

Preoperative and Intraoperative Opioid-Sparing Analgesic Techniques to Reduce Postoperative  
Opioid Consumption in Patients Undergoing Open, Non-Emergent Abdominal Surgeries: An  
Educational Module

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## ABSTRACT

**Background:** Opioids have long been considered the “gold standard” of pain management; however, the significant side effects associated with opioid use make opioid-sparing analgesic methods appealing for various reasons. Reducing postoperative opioid consumption without compromising pain management is an area requiring further exploration.

**Objective:** This study seeks to assess healthcare providers’ knowledge and confidence regarding the use of various preoperative and perioperative interventions aimed at reducing postoperative opioid consumption following non-emergent open abdominal surgeries. Based on the systematic review performed, Certified Registered Nurse Anesthetists were presented with a pre-assessment test, an educational video presentation, and a post-assessment test.

**Data Sources:** Investigator used Pubmed, CINAHL, and EMBASE databases to answer the PICO (i.e., population, intervention, comparison, outcome) question: *In patients undergoing open, nonemergent abdominal surgeries, does the use of multimodal, opioid-sparing pain management techniques during the preoperative and perioperative period reduce postoperative opioid consumption versus non-multimodal pain management?* This question became the basis for the educational module by the same name. Pre-assessment and post-assessment testing were used to measure the effects of the intervention. Statistical analysis was applied to assess the effectiveness of the educational intervention.

**Study Selection:** Nine articles were included in the systematic review and the findings were incorporated into the educational presentation. All found that their respective non-opioid interventions reduced postoperative opioid consumption to some degree. A majority reported secondary outcomes of reduced opioid-related side effects such as nausea and vomiting, decreased time to first meal, first ambulation, and foley removal, and increased patient satisfaction.

**Results:** There were nine participants in the study and survey. The pre- and post-test gauged participants’ knowledge and confidence in non-opioid analgesic methods and implementing them in practice. The average number of correct answers in the pre-test was 4.22, compared to 7.44 in the post-test. Confidence for preoperative and intra-operative interventions improved from 44.44% and 33.33% to 88.89% and 100%, respectively. With education, participants were more likely to advocate for opioid-sparing analgesic interventions to improve postoperative outcomes for patients undergoing non-emergent abdominal surgery. All participants selected more correct answers in the post-test than pre-test.

**Conclusions:** The evidence shows that several non-opioid analgesic interventions can reduce postoperative opioid consumption. The implementation of an educational module based on these findings led to a significant increase in providers’ knowledge and confidence of opioid-sparing analgesic methods in patients undergoing non-emergent open abdominal surgery and the benefits associated with non-opioid interventions.

**Keywords:** abdominal, abdomen, surgery, surgical, opioid-sparing, opioid, enhanced recovery after surgery, protocol, ERAS

## INTRODUCTION

### Problem Identification and Background

One of the most commonly cited fears of patients scheduled for surgery is the fear of postoperative pain.<sup>1</sup> A study on causes of preoperative anxiety before elective surgery found that 78% of participants were concerned about postoperative pain.<sup>2</sup> Responsibilities of a Certified Registered Nurse Anesthetist (CRNA) include implementing acute and chronic pain management modalities throughout the perioperative period.<sup>3</sup> In order to effectively utilize the various analgesic medications available and reduce postoperative pain, the CRNA must have an in-depth understanding of pharmacology, pain pathways, and medication side effects.

Opioids have long been considered the “gold standard” of pain management primarily due to their mechanism of action on presynaptic opioid receptors located throughout the body.<sup>4</sup> Despite their proven efficacy in pain management, the side effects of opioids are significant and include bradycardia, hypothermia, urinary retention, constipation, physical dependence, and respiratory depression.<sup>4</sup> Furthermore, an emerging number of studies show a unique phenomenon of opioid-induced hyperalgesia that may lead to increased morbidity, mortality, length of hospitalization, and chronic pain development.<sup>5</sup>

Over recent decades, the rising risk of opioid abuse, dependence, addiction, and overdose deaths has become increasingly substantial.<sup>6</sup> Beginning in the 1990s, misinformation regarding the addictive properties of opioids was spread by pharmaceutical companies, leading to increased opioid prescriptions by healthcare providers.<sup>7</sup> As diversion and misuse of opioid pain medication escalated, the rates of opioid overdose climbed as well. In 2017, the U.S. Government declared the opioid epidemic a public health emergency, and as a result, opioid prescription and dependence gained heightened attention in the healthcare field.<sup>8</sup>

The incidence of opioid abuse postoperatively varies based on several non-modifiable factors, including age, genetics, medical history, and surgical procedure.<sup>7</sup> Simply undergoing surgery is a risk factor for persistent and chronic opioid use postoperatively.<sup>9</sup> However, an

evidence-based, multimodal pain management approach is not only modifiable, but also within the CRNA's scope of practice to implement in appropriate patient populations. A balanced anesthetic plan is associated with improved patient outcomes, shorter inpatient stays, and reduced rate of complications.<sup>5</sup>

Beyond the side effects and risks associated with prolonged postoperative opioid use, one must also consider the complications associated with inadequate pain control. Ineffectively controlled postoperative pain is related to increased morbidity, decreased functional capabilities, prolonged recuperation time, extended periods of narcotic use, and higher medical services costs.<sup>10</sup> Therefore, aiming to reduce opioid consumption postoperatively requires a solution more comprehensive than simply withholding opioids from surgical patients. A multimodal, opioid-sparing pain management regimen must balance the risks of opioid overuse with the risks of inadequate pain management to reduce the negative impacts of each and provide patients with desirable outcomes.

### **Problem Significance**

A multimodal pain management regimen aims to limit opioid use and the associated side effects, including dependence and addiction, without compromising pain management quality. Studies have shown that over 50 million Americans undergo inpatient surgery each year, and over 80% of surgical patients receive opioids after low-risk surgery.<sup>9</sup> In 2012, six of the fifteen most frequently performed operating room procedures were abdominal surgeries, ranging from colorectal resection to hysterectomy.<sup>11</sup> Considering these statistics, the impact of implementing a multimodal opioid-sparing regimen in patients undergoing abdominal surgeries would be significant in the ongoing battle of reducing opioid prescription in the healthcare field.

### **Consequences of the Problem**

The costly economic impact of opioid-related adverse effects stems from increased length of hospital stay, morbidity, and health care expenses associated with complications.<sup>10</sup> Delayed

recovery time and functional impairment are additional consequences experienced by patients with inadequately controlled postoperative pain. Follow-up management for surgical patients with poorly controlled postoperative pain was estimated to be US\$1,869±\$4,553 per visit.<sup>10</sup> Treatment of chronic pain that evolves from acute pain is estimated to cost up to \$1 million per patient.<sup>10</sup> Studies suggest that multimodal perioperative care pathways can significantly reduce postoperative hospital stay and, in turn, decrease hospital costs.<sup>5</sup>

### **Objectives of the Systematic Review and Proposed Solution**

Considering the known adverse effects of opioids, the national movement to reduce opioid prescription and misuse, the frequency of abdominal surgeries, and the proven importance of adequate postoperative pain management, a notable practice question comes to mind: In patients undergoing open, nonemergent abdominal surgeries (P), does the use of multimodal, opioid-sparing pain management techniques (I) during the preoperative and perioperative period (C) reduce postoperative opioid consumption versus non-multimodal pain management (O)? Opioid-sparing, enhanced recovery after surgery (ERAS) protocols are shown to improve surgical outcomes; however, widespread implementation has been slow, and practice recommendations specific to abdominal surgeries are lacking.<sup>12</sup> Reducing postoperative opioid requirements while adequately managing surgical pain will likely decrease hospital length of stay and healthcare costs, improve patient outcomes, reduce negative opioid side effects, and improve patient outcomes.<sup>5,10</sup> Through an extensive review of existing research, an evidence-based educational module was created.

The proposed study aims to assess provider knowledge and confidence regarding the use of non-opioid interventions in the preoperative and intraoperative period that can reduce postoperative opioid use in patients undergoing open, non-emergent abdominal surgeries. Through preoperative and intraoperative interventions, as well as regional anesthetic techniques, opioid use can be significantly reduced. By educating providers on various multimodal analgesic

methods specific to non-emergent abdominal surgeries, the investigator intends to enhance provider comfort level in recommending and utilizing these interventions in the healthcare setting with the goal of improving patient outcomes and reducing opioid use in this surgical population.

## **METHODOLOGY OF LITERATURE REVIEW**

### **Information Sources and Search Strategy**

A literature search of online databases was conducted utilizing PubMed electronic database, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and Excerpta Medica Database (EMBASE). Search terminology included the following: *abdominal OR abdomen, surgery OR surgical, opioid-sparing OR opioid, enhanced recovery after surgery OR protocol OR ERAS*. The Pubmed, CINAHL, and EMBASE databases produced 207, 304, and 172 results, respectively. After removing duplicates, 228 articles were left for appraisal. The literature search was current as of November 2020.

### **Study Selection and Screening Method**

A total of 683 articles resulted from the three databases on initial search. Of these, 455 duplicates were removed, and 228 articles remained for appraisal. Titles and abstracts of the remaining articles were assessed with the following question in mind: In patients undergoing nonemergent, open abdominal surgeries, does use of multimodal, opioid-sparing pain management techniques during the preoperative and perioperative period reduce postoperative opioid consumption versus non-multimodal pain management? Inclusion criteria included full-text articles, English language articles, randomized controlled trials (RCT), quasi-experimental studies, and published within the last five years. The patient population was limited to adults and excluded pediatric patients. Further exclusion criteria included any emergent surgical procedures, publication before 2015, surveys, case studies, and non-English articles. Anatomical surgical exclusions included foregut surgeries, cesarean sections, and cardiac procedures.

Twenty-one full-text articles were then assessed for eligibility. Twelve articles were excluded for various reasons, including only postoperative interventions, no benefit or correlation

between the intervention and opioid consumption, and intrathecal opioid administration as the only independent variable. Four found no benefit or correlation between the researched intervention and opioid consumption. Four of the articles listed intrathecal opioid administration as the only independent variable and were therefore excluded. One article proved noninferiority; while the outcome was not worse, it does not show that the intervention was beneficial. A manual assessment of the search result's reference list was conducted, and no additional RCTs met the criteria for this systematic review. Ultimately, nine articles were included in a full literature review. Appendix A illustrates the literature search and methodology used in the form of a PRISMA flow diagram.

**Table 1.** Inclusion and Exclusion Criteria

<b>Inclusion</b>	<b>Exclusion</b>
Population: <ul style="list-style-type: none"> <li>• Adults (age 18+)</li> </ul> Type of procedure: <ul style="list-style-type: none"> <li>• Abdominal surgeries</li> <li>• Open incision</li> </ul> Intervention: <ul style="list-style-type: none"> <li>• Opioid-sparing protocol or non-opioid analgesic method aimed at reducing postoperative opioid consumption</li> </ul> Primary outcomes: <ul style="list-style-type: none"> <li>• Decreased opioid consumption</li> <li>• Reduction in patient-reported pain</li> </ul> Type of study: <ul style="list-style-type: none"> <li>• English language</li> <li>• RCTs</li> <li>• Quasi-experimental studies</li> <li>• Meta-analysis</li> <li>• Publication date 2015-Present</li> </ul>	Population: <ul style="list-style-type: none"> <li>• Obstetric</li> <li>• Children (&lt;18 years old)</li> </ul> Type of procedure: <ul style="list-style-type: none"> <li>• Emergent</li> <li>• Cesarean section</li> <li>• Cardiac surgery</li> </ul> Intervention: <ul style="list-style-type: none"> <li>• Intrathecal opioid administration as only independent variable</li> </ul> Outcomes: <ul style="list-style-type: none"> <li>• Noninferiority</li> <li>• No correlation between intervention and postoperative opioid use</li> </ul> Type of study: <ul style="list-style-type: none"> <li>• Non-English</li> <li>• Publication date pre-2015</li> <li>• Systematic reviews</li> <li>• Surveys</li> <li>• Questionnaire</li> <li>• Dissertations/theses</li> </ul>

### **Collection, Analysis, and Data Items**

The selected studies were evaluated in a systematic method. Information obtained included (1) study design and setting, (2) sample size and characteristics, (3) independent and

dependent variables, (4) measurement, (5) data analysis, (6) findings, (7) strengths and limitations, and (8) study conclusion. This information can be found in Appendix B: Matrix Table.

The level of evidence rating based on the John Hopkins Research Evidence Appraisal Tool can also be found in the evaluation table. This tool is used to rank the strength and quality of research studies, with level I being the highest strength of evidence and V being the poorest quality.<sup>13</sup> Level I includes experimental studies, RCTs, and systematic reviews of RCTs.<sup>13</sup> Level II consists of quasi-experimental studies, systematic reviews of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only.<sup>13</sup> Examples of level III studies are non-experimental studies and systematic reviews of a combination of RCTs, quasi-experimental and non-experimental studies, or non-experimental studies only. Within levels I-III of evidence, the quality is graded with the letters A through C. Grade A is high quality while C is considered low quality or containing significant flaws. Conclusions cannot be drawn from grade C quality research. Level IV evidence includes opinions of respected authorities or expert committees, and level V evidence is based on experiential and non-research evidence; neither is considered high-level evidence.<sup>1</sup>

## **RESULTS OF LITERATURE REVIEW**

### **Study Characteristics**

Combined, the selected RCTs, quasi-experimental study, and meta-analysis had a total of 2,498 patients undergoing abdominal surgery who received either the placebo or a non-opioid intervention. All studies were published between 2015 and 2019 and were printed in English. The pediatric population was not included in any of the studies. While the type of abdominal surgery varied, the open abdominal approach was the only method examined in every article but one; the interventional RCT by Bojhaxi included both open and laparoscopic total pancreatectomies in its surgical population.<sup>20</sup>

**Patient demographics.** All patients in the studies were scheduled to undergo an elective abdominal procedure. All patients were at least 18 years of age. Five of the nine articles appraised excluded patients classified as an ASA IV. Of the four studies that did not exclude patients based on ASA classification, only 19 total patients were identified as ASA IV. ASA classification was not discussed in the meta-analysis. Four of the studies excluded participants based on weight or body mass index (BMI). Pregnancy was an exclusion criterion in all studies, and sample sizes ranged from 48 to 1207 participants.

**Hospital demographics.** The hospitals included in the studies appraised are located around the world. Guo et al. conducted their study at First Affiliated Hospital, School of Medicine at Zhejiang University in China.<sup>14</sup> Sarin et al. performed their study at a tertiary care teaching hospital site of UCSF- Mount Zion Hospital.<sup>15</sup> Neither Kaur et al. nor Wang et al. specified where their respective studies were conducted.<sup>16,17</sup> Purdy et al. performed their trial at Kuopio University Hospital in Finland.<sup>18</sup> Mohamed et al. conducted their study at the South Egypt Cancer Institute.<sup>19</sup> Bojhaxi performed his RCT at the Mayo Clinic in Florida, U.S.A.<sup>20</sup> Meyer et al. conducted their 2018 study at MD Anderson.<sup>21</sup> Jarahzadeh et al. performed their double-blind RCT at Shahid Sadoughi Hospital in Yazd, Iran.<sup>22</sup>

**Methodology.** The personnel conducting the interventions varied. Registered nurses, anesthesiologists, nurse anesthetists, and pharmacists were all mentioned, while others did not specify who was administering the intervention. It is important to recognize that the focus of this literature review spans the perioperative period; therefore, preoperative staff, operating personnel, anesthesia providers, and postoperative staff are all included depending on the stage of the intervention and focus of the study.

Two studies examined the effects of implementing an ERAS protocol in which intra-operative and postoperative opioid-sparing multimodal analgesia was one aspect.<sup>15, 21</sup> Those studies examining intraoperative interventions standardized the general anesthetic technique of patients in both the control and test groups.<sup>14, 16, 18-20, 22</sup> The meta-analysis included high-to-

moderate quality RCTs and minimized the selective risk of bias; however, different doses and time intervals of preoperative pregabalin administration varied.<sup>17</sup>

Collection of data varied among the nine studies regarding the specific dependent variables (several pain scales were utilized and recording times of opioid administration varied), but the similarities were significant enough to allow appraisal and comparison. Guo, Sarin, Purdy, Bojhaxi, and Meyer all utilized a numeric rating scale for pain, ranging from 1-10.<sup>14,15,18,20,21</sup> Kaur, Wang, Mohamed, and Jarahzadeh assessed patient pain level using a visual analog scale.<sup>16,17,19,22</sup>

All nine articles assessed opioid consumption postoperatively. Guo assessed cumulative narcotic use from five min postoperative to 48 hours.<sup>14</sup> Sarin et al. assessed median opioid consumption intraoperatively, as well as postoperative day 0 through 2.<sup>15</sup> Kaur et al. assessed total morphine usage within 24 hours.<sup>16</sup> Wang et al. reported total morphine consumption up to 48 hours following abdominal hysterectomy.<sup>17</sup> Purdy et al. looked at numerical values of opioid consumption.<sup>18</sup> Mohamed et al. assessed morphine consumption as well as the time to first request for analgesia.<sup>19</sup> Bojhaxi assessed total opioid consumption.<sup>20</sup> Meyer et al. assessed median intraoperative and postoperative opioid dosages.<sup>21</sup> Jarahzadeh et al. assessed mean narcotic consumption.<sup>22</sup> Though the exact methodology of assessing opioid consumption varied, the results wholly reflected a decrease in opioid usage versus placebo groups.

### **Definitions and Findings of Outcomes**

This systematic review aims to evaluate the effect of multimodal opioid-sparing interventions in various preoperative stages on postoperative opioid consumption. Patient-reported pain levels were a common outcome assessed in conjunction with narcotic usage. Secondary outcomes included a reduction in nausea and vomiting, decreased time to first meal, first ambulation, and foley removal, and increased patient satisfaction. Table 2 summarizes the data collected and each study's outcomes. Table 2 also displays the strengths and weaknesses of

each study, as well as the level of evidence. Small sample size was a recurrent weakness in the articles appraised.

**Table 2.** Studies Included in the Appraisal

<b>Author (Year) &amp; Level of Evidence</b>	<b>Study, Participants, &amp; Interventions</b>	<b>Findings in Intervention Group(s)</b>
Guo et al. (2018) Level I Grade B	70 ASA I-III patients, 18-65 years old, undergoing scheduled open liver resection bilateral ultrasound-guided OSTAP blocks with either 0.375% ropivacaine (group T) or 0.9% isotonic saline (group C)	NRS score rest: Reduced postoperative pain scores in Group T NRS score cough: lower in group T than in group C at all time points except 5 min after extubation Intraoperative sufentanil: significantly less in group T than in group C Cumulative sufentanil (5 min-24 hour postop): lower in group T than Group C Cumulative fentanyl use at 48 hours: no significant difference
Sarin et al. (2015) Level II Grade B	279 patients undergoing abdominal colorectal surgery in the ERAS program compared to 245 patients undergoing surgery prior to ERAS implementation	Median opioid consumption intraoperative: reduced opioid consumption in ERAS group ( $p < 0.001$ ) Median opioid consumption POD 0-2: reduced in ERAS group ( $p < 0.001$ ) Self-reported pain scores: reduced in ERAS group POD 0 and 1.
Kaur et al. (2015) Level I Grade B	80 patients undergoing open cholecystectomy. ASA I-II Age 21-50 Low dose ketamine infusion (group K) versus saline (group C)	Total morphine used within 24 hours was lower in the group with ketamine vs. control Reduced postoperative pain scores
Wang et al. (2017) Level I Grade B	1207 patients Age 18+ Preoperative pregabalin for managing pain after hysterectomy versus placebo	Reduced VAS at 2, 4, and 24 hours with rest and mobilization. Total morphine consumption reduced. Reduced nausea and vomiting. No difference in sedation; increased occurrence of dizziness.
Purdy et al. (2018) Level I Grade B	57 patients undergoing midline laparotomy Age 18-80 BMI 18-35 Independent variables: single-dose rectus sheath block (RSB), repeated dose RSB, continuous infusion RSB, or control group	First 12 hours post-op : oxycodone consumption was less in the infusion and repeated-doses groups than in the single-dose and control groups ( $P=.07$ ) Numerical values of oxycodone consumption at 48 hours post-op less

		in the repeated-doses group, but median was similar. Repeated-doses group performed better at the first 4h after surgery when coughing than the control group Repeated-doses group performed better at rest than other 3 groups at 12 and at 24 hr.
Mohamed et al. (2018) Level I Grade B	90 patients undergoing total abdominal hysterectomy with low midline vertical incision ASA I-II Age 18-80 Weight 50-85 kg Local wound infiltration with ketamine and bupivacaine (group K), dexmedetomidine and bupivacaine (group D), or control (bupivacaine only) after skin closure and before extubation	PCA morphine consumption: less in group K and group D than group C Time to first request analgesia: prolonged in group K and group D Mean VAS-R score: reduced in group K compared to group C in first 24 hours; reduced in group D compared to group C in first 8 hours
Bojhaxi (2019) Level I Grade B	48 patients undergoing elective open or laparoscopic total pancreatectomies ASA I-III Age 18-80 BMI <40 Intervention: lidocaine infusion from induction through time that patient meets discharge criteria from recovery, placebo	Pain in postoperative period was less in the group receiving lidocaine infusion (P= 0.1459) Total opioid consumption in mg was less in the group receiving lidocaine infusion (P = 0.2050)
Meyer et al. (2018) Level II Grade B	533 patients in cohort, 74 patients in historical control Age 18-85 Undergoing open abdominal surgery for gynecologic indications Comparing those receiving ERAS protocol versus those undergoing surgery before its implementation	No difference in pain scores reported, however, intraoperative and postoperative opioid use was lower in ERAS group. Median intraoperative opioid dose was reduced 39% in ERAS group Postoperative opioid dose was reduced 83%, 80%, 71%, and 50% on POD 0, 1, 2, and 3, respectively
Jarazadeh et al. (2016) Level I Grade B	60 patients in Age 35-65 Undergoing abdominal hysterectomy ASA I-II intravenous magnesium sulfate infusion versus placebo	Mean pain scores at all time points were lower in study group than placebo group. Means of narcotic consumption were higher in placebo for all measured time points

**Attenuation of opioid consumption.** All nine articles appraised found that the studied intervention reduced postoperative opioid consumption to some degree. The 2017 meta-analysis by Wang et al. found that preoperative pregabalin had opioid-sparing effects versus the placebo group; morphine consumption was measured at 2, 4, 24, and 48 hours after hysterectomy.<sup>17</sup> Both the 2015 RCT conducted by Sarin et al. and the 2018 RCT performed by Meyer et al. examined the effect of multifaceted ERAS protocols on opioid consumption.<sup>15,21</sup> Meyer et al. ERAS group had a 72% reduction in median opioid consumption when compared to those before implementation of the ERAS protocol.<sup>21</sup> Furthermore, 16% of patients on the ERAS protocol were opioid-free from the first postoperative day to the third postoperative day, versus no patients in the pre-ERAS comparison group.<sup>21</sup> Median opioid consumption in the study by Sarin et al. decreased in the ERAS group compared to the pre-ERAS group both intraoperatively and postoperatively.<sup>15</sup>

Amongst the articles examining an intraoperative intervention, a reduction in postoperative opioid consumption was also seen. Two articles examined regional techniques: rectus sheath block analgesia (RSB) and subcostal transversus abdominis plane block.<sup>14,18</sup> Purdy et al. conducted a RCT in which patients either received single dose, repeated dose, or continuous infusion RSB analgesia. Repeated doses of levobupivacaine showed opioid-sparing efficacy.<sup>18</sup> Guo et al. found that intraoperative sufentanil use as well as cumulative sufentanil use at five minutes post-extubation and 2, 4, 12, and 24 hours after operation in those who received bilateral ultrasound-guided OSTAP blocks were all less than the control group.<sup>14</sup> The 2018 RCT performed by Mohamed et al. examined local wound infiltration with ketamine and dexmedetomidine.<sup>19</sup> Both interventions significantly reduced PCA morphine consumption, prolonged time to first rescue analgesia, and fewer total rescue analgesia doses compared to the control group.<sup>19</sup>

Bojhaxi found that intravenous lidocaine infusion reduced mean opioid consumption at 4 hours and 24 hours postoperative.<sup>20</sup> The 2015 RCT by Kaur et al. reported that intraoperative

ketamine infusion reduced cumulative morphine consumption over 24 hours.<sup>16</sup> Jarahzadeh et al. found the mean value of narcotic consumption at each time point (1, 2, 6, and 12 hours after surgery) to be higher in the placebo group versus those who received intravenous magnesium sulfate.

**Attenuation of reported pain score.** Each of the nine articles found that the respective intervention reduced patient-reported pain levels. The 2017 meta-analysis by Wang et al. found that preoperative pregabalin reduced visual analog scale (VAS) score at 2, 4, and 24 hours postoperatively, both at rest and with mobilization.<sup>17</sup> The 2015 RCT conducted by Sarin et al. showed improvements in early postoperative pain scores.<sup>15</sup> Meyer et al. found that the ERAS group did not have higher pain scores despite significantly reduced opioid consumption.<sup>21</sup>

Of the articles examining regional techniques, each improved patient pain on the pain scales utilized. Purdy et al. found that patients' satisfaction with pain management was higher in the repeated-doses group (the same technique that demonstrated opioid-sparing efficacy).<sup>18</sup> In the study conducted by Guo et al., OSTAP block significantly reduced postoperative numeric rating scale (NRS) pain scores at rest and with coughing compared to the control group.<sup>14</sup> Both local wound interventions performed by Mohamed et al. significantly reduced mean VAS-R score when compared to the control group.<sup>19</sup> There was no significant difference between the ketamine group and the dexmedetomidine group.<sup>19</sup>

Bojhaxi found that intravenous lidocaine infusion reduced patient reported pain on the NRS scale.<sup>20</sup> The RCT conducted by Kaur et al. reported that patients receiving intraoperative ketamine had less pain than the control group on VAS during the first 6 hours, although there was no significant difference in the groups at 24 hours.<sup>16</sup> Jarahzadeh et al. found the pain patients experienced was significantly less in the study group receiving magnesium versus the placebo group.<sup>22</sup>

**Secondary outcomes.** Numerous benefits of opioid-sparing analgesic techniques were found beyond the primary outcomes of reduced postoperative opioid consumption and reduction

in patient reported pain. The 2017 meta-analysis by Wang et al. found that preoperative pregabalin significantly reduced the occurrence of nausea (9.91%) and vomiting (8.83%).<sup>17</sup> Meyer et al. ERAS group had a 25% reduction in median length of stay, less fatigue, and less self-reported interference with walking during hospitalization when compared to those before implementation of the ERAS protocol.<sup>21</sup> Median total hospital length of stay and 30-day readmission rate were decreased in the ERAS group when compared to the historical control group in the study conducted by Sarin et al.<sup>15</sup> Furthermore, median time to first solid meal, median duration for urinary catheterization, and subjective reporting of nausea/vomiting were all reduced in the ERAS group.<sup>15</sup>

In the study by Guo et al. examining OSTAP block efficacy in patients undergoing abdominal surgery, the control group had a higher incidence of nausea and vomiting.<sup>14</sup> Stress responses to postoperative pain elicit changes in hormonal secretion; for this reason, the RCT performed by Mohamed et al. assessed serum glucose, prolactin, and cortisol levels preoperatively and postoperatively.<sup>19</sup> Mean cortisol, prolactin, and glucose levels were significantly lower in the groups receiving local wound infiltration with ketamine and dexmedetomidine compared to the control group at 6 and 24 hours postoperatively.<sup>19</sup> At 24 hours postoperatively, the hormone levels tested were significantly lower in the ketamine group compared to the dexmedetomidine group. Both interventions significantly reduced PCA morphine consumption, prolonged time to first rescues analgesia, and fewer total rescue analgesia doses compared to the control group.<sup>19</sup>

## **DISCUSSION OF LITERATURE REVIEW**

### **Summary of Evidence**

Following an extensive literature review, nine studies with a total of 2,498 patients were included in this systematic review. One article was rated as Level I, grade A. This is the highest level of evidence and quality. Six of the articles were rated as Level I, grade B; the 'B' reflects the quality. Grade B is good quality with reasonably consistent results and sufficient sample

size.<sup>13</sup> While the smaller sample sizes were adequate for each individual RCT, whether the results are able to be generalized to a larger population could be debated. The two quasi-experimental studies reviewed were rated as Level II, Grade B based on design. The results of the systematic review are summarized below, in order by time of intervention and technique:

- One meta-analysis found analgesic efficacy and opioid-sparing effects with preoperative use of pregabalin.
- Two quasi-experimental studies examining ERAS protocols found that preoperative and intraoperative non-opioid analgesics (neuraxial anesthesia, ketamine, acetaminophen, gabapentin, and COX-inhibitors) reduced postoperative opioid usage.
- One RCT found that IV magnesium sulfate infusion reduced pain and postoperative opioid consumption.
- One RCT found intraoperative low-dose ketamine infusion provides postoperative analgesia while reducing the need for opioid analgesics.
- One RCT found that intravenous lidocaine reduced mean opioid consumption.

#### Regional techniques

- A single study reported that oblique subcostal transversus abdominus plane blockade significantly decreased cumulative dosage of analgesics with Mercedes incision.
- One study stated that rectus sheath block analgesia with repeated doses had an opioid sparing effect after midline laparotomy.
- One study showed that local wound infiltration with ketamine or dexmedetomidine added to bupivacaine has an opioid-sparing effect after abdominal hysterectomy.

#### **Limitations of Review**

Several limitations to this systematic review must be acknowledged. The aim of this review was to examine both preoperative and intraoperative opioid-sparing analgesic techniques and their effects on open abdominal surgeries. Rather than reviewing several studies on a single intervention, multiple interventions throughout the perioperative period were examined. The

purpose was to compile a systematic review that offers anesthesia providers various options and interventions based on the patient, surgeon, surgery, facility, medication availability, and individual practice. This was not intended to provide a “one-size-fits-all” recipe for opioid-sparing analgesia in abdominal surgeries, but instead a diverse compilation of proven interventions; therefore, several dissimilarities existed between the nine studies reviewed.

The inclusion criteria of “articles published in English” has the potential to produce language bias. The variability in each studies’ focus led to subsequent inconsistencies in participants and data collection. While several studies specified ASA classification, four did not utilize this metric as an inclusion or exclusion criterion. The same can be said about participants’ BMI ranges. Another limitation was the number of study participants. In the six RCTs, the number of patients ranged from 48 to 90. In the two quasi-experimental design studies, there were 279 and 533 participants. The meta-analysis examining preoperative pregabalin usage has 1207 patients. Time intervals for data collection also greatly varied from study to study, as well as the secondary outcomes measured.

### **Summary of Review**

After appraising the selected articles, the evidence showed that each non-opioid analgesic intervention of focus could reduce postoperative opioid consumption in adults undergoing non-emergent open abdominal surgery. This systematic review examined several modalities that have a favorable effect not only on postoperative opioid use and pain scores, but also on patient satisfaction and postoperative nausea and vomiting. The utilization of these interventions, whether independently or in combination, has the potential to lead to a multitude of positive patient outcomes. The opioid epidemic in this country is a challenge that the U.S. healthcare system continues to face. The knowledge of non-opioid methods outlined in this systematic review offer positive outcomes for patients as well as hospital systems. Non-opioid analgesic methods are indeed effective at reducing opioid consumption, and, in the face of an ongoing epidemic and push for evidence-based practice, a shift in current practice is indicated.

## **PICO and Purpose**

The purpose of the study is to assess provider knowledge and confidence regarding the use of non-opioid interventions in the preoperative and intraoperative period to reduce postoperative opioid consumption. Based on the systematic review performed and the conclusions drawn from the article appraisal, an educational video was composed. The proposed PICO question for this study is the following: If CRNAs are provided an online educational module on opioid-sparing pain management techniques during the preoperative and perioperative period that reduce postoperative opioid consumption for patients undergoing open, nonemergent abdominal surgeries, will change occur in their knowledge and confidence?

## **METHODOLOGY OF QUALITY IMPROVEMENT**

### **Settings and Participants**

The study takes place at a level 1 trauma center in southeast Florida. Primary study participants include CRNAs employed by the anesthesia group that staffs this facility. The participants are recruited voluntarily via an email list provided by the hospitals' Anesthesia Department. They will receive the proposed intervention and provide feedback regarding their experience and learning through an anonymous survey. The anticipated sample size is ten adult participants of both genders.

### **Description of Approach and Subject Procedures**

The primary methodology of the proposed project is to administer an online educational intervention to anesthesia providers that focuses on preoperative and intra-operative methods to reduce postoperative opioid consumption in adult patients undergoing abdominal surgery. With written consent, the participants will complete an anonymous pre-test survey to assess their knowledge and current clinical practices regarding non-opioid analgesic methods and their role in reducing postoperative opioid consumption in patients undergoing open, non-emergent abdominal surgeries in adults. The survey will be completed individually and is expected to take up to 5-15

minutes to complete. This will identify providers' existing knowledge and will determine whether learning took place following the intervention.

Next, the participants will complete an educational PowerPoint presentation based on the results of the systematic review described in the previous section. Implementation of acute and chronic pain management modalities fall within the responsibilities of a CRNA. It is important that providers have the knowledge to effectively utilize various analgesic methods in the preoperative and intraoperative periods to reduce postoperative opioid consumption. The evidence supports the need for a project with comprehensive information regarding opioid-sparing analgesic methods specific to abdominal surgery.

The third phase of the project asks participants to complete the post-test, which will be identical to the pre-test. The post-test survey is expected to take up to 5-15 minutes to complete. This information will provide feedback regarding the impact of the educational intervention and whether learning took place amongst participants. The pre/post-testing will provide relevant information regarding the effectiveness of this online intervention in influencing CRNAs' practice.

### **Protection of Human Subjects**

For this study, the recruitment population will include the southeast Florida hospital systems' CRNAs. This population is directly responsible for the delivery of anesthesia to thousands of patients in South Florida every year and can influence the care provided to patients undergoing abdominal surgery in their respective facilities. Recruitment activities are conducted by email invitations to providers on the email list provided by the hospital's anesthesia department. There will be no penalties if any participants decide to withdraw from the quality improvement project at any stage. Participants are not expected to experience any risks, harms, or discomforts through participation in this project. Potential benefits to participants include improved knowledge of preoperative and intraoperative opioid-sparing interventions that can reduce postoperative opioid consumption in adults undergoing open, non-emergent abdominal

surgeries. There will be no compensation or incentives. This study only requires the time spent by each participant in the educational intervention.

### **Data Collection**

For the study, the primary method used will include pre-assessment and post-assessment testing applications to determine the effects of the educational intervention. Both tests are identical and will be conducted using surveys that will determine participants' understanding of non-opioid interventions in the preoperative and intraoperative period that can reduce postoperative opioid use in patients undergoing open, non-emergent abdominal surgeries. It will also determine the efficacy of a PowerPoint educational intervention to meet this objective.

The survey consists of 12 questions that focus on knowledge and clinical interventions using Qualtrics. In this manner, the pre-test survey will gauge each providers' foundational knowledge of opioid-sparing techniques in this surgical population. The post-test survey will determine if learning took place amongst participants and whether they will apply any gained knowledge to their practice environment. The reliability and validity will be measured in accordance with the intervention and its effectiveness. The data collected will be confidential and anonymous, and no identifiable private information will be collected during any component of the study. Demographic data, including gender, age, ethnicity, and title, will be obtained as part of the survey.

### **Data Management and Analysis Plan**

The co-investigator for the project will be the DNP student who is responsible for administering the survey. To evaluate the responses provided on the pre-test and the post-test, SPSS software will be used to determine if participants have received knowledge and gained confidence. Each question will be measured, and the responses recorded to identify the knowledge base before and after the intervention. No personal identifiers will be recorded for study participants, and confidentiality will be protected. The impact of the intervention will be based upon the results of the pre-test and post-test survey instruments. Through statistical

analysis, the study results will likely identify patterns that will be used to determine the effectiveness of educational intervention and how it affects CRNAs' actions and behaviors. The co-investigator will store the data collected in a password-protected laptop computer.

## RESULTS OF QUALITY IMPROVEMENT

### Demographics

The demographics are shown in Table 3, below.

<b>Table 3: Demographics n (%)</b>	
Total Participants	9 (100%)
<b>Gender</b>	
Male	2 (22.22%)
Female	7 (77.78%)
<b>Age</b>	
18-29	1 (11.11%)
30-49	5 (55.56%)
>50	3 (33.33%)
<b>Ethnicity</b>	
Caucasian	7 (77.78%)
Other	2 (22.22%)
<b>Position</b>	
CRNA	5 (55.56%)
No response	4 (44.44%)
<b>Education</b>	
Masters	3 (33.33%)
Doctorate	6 (66.67%)

There were nine participants in the study and survey. The majority of the participants were female (n=7, 77.78%), as opposed to male (n=2, 22.22%). Ethnicities represented were Caucasian (n=7, 77.78%) and other (n=2, 22.22%). Five of the participants were CRNA's, and four did not answer. It must be noted that the survey was only sent out to CRNAs employed by the specified South Florida hospital; therefore, everyone who had access to the survey was a CRNA. Age of participants ranged from 18-29 years old (n=1, 11.11%) to 50+ years old (n=3, 33.33%). Fifty-five percent of survey participants fell into the 30-49 years old age range (n=5). Highest level of education included master's degree (n=3, 33.33%) and doctorate degree (n=6, 66.67%).

## Pre-Test Findings

The pre-test gauged participants' starting knowledge regarding opioid use, surgical pain, and interventions to reduce opioid use in surgical patients undergoing abdominal surgery. The majority of participants were aware that postoperative pain is one of the most commonly cited fears of patients scheduled for surgery (n= 6, 66.67%). Only 22.22% of CRNAs surveyed knew that the U.S. government declared the opioid epidemic a public health emergency in 2017. When asked about consequences of postoperative pain, 66.67% of the participants knew that nausea and vomiting was not directly related to ineffectively controlled postoperative pain. The majority of participants knew that 80% of surgical patients receive opioids after low-risk surgery (n=5, 55.56%). Only one CRNA knew that treatment of chronic pain that evolves from acute pain is estimated to cost up to \$1,000,000 per patient— the majority selected \$250,000 or \$500,000 (n=6, 66.67%).

The costly economic impact of opioid-related adverse effects stems from multiple factors: increased length of hospital stays, functional impairment, and morbidity. Three participants correctly identified all three factors, two participants identified two of the three, and two identified one of the three. The majority of participants knew that withholding opioids and other analgesics from surgical patients intraoperatively could lead to an increase in chronic pain evolving from poorly managed acute pain (n=6, 66.67%). Secondary outcomes of reduced postoperative opioid consumption include decreased time to first meal, decreased nausea and vomiting, and increased patient satisfaction. Two participants selected all three correctly (22.22%), three selected two of the choices correctly (33.33%), and one selected one of the choices correctly (11.11%). The incidence of opioid abuse postoperatively varies based on age, genetics, medical history, and surgical procedure. The fifth and incorrect answer choice was weight. One survey participant incorrectly selected all five (11.11%), two correctly selected all four answers (22.22%), three selected three of the four correct choices (33.33%), one selected two of the four correct choices (11.11%), and one selected one of the four correct choices (11.11%).

One participant did not correctly select any of the answers (11.11%). Five participants knew that intravenous lidocaine infusion reduces mean opioid consumption (55.56%).

### **Pre-Test Confidence**

The pre-test found that four CRNAs felt extremely comfortable recommending/ordering one of the studied preoperative non-opioid interventions in order to reduce opioid usage postoperatively (44.44%), three felt somewhat comfortable (33.33%), and two felt neither comfortable nor uncomfortable. Similarly, three CRNAs surveyed were extremely likely to recommend one of the studied intraoperative non-opioid interventions in order to reduce postoperative opioid usage postoperatively (33.33%). Three CRNAs were somewhat likely to make recommendations (33.33%), and three were neither likely nor unlikely (33.33%).

### **Post-Test Findings**

The same nine participants that completed the pre-test also participated in a post-test survey. The post-test gauged participants' knowledge regarding opioid use, surgical pain, and interventions to reduce opioid use in surgical patients undergoing abdominal surgery after viewing an educational module. Majority of participants correctly chose postoperative pain as one of the most commonly cited fears of patients scheduled for surgery (n= 8, 88.89%). Eight CRNAs surveyed knew that the U.S. government declared the opioid epidemic a public health emergency in 2017 (88.89%). In the post-test, 77.78% of survey participants knew that increased nausea vomiting was not directly related to ineffectively controlled postoperative pain. Majority of participants knew that 80% of surgical patients receive opioids after low-risk surgery (n=8, 88.89%). Six CRNA's now knew that treatment of chronic pain that evolves from acute pain is estimated to cost up to \$1,000,000 per patient (n=6, 66.67%)—in the pre-test, only one person selected the correct answer.

As previously mentioned, the costly economic impact of opioid-related adverse effects stems from multiple factors: increased length of hospital stays, functional impairment, and morbidity. Five participants correctly identified all three factors (55.56%), two participants

identified two of the three (22.22%), and two identified one of the three (22.22%). The majority of participants knew that withholding opioids and other analgesics from surgical patients intraoperatively could lead to an increase in chronic pain evolving from poorly managed acute pain (n=7, 77.78%). Again, secondary outcomes of reduced postoperative opioid consumption include decreased time to first meal, decreased nausea and vomiting, and increased patient satisfaction. Six participants selected all three correctly (66.67%), and one selected one of the choices correctly (11.11%). One person selected all three correct answers but also chose a fourth incorrect answer (11.11%). Five survey participants correctly selected the four patient factors that influence postoperative opioid abuse (55.56%). One person incorrectly selected all five answer choices (11.11%), one person selected three of the four correct choices (11.11%), and one person selected two of the four correct choices (11.11%). Seven participants knew that intravenous lidocaine infusion reduces mean opioid consumption (77.78%) as opposed to five people in the pre-test. Table 4 shows the differences in responses from pre- to post-test.

<b>Table 4: Difference in Pre- and Post-Test Findings</b>	<b>Pre-test</b>	<b>Post-test</b>	<b>Difference</b>
One of the most commonly cited fears of patients scheduled for surgery is the fear of pain.	66.67%	88.89%	22.22%
The U.S. Government declared the opioid epidemic a public health emergency in 2017.	22.22%	88.89%	66.67%
Ineffectively controlled postoperative pain is related to all of the following <i>except</i> increased nausea and vomiting.	66.67%	77.78%	11.11%
Over 80% of surgical patients receive opioids after low-risk surgery.	55.56%	88.89%	33.33%
Treatment of chronic pain that evolves from acute pain is estimated to cost up to \$1,000,000 per patient.	11.11%	66.67%	55.56%
The costly economic impact of opioid-related adverse effects stems from increased length of hospital stay, functional impairment, and morbidity.	33.33%	55.56%	22.23%
Withholding opioids and other analgesics from surgical patients intraoperatively could lead to an increase in chronic pain evolving from poorly managed acute pain.	66.67%	77.78%	11.11%
Secondary outcomes of reduced postoperative opioid consumption are decreased time to first meal, decreased nausea and vomiting, and increased patient satisfaction.	22.22%	66.67%	44.45%

The incidence of opioid abuse postoperatively varies based on age, genetics, medical history, and surgical procedure.	22.22%	55.56%	33.34%
True: Intravenous lidocaine infusion reduced mean opioid consumption.	55.56%	77.78%	22.22%

As seen in Table 4, learning took place on every question to varying degrees. Significantly more CRNAs recognized when the opioid epidemic became a public health emergency, the drastic cost of treating chronic pain that evolves from acute pain, and the secondary outcomes of reduced postoperative opioid consumption. Those questions in which a stronger starting knowledge existed (most commonly cited fears of surgical patients, factors related to ineffectively controlled postoperative pain, and the harm of withholding opioids and analgesics) saw a smaller margin of improvement when compared to the post-test. All participants selected more correct answers in the post-test than pre-test.

### Post-test Confidence

The post-test found that eight CRNAs felt extremely comfortable recommending/ordering one of the studied preoperative non-opioid interventions in order to reduce opioid usage postoperatively (88.89%). Nine CRNAs surveyed were extremely likely to recommend one of the studied intraoperative non-opioid interventions in order to reduce postoperative opioid usage postoperatively (100%). Table 5 shows the differences in responses from pre- to post-test.

<b>Table 5: Difference in Pre- and Post-Test Confidence</b>	<b>Pre-test</b>	<b>Post-test</b>	<b>Difference</b>
How comfortable are you with recommending/ordering one of the studied preoperative non-opioid interventions for a patient undergoing open non-emergent abdominal surgery?	44.44%	88.89%	44.45%
How likely are you to recommend one of the studied intraoperative non-opioid interventions in order to reduce opioid usage postoperatively?	33.33%	100%	66.67%

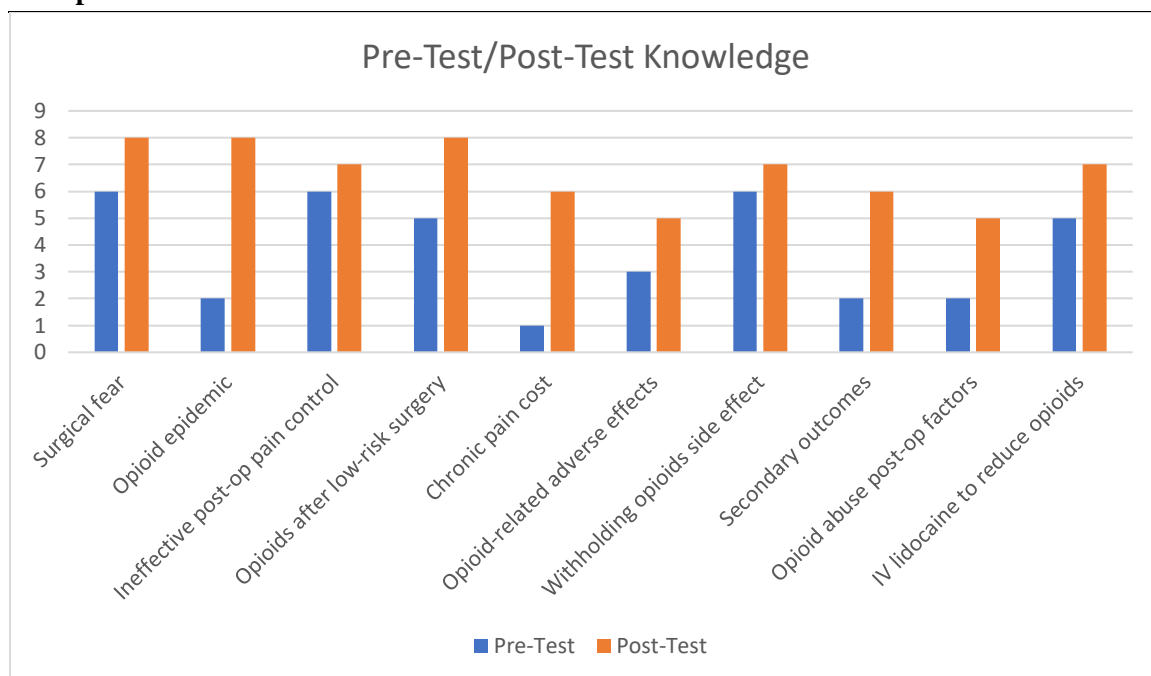
As shown in Table 5, confidence in recommending both preoperative and intraoperative non-opioid interventions to reduce opioid usage postoperatively significantly improved following

this educational module. When asked about the preoperative opioid-sparing modalities discussed, 88.89% of study participants stated they were extremely comfortable recommending or ordering the interventions, while 100% would recommend or utilize one of the intraoperative interventions. With education, participants were more likely to advocate for opioid-sparing analgesic interventions to improve postoperative outcomes for patients undergoing on-emergent abdominal surgery.

### Summary

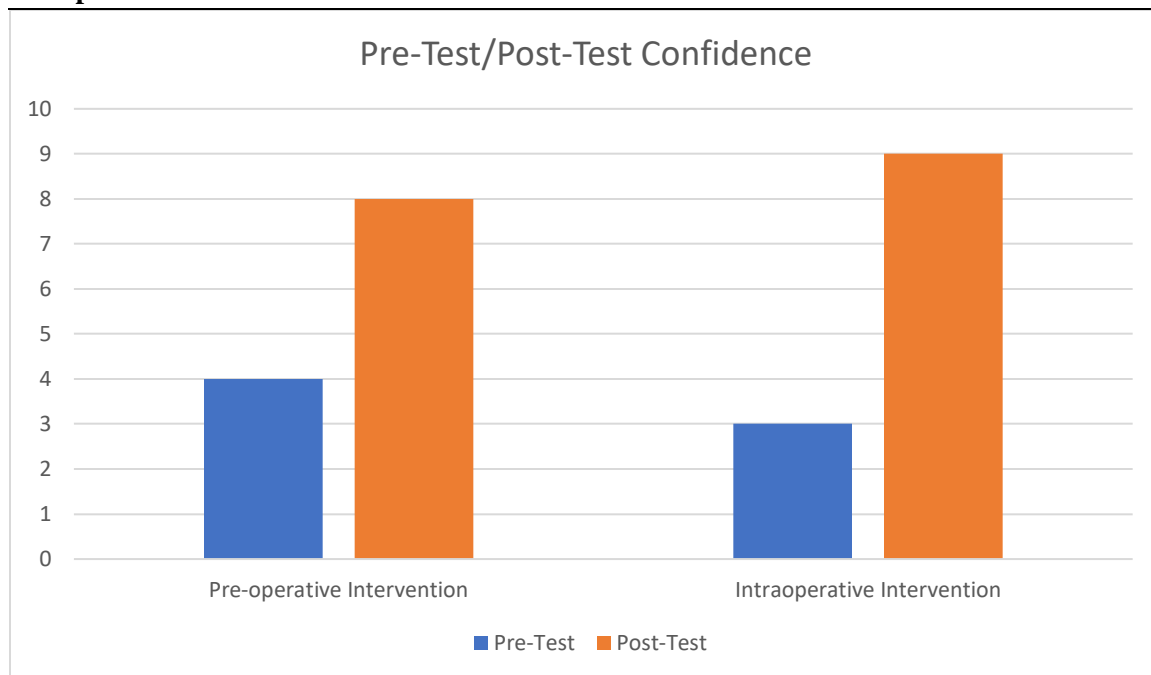
Overall, the results show that there was a difference from pre-test to post-test. There was an increase in knowledge for every question, as well as an increase in confidence. See Graph 1, Table 6, and Graph 2 below for visual representations of the study's findings.

**Graph 1**



**Table 6**

Pre-Test Knowledge			
	N	Mean	Std. Deviation
<b>Score</b>	9	4.22	2.86
Post-Test Knowledge			
	N	Mean	Std. Deviation
<b>Score</b>	9	7.44	3.17

**Graph 2**

## **DISCUSSION OF QUALITY IMPROVEMENT**

### **Limitations of Study**

Limitations of the study include the small sample size. The study was done using an anesthesia group in South Florida. A larger group would have been preferable to increase the strength of the study. The delivery method was another significant limitation. The email list provided by the participating anesthesia group was not updated; several email addresses on the distribution list were no longer valid, and more recently hired staff was not included.

Furthermore, self-selection bias was also present. Survey recipients were allowed to decide entirely for themselves whether they participated or not.

### **Future Implications to Advanced Nursing Practice**

The outcomes of the study are important in demonstrating the importance of education in empowering providers to administer interventions to support patients. As the world becomes increasingly technology-driven, utilizing online videos and resources as an educational tool could indeed be effective; this educational module successfully expanded knowledge and confidence of

the participating CRNAs in the topic. The impact of the intervention could have a positive effect on patient outcomes following non-abdominal surgery. The CRNAs that participated have increased knowledge and confidence regarding preoperative and intraoperative non-opioid analgesic techniques that can reduce postoperative opioid consumption. Utilizing this information could lead to improved outcomes in this surgical population.

## **CONCLUSION**

After appraising the nine selected articles, the evidence showed that several non-opioid analgesic interventions can reduce postoperative opioid consumption. The utilization of these interventions, whether independently or in combination, has the potential to lead to a multitude of positive patient outcomes. Non-opioid analgesic methods are indeed effective at reducing opioid consumption as well as opioid-related adverse effects, and in the face of an ongoing epidemic and push for evidence-based practice, a shift in current practice is indicated.

An educational module was created based on this systematic review and implemented via a pre-test and post-test. The implementation led to a significant increase in providers knowledge and confidence of opioid-sparing analgesic methods in patients undergoing non-emergent open abdominal surgery. However, further research is needed to focus on additional non-opioid analgesic interventions in various surgical populations and how best to distribute this information to CRNAs that are currently practicing.

## References

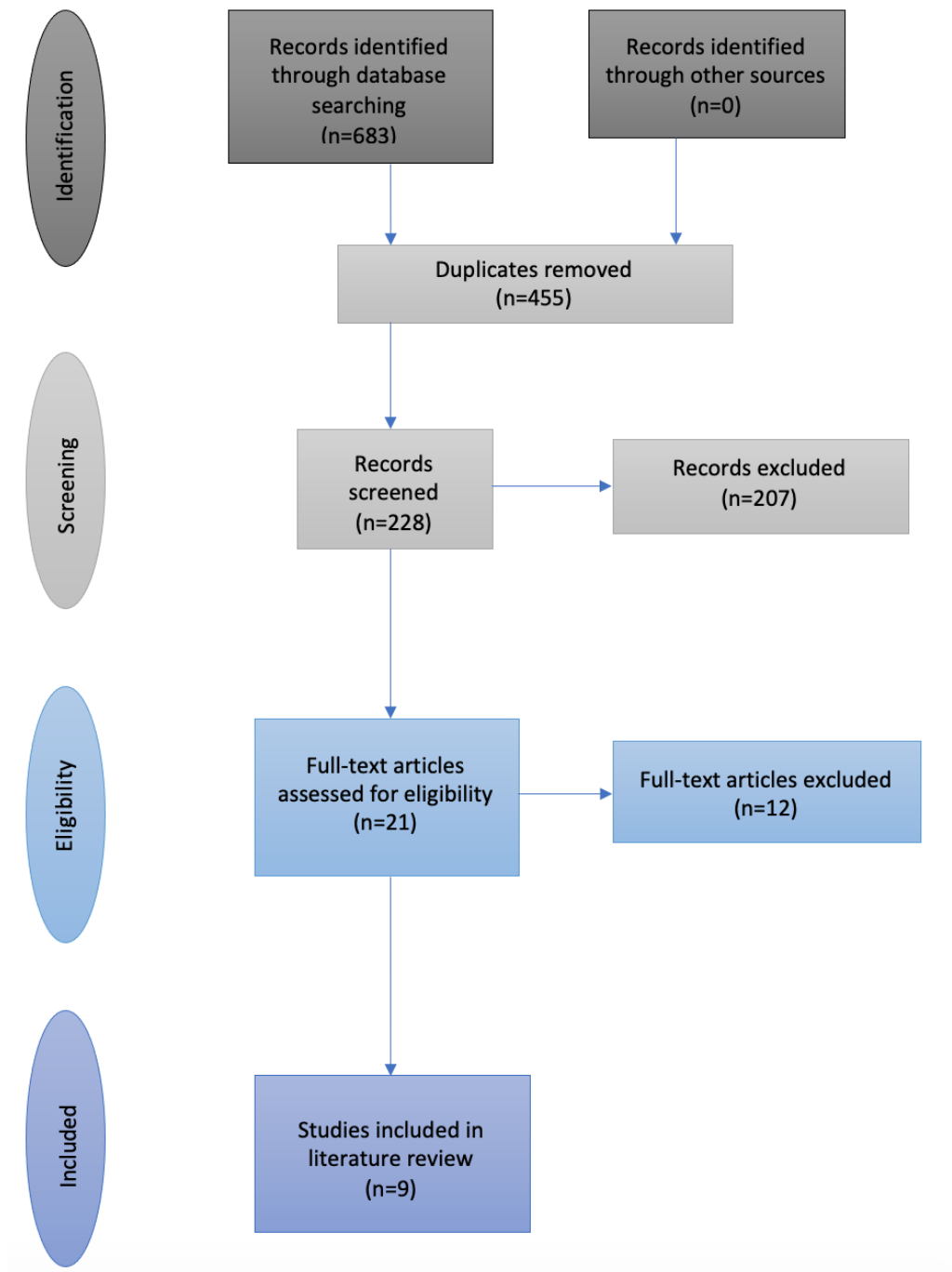
1. Alshehri A, Ruhaiyem M, Saade M, Shoabi T, Zahoor H, Tawfeeq N. Fear of going under general anesthesia: A cross-sectional study. *Saudi J Anaesth*. 2016;10(3):317. doi:10.4103/1658-354x.179094
2. Jawaid M, Mushtaq A, Mukhtar S, Khan Z. Preoperative anxiety before elective surgery. *Neurosciences*. 2007;12(2):145-8. <https://pubmed.ncbi.nlm.nih.gov/21857597/>. Accessed October 10, 2020.
3. Certified Registered Nurse Anesthetist Position Description. Aana.com. [https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/certified-registered-nurse-anesthetist-position-description.pdf?sfvrsn=60649b1\\_2](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/certified-registered-nurse-anesthetist-position-description.pdf?sfvrsn=60649b1_2). Published 2020. Accessed October 20, 2020.
4. Johnson Q, Borsheski R, Reeves-Viets J. A Review of Management of Acute Pain. *Mo Med*. 2013;110(1):74-79. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6179627/>. Accessed October 17, 2020.
5. Kaye A, Urman R, Rappaport Y et al. Multimodal analgesia as an essential part of enhanced recovery protocols in the ambulatory settings. *Journal of Anaesthesiology Clinical Pharmacology*. 2019;35(5):40-45. doi:10.4103/joacp.JOACP\_51\_18
6. Opioid Overdose Crisis. National Institute on Drug Abuse. <https://www.drugabuse.gov/drug-topics/opioids/opioid-overdose-crisis>. Published 2020. Accessed October 20, 2020.
7. Zhao S, Chen F, Feng A, Han W, Zhang Y. Risk Factors and Prevention Strategies for Postoperative Opioid Abuse. *Pain Research and Management*. 2019;2019:1-12. doi:10.1155/2019/7490801
8. Jones M, Viswanath O, Peck J, Kaye A, Gill J, Simopoulos T. A Brief History of the Opioid Epidemic and Strategies for Pain Medicine. *Pain Ther*. 2018;7(1):13-21. doi:10.1007/s40122-018-0097-6
9. Hah J, Bateman B, Ratliff J, Curtin C, Sun E. Chronic Opioid Use After Surgery. *Anesthesia & Analgesia*. 2017;125(5):1733-1740. doi:10.1213/ane.0000000000002458
10. Gan T. Poorly controlled postoperative pain: prevalence, consequences, and prevention. *J Pain Res*. 2017;Volume 10:2287-2298. doi:10.2147/jpr.s144066
11. Fingar K, Stocks C, Weiss A, Steiner C. Most Frequent Operating Room Procedures Performed in U.S. Hospitals, 2003-2012 #186. Hcup-us.ahrq.gov. <https://www.hcup-us.ahrq.gov/reports/statbriefs/sb186-Operating-Room-Procedures-United-States-2012.jsp>. Published 2014. Accessed October 17, 2020.
12. Melnyk M, Casey R, Black P, Koupparis A. Enhanced recovery after surgery (ERAS) protocols: Time to change practice?. *Canadian Urological Association Journal*. 2011:342-348. doi:10.5489/cuaj.11002

13. Dearholt S, Dang D. *Johns Hopkins Nursing Evidence-Based Practice*. 2nd ed. Indianapolis, IN: Sigma Theta Tau International; 2012.
14. Guo J, Li H, Pei Q, Feng Z. The analgesic efficacy of subcostal transversus abdominis plane block with Mercedes incision. *BMC Anesthesiol*. 2018;18(1).
15. Sarin A, Litonius E, Naidu R, Yost C, Varma M, Chen L. Successful implementation of an Enhanced Recovery After Surgery program shortens length of stay and improves postoperative pain, and bowel and bladder function after colorectal surgery. *BMC Anesthesiol*. 2015;16(1). doi:10.1186/s12871-016-0223-0
16. Kaur S, Saroa R, Aggarwal S. Effect of intraoperative infusion of low-dose ketamine on management of postoperative analgesia. *Journal of Natural Science, Biology and Medicine*. 2015;6(2):378. doi:10.4103/0976-9668.160012
17. Wang Y, Xia M, Shan N et al. Pregabalin can decrease acute pain and postoperative nausea and vomiting in hysterectomy. *Medicine (Madr)*. 2017;96(31):e7714. doi:10.1097/md.0000000000007714
18. Purdy M, Kinnunen M, Kokki M et al. A prospective, randomized, open label, controlled study investigating the efficiency and safety of 3 different methods of rectus sheath block analgesia following midline laparotomy. *Medicine (Baltimore)*. 2018;97(7):e9968. doi:10.1097/md.0000000000009968
19. Mohamed S, Sayed D, El Sherif F, Abd El-Rahman A. Effect of local wound infiltration with ketamine versus dexmedetomidine on postoperative pain and stress after abdominal hysterectomy, a randomized trial. *European Journal of Pain*. 2018;22(5):951-960. doi:10.1002/ejp.1181
20. Bojaxhi E. Perioperative Intravenous Lidocaine Infusion for Patients Undergoing Laparoscopic and Open Pancreatectomies - Full Text View - ClinicalTrials.gov. Clinicaltrials.gov. <https://clinicaltrials.gov/ct2/show/NCT02623803>. Published 2019. Accessed November 14, 2020.
21. Meyer, L., Lasala, J., Iniesta, M., Nick, A., Munsell, M., Shi, Q., Wang, X., Cain, K., Lu, K. and Ramirez, P., 2018. Effect of an Enhanced Recovery After Surgery Program on Opioid Use and Patient-Reported Outcomes. *Obstetrics & Gynecology*, 132(2), pp.281-290.
22. Jarahzadeh M, Taghizadeh Harati S, Babaeizadeh H, Yasaei E, Rahimi Bashar F. The effect of intravenous magnesium sulfate infusion on reduction of pain after abdominal hysterectomy under general anesthesia: a double-blind, randomized clinical trial. *Electron Physician*. 2016;8(7):2602-2606. doi:10.19082/2602

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**Appendix A: PRISMA Flow Diagram**

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## Appendix B: Matrix Table

Author(s) and year	Design and Setting	Sample size and characteristics	Variables	Measurement	Data Analysis	Findings	Appraisal	Conclusion	Level of Evidence
<b>Guo et al. (2018)</b>	Prospective, observer blinded, randomized control trial. First Affiliated Hospital, School of Medicine, Zhejiang University in China	70 patients ASA I-III Age 18-65 Undergoing scheduled open liver resection BMI 18-26	Independent: bilateral ultrasound guided OSTAP blocks with either 0.375% ropivacaine (group T) or 0.9% isotonic saline (group C) Dependent: NRS score at rest, NRS score at cough, intraoperative sufentanil use	Verbal numeric rating scale (NRS) Intraoperative and postoperative sufentanil use	SPSS 19.0 software Kolmogorov-Smirnov test Parametric data expressed as mean with 95% confidence intervals. Nonparametric data as median with interquartile range. Group means compared using the Student's t-test or the Mann-Whitney U test	NRS score rest: Reduced postoperative pain scores in Group T than group C at all time points except 5 min after extubation Intraoperative sufentanil: significantly less in group T than in group C Cumulative sufentanil (5 min-24 hour postop): lower in group T than Group C Cumulative fentanyl use at 48 hours: no significant difference	Strength: Findings were consistent with existing investigations on upper abdominal surgery with a bilateral OSTAP blockade. Limitations: No measurement of ropivacaine concentrations, no follow-up beyond hospital discharge, population with "normal" BMI and ASA I-III only	Ropivacaine OSTAP blockade improved perioperative analgesia with decreased opioid use both intraoperatively and postoperatively.	Level I Grade B
<b>Sarin et al. (2015)</b>	Quasi-experimental design (historical control group) Conducted at a tertiary care teaching hospital site of UCSF-Mount Zion Hospital	279 patients in the ERAS program compared to 245 patients undergoing surgery prior to ERAS implementation Abdominal colorectal surgery	Independent: ERAS protocol Dependent: postoperative pain scores, median opioid consumption intraoperatively and postoperatively in milligrams (mg) oral morphine equivalents	Verbal numeric postoperative pain scores (0-10) Opioid consumption (intraoperatively and POD 0 to 2)	t-tests, Mann-Whitney U tests, Fisher's exact tests. Analyses performed using R version 3.1.2	Median opioid consumption intraoperative: reduced ERAS group (p<0.001) Median opioid consumption POD 0-2: reduced in ERAS group (p < 0.001) Self-reported pain scores: reduced in ERAS group POD 0 and 1.	Strengths: ERAS protocol can reduce opioid consumption following colorectal surgery. Limitations: different rates of smoking and HTN in pre-ERAS and ERAS groups. Resource constraints in finding controls due to new electronic medical system.	This multidisciplinary, evidence-based, enhanced recovery after surgery (ERAS) program showed an improvement in pain control and reduced opioid consumption in patients undergoing abdominal colorectal surgery.	Level II Grade B

<b>Kaur et al. (2015)</b>	Double blind Randomized control trial. Conducted at university hospital.	80 patients undergoing open cholecystectomy. ASA I-II Age 21-50	Independent: Ketamine (group K), saline (group C) Dependent: pain scores at rest at 2-, 4-, 6-, 12-, and 24-hours post-surgery, total number of patients requiring morphine and total morphine given in 24 hours	VAS (0 = no pain and 100 = worst pain imaginable) Opioid consumption	SPSS 11.5 software	Total morphine used within 24 hours was lower in group with ketamine vs. control Reduced postoperative pain scores	Strengths: Ketamine related adverse effects are rare under general anesthesia. Opioid-sparing effect could be useful in opioid intolerant and cancer patients. Limitations: could not use high dose ketamine due to potential psychomimetic effects	Low-dose ketamine infusion provided postoperative analgesia while reducing need of opioid analgesia	Level I Grade B
<b>Wang et al. (2017)</b>	Meta-analysis of RCT	1207 patients Age 18+ Preoperative pregabalin for managing pain after hysterectomy	Independent: Preoperative pregabalin or placebo Dependent: morphine consumption, pain score, morphine-related complications	VAS score. Opioid consumption.	Stata software, version 13.0 Chi-squared test and $I^2$ -statistic Funnel plot Begg test	Reduced VAS at 2, 4, and 24 hours with rest and mobilization. Total morphine consumption reduced. Reduced nausea and vomiting. No difference in sedation, increased occurrence of dizziness.	Strengths: Pregabalin has an opioid-sparing effect, and offers other benefits. Limitations: doses vary, optimal dose should be determined, only 10 RCTs, different follow-up durations	Preoperative pregabalin has analgesic efficacy and opioid-sparing effects. Significant decrease in nausea and vomiting was associated with use of pregabalin as well.	Level I Grade A
<b>Purdy et al. (2018)</b>	Randomized control trial Kuopio University Hospital, Kuopio, Finland	57 patients undergoing midline laparotomy Age 18-80 BMI 18-35	Independent: single dose rectus sheath block (RSB), repeated dose RSB, continuous infusion RSB, or control group Dependent: opioid consumption, pain score	Pain at rest, dynamic pain experienced when wound area pressed with 20N force, pain when coughing (all using Numeric rating scale 0-10) Opioid consumption	Mann-Whitney U Analysis of variance (ANOVA). Kruskal-Wallis test Analyzed using IBM SPSS 23.0.	First 12 hours post-op: oxycodone consumption was less in the infusion and repeated-doses groups than in the single-dose and control groups (P=.07) Oxycodone consumption at 48 hours post-op less in repeated-doses group. Repeated-doses group performed better at the first 4h after surgery when coughing and at rest than the control group.	Strengths: surgical operations varied (gastrointestinal, gynecological, and urological cases) and reflects the situation in normal clinical practice. Limitations: no invasive placebo led to lack of blinding, small sample size	Pain relief was superior in the repeated-doses RSB group. Early opioid consumption for rescue analgesia was less in the repeated-doses and continuous infusion groups than in the single bolus and control groups. The use of RSB may be a feasible aspect of multimodal analgesia treatment after midline laparotomy.	Level I Grade B

<p><b>Mohamed et al. (2018)</b></p>	<p>Placebo-controlled, randomized, double-blinded study South Egypt Cancer Institute</p>	<p>90 patients undergoing total abdominal hysterectomy with low midline vertical incision ASA I-II Age 18-80 Weight 50-85 kg</p>	<p>Independent: Local wound infiltration with ketamine and bupivacaine (group K), dexmedetomidine and bupivacaine (group D), or control (bupivacaine only) after skin closure and before extubation Dependent: total dose IV PCA morphine, first request analgesia, VAS score</p>	<p>Morphine consumption, time to first analgesia request, Presence and severity of pain and rest and on coughing (using VAS score—VAS-R and VAS-M)</p>	<p>Chi-square test Kolmogorov-Smirnov normality test Kruskal-Wallis Mann-Whitney test Analyzed using SPSS version 17</p>	<p>PCA morphine consumption: less in group K and group D than group C Time to first request analgesia: prolonged in group K and group D Mean VAS-R score: reduced in group C compared to group K in first 24 hours; reduced in group D compared to group C in first 8 hours</p>	<p>Strengths: Infiltration of wounds with local anesthetics can not only provide analgesia but may also reduce the up-regulation of peripheral nociceptors that manifest as increased sensitivity to pain, and could therefore reduce postoperative stress response Limitations: single dose, postoperative infiltration, lack of measurement of serum levels of ketamine and dexmedetomidine</p>	<p>Local wound infiltration with ketamine or dexmedetomidine (added to bupivacaine, vs bupivacaine alone) had an opioid-sparing effect and delayed first request of rescue analgesia in patients undergoing total abdominal hysterectomy.</p>	<p>Level I Grade B</p>
<p><b>Bojhaxi (2019)</b></p>	<p>Interventional, randomized, clinical trial Mayo Clinic Florida</p>	<p>48 patients undergoing elective open or laparoscopic total pancreatectomies ASA I-III Age 18-80 BMI &lt;40</p>	<p>Independent: lidocaine infusion from induction through time that patient meets discharge criteria from recovery, placebo Dependent: pain in postop period, opioid consumption</p>	<p>Pain in postoperative period measured using numerical rating scale (NRS) Total opioid consumption in PACU converted to morphine equivalents in mg.</p>	<p>Mann-Whitney</p>	<p>Pain in postoperative period was less in the group receiving lidocaine infusion (P= 0.1459) Total opioid consumption in mg was less in group receiving lidocaine infusion (P = 0.2050)</p>	<p>Strengths: Utilizing lidocaine drip to reduce postoperative opioid consumption could feasibly be implemented in wide range of procedures. Limitations: Only evaluated effectiveness in pancreatectomies, not tested in patients with BMI &gt;40.</p>	<p>Lidocaine infusion had an opioid sparing effect and decreased reported postoperative pain in patients undergoing pancreatectomy.</p>	<p>Level I Grade B</p>

<b>Meyer et al. (2018)</b>	Quasi experimental design (historical control group) MD Anderson	533 patients in cohort, 74 patients in historical control Age 18-85 Undergoing open abdominal surgery for gynecologic indications	Independent: ERAS protocol Dependent: median opioid consumption, pain scores	Pain in POD 0-3 using numerical rating scale Opioid consumption	Fisher exact test Wilcoxon rank-sum test	No difference in pain scores reported, however, intraoperative and postoperative opioid use was lower in ERAS group. Median intraoperative opioid dose was reduced 39% in ERAS group Postoperative opioid dose was reduced 83%, 80%, 71%, and 50% on POD 0, 1, 2, and 3, respectively	Strengths: high level of compliance with ERAS pathway, additional positive outcomes associated with ERAS protocol outside of opioid reduction Limitations: historical control group	An ERAS protocol can reduce opioid intake in patients following open abdominal surgery for gynecologic conditions.	Level II Grade B
<b>Jarahzadeh et al. (2016)</b>	Double-blind RCT Shahid Sadoughi Hospital in Yazd, Iran	60 patients in Age 35-65 Undergoing abdominal hysterectomy ASA I-II	Independent: intravenous magnesium sulfate infusion Dependent: narcotic consumption 1, 2, 6, and 12 hours after surgery, pain score	Mean narcotic consumption, VAS pain score	VAS score, t-test, Chi-square test	Mean pain scores at all time-points were lower in study group than placebo group. Means of narcotic consumption were higher in placebo for all measured time-points	Strengths: Magnesium decreases irritability of CNS and can cause uterus to relax. Limitations: small sample size	Pain scores and mean of narcotic consumption in measured time points were lower in the patients who received magnesium sulfate than in the placebo group.	Level I Grade B

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**Appendix C: FIU IRB Exemption Letter**


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**Office of Research Integrity  
Research Compliance, MARC 414**

**MEMORANDUM**

**To:** Dr. Vicente Gonzalez  
**CC:** Rachel Kaplan

**From:** Maria Melendez-Vargas, MIBA, IRB Coordinator 

**Date:** May 25, 2021

**Protocol Title:** "Preoperative and Intraoperative Opioid-Sparing Analgesic Techniques to Reduce Post-Operative Opioid Consumption in Patients Undergoing Open, Non-emergent Abdominal Surgeries: An Educational Module"

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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-21-0190      **IRB Exemption Date:** 05/25/21  
**TOPAZ Reference #:** 110239

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

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**Appendix D: Broward IRB Exemption Letter**

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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:** 05/26/2021

**TO:** Rachel Kaplan, BSN

**FROM:** Broward Health Institutional Review Board

**RECORD NUMBER:** 2021-050

**STUDY TITLE:** Preoperative and Intraoperative Opioid-Sparing Analgesic Techniques to Reduce Post-Operative Opioid Consumption in Patients Undergoing Open, Non-emergent Abdominal Surgeries: An Educational Module

**RE:** NOT HUMAN SUBJECT RESEARCH DETERMINATION

Dear Rachel Kaplan, BSN:

This is to advise you that your project, "Preoperative and Intraoperative Opioid-Sparing Analgesic Techniques to Reduce Post-Operative Opioid Consumption in Patients Undergoing Open, Non-emergent Abdominal Surgeries: An Educational 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.*

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**Appendix E: QI Project Consent**


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March 1, 2021

Vicente Gonzalez, DNP, CRNA, APRN  
 Clinical Education Coordinator  
 Department of Nurse Anesthesiology Practice  
 Florida International University

Dr. Gonzalez

Thank you for inviting Broward Health to participate in Doctor of Nursing Practice (DNP) project conducted by Rachel Kaplan entitled "Preoperative and Intraoperative Opioid-Sparing Analgesic Techniques to Reduce Post-Operative Opioid Consumption in Patients Undergoing Open, Non-emergent Abdominal Surgeries: An Educational Module" in the Nicole Wertheim College of Nursing and Health Sciences, Department of Nurse Anesthetist Practice at Florida International University. I have given 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: Rachel Kaplan and Dr. Vicente Gonzalez.

Once the Institutional Review Board's approval is achieved, this scholarly project's execution will occur over two weeks. Rachel Kaplan 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

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

Date





- a. 60
  - b. 70
  - c. 80
  - d. 90
5. Treatment of chronic pain that evolves from acute pain is estimated to cost up to \_\_\_\_\_ per patient.
- a. \$250,000
  - b. \$500,000
  - c. \$750,000
  - d. \$1,000,000
6. The costly economic impact of opioid-related adverse effects stems from (select all that apply):
- a. Increased length of hospital stay
  - b. Incontinence
  - c. Functional impairment
  - d. Morbidity
  - e. Neuropathic pain
7. Withholding opioids and other analgesics from surgical patients intraoperatively:
- a. Is an effective method of reducing opioid consumption
  - b. Leads to lower patient reported pain scores postoperatively
  - c. Could lead to an increase in chronic pain evolving from poorly managed acute pain

8. Which of the following is a secondary outcome of reduced postoperative opioid consumption (select all that apply)?
- Decreased time to first meal
  - Increased time to first ambulation
  - Increased time to foley removal
  - Decreased nausea and vomiting
  - Increased patient satisfaction
9. The incidence of opioid abuse postoperatively varies based on: (select all that apply)
- Age
  - Genetics
  - Weight
  - Medical history
  - Surgical procedure
10. Which of the following statements is true?
- Pregabalin is most effective when administered postoperatively.
  - IV magnesium reduces opioid consumption and prolongs neuromuscular blockade but does not improve patient reported pain scores.
  - Single dose rectus sheath block is equally effective as repeated dose rectus sheath block
  - Intravenous lidocaine infusion reduced mean opioid consumption
11. How comfortable are you with recommending/ordering one of the studied preoperative non-opioid interventions for a patient undergoing open non-emergent abdominal surgery?
- Extremely comfortable

- b. Somewhat comfortable
- c. Neither comfortable nor uncomfortable
- b. Somewhat uncomfortable
- c. Extremely uncomfortable

12. How likely are you to recommend one of the studied intraoperative non-opioid interventions in order to reduce opioid usage postoperatively?

- a. Very likely
- b. Somewhat likely
- c. Neither likely or unlikely
- d. Somewhat unlikely
- e. Very unlikely

## Appendix G: Educational Module

**Preoperative and Intraoperative Opioid-Sparing Analgesic Techniques to Reduce Post-Operative Opioid Consumption in Patients Undergoing Open, Non-emergent Abdominal Surgeries: An Educational Module**

Rachel H. Kaplan, MSN, RN  
Florida International University



### Learning Goals




Upon completion of this presentation, the learner will be able to:

- Discuss risks associated with poorly controlled postoperative pain
- Demonstrate understanding of opioid abuse risk factors
- Identify the negative impact of opioid overuse in the surgical population
- List ways in which controlling pain with non-opioid methods can improve patient outcomes
- Discuss preoperative, regional, and intraoperative techniques for reducing opioid consumption



### Background

- One of the most cited fears of patients scheduled for surgery is the fear of postoperative pain.
- Ineffectively controlled postoperative pain is related to increased morbidity, decreased functional capabilities, prolonged recuperation time, extended periods of narcotic use, and higher medical services costs.
- Treatment of chronic pain that evolves from acute pain is estimated to cost up to \$1 million per patient.
- Opioids have long been considered the "gold standard" of pain management; however, opioid misuse has become an increasingly substantial problem in the United States.



### Background


In 2017, the U.S. Government declared the opioid epidemic a public health emergency.

Over 50 million Americans undergo inpatient surgery each year and over 80% of surgical patients receive opioids after low-risk surgery.

Economic impact of opioid-related adverse effects stems from increased length of hospital stay, morbidity, and health care expenses associated with complications.

The incidence of opioid abuse postoperatively varies based on several factors, including age, genetics, medical history, and surgical procedure.

Postoperative opioid consumption reduction requires a solution more comprehensive than simply withholding opioids from surgical patients.



**PROBLEM:** How to reduce opioid consumption postoperatively without sacrificing adequate pain control

**POPULATION:** Adults undergoing open, non-emergent abdominal surgeries

**INTERVENTIONS:** Early Recovery After Surgery (ERAS) protocol implementation and oral preoperative medications, intraoperative non-opioid analgesic techniques, regional anesthetic techniques






### Preoperative Interventions


Clinical studies assessing the role of Pregabalin in controlling acute pain after abdominal hysterectomy found that preoperative administration of Pregabalin had opioid-sparing effects versus the placebo group.

An ERAS protocol utilizing multimodal, opioid sparing analgesia saw a 72% reduction in median daily opioid dosage from POD 0 to POD 3 in the ERAS group versus the pre-ERAS comparison.

Implementing neuraxial anesthesia, ketamine, acetaminophen, gabapentin, and COX-inhibitors preoperatively was associated with a decrease in median opioid consumption during POD 0 to POD 2 from 142.2 mg to 75 mg.

In addition to reducing opioid consumption... all the studies included in this literature review found that the respective interventions reduced patient reported pain scores.



### Secondary Outcomes

- Secondary outcomes of reduced opioid intake included reduction in nausea and vomiting, increased patient satisfaction, and decreased time to first meal, first ambulation, and Foley removal.
- Wound infiltration with ketamine or dexmedetomidine attenuated surgical stress response compared to the control group
- Repeated doses of the RSB led to higher patient satisfaction
- OSTAP blockade with Mercoedex incision was also associated with less nausea and vomiting
- ERAS protocols that include non-opioid analgesic methods improved physical and affective aspects of recovery, reduced post-operative nausea and vomiting, quicker time to eating/less days from admission to first solid meal, shorter duration of urinary catheterization
- Pregabalin use preoperatively was linked to significantly less nausea/vomiting

