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The Benefits of Single Dose Perioperative Ibuprofen on Patients Receiving Breast Surgery: An Educational Module

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The Benefits of Single Dose Perioperative Ibuprofen on Patients Receiving Breast Surgery: An Educational Module

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Abstract

Background: Pain is a common complication when undergoing breast surgery. Acute pain leads to several issues, including chronic pain, pneumonia, cardiac ischemia, increased opioid use, opioid addiction, and increased mortality. These issues lead to an increase in hospital stays and hospital costs. Currently, opioids are the most common analgesic for postoperative breast surgery pain. However, medications such as ibuprofen have shown evidence of reducing postoperative breast surgery pain and opioid consumption. This project aimed to increase anesthesia provider knowledge by developing and disseminating an educational module regarding the benefits of ibuprofen on postoperative breast surgery pain.

Methodology: Following Institutional Review Board (IRB) and anesthesia group approval, an educational module on the benefits of preoperative intravenous ibuprofen for postoperative breast surgery pain was disseminated to 45 random CRNA participants via Qualtrics. All participants received a pretest that assessed the anesthesia providers' baseline knowledge of the topic. Pre- and posttests were disseminated via Qualtrics. The pre- and posttest results were then compared using an Excel spreadsheet to analyze the effectiveness of the educational module.

Results: A literature review provided evidence that ibuprofen reduces opioid usage and opioid side effects when compared to gabapentin. The safety profile of ibuprofen is superior when compared with gabapentin. This was exemplified with multiple procedures, but very little research was found involving breast surgery.

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Discussion: Data from the pre- and posttest surveys show an overall increase in knowledge regarding the benefits of ibuprofen and postoperative breast surgery pain. However, the overall attitude towards using single-dose ibuprofen for breast surgery pain was unchanged. The limitations of this project were the sample size, the time allowed for project participation, and the online delivery of educational modules.

Conclusion: The educational module achieved its goal of improving the knowledge of providers. However, the attitudes towards ibuprofen and breast surgery pain were unchanged. This signifies the need for more research involving single-use intravenous ibuprofen and postoperative breast surgery pain.

Keywords: Postoperative pain, pain prevention, breast surgery, ibuprofen, gabapentin, opioid usage, opioid side effects

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Introduction

In adults undergoing breast surgery, would the use of pre-operative intravenous ibuprofen versus perioperative gabapentin reduce postoperative pain and opioid consumption?

Population (P): Postoperative pain control in patients undergoing breast surgery.

Intervention (I): Preoperative single-dose intravenous ibuprofen

Comparison (C): Perioperative gabapentin

Outcome (O): Which agent provides superior analgesic control in the postoperative setting

Problem Identification

Pain control is a significant problem for those undergoing breast surgery.[1] Over the years, opioids have been the primary treatment modality for postoperative breast surgery pain.[2] The most common method for pain control involves a patient-controlled analgesia (PCA) pump that administers an intravenous opioid on command.[2] This PCA pump is provided to the patient postoperatively and administers a set dose upon the push of a button.[2] Unfortunately, the use of opioids carries negative consequences, including addiction, respiratory depression, urinary retention, addiction, and abuse.[3] Medical professionals have now been questioning the use of opioids and have been attempting to find other modalities for pain control.[3,4] Medications such as non-steroidal anti-inflammatories (NSAIDS) have shown promise as adequate analgesics; however, these medications are believed to have drawbacks, such as the increased risk of bleeding.[4]

Currently, there are many options for postoperative analgesic control for breast surgery patients.[2] Multiple medications can be used, including NSAIDS, dexmedetomidine, ketamine, and gabapentin.[2] Regional techniques, including paravertebral blocks and transthoracic epidural, can also be used.[2] More quality research is needed in many of these modalities for 3 reasons. First, postoperative pain led to more extended hospital stays and increased healthcare costs.[3]

Additionally, the use of opioids leads to opioid addiction, and the inability to control acute pain can lead to chronic pain.[3] Finally, there is no gold standard for treating postoperative pain for breast surgery patients.[2]

Background

Pain is one of the most common complications when undergoing surgery. Those undergoing breast surgery are not immune to this complication and can postoperatively develop acute and chronic pain. Multiple factors contribute to acute pain after surgery.[2] For example, patients undergoing mastectomy who are young and unmarried have increased acute pain intensity.[2] Anxiety plays a significant role as well.[2] Research shows that increased anxiety leads to increased pain levels.[2] These factors of age, anxiety, and marital status are complex interrelationships that increase the risk of acute postoperative pain.[2] Poor acute pain control directly after surgery is the number 1 risk factor for chronic pain.[2] Thus, women who are unmarried, young, and anxious also have an increased risk for chronic pain.[2] Patients undergoing a mastectomy can develop a form of chronic pain known as post-mastectomy pain syndrome (PMPS).[2]

PMPS is a chronic pain phenomenon that is poorly understood.[2] This phenomenon occurs mainly in patients undergoing breast surgery involving cancer; however, it may occur in those undergoing multiple types of breast surgery.[2] Breast surgery pain is predominately neuropathic, involving the damaged shoulder, axilla, and arm nerves.[2] Patients describe the pain as burning, stabbing, or similar to an electric shock.[2] Patients have even complained of phantom breast pain, similar to phantom limb pain.[2] Risk factors for chronic pain include age, acute pain management, and type of surgery.[2] Current research states that younger patients are at a greater risk of chronic pain.[2] The incidence of PMPS was 65% for patients 30-49 years, 40% for patients 50-59 years,

and 26% for patients 70 years and over.[2] The type of surgery plays a role in PMPS as well.[2] Chronic pain was more frequent in patients that received breast-sparing surgery versus radical surgery.[2] Acute or chronic pain leads to increased morbidity, decreased quality of life, decreased physical function, increased use of opioids, and opioid addiction.[2]

Scope of the Problem

The Institute of Medicine states that of the patients undergoing surgery, 80% have postoperative pain.[3] Of that 80% , 88% report having moderate to severe pain.[3] Patients undergoing breast surgery are not immune to postoperative pain.[2] Of the several thousand breast surgery patients per year, 57% develop acute postoperative pain.[2] Patients undergoing complex surgeries have an increased risk for acute and chronic pain.[2] For instance, pain lasting more than 1 year for patients undergoing mastectomy and reconstruction was 49%, for those undergoing mastectomy alone, 31%, and for breast reduction surgery, 22%.[2] Chronic pain and the prevalence of PMPS are becoming more widespread. Current studies suggest that more than 50% of patients suffer from PMPS.[2]

Opioids have been the cornerstone for pain control in patients undergoing breast surgery.[4] Several complications can stem from the use of opioids, including opioid abuse and overdose.[4] In 2018, opioid overdose led to 47,000 deaths.[4] Deaths from drug overdose tripled from 1999 to 2017.[4] Of the patients that had undergone breast surgery in 2017, 10% continued to fill their opioid perceptions 1 year after surgery.[4] These statics prove that acute and chronic pain predisposes women to opioid addiction and abuse.[4]

Consequences of the Problem

Pain has a significant impact on the health economy.[3] Studies estimate that the follow-up cost per patient after ambulatory surgery for inadequately controlled pain is $1,869 to $4,553 per visit.[3] Chronic pain, which develops from acute pain, was estimated in 2008 to cost the American economy $560 to $635 billion.[3] Pain affects multiple organs, including the lungs, heart, immune system, renal system, and gastrointestinal (GI) tract.[3] For example, pain causes hypoventilation and decreased vital capacity, leading to pneumonia.[3] Pain increases stress and oxygen demand on the heart, leading to myocardial ischemia.[3] Lack of gastrointestinal mobility leads to decreased gastric motility, constipation, and ileus.[3] The kidneys are also affected as pain increases urinary retention, sphincter tone, and oliguria.[3] The immune system becomes suppressed with pain leading to delayed wound healing and an increased risk for infection.[3] Pain, whether acute or chronic, leads to increased morbidity, decreased quality of life, decreased physical function, increased use of opioids, and opioid addiction.[2]

These adverse effects of opioids have a significant economic impact as they increase hospital costs and length of stay.[3] Chronic pain can lead to opioid abuse, which has created a multibillion-dollar financial burden in the United States.[5] The number of hospital visits and charges involving opioid dependence doubled from 2014-2017.[5] Individuals with severe neuropathic pain similar to breast surgery have poor mental health.[3] This negative consequence stems from poor sleep, decreased physical function, and an increased risk for depression and anxiety.[3]

Knowledge Gaps

Several methods, modalities, and medications are used in various ways to treat breast surgery pain; however, no standardized practice has been developed.[4] According to a survey by

the American Society of Breast Surgeons (ASBrS), multiple physicians use many techniques and medications to treat breast pain.[6] For instance, some surgeons use more than 31 different types of oral agents to treat pain while others utilize standard, enhanced recovery after surgery (ERAS) pathways.[6] This lack of standardization leads to unsafe practices and reduced quality of care.[6]

There is a lack of knowledge when discussing the variety of treatments for breast surgery pain. For example, NSAIDS for breast surgery pain have increased.[6] Fifty percent of surgeons served by the ASBrS utilized NSAIDs as an analgesic.[6] The 2 most used NSAIDs include ketorolac and ibuprofen.[6] These agents have little research on their analgesic efficacy and side effects involving breast surgery pain.[6] Preliminary thoughts on NASID use concern increased bleeding and hematoma risk.[6] However, there is no conclusive evidence of this risk factor.[6] Currently, more research needs to be conducted on NSAIDS to understand better if these medications reduce pain after breast surgery and what side effects may occur.[6]

Proposed Solution

There is currently no gold standard for the treatment of breast surgery pain.[4] Recent trends show that many physicians are moving away from opioids because of their adverse side effect profile.[4] Therefore, medical practitioners have been searching for alternative agents for postoperative pain relief.[4] Research has suggested that NSAIDs, such as ibuprofen and gabapentin, can be used as an analgesic for postoperative pain during breast surgery.[4]

There has been extensive research done on gabapentin and postoperative pain control.[7] Gabapentin contains analgesic properties and is structurally similar to the y-aminobutyric acid neurotransmitter (GABA); however, it does not act on the GABA receptors.[7] This medication reduces hyperexcitability within the spinal cords posterior horn by decreasing central sensitization.[7] The actual mechanism of action of gabapentin is still in question.[7] However, a

popular theory is that gabapentin binds to voltage-gated calcium receptors containing the alpha 2 -delta subunit located on postsynaptic dorsal horn neurons of the spinal cord.[7] This interaction decreases calcium influx, reducing neurotransmitter release and neuron depolarization providing an analgesic effect.[7] Gabapentin has been found to work well on neuropathic pain, which is common in breast surgery patients, especially those undergoing mastectomies.[7]

Ibuprofen can provide analgesia via its anti-inflammatory properties.[8] The mechanism of action involves inhibiting cyclooxygenase enzymes (COX -1 and COX -2).[8] COX-1 and COX-2 enzymes are responsible for the pain signaling cascade and the synthesis of prostaglandins within the peripheral and central nervous systems.[8] Inhibitions of COX enzymes and prostaglandins lead to an increased analgesic effect.[8] Several randomized clinical control trials have demonstrated that ibuprofen can provide adequate analgesia during the postoperative period.[9] These studies involve multiple procedures that show evidence of reduced opioid consumption.[9] Reducing narcotics leads to fewer opioid side effects and reduces the risk of overdose and abuse.[4]

Rationale and Objective

Current research on the use of ibuprofen for breast surgery pain is scarce.[6] More research is needed to determine if single-dose IV perioperative ibuprofen can reduce pain after breast surgery.[6] Multiple studies examine ibuprofen versus placebo and gabapentin versus placebo; however, no current research compares the analgesic efficacy of ibuprofen versus gabapentin on patients receiving breast surgery. The aim is to conduct a literature review to find prior research on gabapentin and ibuprofen individually compared to placebo. Finally, statistically significant data will be obtained to compare and contrast the effects of the 2 medications.

Literature Review

Eligibility Criteria

There was no limit on the design study or level of evidence. Randomized clinical control trials and systemic reviews were preferred over other articles. The applied filters included peer-reviewed articles, full-text articles written in English, and articles published between 2016 and 2022. Inclusion criteria were articles written in English, adult patients 18 years or older, patients undergoing breast surgery, single dose perioperative intravenous ibuprofen/caldalore or perioperative gabapentin for postoperative pain control, peer review articles, and randomized clinical control trials. Exclusion criteria included patients less than 18 years of age, articles written before 2016, and non-English articles.

Information Sources

The PICO question prompted the search for articles that support or refute the question. A literature review was performed using Cumulated Index to Nursing and Allied Health Literature (CINAHL), PubMed, MEDLINE, Cochrane Library, and the American Association of Nurse Anesthesiology (ANAA) website.

Search Strategy

Initially, 150 studies were identified. The search was narrowed to studies comparing perioperative IV ibuprofen versus placebo or perioperative gabapentin versus placebo for postoperative pain control. Studies comparing ibuprofen or gabapentin administered after or during surgery were excluded. The search was limited to studies comparing intravenous ibuprofen. Any studies that examined oral ibuprofen were excluded. Studies included a variety of

procedures due to the lack of randomized control trials (RCTs) involving breast surgery and ibuprofen/gabapentin.

Keywords

The terms used included "Perioperative," "Intravenous Ibuprofen," "Intravenous Caldolor, " "Preoperative gabapentin," "Gabapentin, " "Breast Surgery," "breast surgery patient," "mastectomy," "breast reconstruction," "postoperative pain," "pain control," "reduce," "decrease," and "adult." The linking words AND, OR, and NOT were used with the above phrases to provide research study results.

Study Characteristics

The literature review data was collected from randomized clinical control trials or systematic reviews comparing the analgesic effectiveness of ibuprofen to placebo or gabapentin to placebo in breast surgery patients. An indirect comparison from the data obtained was performed, which allows one to associate these 2 drugs.

Literature Review Results

In the study by Ahiskalalioglu et al., an RCT was performed to study the effects of 400mg preemptive ibuprofen on pain control and opioid consumption for patients undergoing laparoscopic cholecystectomy.[10] The sample of this study contained 60 patients, with 30 patients in the control group who received 100 ml of normal saline and 30 patients in the ibuprofen group who received 400 mg of Ibuprofen.[10] Visual analog scores measured pain with active and passive movements over 24 hours.[10] Opioid consumption of fentanyl was measured over 24 hours via a patient control pump.[10] The study found that opioid consumption was reduced by 45% in the

ibuprofen group and generated lower visual analogue scale (VAS) scores compared to the placebo.[10]

The RCT by Celik et al. examined the analgesic effects and opioid consumption of ibuprofen versus acetaminophen in patients receiving septorhinoplasty.[11] The sample size for this study was 150 patients, with 50 patients in the control group, 50 in the acetaminophen group, and 50 in the Ibuprofen group.[11] The acetaminophen group received 1000mg of IV acetaminophen prior to surgery, while the ibuprofen group received 800mg of IV ibuprofen prior to surgery.[11] VAS scores were collected over 24 hours to measure pain, and opioid consumption was determined by the amount of tramadol administered via a PCA pump over 24 hours.[11] Ibuprofen was found to have lower opioid consumption compared to acetaminophen in the first 12 hours post-surgery.[11] Ibuprofen was found to have a lower VAS score compared to acetaminophen over 24 hours.[11]

The study by Gozeler et al. examined the analgesic effects of 800mg of preemptive Ibuprofen on patients receiving septorhinoplasty.[12] Fifty patients were split into a control group , which received 100 ml of normal saline, and an Ibuprofen group, which received 800 mg of IV Ibuprofen.[12] Pain scores were measured using the VAS scale, and opioid consumption was measured using a fentanyl PCA pump.[12] Both factors were measured over 24 hours.[12] Patients in the ibuprofen group had reduced VAS scores and opioid consumption compared to the placebo group.[12] The control group had a total of 12 patients utilize the analgesic rescue agent, while the Ibuprofen group had 4 patients utilize the rescue agent.[12]

Mutlu et al. performed an RCT that studied the analgesic effects of preoperative IV Ibuprofen administration on patients receiving a thyroidectomy.[13] The study involved 40 patients who were divided into 2 groups: a control group (n = 20) and a study group (n = 20) who

received 800 mg of ibuprofen.[13] VAS scores and opioid consumption were measured over 48 hours.[13] The ibuprofen group received fewer opioids and was measured using a fentanyl PCA.[13] VAS scores were reduced at all time points compared to the control group.[13] The use of analgesic rescue agents was less in the ibuprofen group (n = 8) compared to the control group (n = 2).[13]

The RCT performed by Ekinci et al. compared the analgesic effects of preemptive acetaminophen and ibuprofen on patients receiving a laparoscopic cholecystectomy.[14] The study contained a total of 90 patients who were randomly placed into a control group (n = 30), an acetaminophen group (n = 30), and an Ibuprofen group (n = 30).[14] The control group received 100ml of normal saline, the acetaminophen received 1000 mg preoperatively, and the ibuprofen group 800mg preoperatively.[14] VAS scores were used to measure pain, and opioid consumption was measured using a fentanyl PCA pump.[14] These factors were measured over 24 hours. For all time points, ibuprofen was superior in analgesic control and opioid consumption.[14] The use of an analgesic rescue agent was lowest in the ibuprofen group (n = 1) compared to the control group (n = 10) and the acetaminophen group (n = 9).[14]

Abdallah et al. performed an RCT that examined the analgesic effects and Opioid consumption of patients receiving gabapentin and dexmedetomidine infusion compared to placebo.[15] The study consisted of 30 patients receiving radically modified mastectomy.[15] Fifteen patients (GD group) received 400mg of preoperative gabapentin with a dexmedetomidine bolus and continuous drip during the intraoperative period.[15] The control group consisted of 15 patients who received a placebo pill and normal saline.[15] Opioid consumption was measured by the amount of morphine administered by the nurse over 24 hours.[15] VAS scores measured pain over 24 hours.[15] VAS scores and morphine consumption were lower in the GD group than in the control group.[15]

Jiang et al. performed a systemic review on gabapentin and its effects on reducing pain intensity and morphine consumption after breast surgery.[16] A total of 9 RCTs were found in this meta-analysis.[16] VAS scores were utilized in all studies to measure pain.[16] Six studies measured VAS scores directly after surgery pooled results and found that gabapentin reduced VAS scores by 16 points.[16] Four studies examined VAS scores throughout 24 hours, and pooled results found that gabapentin reduced VAS scores by 27 points after 24 hours.[16] Total morphine consumption was determined in 8 studies, and pooled results indicated a decrease in morphine consumption after surgery by 4.59 mg when using gabapentin.[16]

Hu et al. performed a systemic receive examining the effects of preemptive gabapentin on acute postoperative pain.[17] This meta-analysis evaluated the effects of postoperative pain and opioid consumption involving the dose of gabapentin and pregabalin.[17] The meta-analysis found 69 studies with a total of 6,201 that were administered single-dose pregabalin and gabapentin.[17] These studies included multiple types of surgical patients ranging from cardiac to neurosurgical patients.[17] Fifty-two of the studies, which included 3,027 total patients, reported data on opioid consumption and found that all doses of gabapentin and pregabalin reduced pain.[17] This effect was increased as the dosage of gabapentin and pregabalin increased.[17] Patients who received 150-300mg of pregabalin and 900-1200mg of gabapentin experienced the least pain.[17] However, those who received 1200mg of gabapentin experienced increased nausea and vomiting.[17]

Eidy et al. conducted a randomized clinical control trial that studied the effects of gabapentin and pregabalin on patients receiving laparoscopic cholecystectomies.[18] The study contained 108 patients who were placed into 3 groups: a control group (n = 36), a pregabalin group (n = 36), and a gabapentin group (n = 36).[18] Patients prior to surgery received gabapentin 800 mg or pregabalin 150mg.[18] The patients' pain was measured using the VAS score, and a

pethidine PCA pump measured Opioid consumption.[18] Both factors were measured over 24 hours.[18] Opioid consumption and VAS scores were the lowest in the pregabalin group compared to gabapentin and placebo.[18]

Sanders et al. performed an RCT involving gabapentin on postoperative tonsillectomy pain.[19] A sample size of 73 patients participated in this study.[19] The patients were divided into a control group (n = 31), which received 1000 mg of acetaminophen and placebo, and a gabapentin group (n = 27), which received 600mg of gabapentin and 1000mg of acetaminophen.[19] A VAS scale was used to measure pain, and fentanyl, Tylenol, and Codeine administration measured analgesic consumption.[19] VAS scores were broken down into 2 categories: VAS with swallowing (VASs) and VAS at rest (VASr).[19] There was no difference in VASs or VASr when comparing gabapentin and placebo.[19] VAS scores were higher in the gabapentin group on postoperative days compared with the placebo.[19]

Discussion/Summary of Evidence

Perioperative administration of multiple medications has been researched to help reduce postoperative pain following breast surgery. NSAIDs, particularly ibuprofen, have been shown to reduce postoperative pain and opioid consumption in multiple surgical populations. The 2 most popular NSAIDs currently used for breast surgery pain are ketorolac and ibuprofen.[6] While the research with breast surgery patients is extensive regarding ketorolac, research with single-dose preoperative ibuprofen is still in the preliminary stages.[6] Many RCTs involve different surgical populations, such as thyroid surgery, laparoscopic cholecystectomy, and septorhinoplasty, all of which found ibuprofen to provide adequate analgesia.[9-14] For example, Ahiskalioglu et al. and Ekinci et al. found that preemptive ibuprofen reduced postoperative pain and opioid consumption for patients undergoing laparoscopic cholecystectomy.[10,14] Both studies found that using an

analgesic rescue agent for pain control was less in groups receiving Ibuprofen. Ekinci et al. also found that Ibuprofen was superior to Tylenol for postoperative analgesia control and opioid consumption.[14] Multiple studies found that Ibuprofen reduced acute postoperative pain.[9-14] For instance, Celik et al. found that the analgesic effects of ibuprofen were greatest 12 hours after surgery for those receiving septorhinoplasty.[11] The proper dosage of ibuprofen that allows for adequate pain control must be better researched.

Gozeler et al. and Celik et al. found that preoperative intravenous (IV) Ibuprofen at a dose of 800 mg provided adequate postoperative pain control in those undergoing septorhinoplasty.[11,12] Ibuprofen has been shown to reduce the number of opioids needed after surgery.[9-14] The use of opioids causes several unwanted side effects. Mutlu et al. found that because of the opioid-sparing effects of ibuprofen, patients had fewer opioid-induced side effects such as nausea and vomiting.[13]

Gabapentin has been incorporated into numerous studies, and research shows that it reduces acute postoperative breast pain and analgesia requirements.[7] For example, Abdallah et al. found that patients undergoing modified radical mastectomies had reduced pain scores and opioid consumption when receiving perioperative gabapentin.[15] Similar results were found in a systemic review by Jiang et al., who found that gabapentin reduced acute postoperative and chronic postoperative breast pain.[16] Hu et al. found that patients had increased acute pain control depending on the dosage of gabapentin; however, this systemic review involved multiple types of surgery, not just breast surgery alone.[17] This study also found that large doses of gabapentin can increase the risk of side effects such as nausea and vomiting.[17] Not all studies found that gabapentin provides postoperative analgesia. Sanders et al. found that patients undergoing

tonsillectomy receiving gabapentin had no reduction in postoperative pain compared to a placebo.[19]

The current research on postoperative breast surgery pain found that the methodology between RCTs and systemic reviews was similar. All studies reviewed used the visual analog scale to measure postoperative pain.[10-19] Hu et al. used the visual analog scale (VAS) and numeric rating scale (NRS) to measure pain.[17] The reason for the use of the visual analog scale is that many of the studies were performed in different countries where different languages and dialects are spoken; thus, using a tool that provides images to interpret and quantify pain allows for more accurate results.[16] Many studies used the patient analgesia control device (PCA) to quantify opioid consumption.[9-16] Opioid consumption was measured over 24 hours in most studies.[10,12,13-18] Some studies would administer the opioid once a specific VAS score was reached.[12] Abdallah et al. administered morphine once the VAS score was above 3.15. The most popular opioid quantified was fentanyl. Other opioids used included morphine, meperidine, and tramadol.[11,16,18] Three studies found only used opioid consumption but also quantified the number of times a rescue agent was needed for postoperative pain.[10,12-14]

Conclusions

Research has been conducted on postoperative pain control and ibuprofen with multiple surgeries.[9-14] These studies have exemplified its analgesic properties for postoperative pain with various procedures; however, the research on ibuprofen and postoperative breast surgery pain is minimal.[6] This lack of knowledge may stem from current beliefs and the adverse effects of Ibuprofen. Ibuprofen is believed to increase the risk of hematoma in patients who have received breast surgery.[6] Evidence is conflicting on this matter; however, Walker et al. performed a systemic review involving hematoma development after plastic surgery and found no increase in

the risk for hematoma with NSAIDs.[20] The current research exemplifies the lack of data on single-dose ibuprofen and its effects on postoperative breast surgery pain.[6] More research on this topic must be conducted to bridge this gap.[6] Large multicenter studies are needed to understand better ibuprofen's effects on breast surgery pain and its possible adverse effects. This project can provide vital information to understand better ibuprofen and its relationship to postoperative breast surgery pain.

Citation	Design/Methods	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Ahiskalioglu et al.,[10] 2017	Randomized Double-Blind Clinical Control Trial Effects of single-dose preemptive intravenous ibuprofen on postoperative opioid consumption and acute pain	60 patients undergoing Laparoscopic Cholecystectomy Age 18-65 with a American Society of Anesthesiology (ASA) I-II	DV1: Postoperative analgesia was assessed by VAS with passive and active movements. Active movements were defined as moving from a lying to sitting position. DV 2: Opioid consumption was defined as Fentanyl consumption within a 24-hour period. IV 1: Age IV 2: ASA IV 3: Gender	Postoperative analgesia was assessed by VAS with passive and active movements: 0 = no pain VAS = 10 the most severe pain. VAS score above 4 received 25 mg of Meperidine. VAS scores were determined at 30 min, 1, 2, 4, 8, 12, and 24 hours. Fentanyl consumption was measured to determine the amount of opioid consumption. Patients received PCA postoperatively. PCA was set to 10 mcg concentration with a 10-minute lockout period and a 25-mcg bolus with no basal infusion for 24 hours. SPSS Statistical analysis was used. Categorical variables analyzed using chi square test. A P value of less than 0.05 was statistically significant. Data with a Normal distribution was analyzed using the student t-test, or a man-Whitney U test.	There was no difference found within the groups involving height, age, weight, ASA classification, duration of anesthesia or surgery, *p*-value > 0.5. VAS scores were found to be lower in the ibuprofen group, *p*-value < 0.05. Fentanyl consumption was always lower in the ibuprofen group with a *p*-value of less than 0.001. Use of postoperative analgesic rescue agent was higher in the placebo group compared to Ibuprofen, *p* < 0.012.	Ibuprofen produced lower VAS scores over a 24-hour period when compared with the placebo. Ibuprofen reduced fentanyl consumption over the 24-hour period when compared with the placebo. The use of postoperative rescue agent was lower in the ibuprofen group then the placebo group.	For patients undergoing laparoscopic cholecystectomy Ibuprofen can used for adequate analgesia control and reduced opioid consumption.	Randomized clinical control trial Level II Evidence. Strengths: All operations performed by the same surgical team under the same technique. Anesthesia technique was performed in the same manner. No differences were reported involving height, weight, gender, or length of procedure P > 0.05. Weaknesses/limitations: Sample size is small. Patients who have a greater ASA or increased morbidities were not included. Risks to patients: use of narcotics can cause nausea vomiting, drowsiness, dizziness, respiratory depression, and urinary incontinence. Feasibility: The RCT demonstrates that ibuprofen can provide adequate analgesia for patients undergoing laparoscopic cholecystectomy is clinically relevant

Citation	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Celik et al.[11], 2018	Randomized Clinical Control Trial Comparison of perioperative IV ibuprofen vs. acetaminophen for postoperative pain control	150 patients undergoing septorhyioplasty ages 18-65 ASA I-II were selected. Study was performed in a hospital setting.	DV 1: Postoperative pain defined by VAS scores. DV 2: Opioid consumption was defined as a patient analgesic control device (PCA) that administers IV tramadol. IV 1: Age IV 2: ASA IV 3: Gender	Postoperative pain measured by VAS scores VAS of 0 no pain and a VAS of 10 equals the most server pain. VAS scores were measured at hours 0, 6, 12, and 24 hours postoperatively. Opioid consumption was measured by a PAC device that administered a loading dose of 50mg IV tramadol and a demand dose of 20mg Tramadol with a 20-minute lockout time. Opioid consumption was measured at 0-6, 6-12, and 12-24 hours. SPSS was used for statistical analysis. Data distribution was evaluated with the Kolmogorov–Smirnov test. Pearson x^2 compared groups involving categorical data. One way ANOAVA with a Tukey's test was used to determine differences among groups.	VAS scores were lower for ibuprofen group compared with the placebo group and the control group ($p < 0.05$) for all postoperative hours. Group I and group P had lower opioid consumption for all post- operative hours then group C ($p < 0.05$).	Ibuprofen allowed for the lower VAS scores in the first 24 hours postoperatively compared to the placebo. Ibuprofen allowed for lower opioid consumption compared to the placebo.	Ibuprofen provides better analgesic control. Ibuprofen reduces opioid consumption more in the first 12 hours compared to acetaminophen postoperatively for patients undergoing septorhinoplasty.	Strengths: Randomized clinical control trial Level II Evidence. No deviation from anesthetic technique. Limitations/weaknesses: only 800mg of Ibuprofen and 1000mg of Paracetamol were used the dosages did not consider the patient's weight. All patients received methyl-prednisolone which has analgesic effects. All patients received remifentanil intraoperatively. Cost and length of stay was not takin into account. Small sample size. Risks to patients: Use of narcotics can cause nausea vomiting, drowsiness, respiratory depression, dizziness, and urinary incontinence. Feasibility: The RCT demonstrates that ibuprofen can provide adequate analgesia for patients undergoing septorhinoplasty and is clinically relevant.

Citation	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Gozeler et al.,[12] 2018	Randomized Clinical Control Trial Compares perioperative IV Ibuprofen VS placebo and how they change postoperative pain.	51 patients undergoing septorhinoplasty ages 18-40 ASA I-II. Study performed in the hospital setting	DV 1: Postoperative pain defined by a VAS score. DV 2: Postoperative opioid consumption define by the amount of fentanyl administered 24 hours postoperatively. IV 1: Age IV 2: Gender IV 3: ASA	Postoperative pain measured by a VAS score, 0 equal to no pain and 10 equals the most severe pain. Postoperative opioid consumption was measure by a fentanyl consumption by a PCA. The PCA was set to 10 mcg concentration with a 10-minute lock out period and a 25-mcg bolus with no basal infusion for 24 hours. Distribution variables were assessed using the Kolmogorov–Smirnov test. The *t*-test was used to assess categorical variables. Normal distribution was analyzed using the student *t*-test. Nonparametric data was assessed with the Mann-Whitney U test. A *p*-value of less then 0.05 was statistically significant.	VAS scores at 10, 20, and 30 minutes and at 1, 2, 4, 8, 12 and 24 hours were lower in the ibuprofen group than in the control group ($p < 0.05$) Total fentanyl consumption was lower in the ibuprofen group compared to the placebo group (148.8 ± 86.4 mcg vs 338.00 ± 81.00 mcg, respectively) ($p < 0.001$). Postoperative rescue analgesic use was significantly higher in the placebo group ($n = 12$) than in the ibuprofen group ($n = 4$) ($p = 0.012$).	Ibuprofen allows for lower VAS scores postoperatively when comparing the ibuprofen group and placebo group. opioid consumption was reduced postoperatively when comparing the ibuprofen group vs the placebo group.	A single dose of 800mg Ibuprofen preoperatively allows for pain control and reduces opioid consumption in patients receiving septorhino-plasty.	Strengths: Randomized Clinical Control trial level 2 evidence. No deviation from anesthetic technique. No variation was seen regarding age, height, weight, ASA score, length of surgery, or duration of anesthesia. Limitations/ weaknesses: small sample size, surgeons fear of increased risk of bleeding with ibuprofen administration. Risks to patients: use of narcotics can cause nausea vomiting, drowsiness, respiratory depression dizziness, and urinary incontinence. Feasibility: The RCT demonstrates that ibuprofen can provide adequate analgesia for patients undergoing septorhinoplasty.

Citation	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Mutlu et al.,[13] 2019	Randomized Clinical Control Trial Compares perioperative ibuprofen and its effects on postoperative pain	50 patients Receiving thyroidectomy. ASA I-III Age 18-65. Study was performed in a hospital setting	DV 1: Postoperative pain was defined by the VAS scale. DV2: Postoperative opioid consumption was defined as the total amount of fentanyl used 48 hours postoperatively. IV 1: Age IV 2: Gender IV 3: ASA	Postoperative pain was measured by the VAS scale. 0 equals no pain and 10 equals the most severe pain. Postoperative opioid consumption was measured by fentanyl consumption. Patients received PCA postoperatively. PCA was set to 10 mcg concentration with a 10-minute lock out period and a 25 mcg bolus with no basal infusion for 48 hours. SPSS statistical analysis was used. The Kolmogorov-Smirnov test was used to measure variable distribution. Chi-square test was used to measure categorical variables. The student *t*-test measured normally distributed data, otherwise The Mann Whitney U-test was used P values of less than 0.05 were statistically significant.	VAS scores at 30th minute and 1, 2, 4, 8, 12, 24 and 48th hours were lower in the ibuprofen group than the control group $p < 0.05$ Fentanyl consumption was lower in the ibuprofen group compared to the control group during postoperative 48 hour period. $p < 0.0001$ Th use of postoperative rescue analgesic (paracetamol IV) was higher in the control group VS the ibuprofen group $p = 0.028$.	The use of Ibuprofen provides adequate analgesia and reduces opioid consumption and opioid induced side effects in patients who have undergone a thyroidectomy.	Single dose IV ibuprofen decreases pain scores and postoperative opioid consumption in patients following thyroidectomy. Ibuprofen also increases patient comfort reducing nausea and vomiting postoperatively.	Strengths: Randomized clinical control trial. All operations were performed under the same anesthesia technique with the same surgical team. No other premedications were administered. Weakness/limitations: Was not compared with another analgesic, only a single dose of Ibuprofen was administered, and small sample size. Risks to patients: Use of narcotics can cause nausea vomiting, drowsiness, respiratory depression dizziness, and urinary incontinence. Feasibility: The RCT demonstrates that ibuprofen can provide adequate analgesia for patients undergoing thyroidectomy.

Citation	Design/ Method	Sample/Setting	Major Variables Studied and Their Definitions	Measurement And Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Ekinci et al.,[14] 2020	Randomized Clinical Control Trial Compares perioperative intravenous Ibuprofen versus placebo for postoperative pain control	90 patients undergoing laparoscopic cholecystectomy ages 17-70, ASA I-II. Study was performed in a hospital setting.	DV1: Pain was defined by the VAS score 0 being no pain and 10 being the worst pain. DV 2: Opioid consumption was defined as the amount of fentanyl consumed over a 24-hour period postoperatively. IV 1: Age IV 2: Gender IV 3: ASA	Pain was measured by assessing VAS scores with 0 = no pain and 10 = the most severe pain. Opioid consumption was measured by the amount of fentanyl consumed by the patient in a 24-hour period. The PCA device with a dose of 10 mcg concentration fentanyl was programmed no basal infusion, 20 mcg bolus dose, and 20-min lockout time. SPSS statistical analysis was used. One way ANOVA with a Tukey's test was used to determine differences among groups. Distribution variables were assessed using the Kolmogorov-Smirnov test. Chi-square test was used to measure categorical variables.	Pain scores in group A and B were lower than group C, *p*-value < 0.05. Patients in the I group had lower VAS scores compared to acetaminophen *p*-value < 0.05. Opioid consumption was lower in group I then all other groups, *p*-value < 0.05. Ibuprofen had less rescue agent compared to the other groups *p*-value < 0.05.	Acetaminophen and ibuprofen both reduced pain scores over the 24-hour postoperative period. Patients receiving ibuprofen experienced lower VAS scores then those who received acetaminophen. The ibuprofen group utilized the rescue analgesic agent the least when compared to the acetaminophen group and the control group.	Ibuprofen compared to acetaminophen provides lower pain scores and less opioid consumption in patients undergoing laparoscopic cholecystectomy.	Strengths: Randomized clinical control trial, Level II evidence. Ibuprofen is compared to another agent. No other agents administered that could interfere with the results. Weaknesses/ Limitations: There is confusion in this article for the author on whether ibuprofen and acetaminophen were administered once perioperatively or every 8 hours postoperatively. Small sample size. Ibuprofen comes in 2 forms 800mg and 400mg only the 800g was used. Risks to Patient: Use of narcotics can cause nausea vomiting, drowsiness, respiratory depression dizziness, and urinary incontinence. Feasibility: This study can be applied to clinical practice and shows strong evidence that ibuprofen can be used for analgesic control for laparoscopic cholecystectomy surgery.

Citation	Design/Method	Sample/Setting	Major Variables Studied and Their Definitions	Measurement And Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Abdallah et al.,[15] 2022	Double blind randomized clinical control trial Compares the efficacy of perioperative gabapentin vs dexmedetomidine for postoperative pain control	Sample included 30 Female patients ASA I-II receiving modified radical mastectomy at a medical center located in Egypt.	DV 1 = VAS scores were used to determine patient's pain. DV 2 = Morphine consumption was defined as the amount of morphine administered to the patient in the first 24 hours post op. IV 1 = Weight IV 2 = Age	Pain was assessed immediately after surgery using the VAS score at 2, 4, 6, 12, 18, 24 hours post op. If the VAS score was greater than 3, then 2 mg of morphine was administered. Statistical analysis was done using SPSS. Data was expressed as a mean and standard deviation Qualitative data was expressed as a frequency or percentage. The Chi square test determined the relationship between qualitative variables. *P*-values less then 0.05 were considered significant.	VAS score was lower in the GD group then in the placebo group. VAS scores were lower at all hours of postoperatively except for hour 18. Intraoperative fentanyl consumption and postoperative morphine consumption were drastically reduced in the GD group compared to the placebo group.	VAS scores were lower in the group receiving gabapentin. Opioid consump-tion during the intra-operative and post-operative period was reduced in the gabapentin group.	Perioperative gabapentin and intraoperative infusion of dexmedetomidine can be utilized as analgesic alternatives for patients undergoing MRM surgery.	Strengths: Randomized clinical control trial. Level II evidence. The same anesthetic technique was used for each patient. Limitations: Small sample size. There seems to be no statistical findings reported. Risk to Patients: Harmful effects of opioid use include respiratory depression, urinary retention, constipation, drowsiness, dizziness, nausea and vomiting, Patients are at risk of bradycardia and hypotension with the use of dexmedetomidine. Feasibility: This study demonstrates that gabapentin and dexmedetomidine can be used to provide analgesia control to those undergoing MRM surgery.

Citation	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Jiang Y et al.,[16] 2018	A systemic review of randomized clinical control trails (RCTs) Studies the effects of gabapentin on postoperative pain control	9 Articles were found that fit the inclusion criteria which was to determine the efficacy of gabapentin for the treatment of postoperative breast cancer surgery.	DV 1 = Pain was defined through the visual analog scale after surgery. DV 2 = Opioid consumption was defined as the amount of morphine consumed in a 24-hour period. IV 1 = Amount of gabapentin administered. IV 2 = Patients undergoing breast cancer surgery.	Opioid consumption was measured as the amount of morphine consumed in a 24-hour period. If other opioids such as hydromorphone or fentanyl was used they were converted to equivalent amount of morphine. Pain was measured through the visual analog scale after surgery if the numerical rating scale was used it was converted to the VAS scale. VAS was measured directly after surgery and 24 hours after surgery. Statistically heterogeneity was tested using the chi-squared test and I^2 statistic. $I^2 < 50\%$ and $P > .1$ indicates no evidence of statistical heterogeneity.	VAS directly after surgery middle heterogeneity was found $I^2 = 46.3\%$, $p = .097$. VAS scores 24 hours after surgery high heterogeneity $I^2 = 95.7\%$ $p = 0.00$ Total morphine consumption high heterogeneity $I^2 = 97.4\%$ $p = .000$.	VAS scores were reduced by 16.14 points directly after surgery when administering gabapentin. VAS scores were reduced by 27.33 points 24 hours after surgery when administering gabapentin. Total morphine consumption was reduced by 4.59 mg when administering gabapentin.	Gabapentin can provide immediate pain control, chronic pain control, and a reduction in opioids for those undergoing breast cancer surgery.	Strengths: Level I evidence. The meta-analysis only including studies that involved breast cancer surgery and gabapentin alone. Limitations: Only 9 RCTs were found, which could affect the accuracy of the results. The studies that were chosen administered gabapentin at given times, which may increase heterogeneity. Unable to determine publication bias. Feasibility: Gabapentin can provide postoperative pain control for those receiving breast surgery and can be used in the clinical setting.

Citation	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Hu et al.,[17] 2018	Systematic review of RCTs Systemic review examining the efficacy of perioperative gabapentin and pregabalin on postoperative pain control	Sample size including 79 RCTs involving the analgesic effects of gabapentin in the postoperative stage of surgery Several different types of surgeries were included in the systemic review. Inclusion criteria: Premedication with gabapentin or pregabalin. Acute postoperative pain. Operation under intervertebral or general anesthesia. Exclusion criteria: Chronic pain, multiple doses of pregabalin or gabapentin, operations under local anesthesia	DV I = Pain score was defined through a Visual analog scale or Numerical rating scale, and pain with movement. DV II = Opioid consumption amount of opioids consumed post-surgery IV I = Use of gabapentin as the intervention and amount of gabapentin administered IV II = Type of surgery that was performed IV III = Patient age and gender	The VAS and NRS tools were used to measure pain. 0 indicated no pain and 10 indicated the most severe pain. Opioid consumption was determined by the amount of opioids administered after surgery. There was no standard unit for the measurement opioid consumption Standardized mean difference (SMD) was used to measure the outcomes pain score with movement, pain score at rest, and opioid consumption. Surface under the cumulative ranking curve (SURCA) was used to rank each outcome and the quality of that intervention. The higher the value, the better the quality of the intervention.	The largest SUCRA values were as follows for opioid consumption GBP 1,200mg = 81.1, GBP 900 mg = 69.4 The largest SURCA values were as follows for pain control at rest. GBP 1200mg = 77.6 GBP 900 = 86.1 Patients who received 1200mg of gabapentin demonstrated an increase in PONV OR 5.21, 95% CI 1.48, 18.34.	Gabapentin and pregabalin allow for a reduction in opioid consumption and an increase pain control during the postoperative time frame.	Gabapentin and pregabalin can reduce pain scores and opioid consumption in patients undergoing a variety of different procedures in a dose dependent manner.	Strengths: Level I evidence. Large sample size. This study only including RCTs that administered perioperative gabapentin and pregabalin. Limitations: Examines 2 agents not only gabapentin. Large study that incorporates a variety of procedures. Examines the dosing effect of the drugs. There was heterogeneity of opioid consumption Feasibility: Exemplifies that the dosage of gabapentin has s large impact on pain control and opioid consumption however it does not show evidence of gabapentin and its effect on breast surgery pain

Citation	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement and Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Eidy et al.,[18] 2017	Randomized clinical control trial This study examined the efficacy of pregabalin and gabapentin on postoperative pain control.	108 patients undergoing laparoscopic cholecystectomy ASA 1-II age 20-60 The setting was Shahid Beheshti Hospital at the Kashan University of Medical Sciences.	DV 1 = Pain intensity was measured using the Visual analog scale. DV 2 = Opioid consumption was defined by the amount of pethidine administer by the PCA. IV I = ASA IV 2 = Age IV 3 = Gender	Pain intensity was measured using the Visual analog scale. 0 indicated no pain and 10 indicated the most server pain. Pain intensity scores were measured as 2,4,6,12 and 24 hours postoperatively. Opioid consumption was defined by the amount of pethidine administer by the PCA at hours 2, 4, 6, 12, and 24 post surgery. If patient VAS score was above 4 then the patient received a rescue dose of 25 mg. Data were analyzed using a repeated measurement test chi-square test, 1-way ANOVA test, and post hoc Dunnett's test. *P*-values less then 0.05 were statistically significant.	Postoperative pain scores differed significantly between groups $p < 0.001$. Postoperative pethidine consumption showed interaction between the groups $p < 0.001$ so a comparison was not possible. Based on the 1-way ANOVA test there was a difference between the groups. Post hoc Dunnett's test showed that all pair wise comparisons of the groups were significant $p < 0.05$	The gabapentin and pregabalin groups showed reduced pain intensity scores compared to the placebo group. Comparison of opioid consumption was not possible due to interaction between the groups.	The use of gabapentin and pregabalin can be used to control pain in patients receiving laparo-scopic cholecystectomy	Strengths: Level II evidence. Compares gabapentin to a placebo and another agent. Patients receive these medications only in perioperative setting. Limitations: Small sample size, does not include patients with major comorbidities, interactions between the groups disallowed the comparison of opioid consumption with gabapentin vs pregabalin. Risk to patients: Opioid and Gabapentin side effects such as nausea vomiting dizziness and lightheaded ness from gabapentin. Feasibility: This study shows strong evidence that gabapentin can be utilized for adequate pain control in patients receiving laparoscopic cholecystectomy.

Citation	Design/Method	Sample/Setting	Major Variables Studied and Their Definitions	Measurement And Data Analysis	Findings	Results	Conclusions	Appraisal: Worth to Practice/Level
Sanders et al.,[19] 2017.	Randomized double blind clinical control trial Studies the efficacy of gabapentin on postoperative pain	73 adults undergoing tonsillectomy surgery age 16-65. Southern district Health board University Hospitals New Zealand.	DV 1= Pain was defined by the visual analog scale. DV 2 = Analgesic consumption was defined as the amount of fentanyl, acetaminophen, and codeine consumed. IV 1= ASA IV 2 = Weight IV 3 = Age	A VAS score was used to measure pain. The face to the far left indicated no pain while the face to the far right indicated the most severe pain. Analgesic consumption was determined by the amount of fentanyl, codeine, and acetaminophen consumed during the day of surgery and the entirety of the hospital stay. Acetaminophen and codeine were offered at regular intervals. Fentanyl was administered when the VAS score was at or above 4. VAS scores were taken at rest (VASr) and with swallowing (VASs). Linear mixed model was used to compare the continuous outcomes of VASr and VASs.	VASr and VASs scores showed the following differences. For the placebo group 6.3 and 23.2. For the gabapentin group 6.3 and 25.9. Rest Pain: Pain intensity was lower in the gabapentin group, but no statical differences were found 2 hours, $P = .309$; 4 hours $P = .338$; 6 hours $P = .369$	There was no significant statistical difference in pain scores between the gabapentin group and the placebo group.	For patients undergoing tonsillectomy, the gabapentin shows no benefit to pain control during the postoperative period.	Strengths: Randomized Clinical Control trail level II evidence. Limited selection, allocation, and bias. More participants were recruited then suggested by power analysis. Limitations**:** 2 surgeons used for the procedures performed increasing variability. Nurse controlled analgesia was used instead of patient-controlled analgesia. Risk to patient: Side effects of opioids respiratory depression, constipation, nausea, and vomiting. Feasibility: This study is applicable to clinical practice

Purpose of DNP Project

Primary DNP Project Goal

Opioids have become the primary treatment for postoperative breast surgery pain.[2] The current medical facility in South Florida is no stranger to this technique, as it uses intravenous hydromorphone as the primary postoperative analgesia for multiple surgical populations, including those receiving breast surgery. This center also uses other medications, including oral preoperative acetaminophen and gabapentin. The administration of IV ibuprofen is usually done during the intraoperative period. Intravenous ibuprofen is only used by a few certified registered nurse anesthetists (CRNAs). This hospital's current beliefs and culture suggest that ibuprofen is not used for analgesic purposes in breast surgery patients due to its risk for hematoma. Research demonstrates inconclusive evidence on the increased risk of hematoma formation with ibuprofen use.[6] The primary goal of this quality improvement project was to educate the CRNAs at this level 1 trauma center in South Florida about the benefits of preoperative IV ibuprofen in reducing postoperative pain and opioid consumption in breast surgery patients.

Conceptual Underpinning

SMART Goals and Outcomes

Specific.

To educate the CRNAs on the benefits of using preoperative IV Ibuprofen versus preoperative oral gabapentin for pain control after breast surgery. Administering ibuprofen before breast surgery can reduce postoperative pain and the number of opioids during the postoperative period.[2] This decrease in opioids reduces opioid-induced side effects, the risk of addiction, and overall hospital costs.[2]

Measurable

An educational module was performed to educate CRNAs on why ibuprofen is superior analgesia for breast surgery patients compared to gabapentin. Surveys were given before and after the educational module to determine the knowledge base of postoperative breast surgery pain and whether this knowledge improves. Increasing the number of correct answers presurvey versus postsurvey determined project success. An increase in correct questions of 40% indicated that the goal was achieved.

Achievable

Ibuprofen has already been utilized in this level-one trauma center for other surgical populations indicating that the educational foreground is already there. This knowledge allows for an easy transition when educating CRNAs about the benefits of ibuprofen and breast surgery patients, thus increasing the likelihood of its use with this population. Breast surgery is an uncommon procedure at this facility, which may increase the difficulty of achieving the goal.

Relevant

Acute pain during the postoperative period after breast surgery leads to an increased risk for chronic pain.[2] Well-informed and educated CRNAs can use ibuprofen to their advantage and reduce this risk. Reduced pain and less consumption of opioids allow for faster recovery times, less chance of addiction, and increased patient satisfaction for those undergoing breast surgery.[4]

Time Bound

An educational module with pre and posttests was conducted in June 2023. This allowed the author to determine the CRNAs' baseline understanding of ibuprofen and breast surgery pain.

Posttests determined if there was an increase in baseline knowledge of ibuprofen. The post-survey also determined if there was an increased use of preoperative IV ibuprofen.

SWOT

Strengths

This quality improvement project had multiple strengths. First, surveys are easy to construct and are quickly disseminated via email. They are also efficient and can be filled out promptly, allowing the author to gather a large amount of information quickly. Additionally, educational modules equip CRNAs with more knowledge that enhances their practice and improves patient care. For example, preoperative ibuprofen provides CRNAs with another modality for pain control and increases patient satisfaction.

Weaknesses

Surveys are optional, and CRNAs may want to refrain from participating in filling out the survey. This decreases the author's ability to determine baseline knowledge of the CRNAs. Further, educational modules are optional, and the dissemination of knowledge takes time. The South Florida hospital is a busy facility, and CRNAs may have needed more time to view the educational modules.

Opportunities

This study presented several opportunities for participants. First, CRNAs can add another analgesic to their arsenal of medications. Educational modules allow feedback from CRNAs to determine possible barriers to preoperative IV ibuprofen. For instance, production pressures may not allow adequate time for IV ibuprofen administration. Bridging the knowledge gap of IV ibuprofen for breast surgery pain may allow for increased ibuprofen use, improving pain control

and patient outcomes. For example, improved pain control increases activity and movement, leading to faster recovery and reduced hospital stays.[3]

Threats

Significant threats to the quality improvement (QI) project are CRNAs who are only interested in short-term goals. For instance, opioids allow CRNAs to have a smooth emergence with adequate pain control and provide less hustle in the Post Anesthesia Care Unit (PACU) however, this leads to prolonged recovery times for the patient and increases the risk for opioid-induced side effects. CRNAs who carry negative attitudes or beliefs about IV ibuprofen can lead to a decrease in participation in educational modules and surveys. This same effect may also be seen with CRNAs who are resistant to change. Competition from other agents such as acetaminophen, gabapentin, and dexmedetomidine can pose a significant threat to this project, as the CRNA or anesthesiologist may prefer these agents.

Organizational Factors

An interdisciplinary team built and developed the breast surgery pain educational module. There were several steps that provided guidance for developing the module. Accomplishing program goals was measured by analyzing and comparing data. A posttest questionnaire was distributed during the evaluation period to calculate the program's effectiveness. The quality and efficacy of the program will improve based on the results obtained and recommendations made by the participants.

Program Structure

This quality improvement project aimed to educate CRNAs on the benefits of pre-operative ibuprofen versus gabapentin for postoperative pain control in patients receiving breast surgery. The first step in this project was to gather an email list of the CRNAs and

anesthesiologists working at the facility. Next, the dissemination of the educational module, along with the pre- and posttests, was conducted. These tests asked a series of questions about knowledge involving pain, breast surgery, ibuprofen, and gabapentin. This preliminary survey aimed to gauge the depth of knowledge about these topics and determine what gaps in knowledge needed to be filled. This survey asked what type of analgesics the CRNAs use for breast surgery patients and what type of analgesics the facility CRNAs most commonly use. The initial survey also determined the usage of ibuprofen and gabapentin by the facility's CRNAs.

This program's second phase involved disseminating the educational module to the target audience. This educational module was developed by the author using Microsoft PowerPoint. Education included but was not limited to the ibuprofen mechanism of action and positive factors such as reducing opioid consumption and risk for chronic pain.[2] This educational module also involved education on pain after breast surgery and what complications may occur. Finally, the negative attributes of gabapentin were discussed. For instance, increasing the dose of gabapentin leads to an increased risk of nausea, vomiting, sedation, and dizziness.[7]

The final phase of this quality improvement project involved the analysis of the pre- and post-results. The objective was to determine if the educational seminar increased the CRNAs' knowledge on the 4 main topics: pain, breast surgery, gabapentin, and ibuprofen. An increase in the knowledge base was measured by the number of survey questions answered correctly. The questions in the post-educational survey determined if the educational gaps were filled and if the CRNAs were more willing to use ibuprofen as an analgesic agent for breast surgery patients in response to the educational seminar.

Theoretical Framework

Change is a necessary entity in the world of healthcare and allows for progress and innovation. For hospitals and medical centers to be successful, they must keep up with the new knowledge and technology that is constantly evolving. Evidence-based practice (EBP) allows this change to be implemented within medicine. Multiple theories of change exist. Lewin's model contains[3] phases of change that allow for the translation of EBP.[21] The first phase is the unfreezing phase.[21] In this phase, the dissemination of postoperative pain involving breast surgery must be accomplished. This allows CRNAs to understand the current literature about breast surgery pain and influences them to change their behavior about the problem.[21] The second phase is the moving or changing phase.[21] In this phase, CRNAs make more sound decisions based on the knowledge that they have received on pain control and breast surgery. Factors inhibiting better decision-making, such as "traditional beliefs about Ibuprofen," are reduced.[21] Once this change has been implemented, it must remain in CRNA practice.[21] This is known as the refreezing phase and would involve maintaining the use of perioperative IV Ibuprofen to control postoperative breast surgery pain.[21]

Methodology

Settings and Participants

The setting for this quality improvement project was a level 1 trauma center in South Florida. This medical center provides 24-hour care and contains 750 beds. Anesthesia services are provided by anesthesiologists and certified registered nurse anesthetists who participated in this project. The Institutional Review Boards requested approval for this project. Email addresses were used to send information regarding the project, including pretests and posttests and the educational PowerPoint module. Participants in this project were left anonymous and voluntary.

Intervention and Procedures

The educational module increased anesthesia providers' knowledge of postoperative breast surgery pain, including risks, complications, etiology, and treatment. The educational seminar pre- and post-surveys followed standard protocols. The project was sent to Florida International University and the anesthesia group for approval. After approval was granted from both parties, IRB exemption was achieved. Pre- and posttests, along with the PowerPoint educational module, were administered via email to the CRNAs and anesthesiologists of the group.

Protection of Human Rights

All survey responses remained anonymous; this allowed for the protection of privacy for all who participated. There were no identifiers from participating anesthesia providers. There was no need for access to any personal or medical information. There was no harm or risk to participants who engaged in this project.

Data Collection

The voiceover PowerPoint was used to disseminate knowledge about postoperative breast surgery pain. Pre- and posttest data were collected and disseminated by using Qualtrics. The number of expected participants was 12, all working in the anesthesia department at the level 1 trauma center. The data collected for the pre- and posttest were uploaded and compared in an Excel spreadsheet. There were 10 questions on the pretest and 10 questions on the posttest. The questions tested the participants' knowledge of the risks, complications, etiology, and treatment of breast surgery pain. All standards and procedures for data collection were followed via the IRB guidelines to guarantee validity and reliability.

Data Management/Analysis

During the data collection, no participant identifiers were collected. The data was password protected, and the author only obtained access. Data entry was also not connected to any of the participants. The Microsoft Excel spreadsheet was utilized to set up a comparative analysis of pre- and posttest results. This data comparison allowed the author to determine participants' baseline knowledge and if any improvement of knowledge occurred after the educational module.

Results

Demographics

Four anesthesia providers participated and completed the pretest survey, the educational module video presentation, and the posttest survey. The average age of the anesthesia providers was 46 years. Two of the participants (50%) were male, and 2 of the participants (50%) were female. The following range of ethnicities were represented: Caucasian (*n* = 2, 50%), African-American (*n* = 1, 25%), and other (*n* = 1, 25). All the participants in this quality control project were CRNAs. Two (50%) of the participants hold a bachelor’s degree in nursing, while the other 2 participants (50%) hold a Doctor in Nursing Practice (DNP) degree. Those who participated in the study were questioned on their years of experience in practicing anesthesia, which included 2-5 years (*n* = 2, 50%) and over 10 years (*n* = 2, 50%).

Pretest Knowledge of Postoperative Breast Surgery Pain and Complications

Questions on the most common complications and incidence of postoperative breast surgery pain were used to evaluate the knowledge base of the participants. Question 1 asked about the 3 major risk factors for acute postoperative pain in patients receiving breast surgery. Two providers (50%) answered correctly, selecting age, anxiety level, and marital status. In

comparison, the other 2 providers (50%) answered incorrectly, 1 selected anxiety level, cardiovascular disease, and age (25%), and the other selected (25%) age, marital status, and severity of cancer. Question number 2 asked about the number 1 risk factor for chronic pain .50% of providers selected acute postoperative pain, and 2 providers chose incorrectly, with 1 provider selecting age (25%) and the other selecting anxiety level (25%). Question 3 asked what type of pain dose breast surgery cause. All providers selected the wrong answer; 2 providers chose visceral pain (50%), 1 provider (25%) chose radicular pain, and 1 provider (25%) chose somatic pain.

Question 4 asked what post-mastectomy pain syndrome is. Three providers answered incorrectly, with 1 provider (25%) selecting acute pain, more prevalent in the young, 1 provider (25%) selecting chronic pain, more prevalent in the elderly, and 1 provider (25%) selecting acute pain with a hyperdynamic response. One provider (25%) selected correctly that chronic pain is more prevalent in the young. Question 6 asked providers how prostaglandins cause pain. One provider (25%) correctly selected stimulation of nociceptors within the peripheral nervous system and spinal cord. Three providers selected incorrectly, with 1 provider (25%) selecting stimulation of kappa receptors within the medulla. One provider (25%) selected stimulation of delta receptors in the peripheral nervous system, and the last provider (25%) selected stimulation of alpha receptors located within the spinal cord.

Question 5 asked providers how Ibuprofen produces analgesia. One provider selected correctly (25%), while 3 providers selected incorrectly. One provider (25%) selected COX 1 inhibition, increasing prostaglandin synthesis. Another provider (25%) selected COX 2 inhibition, increasing the inflammatory response. Finally, the 4th provider (25%) selected COX 3 inhibition resulting in a reduction of inflammatory mediators. Question 7 asked providers about

the major benefits of administering Ibuprofen for those undergoing breast surgery. This question had 2 correct answers, which providers were instructed to select. Only 1 (25%) provider selected 2 answers, which were incorrect. The other 3 providers did not select 2 answers and therefore did not answer the question correctly (75%).

Number 8 questioned participants on why Ibuprofen would be a better choice of analgesia over gabapentin. One provider selected the correct answer with decreased postoperative nausea and vomiting. The 3 other providers (75%) selected ibuprofen as a superior analgesic compared to gabapentin. Number 9 asked providers to select the main reason for ibuprofen not being utilized for analgesic control for breast surgery patients. One provider selected correctly (25%) that ibuprofen is believed to increase the risk of hematoma. Three providers selected incorrectly (75%), with 2 providers (50%) selecting ibuprofen increases the risk of cancer, and 1 provider (25%) selecting ibuprofen reduces renal function intraoperatively. Question 10 asked providers how Ibuprofen can improve patient outcomes for breast surgery patients. Three providers answered correctly and selected all of the above. One provider answered incorrectly selecting decreases mortality and morbidity.

Pretest Attitude Related to Recommendation of Ibuprofen for Breast Surgery

The last question in the pre-test asked providers how likely they are to use ibuprofen as an analgesic for patients receiving breast surgery. Of the 4 participating providers, 50% stated most likely, and 50% stated somewhat likely. These results were compared to the posttest attitudes to determine the educational impact of the module.

Posttest Knowledge of Postoperative Breast Surgery Pain and Complications

When asked about the 3 most important factors for acute postoperative breast surgery pain, 2 providers (50%) answered correctly age, anxiety, and marital status. The 2 other

providers (50%) selected incorrectly, with 1 provider (25%) selecting marital status, diabetes, and anxiety level, while the other selected (25%) age, marital status, and cancer status. No improvement was found when comparing question number 1 with pre- and posttest results. Two providers correctly answered the number 1 risk factor for chronic pain, selecting acute postoperative pain. The 2 other providers answered incorrectly, selecting age and anxiety level respectfully. There was no improvement for question 2 when comparing the pre- and posttest results. Question 3 had 2 providers answer correctly, selecting neuropathic pain. The other 2 providers selected visceral pain. There was a 50% improvement compared to the pre- and posttest for question 3. When questioned about post-mastectomy pain syndrome, 2 providers (50%) answered correctly, selecting chronic pain syndrome more prevalent in the young. The other 2 providers (50%) selected chronic pain syndrome as more prevalent in the elderly (25%) or a type of acute pain resulting in a hemodynamic response (25%). There was a 25% improvement when comparing the pre and posttest for question 4.

Two providers (50%) answered correctly when questioned about how prostaglandins produce pain, selecting the stimulation of nociceptors in the peripheral nerves and spinal cord. Two providers (50%) answered incorrectly, with 1 provider (25%) selecting stimulation of alpha-2 receptors and the other (25%) selecting stimulation of delta receptors. There was a 25% improvement upon comparison of the pre- and posttest with question 6.

Question 5 had 2 providers (50%) answer correctly with ibuprofen inhibiting COX 1 and COX 2 enzymes to produce analgesia. Two providers (50%) answered incorrectly, selecting COX 2 inhibition resulting in more inflammation. There was a 25% improvement with question 6 when comparing the pre- and posttest. Question 7 had 2 providers (50%) answer correctly

when asked about the major benefits of ibuprofen for breast surgery patients: Reduced opioid consumption and increased pain control over 24 hours. This question had 2 answers, and the other 2 providers (50%) answered incorrectly due to selecting only 1 option. Question 7 saw a 50% improvement when comparing the pretest and posttest. When asked about why ibuprofen is a better analgesic than gabapentin, 2 providers (50%) answered correctly, selecting decreased PONV. Two providers (50%) answered incorrectly, with both selecting ibuprofen to have superior analgesic efficacy over gabapentin. Question 8 saw a 25% increase when comparing the pre and posttests.

Question 9 saw 2 providers answer correctly, selecting hematoma as the main reason why ibuprofen has not been used for breast surgery pain. Two providers (50%) selected incorrectly, with 1 provider (25%) selecting ibuprofen reducing renal function and the other selecting ibuprofen can increase the risk of gastrointestinal bleeding. A 25% improvement was found when comparing the pre and posttests. Question 10 had 2 providers (50%) answer correctly (all of the above) when asked what the benefits are of using ibuprofen for perioperative analgesia with breast surgery patients. 2 providers (50%) answered incorrectly, with 1 provider (25%) selecting prevents addiction and the other (25%) selecting decreased mortality and morbidity. When comparing the pre- and posttest, a 25% decrease occurred.

Posttest Attitude Related to Recommendation of Ibuprofen for Breast Surgery

The last question in the pre- and posttest asked providers how likely they were to use ibuprofen for perioperative analgesia control for breast surgery patients. The providers split the results evenly: 25% most likely, 25% somewhat likely, 25% somewhat unlikely, and 25% most unlikely. This was a 50% decline in the likelihood to use in practice compared to the pretest attitude toward ibuprofen and breast surgery pain.

Discussion

Limitations

The major limitation of this study was the sample size. A larger sample size would have provided more valid and reliable data for this project. Other limitations included time and delivery method. Participants only had 2 weeks to complete the pretest, educational model, and posttest. More time may have allowed for more clinicians to participate in the project. The delivery method of the survey was only online. An in-person educational module may have allowed for more participation, increasing the project's strength.

Future Implications for Advanced Nursing

Evidence-based practice has provided clinicians with information and data that increase provider knowledge and improves patient outcomes and safety. The information disseminated in this project allowed participants to increase their knowledge base on ibuprofen and breast surgery pain. The educational module of this project has equipped providers with another analgesic agent that can help manage postoperative breast surgery pain. Not only does ibuprofen have a reduced side effect profile compared to opioids, but it assists in reducing opioid usage. This decrease in opioid usage improves patient safety and outcomes.

Conclusion

The benefits of single-dose ibuprofen have been demonstrated through the literature review. Ibuprofen provides a more significant reduction in opioid consumption during the immediate postoperative time frame when compared to gabapentin. This information was delivered via a digital educational module to multiple anesthesia providers. The posttest results demonstrate improvement in multiple categories involving breast surgery pain and ibuprofen. The quality improvement project achieved its goal of enhancing the knowledge of anesthesia

providers. However, posttest attitude towards the use of single-dose ibuprofen for postoperative breast surgery pain was mixed. The lack of provider participation may have been a reason for this attitude. Presenting the educational module in different forms and increasing the time allotted to participate in the educational module may provide more accurate posttest attitudes.

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Appendix A: Letter of Support

ANESCO™
Driving Results in Anesthesia

February 7, 2023
Yasmine Campbell, DNP, CRNA, APRN
Clinical Assistant Professor
Department of Nurse Anesthesiology
Florida International University

Dr. Yasmine Campbell,

Thank you for inviting Anesco to participate in the Doctor of Nursing Practice (DNP) project conducted by **Ryan Covey** " Providing an educational module for CRNAs on The Benefits of Ibuprofen for patients Undergoing Breast Surgery an Educational Module" in the Nicole Wertheim College of Nursing and Health Sciences, Department of Nurse Anesthesiology 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 utilize the latest literature to increase providers awareness on the benefits of perioperative Ibuprofen for patients undergoing breast surgery, including reduced postoperative pain and opioid consumption.

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: Ryan Covey and Yasmine Campbell

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

2/9/23

Edward Punzalan, DNP, CRNA, APRN — Date
Administrative Director of Nurse Anesthesia
Healthcare Performance Anesco

Appendix B: Recruitment Letter

FIU Department of Nurse Anesthesiology

Nicole Wertheim College of Nursing & Health Sciences

The Benefits of Single Dose Perioperative Ibuprofen on Patients Receiving Breast Surgery An Educational Module.

Dear Providers:

My name is Ryan Covey, and I am a student from the Anesthesiology Nursing Program Department of Nurse Anesthesiology at Florida International University. I am writing to invite you to participate in my quality improvement project. The goal of this project is to increase health care providers' awareness on the benefits of perioperative Ibuprofen for patients undergoing breast surgery. You are eligible to take part in this project because you are a part of the Anesco anesthesia provider.

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 10 minutes long educational presentation online. After going through the educational module, 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 Ryan Covey rcove005@fiu.edu/ 480-881-9055

Thank you very much.

Sincerely,

Ryan Covey rcove005@fiu.edu/ 480-881-9055

Appendix C: Educational Module

Background of the Problem

- Patients that are young, unmarried, and anxious have increased risk for acute postoperative pain.[1]
- Uncontrolled acute pain is the number one risk factor for chronic pain in patients undergoing breast surgery.[1]
- Post mastectomy pain syndrome is a form of chronic pain. The incidence of PMPS was 65% for 30-49 years, 40% for 50-59 years, and 26% for 70 years and over.[1]
- Currently there is no gold standard for postoperative pain control for those undergoing breast surgery therefore opioids have become a popular drug of choice.[1]
- Acute or chronic pain leads to increased morbidity, decreased quality of life, decreased physical function, increased use of opioids, opioid addiction and increased healthcare cost.[1]

Scope of the problem

- Breast surgery pain is predominately neuropathic, involving damaged shoulder, axilla, and arm nerves.[1]
- Of those who undergo breast surgery 57% experience acute post operative pain.[1]
- Post mastectomy pain syndrome is a form of chronic pain. The incidence of PMPS was 65% for 30-49 years, 40% for 50-59 years, and 26% for 70 years and over.[1]
- Of the patients that had undergone breast surgery in 2017, 10% continued to fill their opioid perceptions one year after surgery.[1]
- NSAIDs such as ibuprofen have been found to reduce not only acute postoperative pain but postoperative opioid consumption in multiple types of surgery.[1]

Ibuprofen

Ibuprofen can provide analgesia via its anti-inflammatory properties.[2]

The mechanism of action involves the inhibition of cyclooxygenase enzymes (COX -1 and COX -2).[2]

COX-1 and COX-2 enzymes are responsible for the pain signaling cascade and the synthesis of prostaglandins within the peripheral and central nervous systems.[2]

Prostaglandins activate nociceptors in the peripheral nervous system and at synapses in the spinal cord. Prostaglandins also active ion channels leading to increased sensitivity of the neurons (central sensitization).[2]

Inhibition of COX enzymes and prostaglandins lead to an increased analgesic effect.[2]

FIU

The benefits of Ibuprofen

- Ibuprofen reduced pain scores for a variety of different surgical populations.[3-5]
- These populations include patients receiving thyroidectomy, septorhinoplasty and laparoscopic cholecystectomy.[3-5]
- Several RCTs found a reduction in fentanyl PCA consumption over a 24-hour postoperative period.[3-5]
- Single does perioperative Ibuprofen reduces acute pain the greatest within the first 12-24 hours postoperatively. [3-5]
- NSAIDS such as ibuprofen reduce the reoccurrence of breast cancer.[6]

The Benefits of Ibuprofen cont.

- When Ibuprofen was compared with acetaminophen Ibuprofen provided superior analgesic effects and reduced fentanyl consumption.[5]
- Due to ibuprofens opioid sparing effects less opioid side effects occur including nausea and vomiting.[7]
- The side effect profile of Ibuprofen is limited with short term use which reduces the number of complications that occur during the postoperative period.[7]
- NSAIDS do not cause respiratory depression or neurological dysfunction leading to increased postoperative recovery.[5]

Ibuprofen vs Gabapentin

- Gabapentin has been found to show a reduction in postoperative breast pain and opioid consumption.[8]
- However, these effects are dose dependent.[8]
- An increase in gabapentin dosage leads to an increase in side effects such as dizziness, nausea, vomiting and sedation.[8]
- The side effect profile for ibuprofen is extremely limited with short term use and has no addictive qualities.[7]
- Patients can go home on NSAIDs due to their safety profile whereas medications such as opioids and Gabapentin have addictive tendencies and decrease neurological function.[7]

Ibuprofen: Why the Hesitation?

- There is very limited research on the use of single dose IV ibuprofen for patients undergoing breast surgery.[9]
- A major side effect is that NSAIDS such as Ibuprofen may increase the risk of bleeding and hematoma.[9]
- The research on this side effect is limited and data thus far has been inconclusive.[9]
- Multiple studies on the use of NSAIDS and hematoma development after breast surgery found no increase in the risk for hematoma with the use of NSAIDs. [9]
- COX II inhibition may even reduce the risk for postoperative hematoma.[6]

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Appendix D: Pre-/Posttest Questions

FIU | FLORIDA INTERNATIONAL UNIVERSITY

Pretest and Posttest Questionnaire:

The Benefits of Ibuprofen on Patients Receiving Breast Surgery an Educational Module

INTRODUCTION

The primary aim of this QI project is to increase providers awareness of the the benefits of ibuprofen for those receiving breast surgery.

Please answer the question below to the best of your ability. The questions are either in multiple choice or true/false format and are meant to measure knowledge on the benefits of ibuprofen on those who receive brest surgery.

PERSONAL INFORMATION

1. **Gender:** Male Female Other_____
2. **Ages 25 and above:** _____
3. **Ethnicity:** Hispanic Caucasian African American Asian Other_____
4. **Position/Title:** CRNA Anesthesiologist Resident Anesthesiologist Assistant
5. **Level of Education:** Certificate Bachelors Masters DNP PhD
6. How many years have you been a perioperative provider?

   Over 10 5-10 years 2-5 years 1-2 years

Educational module Pre and Post Exam

The benefits of Single Dose Preoperative Ibuprofen for Breast Surgery

1. What are 3 major risk factors for acute postoperative pain in patients that have undergone breast surgery.
   A.) Age, anxiety level, marital status
   B.) Age, marital status, severity of cancer
   C.) Marital status, diabetes, anxiety level
   D.) Anxiety level, Cardiovascular disease, Age

2. What is the number 1 risk factor for chronic pain?
   A.) Secondary Disease Processes
   B.) Age
   C.) Anxiety level
   D.) Uncontrolled Acute Postoperative Pain

3. What type of pain does breast surgery cause?
   A.) Somatic
   B.) Visceral
   C.) Neuropathic
   D.) Radicular

4. What is post mastectomy pain syndrome?
   A.) A type of chronic pain that can occur after breast surgery and is more prevalent in the young.
   B.) A type of acute pain that can occur after breast surgery and is more prevalent in the young
   C.) A type of chronic pain that can occur after breast surgery and is more prevalent in the elderly.
   D.) A type of acute pain that can during breast surgery resulting a hyperdynamic response.

5. How dose Ibuprofen produce Analgesia?
   A.) COX- 1 and COX 2 inhibition resulting in a reduction in prostaglandin synthesis.
   B.) COX -1 inhibition resulting in increased production of prostaglandins.
   C.) COX -2 inhibition resulting in an increase in inflammatory mediators.
   D.) COX 3 inhibition resulting in a decrease in inflammatory mediators.

6. How do prostaglandins cause pain?
   A.) Stimulate kappa receptors located within the medulla of the CNS.
   B.) Stimulate Nociceptors within the peripheral nervous system and spinal cord synapses.
   C.) Stimulate delta receptors located within the peripheral nervous system
   D.) Stimulate Alpha 2 receptors located within the spinal cord synapse.

7. What are the major benefits of administering Ibuprofen to those receiving breast surgery? Select 2
   A.) Reduced Opioid consumption.

B.) Hemodynamic Stability
C.) Increased pain control 48 hours after surgery
D.) Increased pain control 24 hours after surgery

8. Why may Ibuprofen be a better choice for analgesia over Gabapentin?
   A.) Allows for increased pulmonary function postoperatively.
   B.) Decreased risk for PONV
   C.) Maintain adequate heart rate and blood pressure.
   D.) Ibuprofen provides superior analgesic effects compared to gabapentin.

9. What is the major issue that seems to be preventing Ibuprofen from being used as an analgesic agent for breast surgery?
   A. It is believed that ibuprofen reduces renal function intraoperatively.
   B. It is believed that the use of ibuprofen will increase the risk of a GI bleed.
   C. It is believed that the use of ibuprofen can increase the incidence of breast cancer.
   D. It is believed that ibuprofen causes hematoma.

10. How can ibuprofen improve patient outcomes after breast surgery?
   A. Increase patient activity thus reducing hospital stay and cost
   B. Decreases mortality and morbidity
   C. Prevents addiction.
   D. All of the above

Appendix E: IRB Approval/Exception

FIU | Research & Economic Development
FLORIDA INTERNATIONAL UNIVERSITY

MEMORANDUM

To: Dr. Yasmine Campbell

CC: Ryan Covey

From: Carrie Bassols, BA, IRB Coordinator CeB

Date: March 2, 2023

Proposal Title: "The Benefits of Ibuprofen for Patients Undergoing Breast Surgery an Educational 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-23-0079 **IRB Exemption Date:** 03/02/23
TOPAZ Reference #: 112768

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.
1) 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.

Appendix F: Informed Consent

FIU | FLORIDA INTERNATIONAL UNIVERSITY

CONSENT TO PARTICIPATE IN A QUALITY IMPROVEMENT PROJECT

The Benefits of Single Dose Perioperative Ibuprofen on Patients Receiving Breast Surgery An Educational Module.

SUMMARY INFORMATION

Things you should know about this study:

- **Purpose:** Educational module to increase providers awareness of how Ibuprofen can reduce post operative pain and opioid consumption for patients undergoing breast surgery.
- **Procedures**: If the participant chooses to participate, they will be asked to complete a pretest, watch a voice PowerPoint, and then a post test
- **Duration:** This will take about a total of 20 minutes total.
- **Risks**: There will be minimal risks involved with this project, as would be expected in any type of educational intervention, which may include mild emotional stress or mild physical discomfort from sitting on a chair for an extended period.
- **Benefits:** The main benefit to you from this research is to increase the participants knowledge on how ibuprofen can reduce postoperative pain and opioid consumption for patients undergoing breast surgery.
- **Alternatives:** There are no known alternatives available to the participant other than not taking part in this quality improvement project.
- **Participation:** Taking part in this quality improvement project is voluntary.

Please carefully read the entire document before agreeing to participate.

NUMBER OF STUDY PARTICIPANTS:

If the participant decides to be in this study, they will be one of approximately 10 people in this research study.

PURPOSE OF THE PROJECT

The participant is being asked to be in a quality improvement project. The goal of this project is to increase providers' knowledge on how single dose perioperative IV ibuprofen can reduce postoperative pain and opioid consumption for patients undergoing breast surgery. If you decide to participate, you will be 1 of approximately 10 participants.

DURATION OF THE PROJECT

The participation will require about 15 minutes

PROCEDURES

If the participant agrees to be in the project, PI will ask you to do the following things:

1. Complete an online 10 question pre-test survey via Qualtrics, an Online survey product for which the URL link is provided

2. Review the educational PowerPoint Module lasting 15 minutes via Qualtrics, an Online survey product for which the URL link is provided.

3. Complete the online 10 question post-test survey via Qualtrics, an Online survey product for which the URL link is provided.

RISKS AND/OR DISCOMFORTS

The main risk or discomfort from this research is minimal. There will be minimal risks involved with this project, as would be expected in any type of educational intervention, which may include mild emotional stress or mild physical discomfort from sitting on a chair for an extended period.

BENEFITS

The following benefits may be associated with participation in this project: To increase participants knowledge on the benefits of using single does perioperative ibuprofen in patients receiving breast surgery. These benefits include a reduction in opioid consumption as well as increased pain control during the postoperative period. The overall objective of the program is to increase the providers' knowledge based on the current literature.

ALTERNATIVES

There are no known alternatives available to the participant other than not taking part in this project. However, if the participant would like to receive the educational material, it will be provided to them 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, PI might publish, it will not include any information that will make it possible to identify the participant. Records will be stored securely, and only the project team will have access to the records.

PARTICIPATION: Taking part in this quality improvement project is voluntary.

COMPENSATION & COSTS

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

RIGHT TO DECLINE OR WITHDRAW

The participation in this project is voluntary. The participant is free to participate in the project or withdraw the consent at any time during the project. The participant's withdrawal or lack of participation will not affect any benefits to which you are otherwise entitled. The investigator reserves the right to remove the participant without their consent at such time that they feel it is in their 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 Ryan Covey at rcove005@fiu.edu / 480-881-9055 and Dr. Yasmine Campbell 305-343-9894 / yacampbell@fiu.edu

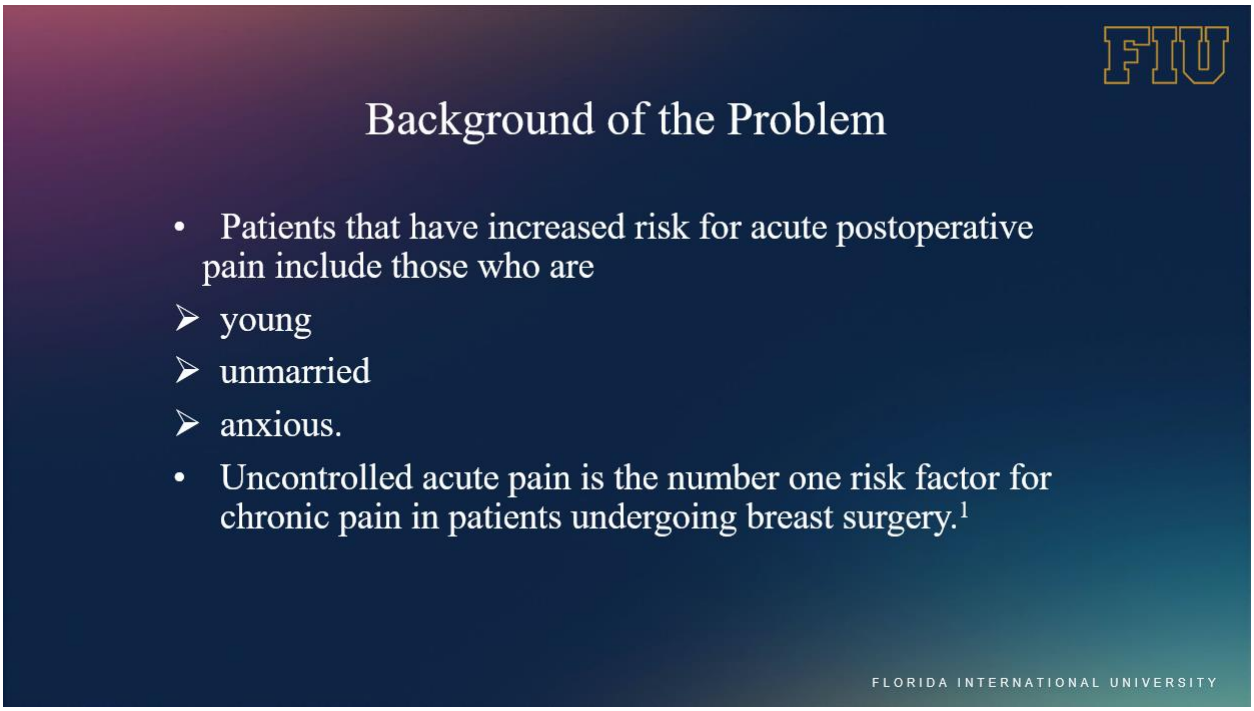
IRB CONTACT INFORMATION

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

PARTICIPANT AGREEMENT

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. By clicking on the "consent to participate" button below I am providing my informed consent.

Appendix G: Dissemination PowerPoint



Background

- Post mastectomy pain syndrome is a form of chronic pain.
- The incidence of PMPS is as follows
  - 65% for 30-49 years old
  - 40% for 50-59 years old
  - 26% for 70 years and over.[1]

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Background

- Acute or chronic pain leads to several issues including morbidity, decreased quality of life, decreased physical function, increased use of opioids, opioid addiction, and increased healthcare cost.[1]
- Currently there is no gold standard for postoperative pain control for those undergoing breast surgery.[1]Therefore, opioids have become a popular drug of choice.[1]

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Scope of the problem

- Breast surgery pain is predominately neuropathic, involving damaged shoulder, axilla, and arm nerves.[1]
- Of those who undergo breast surgery 57% experience acute post operative pain.[1]
- Of the patients that had undergone breast surgery in 2017, 10% continued to fill their opioid perceptions one year after surgery.[1]
- NSAIDs such as ibuprofen have been found to reduce not only reduce acute postoperative pain but postoperative opioid consumption in multiple types of surgery.[1]

FIU

Ibuprofen

- Ibuprofen can provide analgesia via its anti-inflammatory properties.[2] The mechanism of action involves the inhibition of cyclooxygenase enzymes (COX -1 and COX -2).[2]
- COX-1 and COX-2 enzymes are responsible for the pain signaling cascade and the synthesis of prostaglandins within the peripheral and central nervous systems.[2]
- Prostaglandins activate nociceptors in the peripheral nervous system and at synapses in the spinal cord. Prostaglandins also active ion channels leading to increased sensitivity of the neurons (central sensitization).[2]
- Inhibition of COX enzymes and prostaglandins lead to an increased analgesic effect.[2]

FIU

The Benefits of Ibuprofen

- Ibuprofen reduced pain scores for a variety of different surgical populations.[3-5]
- These populations include patients receiving thyroidectomy, septorhinoplasty and laparoscopic cholecystectomy.[3-5]
- Several RCTs found a reduction in fentanyl PCA consumption over a 24-hour postoperative period.[3-5]
- Single does perioperative Ibuprofen reduces acute pain the greatest within the first 12-24 hours postoperatively. [3-5]
- NSAIDS such as ibuprofen reduce the reoccurrence of breast cancer.

FIU

DNP Project Purpose / PICO

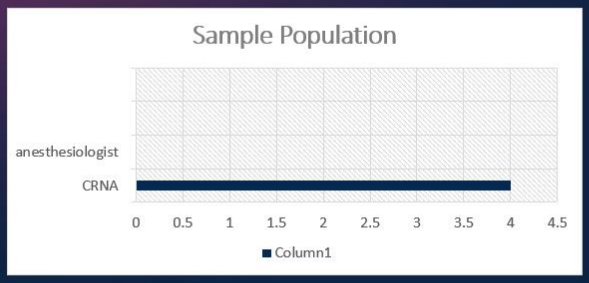
- In Adults undergoing breast surgery would the use of pre-operative intravenous ibuprofen versus perioperative gabapentin reduce postoperative pain and opioid consumption?
- Population (P): Postoperative pain control in patients undergoing breast surgery.
- Intervention (I): Preoperative single dose Intravenous Ibuprofen
- Comparison (C): Perioperative gabapentin
- Outcome (O): Which agent provides superior analgesic control in the postoperative setting.

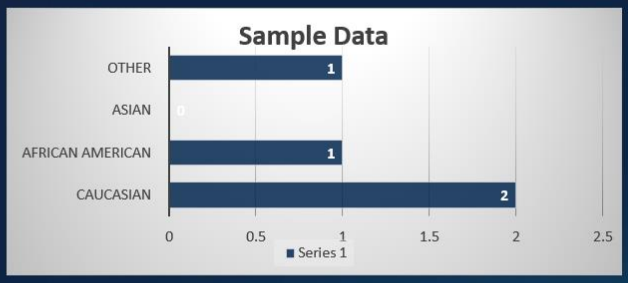
FIU

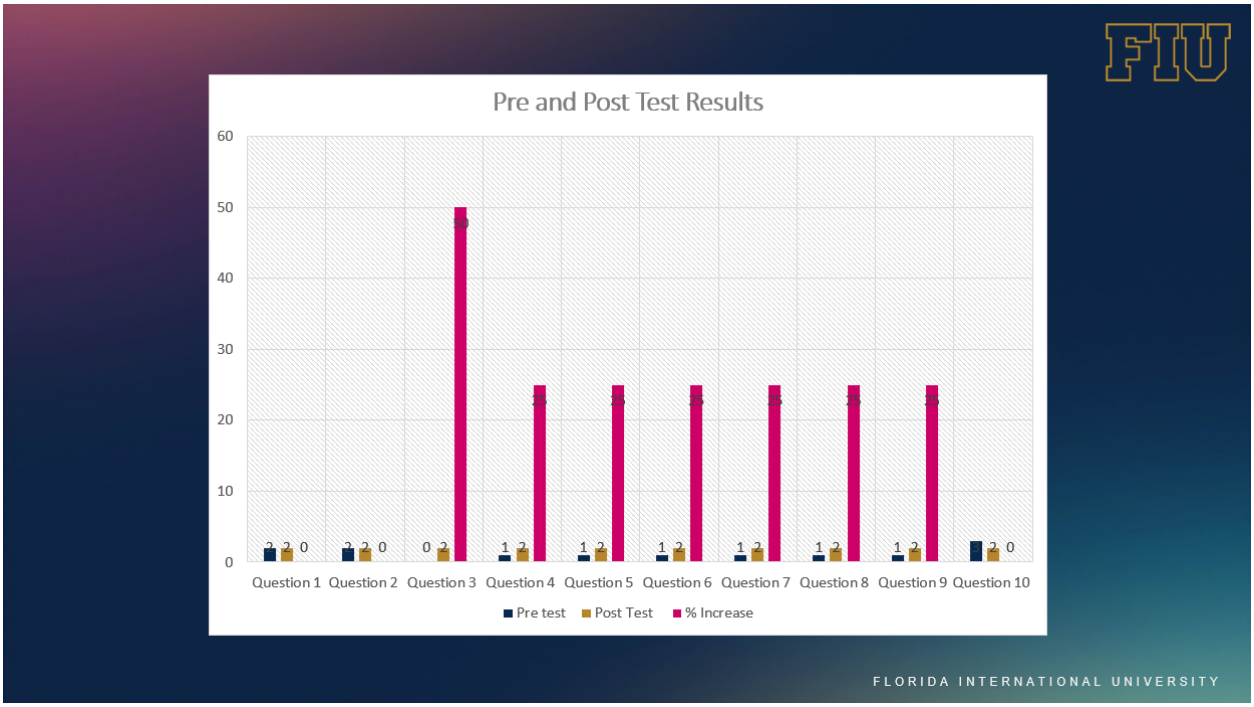
Quality Improvement Methodology

- Quality improvement project performed at a level one trauma center in South Florida.
- Participants were emailed information regarding the project, including pre- and post-survey and the PowerPoint educational module.
- The voiceover PowerPoint was used to disseminate knowledge about post-operative breast surgery pain. Pre and post-test data were collected and disseminated by using Qualtrics.
- There were ten questions on the pre-survey and ten questions on the post-survey. The questions tested the participants' knowledge of the risks, complications, etiology, and treatment of breast surgery pain.
- Pre and post results were compared to determine if there was a increase in provider knowledge regarding the topic.

Demographics






Pre and Post Test Results
60
50
40
30
20
10
0
Question 1
Question 2
Question 3
Question 4
Question 5
Question 6
Question 7
Question 8
Question 9
Question 10
Pre test
Post Test
% Increase
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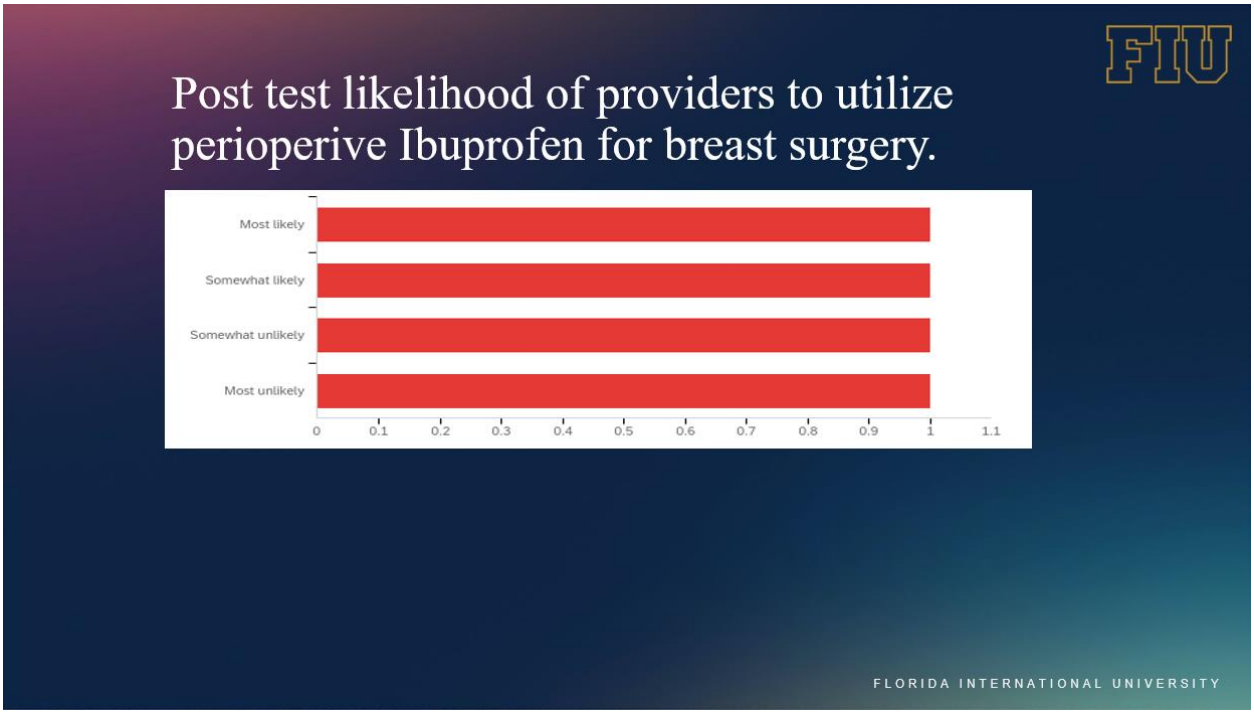
Post test likelihood of providers to utilize perioperive Ibuprofen for breast surgery.
Most likely
Somewhat likely
Somewhat unlikely
Most unlikely
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
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Discussion: Limitations

- limitation of this study was the small sample size.
- Participants only had 2 weeks to complete the pretest educational model and post-test.
- An in-person educational module may have allowed for more participation, increasing the project's strength.

Discussion: Future Implications

- The educational module of this project has equipped providers with another analgesic agent that can help manage post-operative breast surgery pain.
- Not only does ibuprofen have a reduced side effect profile compared to opioids, but it assists in reducing opioid usage.[3]

Discussion: Future Implications

This decrease in opioid usage improves patient safety and outcomes.[3]

- Reduced respiratory depression leading to reduce incidence of pneumonia and postoperative recovery.[3]
- Reduced incidence of constipation and bowel obstruction.
- Reduction in CNS side effects leading to increased activity better post operative recovery times.[3]
- All of these positive attributes lead to a reduction in hospital cost.[3]

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Conclusions

- Likelihood of providers utilizing single dose perioperative IV Ibuprofen for post operative breast surgery pain control was inconclusive.
- Ibuprofen provides a more significant reduction in opioid consumption during the immediate post-operative time frame when compared to gabapentin.
- This information was delivered via a digital educational module to multiple Anesthesia providers.

Conclusions

- The post-test results demonstrate improvement in multiple categories involving breast surgery pain and ibuprofen.
- The quality improvement project achieved its goal of enhancing the knowledge of anesthesia providers.

Thank you!

- Dr. Campbell
- All participants of the quality improvement project.