Conducting a Medical Chart Audit to Identify Common Opioid Prescribing Patterns in Postoperative Orthopedic Patients: A Quality Improvement Initiative

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NURS 703B: DNP Project

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March 23, 2023

Abstract

Background: While historically, opioids have been used broadly to manage severe acute postoperative pain, recent studies have shown that patients are frequently prescribed opioids either unnecessarily or more than their requirements for surgical pain control. Tailoring opioid prescriptions to inpatient use after orthopedic procedures may effectively control pain while limiting overprescription but may not be common in the current orthopedic practice. The main goal of this quality improvement project was to determine if there is any association between a postoperative patient's predischarge day opioid use and the quantity of opioids prescribed for post discharge use.

Methods: A prospective chart review identified patients admitted after any orthopedic procedure across several orthopedic subspecialties. Daily and total prescription quantities as well as patient-specific factors were collected. The total opioids used the day before discharge were compared with the total opioids prescribed for the day after discharge.

Intervention: This project utilized a collaborative approach to examine the post-operative discharge prescribing pattern for the academic medical center's general orthopedic inpatient service, for a prospective chart audit to identify gaps in practice compared with current evidence. The prospective chart audit assessed formulation, quantity, and dosing regimen of opioid medications administered orally, intravenously, or transdermally during the predischarge day of each patient's hospitalization; as well as the formulation, quantity, and dosing regimen of opioid medications prescribed post discharge.

Results: Sixty-four patients were included, ages 18 to 95 years (mean age: 49 years; 43.75% male and 56.25% female patients). The amount of opioid MMEs prescribed daily for post discharge ($M = 69.09$, $SD = 25.90$, $n = 64$) was greater than the amount of opioid MMEs

prescribed for predischarge day (M = 51.13, SD = 18.93, n = 64). Statistical analysis showed that the difference in prescribed opioids MMEs was notable, t (126) = 1.98, P = 0.03 (1 tail).

Conclusion: The findings of this quality improvement project suggest that opioid regimens prescribed at discharge after inpatient orthopedic procedures at this academic medical center commonly exceed predischarge requirements. Over-prescribing may result in dangerous and illegal diversion of opioids to those for whom opioids were not prescribed. Also, an increased duration of initial opioid prescription has also been associated with an increased incidence of chronic opioid use and risk of opioid misuse and overdose. Discharge regimens and protocols that approximate inpatient opioid use may decrease the current overprescription practices while effectively controlling pain, as they are not associated with higher refill rates compared with more excessive prescription patterns.

Key words: adult, opioid/ administration and dosage, orthopedic procedures, postoperative pain / drug therapy, pain management, drug prescriptions/ statistics and numerical data, inpatients, patient discharge

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Problem Description

Pain Management Changes in the 1990's

The appropriate management of pain has been a long-standing controversial topic in health care. Before the 1980s, pain was viewed as a disease symptom and not a disease itself, which often led to suboptimal pain control (Jones et al., 2018). A radical change in the way providers managed pain occurred in the 1990s. It was determined that health care providers were doing a poor job of managing pain (Scher et al., 2018). During that era, pain became, "what the patient said it was" (Scher et al., 2018, p. 1). Research efforts targeted optimizing opioid effectiveness and the American Pain Society (APS) urged medical providers to treat "pain as the fifth vital sign" (Scher et al., 2018, p. 1). Patient feedback regarding pain management was linked to performance and reimbursement. Also, initiatives conducted by the Joint Commission and the Veterans Health Administration assisted in this transition and encouraged providers to treat pain with opioid medications (Sabatino et. al, 2018). These focused movements led to a marked increase in opioid prescribing.

This was a change of perspective, and now medical providers recognize pain as a medical problem. More effort was then spent on treating pain and providers became more relaxed in their opioid prescribing practice. This change in practice led to some unfortunate consequences. For centuries, opioids have been part of medical pharmacopoeia, primarily because of their capacity to treat pain (Corder et al., 2018). Unfortunately, opioids are also powerful euphoriants

and thus have substantial abuse liability. Although opium itself has been used for centuries, the isolation of morphine and codeine from opium in the 19th century, along with the introduction of the hypodermic needle, led to the increased prevalence of intravenous opioid use (Stefano et al., 2017). Opioids in the modern era are now more complex and diverse. They can be divided into four categories: natural opium alkaloids, including opium, morphine, and codeine; semisynthetic derivatives of morphine including heroin and oxycodone; synthetic opioids that are not derived from morphine, including methadone and meperidine; and opioid-containing preparations (Corder et al., 2018).

Opioid Prescribing Practices in 2000's

The amount of prescription opioids has risen steeply in the 2000s. Efforts to improve pain management led to a 10-fold increase in opioid prescriptions, accompanied by a substantial increase in abuse, serious injuries, and deaths (Sabatino et al., 2018). In 2016, there were more than 63,000 overdose deaths in the United States, and over 65% of these deaths involved an opioid medication (Hedegaard et al., 2018). In 2017, the office of Health and Human Services (HHS) declared a national public health emergency to address the opioid crisis in the United States. In addition to the declaration, HHS provided a strategy for management of the crisis (US Department of Health and Human Service, 2021). The top five priorities at that time included improving access to treatment and recovery services, promoting use of overdose-reversing drugs, strengthening our understanding of the epidemic through better public surveillance, providing support for cutting-edge research on pain and addiction, and advancing better practices for pain management (HHS, 2021).

What was initially considered an epidemic isolated to the United States, the opioid epidemic has transitioned to a worldwide occurrence, resulting in global disease burden and

premature mortality (Jones et al., 2018). According to the World Health Organization (WHO) in 2021, approximately 35.6 million people suffered from an opioid use disorder, and 0.5 million deaths were attributed to drug use. More than 70% of these deaths are related to opioids, with more than 30% of those deaths caused by overdose (World Health Organization, 2021).

Opioid Use Disorder

Opioid use disorder represents a significant public health problem and accounts not only for many persons with addiction problems needing treatment, but also for increasing mortality over the past decade. According to the United States Centers for Disease Control and Prevention (CDC), opioid overdoses accounted for more than 75,673 deaths in 2021, up from 56,064 the year before, and quadrupling since 1999 (Centers for Disease Control and Prevention, 2021). Opioids are the most misused prescription drugs. Most people who abuse opioids report that they initially obtained them from a friend or relative who had leftover medications, often due to over-prescription for their medical condition (Jones et al., 2018).

Opioid Prescribing by Orthopedic Surgery

While the opioid epidemic has multiple interrelated parts, managing acute postoperative pain after orthopedic surgery plays a critical role in reducing the risk of long-term opioid misuse in this population. Postoperative pain management in orthopedic surgery accounts for a substantial portion of opioid medications prescribed in the United States (Sabatino et al., 2018). Medical providers have a moral responsibility to provide safe and effective acute postoperative pain management, but research shows that there is a correlation between prescribing opioids for acute pain and long-term use and misuse (Sabatino et al., 2018). Poorly treated postoperative pain after orthopedic surgery has a negative impact on the patient, their family, the healthcare

system, and our society. Patients with postoperative pain after discharge are at high risk of experiencing hardship, morbidity and mortality, depression, and poor wound healing (Pogatzki-Zahn et al., 2017). When postoperative pain is not treated properly, patient satisfaction decreases, and patient feedback regarding pain management increases, both important quality measures in healthcare (Ramia et al., 2017). Improper treatment of postoperative pain may also lead to prolonged admissions as well as increased re-admission rates, which results in increasing costs for our healthcare system (Ramia et al., 2017). The American Academy of Pain Medicine (2019) stated that pain management costs may range anywhere between 560 billion and 635 billion dollars annually.

The effective relief of pain is of utmost importance to any medical provider treating patients undergoing surgery. Pain relief has significant physiological and psychological benefits for patients. The goal for postoperative pain management after orthopedic surgery is to reduce or eliminate pain and discomfort while minimizing side effects. Additionally, the provider should target optimal dosing frequency and length, to decrease the incidence of habitual, long-term opioid use (Sampognaro & Harrell, 2022). According to Hah et al. (2017), over-prescribing opioids after surgery increases the risk of long-term use. This same study has estimated that seventy-two percent of prescribed opioids go unused, they then become available for misuse. Safe prescribing of opioids needs to be a priority for all medical providers. Additionally, combating opioid abuse has become a state and federal priority.

Since orthopedic surgeries account for a substantial portion of opioid medications prescribed in the United States, extra attention needs to be given to prescribing practices after orthopedic surgery (Sabatino et al., 2018). An evidence-based pain management system should not only aim to improve both patient satisfaction and outcomes. It should also be tailored to the

specific musculoskeletal injury, include patient and provider education, and define procedure-specific opioid prescribing limits, to reduce the surplus of prescribed opioid pills.

Literature Review

Theoretical Framework

Stetler's model of research utilization has been chosen as the framework for this project. The Stetler model (see Appendix A), helps medical providers assess how research findings and other pertinent evidence can be applied in practice. This model investigates how to use evidence to create formal change within organizations. Additionally, the model guides individual medical providers to use research on an informal basis as part of critical thinking and reflective practice to create change that fosters patient-centered care. (Stetler, 2001).

This model consists of five phases: preparation, validation, comparative evaluation or decision-making, translation or application, and evaluation (Stetler, 2001). During preparation, the researcher identifies a priority need, the purpose of the evidence-based practice (EBP) project, the context in which the project will occur, and relevant sources of evidence. In Phase II, validation, assessment of sources of evidence for level and overall quality occurs, and the researcher determines whether sources found have quality and legitimacy. Also, an assessment of whether to accept or reject the evidence in relation to the project's purpose. During comparative evaluation or decision-making, the researcher summarizes the evidence, including evaluating similarities and differences among sources of evidence. Then, the researcher determines whether it is acceptable and feasible to apply his findings to practice. In phase IV, translation or application, development of the "how to's," for implementation of summarized findings occurs, as well as identification of practice implications that justify application of

findings for change. Finally, during evaluation, the researcher identifies expected outcomes of the project and determines whether the goals of EBP were successfully achieved.

Phases I through III of Stetler's model have been used as guidance for this Doctor of Nursing Practice (DNP) project. During Phases I and II, a current clinical practice problem was identified to develop the following question: "What is the standard evidence-based practice for prescribing opioids in postoperative orthopedic patients?" A literature search, review, and analysis were conducted, which disclosed that despite the growing awareness of the current opioid epidemic and the attention it has gained from the highest levels of US government, a lack of consensus remains regarding optimal discharge opioid prescriptions after orthopedic procedures (Grace et al., 2020). In phase III of Stetler's model, the investigator will evaluate current opioid prescribing practices at the chosen institution, by conducting a thorough chart review of all inpatient orthopedic patients seen over a 2-month period and compare the findings with the current literature.

Background

Medical providers, legislators, pharmaceutical companies, and researchers are progressively preoccupied on finding ways to decrease opioid use and overdose in the United States both of which have significantly increased over the past decade (Hah et al., 2017). While many efforts are concentrated on the management of chronic pain, the use of opioids in orthopedic surgical patients presents a particularly difficult problem requiring medical providers to find balance between managing acute pain in the postoperative phase and decreasing the risks of continuous opioid use following the surgery (Sabatino et al., 2018). Finding ways to decrease this risk is "...particularly salient in light of a growing literature suggesting that post-surgical patients are at increased risk for chronic opioid use" (Hah et al., 2017, p. 2).

While historically, opioids have been used broadly to manage severe acute postoperative pain, recent studies have shown that patients are frequently prescribed opioids either unnecessarily or more than their requirements for surgical pain control (Neuman et al., 2019). Amongst orthopedic patients, Sabatino et al. (2018) demonstrated not only a wide variation across different procedures but also that sixty percent of patients undergoing orthopedic procedures were prescribed excess opioids postoperatively. Over-prescribing may result in dangerous and illegal diversion of opioids to those for whom opioids were not prescribed. Also, an increased duration of initial opioid prescription has also been associated with an increased incidence of chronic opioid use and risk of opioid misuse and overdose (Neuman et al., 2019). Unfortunately, there is no consensus across literature on the optimal quantity of opioids that should be prescribed at discharge for a given orthopedic procedure.

Adjusting Discharge Opioid Prescriptions after Orthopedic Procedures

Grace et al. (2020) conducted a retrospective cohort study of adult patients who underwent inpatient orthopedic surgical procedures at a single tertiary referral center between January 1, 2015, and December 31, 2017. The primary aim of the study was to determine if discharge opioid prescriptions given after inpatient orthopedic surgery were commonly tailored to inpatient opioid consumption at the time immediately before discharge. The secondary aim was to compare the post-discharge refill requests between discharge prescription regimens that approximated or far exceeded inpatient use. The end point of the study was to determine if adjusting opioid prescriptions to inpatient use after orthopedic procedures may effectively control pain while limiting over-prescribing.

Data was extracted from electronic documentation and inpatient medication administration records. Grace et al. (2020), included six hundred thirteen patients that were

admitted for greater than twenty-four hours postoperatively (ages 18 to 95 years) in the study; and excluded those who had a medication reconciliation record that showed active opioid use at the time of surgery, an indwelling peripheral nerve infusion catheter in the 24 hours before discharge, and those that were discharged from a non-orthopedic service. Information on formulation, quantity, and dosing regimen of opioid medications used during the last 24 hours of each patient's hospitalization, and opioid medications prescribed at discharge was obtained from electronic medical records. All opioid prescribed quantities were converted into oral morphine equivalents (OMEs) using the opioid conversion calculator for morphine equivalents (Grace et al., 2020). A comparison was performed by calculating the difference between opioid medication prescribed for the day after discharge (post-discharge day) and the opioid consumption during the day before discharge (pre-discharge day). "The difference between these quantities (post-discharge day minus predischarge day) was termed the daily prescription excess" (Grace et al., 2020, p. 281). Patients were retrospectively classified into two groups: an "excessive-prescription" group if their daily prescription excess was 30 or more OMEs (n=409), and an "approximated-prescription" group if their daily prescription excess was less than 30 OMEs (n=204).

Grace et al. (2020), results revealed that the number of opioids prescribed for the day after discharge significantly exceeded the opioids used in the day before discharge for each orthopedic subspecialty. The "excessive prescription" group (409 patients) were prescribed a considerable larger number of daily opioids (120 oral morphine equivalents [OMEs] versus 60 OMEs; P = 0.01) and total opioids (750 OMEs versus 512.5 OMEs; P = 0.01) at discharge, and were more likely to refill their opioid prescription within 30 days of discharge (27.6% versus 20.1%; P = 0.043) when compared with the "approximated-prescription" group. Grace et al.

(2020), study shows that opioid regimens that estimate inpatient use may help decrease over-prescribing and are not connected with higher refill rates when compared with more excessive prescription regimens. “This study is unique in that it is one of only a few across multiple inpatient orthopedic specialties to compare discharge opioid prescriptions with inpatient opioid use” (Grace et al., 2020, p. 284).

Chen et al. (2020) conducted a prospective, quality improvement study on the implementation of a new opioid prescribing protocol for patients discharged after inpatient orthopedic surgery at two Massachusetts (MA) medical centers. The prescribing protocol implemented focused on the use of an opioid taper calculator that created a custom opioid taper for each patient based on their 24-hour predischarge opioid usage (See Appendix B). All opioid discharge quantities were converted into oral morphine equivalents (MMEs) using the opioid conversion calculator for morphine equivalents, and a comparison has been made between discharge opioid quantities prescribed to orthopedic patients before and after protocol implementation. The study included patients who had a postoperative inpatient stay greater than twenty-four hours and were discharged home by the orthopedic service. It excluded patients who were discharged to other healthcare facilities such as rehabilitation centers or skilled nursing facilities. Opioid prescriptions were compared against two control cohorts: the pre-protocol cohort and post-protocol cohort.

For Chen’s study, the pre-protocol cohort included 1,532 patients from 1,597 admissions and 1,677 surgeries, while the post protocol cohort incorporated 1,408 patients from 1,475 admission and 1,514 surgeries. Both cohort patients were similar in sex, body mass index, postoperative length of stay, procedure length, procedures with regional blocks or epidurals, and distance to hospital. Before protocol implementation, the average discharge quantity of opioids

prescribed was 427 MME at discharge. After implementation, the mean discharge quantity of opioids was 326 MME at discharge, a 24% reduction ($P < 0.001$, 3A) in the number of opioids prescribed. According to Chen et al. (2020), the decrease occurred primarily due to a reduction of the most frequent prescriptions from approximately 400 to 600 MME pre-implementation to 200 to 300 MME post-implementation. Additionally, post-implementation, the patient-specific taper was used in 74% of eligible discharges, which resulted in a 24% reduction in opioid quantity prescribed at discharge. Chen et al. (2020) argued that the most notable reductions in opioid prescriptions were seen after total joint arthroplasty and spinal fusions. Despite this reduction, most patients (65%) reported receiving enough opioids. Also, there was no substantial change noted in the 30-day post-discharge opioid prescription refills after versus before protocol implementation (1.58 versus 1.71 fills per discharge). Chen et al. (2020), demonstrated that using an opioid taper calculator, or a patient-specific taper can be successfully used to standardize opioid prescribing at discharge after inpatient orthopedic surgery without a substantial risk of under-prescription or a decrease in patient satisfaction.

Choo et al. (2019) conducted a quality improvement (QI) initiative study at a single tertiary-care, academic hospital with the main goal to decrease the post-discharge prescription quantity of opioid medications in post-operative orthopedic patients by 10%. In this study, the amount, type, and regimen of opioid medications prescribed at discharge were obtained prospectively for all patients undergoing orthopedic surgery during a six -month period. All opioid regimens were converted into OMEs (oral morphine equivalents). Medical providers were provided with reports every two months that showed the median discharge OMEs prescribed and summarized the department's progress toward reaching the established goal. After six months, a retrospective comparison was made between pre-intervention and post-intervention patient

cohorts. Opioid prescription refills were also measured during this QI at 0 to 30 days, 31 to 60 days, and 61 to 90 days after discharge. The QI project included patients undergoing orthopedic surgery in a six-month period. It excluded pediatric patients (younger than 18 years), patients taking opioids before surgery, and patients discharged in under twenty-four hours.

Opioid prescriptions were compared against two control cohorts: the pre-intervention cohort and post-intervention cohort. The pre-intervention cohort included 401 patients who underwent surgery six months before the QI implementation, and the post-intervention cohort included 429 patients who underwent surgery in the first six months after the QI implementation. Both cohort patients were comparable regarding age, sex, rates of depression, surgical time, length of stay, and orthopedic subspecialty groups (Choo et al., 2019). The results showed that the opioid quantities needed during the day before discharge were comparable between both groups (37.5 OMEs versus 40 OMEs, $P = 0.48$). Nonetheless, the pre-intervention cohort was prescribed noticeably more opioids at discharge than the intervention cohort (600 OMEs versus 450 OMEs, $P < 0.001$). Choo et al. (2019) also found that the median discharge prescription quantities decreased for all orthopedic subspecialties except for sports medicine and spine surgery. Opioid refill rates, that were identified from the EMR (electronic medical record), were found to be comparable the between preintervention and intervention groups at 0 to 30 days (25.7% versus 24.0%, $P = 0.58$), 31 to 60 days (14.2% versus14.9%, $P = 0.77$), and 61 to 90 days (6.5% versus 7.5%, $P = 0.58$) (Choo et al., 2019).

In this study, Choo et al. (2019) demonstrated the positive outcome of a goal-directed initiative to decrease over-prescription of opioid medications in postsurgical orthopedic patients. The QI initiative reduced discharge opioid prescriptions without increasing the risk of requiring a post-operative refill prescription. The author concluded that, “this indicates that such an

approach can result in opioid reduction, while still providing appropriate care and pain control for patients" (Choo et al., 2019, p. 1).

While there is a heightened awareness of the ongoing opioid epidemic amongst medical providers, legislators, and pharmaceutical companies (Hah et al., 2017), there also remains a lack of agreement by orthopedic providers regarding optimal discharge opioid prescriptions after inpatient orthopedic procedures (Sabatino et al., 2018). Choo et al. (2019) stated that across the literature, opioid prescribing was seldomly patient-centered, with almost no association between a patient's inpatient opioid use and their discharge prescription (Choo et al., 2019). This has led to over-prescription which may result in dangerous and illegal diversion of opioids to those for whom opioids were not prescribed (Neuman et al., 2019). In general, there has been a lack of a uniform, patient-centered approach to opioid prescribing.

While national guidelines have helped medical providers reduce the average number of opioid pills prescribed to most patients, there is still significant room for improvement (Hah et al., 2017). Chen et al. (2020) has argued that personalizing prescriptions to individual patients' needs is a necessary next step in improving postoperative opioid stewardship. According to Grace et al. (2020), adjusting opioid discharge regimens to inpatient opioid use has not been thoroughly explored as an approach to establish an effective yet safe postsurgical pain regimen in orthopedic patients. To date, few studies have examined pre-discharge opioid use as a guideline for discharge opioid prescriptions. There remains much room to improve post-discharge opioid prescribing patterns after orthopedic surgery.

Rationale

An orthopedic department in an academic medical center provides comprehensive orthopedic care, ranging from everyday bone and joint care to the most complex and highly sophisticated treatments, surgeries, and procedures. The services provided do not include just surgery but also complementary medicine, injury prevention, physical therapy, and pain management. Cutting edge treatments are often available in an academic medical center as their faculty and surgeons have often developed these new treatments. Since these specialists are training tomorrow's orthopedists, they seek an awareness of the most up-to-date therapies and technology. On the other hand, the orthopedic department does not have a comprehensive and universal patient-centered approach when it comes to post-operative opioid prescribing. Unfortunately, an omission of this type of prescribing program is not unique. Throughout the literature, other centers report a similar deficiency in consensus, which extends to other surgical and non-surgical subspecialties (Chen et al., 2018).

For this project, the project investigator will examine the post-operative discharge prescribing pattern for the academic medical center's general orthopedic inpatient service. Stetler's model of research utilization will be used (Stetler, 2001). The Stetler model helps medical providers assess how research findings and other pertinent evidence can be applied in practice. This model investigates how to use evidence to create formal change within organizations. Additionally, the model guides individual medical providers to use research on an informal basis as part of critical thinking and reflective practice to create change that fosters patient-centered care (Stetler, 2001).

For this QI project this investigator followed Stetler's model which consists of five phases: preparation, validation, comparative evaluation or decision-making, translation or

application, and evaluation (Stetler, 2001). During preparation, the investigator identifies a priority need, the purpose of the EBP project, the context in which the project will occur, and relevant sources of evidence (Stetler, 2001). In Phase II, validation, assessment of sources of evidence for level and overall quality occurs, and the investigator determines whether sources found have quality and legitimacy. Also, an assessment of whether to accept or reject the evidence in relation to the project's purpose (Stetler, 2001). During comparative evaluation or decision-making, the investigator summarizes the evidence, including evaluating similarities and differences among sources of evidence. Then, the investigator determines whether it is acceptable and feasible to apply his findings to practice (Stetler, 2001). In phase IV, translation or application, development of the "how to's," for implementation of summarized findings occurs, as well as identification of practice implications that justify application of findings for change (Stetler, 2001). Finally, during evaluation, the investigator identifies expected outcomes of the project and determines whether the goals of EBP wereas successfully achieved (Stetler, 2001).

Phases I through III of Stetler's model have been chosen as guidance for this DNP project. During Phases I and II, a current clinical practice problem was identified to develop the following question: "What is the standard evidence-based practice for prescribing opioids in postoperative orthopedic patients?" A literature search, review, and analysis were conducted, which disclosed that despite the growing awareness of the current opioid epidemic and the attention it has gained from the highest levels of US government, a lack of consensus remains regarding optimal discharge opioid prescriptions after orthopedic procedures (Grace et al., 2020). In phase III of Stetler's model, the investigator will evaluate current opioid prescribing practices at the chosen institution, by conducting a thorough chart review of all inpatient orthopedic

patients that underwent a surgical orthopedic procedure over a 2-month period. Information on formulation, quantity, and dosing regimen of opioid medications used during the last twenty-four hours of each patient's hospitalization, and opioid medications prescribed at discharge will be obtained from the electronic medical record (EMR), and the investigator will compare findings with the current literature, summarize the findings, and present the results to the orthopedic department.

Specific Aims

By March 2023, after approval by Institutional Review Board (IRB) (see Appendix C), a prospective investigation will be undertaken in a cohort of consecutive adult patients who underwent inpatient orthopedic surgical procedures between February 2nd 2023 and March 12th 2023. Data will be extracted from the academic medical center's clinical database, which contains and stores patient-related information from the clinical care setting, such as electronic documentation and inpatient medication administration records. The prospective chart audit will assess formulation, quantity, and dosing regimen of opioid medications administered orally, intravenously, or transdermally during the predischarge day of each patient's hospitalization; as well as the formulation, quantity, and dosing regimen of opioid medications prescribed post discharge. The main goal of the prospective chart audit is to determine if there is any association between a postoperative patient's predischarge day opioid use and the quantity of opioids prescribed for post discharge use.

Based on the chart audit findings, an information session will be provided to the institution's Orthopedic Department. This forum will include national guidelines and evidence-based recommendations, to improve orthopedic postsurgical opioid prescription practices, to increase patient satisfaction, and to decrease over-prescription of opioids at discharge. For all

patients within each orthopedic subspecialty, the opioid quantities consumed on the predischarge day and the opioid quantities prescribed for the post discharge day will be compared using the Wilcoxon Signed-Rank test. The data retrieved will be exported to Microsoft Excel, and additional statistical software such as the Mann-Whitney U test will be used. All statistical analyses will be performed using STATA software (Version 18.0; Statacorp), with significance set as $P < 0.05$. The project will be completed according to the timeline mentioned in Figure 1.

Methods

Context

The project will be accomplished within the orthopedic department of an academic medical center. The institution is one of only two Level I Trauma Centers in the region. Trauma teams are available 24 hours a day, seven days a week, as the first hour after an orthopedic injury is critical, bone and joint trauma specialists are always available. The orthopedic department provides a comprehensive diversity of orthopedic services from everyday bone and joint care to the most complex and highly sophisticated treatments, surgeries, and procedures. The Orthopedic and Rehabilitation team includes attending orthopedic surgeons, advanced practice providers (APPs), residents, physical therapists, and pharmacists. This team has the skill and experience to manage nearly all orthopedic conditions or illnesses in children and adults. Around 30,000 surgeries are done each year at the institution, and the volume of orthopedic patients, including those undergoing emergent orthopedic surgeries due to trauma is growing. The orthopedic inpatient service manages 15 to 25 primary patients daily. They also have an additional 10 to 20 consultations per day. It is a busy service with most patients requiring pain control with opioids. Yet, there is a lack of a comprehensive and universal patient-centered approach amongst orthopedic providers when it comes to opioid prescribing at the time of discharge.

Interventions

After approval by Institutional Review Board (IRB), a prospective investigation will be undertaken in a cohort of consecutive adult patients (age 18 and above) who will undergo inpatient orthopedic surgical procedures between February 2nd 2023 and March 12th 2023. Data will be extracted from the large, institutional clinical database, which collects and stores patient-related information from the clinical care setting, such as electronic documentation (EPIC), and inpatient medication administration records. The prospective chart audit will assess formulation, quantity, and dosing regimen of opioid medications administered orally, intravenously, or transdermally during the predischarge day of each patient's hospitalization; as well as the formulation, quantity, and dosing regimen of opioid medications prescribed post discharge.

The main goal of the prospective chart audit is to determine if there is any association between a postoperative patient's predischarge day opioid use and the quantity of opioids prescribed post discharge. All opioid quantities will be converted into morphine milligram equivalents (MMEs) using the CDC's guidelines on calculating total daily dose of opioids for safer dosage (see Appendix D). For example, if a discharge prescription included number sixty, 5 mg oxycodone pills and the instructions were to "take one pill by mouth every 4 hours as needed for pain" this would represent 450 MMEs prescribed in total (60 total pills of oxycodone 5 mg is 300 mg of oxycodone or 450 equivalents of oral morphine after the appropriate opioid strength conversion between oral oxycodone and oral morphine) and 45 MMEs prescribed per day (6 pills of oxycodone 5 mg per day is 30 mg of oxycodone or 45 equivalents of oral morphine after conversion). If patients were prescribed multiple opioids post discharge, each prescription will be converted to MMEs separately and then combined to determine the amount of total and daily MMEs prescribed.

For all patients within each orthopedic subspecialty, the opioid quantities administered on the predischarge day, and the opioid quantities prescribed post discharge will be compared using the Wilcoxon Signed-Rank test and will be displayed in an Excel spreadsheet. The Wilcoxon signed-rank test is very appropriate for a repeated measure design where the same subjects are evaluated under two different conditions (Li et al., 2022). After data has been collected and analyzed using the Wilcoxon signed-rank test, the investigator will compare findings with the current literature, summarize the findings, and present the results to the institutions' orthopedic department.

Study of the Intervention

Measures

Process measures will include: 1) formulation, quantity, and dosing regimen of opioid medications administered orally, intravenously, or transdermally during the predischarge day of each patient's hospitalization 2) formulation, quantity, and dosing regimen of opioid medications prescribed postdischarge**.** All opioid quantities will be converted into morphine milligram equivalents (MMEs) using the CDC's guidelines on calculating total daily dose of opioids for safer dosage.

The outcome measures will include assessing whether or not there is a correlation between opioid use on predischarge day and the quantity of opioids prescribed at hospital discharge for each chart audit conducted, as well as assessing the percentage of charts that pertain to different orthopedic subspecialties (sports medicine, foot and ankle, hip and knee, hand and upper extremity, spine, joint replacement, fracture care and trauma, and bone and soft tissue services/ ortho oncology). Balancing measures will include feedback from the orthopedic

department, including orthopedic surgeons/ attendings, advanced practice providers (APPs), and residents. Table 1 lists all the measures included in the investigator's evaluation.

Analysis

This prospective chart audit reviewed a total of 64 patient charts from February 2nd 2023, to March 12th 2023. The audit collected qualitative data including information on formulation, quantity, and dosing regimen of opioid medications administered orally, intravenously, or transdermally during the predischarge day of each patient's hospitalization. Additional qualitative data included the formulation, quantity, and dosing regimen of opioid medications prescribed at the time of discharge. Then, the total opioid quantities consumed on the predischarge day, and the opioid quantities prescribed for the post discharge day were compared using the Wilcoxon Signed-Rank test. The investigator also compared demographics and amounts of opioid prescribed predischarge day and post discharge day for each specialty within the orthopedic department using the Mann-Whitney U test and the chi square test. Post chart audit, the data collected was compiled in bar charts that demonstrate the occurrence of each variable measured both in percentile and numerical aspects. All statistical analyses were performed using STATA software (Version 18.0; Statacorp), with significance set as $P < 0.05$.

Ethical Considerations

This is considered a quality improvement project (QI) proposal for the purposes of a specific department and is intended neither for generalizable knowledge nor to be applied to another healthcare setting. In order to protect human rights, the proposal will be submitted to the medical center's Institutional Review Board (IRB) for a Non-Human Subjects Research (NHSR) determination. All providers within the institutions' orthopedic department are aware of the purpose of the project proposal, and that it will include a retrospective chart audit. Beneficence

and non-maleficence guided this work with the fundamental belief that providers are practicing with the intention of doing good, helping others, and preventing harm. Information on each specific prescribing provider will not be collected as the goal of this project is not to single out a specific provider's prescribing practices. The department representative provided a written and signed letter of support to conduct the project proposal and chart audit within the orthopedic department, along with assurance of staff compliance and support where needed (see Appendix E). No identifiable patient data will be collected since the chart review is part of a cross sectional study.

Results

Between February 2nd 2023 and March 12th, 2023, a total of 64 patients who underwent an orthopedic surgical procedure at the above mentioned institution met the inclusion and exclusion criteria for this study (mean age: 49 years; 43.75% female and 56.25% male patients) (See Appendix F and G, and Table 2).

The median predischarge opioid dose per day for the entire sample was 45 MMEs (interquartile range: 30 to 105 MMEs) (See Appendix H and Table 3), and the most common opioids prescribed at discharge included oxycodone immediate release tablets (69.4%), acetaminophen/hydrocodone tablets (12.5%), tramadol tablets (10.6%), hydromorphone tablets (2.3%), and morphine tablets (5.2%) (See Appendix I). The median post discharge day opioid prescription for the entire sample was 65 MMEs (interquartile range: 30 to 137 MMEs) (See Appendix H and Table 3), and the most common opioids prescribed at discharge included oxycodone immediate release tablets (75.6%), acetaminophen/hydrocodone tablets (10.3%), tramadol tablets (9.6%), hydromorphone tablets (1.5%), and morphine tablets (3%) (See Appendix I).

The median predischarge day opioid dose was similar between most orthopedic specialty groups (ortho foot and ankle = 47.5 MMEs; ortho joints = 50 MMEs; ortho spine = 57.5 MMEs; ortho sports = 50 MMEs; and ortho upper extremity = 45 MMEs). Two orthopedic specialty groups utilized a higher opioid dose, ortho oncology = 105 MMEs and ortho trauma = 101 MMEs (See Appendix J). The median number of opioid medications prescribed daily post discharge was also very similar between the same specialty groups (ortho foot and ankle 30 MMEs versus ortho joins 45 MMEs versus ortho spine 57.5 MMEs versus ortho sports 45 MMEs versus ortho upper extremity 45 MMEs). Again, two specialty groups prescribed a higher post-discharge amount, ortho oncology at 90 MMEs and ortho trauma at 75 MMEs (See Appendix K).

For the entire data set, the amount of opioid MMEs prescribed daily for post discharge ($M = 69.09$, $SD = 25.90$, $n = 64$) was greater than the amount of opioid MMEs used during the predischarge day ($M = 51.13$, $SD = 18.93$, $n = 64$). Statistical analysis showed that the difference in prescribed opioids MMEs was notable, $t(126) = 1.98$, $P = 0.03$ (1 tail) (See Table 3).

Summary

This project utilized a collaborative approach to examine the post-operative discharge prescribing pattern for the academic medical center's general orthopedic inpatient service, for a prospective chart audit to identify gaps in practice compared with current evidence. Three key findings from this project include: notable differences in prescribing patterns between specialties; no relative correlation between the amount of opioid MMEs prescribed during predischarge day and the amount prescribed for post discharge day; and across all orthopedic subspecialties, the number of opioids prescribed daily post discharge were higher than the number of opioids patients consumed during the final twenty-four hours of their hospitalization (See Appendix H).

Discussion

While opioids have been used broadly to manage severe acute postoperative pain, recent studies have shown that patients are frequently prescribed opioids either unnecessarily or more than required for surgical pain control (Neuman et al., 2019). Despite the growing awareness of the current opioid epidemic and the attention it has gained from the highest levels of US government, a lack of consensus remains regarding optimal discharge opioid prescriptions after orthopedic procedures (Hah et al., 2017). While many efforts are concentrated on the management of chronic pain, the use of opioids in orthopedic surgical patients presents a particularly difficult problem requiring medical providers to find balance between managing acute pain in the postoperative phase and decreasing the risks of continuous opioid use following the surgery (Sabatino et al., 2018). Finding ways to decrease this risk is "...particularly salient in light of a growing literature suggesting that post-surgical patients are at increased risk for chronic opioid use" (Hah et al., 2017, p. 2).

This quality improvement project used a prospective chart audit and aimed to examine the post-operative discharge prescribing pattern for the academic medical center's general orthopedic inpatient service by comparing the amount of MMEs consumed on the predischarge day to the post discharge prescribed opioid amounts in MMEs. Were these two amounts closely correlated? Also, were there prescribing patterns in line with current evidence and best practices? The investigator found that across all orthopedic subspecialties, the number of opioids prescribed for the post discharge notably exceeded the number of opioids patients were given during the predischarge day ($M = 69.09$ versus $M = 51.13$, $P = 0.03$). This dose escalation at the time of discharge is not in line with best practice principles.

The QIs findings reinforce those of other studies, revealing that orthopedic providers often overprescribe postoperative pain medication, as illustrated by the evident discrepancy between post discharge day prescription quantities and the quantity of MMEs used on the day before discharge (Chen et al., 2020). Adjusting discharge regimens to inpatient opioid use has not been previously explored as a strategy to establish an effective yet safe postsurgical pain regimen, and to date, few studies have examined predischarge opioid use as a standard for discharge opioid prescriptions (Choo et al., 2019). In a recent study, Chen et al. (2020) quantified inpatient opioid use and discharge prescriptions across multiple orthopedic specialties and reported that even patients who required no opioids during the day before discharge were still often given opioid prescriptions. Wibbenmeyer et al. (2015), found that daily discharge opioid regimens that more closely estimated predischarge requirements were associated with decreased refill rates after discharge compared with higher prescription trends.

Such findings, as the ones mentioned in this paper, may give orthopedic prescribers new insight on how to customize discharge prescriptions to individual patient needs as part of a collective effort to both prevent overprescription while effectively treating pain. Other systemic changes may also be successful in accomplishing this goal and warrant further study, such as designing the electronic health record to automatically offer orthopedic prescribers discharge prescription options that are based on inpatient consumption quantities.

Limitations

This quality improvement project has several important limitations. First, this was a prospective study, conducted at a single, academic medical center, with a small sample size. As such, the case complexity and patient cohort may not be broadly generalizable. In this project patients were included if they were admitted for greater than twenty-four hours postoperatively;

but patients were not excluded if medication reconciliation documented active opioid use at the time of surgery, if they had a peripheral nerve infusion catheter in the twenty-four hours before discharge, or if they were discharged from a non-orthopedic service. Furthermore, although this study included all orthopedic subspecialties, it failed to take into consideration surgical time and the length of hospitalization for all subjects. Lastly, this quality improvement project also lacks post discharge data such as refill request rates, MMEs consumed (rather than prescribed) and the amount of unused opioid pills remaining after discharge. Although such data may be helpful to accurately determine the actual amount of MMEs used, it is challenging to collect this data, and is often subject to inaccuracy due to misreporting by patients.

Conclusions

In conclusion, this quality improvement project found that opioid regimens prescribed at discharge after inpatient orthopedic procedures at this academic medical center, commonly exceed predischarge requirements. Amongst orthopedic patients, Sabatino et al. (2018) demonstrated not only a wide variation in prescribing practices across different specialties but also that sixty percent of patients undergoing orthopedic procedures were prescribed excess opioids postoperatively. Over-prescribing may result in dangerous and illegal diversion of opioids to those for whom opioids were not prescribed. Also, an increased duration of initial opioid prescription has also been associated with an increased incidence of chronic opioid use and risk of opioid misuse and overdose (Neuman et al., 2019). Discharge regimens and protocols that approximate inpatient opioid use may decrease the current overprescription practices while effectively controlling pain, as they are not associated with higher refill rates compared with more excessive prescription patterns (Neuman et al., 2019). Further study is needed to determine effective, feasible methods to target prescriptions to individual patient needs. This quality

improvement project may provide guidance and/or reference for all orthopedic subspecialties at this academic center, and the data may provide insights and helpful ideas for navigating the complicated opioid prescribing patterns for postoperative orthopedic patients.

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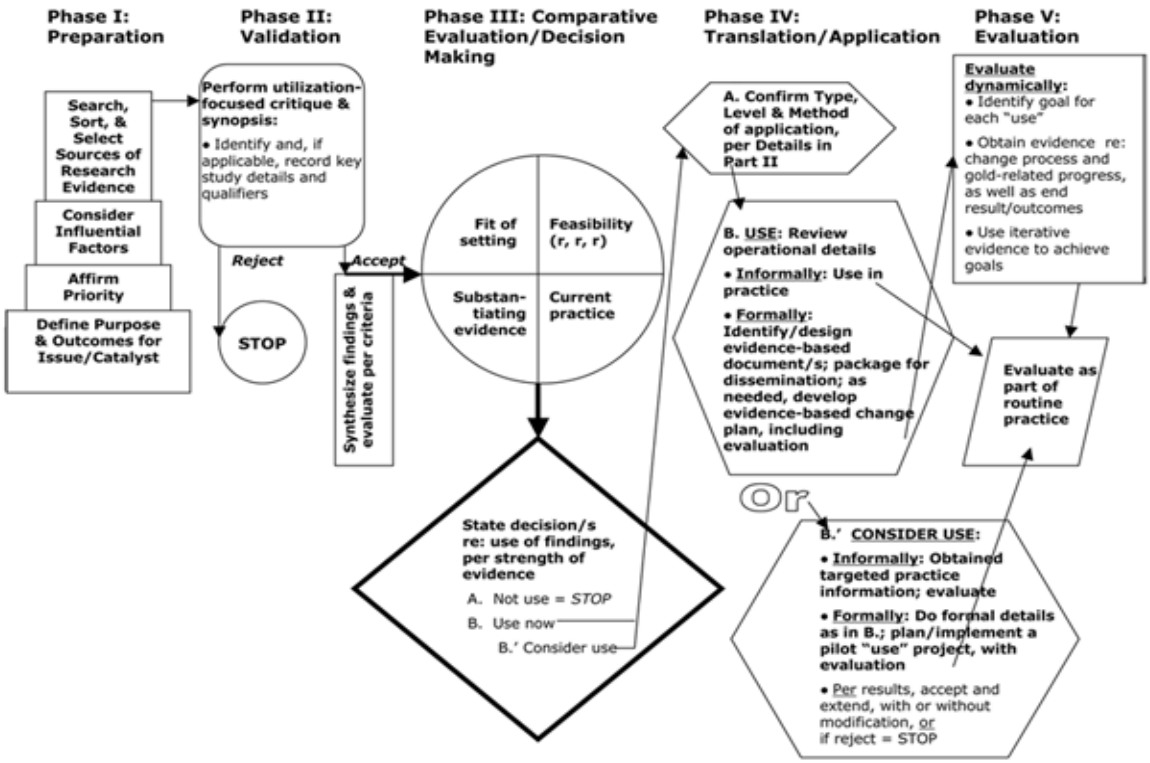
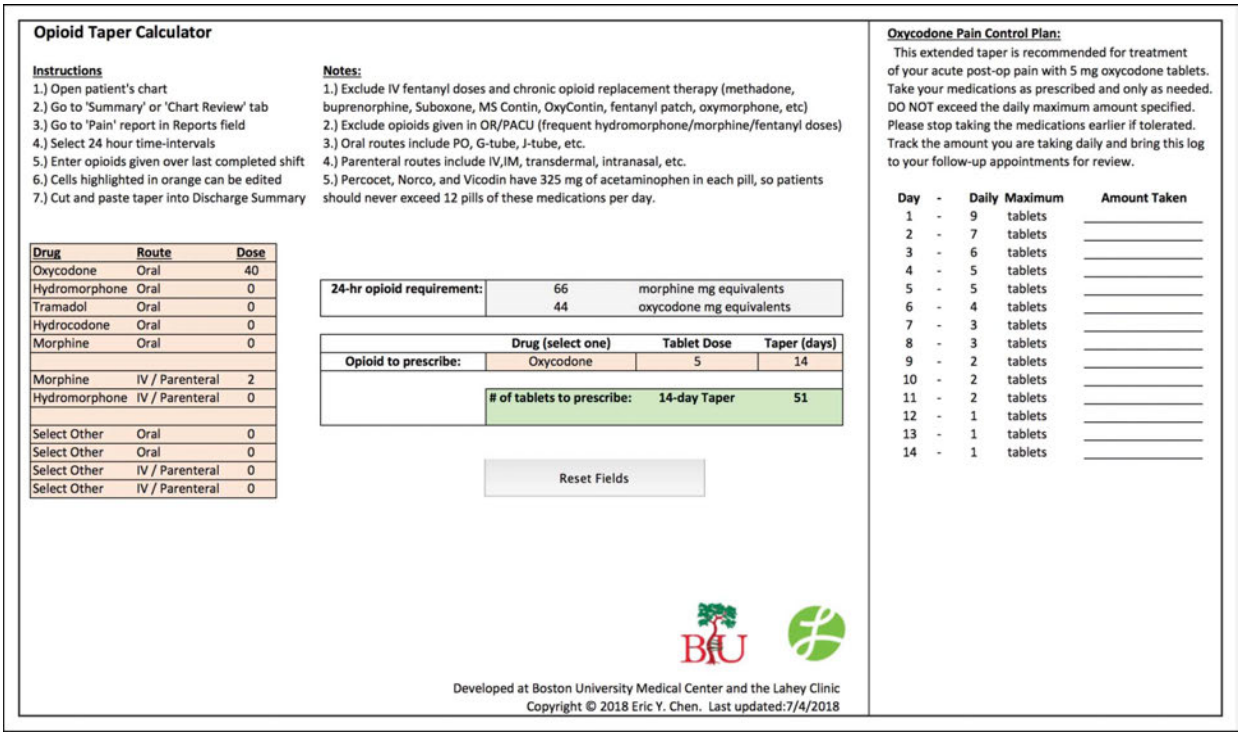
Appendix A



Appendix A. The Stetler Model of Research Utilization. (Reprinted from Nursing Outlook, Vol. 49, Stetler, C. B., Updating the Stetler model of research utilization to facilitate evidence-based practice, pg. 272–279, copyright © 2001, see Appendix A for reprint license from Elsevier)

Appendix B



Opioid Taper Calculator

Instructions
1.) Open patient's chart
2.) Go to 'Summary' or 'Chart Review' tab
3.) Go to 'Pain' report in Reports field
4.) Select 24 hour time-intervals
5.) Enter opioids given over last completed shift
6.) Cells highlighted in orange can be edited
7.) Cut and paste taper into Discharge Summary

Notes:
1.) Exclude IV fentanyl doses and chronic opioid replacement therapy (methadone, buprenorphine, Suboxone, MS Contin, OxyContin, fentanyl patch, oxymorphone, etc)
2.) Exclude opioids given in OR/PACU (frequent hydromorphone/morphine/fentanyl doses)
3.) Oral routes include PO, G-tube, J-tube, etc.
4.) Parenteral routes include IV,IM, transdermal, intranasal, etc.
5.) Percocet, Norco, and Vicodin have 325 mg of acetaminophen in each pill, so patients should never exceed 12 pills of these medications per day.

Drug	Route	Dose
Oxycodone	Oral	40
Hydromorphone	Oral	0
Tramadol	Oral	0
Hydrocodone	Oral	0
Morphine	Oral	0
Morphine	IV / Parenteral	2
Hydromorphone	IV / Parenteral	0
Select Other	Oral	0
Select Other	Oral	0
Select Other	IV / Parenteral	0
Select Other	IV / Parenteral	0

24-hr opioid requirement:	66	morphine mg equivalents
	44	oxycodone mg equivalents

	Drug (select one)	Tablet Dose	Taper (days)
Opioid to prescribe:	Oxycodone	5	14
	# of tablets to prescribe:	**14-day Taper**	**51**

Reset Fields

Developed at Boston University Medical Center and the Lahey Clinic
Copyright © 2018 Eric Y. Chen. Last updated:7/4/2018

Oxycodone Pain Control Plan:
This extended taper is recommended for treatment of your acute post-op pain with 5 mg oxycodone tablets. Take your medications as prescribed and only as needed. DO NOT exceed the daily maximum amount specified. Please stop taking the medications earlier if tolerated. Track the amount you are taking daily and bring this log to your follow-up appointments for review.

Day		Daily Maximum		Amount Taken
1	-	9	tablets	
2	-	7	tablets	
3	-	6	tablets	
4	-	5	tablets	
5	-	5	tablets	
6	-	4	tablets	
7	-	3	tablets	
8	-	3	tablets	
9	-	2	tablets	
10	-	2	tablets	
11	-	2	tablets	
12	-	1	tablets	
13	-	1	tablets	
14	-	1	tablets	

"Diagram showing an example of the opioid taper calculator for a patient who used 40 mg PO oxycodone and 2 mg IV morphine in the 24 hours before discharge. The orange boxes represent fields that the user may edit. Per the user's selection to prescribe a 14-day taper of oxycodone, the taper recommended prescribing a taper of 51 tablets, tapering from a daily maximum of nine tablets per day down to one by the end of the taper. The taper on the right can be copied and pasted into the patient's discharge instructions. Instructions are given for use with Boston Medical Center's EMR (Epic)" (Chen et al., 2020, p. e306).

Appendix C. IRB Determination Letter

OREGON HEALTH & SCIENCE UNIVERSITY

IRB MEMO

Research Integrity Office
3181 SW Sam Jackson Park Road - L106RI
Portland, OR 97239-3098
(503)494-7887 irb@ohsu.edu

NOT HUMAN RESEARCH

February 2, 2023

Dear Investigator:

On 2/2/2023, the IRB reviewed the following submission:

Title of Study:	Conducting a Medical Chart Audit to Identify Common Opioid Prescribing Patterns in Postoperative Orthopedic Patients: A Quality Improvement Initiative
Investigator:	Kristi Vaughn
IRB ID:	STUDY00025449
Funding:	None

The IRB determined that the proposed activity is not research involving human subjects. IRB review and approval is not required.

Certain changes to the research plan may affect this determination. Contact the IRB Office if your project changes and you have questions regarding the need for IRB oversight.

If this project involves the collection, use, or disclosure of Protected Health Information (PHI), you must comply with all applicable requirements under HIPAA. See the HIPAA and Research website and the Information Privacy and Security website for more information.

Sincerely,

The OHSU IRB Office

Version Date: 04/08/2016 Page 1 of 1

Appendix D. MORPHINE MILLIGRAM EQUIVALENT

Opioid (doses in mg/day, except where noted)	Conversion factor
Codeine	0.15
Fentanyl transdermal (in mcg/hr)	2.4
Hydrocodone	1
Hydromorphone	4
Methadone	
1–20 mg/day	4
21–40 mg/day	8
41–60 mg/day	10
≥ 61–80 mg/day	12
Morphine	1
Oxycodone	1.5
Oxymorphone	3

Centers for Disease Control and Prevention. (2022). *Clinical Tools for Primary Care Providers. Calculating Total Daily Dose of Opioids for Safer Dosage*. U.S. Department of Health and Human Services. https://www.cdc.gov/opioids/providers/prescribing/clinical-tools.html

Appendix E. Letter of support

Letter of Support from Clinical Agency

Date: *08/12/2022*

Dear *Anamaria Sevedean*,

This letter confirms that I, Jennifer Shatzer , allow *Anamaria Sevedean* (OHSU Doctor of Nursing Practice Student) access to complete his/her DNP Final Project at our clinical site. The project will take place from approximately *August 2022* to *April 2023*.

This letter summarizes the core elements of the project proposal, already reviewed by the DNP Project Preceptor and clinical liaison (if applicable):

- **Project Site(s):** OHSU Hospital, 3181 SW Sam Jackson Park Rd, Portland, OR 97239
- **Project Plan: Use the following guidance to describe your project in a brief paragraph.**
  - **Identified Clinical Problem:** *An orthopedic department in an academic medical center provides comprehensive orthopedic care, ranging from everyday bone and joint care to the most complex and highly sophisticated treatments, surgeries, and procedures. On the other hand, the orthopedic department does not have a comprehensive and universal patient-centered approach when it comes to post-operative opioid prescribing. Unfortunately, an omission of this type of prescribing program is not unique.*
  - **Rationale:** *The services provided do not include just surgery but also complementary medicine, injury prevention, physical therapy, and pain management. . Cutting edge treatments are often available in an academic medical center as their faculty and surgeons have often developed these new treatments. Since these specialists are training tomorrow's orthopedists, they seek an awareness of the most up-to-date therapies and technology.*
  - **Specific Aims:** *By March 2023, after approval by Institutional Review Board (IRB) (see Appendix C), a prospective investigation will be undertaken in a cohort of consecutive adult patients who underwent inpatient orthopedic surgical procedures between February 2nd 2023 and March 12th 2023. The prospective chart audit will assess formulation, quantity, and dosing regimen of opioid medications administered orally, intravenously, or transdermally during the predischarge day of each patient's hospitalization; as well as the formulation, quantity, and dosing regimen of opioid medications prescribed post discharge. The main goal of the prospective chart audit is to determine if there is any association between a postoperative patient's predischarge day opioid use and the quantity of opioids prescribed for post discharge use.*
  - **Methods/Interventions/Measures:** *A prospective chart review will be conducted for patients admitted after any orthopedic procedure across several orthopedic subspecialties. Daily and total prescription quantities as well as patient-specific factors will be collected. The total opioids used the day before discharge will be compared with the total opioids prescribed for the day after discharge.*
  - **Data Management:** *Data will be extracted from the academic medical center's clinical database, which contains and stores patient-related information from the clinical care setting, such as electronic documentation and inpatient medication administration records, and it will be kept private in accordance with HIPAA.*
  - **Site(s) Support:** *We will provide space and support to conduct the study, access to required data, and faculty support.*
  - **Other:** *N/A*

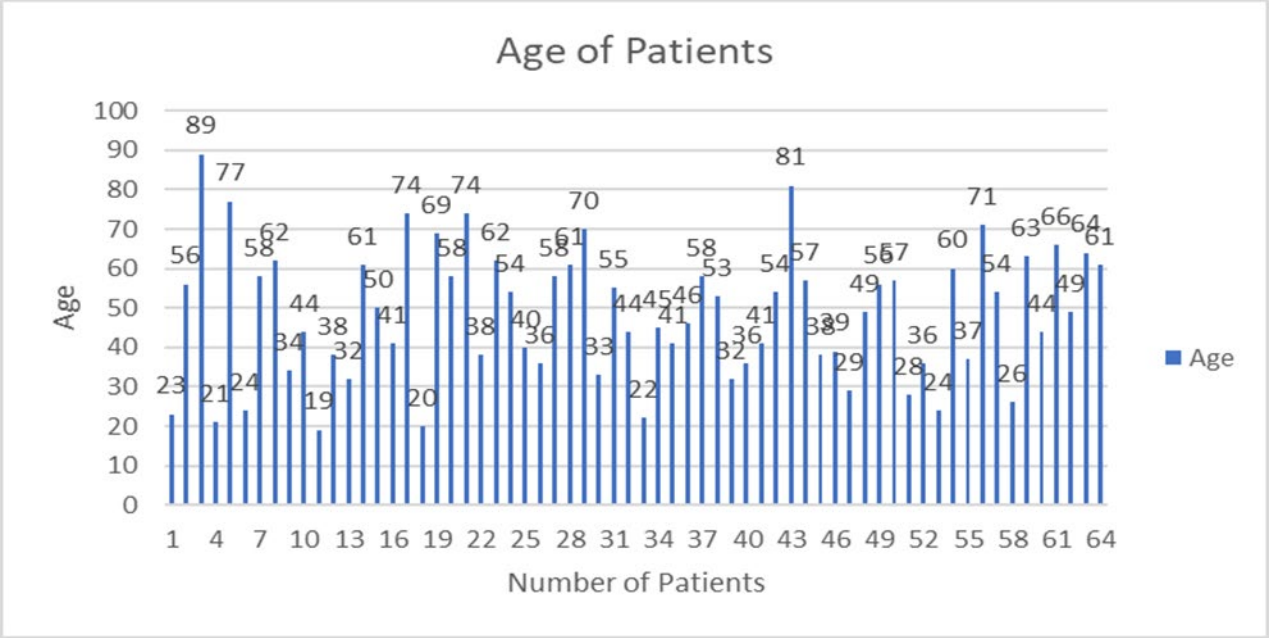
During the project implementation and evaluation, *Anamaria Sevedean* will provide regular updates and communicate any necessary changes to the DNP Project Preceptor.

Our organization looks forward to working with this student to complete their DNP project. If we have any concerns related to this project, we will contact *Anamaria Sevedean* and *Dr. Kristi Vaughn* (student's DNP Project Chairperson).

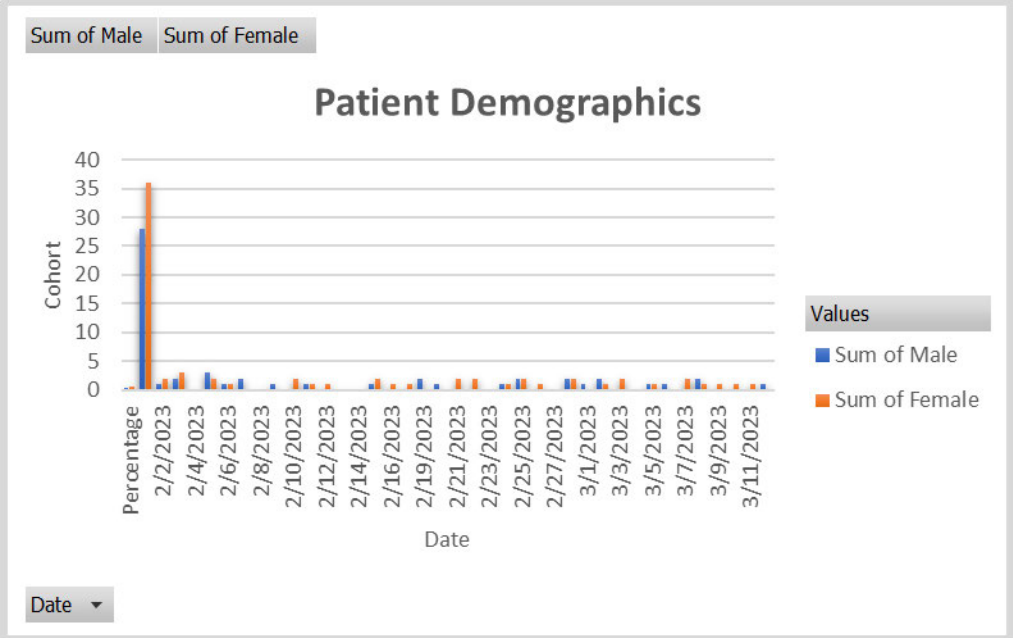
Regards,

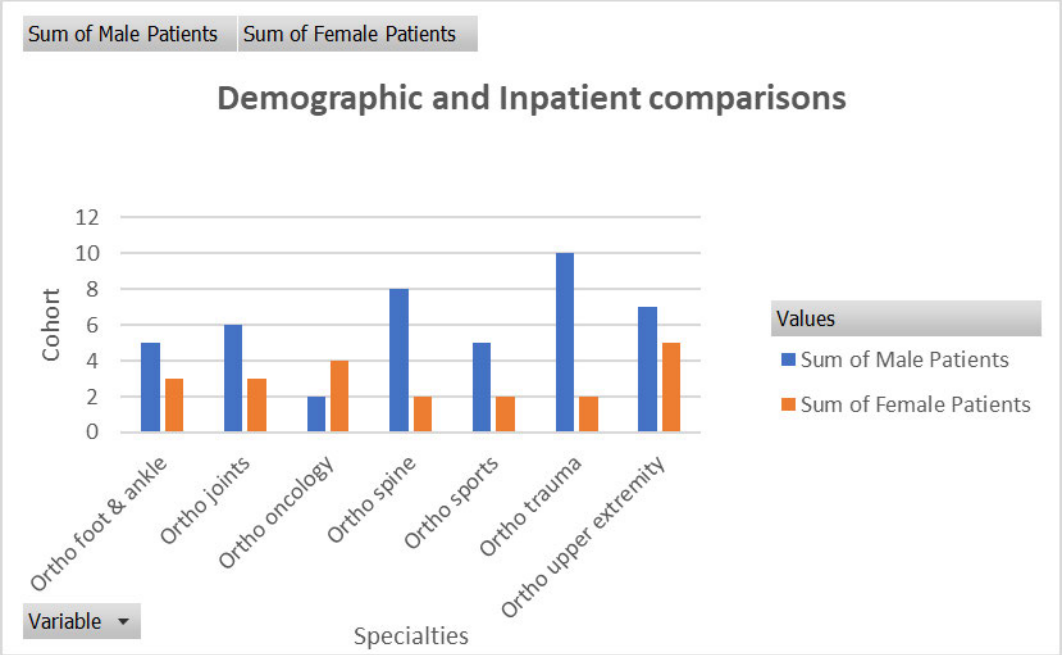
_____Jennifer Shatzer, Ortho Trauma NP, shatzer@ohsu.edu, 503-494-8478
DNP Project Preceptor (Name, Job Title, Email, Phone_____

Appendix F. Cohort Age Chart

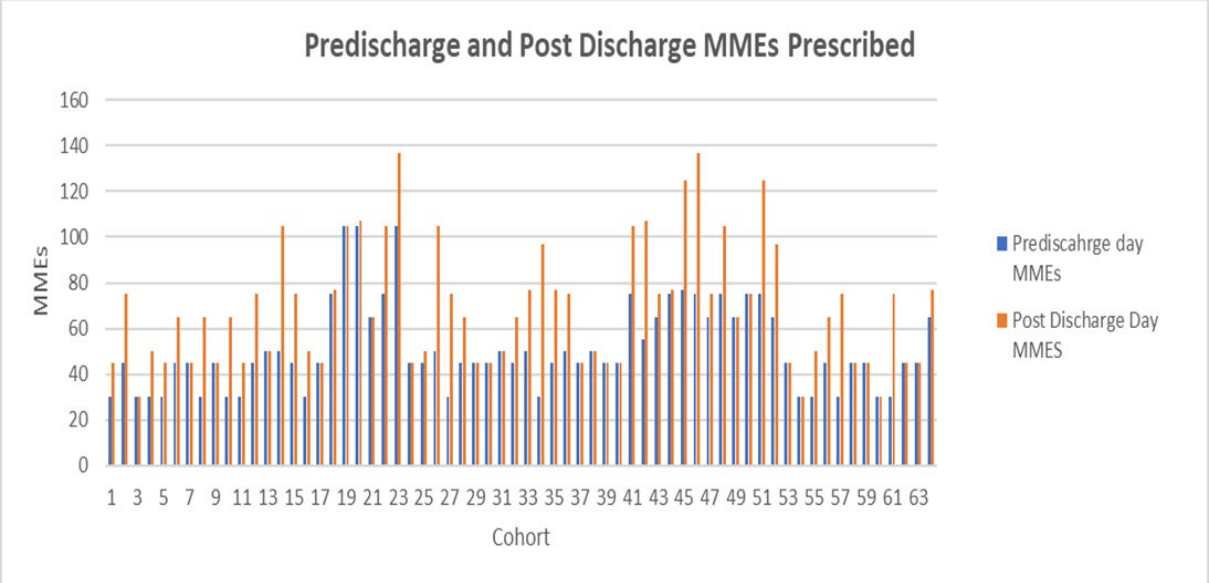


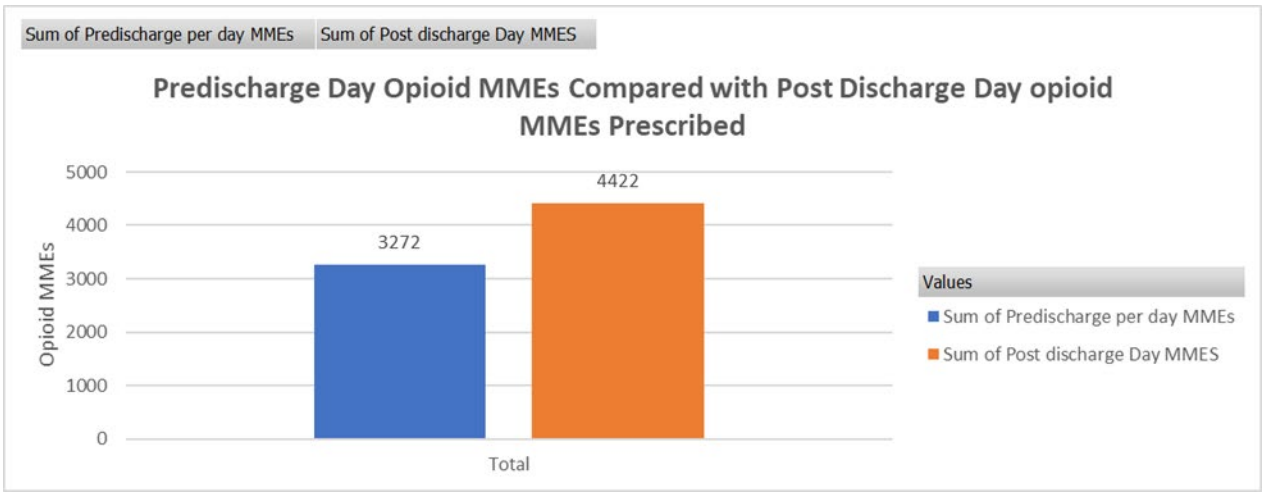
Appendix G. Cohort Demographics

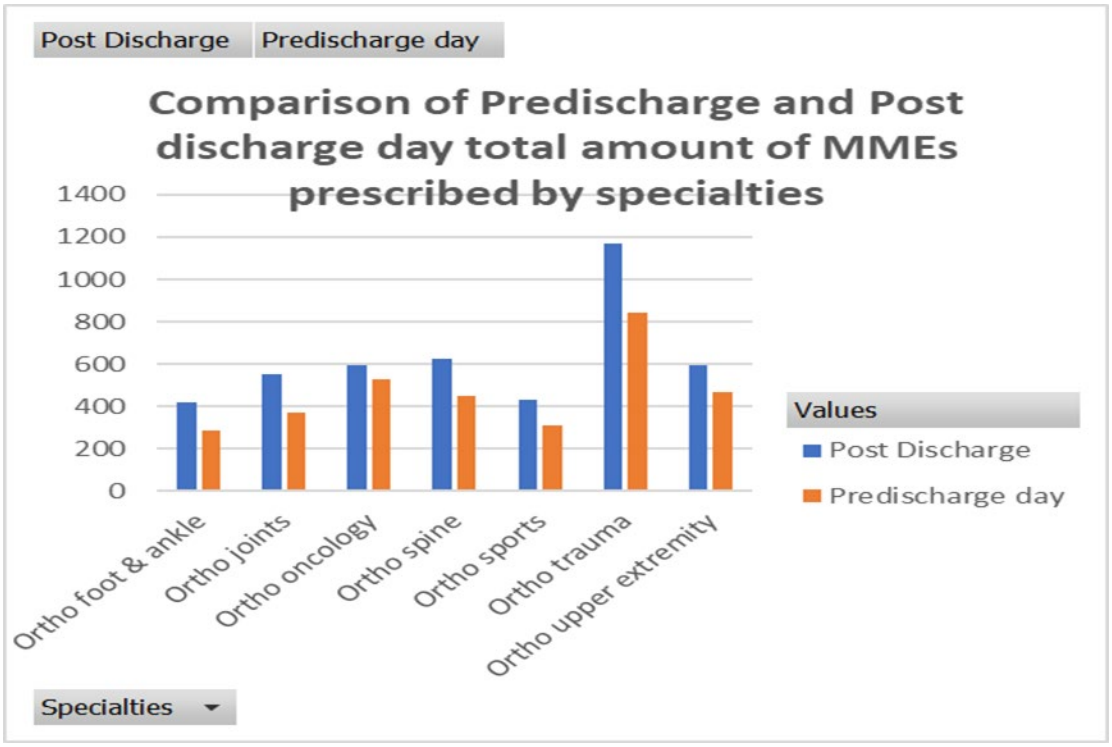




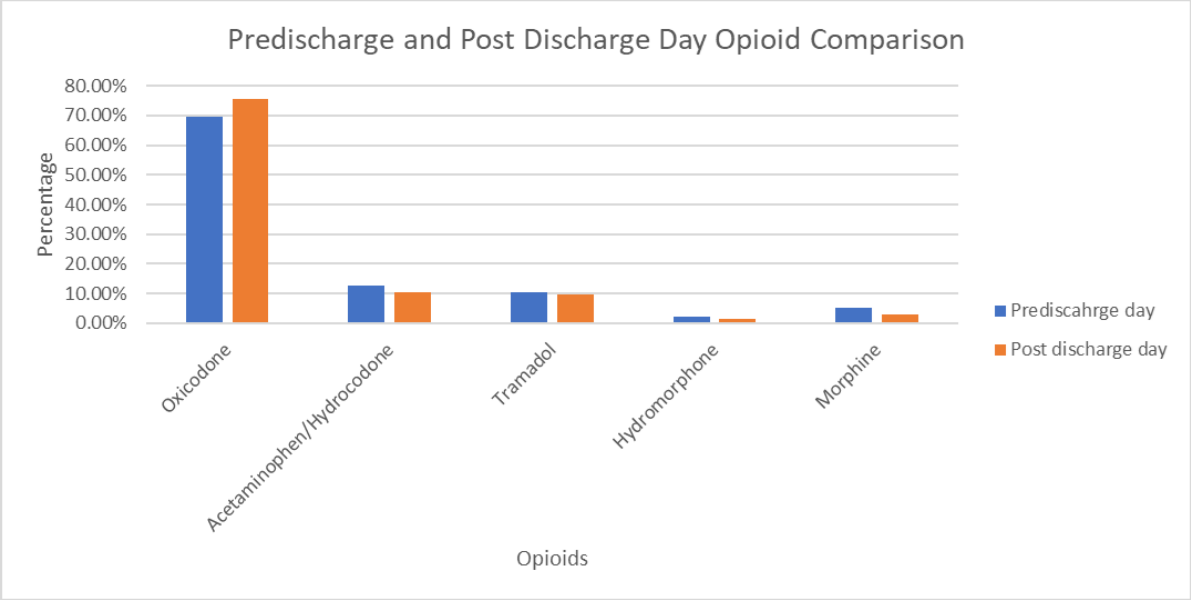
Appendix H. Predischarge and Post Discharge MMEs Prescribed Charts



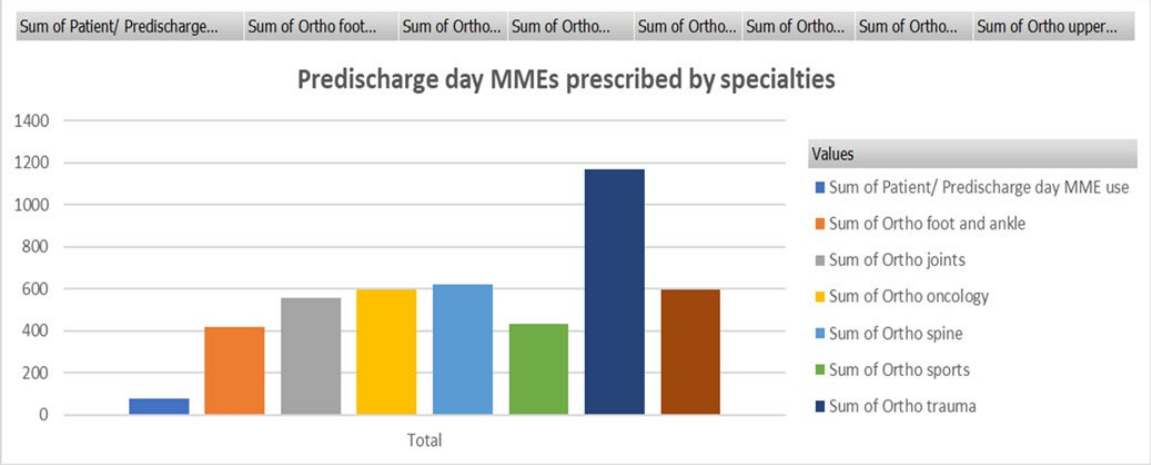

Sum of Predischarge per day MMEs
Sum of Post discharge Day MMES
Predischarge Day Opioid MMEs Compared with Post Discharge Day opioid MMEs Prescribed
5000
4000
3000
2000
1000
0
Opioid MMEs
3272
4422
Total
Values
Sum of Predischarge per day MMEs
Sum of Post discharge Day MMES


Post Discharge
Predischarge day
Comparison of Predischarge and Post discharge day total amount of MMEs prescribed by specialties
1400
1200
1000
800
600
400
200
0
Ortho foot & ankle
Ortho joints
Ortho oncology
Ortho spine
Ortho sports
Ortho trauma
Ortho upper extremity
Values
Post Discharge
Predischarge day
Specialties

Appendix I. Predischarge and Post Discharge Opioid Type Comparison Chart



Appendix J. Predischarge Day MMEs Prescribed by Specialties Chart



Appendix K. Post Discharge Day MMEs Prescribed by Specialties Chart

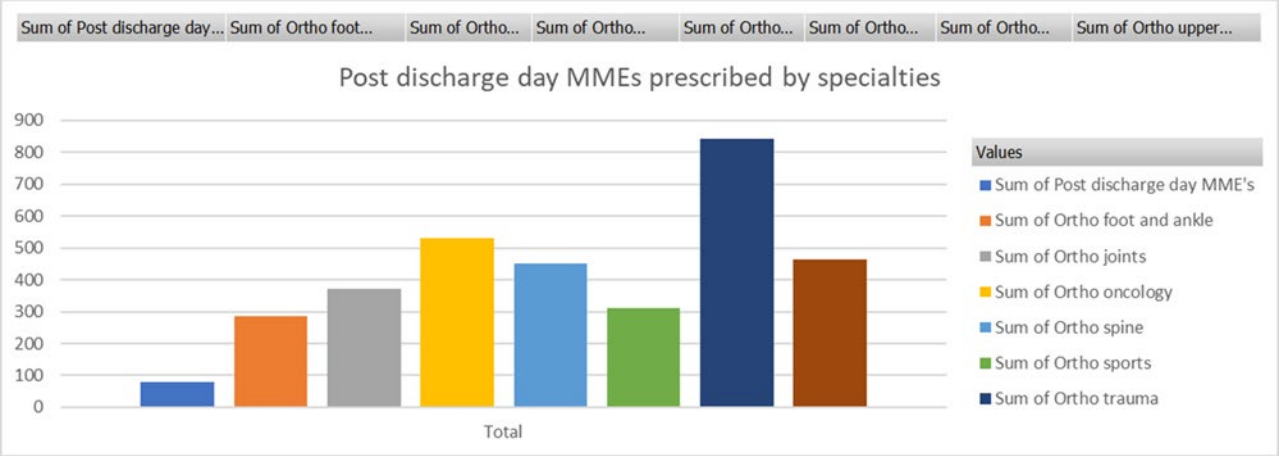


Figure 1. Project Completion Timeline

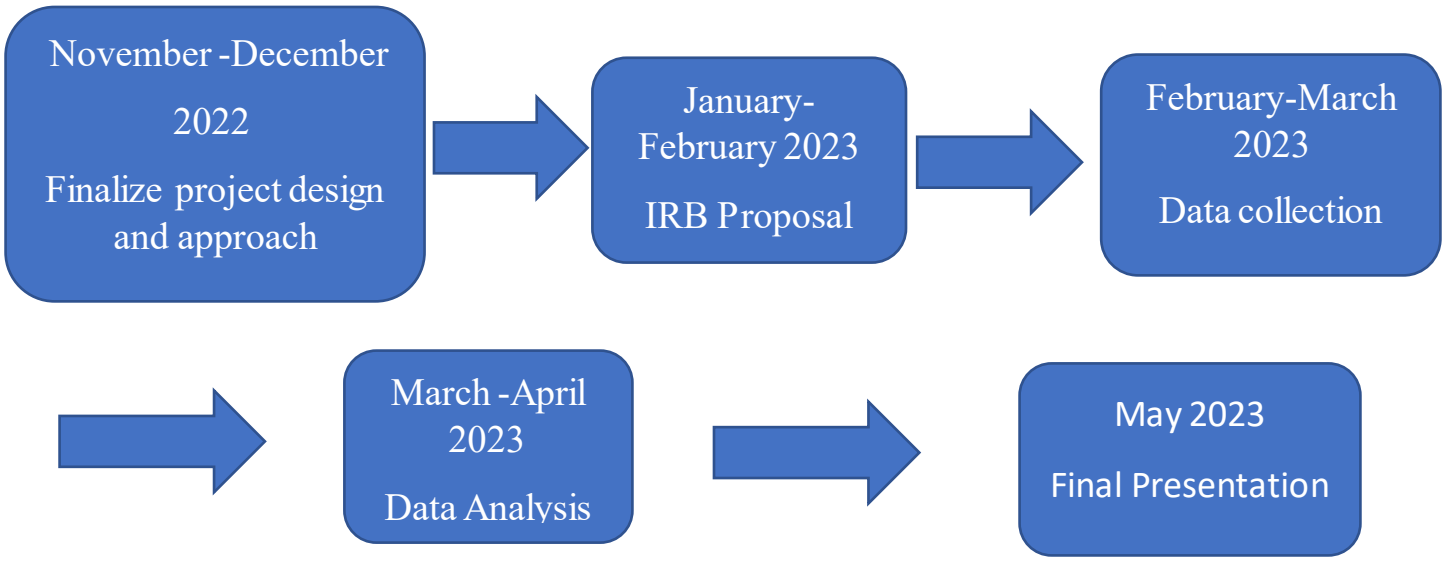


Table 1: Evaluated Measures

Process Measures	Outcome Measures	Balancing Measures
1. Formulation, quantity, and dosing regimen of opioid medications administered orally, intravenously, or transdermally during the day before discharge of each patient's hospitalization	1. Assessment of a correlation between a postoperative day before discharge opioid use and the quantity of opioids prescribed at hospital discharge	1. Feedback from the orthopedic department
2. Formulation, quantity, and dosing regimen of opioid medications prescribed at discharge.	2. Assessment of the percentage of charts that pertain to different orthopaedic subspecialties (sports medicine, foot and ankle, hip and knee, hand and upper extremity, spine, joint replacement, fracture care and trauma, and bone and soft tissue services) that demonstrate a patient-centered approach to prescribing opioids at discharge.	

3. Identify perceived benefits of a patient-centered approach to prescribing opioids at discharge.		

Table 2. Statistical Analysis for Cohort Age. Wilcoxon Signed-Rank Test.

Age	
Mean	48.3125
Standard Error	2.073055003
Median	49
Mode	58
Standard Deviatic	16.58444002
Sample Variance	275.0436508
Kurtosis	-0.6110882
Skewness	0.130188555
Range	70
Minimum	19
Maximum	89
Sum	3092
Count	64

Table 3. Statistical Analysis of Predischarge Day Prescribed Compared with Post Discharge Day Prescribed Opioid MMEs. Wilcoxon Signed-Rank Test.

Predischarge Day			*Post Discharge Day*	
Mean	51.13		Mean	69.09
Standard Error	2.39		Standard Error	3.39
Median	45.00		Median	65.00
Mode	45.00		Mode	45.00
Standard Deviatio	18.93		Standard Deviation	26.90
Sample Variance	358.38		Sample Variance	723.41
Kurtosis	1.10		Kurtosis	-0.12
Skewness	1.11		Skewness	0.78
Range	75.00		Range	107.00
Minimum	30.00		Minimum	30.00
Maximum	105.00		Maximum	137.00
Sum	3242.00		Sum	4377.00
Count	64.00		Count	64.00

t-Test: Two-Sample Assuming Equal Variances		
	Predischarge per day MMEs	*Post discharge Day MMES*
Mean	51.13	69.09
Variance	359.89	721.29
Observations	64.00	64.00
Pooled Variance	540.59	
Hypothesized Mean Differenc	0.00	
df	126.00	
t Stat	-4.37	
P(T<=t) one-tail	0.03	
t Critical one-tail	1.66	
P(T<=t) two-tail	0.05	
t Critical two-tail	1.98	