

Otterbein University

Digital Commons @ Otterbein

Doctor of Nursing Practice Scholarly Projects

Student Research & Creative Work

5-26-2024

Evidence-Based Practice Guidelines: Anesthesia for Total Knee and Hip Arthroplasty

Amanda Kleinfelder
kleinfelder1@otterbein.edu

Follow this and additional works at: https://digitalcommons.otterbein.edu/stu_doc



Part of the [Medicine and Health Sciences Commons](#)

Recommended Citation

Kleinfelder, Amanda, "Evidence-Based Practice Guidelines: Anesthesia for Total Knee and Hip Arthroplasty" (2024). *Doctor of Nursing Practice Scholarly Projects*. 85.
https://digitalcommons.otterbein.edu/stu_doc/85

This Project is brought to you for free and open access by the Student Research & Creative Work at Digital Commons @ Otterbein. It has been accepted for inclusion in Doctor of Nursing Practice Scholarly Projects by an authorized administrator of Digital Commons @ Otterbein. For more information, please contact digitalcommons07@otterbein.edu.

**Final Scholarly Project: Evidence-Based Practice Guidelines: Anesthesia for
Total Knee and Hip Arthroplasty**

Amanda Kleinfelder, RN, BSN, SRNA

Department of Nursing, Otterbein University

2023

In Partial Fulfillment of the Requirements of the Degree

Doctor of Nursing Practice

DNP Final Scholarly Project Team



Dr. Brian Garrett, DNP, CRNA, Advisor



Dr. Joy Shoemaker, DNP, RN, APRN.CNP, FNP-C, CNE, Project Team Member



Dr. Amy Bishop, DNP, AGCNS, Project Team Member

Abstract

Total knee and hip arthroplasty are the two most common orthopedic surgeries in the United States. Traditional perioperative practice is multidisciplinary, with each professional, including anesthesia, making decisions based on their current knowledge or past experience. Postoperative complications pose a threat to any patient undergoing a surgical procedure. Enhanced Recovery After Surgery (ERAS) protocols were developed to streamline best practice guidelines during the perioperative period. ERAS pathways aim to decrease postoperative complications, accelerate recovery after surgery, decrease narcotic use and promote early mobilization and discharge from the hospital. The aim of this project is the development of evidence-based practice (EBP) guidelines using recommendations from ERAS protocols. The EBP guidelines include preoperative education, patient optimization and euvolemic fluid management. During the intraoperative period, the EBP guideline includes opioid-sparing anesthetic, spinal anesthesia, and/or intraarticular block. The EBP guideline recommends scheduled medications preoperatively and postoperatively. In the postoperative period, the EBP guideline recommends early mobilization. Project managers will implement the EBP guideline at an urban mid-western level one hospital. Progress of implementation and staff adherence to guidelines will be tracked electronically. Data will be collected in excel spreadsheets and evaluated.

Keywords: ERAS, TKA/THA, Evidence-based practice guidelines

Final Scholarly Project: Evidence-Based Practice Guidelines: Anesthesia for Total Knee and Hip Arthroplasty

Introduction of the Problem

Postoperative complications continue to be a significant problem for the healthcare system and the individual and result in poor patient outcomes and high healthcare costs. According to Dencker et al. (2021), studies show that 7-15 percent of patients undergoing major surgeries result in postoperative complications, and 0.79 to 5.7 percent result in postoperative mortality. Postoperative complications can range from non-life-threatening complications with no long-lasting disabilities to morbid outcomes (Dencker et al., 2021). Any complication can be devastating to a patient's wellbeing.

As well as being detrimental to the patient, surgical outcomes significantly increase healthcare costs, ranging from \$11,626 to \$19,626 per patient related to intensive care unit (ICU) admissions, reoperation or readmission (Davrieux et al., 2019). Many times, these costs are passed along to payers. According to Moloney et al. (2014), if surgical complications were decreased by five percent Medicare could save up to 31 million dollars per year. The cost related to surgical complications is inversely proportionate to reimbursement rates from payer to hospital. Thus, U.S. hospitals face significant financial loss to surgical outcomes (Moloney et al., 2014). Postoperative complications are costly for the patient and hospitals.

THA/TKA are not immune to postoperative complications. Heo et al. (2020) conducted a study that determined 14.4 percent of THA/TKA procedures resulted in a major postoperative complication requiring complex medical intervention such as death, reoperation, dislocation, fracture, deep vein thrombosis, pulmonary embolism, surgical site infection, cardiovascular

complication, and stroke. Around 46.6 percent resulted in a minor postoperative complication (all other complications). Overall complication rates for THA/TKA patients were 53.6 percent.

Enhanced Recovery After Surgery (ERAS) protocols are evidence-based guidelines implemented in the perioperative period and aim to improve postoperative outcomes. ERAS protocols also help create an environment for the multidisciplinary team to collaborate and develop a rapport necessary for successful implementation of ERAS protocols and improve patient perioperative experience (Stowers et al., 2016). ERAS protocols were originally developed for colorectal procedures. Now ERAS protocols extend into many different types of surgical procedures such as total hip and knee arthroplasty (THA/TKA). The implementation of ERAS protocols for THA/TKA patients will aim to improve postoperative outcomes, length of stay and opioid consumption.

Background

The surgical procedure is only a part of the entire surgical experience. The time surrounding the surgical procedure defines the perioperative period and consists of the preoperative, operative, and postoperative periods (Davrieux et al., 2019). During the preoperative period, patients are prepped for surgery. The preoperative nurse verifies the correct patient and surgical site, administers any prescribed medications, and completes the preoperative order set. Anesthetic induction, surgery, and anesthetic recovery are three sub-groups in the operative stage (Davrieux et al., 2019). The anesthesiologist or nurse anesthetist perform anesthetic induction and anesthetic recovery. The surgeon and surgical team perform the surgery. The postoperative nurse observes the patient during the postoperative period to detect any early signs of postoperative complications and keep the patient comfortable after surgery.

The current non-standardized approach to the perioperative period is multidisciplinary, including surgeons, anesthesiologists, physical therapists, nurses, and pharmacists, and can result in variations in care. An anesthesiologist at UCLA, explains that care variability comes from each discipline “doing their own things, often based on knowledge that might not have been up to date” (UCLA, 2020). ERAS guidelines are an effort to standardize best practices throughout the perioperative period to improve patient outcomes.

The development of ERAS protocols will change the future of perioperative management. A colorectal surgeon created ERAS in the 1990s and led a group of surgeons to develop the first ERAS model of care aimed at determining why patients remained in the hospital after surgery (Taurchini et al., 2018). The group of surgeons determined that the causes were due to multiple reasons, centered around delays in gut function and physical mobility after surgery. The goals of ERAS pathways in the perioperative period are to decrease postoperative complications, accelerate recovery after surgery, and promote early mobilization and discharge from the hospital (Ren et al., 2011). Various surgical procedures, including abdominal vascular surgeries, esophagectomy, pancreatectomy, gastric resection, cystectomy, colorectal surgeries, gynecologic surgeries, orthopedic, and bariatric surgeries now utilize ERAS protocols. ERAS protocols are multidisciplinary, evidence-based list of recommendations for the care of a patient in the perioperative period and aim to decrease the stress response to surgery to improve surgical outcomes (Ren et al., 2011). The development of ERAS protocols provides a more standardized approach to the perioperative period using evidence-based recommendations.

ERAS protocols began growing in popularity and became an interest in quality improvement projects. In 2010 following the significant and growing success in ERAS protocols, the ERAS Society was officially created, housing members from different professions involved

in surgical care (Taurchini et al., 2018). The ERAS implementation program originated in Sweden but soon spread to the Netherlands, United Kingdom, Switzerland, and later to Canada, Australia, United States, France, Spain, and Latin America (Taurchini et al., 2018). The purpose of the ERAS Society is to develop, publish and update guidelines addressing additional surgery specialties. The ERAS Society developed the ERAS implementation program, which includes teams of surgeons, anesthesiologists, nurses, and allied health professionals who are coached for 8-10 months while implementing ERAS protocols in their own units (Taurchini et al., 2018). “ERAS is not a single and rigid protocol but is a method, a ‘modus operandi,’ a new way of multidisciplinary teamwork with readiness to make changes as knowledge evolves, i.e., a revolution of medical-scientific thought” (Taurchini et al., 2018, p. 2). ERAS protocols adapt as new evidence arises for best patient outcomes.

Traditionally, in the preoperative period, patients would follow guidelines to fast after midnight with the goal of preventing vomiting and avoiding the risk of aspiration. Overnight fasting results in a catabolic state that causes a release of cortisol and glucagon that lead to insulin resistance, glycogen depletion, and protein breakdown in the postoperative period (Gupta & Gan, 2015). ERAS protocols recommend avoiding preoperative fasting and intentional carbohydrate loading prior to surgery to prevent the catabolic state associated with long periods of fasting and fluid restriction (Gupta & Gan, 2015). Research evidence shows that consuming clear liquids up to two hours before surgery results in lower gastric volume than patients following traditional fasting guidelines (Feldheiser et al., 2016).

During the intraoperative period, fluid management is vital. Fluid overload throughout the perioperative period is associated with increased morbidity, postoperative ileus, and increased length of stay (Gupta & Gan, 2015). The goal of fluid therapy when using ERAS

protocols is to maintain euvolemia and avoid using normal saline due to the potential for developing hyperchloremic metabolic acidosis, which can decrease blood flow to the gut and alter perfusion to the kidneys (Gupta & Gan, 2015). Anesthetic management should consist of short-acting anesthetic agents with minimal side effects, regional anesthesia, and nonsteroidal anti-inflammatory drugs to minimize the use of opioids, use of short-acting neuromuscular blockade with an adequate reversal to avoid postoperative respiratory depression and aggressive multimodal postoperative nausea and vomiting prophylaxis (Feldheiser et al., 2016). Opioid sparing technique and a multimodal approach is an important aspect of ERAS protocols.

Opioid-sparing anesthesia is the process of limiting intraoperative narcotic use and substituting other alternatives. Scheduled pre-operative acetaminophen, gabapentinoids and COX-2 inhibitors, as well as intra-articular block or spinal anesthesia helps with intra-operative pain management. To minimize opioid use, beta blockers can be considered during laryngoscopy. A lidocaine infusion, ketamine bolus and infusion, dexmedetomidine bolus and infusion, magnesium sulfate infusion and propofol infusion can all be used as alternative medications to opioids (Newman et al., 2022). Opioid-sparing anesthesia will aide in improved patient outcomes as well as proper fluid management.

Maintaining euvolemia is essential for the patient. To decrease the risk of infection and length of stay, the resumption of oral intake to maintain a euvolemic state should occur as early as possible in the postoperative period (Gupta & Gan, 2015). Recommendations for the postoperative period include early mobilization, avoidance of nasogastric tubes, early oral nutrition to stimulate gut motility, and an audit of ERAS compliance (Wainwright et al., 2020). There are many factors that can improve patient outcomes.

Significance of Problem to Nurse Anesthesia

Patient safety is the number one priority to the nurse anesthetist. Patient's Rights is the first standard of care for nurse anesthesia practice and is defined as "Respect the patient's autonomy, dignity, and privacy, and support the patient's needs and safety" (AANA, 2019). The CRNA must work with the patient and healthcare team to provide patient-centered anesthesia and create a culture of safety (AANA, 2018). CRNAs are held accountable for keeping the patient safe throughout the perioperative period, and the decisions CRNAs make directly impact postsurgical outcomes.

CRNAs play a pivotal role in guiding patient-centered care. During the perioperative period, the CRNA is responsible for pain and fluid management, monitoring the patient's vital signs, airway, and body position, and most importantly, advocating for the patient. CRNAs "bridge the gap between pre- and postoperative care" (Moningi et al., 2019, p. S6). For positive patient outcomes, ERAS protocols require cohesive teamwork from surgeons, anesthesiologists/nurse anesthetists, and preoperative and postoperative nurses.

In the United States, there are over 14 million admissions for surgical procedures (Tevis & Kennedy, 2013). Patients undergoing a surgical procedure have a 30 percent chance of postoperative complications (Tevis & Kennedy, 2013). Postoperative complications, including poor pain management and prolonged length of stay, increase patient mortality and morbidity. An increase in mortality and morbidity negatively impacts the patient and results in care not centered around the patient. Patient-centered care encompasses respecting the patient as an individual and focusing outcomes on their priorities. ERAS protocols lead to reduced complications and length of stay, improved cardiac function, and faster recovery (Moningi et al.,

2019). Maintaining patient safety is a standard of nurse anesthesia care. Thus, the CRNA should guide decisions focused on the priority of patient safety and advocate for ERAS protocols.

Certified registered nurse anesthetists (CRNAs) contribute to the perioperative period and influence the patient's success postoperatively. Therefore, the problem is improper judgment by the CRNA can contribute to postoperative complications such as increased length of stay and increased postoperative opioid consumption. Thus, leading to more complications such as constipation, nausea and vomiting, inadequate pain management, respiratory depression, and poor patient satisfaction.

PICO Question

The question being investigated is as follows: In patients undergoing anesthesia for total hip or knee arthroplasty, how does the development and implementation of a perioperative evidence-based practice (EBP) guideline compared to current, traditional practices affect length of stay and opioid consumption? The following include the population, intervention, comparison, and outcome:

- The evaluated population includes patients undergoing general anesthesia for total hip or knee arthroplasty.
- The intervention is the use of a perioperative EBP guideline.
- The intervention will be compared to current, traditional perioperative practices.
- The outcome evaluates the effect of EBP guidelines on length of stay and opioid consumption.

Project Objectives

The following are objectives for the project:

- Develop EBP guideline for total hip and knee arthroplasty

- Develop comprehensive plan to implement EBP guideline
- Develop comprehensive plan to monitor/measure EBP guidelines outcomes such as length of stay and opioid consumption
- Develop comprehensive plan on how to adjust EBP guideline if the outcomes (length of stay and opioid consumption) are less than desirable

Literature Review

The author used PubMed databases to evaluate the proposed PICOT question. PubMed consists of over 34 million citations of biomedical literature. These citations include MEDLINE, life science journals, and online books. PubMed offers articles with various levels of evidence such as meta-analysis, systematic review, randomized control studies, cohort studies, and clinical practice guidelines. To generate a more focused search, PubMed uses a Boolean Operating system. The Boolean Operator uses “AND,” “OR,” and “NOT,” allowing for a more streamlined search and eliminating irrelevant results.

When using PubMed, the author used the advanced search technique and selected “All Fields” in the query box for all searches. The first search in PubMed contained the terms “ERAS” and “opioids” with the operator “AND.” The initial search resulted in 224 articles with a broad range of topics. The author modified the terms to “perioperative” and “ERAS” with the operator “AND” to focus the search more on the perioperative period. The second search yielded 798 results with a broad range of surgeries related to the search terms. The author then modified search terms to “perioperative,” “ERAS,” and “total knee and hip replacement” with the operator “AND.” The third search resulted in 25 results.

The final literature search contained the terms “ERAS,” “opioids,” and “total knee or total hip” with the operator “AND.” The last search returned 13 articles. Exclusion criteria

included pediatrics, articles not in English, and articles not including total hip or total knee arthroplasty. One article was an educational review on what ERAS protocols are and will be excluded in this literature review as it does not evaluate the PICOT question. Another article studied the difference between two different drugs within an already developed ERAS protocol which did not relate to the proposed PICOT question. The exclusion criteria eliminated six articles from evaluation, leaving seven to be reviewed.

ERAS

Postoperative complications pose a threat to any type of surgical procedure, TKA/THA included. Total knee arthroplasty (TKA) and total hip arthroplasty (THA) are the two most common orthopedic surgeries, with over one million performed each year in the United States (Orland et al., 2020). Over the next couple of years, TKA/THA surgeries are expected to significantly increase in the United States (Singh et al., 2019). Increased length of stay in the hospital and excessive opioid consumption can contribute to postoperative complications. Within six months after surgery 9.5 percent of THA and 14.4 percent of TKA patients experienced a major complication and 34 percent of THA and 46.6 percent of TKA patients experienced a minor complication (Heo et al., 2020). These protocols have expanded to numerous other surgeries, including TKA/THA. A literature search was conducted to evaluate the proposed PICOT question. See Appendix A for literature synthesis.

The first article reviewed aimed to determine if there are any benefits in using a perioperative ERAS protocol. Alvis et al. (2020) conducted a quality improvement before and after cohort study. The Anesthesia Perioperative Care Service (APCS) quality improvement team developed an ERAS protocol for patients undergoing total knee and hip arthroplasty. The developed ERAS protocol was implemented at the Tennessee Valley Health System Nashville

VA Medical Center and evaluated 282 patients, 96 patients before and 186 after implementation (after adjusting potential confounding factors). The cohort study aimed to determine if the ERAS protocol affected length of stay, opioid consumption, hospital readmission, and costs.

The ERAS pathway is led by critical care anesthesiologists and includes a preoperative dose of acetaminophen, meloxicam, and gabapentin. Intraoperatively ropivacaine, epinephrine, and ketorolac are used for a periarticular block. Postoperatively intravenous (IV) hydromorphone or morphine are ordered to be given as needed for pain (Alvis et al., 2020). The ERAS protocol includes nausea/vomiting prophylaxis, temperature control, fluid management, discharge criteria, and follow-up (Alvis et al., 2020). Alvis et al. (2020) determined that using the ERAS pathway reduced length of stay and in-patient opioid use. After adjusting potential confounders such as sex, age, body mass index, and chronic opioid use within six months of surgery, Alvis et al. (2020) determined no correlation between the ERAS pathway and out-patient opioid consumption, chronic opioid use, cost, and readmission.

The second article reviewed was a cohort study of patients undergoing total knee arthroplasty (TKA). Following the implementation of the ERAS protocol, a retrospective review was performed on all patients who received a TKA from 2013 to 2018 at Veterans Affairs North Texas Health Care System (VANTHCS) in Dallas, Texas. The study by Collett et al. (2021) aimed to determine if implementing a multidisciplinary ERAS protocol affected the length of hospital stay and opioid consumption in patients receiving a TKA. VANTHCS's ERAS protocol consists of a spinal block performed before incision, preoperative acetaminophen, oral gabapentin, IV ondansetron, and oral oxycodone. Intraoperatively the patients received periarticular injections and minimal opioids. Postoperatively acetaminophen, gabapentin, and meloxicam were scheduled, oxycodone was scheduled as needed for pain, and dilaudid for

breakthrough pain. Physical therapy was scheduled 90 minutes after the conclusion of surgery for early mobilization. Collett et al. (2021) concluded that using the ERAS protocol reduced length of stay and perioperative opioid use. However, population selection bias could be a limitation due to the VHA's population being mostly older males compared to the general public.

The third study reviewed aimed to determine if adverse events were reduced when an ERAS protocol was used compared to the standard in-patient protocol while also determining the effect on opioid consumption, patient range of motion, patient satisfaction, and functional recovery. Hardy et al. (2022) conducted an ambidirectional single-subject cohort study on 48 patients who experienced both the standard in-patient protocol and ERAS out-patient protocol during their TKA/THA. The ERAS protocol was adapted from a previously published study by Vendittoli et al., Hardy et al. concluded that postoperative complications were decreased by 50 percent, postoperative opioid consumption was decreased, and patient satisfaction was improved for the ERAS protocol patients (Hardy et al., 2022). Patient's range of motion did not change. However, the small study size, the time between surgeries (around seven years), and patient information recall limit this study.

The fourth study reviewed aimed to determine the best ERAS practice recommendations for anesthetic management to improve patient outcomes, length of stay, and postoperative pain control in patients undergoing TKA/THA. Oseka and Pecka (2018) conducted an integrative review of articles published between 2006 and 2016. The selected articles were critically reviewed by Oseka and Pecka (2018) for validity, reliability, and rigor of the study. Oseka and Pecka (2018) recommend using acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDs) to decrease opioid requirements during the perioperative period. Gabipentinoids and corticosteroids are also recommended to facilitate a decrease in postoperative pain and decrease

the use of opioids. Intraoperatively peripheral nerve blocks or spinal anesthesia are recommended as an adjunct therapy to decrease opioid requirements and the level of anesthesia required to keep the patient comfortable. Limitations to the integrative review include non-specific drug dosage recommendations and low-strength evidence (Oseka & Pecka, 2018).

The fifth study reviewed aimed to assess the outcomes and possibility of same-day discharge when using an opioid-sparing ERAS protocol while also assessing its effects on postoperative complications, patient satisfaction, and opioid consumption. Van Horne and Van Horne (2019a) conducted a single-center retrospective chart review on 601 patients from 2015 through 2017 who underwent surgery for TKA/THA. The TKA/THA were all performed by one surgeon in a rural hospital. Van Horne and Van Horne (2019a) developed the ERAS pathway over ten years based on patient needs and outcomes.

Per the ERAS protocol, patients were asked to participate in education, physical therapy and to optimize themselves physically and medically prior to surgery. Each patient was assigned a “joint coach,” usually a family member, to encourage them throughout physical therapy and ensure the patient completed recommended therapies prior to the surgery date. A non-opioid pain regimen including acetaminophen, meloxicam, or celecoxib was initiated one week prior to surgery and continued six weeks after surgery, for DVT prophylaxis compression stockings were in place throughout the perioperative period. Intraoperatively multimodal analgesia and hypotensive technique were used to decrease trauma, pain, and blood loss, and periarticular blocks were performed (Van Horne & Van Horne, 2019a). Postoperatively physical therapy was ordered and started as soon as possible. Van Horne and Van Horne (2019a) concluded that the patient-optimizing, opioid-sparing ERAS pathway for TKA/THA patients led to decreased postoperative complications, increased patient satisfaction, decreased postoperative opioid

consumption, and decreased length of stay (most patients discharged the day of surgery).

Limitations to this study include uncontrolled confounding factors and retrospective study design.

The sixth study reviewed aimed to evaluate an ERAS protocol implemented for TKA/THA surgeries and determine the effect on postoperative complications, opioid consumption, and patient satisfaction. Van Horne and Van Horne (2019b) conducted a retrospective study including 220 patients who underwent surgery for TKA/THA at an ambulatory surgery center between 2015 and 2017. The ERAS pathway used for this study is the pathway used in the study by Van Horne and Van Horne (2019a). Van Horne and Van Horne (2019b) concluded that 100 percent of patients were discharged home the day of surgery, postoperative opioid consumption was decreased, and patient satisfaction was high. Limitations to this study include moderate study size and retrospective study design.

The seventh study reviewed aimed to make best practice recommendations based on evidence-based research. Wainwright et al. (2020) developed a consensus statement after evaluating meta-analyses, randomized control studies, and large prospective cohort studies about the use of ERAS protocols in TKA/THA patients. A group of experts, including surgeons, anesthesiologists, physicians, and physiotherapists, who specialize in TKA/THA patient populations, evaluated the articles. The studies were evaluated to summarize the literature and provide evidence-based recommendations for the perioperative care of patients undergoing TKA/THA. The ERAS Society guideline was used as a guide when developing the optimal protocol. The consensus statement evaluates 17 topic areas to be considered for ERAS pathways. Each topic area was rated based on the level of evidence, either “high quality,” “moderate quality,” “low quality,” or “very low quality.” Wainwright (2020) determined the best components to include in

the ERAS pathway include preoperative patient education, opioid-sparing multimodal technique, and early patient mobilization.

Exclusion Criteria/Limitations

ERAS protocols are multidisciplinary, requiring nurses, surgeons, anesthesiologists, physical therapists, and physicians to follow strict guidelines. Each discipline needs to adhere to the protocol for the best patient outcomes. The multidisciplinary approach can lead to limitations in the ERAS pathway's efficacy. According to Alvis et al. (2020), staff adherence to ERAS protocols decreases the longer the guidelines are implemented. This further decreases the efficacy of the ERAS protocol.

Other limitations include patient participation and patient response bias. Patients were expected to follow patient-optimizing pathways to prepare for surgery, including education, physical therapy, appointing a “joint coach,” and resolving/optimizing any pertinent comorbidities (Van Horne & Van Horne, 2019b; Van Horne & Van Horne, 2019a). Other studies required patients to give feedback regarding their experience with the ERAS protocol and report the number of opioids consumed after discharge from the hospital (Alvis et al., 2020; Collett et al., 2021; Hardy et al., 2022). Patient feedback on experience and opioid consumption can be biased.

Excluding exclusion criteria may lead to limitations or bias in a study. No exclusion criteria was considered for the use of ERAS protocols in TKA/THA patients in Van Horne and Van Horne's (2019a; 2019b) retrospective studies. Alvis et al. (2020) adjusted for confounding factors, but all other studies reviewed did not. Not removing confounding factors affects results being evaluated because there would be no way to differentiate results from ERAS protocol efficacy or confounding factors affecting results.

Summary of Findings

Based on the literature review, ERAS protocols for TKA/THA have many benefits. Using perioperative ERAS protocols decreases hospital length of stay (Alvis et al., 2020; Collett et al., 2021; Van Horne & Van Horne, 2019a; 2019b). According to Alvis et al. (2020), Collett et al. (2021), Hardy et al. (2022), Oseka and Pecka et al. (2018), and Van Horne and Van Horne et al. (2019a; 2019b), following ERAS protocols led to decreased opioid consumption after TKA/THA surgeries. ERAS protocols were also shown to decrease postoperative complications (Hardy et al., 2022; Van Horne & Van Horne, 2019a). ERAS protocols are advantageous because they decrease length of stay, opioid consumption and postoperative complications

Other studies showed even more benefits to ERAS protocols. After conducting an integrative review, Oseka and Pecka (2018) determined that following an ERAS protocol with specific anesthetic management leads to decreased length of stay, decreased narcotic consumption, decreased pain, and earlier return of mobility. Wainwright et al. (2020) determined the most important aspects of an ERAS protocol are patient education, opioid-sparing anesthetic, and early mobilization. Other important components of an ERAS protocol include preoperative patient education, administration of acetaminophen, COX-2 inhibitor/NSAID, and gabapentinoid preoperatively and scheduled postoperatively, intraoperative opioid-sparing anesthetic, and periarticular block or spinal anesthetic, and early mobilization postoperatively (Alvis et al., 2020; Collett et al., 2021; Oseka & Pecka, 2018; Van Horne & Van Horne, 2019a; 2019b; Wainwright, 2020). The components included in ERAS protocols determines the patient's postoperative success.

Development of EBP Guideline

After reviewing the literature, project managers developed an evidence-based practice (EBP) guideline based on ERAS protocols for patients undergoing THA/TKA, see Appendix B. The first component of the EBP guideline consists of thorough preoperative patient education and risk stratification. The surgical team can provide patient education during an inpatient visit or via a telephone call. The surgical team will provide information about enhanced recovery, fasting guidelines and carbohydrate (CHO) beverage information, incentive spirometer demo, and a prescription for emend and/or scopolamine patch if at high risk for postoperative nausea and vomiting (PONV). After the visit or phone call, the surgical staff will provide contact information for any questions. The surgery team will perform a history and physical before surgery to risk stratify and optimize the patient. If patients smoke or drink alcohol, they should cease four weeks before surgery. The patient should be optimized before surgery, this consists of correcting any labs, correcting anemia, improving nutrition, and prehabilitation.

The anesthetist will assess the patient during the preoperative period and confirm NPO status (no clear liquids two hours before surgery, no solid foods 8 hours before surgery). The anesthetist will confirm the scopolamine patch and administration of emend in high risk PONV patients. Medications to be administered in the preoperative period include acetaminophen, COX-2 inhibitor/NSAID, and a gabapentinoid unless contraindicated for the patient.

During the intraoperative period, the anesthetist will perform a spinal anesthetic or intraarticular block to assist with postoperative pain control. The anesthetic technique will be opioid-sparing and consist of a multimodal approach to pain management. A multimodal approach to prevent PONV is beneficial. Therefore, the anesthetist will administer more antiemetics during the operative period. The anesthetist will ensure that normothermia and

euvolemia are maintained throughout the perioperative period. To minimize pain in the postoperative period, acetaminophen, a COX-2 inhibitor/NSAID, and a gabapentinoid will be scheduled to be given at appropriate time intervals (based on each medication's redosing requirements). Early mobilization, use of an incentive spirometer, and early nutrition will be encouraged.

Project Model

The first step to implementing change in a healthcare system is determining the need for improvement and selecting the proper model to make a change. The Juran Trilogy Model focuses on the customer and the customer's needs. The Juran Trilogy (also known as Quality Trilogy) consists of three elements, Quality Planning, Quality Control, and Quality Improvement. The first step, Quality Planning, determines the customer and the needs of the customer and develops a service that addresses those needs (Finkelman, 2017). The second step, Quality Control, consists of ongoing inspection and metric tracking to determine the service's success (Juran, 2022). The third step, Quality Improvement, develops a process to produce the service and then optimizes that process (Finkelman, 2017). The project managers will use the Juran Trilogy Model as a framework to improve quality in patients undergoing total hip or knee arthroplasty.

Quality Planning

The customers are patients undergoing anesthesia for total hip or knee arthroplasty. The needs of the customer are reduced length of hospital stay and opioid consumption. The service provided is the implementation of the EBP guideline during the perioperative period.

Quality Control

Project managers will track the implemented EBP guideline through an electronic chart review. The tracked metrics will include hospital length of stay and dose and route of opioid

consumption (IV vs oral). To determine a frame of reference, project managers will electronically chart review all patients who underwent total hip and knee arthroplasty six months before implementing the EBP guideline. After implementing the EBP guideline, the same metrics will be tracked (length of stay and opioid consumption) for a sixth-month period.

Quality Improvement

Project managers will determine any issues in the implementation process to ensure continual improvement and work to discover the root cause. To discover the root cause a root cause analysis will be performed by the project managers using a six-step method. The six-step method includes defining the problem, collecting data about the problem, determining the potential causal factors, determining the root cause of the problem, prioritizing the causes, and determining a solution, recommendation, and implementation. The QI manager will determine any issues through a chart review tracking system. The QI manager will also track adherence to EBP guidelines through electronic charting. The QI manager will review chart documentation monthly to ensure the EBP guideline is followed appropriately. Once the root cause is determined, the QI manager works to optimize the process through adaptation and change.

Implementation

Project managers will implement the EBP guideline in an urban mid-western level one hospital. The implementation process consists of the project manager meeting with the OR director and chief CRNA to discuss the benefits of the EBP guideline for TKA/THA patients. The chief CRNA and OR director will be invited to share their opinions on the proposed EBP guidelines and determine how the guidelines would be adopted as the new process. The implementation process will be a collaboration between the project manager, chief CRNA and OR director. Once the OR director and chief CRNA approve the guidelines, the project manager

will plan meetings for all OR staff involved in the EBP guidelines. The OR staff includes preoperative and postoperative nurses, anesthesia staff, surgeons, residents, and physician assistants (PAs).

The preoperative nurses will be involved in following the preoperative guidelines outlined in the EBP guidelines. These steps include ensuring NPO status and administering the scheduled preoperative medications. Surgeons, nurse practitioners, and physician assistants will be involved in following the pre-procedure guidelines. This includes preoperative education such as fasting guidelines, enhanced recovery education, smoking and alcohol cessation and nutritional optimization. The anesthesia provider will be involved in following the pre-procedure, pre-operative, and intra-operative guidelines. This includes educating the patient about the EBP guideline, ensuring NPO status, using an opioid sparing anesthetic technique, maintaining normothermia and euvolemia and collaborating with the surgeon about a spinal anesthetic or intraarticular block. The postoperative nurse will be involved in following the postoperative guidelines. This includes administering scheduled postoperative medications, advocating for early mobilization, early nutrition and ensuring the patient is using their incentive spirometer.

Mandatory meetings will be held three times a week, from six in the morning to one in the afternoon, for one month. All necessary staff must attend at least one full information session. The meetings will supply EBP guidelines, tip sheets, coffee, and bagels for staff. The meetings will discuss each disciplinary role in the EBP guideline and answer any question regarding the implementation process and each providers role in the process. Project managers will initiate the EBP guidelines after one month of informational sessions. The QI manager will

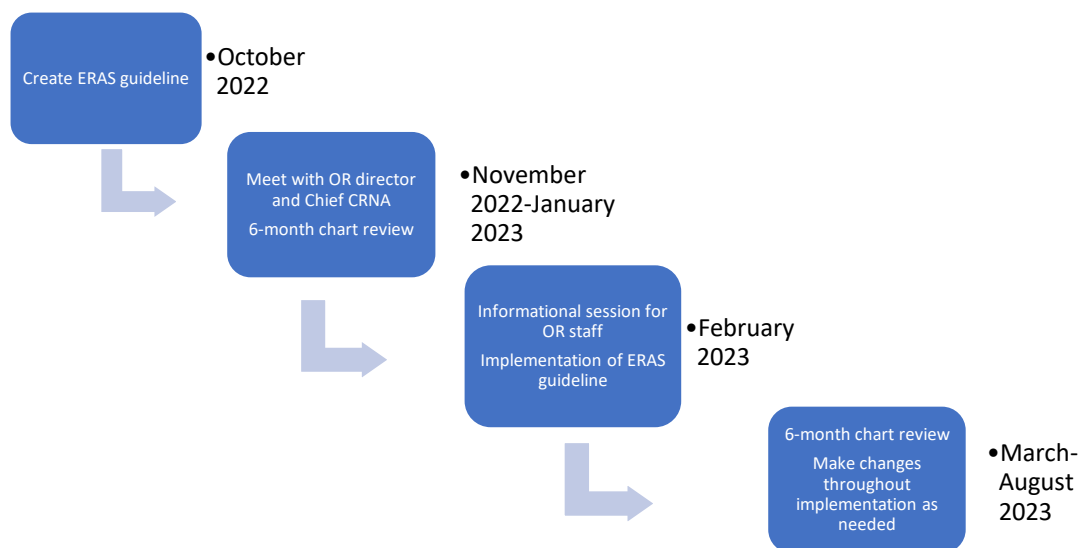
track the EBP guideline adherence through electronic documentation. The QI manager will assess guideline adherence monthly to ensure the guidelines are followed properly.

If any issues arise, additional meetings will be held with staff to determine how the process can be adapted and improved. The project managers will provide coffee and bagels for the staff during these meetings, re-educate the staff about the EBP guidelines, and encourage them to discuss their thoughts on the current EBP process. Staff feedback is vital in determining the most proficient implementation process that all staff will adhere to.

Outcome & Analysis

Project managers will collect data six months before implementing the TKA/THA EBP guideline via electronic chart review. The tracked metrics are length of stay and opioid consumption of TKA/THA patients. The data will determine how long opioids were consumed after surgery and when they were transitioned from intravenous (IV) to oral (PO), as well as, type of opioid, dose, and route. Project managers will collect data six months after implementing the EBP guideline. Data will be collected in an excel spreadsheet by the project manager. The project managers will evaluate the data using descriptive statistics through an excel spreadsheet that can perform inferential statistics to produce QI metrics. The data analysis will use a paired sample T-test to determine if the data is statistically significant. The analysis will determine whether the implementation of the EBP guideline was beneficial or not. One limitation to the success of the EBP guidelines is staff adherence to the guidelines. Missed steps in the EBP guideline will negatively impact the patient and their outcomes. This limitation will be monitored, by the QI manager, through electronic documentation of the EBP guideline. Project managers will hold meetings to discuss ways to improve the implementation process if any issues arise.

Timeline & Budget



The proposed timeline is pictured above. The estimated project cost includes chart reviews, informational sessions for staff, and the cost of paper for informational tip sheets. Chart reviews cost around \$750-\$1,000 per review and informational sessions cost around \$1,500-\$2,000 (Calnan, 2006). Paper costs around 2 cents per sheet of paper (Errera, 2019). The total number of chart reviews will depend on the number of TKA/THA in the sixth-month period. The estimated number of informational sessions is 12 before implementation. There is the potential for more meetings if any issues arise with implementing the EBP guideline resulting in additional costs.

Conclusion

ERAS protocols decrease postoperative complications, length of stay and opioid consumption. The EBP guidelines developed for this project are a combination of best practice recommendations from articles gathered during the literature review. The EBP guidelines are significant to anesthesia staff and help protect patient's safety throughout the perioperative period.

References

- AANA. (2018). *Code of ethics for the certified registered nurse anesthetist*. American Association of Nurse Anesthesiology. [https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/professional-practice-manual/code-of-ethics-for-the-crna.pdf?sfvrsn=d70049b1_8](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/professional-practice-manual/code-of-ethics-for-the-crna.pdf?sfvrsn=d70049b1_8)
- AANA. (2019). *Standards for nurse anesthesia practice*. American Association of Nurse Anesthesiology . [https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/professional-practice-manual/standards-for-nurse-anesthesia-practice.pdf?sfvrsn=e00049b1_20](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/professional-practice-manual/standards-for-nurse-anesthesia-practice.pdf?sfvrsn=e00049b1_20)
- Alvis, B. D., Amsler, R. G., Leisy, P. J., Feng, X., Shotwell, M. S., Pandharipande, P. P., Ajmal, M., McHugh, M., Walia, A., & Hughes, C. G. (2020). Effects of an anesthesia perioperative surgical home for total knee and hip arthroplasty at a veterans affairs hospital: A quality improvement before-and-after cohort study. *Canadian Journal of Anesthesia/Journal canadien d'anesthésie*, 68(3), 367–375. <https://doi.org/10.1007/s12630-020-01865-4>
- American Association of Nurse Anesthesiology. (2022). *Advocacy & Policy*. AANA. <https://www.aana.com/advocacy>
- Berardino, K., Carroll, A. H., Popovsky, D., Ricotti, R., Civiletti, M. D., Sherman, W. F., & Kaye, A. D. (2022). Opioid use consequences, governmental strategies, and alternative pain control techniques following total hip arthroplasties. *Orthopedic Reviews*, 14(4), 1–12. <https://doi.org/10.52965/001c.35318>
- Calnan, J. (2006). *Chart reviews are good medicine they can help assure that a practice is compliant and maximizing revenue*. HCN healthcare news.

<https://healthcarenews.com/chart-reviews-are-good-medicine-they-can-help-assure-that-a-practice-is-compliant-and-maximizing-revenue/#:~:text=What%20Does%20it%20Cost%3F,and%20individual%20training%20around%20%24750.>

Collett, G., Insley, A. P., Michaelis, S., Shaji, S., Feierstein, B., & Martell, J. R., Jr. (2021). Reduction of opioid use with enhanced recovery program for total knee arthroplasty. *Federal Practitioner*, 38(5), 212–219. <https://doi.org/10.12788/fp.0124>.

Davrieux, C., Palermo, M., Serra, E., Houghton, E., Acquafresca, P., Finger, C., & Giménez, M. (2019). Stages and factors of the “perioperative process”: Points in common with the aeronautical industry. *ABCD. Arquivos Brasileiros de Cirurgia Digestiva (São Paulo)*, 32(1), e1423. <https://doi.org/10.1590/0102-672020180001e1423>

Dencker, E. E., Bonde, A., Troelsen, A., Varadarajan, K. M., & Sillesen, M. (2021). Postoperative complications: An observational study of trends in the united states from 2012 to 2018. *BMC Surgery*, 21(1), 393. <https://doi.org/10.1186/s12893-021-01392-z>

Errera, R. (2019). *Printing costs: how to accurately calculate your printing cost per page*. Toner Buzz. <https://www.tonerbuzz.com/blog/printing-costs-how-to-accurately-calculate-your-printing-cost-per-page/#:~:text=A%20standard%20cost%20of%20printing,recycled%20printer%20paper%20is%20garbage.>

Feldheiser, A., Aziz, O., Baldini, G., Cox, B., Fearon, K., Feldman, L., Gan, T., Kennedy, R., Ljungqvist, O., Lobo, D., Miller, T., Radtke, F., Ruiz Garces, T., Schricker, T., Scott, M., Thacker, J., Ytrebø, L., & Carli, F. (2016). Enhanced Recovery After Surgery (ERAS) for

- gastrointestinal surgery, part 2: consensus statement for anaesthesia practice. *Acta Anaesthesiol Scand*, 60(3), 289–334. <https://doi.org/10.1111/aas.12651>
- Finkelman, A. (2017). *Quality improvement: A guide for integration in nursing*. Jones & Bartlett Learning.
- Gupta, R., & Gan, T. J. (2015). Peri-operative fluid management to enhance recovery. *Anaesthesia*, 71, 40–45. <https://doi.org/10.1111/anae.13309>
- Hardy, A., Courgeon, M., Pellei, K., Desmeules, F., Loubert, C., & Vendittoli, P.-A. (2022). Improved clinical outcomes of outpatient enhanced recovery hip and knee replacements in comparison to standard inpatient procedures: A study of patients who experienced both. *Orthopaedics & Traumatology: Surgery & Research*, 103236. <https://doi.org/10.1016/j.otsr.2022.103236>
- Heo, S., Harris, I., Naylor, J., & Lewin, A. M. (2020). Complications to 6 months following total hip or knee arthroplasty: Observations from an Australian clinical outcomes registry. *BMC Musculoskeletal Disorders*, 21(1). <https://doi.org/10.1186/s12891-020-03612-8>
- Heo, S. M., Harris, I., Naylor, J., & Lewin, A. (2020). Complications to 6 months following total hip or knee arthroplasty: observations from an Australian clinical outcomes registry. *BMC Musculoskeletal Disord*, 602(21). <https://doi.org/10.1186/s12891-020-03612-8>
- Juran. (2022). *The father of quality*. <https://www.juran.com/about-us/dr-jurans-history/>
- Kang, Y., Liu, J., Chen, H., Ding, W., Chen, J., Zhao, B., & Yin, X. (2019). Enhanced recovery after surgery (eras) in elective intertrochanteric fracture patients result in reduced length of hospital stay (los) without compromising functional outcome. *Journal of Orthopaedic Surgery and Research*, 14(1), 1–7. <https://doi.org/10.1186/s13018-019-1238-2>

- Moloney, R., Conley, R., Messner, D., Mitchell, K., Ganesan, N., & Tunis, S. (2014). *A multi-stakeholder agenda to advance enhanced recovery for U.S. surgical patients* [White Paper]. Center for Medical Technology Policy.
https://www.cmtpNet.org/docs/resources/Enhanced_Recovery_White_Paper_9_OCT_2014.pdf
- Moningi, S., Patki, A., Padhy, N., & Ramachandran, G. (2019). Enhanced recovery after surgery: An anesthesiologist's perspective. *J Anaesthesiol Clin Pharmacol.*, 35(Suppl1), S5–S13.
https://doi.org/10.4103/joacp.JOACP_238_16
- National Library of Medicine. (2022). *PubMed*. PubMed.gov. <https://pubmed.ncbi.nlm.nih.gov/>
- Newman, J., Douglas, K., Chappel, D., & Chapman, J. (2022). *Enhanced recovery at a glance intra operative*. American association of nurse anesthesiology.
[https://www.aana.com/docs/default-source/practice-aana-com-web-documents-\(all\)/enhanced-recovery-at-a-glance-intra-operative.pdf?sfvrsn=e978ae26_4](https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/enhanced-recovery-at-a-glance-intra-operative.pdf?sfvrsn=e978ae26_4)
- Noel, E., Miglionico, L., Leclercq, M., Jennart, H., Fils, J.-F., & Van Rompaey, N. (2020). Sufentanil sublingual tablet system versus oral oxycodone for management of postoperative pain in enhanced recovery after surgery pathway for total knee arthroplasty: A randomized controlled study. *Journal of Experimental Orthopaedics*, 7(1), 1–8. <https://doi.org/10.1186/s40634-020-00306-x>
- Orland, M. D., Lee, R. Y., Naami, E. E., Patetta, M. J., Hussain, A. K., & Gonzalez, M. H. (2020). Surgical duration implicated in major postoperative complications in total hip and total knee arthroplasty: A retrospective cohort study. *JAAOS: Global Research and Reviews*, 4(11), e20.00043. <https://doi.org/10.5435/jaaosglobal-d-20-00043>

Oseka, L., & Pecka, S. (2018). Anesthetic management in early recovery after surgery protocols for total knee and total hip arthroplasty. *AANA Journal*, 86(1), 32–38.

www.aana.com/aanajournalonline

Project Management Institute. (2022). *Thesis & Doctoral research grant guidelines*. Project management institute. <https://www.pmi.org/learning/academic-research/sponsored/research-submission-guideline>

Ren, L., Zhu, D., Wei, Y., Pan, X., Liang, L., Xu, J., Zhong, Y., Xue, Z., Jin, L., Zhan, S., Niu, W., Qin, X., Wu, Z., & Wu, Z. (2011). Enhanced recovery after surgery (eras) program attenuates stress and accelerates recovery in patients after radical resection for colorectal cancer: A prospective randomized controlled trial. *World Journal of Surgery*, 36(2), 407–414. <https://doi.org/10.1007/s00268-011-1348-4>

Singh, J. A., Yu, S., Chen, L., & Cleveland, J. D. (2019). Rates of total joint replacement in the united states: Future projections to 2020–2040 using the national inpatient sample. *The Journal of Rheumatology*, 46(9), 1134–1140. <https://doi.org/10.3899/jrheum.170990>

Stowers, M. J., Manuopangai, L., Hill, A. G., Gray, J. R., Coleman, B., & Munro, J. T. (2016). Enhanced recovery after surgery in elective hip and knee arthroplasty reduces length of hospital stay. *ANZ Journal of Surgery*, 86(6), 475–479. <https://doi.org/10.1111/ans.13538>

Taurchini, M., Del Naja, C., & Tancredi, A. (2018). Enhanced recovery after surgery: A patient centered process. *Journal of Visualized Surgery*, 4(40), 1–4.

<https://doi.org/10.21037/jovs.2018.01.20>

Tevis, S. E., & Kennedy, G. D. (2013). Postoperative complications and implications on patient-centered outcomes. *Journal of Surgical Research*, 181(1), 106–113.

<https://doi.org/10.1016/j.jss.2013.01.032>

UCLA Health. (2020). *Standardized protocols improve outcomes for patients across a broad spectrum of surgical procedures.*

<https://www.uclahealth.org/physiciansupdate/standardized-protocols-improve-outcomes-for-patients-across-a-broad-spectrum-of-surgical-procedures>

Van Horne, A., & Van Horne, J. (2019a). Patient-optimizing enhanced recovery pathways for total knee and hip arthroplasty in medicare patients: Implication for transition to ambulatory surgery centers. *Arthroplasty Today*, 5(4), 497–509.

<https://doi.org/10.1016/j.artd.2019.08.008>

Van Horne, A., & Van Horne, J. (2019b). Presurgical optimization and opioid-minimizing enhanced recovery pathway for ambulatory knee and hip arthroplasty: Postsurgical opioid use and clinical outcomes. *Arthroplasty Today*, 6(1), 71–76.

<https://doi.org/10.1016/j.artd.2019.08.010>

Vendittoli, P.-A., Pellei, K., Desmeules, F., Massé, V., Loubert, C., Lavigne, M., Fafard, J., & Fortier, L.-P. (2019). Enhanced recovery short-stay hip and knee joint replacement program improves patients outcomes while reducing hospital costs. *Orthopaedics & Traumatology: Surgery & Research*, 105(7), 1237–1243.

<https://doi.org/10.1016/j.otsr.2019.08.013>

Wainwright, T. W., Gill, M., McDonald, D. A., Middleton, R. G., Reed, M., Sahota, O., Yates, P., & Ljungqvist, O. (2020). Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced recovery after surgery (eras®) society recommendations. *Acta Orthopaedica*, 91(3), 363–363.

<https://doi.org/10.1080/17453674.2020.1724674>

Appendix A

Literature Synthesis

Articles	Aim	Method	Population	Results	Level of evidence	Limitations
Alvis et al. (2020)	determine if the implemented ERAS protocol affected length of stay, opioid consumption, hospital readmission and costs	Cohort study	Tennessee Valley Health System Nashville VA Medical Center and evaluated 282 patients, 96 patients before and 186 after implementation	Decreased LOS and inpatient opioid consumption; no correlation between the ERAS pathway and outpatient opioid consumption, chronic opioid use, cost and readmission	II	Only tracked VA admission and opioid prescription ordered and picked up from VA; multidisciplinary approach to ERAS protocol **adjusted for confounding factors
Collett et al. (2021)	determine if the implementation of a multidisciplinary ERAS protocol affected length of hospital stay and opioid consumption in patients receiving a TKA	Cohort study	patients who received a TKA from 2013 to 2018 at Veterans Affairs North Texas Health Care System (VANTHCS) in Dallas, Texas	reduced length of stay and perioperative opioid use	II	population selection bias could be a limitation due to the VHA's population being mostly older males compared to the general public, confounding factors
Hardy et al. (2022)	determine if adverse events were reduced when the	an ambidirectional single subject	48 patients who experienced both the standard in-	postoperative complications were decreased by 50 percent,	II	small study size, time between surgeries (around 7

	ERAS protocol was used compared to the standard in-patient protocol while also determining the effect on opioid consumption, patient range of motion, patient satisfaction, and functional recovery	cohort study	patient protocol and ERAS out-patient protocol for patients undergoing TKA/THA	postoperative opioid consumption was decreased, and patient satisfaction was improved for the ERAS protocol patients; no change in PROM		years), and patient information recall, confounding factors
Oseka & Pecka et al. (2018)	determine best ERAS practice recommendations for anesthetic management to improve patient outcomes, length of stay and postoperative pain control in patients undergoing TKA/THA	Integrative review	articles published between 2006 and 2016	improvements in pain, narcotic consumption, mobility, and hospital LOS are influenced by preoperative and perioperative anesthetic management strategies for patients undergoing TKA or THA procedures	V	non-specific drug dosage recommendations and low strength evidence. Systematic reviews and larger randomized control studies are needed
Van Horne & Van	assess the outcomes and possibility of same day discharge	Retrospective chart review	601 patients from 2015 through 2017 who underwent	decreased postoperative complications, increased patient satisfaction,	II	uncontrolled confounding factors and retrospective study design,

Horne et al. (2019a)	when using an opioid sparing ERAS protocol while also assessing effects on postoperative complications, patient satisfaction, and opioid consumption		surgery for TKA/THA	decreased postoperative opioid consumption and decreased length of stay (most patients discharged day of surgery)		patient participation
Van Horne & Van Horne et al. (2019a)	evaluate an ERAS protocol implemented for TKA/THA surgeries and determine the effect on postoperative complications, opioid consumption, and patient satisfaction	Retrospective chart review	220 patients who underwent surgery for TKA/THA at an ambulatory surgery center between 2015 and 2017	100 percent of patients were discharged home day of surgery, postoperative opioid consumption was decreased, and patient satisfaction was high	II	moderate study size and retrospective study design, patient participation, uncontrolled confounding factors
Wainwright et al. (2020)	summarize the literature and provide evidence-based recommendations for the perioperative care of	consensus statement	evaluating meta-analyses, randomized control studies, and large prospective cohort studies about the	best components to include in the ERAS pathway include preoperative patient education, opioid-sparing	V	Level of evidence

	patients undergoing TKA/THA		use of ERAS protocols in TKA/THA patients	multimodal technique, and early patient mobilization		
--	-----------------------------	--	---	--	--	--

LOS- length of stay

PROM- patient range of motion

ERAS- enhanced recovery after surgery

TKA/THA- total knee arthroplasty/total hip arthroplasty

Appendix B**EBP Guidelines for TKA/THA**

EBP Guidelines	
Pre-procedure	<ul style="list-style-type: none"> • Preoperative education <ul style="list-style-type: none"> ○ Enhanced recovery education ○ Fasting guidelines ○ Incentive spirometer demo ○ Contact information • Optimization/Risk stratification <ul style="list-style-type: none"> ○ Smoking cessation 4 weeks before surgery ○ Alcohol cessation 4 weeks before surgery ○ Labs and screening for anemia ○ Nutritional optimization ○ Prehabilitation
Pre-operative	<ul style="list-style-type: none"> • NPO status • Antiemetics <ul style="list-style-type: none"> ○ Emend ○ Scopolamine patch • Administration of acetaminophen, COX-2 inhibitor/NSAID, and gabapentinoid
Intra-operative	<ul style="list-style-type: none"> • Spinal anesthetic or intraarticular block • Opioid-sparing anesthetic technique

	<ul style="list-style-type: none">• Normothermia• Euvolemia
Post-operative	<ul style="list-style-type: none">• Scheduled acetaminophen, COX-2 inhibitor, and gabapentinoid• Early mobilization• Incentive spirometer• Early nutrition