Multimodal Opioid-Sparing Analgesia: Increasing Regimen Adherence In Minimally Invasive Abdominal Surgery

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Multimodal Opioid-Sparing Analgesia:
Increasing Regimen Adherence in Minimally Invasive Abdominal Surgery

Submitted to the Faculty
Yale University School of Nursing

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Nursing Practice

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MULTIMODAL OPIOID-SPARING ANALGESIA – KITTI PHA, P.

This DNP Project is accepted in partial fulfillment of the requirements for the degree
Doctor of Nursing Practice.

Signed_________________________

Shelli L. Feder PhD, FNP-C, ACHPN, FPCN

Date here  May 8, 2023
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Abstract

Multimodal Opioid-Sparing Analgesia:
Increasing Regimen Adherence in Minimally Invasive Abdominal Surgery

In 2016, the CDC estimated 11.5 million persons in the United States, aged 12 years and older, misused opioids in the past year. The opioid epidemic poses a challenge to the healthcare profession as it continues to care for, treat, and manage pain with associated complications from opioid dependence. Patients who primarily use opioids for pain control postoperatively and at discharge are at a 44% increased risk for opioid dependence after only five days of use. The incorporation of multimodal analgesia and opioid-sparing approaches has led to improved pain management with decreased opioid consumption. However, upon further evaluation, regimen adherence among clinicians is crucial to ensuring postoperative pain is adequately managed. This DNP project aimed to modify a current multimodal opioid-sparing analgesic regimen in a surgical division to increase clinician adherence, decrease opioid consumption, and evaluate patient satisfaction with the pain regimen. Despite a small number of patients, this project found that increased adherence to the regimen led to a decrease in opioid consumption in the postoperative inpatient setting. Additionally, patients were satisfied with the pain regimen and pain control. This project provides a framework for healthcare providers to implement among postoperative minimally invasive surgical patients to increase clinician adherence and patient satisfaction while decreasing opioid consumption.
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Abbreviations

- Minimally Invasive Surgery (MIS)
- Acetaminophen (APAP)
- Nonsteroidal Anti-inflammatory Drug (NSAID)
- N-Methyl-D-Aspartate (NMDA)
- Opioid-related adverse events (ORAE)
- Enhanced recovery after surgery (ERAS)
- Morphine milligram equivalents (MME)
- Length of stay (LOS)
- Randomized-controlled trials (RCTs)
- Transversus abdominus plane (TAP)
- Intravenous (IV)
- American Society for Metabolic & Bariatric Surgery (ASMBS)
- Metabolic and Bariatric Surgery Accreditation & Quality Improvement Program (MBSAQIP)
- Quality improvement (QI)
- Bariatric Surgery Targeting Opioid Prescribing (BSTOP)
- Roux-en-Y Gastric Bypass (RYGB)
- Vertical Sleeve Gastrectomy (VSG)
- Transoral Incisionless Fundoplication (TIF)
- Intensive Care Unit (ICU)
- Cyclooxygenase-2 (COX-2)
- Postoperative Nausea and Vomiting (PONV)
- Total Morphine equivalent (TME)
- Post-Anesthesia Care Unit (PACU)
- Agency for Healthcare Research and Quality (AHRQ)
- Plan-Do-Study-Act (PDSA)
- Workstation on Wheels (WOW)
- Enhanced Recovery Pathway (ERP)
- Patient administered analgesia (PCA)
- Drug Enforcement Agency (DEA)
- Socioeconomic status (SES)
- Breakthrough pain (BTP)
- Postoperative Day (POD)
- Around the clock (ATC)
- Glomerular Filtration Rate (GFR)
- As Needed (PRN)
- Medication administration record (MAR)
- Pain Treatment Satisfaction Scale (PTSS)
- Evidence-Based Practice (EBP)
- Advanced Practice Nurse (APRN)
- Advanced Practice Provider (APP)
- Centers for Medicare and Medicaid (CMS)
- American College of Surgeons (ACS)
- Body mass index (BMI)
- Obstructive sleep apnea (OSA)
- Operating room (OR)
- Registered Nurse (RN)
- Doctor of Nursing Practice (DNP)
Part 1

Multimodal Opioid-Sparing Analgesia: Increasing Regimen Adherence in Minimally Invasive Abdominal Surgery

The opioid epidemic poses a challenge to the healthcare profession as it continues to care for, treat, and manage pain with associated complications from opioid dependence. According to the Centers for Disease Control and Prevention (2018), in 2016, an estimated 11.5 million persons in the United States, aged 12 years and older, reported misusing opioids in the past year. In 2020, the CDC reported an estimate of 92,000 people who died from drug overdoses, a 31% increase from 2019. In addition, among overdose deaths in 2020, the CDC reported that 75% of those deaths involved a prescription or illicit opioid (CDC, 2021). The CDC notes that early opioid prescribing patterns, such as postoperatively for patients who are opioid naïve, have been associated with the increased likelihood of long-term use (CDC, 2021; Hah et al., 2017).

Incorporating alternative modalities for pain control other than opioids alone can be an effective tool in preventing opioid dependence in the clinical setting among postoperative patients undergoing minimally invasive surgery (MIS) of the abdomen. There has been a growing consensus to incorporate nonopioid analgesics among MIS of the abdomen postoperatively in patients to decrease opioid overutilization. Analgesic modalities include neuroaxial or regional anesthesia, local anesthesia, long-acting local anesthetics, acetaminophen (APAP), nonsteroidal anti-inflammatory drugs (NSAIDs), gabapentenoids, N-methyl-D-aspartate (NMDA) receptor antagonists, systemic lidocaine, alpha-2 agonists, and glucocorticoids (Richebé et al., 2019). Multimodal opioid-sparing analgesia is the integration of nonopioid agents or techniques to decrease opiate use in the perioperative setting and to reduce opioid-related adverse events (ORAE) (Dunkman & Manning, 2018; Richebé et al., 2019; Wick et al., 2017).
The enhanced recovery after surgery (ERAS) pathway emerged as a guideline to help improve the quality of surgical care, including pain management in the postoperative setting by integrating multimodal opioid-sparing analgesia to decrease opioid utilization (Dunkman & Manning, 2018; Gastaldo et al., 2021; Nagliati et al., 2020; Thorell et al., 2016; Wick et al., 2017). Today, ERAS pathways are utilized by many institutions to continue to improve patient care through ongoing evidence-based, multidisciplinary, multimodal care pathways focused on enhancing patients’ surgical recovery in the various surgical specialties.

**Problem Statement**

The ERAS guideline provides a framework for perioperative care for surgical patients. However, a critical aspect of the ERAS pathway, opioids have typically been the mainstay in the treatment of pain for patients undergoing MIS of the abdomen. The different types of MIS of the abdomen continue to challenge surgeons who depend on traditional analgesic regimens that rely heavily on opioids for perioperative pain management. ERAS guidelines incorporate multimodal opioid-sparing analgesic strategies, but its framework does not define or specify regimens for MIS of the abdomen procedures (Dunkman & Manning, 2018).

The goal of this DNP project was to modify and implement an approach for increased adherence to an underutilized multimodal opioid-sparing analgesia regimen. The regimen was integrated consistently to reduce opiate use while managing pain among postoperative patients undergoing MIS of the abdomen, focused within the foregut (e.g., bariatric surgery, hiatal hernias, paraesophageal hernias, and fundoplication). By decreasing the overutilization of opioids used solely for pain control, incorporating a multimodal opioid-sparing analgesic regimen will lead to a decrease in the number of opioids (morphine milligram equivalents [MME]) required for pain management, improvement in pain management, decrease length of stay (LOS),
decrease ORAE, and increase patient engagement with recovery as evidenced by functionality (increased ambulation, sitting in chair, use of incentive spirometer) during hospitalization and upon discharge to home (Lawal et al., 2020; Ng et al., 2017; Pardue et al., 2020; Saurabh et al., 2015; Ziemann-Gimmel et al., 2013).

**Significance**

Opioid overdose is the leading cause of injury-related death in the United States and has exceeded motor vehicle accidents for the first time (Hill et al., 2017). Reasons for increasing mortality include the continued rise in the rate of opioid prescribing in the United States over the last decade (CDC, 2021; Hill et al., 2017; Lawal et al., 2020; Neuman et al., 2019). Forty-four people die every day from overdoses that involve a prescription opioid (CDC, 2021). The opioid epidemic is a current societal and healthcare burden that affects every person of any socioeconomic status. Patients who use opioids for pain control postoperatively and at discharge are at a 44% increased risk for opioid dependence – after only five days of use (Hah et al., 2017; Hill et al., 2017; Lawal et al., 2020).

The task of decreasing excess opioid prescriptions has fallen to healthcare providers who prescribe opioid prescriptions. As designated providers who are vested with the authority to prescribe opioids, there is a societal imperative to avoid overprescribing while adequately treating postoperative pain. Broad guidelines for managing and treating postoperative pain have been developed (Beverly et al., 2017; Dunkman & Manning, 2018; Gabriel et al., 2019; Hill et al., 2017; Nagliati et al., 2020). However, there are no clear operation-specific guidelines for opioid prescriptions to address pain management for general surgical procedures until recently (Ford et al., 2021; Hill et al., 2017; Thorell et al., 2016).
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Background

Review of Literature

The review of the literature was focused on multimodal analgesia/multimodal opioid-sparing analgesia in MIS of the abdomen with a focus towards the foregut. The literature search was done through an electronic search in the database PubMed, EBSCOhost, and Cochrane Library. Key terms were utilized and included MeSH wording with the use of “AND”/“OR” Boolean operators incorporated between key terms. Key terms involved with the search were the following: “multimodal analgesia”, “postoperative pain”, “decrease opioids”, “bariatric surgery”, “decrease opioid use”, “minimally invasive surgery”, “abdominal surgery”, “foregut”, “laparoscopic surgery”, “nonopioid intervention”, “ERAS protocol”, “multimodal regimen”, “decreased pain”, “ketorolac”, “acetaminophen” and “NSAIDs”. Inclusion criteria for relevant evidence addressed multimodal analgesia, decreased opioid use or improved pain management, abdominal/foregut surgery, ERAS, Meta-Analysis, Randomized-Controlled Trials (RCTs), Retrospective Cohort Studies, and Observational Studies. Exclusion criteria included articles that had no clear discussion or indication of multimodal analgesia, and transversus abdominus plane (TAP) blocks. The electronic databases were searched utilizing the key terms. After articles were removed for duplicates and filtered for 2012-2022, 114 articles were identified. Thirty-five articles were excluded as they focused on TAP blocks or were of a different surgical procedure (e.g., orthopedic surgery, gynecology, oncology, etc.). The remaining 44 full-text articles were assessed for eligibility and application with 35 articles focused on relevance in practice. Of the 35 articles, 23 full-text articles were analyzed to focus on practice evidence in the clinical setting without multiple measured variables, and 14 articles were kept for the final review of the literature. Results of the search can be seen in the PRISMA flow chart (see Appendix A).
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This review of the literature outlined current knowledge regarding multimodal opioid-sparing analgesia highlighting integral pieces of evidence in support for the use of multimodal opioid-sparing analgesia and the benefits of this approach on postoperative pain. In addition, the review of the literature described the effectiveness of specific medications used in multimodal therapy, what is known currently regarding the problem of opioid utilization in MIS of the abdomen, and the strengths and weaknesses of the evidence in the literature findings. Among the 14 articles chosen for literature review of its supporting evidence for safely incorporating a multimodal opioid-sparing analgesia approach in MIS of the abdomen/foregut, the articles addressed postoperative pain management, bleeding risks, and LOS in MIS of the abdomen with a design focused on a multimodal opioid-sparing regimen approach to decrease the utilization of opioids by integrating nonopioid analgesics (Erdogan Kayhan et al., 2018; Gago Martínez et al., 2016; Gobble et al., 2014; Hariri et al., 2019; Horsley et al., 2019; Lange et al., 2018; Marcotte et al., 2020; Ng et al., 2017; Olmos et al., 2021; Pardue et al., 2020; Saleh et al., 2014; Saurabh et al., 2015; Song et al., 2014; Ziemann-Gimmel et al., 2013). The 14 articles focused on multimodal opioid-sparing analgesia in which nonopioids were integrated into their regimens utilizing the following: ketorolac, celecoxib, intravenous (IV) acetaminophen (APAP), and the routine use of nonsteroidal anti-inflammatory drugs (NSAIDs).

The literature review identified several regimens currently in use. A key article presented at the American Society for Metabolic and Bariatric Surgery (ASMBS) Annual Meeting 2021 by the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) was the nationwide multi-center quality improvement (QI) project Bariatric Surgery Targeting Opioid Prescribing (BSTOP) protocol (Petrick et al., 2021). This QI project developed a pain management regimen to decrease opioid use and serves as an updated cornerstone for the application of a multimodal opioid-
sparing analgesia protocol for postoperative pain management among MIS of the abdomen among bariatric surgery.

**Ketorolac**

Among the 14 articles, five incorporated ketorolac as part of the treatment regimen for multimodal opioid-sparing analgesia and found that there was at least a 34%-73.8% decrease in opioid utilization and was found to be safe for patients in terms of incidence of gastric bleeding, marginal ulcer development, and anastomotic leaks (Gobble et al., 2014; Hariri et al., 2019; Pardue et al., 2020; Saleh et al., 2014; Ziemann-Gimmel et al., 2013). Furthermore, it did not increase the incidence of gastric bleeding and/or anastomotic leak and was effective for pain control while also reducing opiate use when used in combination with intravenous APAP (Gobble et al., 2014; Saleh et al., 2014; Ziemann-Gimmel et al., 2013). Despite the nonselective mechanism of ketorolac, it effectively managed pain resulting in reduced opioid utilization and had no significant impact on the risk for gastrointestinal bleeding or marginal ulcers postoperatively when use is restricted to five days or less (Gobble et al., 2014; Hariri et al., 2019; Saleh et al., 2014).

According to Saleh et al. (2014), ketorolac use was determined to be safe as an adjuvant for multimodal opioid-sparing analgesia in colorectal surgery and when used within five days or less, found no association between ketorolac use and anastomotic leaks ($p = .021$). Additional evidence was reviewed by Gobble et al. (2014) in the first meta-analysis of RCTs that evaluated the use of ketorolac and its safety profile concerning risk for postoperative bleeding. The meta-analysis reviewed 27 studies and found ketorolac did not significantly increase postoperative bleeding (2.5% ketorolac group vs 2.1% control group OR, 1.1; 95% CI, 0.61 to 2.06; $p = .72$). Furthermore, when comparing the ketorolac group between low-dose (30 mg or less) versus high-dose (greater than 30 mg) interventions, there was no significant difference in bleeding events.
found (OR, 0.76; \( p = .71 \); and OR, 1.24; \( p = .55 \), respectively). The authors emphasized duration of treatment postoperatively be limited to five days or less to lower the incidence of adverse effects of ketorolac (OR, 0.49; \( p = .02 \)).

Per Hariri et al. (2019), patients receiving ketorolac-opioid regimens as part of a multimodal-opioid sparing analgesia regimen had an average decrease in opioid utilization by more than 34% compared to an opioid-only approach (\( p < 0.001 \)) with no associated risk of bleeding when given for less than five days. The team found that the ketorolac treatment group (15 or 30 mg) required less opioids compared to the opioid-only group (109.1 ± 97.2 mg versus 167.9 ± 85.2 mg, \( p < 0.001 \)). In addition, Ziemann-Gimmel et al. (2013), concluded that ketorolac (30 mg) in combination with APAP (1,000 mg) together for multimodal opioid-sparing analgesia led to a 73.8% reduction in opioid consumption. The ketorolac and APAP group required only 1.1 mg of opioids compared to 4.2 mg in the opioid-only group. The authors also found an estimated range of 20%-40% for the narcotic sparing effect with nonopioid use. Therefore, the literature supports the use of ketorolac, given its length of use remain less than five days with a dosing recommendation of at least 15 mg minimum.

**Acetaminophen (APAP)**

The use of oral or intravenous APAP as either one of the nonopioids or only nonopioid included in the treatment regimen for decreasing opioid utilization was identified in nine of the 14 articles (Erdoğan Kayhan et al., 2018; Horsley et al., 2019; Lange et al., 2018; Marcotte et al., 2020; Ng et al., 2017; Pardue et al., 2020; Saurabh et al., 2015; Song et al., 2014; Ziemann-Gimmel et al., 2013). There is increasing literature supporting the use of intravenous APAP (1,000 mg) within the early postoperative hours to aid multimodal opioid-sparing analgesia regimens due to its efficacy in its intravenous formulation compared to oral use for pain management and reduced opioid consumption.
According to Lange et al. (2018); Ng et al. (2017); Pardue et al. (2020) and Ziemann-Gimmel et al. (2013), intravenous APAP’s usefulness for effective pain control and significantly decreased opioid consumption was due to the pharmacokinetics of its bioavailability and absorption in the body from its rapid onset with peak effect which provides effective plasma concentrations in comparison to the oral formulation. Song et al. (2014), notes that intravenous APAP penetrates the central nervous system quickly, allowing for earlier clinically effective plasma and cerebrospinal levels for pain control compared to the oral and rectal formulations. The intravenous formulation was frequently seen in bariatric surgical patients, especially Roux-en-Y Gastric Bypass (RYGB), as there was impaired absorption and altered pharmacokinetics when medications such as oral APAP were taken in the initial postoperative period. Oral APAP was inadequate in the early postoperative period for the bariatric surgical population as oral administration may not be absorbed adequately due to decreased gut motility from the surgery itself, anesthesia, fasting, stress, and/or alterations to the gastrointestinal tract affecting absorption of the medication leading to decreased bioavailability, absorption, and efficacy (Lange et al., 2018; Song et al., 2014).

According to Saurabh et al. (2015), when intravenous APAP (1,000 mg) was used among postoperative laparoscopic RYGB patients, there was a 25% reduction in opioid demand ($p < 0.05$) and a 20% decrease in the opioid-analgesic dose required ($p < 0.05$). A frequently cited study by Song et al. (2014), supports the use of intravenous APAP (1,000 mg) in optimizing multimodal opioid-sparing analgesia postoperatively. The data showed a decrease in opioid utilization when intravenous APAP was incorporated compared to monotherapy with opioids ($33.0 \pm 12.8$ mg versus $60.7 \pm 20.9$ mg).

Therefore, intravenous APAP has become the preferred formulation for multimodal opioid-sparing analgesia during the perioperative phase.
**NSAIDs – intravenous ibuprofen and celecoxib**

Among the 14 studies, only two included intravenous NSAIDs, such as intravenous ibuprofen, as part of the multimodal opioid-sparing analgesia regimen (Erdogan Kayhan et al., 2018; Gago Martínez et al., 2016). Two of the 14 articles had regimens that administered celecoxib as part of the multimodal opioid-sparing analgesic regimen either preoperatively or both preoperatively and postoperatively for pain management (Horsley et al., 2019; Pardue et al., 2020). According to Erdogan Kayhan et al. (2018); Gobble et al. (2014); Hariri et al. (2019); Horsley et al. (2019) and Saleh et al. (2014), the use of NSAIDs such as ibuprofen, ketorolac, or celecoxib did not increase the risk for gastric bleeding, marginal ulcers, and anastomotic leaks. In addition, NSAIDs and celecoxib were deemed safe for use in bariatric and abdominal surgery given a limited duration of less than five days (Gobble et al., 2014).

Several studies targeted bariatric surgery, as it is a common MIS of the abdomen that limits its use of NSAIDs due to the increased risk and concern for anastomotic leaks, marginal ulcers, and gastric bleeding. However, in the review, NSAIDs were found to be safe for use in bariatric and abdominal surgery and did not further increase the risk for gastric bleeding or marginal ulcers while at the same time improving pain control and decreasing opioid utilization postoperatively (Erdogan Kayhan et al., 2018; Gobble et al., 2014; Hariri et al., 2019; Horsley et al., 2019; Saleh et al., 2014). In the RCT by Gago Martínez et al. (2016), incorporating intravenous ibuprofen (800 mg) in postoperative pain management reduced morphine consumption by 47.6% with mean morphine intake in the intravenous ibuprofen group significantly less than the morphine only group (14.22 ± 3.23 mg versus 29.8 ± 5.29 mg). Among other NSAIDs, celecoxib was included due to the selective nature of targeting the cyclooxygenase-2 (COX-2) receptor, which decreased the risk for gastric bleeding in comparison to the nonselective mechanism of ketorolac. However, the integration of either intravenous ketorolac (15 or 30 mg) or oral
celecoxib (400 mg) was both effective in reducing opioid utilization by decreasing the inflammatory process by inhibiting the COX-2 receptor (Gobble et al., 2014; Hariri et al., 2019).

**Intravenous acetaminophen (APAP) and NSAIDs (e.g., celecoxib) – Synergism**

The literature has shown that incorporating nonopioids such as intravenous APAP or NSAIDs alone improved postoperative pain and decreased opioid utilization. However, if more than one nonopioid is used in combination with each other as a regimen, it can increase efficacy in postoperative pain management. Multiple nonopioids can have a synergistic effect on different pain receptor sites, leading to outcomes such as decreased opioid utilization, shorter length of stay (LOS), and decreased opioid-related adverse events (ORAE) such as postoperative nausea and vomiting (PONV), respiratory depression, or somnolence (Horsley et al., 2019; Ng et al., 2017; Olmos et al., 2021; Ziemann-Gimmel et al., 2013). According to Erdogan Kayhan et al. (2018) and Horsley et al. (2019), the co-administration of APAP with an NSAID were synergistic because of the central analgesic effects they provide potentially decreasing opioid requirements. The authors concluded that an integration of both NSAID use and intravenous APAP with a multimodal opioid-sparing analgesia regimen can synergistically manage pain and decrease opioid needs.

According to Horsley et al. (2019), the use of oral celecoxib (400 mg) with scheduled oral APAP (975 mg) for postoperative pain control in MIS of the abdomen, such as bariatric surgery, resulted in a 28% decrease in total morphine equivalents (TME) when nonopioids were implemented in the regimen postoperatively. The authors found a statistically significant ($p = .006$) decrease in TME required between the opioid-sparing group versus the control group (163.4 mg v. 225.2 mg). The data was further supported by previous studies from Ziemann-Gimmel et al. (2013) and Song et al. (2014), indicating that a nonopioid based regimen led to a 74% reduction of opioid use
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(Ziemann-Gimmel et al., 2013), and an associated shorter LOS and 45% reduction in morphine milligram equivalents (MME) with nonopioids when included in a multimodal opioid-sparing analgesic regimen (Song et al., 2014).

**Strengths**

Enhanced recovery after surgery (ERAS) guidelines recommend approaches to managing perioperative pain with a decreased reliance on opioids alone for control. Olmos et al. (2021) conducted a quality improvement (QI) project within the surgical services of four distinct hospitals focused on increasing acceptance of a multimodal opioid-sparing protocol/regimen during the perioperative period. The team was able to increase use of a multimodal opioid-sparing analgesia from 53.9%-67.5% ($p < 0.001$). The team also found a decrease in opioid needs by 11.3% in the post-anesthesia care unit (PACU) and a 12.2% decrease by 48 hours postoperatively ($p < 0.001$). Of the 14 articles in the table of evidence, each supported the need for the utilization of nonopioids for pain management during the perioperative period and into the postoperative period until discharge to home. This review emphasized the ongoing concern about the opioid epidemic, ORAE that occurred with increased opioid utilization, and the value of nonopioid pharmacological approaches to pain management in decreasing the need for opioids for pain management while maintaining patient satisfaction with pain control. Reviewed articles indicated the continued effectiveness of a multimodal opioid-sparing analgesic regimen with the use of APAP, ketorolac, and/or NSAIDs in conjunction with the sparingly use of opioids. Moreover, several studies found decreased opioid consumption and successful pain management when one or several nonopioids were implemented collectively as a multimodal opioid-sparing analgesic regimen.

**Limitations**

The studies had several limitations including the following: risk of confounding in observational studies, limited generalizability, documentation dependence due to the
retrospective approach, varying approaches to measurement of pain assessment, limited statistical power, and observer bias. However, despite weaknesses, the retrospective and observational studies yielded statistically significant differences and were later reproduced in RCTs yielding statistically significant results. Few studies focused specifically on MIS of the abdomen as these tend to focus on the foregut and upper relative to lower gastrointestinal tract. However, in the last seven years, increasing evidence has focused on bariatric surgery, as this falls into the purview of MIS of the abdomen/foregut. There was limited to no data regarding use of multimodal opioid-sparing analgesia for fundoplication patients.

**Project Model**

The Institute for Healthcare Improvement and the Agency for Healthcare Research and Quality (AHRQ) recommends the Plan, Do, Study, Act (PDSA) Model of Improvement as a systematic process for gaining knowledge, information, and implementing innovative change (AHRQ, 2015; IHI, 2022). The PDSA Model of improvement begins with three questions of “What are we trying to accomplish: *Aim*”, “How will we know that a change is an improvement: *Measures*”, and “What changes can be made that will result in an improvement: *Changes*” (IHI, 2022). In this project, the *Aim* was to modify and implement an approach for increased adherence to an underutilized multimodal opioid-sparing analgesia regimen, decrease opiate use, and improve pain control with nonopioids. The *Measure* was to decrease morphine milligram equivalents (MME) given postoperatively and manage pain with nonopioids and evaluate patient satisfaction with the use of a multimodal opioid-sparing analgesic regimen. Finally, *Changes* would include consistent adherence to a multimodal opioid-sparing analgesic regimen, provider pocket card with the regimen for reference, reference card for workstation on wheels (WOWs) for Nursing, QR Code for electronic touchless access
with a smart phone, and education to providers and Nursing staff on multimodal opioid-sparing regimen being instituted.

The first stage, **Plan**, consisted of: modifying an underutilized pre-existing multimodal opioid-sparing analgesia regimen, creating a tool to measure and track MME given during the postoperative recovery, developing a pocket card for both the Residents and Nurses, and educating Residents and Nurses on the multimodal opioid-sparing analgesia that was utilized postoperatively in MIS of the abdomen patients (Bariatric or Fundoplication surgery). The **Plan** stage involved the identification of data that was collected to determine the outcomes/effect of the multimodal opioid-sparing analgesic regimen. Data that was collected included the following items: pain score upon arrival to the unit from Post-Anesthesia Care Unit (PACU), total MME given during hospitalization, and if opioids were prescribed at discharge. The second stage **Do**, involved the implementation of the multimodal opioid-sparing analgesic regimen from September 2022 until December 2022 at a non-profit, academic Level I Trauma medical center among postoperative MIS of the abdomen-foregut patients. The multimodal opioid-sparing analgesic regimen included the utilization of Ofirmev (intravenous acetaminophen), oral acetaminophen (APAP), intravenous methocarbamol, oral methocarbamol, intravenous ketorolac, oral tramadol, and intravenous and/or oral opioids (oxycodone or hydromorphone), and team education occurred. The third stage **Study**, MME data collected was analyzed and compared to pre-implementation of the multimodal opioid-sparing analgesia regimen for predictions of decreased opiate use and pain reduction, and clinician adherence. In the fourth and final stage **Act**, lessons from the unit led to decisions to **adapt** or **adjust** the multimodal opioid-sparing analgesia regimen from the **Study** stage or **adopt** the multimodal opioid-sparing analgesic regimen to a larger scale for the Division of GI Surgery and potentially General Surgery. Finally,
Organizational Description and Assessment

Description of the System

The institution of implementation is a non-profit, academic medical center and healthcare system consisting of six hospitals including a Level I Trauma for adults and children, a physician practice corporation, a behavioral medical center, an inpatient rehabilitation center, outpatient care services, and remote clinics in the western United States, and affiliate organizations around the world.

Setting

The Division for GI Surgery had an unofficial multimodal opioid-sparing analgesia regimen that was not utilized consistently. Pain management postoperatively was dependent upon Attending preference, experience, and training. In addition, as a teaching hospital with a fellowship program, the Division had rotating Residents each month and a MIS Fellow each year. New residents may be unfamiliar with multimodal opioid-sparing analgesic regimens and practices which impacts decision making for pain management approaches postoperatively based on exposure, training, and experience. MIS typically range from cholecystectomy, fundoplication, bariatric surgery, complex hernia repairs, complex foregut surgeries, and other gastrointestinal complications requiring surgical intervention. As an academic institution, Residents engaged in surgical training including patient management preoperatively, perioperatively, and postoperatively. Postoperative pain management tended to be primarily focused on the use of opioids as the first line for pain control rather than the incorporation of multimodal opioid-sparing analgesia. Most surgeons with the Division had trialed multimodal opioid-sparing analgesia with their postoperative patients but had not come to a consensus on a regimen for multimodal opioid-sparing analgesia that had been used consistently and after modifications from the Act step, repeat the PDSA cycle. Refer to Appendix B for a graphic reference of the Project Model.
established as a part of the team’s protocol for an enhanced recovery pathway (ERP).

Methods of pain management among surgeons in the Division varied with the use of opioids, patient-administered analgesia (PCA) with hydromorphone, and on occasion the use of nonopioid analgesics such as APAP, muscle relaxants, and/or NSAIDs would be utilized. Due to the varying practices of pain management, patients at discharge were typically discharged home with the quantity of opioids per Drug Enforcement Agency (DEA) guidelines (quantity of 20 tablets of opioids/limit of five days postoperatively).

**Need**

The pre-existing regimen was a multimodal opioid-sparing analgesia regimen that was adopted by the Division of GI Surgery after recent participation in the MBSAQIP BSTOP QI Project. Division of GI Surgery was involved with this nationwide multi-center QI Project and had adopted and revised the regimen for its Division use. However, despite the multimodal opioid-sparing analgesia regimen existing in the Division of GI Surgery for use, there had been a decline in clinician fidelity and inconsistent application. The Division of GI Surgery did not have an extensive evaluation of adherence or outcomes at the institution to the use of the multimodal opioid-sparing analgesia regimen among MIS of the abdomen and opioid impact. Therefore, modifying and implementing an approach to increase adherence to the Division’s multimodal opioid-sparing analgesia regimen that was adopted from the BSTOP QI Project was necessary to decrease opioid use postoperatively. Through reductions in postoperative opioid use the ultimate aim of this project was to discharge patients on little to no opioids, decreasing the risk for opioid dependence, and opioid-related adverse events (ORAE).

**SWOT Analysis**

The internal strengths at the institution that served as facilitators for this DNP project included its status as a Magnet and academic institution, an engaged Nursing
team, emphasis on evidence-based practices, support from surgical Attendings, a
professional governance group that was engaged for improved practices, and a
dedicated Lead Pharmacist that was interested in this project. The internal weaknesses
that were present within the institution and presented as potential barriers to the project
included rotating Residents each month, Surgeon preferences on pain management
based on individual experiences, a Fellow who would have their individual experiences
influence pain management, opioids currently used as first line for pain control,
experienced Nurses who may be resistant to change, and lack of ongoing educational
updates of evidence-based practices.

Externally, there were opportunities that supported this project at the local,
community, and state level. There was community interest for change to decrease opioid
use with a continued healthcare interest to improve opioid utilization. On a larger scale at
the state and national level, policies continued to emerge to improve and reduce the
negative impacts of opioid use in the community as evidenced by continued education
and policy enforcement by the DEA.

Lastly, external threats that were barriers to this project included insurance
limitations/restrictions for multimodal nonopioid analgesia at discharge for continued pain
management at home, patient’s socioeconomic status (SES) impacting out-of-pocket
costs for multimodal nonopioid analgesics at discharge, and non-adherence to
postoperative opioid-sparing regimen due to financial burden limiting the patient. The
SWOT analysis can be found in Appendix C in a graphic illustration.

Goals and Aims

The goal of this DNP project was to modify and implement an approach for
increased adherence to an underutilized multimodal opioid-sparing analgesia regimen.
The regimen was integrated consistently to reduce opiate use while managing pain
among opioid naive postoperative patients undergoing MIS of the abdomen, focused
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within the foregut. The goal was to decrease the over-utilization of opioids used solely for pain control leading to a decrease in the number of opioids required for pain control while in the postoperative setting and upon discharge to home. The project had the following aims:

1. Modify a multimodal opioid-sparing analgesia regimen to reduce opioid consumption in postoperative MIS of the abdomen patients by utilizing Division of GI Surgery nonopioid analgesic approaches.

2. Implement the multimodal opioid-sparing analgesia regimen among opioid naïve postoperative MIS of the abdomen patients and evaluated the reduction of opiate use as evidenced by a decrease in the total number of morphine milligram equivalents (MME) given while inpatient and prescribed at discharge. The secondary outcome was to improve patient satisfaction with pain management with the integrative use of a multimodal opioid-sparing analgesia regimen.

3. Develop and implement recommendations for sustainability and scalability for the use of the multimodal opioid-sparing analgesia regimen for GI/General MIS patients postoperatively within the institution of practice.
Part 2

Methods

Various multimodal opioid-sparing analgesia regimens exist but were not used extensively, consistently, and/or adequately leading to continued dependence on opioid use for pain management. The goal of this DNP project was to modify and implement an approach for increased adherence to an underutilized multimodal opioid-sparing analgesia regimen to be integrated consistently to reduce opiate use while managing pain among postoperative patients undergoing minimally invasive surgery (MIS) of the abdomen, focused within the foregut. The project employed a quality improvement (QI) approach to improve clinical practice of a pre-existing regimen where there was insufficient fidelity with a focus to standardize the use of the regimen in MIS of the abdomen postoperatively during inpatient hospitalization and increase adherence to decrease opiate use while improving patient outcomes. The design of the QI project included modifications to increase adherence to an underutilized multimodal opioid-sparing analgesia regimen, training for rotating Residents to the Division of GI Surgery, in-service education with Nursing staff, and an in-service with surgical Attendings on the pre-existing regimens uses, benefits, and previous success when utilized consistently. We anticipated approximately 50 patients would be involved in the implementation of this project. The estimates were based on the average total elective cases per week. We evaluated the intervention using a pre- and post-implementation chart review collecting data on the following outcomes: 1) morphine milligram equivalents (MME) used postoperatively (primary outcome), 2) clinician practices in the use of the multimodal opioid-sparing analgesia regimen, 3) patient reported pain score postoperatively, 4) quantity and type of opioids dispensed at discharge, and 5) clinician fidelity to the multimodal opioid-sparing analgesia regimen.
**Aim 1:** Modify a multimodal opioid-sparing analgesia regimen to reduce opioid consumption in postoperative MIS of the abdomen patients by utilizing Division of GI Surgery nonopioid analgesic approaches.

The project required modification within the clinical setting prior to implementation of the following: multimodal opioid-sparing analgesia regimen, education/in-services for rotating Residents, surgical Attendings, and Nursing staff at baseline, and data collection. The project also required an approval from the institution as a QI Project. Aim 1 was implemented in the following steps.

1. **Pre-existing multimodal opioid-sparing analgesia regimen**
   - Evaluated pre-existing regimen for GI Surgery: integrated use of nonopioids and opioids
   - Incorporated nonopioid analgesia as adopted by BSTOP QI Project involving Division of GI Surgery
   - Implemented consistent use of acetaminophen, methocarbamol, and ketorolac for nonopioid management of pain per evidence-based practices from BSTOP QI Project
   - Implemented consistent use of hydromorphone, oxycodone, and/or tramadol for opioid management of pain per evidence-based practices from BSTOP QI project
   - Regimen from evidence matrix pulled together targeted postoperative day (POD) zero, one and two (See Appendix D and Appendix E)

2. **Approval of Project implementation**
   - Presented project proposal to institution Nursing Research Council for approval
   - Coordinated with lead researcher for institution Nursing Research
   - Coordinated with Nurse Director and Nurse Educator
3. **Education/In-service for Providers and Nursing Staff**

- Developed provider training for Pharmacy Supervisor on site that included:
  - Multimodal opioid-sparing analgesia regimen
  - Use of nonopioid analgesics
  - Limited opioid quantity at discharge
  - Morphine milligram equivalents calculation according to CDC guidelines
  - Point of contact for QI Project

- Developed staff Nursing training that covered:
  - Multimodal opioid-sparing analgesia regimen
  - Use of nonopioid analgesics
  - Pain score documentation in EPIC
  - Pain assessment
  - Uncontrolled pain despite use of breakthrough pain (BTP) medication
  - Patient education on pain management with use of multimodal approach
  - Point of contact for QI project

- Training included:
  - In-person and virtual presentation on multimodal opioid-sparing analgesia regimen
  - Discussion of BSTOP QI project and goal of adherence
  - Orientation with Residents included on-going dialogue and education on role of nonopioid approaches to pain management versus opioid monotherapy
  - Email with handout of multimodal opioid-sparing analgesia regimen for Residents.
  - In-person in-service with Nursing covered items indicated above in section for Nursing staff training
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- Provider reference card of multimodal opioid-sparing analgesia regimen (See Appendix F)
- Nursing workstation on wheels (WOWs) reference card of regimen (See Appendix G)

4. Data collection

- Division of GI Surgery actively engages in research for the Department of Surgery. Permission was granted through Division for reviewing and extracting data as Division was involved with active research with the same patient population. CITI certification was up to date per Departmental guidelines for continued research participation with surgical Attendings. Patient information was deidentified.
- Utilized prior BSTOP QI project questionnaire for data collection of MME and opioids during pre- and post-implementation period for comparison of fidelity to regimen and opiate reduction (See Appendix J).
- Chart reviewed 6/1/22 – 8/31/22 on current regimen adherence and trends for multimodal opioid-sparing analgesia that was completed using BSTOP QI project data collection questionnaire (See Appendix J).

Aim 2: Implement the multimodal opioid-sparing analgesia regimen in postoperative MIS of the abdomen patients and evaluate the reduction of opiate use with the primary outcome of decreased total number of morphine milligram equivalents (MME) given while inpatient and prescribed at discharge.

Implementation

Aim 2 was implemented in the following steps:

1. Training of Providers: Orientation to GI Surgery Service included multimodal opioid-sparing analgesia regimen that was implemented postoperatively on MIS of the abdomen in Bariatric and Fundoplication surgery.
Beginning of each month in 2022 (September, October, November, and December) – first Thursday at switch day for Residents, orientation to service
Email attachment of handout was sent to each incoming Resident for reference.
Consistent follow up and positive reinforcement with Residents to adhere to multimodal opioid-sparing analgesia regimen.
Monthly education with incoming rotating Residents continued to ensure adherence with all providers.
GI Surgery APRN contact information was given for any questions.
MIS Fellow, Chief Resident, APRN, Junior Residents – entered orders for multimodal opioid-sparing analgesia regimen.
Evaluated responses to multimodal opioid-sparing analgesia and pain
Evaluated patient if concerns raised by Nursing staff for breakthrough pain (BTP) despite regimen
Communication per chain of command per institutional policy for communication with providers – if Resident was notified, APRN was contacted as well.
If pain was unresolved after receiving two consecutive doses for breakthrough pain, provider evaluated patient face-to-face regarding pain.
  o If pain persisted, evaluated source of pain (e.g., gas pain, stomach spasm, etc.) and notified team to discuss if requiring additional opioid intervention or alternative intervention (e.g., simethicone, dicyclomine, ambulation, etc.).
Regimen was not adjusted or altered unless there was a contraindication and/or allergy.
Communicated with Nursing staff about any changes

2. Reference cards: reference pocket card was given to each Resident at the start of rotation with GI Surgery to ensure adherence (See Appendix F).
3. **Nursing education:** Nursing staff received in-service by GI Surgery APRN
   - Discussed multimodal opioid-sparing analgesia regimen for MIS of the abdomen patients postoperatively from Bariatric or Fundoplication surgery
   - Nursing Staff – ensured correct orders, carried out orders, if incorrect, notified GI Surgery APRN, documented pain score, documented pain score goal, and notified team with any additional concerns
   - Charge Nurse/Team Leader – chain of command communication when resident was not able to be reached regarding regimen implementation, assisted in double checking orders were entered properly and notifying provider if any were missing.
   - Contact information was provided for any additional questions when an order needed clarification or was missing.
   - Consistent follow up and positive reinforcement with Nursing staff to adhere to multimodal opioid-sparing analgesia regimen
   - Discussed documentation of pain score on EPIC flowsheet using numeric pain score
     - Upon arrival to unit from Post-Anesthesia Care Unit (PACU)
     - Prior to administration of opioid
     - Every physical exam
     - Every set of vital signs obtained
     - 15-30 minutes after opioid is administered
     - Uncontrolled pain despite breakthrough pain intervention

4. **WOW Cards:** each mobile Nursing workstation had a laminated reference card of the multimodal opioid-sparing analgesia regimen with GI Surgery APRN contact info for order clarification if necessary (See Appendix G).
5. **Pharmacy Supervisor LLUSH:** tabulation of morphine milligram equivalents during inpatient hospitalization using BSTOP questionnaire and CDC calculation as previously done during QI project with MBSAQIP.

6. **Project fidelity:** ensured provider adherence to regimen including follow up with provider for continued fidelity
   - Providers had pocket card with regimen as a reference guide to ensure adherence.
   - QR Code was developed and incorporated the multimodal opioid-sparing analgesia regimen embedded into the code when scanned with a smart phone or QR Code scanner (See Appendix E).
     - The QR Code was designed with the use of a program found online that enabled information to be entered into one location.
     - The QR Code was downloaded into the appropriate size and frame for scanning.
     - The QR Code identified the name of the project, the multimodal opioid-sparing analgesia regimen, and the APRN.
     - Multiple QR Codes were duplicated, cut into smaller sizes, and laminated to institutional approval for unit.
     - Each laminated QR Code was affixed to each desktop computer
     - Each QR Code that was affixed increased accessibility to the multimodal opioid-sparing analgesia regimen and increased clinician fidelity to the project when pocket cards were misplaced, forgotten, or lost.
     - Any provider on the team (Fellow, Chief Resident, Senior Resident, and Junior Residents) was able to use their smart phone to scan the QR Code to access the multimodal opioid-sparing analgesia regimen for accurate order entry.
Bedside Nurse had a WOW card (reference card of regimen) that was attached to a mobile Nursing workstation to refer to the regimen as needed to confirm correct orders were entered correctly by providers.

When a postoperative Bariatric or Fundoplication surgical patient arrived at the unit Nursing staff followed institutional policy workflow for admission:

- Bedside Nurse or Charge Nurse reviewed orders that were entered by team that were Sign and Held
- Bedside Nurse or Charge Nurse “Acknowledge” and “Release” Sign and Held orders
- Bedside Nurse or Charge Nurse reviewed Orders tab for admitted patient to confirm multimodal opioid-sparing analgesia regimen was ordered correctly according to WOW card
- When item was missing from multimodal opioid-sparing analgesia regimen, Bedside Nurse or Charge Nurse paged on-call resident and APRN to notify which medication was missing from the multimodal opioid-sparing analgesia regimen.
- Resident or APRN entered missing order for Bedside Nurse.
- Resident received positive reinforcement and education by APRN when notified of missing item immediately to ensure adherence and increase project fidelity.

7. Multimodal opioid-sparing analgesia regimen: multimodal opioid-sparing analgesia regimen was used consistently and adhered to. Monitoring of medication used was through patient medication administration record in EPIC. Each postoperative day had the following regimen that was utilized by GI Surgery as adapted per BSTOP protocol. Each choice of medication pharmacologically impacts pain at specific receptor sites per literature and BSTOP QI recommendations. Every opioid naïve
patient received the multimodal opioid-sparing analgesia regimen while inpatient and at discharge to home. Opioid naïve patients were individuals who did not receive opioids in the 30 days prior to surgery and were not chronically receiving opioids on a daily basis to treat chronic pain (Petrick et al., 2021).

**Postoperative Day 0 (POD 0)**

◆ Scheduled around-the-clock (ATC) nonopioid analgesics:
  
  o Ofirmev/acetaminophen (analgesic) 1,000 mg intravenously every 6 hours for 24 hours
  
  o Robaxin/methocarbamol (muscle relaxant) 750 mg intravenously every 8 hours, if renal dysfunction present – renal dosing per Creatinine Clearance and Glomerular Filtration Rate (GFR)

◆ As Needed (PRN):
  
  o Toradol/ketorolac (NSAID) 15 mg intravenously every 6 hours as needed for mild to moderate pain (pain score 0-6)
    
  o Contraindicated if GFR less than 60
  
  o Dose not to exceed 60 mg daily
  
  o Dilaudid/hydromorphone (opioid) 0.2 mg intravenously every 2 hours as needed for severe to breakthrough pain (pain score 7-10)

**Postoperative Day 1 (POD 1) until discharge to home**

◆ Scheduled around-the-clock nonopioid analgesics:
  
  o Changed dose and route: Tylenol/acetaminophen (analgesic) 650 mg by mouth every 6 hours
  
  o Changed dose and route: Robaxin/methocarbamol (muscle relaxant) 500 mg by mouth every 8 hours
◆ As Needed (PRN):
  o Toradol/ketorolac (NSAID) 15 mg intravenously every 6 hours as needed for mild to moderate pain (pain score 0-6)
  o Added to medication administration: Roxicodone/oxycodone (opioid) 5 mg by mouth every 6 hours as needed for severe pain (pain score 7-10)
  o Modified order for use: Dilaudid/hydromorphone (opioid) 0.2 mg intravenously every 2 hours as needed for breakthrough pain ONLY
    o Notified provider if received two consecutive doses for breakthrough pain, for face-to-face evaluation

**Discharge to Home**
  o Tylenol/acetaminophen (analgesic) 650 mg by mouth every 6 hours for 5 days
  o Robaxin/methocarbamol (muscle relaxant) 500 mg by mouth three times a day for 5 days (or equivalent covered by insurance)
  o Ultram/tramadol (opioid) 50 mg by mouth every 6 hours as needed for breakthrough pain IF scheduled nonopioid analgesics not effective.

*Dispense quantity 10 tablets* || GOAL: no opioids prescribed at discharge only nonopioids for pain management.

Refer to Appendix D for flowchart of multimodal opioid-sparing regimen.

**Evaluation**: Refer to the table below for a summary of items evaluated including outcome, measurement tool, and statistical analysis.
1. **Data collection**: Monitored medication use, implementation, and outcomes were conducted through data collection from the patient medication administration record and patient questionnaires. Morphine milligram equivalents (MME) was the primary outcome collected in this step as well.

- Completed BSTOP questionnaire for each patient that was included in regimen to obtain the data for MME
- Each patient completed The Pain Treatment Satisfaction Scale (PTSS) questionnaire with the use of Appendix H and Appendix I.
- Chart check 9/23/22 – 12/19/22 once a week
  - Morphine milligram equivalents inpatient
  - Distributions and Frequencies of pain score
  - Patient reported pain score goal – evaluated success of integrating multimodal opioid-sparing analgesia regimen
  - Rate of fidelity to regimen measured by frequency of order changes that occurred on EPIC by the team from notifications by Nursing staff to APRN
  - The number of nonopioids prescribed at discharge to home (e.g., acetaminophen, methocarbamol)
  - If opioid dispensed:
    - Which one? Tramadol, oxycodone, or none

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<th>OUTCOME</th>
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<td>Patient Satisfaction</td>
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<td>Clinician fidelity</td>
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- Quantity dispensed: less than 10, less than 15, or 20 tablets
- Postoperative follow up in 2 weeks, was opioid used? If so, how many? (Utilized question set already built into EPIC Outpatient follow up note)
- What was MME of opioids used after discharge while at home?

2. **Patient Satisfaction:** We evaluated patient satisfaction with pain management using The Pain Treatment Satisfaction Scale (PTSS), a reliable and verified questionnaire developed by Evans et al. (2004). The PTSS questionnaire contained several categories and groups of questions targeting pain treatment satisfaction from current pain medication, medication characteristics, medical care, information about pain treatment, route of medication, side effects of medication, and satisfaction with medication and care. Questionnaire was scored by points tallied on how often a patient choose a particular answer. The PTSS utilized focused on *General pain* and *Satisfaction with Current Pain Medication*.

- Every postoperative opioid naïve MIS of the abdomen patient completed an evaluation questionnaire Appendix H and Appendix I at time of discharge.
- Questionnaires added for a global score, averaged score for each question item, percentage responded for each question item
- All questionnaires were deidentified for patient confidentiality.
- All hard copy of questionnaires were stored in a locked cabinet drawer in a locked office of the APRN.
- Questionnaire data was entered into an Excel spreadsheet that was saved on a locked “H Drive” at the institution that was encrypted and authenticated with a code.

3. **Pain Score:** Numeric scale via EPIC flowsheet entered by bedside Nurse

- Upon arrival to unit
- Every physical exam
- Every set of vital signs obtained
- Prior to administration of opioid
- 30 minutes to 1 hour after opioid was administered

4. **Analysis:** data from the BSTOP questionnaire and The Pain Treatment Satisfaction Scale (PTSS) questionnaire were collected, and results were evaluated and analyzed utilizing SPSS version 28. Analyses included the use of descriptive statistics, two sample t-test, and Chi-square analysis when applicable. We hypothesized that the mean MME would be lower in the post-implementation compared to the pre-implementation due to increased adherence to the multimodal opioid-sparing analgesia regimen. All outcome measures were analyzed including the primary outcome of MME used postoperatively and the secondary outcome of patient satisfaction; followed by additional outcomes of patient reported pain goal (pre-implementation and implementation), pain at discharge (pre-implementation and implementation), and clinician fidelity to division regimen (pre-implementation and implementation). Sub-outcomes evaluated from clinician fidelity included quantity of opioids prescribed at discharge.

- MME tabulation: nominal data with a two-sample t-test to evaluate if differences were significant in opioid consumption and its reduction. Additional analysis included percent decrease in opioid consumption during implementation of consistent adherence to multimodal opioid-sparing analgesia regimen.

- Patient satisfaction: PTSS questionnaire was evaluated and analyzed with descriptive statistics. Any nominal and ordinal variables were calculated from the number of patients and the percentage for each response category.
• Pain score: electronic health record review using EPIC to collect reported pain scores. Scores were analyzed using descriptive statistics and two sample t-tests of pre-implementation compared to implementation period.

• Quantity of opioids: utilizing BSTOP questionnaire, data was obtained as to how many opioids were prescribed at discharge and if there was a percent reduction in opioid use during inpatient hospitalization.

• Fidelity: monitored via chart check and reports from nursing staff that was tallied into an Excel spreadsheet. Fidelity was monitored to 1) ordering multimodal opioid-sparing analgesia regimen and 2) following regimen through discharge. Data was reported through descriptive statistics and Chi-square of independent proportions.

**Aim 3:** *Develop and implement recommendations for sustainability and scalability for the use of the multimodal opioid-sparing analgesia regimen for GI/General MIS patients within the institution of practice.*

**Sustainability**

We will present project findings and recommendations at Grand Rounds, and unit meetings within the institution. We will take additional steps to maintain the sustainability of the regimen:

• Continue with integrated information of multimodal opioid-sparing analgesia regimen with monthly orientation for Residents rotating with the service and email attachments of the regimen

• Affix the QR Code to each desktop computer on the unit with multimodal opioid-sparing analgesia regimen as a mechanism of sustainability and increasing adherence through the incorporation of technology and feasibility.

• Integrate reference card and orientation material to the Department of Surgery, Division of GI Surgery webpage and Shared Drive for Resident access
Incorporate regimen into standard of practice and care for pain management for Division of GI Surgery through ongoing meetings with stakeholders such as Division Chief, Surgical Attendings, and other providers in Division.

Expand regimen into standardization of care for patients within care of the service.

**Scalability**

- Once interventions have been implemented successfully with outcome data collected and evaluated, findings will be disseminated at Grand Rounds and presentations to the various Departments and Divisions within the institution.
- Multimodal opioid-sparing analgesia regimen broadened to other Divisions within the Department of Surgery
- Establish standard of care incorporating nonopioid analgesia for pain management with minimal opioid use for pain management
- Education of pain management expectations postoperatively

**Dissemination Plan**

An abstract proposal for poster presentation was submitted to the Annual Evidence-Based Practice (EBP) and Nursing Research Conference at the institution of implementation. Future dissemination includes the presentation of findings at the SIGMA Southern California Odyssey Research Conference, and the Annual PAINWeek Conference. Additionally, podium presentations, manuscript publications, Grand Rounds, and presentations with Professional Governance groups within the institution and among professional organizations will further disseminate the information obtained from the QI Project.

**Project Timeline**

During the summer of 2022 (6/1/2022 – 8/31/2022) we conducted a pre-implementation chart review of the current site’s adherence to the multimodal opioid-
sparing analgesia regimen, developed the provider reference cards for multimodal opioid-sparing analgesia regimen to increase adherence, reference cards with the multimodal opioid-sparing analgesia regimen for nursing workstation on wheels (WOWs), and updated orientation material to be given to monthly rotating Residents and surgical Attendings. Finally, the BSTOP questionnaire from MBSAQIP for opioid data collection was adopted. On 9/1/2022, incoming Residents rotating monthly through the GI Surgery service were given orientation education on the first Thursday of each rotating month (Switch Day) during orientation by the GI Surgery Division APRN. On 9/1/2022 – 9/3/2022, surgical Attendings received a brief in-service regarding the multimodal opioid-sparing analgesia regimen that was utilized with the targeted population of MIS of the abdomen patients postoperatively from foregut surgery (Bariatric or Fundoplication surgery). On 9/1/2022 – 9/3/2022, the on-site Pharmacy Supervisor received an in-service on questionnaire for morphine milligram equivalents (MME) during inpatient hospitalization and MME calculation per CDC guidelines. Adjustments were made from the feedback from the in-service with all stakeholders of surgical Attendings and Pharmacy Supervisor. On 9/19/2022 – 9/20/2022, Nursing staff received a brief in-service regarding the ongoing QI project, the project expectations from Nursing staff, and the use of multimodal opioid-sparing analgesia regimen on MIS of the abdomen patients postoperatively from Bariatric or Fundoplication Surgery. Starting on 9/23/2022 – 12/22/2022, all MIS of the abdomen patients undergoing Bariatric or Fundoplication Surgery and are opioid naïve received the multimodal opioid-sparing analgesia regimen. Data collection included the calculation of the patient’s MME and questionnaires filled out by Pharmacy and GI Surgery APRN. We averaged pain scores from ongoing weekly chart reviews, and adjusted the project, if necessary, based on feedback from clinical staff. A final evaluation of data occurred on 12/22/22. Refer to Appendix K for Gantt chart of the timeline.
Statement Related to Human Subjects

The following project was deemed “exempt” from IRB approval by the Yale University IRB. Ethical considerations include upholding the highest confidentiality standards, and respect for patient privacy and safety by taking on measures such as the following:

- Safeguarding patient information by deidentifying patient information
- Consideration of patient medical history and clinical judgment for best and safe practices for pain management given patient allergies to any medications in regimen
- Consideration of patient’s medical insurance that may impact access to medications upon discharge which may aid in pain management postoperatively – prescribing medications within insurance formulary to ensure adherence and decrease burden of cost to patient.
- Opioid dependent patients continued their designated regimen as set by their chronic pain management physician to ensure continuity of effective care in pain management.
- Pain management and reduction of opioid use was balanced through physical exam and assessments, use of pain scale, and around-the-clock treatment of pain with nonopioids. Reported pain was treated with use of opioids as needed per severity of pain reported to ensure pain is managed for postoperative opioid naïve patients. Pain was assessed 15-20 minutes after intervention to ensure pain was adequately managed for patient safety.
Part 3

Systems Considerations and Implications

Leadership and Stakeholder Engagement

The quality improvement (QI) project required engagement and “buy-in” from key leadership figures and stakeholders within the Division of GI Surgery and Nursing for project initiation and success. The stakeholders were individuals with a vested interest in the project’s success, outcomes, and potential impact towards patients, including the Division, the Unit, and the organization. To attain stakeholder engagement, an evaluation and analysis of individuals in leadership positions and those likely to be involved in the project were assessed and identified as stakeholders.

Patients were considered primary stakeholders as their outcomes were influenced by the implementation of the multimodal opioid-sparing analgesia regimen which could possibly impact them in a positive manner. Bedside nursing staff also were primary stakeholders as they interacted with every patient on the unit and their families during hospitalization and were involved with their pain management. As primary stakeholders in this project, bedside nursing “buy-in” for the project was critical in its success as they provided reinforcement of regimen implementation with rotating residents. The bariatric coordinators were secondary stakeholders as majority of the patients who received the implementation of the multimodal opioid-sparing analgesia regimen underwent bariatric surgery and pain management postoperatively is evaluated as part of the program’s accreditation. The nurse director and nurse manager also held a secondary stakeholder role as they had a vested interest in maintaining excellent patient satisfaction scores which are influenced by patient satisfaction with pain management.

All stakeholders provided support throughout the project during implementation from ensuring designated time for orientation and in-services, assisting with PTSS data collection, providing feedback regarding the use of the reference cards, completing MME
calculations, and communicating goal for improved pain management with decreased opioid use. Refer to Table 1 for identification of stakeholders and analysis.

**Business/Financial Considerations**

The project took into consideration the fiscal impact the implementation would have during its enactment. The project weighed financial implications along with its potential benefits to patients, families, and clinical staff involved.

**Table 1**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Role</th>
<th>Interest</th>
<th>Engagement/ Priority</th>
<th>Potential Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Attending</td>
<td>Division Chief</td>
<td>Multimodal pain management. Supportive.</td>
<td>High/1</td>
<td>Biweekly to Monthly updates on project planning and progress including findings</td>
</tr>
<tr>
<td>Nurse Director</td>
<td>RN Director</td>
<td>Leadership. Patient improvement and patient satisfaction. Supportive.</td>
<td>High/1</td>
<td>Key information updates</td>
</tr>
<tr>
<td>Nurse Manager</td>
<td>RN Manager</td>
<td>Leadership. Supportive.</td>
<td>High/1</td>
<td>Key information updates</td>
</tr>
<tr>
<td>Nurse Educator</td>
<td>RN Educator</td>
<td>Patient satisfaction and improvement of pain management opioid reduction. Supportive.</td>
<td>High/1</td>
<td>Monthly update on project planning, progress, and findings</td>
</tr>
<tr>
<td>APRN Project Leader</td>
<td>Operational Leader, APRN GI Surgery, DNP Candidate</td>
<td>Multimodal opioid-sparing analgesia, clinician fidelity, QR technology</td>
<td>High/1</td>
<td></td>
</tr>
<tr>
<td>Surgical Attending</td>
<td>Surgical Attending</td>
<td>Multimodal pain management. Supportive</td>
<td>High/1</td>
<td>Key information updates</td>
</tr>
<tr>
<td>RNs</td>
<td>Immediate postoperative care &amp; discharge</td>
<td>Pain management with non-opioids. Clinician fidelity to order regimen. Supportive.</td>
<td>High/1</td>
<td>Include training of PTSS survey collection, notification of missing order items, update on project successes.</td>
</tr>
<tr>
<td>Surgical Residents &amp; Fellow</td>
<td>Immediate pre/intra/post operative management.</td>
<td>Supportive</td>
<td>Intermediate/1</td>
<td>Include: updated revisions of tool development for adherence. Education during orientation.</td>
</tr>
<tr>
<td>Bariatric Coordinators</td>
<td>Coordinate &amp; navigate bariatric surgical patients pre and postoperatively</td>
<td>Patient satisfaction. Pain management. Supportive.</td>
<td>Intermediate/2</td>
<td>Education of project &amp; patient expectations for pain management</td>
</tr>
</tbody>
</table>
Project Expense Budget

Table 2
DNP Project Budget

<table>
<thead>
<tr>
<th>TYPE OF EXPENSE</th>
<th>BUDGET</th>
<th>ACTUAL COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference cards - Residents</td>
<td>$100</td>
<td>$24</td>
</tr>
<tr>
<td>Reference cards - RNs</td>
<td>$100</td>
<td>$50</td>
</tr>
<tr>
<td>RN staff training (20 RNs) x 1 hour</td>
<td>$50/RN</td>
<td>~ $1,000</td>
</tr>
<tr>
<td>QR Code for unit</td>
<td>$100</td>
<td>$25</td>
</tr>
<tr>
<td><strong>TOTAL EXPENSEES</strong></td>
<td><strong>$1300</strong></td>
<td><strong>$1099</strong></td>
</tr>
</tbody>
</table>

Cost/Benefit Analysis

**Financial.** According to Song et. al., (2014); Lange et. al., (2018); Pardue et. al., (2020); and Marcotte et. al., (2020), incorporating multimodal opioid-sparing analgesia impact outcomes for patients ranging from decreased length of stay, decreased opioid related adverse events (ORAE), decreased use of opioids, earlier postoperative discharge, and improved pain management. Costs for the project are from the hospital which include staffing hours for clinical nursing, medication costs, equipment, surgical costs, and reimbursement. Materials that were utilized to implement the project, such as printed materials for training and reference guides were absorbed by the project leader, refer to Table 2.

**Potential Benefits to Patients/Families.** It was hypothesized that implementing a multimodal opioid-sparing analgesic regimen with clinician fidelity could positively impact several patient outcomes (Lange et. al., 2018; Pardue et. al., 2020; Song et. al., 2014). The potential benefits of this project were increased patient satisfaction with pain management postoperatively, improved quality of care, decreased length of stay, decreased ORAE (e.g., nausea, vomiting, constipation, respiratory depression, etc.), and
decreased risk for opioid dependence which further impacts reduction in risk for opioid overdose, abuse, misuse, and diversion. Additionally, length of stay is potentially decreased due to decreased ORAE such as constipation, respiratory depression, nausea, bowel obstruction, ileus (Song et al., 2014 and Pardue et al., 2020).

**Potential Benefits to Staff.** Adherence to a multimodal opioid-sparing analgesia regimen that is evidence-based ensures streamlined care but also encourages enhanced recovery after surgery according to the American College of Surgeons (ACS) (Allan et al., 2020; Magrum et al., 2020; Mouawad, 2017). Potential benefits to staff included increased levels of confidence and self-efficacy in providing evidence-based care related to multimodal pain management with nonopioids. Potential staff benefits included improved education and reinforcement of multimodal pain management guidelines concordant with current practices. Medical residents could also learn how to manage postoperative pain with evidence-based guidelines by integrating multimodal opioid-sparing analgesia which will impact their clinical understanding, knowledge, and practice.
Part 4

Results

A total of 29 patients underwent surgery during the implementation of the multimodal opioid-sparing analgesia regimen from September 2022 to December 2022. Of the 29 individuals, 24 patients met criteria for the project and received the regimen, while the remaining five patients were excluded: two did not have minimally invasive abdominal surgery (hiatal hernia repair with transoral incisionless fundoplication [TIF]), two were admitted to the intensive care unit (ICU) postoperatively for an adverse event (e.g., return to the operating room or capnothorax), and one was opioid tolerant with chronic pain on a chronic opioid regimen before surgery (e.g., methadone use). In contrast, a total of 33 patients met the criteria during pre-implementation (June 2022 to August 2022) and underwent evaluation through an in-depth chart review.

The pre-implementation group had a mean age of 47 years with 82% of patients identifying as female at birth with an average body mass index (BMI) of 40 kg/m². Comorbidities were common and included obesity ($N = 29$, 88%), obstructive sleep apnea (OSA, $N = 19$, 58%), followed by hypertension ($N = 19$, 58%). During our pre-implementation chart review, 88% of patients underwent minimally invasive bariatric surgery while the remaining 12% had minimally invasive fundoplication surgery.

Among the implementation group, mean age was 45 years, 92% identified as female at birth with an average BMI of 43.1 kg/m². Comorbidities were also common and included obesity ($N = 21$, 88%), OSA ($N = 17$, 71%), followed by hypertension ($N = 13$, 54%). Fifty-two percent of patients received robotic-assisted vertical sleeve gastrectomy (VSG) during the implementation period followed 24% of patients who received the robotic Roux-en-Y-gastric bypass (RYGB). Seventy-six percent of patients during the implementation period underwent minimally invasive (laparoscopic or robot-assisted) bariatric surgery, and 17% of patients underwent minimally invasive (laparoscopic or
robot-assisted) fundoplication surgery. The PTSS questionnaire had a 99% completion during implementation. Table 3 summarizes our patient demographics for this project for both the pre-implementation and implementation period.

**Table 3**

*Patient Demographics*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-Implementation N = 33</th>
<th>Implementation N = 29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total eligible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluded patients</td>
<td>N = 0</td>
<td>N = 5</td>
</tr>
<tr>
<td>Variable</td>
<td>Pre-Implementation N = 33</td>
<td>Implementation N = 24</td>
</tr>
<tr>
<td>Age [mean, (SD)]</td>
<td>47 (13.1)</td>
<td>45 (13.7)</td>
</tr>
<tr>
<td>Sex at Birth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>27 (82%)</td>
<td>22 (92%)</td>
</tr>
<tr>
<td>BMI</td>
<td>40.0 (7.6)</td>
<td>43.1 (10.7)</td>
</tr>
<tr>
<td>Comorbidities at Surgery, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>29 (88%)</td>
<td>21 (88%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>19 (58%)</td>
<td>13 (54%)</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>15 (46%)</td>
<td>0</td>
</tr>
<tr>
<td>Type 2 Diabetes</td>
<td>13 (39%)</td>
<td>7 (29%)</td>
</tr>
<tr>
<td>Pre-Diabetes</td>
<td>2 (6%)</td>
<td>4 (17%)</td>
</tr>
<tr>
<td>Obstructive Sleep Apnea</td>
<td>19 (58%)</td>
<td>17 (71%)</td>
</tr>
<tr>
<td>GERD</td>
<td>14 (42%)</td>
<td>11 (46%)</td>
</tr>
<tr>
<td>Hiatal Hernia</td>
<td>3 (9%)</td>
<td>4 (17%)</td>
</tr>
<tr>
<td>Type of Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lap VSG</td>
<td>3 (9%)</td>
<td></td>
</tr>
<tr>
<td>Lap RYGB</td>
<td>3 (9%)</td>
<td></td>
</tr>
<tr>
<td>Robot VSG</td>
<td>14 (43%)</td>
<td>15 (52%)</td>
</tr>
<tr>
<td>Robot RYGB</td>
<td>9 (27%)</td>
<td>7 (24%)</td>
</tr>
<tr>
<td>Robot Hiatal Hernia Repair</td>
<td>4 (12%)</td>
<td>5 (17%)</td>
</tr>
</tbody>
</table>

**Primary Outcome**

*Morphine Milligram Equivalents (MME) and Opioid Reduction*

During implementation of the multimodal opioid-sparing analgesia regimen, mean MME decreased by 88.2% relative to pre-implementation while inpatient (8.3 mg vs. 51.18mg, \( p = .003 \)) (Table 4). Figure 1 provides a comparison of the MME across each
of the phases of care during the pre-implementation and implementation period. In addition, mean MME was significantly lower during the Discharge and Follow-Up phases during implementation of the regimen relative to pre-implementation (56.7 mg vs. 90.9 mg and 5 mg vs. 24.9 mg) (Table 4).

Table 4
Outcomes during the pre-implementation and implementation period including mean, standard deviation, p-value, and percent decrease of opioids.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre-Implementation N = 33</th>
<th>Implementation N = 24</th>
<th>P-Value</th>
<th>Percent Decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Outcome</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morphine Milligram Equivalents (MME) [mean, (SD)]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inpatient</td>
<td>51.2 (67.6)</td>
<td>8.3 (10.6)</td>
<td><em>p = .003</em></td>
<td>88.2%</td>
</tr>
<tr>
<td>Discharge</td>
<td>90.9 (19.5)</td>
<td>56.7 (37.6)</td>
<td><em>p &lt; .001</em></td>
<td>54.7%</td>
</tr>
<tr>
<td>Follow Up</td>
<td>24.9 (33.1)</td>
<td>5.0 (14.1)</td>
<td><em>p = .007</em></td>
<td>85.4%</td>
</tr>
<tr>
<td><strong>Secondary Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient-reported pain [mean, (SD)]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS: Pain Before Asking: Numeric pain scale</td>
<td>-</td>
<td>7 (2.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSS: Pain Before Taking: Numeric pain scale</td>
<td>-</td>
<td>7 (2.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reported Pain Goal</td>
<td>4 (0.6)</td>
<td>5 (0.7)</td>
<td><em>p &lt; .001</em></td>
<td></td>
</tr>
<tr>
<td>Reported Pain at Discharge</td>
<td>3 (2.6)</td>
<td>3 (2.2)</td>
<td><em>p = 1.000</em></td>
<td></td>
</tr>
<tr>
<td>PTSS: Satisfaction Pain Regimen &amp; Pain Goal [mean, (SD)]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Taken Medication to Work</td>
<td>-</td>
<td>1 (0.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level/Amount of Pain Relief</td>
<td>-</td>
<td>2 (0.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of Pain Relief</td>
<td>-</td>
<td>2 (0.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Satisfaction: Current Pain Medication</td>
<td>-</td>
<td>2 (0.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Relief Meeting Expectation</td>
<td>-</td>
<td>2 (0.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Pain Medication: Could be More Effective</td>
<td>-</td>
<td>4 (1.4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Secondary Outcomes

**Patient Satisfaction and Reported Pain**

During the implementation of the regimen, the mean pain score reported among patients prior to **asking** for and prior to **taking** opioid medication for their pain was seven. At discharge, patients’ mean pain score decreased to three (Table 4).

**Patient Satisfaction and Pain Regimen**

Ninety-six percent (N = 23) of patients were either very satisfied or satisfied at the time it took for the multimodal opioid-sparing analgesia to address their pain. One hundred percent (N = 24) of respondents were very satisfied to satisfied with the amount of pain relief they had from the multimodal opioid-sparing analgesia pain regimen. Ninety-six percent (N = 23) of patients were either very satisfied or satisfied with the
duration of pain relief. Forty-six percent \((N = 11)\) of patients were overall very satisfied while 54% \((N = 13)\) of patients were overall satisfied with the regimen. Finally, 42% \((N = 10)\) of respondents indicated that the pain regimen greatly exceeded their expectations (Figure 2).

**Figure 2**

*Frequency of patient-reported satisfaction with pain management regimen during the implementation of multimodal opioid-sparing analgesia in the inpatient phase of care. The total number of patients surveyed was 24.*

**Clinician Fidelity**

We assessed clinician fidelity to the regimen (per reference card/QR Code) during inpatient hospitalization and at discharge to home. Clinician fidelity was defined as 1) instances where medical staff correctly ordered from the multimodal opioid-sparing regimen, 2) nonopioids or opioids were dosed within the regimen, 3) no additional medications were ordered in supplement to the regimen while inpatient (e.g., additional nonopioids: lidocaine patches or additional opioids as needed beyond regimen – various
strengths of oxycodone), 4) nonopioids prescribed at discharge, 5) quantity of opioids
being prescribed at discharge not exceeding the amount set by regimen (quantity
greater than 10 tablets).

In the inpatient phase of care, clinicians correctly adhered to the multimodal
opioid-sparing analgesia regimen for nonopioids 92% of the time during implementation
of the regimen versus 27% of the time during pre-implementation (Table 5, \( p < 0.0001 \)).
Clinicians adhered to the regimen for opioids 83% of the time during implementation
versus 42% of the time pre-implementation (\( p = .002 \)). However, there were no
significant differences in adherence to the multimodal opioid-sparing analgesia regimen
for both nonopioids and opioids at discharge relative to pre-implementation (67% vs.
52%, \( p = .261 \)). At discharge, mean quantity of opioid tablets was 10.5 which was
significantly lower than pre-implementation quantities (pre-implementation \( M = 19.9 \),
\( p = .003 \)). See Table 5.

**Table 5**  
**Clinician Fidelity outcomes of pre-implementation versus implementation period**

<table>
<thead>
<tr>
<th>Outcome: Clinician Fidelity</th>
<th>Pre-Implementation ( N = 33 )</th>
<th>Implementation ( N = 24 )</th>
<th>P-Value ( t )-Test</th>
<th>P-Value ( X^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient Nonopioid Adherence</td>
<td>9 (27%)</td>
<td>22 (92%)</td>
<td>-</td>
<td>( X^2 = 23.25 ) ( p &lt; 0.0001 )</td>
</tr>
<tr>
<td>Inpatient Opioid Adherence</td>
<td>14 (42%)</td>
<td>20 (83%)</td>
<td>-</td>
<td>( X^2 = 9.51 ) ( p = .002 )</td>
</tr>
<tr>
<td>Discharge Nonopioid Adherence</td>
<td>17 (52%)</td>
<td>16 (67%)</td>
<td>-</td>
<td>( X^2 = 1.26 ) ( p = .261 )</td>
</tr>
<tr>
<td>Discharge Opioid Adherence</td>
<td>17 (52%)</td>
<td>16 (67%)</td>
<td>-</td>
<td>( X^2 = 1.26 ) ( p = .261 )</td>
</tr>
<tr>
<td>Discharge Opioid Adherence Quantity</td>
<td>19.9 (14.8)</td>
<td>10.5 (4.4)</td>
<td>( p = .003 )</td>
<td>-</td>
</tr>
</tbody>
</table>
Part 5

Discussion and Conclusion

The use of multimodal opioid-sparing analgesia in minimally invasive abdominal surgery is effective in decreasing opioid intake and improving pain control and patient satisfaction with pain management. During the implementation period, patients who received the regimen had significantly decreased opioid consumption while inpatient, at discharge to home, and at follow-up relative to patients cared for during the pre-implementation period. Despite a reduction in opioids during the implementation, patient-reported pain was improved by the day of discharge. Clinician adherence and engagement to the multimodal opioid-sparing analgesia regimen did increase during the implementation period relative to the pre-implementation period by reinforcing adherence to the regimen, ensuring access to the regimen, and noting a decrease in the quantity of opioids prescribed at discharge to home.

The use of multimodal analgesia and opioid-sparing approaches with nonopioids aligns with evidence-based guidelines (Gobble et al., 2014; Hartford et al., 2019; King et al., 2018; Monte et al., 2021; Nagliati et al., 2020; Ng et al., 2017; Pardue et al., 2020; Song et al., 2014; Ziemann-Gimmel et al., 2013). For example, Petrick et al. (2021), utilized scheduled intravenous acetaminophen 975 to 1,000 milligrams every six hours, methocarbamol 750 milligrams intravenously every eight hours, ketorolac 15 milligrams intravenously every six hours as needed, and oxycodone immediate release five milligrams by mouth every six hours as needed. Our team achieved decreased opioid requirements through the scheduled use of acetaminophen and methocarbamol as well as ketorolac as needed for additional pain.

Our findings are similar to other studies using nonopioid regimens. For example, Ziemann-Gimmel and colleagues (2013), found that the scheduled use of a nonopioid intravenous acetaminophen and intravenous ketorolac led to a 74% decrease in opioid
consumption (inpatient mean MME = 1.1 mg ± 1.07). Song et al. (2014) incorporated intravenous acetaminophen as part of a multimodal analgesic regimen postoperatively within the first 24 hours after surgery, which reduced the need for opioids resulting in a 45% reduction of opioid requirements with a mean MME of 33 mg ± 1.07. Our study contributes to this body of research by further supporting the effective use of ketorolac, acetaminophen, and the additional use of methocarbamol as an effective nonopioid adjuvant in decreasing postoperative inpatient opioid needs among minimally invasive abdominal surgery.

Our team sought to evaluate subjective pain and perceived satisfaction with pain management. During the implementation of the regimen, we found that patients reported their pain at discharge as 3/10, a 25% decrease in pain scores immediately postoperatively. This suggests that despite a regimen that consisted primarily of nonopioids, patients were able to achieve significant reductions in their pain while inpatient and met pain goals by discharge to home. Our project aligns with past reports that have found that patients receiving multimodal opioid-sparing analgesia consisting of nonopioids such as acetaminophen and intravenous ketorolac report improved pain management. For example, Horsley et al. (2019), found that when a multimodal pain regimen was utilized among postoperative minimally invasive bariatric surgical patients, there was a significant reduction in pain immediately postoperatively till the day of discharge ($p = 0.001$).

The project is the first, to our knowledge, to report on patient satisfaction with multimodal opioid-sparing analgesia among postoperative minimally invasive bariatric surgical patients. The body of research surrounding this topic is limited and the integration of patient satisfaction with their current pain regimen provides insight into how current Enhanced Recovery After Surgery (ERAS) protocols could be improved for
the bariatric surgical population, such as pain management. Our project incorporated the adapted PTSS questionnaire, which showed 96% of patients were satisfied with the duration of their pain relief, and 42% of patients found the multimodal opioid-sparing analgesia regimen utilized had greatly exceeded their expectations for pain management. Previous studies evaluated patients’ superficial (noncavitary) surgical procedure’s postoperative satisfaction and outcomes with the use of a verbal rating scale (VRS) postoperatively and at discharge to home (White et al., 2007; White et al., 2011). However, no other study to date has incorporated the use of the PTSS questionnaire for patient pain treatment satisfaction. A future consideration includes the use of the entire 69-multi-item questionnaire in both the pre-implementation and implementation periods to compare patient satisfaction before and after regimen implementation. The multi-item questionnaire further explores and evaluates five dimensions related to patient satisfaction in receiving treatment for acute or chronic pain. Such measurement could provide a further understanding of the patient’s perceived pain satisfaction and the effectiveness of the treatment provided.

Clinician fidelity was essential in consistently ordering the appropriate items for the multimodal opioid-sparing regimen for patients during inpatient hospitalization. However, when residents rotated into the operating room (OR), they would be in OR scrubs and often without the study reference card, limiting access to the regimen. To address this, our team developed a QR Code that led to a depiction of the regimen that could be referred to in between the OR using a smart phone.

QR Codes have been used to track medication administration (barcode scanning), and among nursing programs as a part of an educational tool incorporated into simulation scenarios for clinical nursing education. However, utilization of a QR Code for clinician adherence has not been examined in the clinical setting, but the use of QR Codes have been incorporated in the healthcare. The COVID-19 pandemic created
an opportunity for the mainstream use of QR Codes in businesses and healthcare to promote touchless access. Our study is the first, to our knowledge, to incorporate QR Codes in the support of adherence to a multimodal opioid-sparing analgesic regimen. Having coauthored with Zamora et al. (2019) on the development of QR Codes for simulation scenarios, it was an applicable and creative approach for our project to create a QR Code embedded with the study reference regimen to increase clinician adherence. Our study underscores the value of QR Codes to complement adherence procedures and inform future quality improvement efforts.

**Strengths**

The project addressed clinician fidelity in decreasing opioid use among the postoperative minimally invasive bariatric surgical patient population. Previous studies have focused on decreasing opioid consumption with the use of a multimodal analgesic regimen. However, our study examined how clinician adherence led to decrease in opioid consumption. The Division of GI Surgery participated in a recently completed nationwide multi-centered QI project: Bariatric Surgery Targeting Opioid Prescribing (BSTOP) protocol by the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) by the American College of Surgeons (ACS). The QI BSTOP project focused on decreasing opioid use and overprescribing opioids at discharge. In comparison, our project differed from this recent QI project in that we focused on increasing clinician adherence to our multimodal opioid-sparing analgesia which decrease opioid consumption.

The project examined patient satisfaction with pain management postoperatively among minimally invasive bariatric surgery. Most of the research to date has focused on decreasing opioid use, integrating nonopioids for pain management, decreasing length of stay, and reduction of opioid-related adverse events (ORAE) (Brandal et al., 2017; Erdogan Kayhan et al., 2018; Hariri et al., 2019; Horsley et al., 2019; Lange et al., 2018;
Malczak et al., 2020; Pardue et al., 2020; Saurabh et al., 2015; Song et al., 2014; Ziemann-Gimmel et al., 2013). No study to date has examined patient satisfaction with pain relief related to nonopioid pain management. Among the postoperative minimally invasive abdominal surgical population, this study adds an objective measurement of patient satisfaction to their pain management regimen postoperatively among this population.

The project is unique in that it also empowered an interdisciplinary collaboration among Nursing, Residents, Fellows, Advanced Practice Providers (APPs), and Attendings. Bedside nurses were trained regarding the multimodal opioid-sparing analgesia regimen; empowering them to reinforce best practices with residents and their prescribing/ordering practices in an academic setting. This created a forum for an exchange of knowledge and learning among members of the team (residents, nurses, medical students, physician assistant students, and nursing students) on the role of multimodal opioid-sparing analgesia, the efficacy of nonopioids in patient satisfaction for pain management postoperatively, and the reduction of ORAE.

Limitations

This project has several limitations. First, we conducted the project with a single academic medical center and the generalizability of our findings may be limited. Second, three surgical attendings from the organization left their positions during the project timeframe which reduced the number of surgeries performed. The loss of surgical attendings likely accounted for the decreased number of surgeries impacting the final sample size. Third, the project had a short timeframe which overlapped with several year-end holidays, conferences, and vacations for the surgical attendings further decreasing the number of surgical days and sample size. Fourth, the median MME at discharge was still relatively high in the implementation period (implementation $M = 56.7, SD = 37.6$ versus pre-implementation $M = 90.9, SD = 19.5$). The implementation period
consisted of patients who received opioids, but in oral formulation only with a decreased quantity which contributed to the relatively high discharge MME. Access to medications at discharge varied from patient to patient due to insurance-imposed medication coverage. The insurance-imposed medication coverage included quantity limits based on medication class and type (e.g., over-the-counter versus prescription) which varied on patient insurance, impacting patients from a lower socioeconomic status, and creating health disparities in achieving equitable care. Thus, the unexpectantly higher median MME at discharge may be the result of patient’s inability to obtain nonopioids from insurance-imposed coverage regulations, the cost of out-of-pocket over-the-counter nonopioids creating a financial strain, and fear of ineffective pain control with nonopioids once home despite education regarding prolonged opioid use and advantages of nonopioids for pain management.

**Review/Modifications for Sustainability**

We have made the following revisions and modifications to the protocol to support the sustainability of this project. We revised the QR Code to include service line contact information and the pager of APRN who would be able to clarify orders for bedside nurses if residents are unavailable. The unit educator and GI Surgery Division Chief approved the QR Code for official use on the unit. Nurses will continue to have access to the regimen through their reference cards that will remain on their workstation on wheels (WOWs). Each nurse will continue to refer to the regimen as needed during admission of a postoperative patient from GI Surgery to the unit to ensure appropriate multimodal opioid-sparing analgesia orders are entered at admission and the following postoperative days until discharge to home. The charge nurse will continue to have access to the reference card on their stationary desktop for their reference of the regimen when checking a chart on admission. Finally, modifications for sustainability are underway with the Division of GI Surgery with further discussion of incorporating other
nonopioids to the regimen, such as the integration of selective COX-2 inhibitors (e.g., celecoxib).

**Recommendations for Scalability**

Project recommendations for scalability include the integration of QR Codes to other units that involve similar patient populations such as those found on the unit of implementation. We also plan to use the regimen for other minimally invasive surgeries such as cholecystectomy and hernia repairs. Additional project recommendations for scalability include the expansion of a multimodal opioid-sparing analgesic regimen to other Department, units, and patient populations to include Surgical Oncology, Vascular Surgery, Acute Care/Trauma Surgery, Transplant Surgery, and Colorectal Surgery. Departments and patient populations outside of the Department of Surgery to consider include Urology, Orthopedics, Cardiothoracic Surgery, and Neurosurgery.

**Policy and Broader Healthcare Systems Implications**

According to the literature, patients are at a 44% increased risk of developing opioid dependence after only five days of opioid use postoperatively (Hah et al., 2017; Hill et al., 2017; Lawal et al., 2020). The current standard of practice for postoperative pain management at discharge to home is opioids with a quantity and supply that is sufficient for five days (Dowell et al., 2022). The continued opioid epidemic requires healthcare providers to seek evidence-based practices to decrease and abate the epidemic through alternative means of pain management postoperatively with nonopioids.

Our project found decreased opioid use and increased patient satisfaction when a multimodal opioid-sparing analgesic regimen was utilized consistently among postoperative minimally invasive bariatric and fundoplication surgical patients. This project has several healthcare implications. First, our findings reflect the potential benefit of changing the standard of care and practice to nonopioid integration for pain
management for patients postoperatively after minimally invasive abdominal surgery. Healthcare systems could adopt this regimen to improve patient safety and potentially reduce patients’ risks of opioid misuse. This project underscores the potential value of ketorolac as a nonopioid alternative for use in minimally invasive abdominal surgery. Other studies have found ketorolac beneficial with minimal risk for gastrointestinal bleeding, marginal ulcer development, and anastomotic leaks (Gobble et al., 2014; Hariri et al., 2019; Marcotte et al., 2020).

Healthcare systems should consider implementing an opioid stewardship program to provide healthcare clinicians support in evidence-based practices in optimal patient care. Multidisciplinary opioid stewardship program could help optimize nonopioid usage and decrease overutilization of opioids through benchmark oversight (AHA, 2020; Mouawad, 2017). Multidisciplinary opioid stewardship programs are aimed at 1) ensuring optimal prescribing patterns in the healthcare system, 2) utilizing opioid and nonopioid alternatives, 3) reducing the risk of adverse events from opioid overutilization within the healthcare system, and 4) decreasing/avoiding the development of opioid use disorders within the institution. These programs mirror antibiotic stewardship committees created by healthcare systems to combat the overutilization of inappropriate use of antibiotics. Healthcare systems should also consider preventative measures in addition to postoperative multimodal opioid-sparing analgesia. Such measures may include 1) the development of a multidisciplinary opioid stewardship program with our Pharmacy department, 2) educating patients preoperatively regarding expectations on pain postoperatively, 3) educating patients regarding the role of nonopioids for pain management compared to opioids, and 4) educating resident physicians, nurses, medical students, nursing students, and physician assistant students regarding multimodal analgesia and nonopioids. Integrating these recommendations could improve pain management across the healthcare system.
Conclusion

Clinician fidelity to a multimodal opioid-sparing analgesia regimen decreases opioid use among patients undergoing minimally invasive abdominal surgery without compromising patient satisfaction with pain management. Further work should evaluate if this project can achieve similar outcomes with other minimally invasive surgeries. The project provides a framework that healthcare providers can apply to develop and implement a multimodal opioid-sparing analgesic regimen among postoperative minimally invasive abdominal surgical patients. The continued use of a multimodal opioid-sparing analgesic framework can positively impact the community with the potential to decrease the risk for opioid dependence, thereby improving the burden of the opioid epidemic among the surrounding community.
References

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MULTIMODAL OPIOID-SPARING ANALGESIA – KITTIPHA, P.

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APPENDIX A

Prisma Flowchart

Does the integration of multimodal opioid-sparing analgesia (MMA) in minimally invasive abdominal surgical patients reduce opioid utilization postoperatively and at discharge?

Identification

Records identified through PubMed, EMBASE, Cochrane Library database searching 
\(n = 569\)

Records identified through other sources (reference/citations of other articles) 
\(n = 10\)

Records filtered within last 10 years 
\(n = 114\)

Screening

Abstracts screened 
\(n = 79\)

Records excluded
\(n = 35\)
Orthopedic surgery
Gynecological surgery
Surgical Oncology

Eligibility

Full-text articles assessed for eligibility & application 
\(n = 44\)

Records excluded
\(n = 35\)
TAP block
Regional Anesthesia

Studies screened for relevance 
\(n = 37\)

Records excluded
\(n = 9\)
General Surgery
Preoperative focused

Included

Full text articles analyzed to include in final matrix/evidence 
\(n = 23\)

Records excluded
\(n = 12\)
Single dose nonopioid postoperatively

Articles included in matrix 
\(n = 14\)

Records excluded
\(n = 9\)
Multiple variables

APPENDIX B

Project Model: PDSA Model of Improvement for multimodal opioid-sparing analgesia

AIM
What are we trying to accomplish?

Δ Implement multimodal opioid-sparing analgesia regimen
Δ Decrease opiate use
Δ Improve pain control with nonopioids

MEASURES
How will we know that a change is an improvement?

Δ Decreased MME/TME given postoperatively
Δ Pain controlled with nonopioids

CHANGES
What changes can be made that will lead to improvement?

Δ Multimodal opioid-sparing regimen
Δ Provider pocket cards with regimen
Δ Education to providers and nursing staff

Adapted by IHI, 2022
MULTIMODAL OPIOID-SPARING ANALGESIA – KITTIPHA, P.

APPENDIX C

SWOT Diagram of Institution

- **S** - Magnet institution
  - Academic institution
  - Engaged RN team
  - Evidence-based practices
  - Attending support
  - Professional Governance
  - Dedicated Lead Pharmacist for unit

- **W** - Rotating residents each month
  - Surgeon preferences based on personal experiences
  - Fellow based experiences
  - Opioids 1st line for pain control
  - RNs set with ways/resistant to change
  - Lack of education - updated practices

- **O** - Community interest for change in opioid impact
  - Health care interested to improve opioid utilization
  - Policy to improve and reduce the negative impacts of opioid use in the community

- **T** - Insurance restriction/limitations of coverage for multimodal non-opioid analgesia for discharge
  - Patient's socioeconomic status impacts out of pocket costs for multimodal non-opioid analgesia regimen at discharge

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MULTIMODAL OPIOID-SPARING ANALGESIA – KITTIPHA, P.

APPENDIX D

Division of GI Surgery multimodal opioid-sparing analgesia regimen reference

Postoperative Day (POD) 0
Scheduled on medication administration record (MAR) around the clock analgesics:
- Ofirmev/acetaminophen 1,000 mg IV Q6H x 24 hours
- Robaxin/methocarbamol 750 mg IV Q8H, if renal dysfunction present – renal dosing

As Needed/PRN:
- Toradol/ketorolac 15 mg IV Q6H PRN mild to moderate pain
  - Contraindicated if GFR < 60
  - Dose not to exceed 60 mg daily
- Dilaudid/hydmorphone 0.2 mg IV Q2H PRN severe to Breakthrough pain (BTP)

POD 1 UNTIL DC TO HOME
Scheduled on MAR around the clock analgesics:
- Acetaminophen 650 mg PO Q6H
- Methocarbamol 500 mg PO Q8H, if renal dysfunction present – renal dosing

As Needed/PRN:
- Ketorolac 15 mg IV Q6H PRN mild to moderate pain
  - Contraindicated if GFR < 60
  - Dose not to exceed 60 mg daily
- Oxycodone 5 mg PO Q6H PRN severe pain
- Dilaudid 0.2 mg IV Q2H PRN BTP
  → Notify provider if received two consecutive doses for BTP || face-to-face evaluation

DISCHARGE TO HOME
- Acetaminophen 650 mg PO Q6H x 5 days
- Methocarbamol 500 mg PO TID x 5 days (or equivalent covered by insurance)
- Ultram/tramadol 50 mg Q6H PRN BTP IF scheduled analgesics not effective.
Dispense quantity 10 tablets || GOAL: no opioids at discharge
Flowchart of Multimodal Opioid-Sparing Analgesia Regimen: QR Code information and QR Code created

Clinical DNP Project: Multimodal Opioid-Sparing Analgesia in Minimally Invasive Abdominal Surgery
PK Kittipha, MSN, APRN, PHN, AGACNP-BC, CCRN

Created by P. Kittipha, MSN, APRN, PHN, AGACNP-BC, CCRN
MULTIMODAL OPIOID-SPARING ANALGESIA REGIMEN

POINT OF CONTACT:
• GI SURGERY NP: PK KITIPHA

PATIENT POPULATION:
• OPIOID NAIVE
• POSTOP BARIATRIC, HIATAL HERNIA, FUNDOPICATION

POD 0
• Ofirmev 1,000 mg IV Q6H x 24 hours
• Methocarbamol 750 mg IV Q8H, if renal dysfunction present – renal dosing
• Ketorolac 15 mg IV Q6H PRN mild to moderate pain
  ◦ CI if GFR < 60
• Dilaudid 0.2 mg IV Q2H PRN severe to BTP

POD 1 UNTIL DC TO HOME
• Acetaminophen 650 mg PO Q6H
• Methocarbamol 500 mg PO TID
• Ketorolac 15 mg IV Q6H PRN mild to moderate pain
• Oxycodone 5 mg PO Q6H PRN severe pain
• Dilaudid 0.2 mg IV Q2H PRN BTP
  ◦ Notify provider if received two consecutive doses for BTP || face-to-face evaluation

DISCHARGE TO HOME
• Acetaminophen 650 mg PO Q6H x 5 days
• Methocarbamol 500 mg PO TID x 5 days
• Tramadol 50 mg Q6H PRN BTP
  ◦ Dispense quantity 10 tablets
  ◦ GOAL: no opioids at DC

Created by P. Kittipha, MSN, APRN, PHN, AGACNP-BC, CCRN.
MULTIMODAL OPIOID-SPARING ANALGESIA

POD 0
- Ofirmev 1,000 mg IV Q6H x 24 hours
- Methocarbamol 750 mg IV Q8H
- Ketorolac 15 mg IV Q6H PRN mild to moderate pain
  - CI if GFR < 60
- Dilaudid 0.2 mg IV Q2H PRN severe to BTP

POD 1 UNTIL DC TO HOME
- Acetaminophen 650mg PO Q6H
- Methocarbamol 500 mg PO TID
- Ketorolac 15 mg IV Q6H PRN mild to moderate pain
- Oxycodone 5 mg PO Q6H PRN severe pain
- Dilaudid 0.2 mg IV Q2H PRN BTP
  - Notify provider if received two consecutive doses for BTP || face-to-face evaluation

Created by P. Kittipha, MSN, APRN, PHN, AGACNP-BC, CCRN
## APPENDIX H

The Pain Treatment Satisfaction Scale (PTSS): General Questionnaire

1. In general, do you feel that your health is: (check one)

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Very Good</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
</table>

The following statements ask you about the level of pain that you suffer from. On a scale from 0 to 10, with 0 representing “no pain” and 10 representing the “worst pain possible,” please circle the number that represents:

2. How much pain you had in the **last week**.

<table>
<thead>
<tr>
<th></th>
<th>No pain</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

3. How much pain had you had in the **last 24 hours**.

<table>
<thead>
<tr>
<th></th>
<th>No pain</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

4. How much pain you have **right now**.

<table>
<thead>
<tr>
<th></th>
<th>No pain</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

5. The level of pain you reach before **asking** your doctor for medication.

<table>
<thead>
<tr>
<th></th>
<th>No pain</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

6. The level of pain you reach before **taking** your medication.

<table>
<thead>
<tr>
<th></th>
<th>No pain</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>

*Adapted from Pain Treatment Satisfaction Scale (PTSS), Evans et al., 2004*
## APPENDIX I

The Pain Treatment Satisfaction Scale (PTSS): Satisfaction with Current Pain Medication

The following statements are about your satisfaction with your **current pain medication during your hospital stay**. Please answer each question below **checking the box** that best describes your level of satisfaction (check only one box per question).

<table>
<thead>
<tr>
<th>How satisfied are you with each of the following:</th>
<th>Very Satisfied</th>
<th>Satisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Dissatisfied</th>
<th>Very Dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The <strong>time</strong> it took your pain medication to work</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☐ 4</td>
<td>☐ 5</td>
</tr>
<tr>
<td>2. The <strong>level or amount</strong> of pain relief provided by your pain medication</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☐ 4</td>
<td>☐ 5</td>
</tr>
<tr>
<td>3. The <strong>duration</strong> of pain relief provided by your pain medication</td>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☐ 4</td>
<td>☐ 5</td>
</tr>
</tbody>
</table>

4. **Overall**, how satisfied were you with your current pain medication?

<table>
<thead>
<tr>
<th>How satisfied</th>
<th>Very Satisfied</th>
<th>Satisfied</th>
<th>Neither satisfied nor dissatisfied</th>
<th>Dissatisfied</th>
<th>Very Dissatisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☐ 4</td>
<td>☐ 5</td>
<td></td>
</tr>
</tbody>
</table>

5. **Overall**, how did your **level of pain relief** meet your expectations of pain relief?

<table>
<thead>
<tr>
<th>How satisfied</th>
<th>Greatly exceeds my expectations</th>
<th>Somewhat exceeds my expectations</th>
<th>Meets my expectations</th>
<th>Does not quite meet my expectations</th>
<th>Does not meet my expectations at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☐ 4</td>
<td>☐ 5</td>
<td></td>
</tr>
</tbody>
</table>

6. Do you think that your current pain medication **could be** more effective in relieving your pain?

<table>
<thead>
<tr>
<th>How satisfied</th>
<th>Yes, Definitely</th>
<th>Probably yes</th>
<th>I don’t know</th>
<th>Probably not</th>
<th>Definitely not</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ 1</td>
<td>☐ 2</td>
<td>☐ 3</td>
<td>☐ 4</td>
<td>☐ 5</td>
<td></td>
</tr>
</tbody>
</table>

*Adapted from Pain Treatment Satisfaction Scale (PTSS), Evans et al., 2004*
### APPENDIX J

**Opioid data collection form/questionnaire**

<table>
<thead>
<tr>
<th><strong>PREOPERATIVE</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opioid medication TAKEN less than or 10 days preoperatively?</td>
<td><strong>YES / NO</strong> IF YES, SKIP REST OF QUESTIONNAIRE</td>
</tr>
<tr>
<td>Nonopioid analgesics given/taken? (From MN to time of anesthesia induction)</td>
<td><strong>YES / NO</strong> If Yes, how many?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>POSTOPERATIVE INPATIENT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled nonopioid analgesics given in hospital?</td>
</tr>
<tr>
<td>Morphine Equivalent (inpatient)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>DISCHARGE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled nonopioid analgesics Rx at discharge? If yes, number prescribed?</td>
</tr>
<tr>
<td>Opioids prescribed at discharge?</td>
</tr>
<tr>
<td>If yes, indicate opioid(s) prescribed at discharge</td>
</tr>
<tr>
<td>If yes, indicate strength of opioid(s) prescribed at discharge</td>
</tr>
<tr>
<td>If yes, indicate total opioid quantity prescribed</td>
</tr>
<tr>
<td>Morphine Equivalent (discharge)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>POSTDISCHARGE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total opioids used (outpatient)</td>
</tr>
<tr>
<td>Morphine Equivalent (outpatient)</td>
</tr>
<tr>
<td>Unused opioids returned/discarded?</td>
</tr>
<tr>
<td>Additional opioid refill provided?</td>
</tr>
</tbody>
</table>

*Adapted by Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) Bariatric Surgery Targeting Opioid Prescriptions (BSTOP) Protocol. 2021.*
## Appendix K

**Project Timeline Gantt Chart**

### Multimodal Opioid-Sparing Analgesia

Company Name: PROJECT IMPLEMENTATION SITE  
Project Lead: PK/KITTIPHA

Project Start: 6/1/2022  
Project End: 12/31/2022

<table>
<thead>
<tr>
<th>TASK</th>
<th>ASIGNED TO</th>
<th>PROGRESS</th>
<th>START</th>
<th>END</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Development</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-intervention chart review</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>Develop provider reference card</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>Update resident orientation RPT</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>Develop nursing orientation reference card</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>Adapt &amp; Renovate BESTOP questionnaire from MESAQP</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educate incoming residents on orientation.</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>In-service with Surgical Attenders</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>In-service with Pharmacy Supervisor</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>In-service with nursing staff</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td>Implementation with adjustments. PRN</td>
<td>PK</td>
<td>Completed</td>
<td>6/1/22</td>
<td>6/30/22</td>
</tr>
<tr>
<td><strong>Evaluation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data collection weekly</td>
<td>PK</td>
<td>Completed</td>
<td>6/25/22</td>
<td>12/31/22</td>
</tr>
<tr>
<td>Final evaluation of data</td>
<td>PK</td>
<td>Completed</td>
<td>12/32/22</td>
<td>12/31/22</td>
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