medication adherence and guidelines implementations to reduce the risk of cardiovascular events. The overall objective of the program is to increase the quality of healthcare delivery, improving the health indicator of our patients, and increase patient engagement.

ALTERNATIVES

There are no known alternatives available to you other than not taking part in this project. However, if you like to receive the educational material given to the participants in this project, it will be provided to you at no cost.

CONFIDENTIALITY

The records of this project will be kept private and will be protected to the fullest extent provided by law. If, in any sort of report, we might publish, we will not include any information that will make it possible to identify you as a participant. Records will be stored securely, and only the project team will have access to the records.

COMPENSATION & COSTS

There is no cost or payment to you for receiving the health education and/or participating in this project.

RIGHT TO DECLINE OR WITHDRAW

Your participation in this project is voluntary. You are free to participate in the project or withdraw your consent at any time during the project. Your withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove you without your consent at such time that they feel it is in the best interest.

RESEARCHER CONTACT INFORMATION

If you have any questions about the purpose, procedures, or any other issues relating to this research project, you may contact Katelyn Reckamp at 916-806-1616, kmoor075@fiu.edu or Dr. Valerie Diaz at 305-348-9027, vdiaz@fiu.edu

IRB CONTACT INFORMATION

If you would like to talk with someone about your rights of being a subject in this project or about ethical issues with this project, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu

PARTICIPANT AGREEMENT

I consent by participating in the survey. I have read the information in this consent form and agree to participate in this project.

Appendix L: PRISMA Flow Diagram

Figure 1. PRISMA Flow Diagram

