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Recommending an ERAS Guideline for Patients Undergoing Total Joint Arthroplasty

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Final Scholarly Project: Recommending an ERAS Guideline for Patients Undergoing Total Joint Arthroplasty

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Abstract

Enhanced recovery after surgery (ERAS) is a comprehensive guideline that guides patients' care throughout their surgical journey. ERAS is intended to reduce the body's response to the many stressors of surgery. ERAS is proven effective in various specialty surgical areas, including orthopedics. Orthopedic surgery rates increase parallel with the patient population ages, indicating a need for more joint replacements. Implementing an ERAS guideline reduces healthcare costs to the patient and hospital facility by reducing the length of stay (LOS) and complications postoperatively. The investigation revealed a lack of consistent direction of care, and the developed approach for patients undergoing joint arthroplasty has led to the research and recommendation of an ERAS guideline. The primary goal of this scholarly project is to recommend an evidence-based ERAS guideline for patients undergoing total joint arthroplasty to decrease the LOS at the hospital facility of interest. This educational project utilizes the Edward Deming Plan-Do-Study-Act (PDSA) cycle model, commonly called the Deming Cycle. The team then identified a focal point of the ERAS guideline to assess the effectiveness of the recommended guideline. The recommended ERAS guideline emphasizes patients receiving regional anesthesia before their total joint arthroplasty for its benefits of decreasing surgical stress on the body. It is a multimodal analgesic technique reducing opioid requirements and decreases postoperative pain to allow early ambulation. This project can be seen as a significant cost-saving guideline for the hospital and the patients. The outcomes from this scholarly project can be vital to recommending an ERAS guideline to other surgical specialty areas.

Keywords: enhanced recovery after surgery (eras), eras guideline, length of stay, eras outcomes, total hip arthroplasty, total knee arthroplasty, total joint arthroplasty

Recommending an ERAS Guideline for Patients Undergoing Total Joint Arthroplasty

Introduction

Background

The idea and utilization of ERAS have been around for quite some time. Henrik Kehlet, in the late twentieth century, first theorized the concept of enhanced recovery after surgery (ERAS) (Kaye et al., 2019). Based on his idea of ERAS, the goal was to facilitate a decrease in bodily strain postoperatively, which would prevent end-organ damage and reduce costs and, overall, less recovery time (Kaye et al., 2019). Colorectal surgeries were the first to implement ERAS (Kaye et al., 2019). Upon completing his studies, he identified a correlation between appropriate pain control and fewer adverse effects (Carli, 2014). Kaye et al. (2019) noted early ambulation occurred from the effective postoperative pain reduction, which led to fewer incidents of emesis and bowel obstruction in elderly patients; therefore, a belief emerged that early intervention could reduce risks in colonic surgery patients.

Surgical procedures are a daily occurrence day. Globally, over 300 million surgical procedures are performed yearly (Ripollés-Melchor et al., 2020). Of the orthopedic practices in the United States each year, total hip and knee replacements account for nearly a million, with estimated projections continuing to increase due to the aging population (Ripollés-Melchor et al., 2020). Total joint arthroplasties have risen considerably in the last two decades, and roughly 4 million Americans live with a total knee arthroplasty (Kaye et al., 2019). Schreurs & Hannink (2017) reveal that by 2030, the most significant jump in early TKAs and THAs will happen in the patient population between ages 45 and 55. The primary goals of ERAS implementation are to reduce the length of hospitalization and decrease morbidity and mortality rates and overall costs (Ripollés-Melchor et al., 2020).

While utilized in multiple healthcare specialties, incorporating ERAS in orthopedics has a bright future (Wainwright et al., 2019). Although incorporated, a lack of consistent use of an ERAS guideline continues to be a disservice to the orthopedic specialty (Tanious et al., 2017). The evidence suggests a reduction in length of stay when utilizing an ERAS guideline in patients undergoing total hip or knee arthroplasty (Ripollés-Melchor et al., 2020). Kaye et al. (2019) report that using ERAS reduces the average length of stay from 4-12 days to 1-3 days. Kaye et al. (2019) also note that readmission rates do not increase from ERAS use. Although the results of ERAS guideline use are favorable, surgeon acceptance and compliance with ERAS use remain low (Ripollés-Melchor et al., 2020). ERAS has an opportunity to be instrumental in the future success of orthopedic surgeries and healthcare with an aging population requiring more joint arthroplasties.

The positive effects of implementing an ERAS guideline not only benefit the patient but favors the overall hospital system as well (Tippireddy & Ghatol, 2021). Surgeons benefit through earlier discharged home dates and fewer readmissions. Hospitals see a quicker patient turnover in LOS; therefore, more patients can be seen, a less bottlenecked system, and a decreased overall cost per patient undergoing arthroplasties. To better serve the patients in our communities, utilizing the most up-to-date research studies for practicing efficient and effective healthcare suggests using an ERAS guideline.

The success of the ERAS guideline places great significance on the skills of the shareholders implementing it (Tippireddy & Ghatol, 2021). The most notable shareholders identified in ERAS guidelines are the perioperative personnel, mainly the anesthesia team, nurses, and the surgical team (Tippireddy & Ghatol, 2021). To lead a seamless pathway transition, the shareholders must fully understand their roles and responsibilities within an ERAS

guideline (Tippireddy & Ghatol, 2021). Achieving all the benefits of ERAS requires effective teamwork and communication among the care team in the separate perioperative phases (Tippireddy & Ghatol, 2021).

Problem

For ERAS to be effective, there needs to be overwhelming support for it. The anesthesia team must lead in providing regional anesthesia to block pain, decrease surgical stress, limit narcotic use, therefore less chance of nausea and vomiting, etc. Unfortunately, there are several central issues regarding ERAS guidelines, like lack of consistent use, surgeon unfamiliarity, or low administration support (Melnyk et al., 2011). With an ever-increasing number of orthopedic surgeries in the coming years, it is essential as healthcare providers to implement guidelines, such as ERAS, to deliver high-quality care. The ERAS guidelines have known benefits and should be implemented in surgical populations that lack utilization or compliance. The benefits of implementing an ERAS guideline or pathway for orthopedic patients are severely undervalued. ERAS guidelines display very few limitations. The goal between healthcare systems and providers is to provide the most updated and efficient practice for our patients while driving down the cost of healthcare for patients undergoing total joint arthroplasty. An ERAS guideline can solve this. The data reflects the importance of ERAS guidelines in reducing the length of stay, decreasing costs, and improving recovery while limiting morbidity (Soffin & YaDeau, 2016).

The ERAS protocol can be implemented for all patients but is surgeon dependent; therefore, it is not always followed. An ERAS guideline is a comprehensive, multifaceted plan based on research that follows patients through surgery's perioperative phases (Tippireddy & Ghatol, 2021). In the steps that make up an ERAS pathway, all patients receive specific but

uniform interventions based on each stage of their surgery. Not everyone uses it, but if they do, it will reduce costs by reducing patient LOS.

Anesthesia is critical to ERAS guideline implementation (Tippireddy & Ghatol, 2021). Depending on the details of the ERAS guideline, the anesthesia team has a great deal of responsibility to continue implementing each phase of the guideline, particularly utilizing trained skills in regional anesthesia as an opioid-sparing technique. Even though research data supports the effectiveness of ERAS, a deficiency in direction and provider use remains an obstacle even for the anesthesia team (Tanious et al., 2017).

Significance to the Profession

The anesthesia team plays one of the most significant roles in the ERAS pathway implementation (Tippireddy & Ghatol, 2021). They do the critical decision-making in the perioperative phases that can have lasting effects on the patient's headway in the recovery process (Tippireddy & Ghatol, 2021). Crucial to the patient's success is preoperative optimization for their current medical conditions; the anesthesia team manages acute and chronic illnesses while the patient's body goes through the intense stress of surgery (Tippireddy & Ghatol, 2021). The anesthesia team delivers a high degree of patient appeasement, skillfully transitioning them through all three perioperative phases (Tippireddy & Ghatol, 2021). During these phases, the anesthesia team will perform numerous interventions such as multimodal opioid and non-opioid analgesics like neuraxial and regional techniques (Tippireddy & Ghatol, 2021). They are also relied on to conduct other tasks that reduce postoperative nausea and vomiting (PONV), infection, maintain fluid balance status, airway management, and mechanical ventilation (Tippireddy & Ghatol, 2021). These tasks are achieved with opioid-sparing techniques that sufficiently manage pain, administer short-acting medications, minimize volatile

anesthetic gases, and implement antiemetic strategies such as total intravenous anesthesia (TIVA) (Tippireddy & Ghatol, 2021). When the anesthesia team can utilize ERAS protocols, improved patients' surgical experience coincides.

Project Objectives

This Doctor of Nursing Practice Project aims to clarify the use and recommendation guidelines for an ERAS guideline for patients undergoing total joint arthroplasty. Within this scholarly project, the objectives hope to deliver positive results for future hospital implementation. Among the shareholders identified in this project, the anesthesia personnel, primarily Certified Registered Nurse Anesthetists (CRNAs), are essential to the project objectives. The proposed goals for quality improvement are based on the Plan-Do-Study-Act (PDSA) model framework (Moran et al., 2020) designed to steer this project to completion. To achieve the point of this project, the following objectives have been constructed:

Objectives

1) Recommend evidence-based practice (EBP) ERAS guideline
2) Develop a comprehensive plan on how to monitor and measure said guideline
3) Identify and develop a comprehensive alternative plan to adjust the recommendation if ERAS outcomes are less than desirable
4) To identify if implementing an ERAS guideline for patients improves their recovery outcomes, LOS
5) To determine if the implementation of an ERAS guideline has efficient, cost-saving benefits
6) To assess whether patients report increased satisfaction with the implemented ERAS guideline

Review of the Literature

PICO Question

For this Doctor of Nursing Practice (DNP) project, the created PICO question is Among surgical patients undergoing total joint arthroplasty (TJA) (P), does implementing an ERAS guideline (I), compared to no ERAS guideline (C), affect the length of stay (O)?

Literature Search Strategy

In the literature search on enhanced recovery after surgery (ERAS), the following terms used in the database search included enhanced recovery after surgery (ERAS), ERAS guideline, length of stay, outcomes, fast track, total hip arthroplasty, total knee arthroplasty, total joint arthroplasty, and total joint replacement. The key terms have the project focus and the constructed PICO question in mind. In the beginning, the literature search considered numerous databases. The databases ultimately used in the literature search were Cochran, CINAHL (EBSCO), Medline, ProQuest, and PubMed. In conjunction with the search keywords and phrases, the Boolean operators "and" and "or" were included to scrutinize further and narrow down the search data. The searches resulted in several systematic reviews, meta-analyses, retrospective studies, prospective cohort studies, and an umbrella review. The inclusion criteria for the inquiries included a date range from 2016-2022 to factor in the change in the year when the project research began. Also included were articles peer-reviewed, in full text, and written in English. A few articles were discovered in the references from other related articles. Factors that excluded articles were articles outside the six-year window, articles not written in English, and articles not about ERAS or total joint arthroplasty.

Synthesis of the Literature

ERAS Guideline for Reducing Hospital Length of Stay

Agarwala et al. (2020) conducted a retrospective analysis that found a decreased length of stay by incorporating an ERAS pathway in patients undergoing TKA. The authors in the study not only measured the average length of stay (ALOS) but also monitored visual analogue score (VAS) for pain at rest and with movement, transfusions of blood products, milestones, complications occurring postoperatively, and functional scores at one year (Agarwala et al., 2020). This study's average length of stay was 3.98 days, respectively (Agarwala et al., 2020). Agarwala et al. (2020) further divided the study participants based on whether they had unilateral (UTKA) or bilateral (BTKA). For UTKA patients, their LOS was 3.17 days with a complication rate of 1.55%, and for BTKA patients, their LOS was 4.78 days with a 6.05%, respectively (Agarwala et al., 2020). The authors also noted that in 3, 6, and 12-month segments, UTKA and BTKA patients had notable advances in Oxford Knee Score (OKS) and WOMAC scores (Agarwala et al., 2020). The OKS is a quick, reproducible, and reliable list of 12 questions completed by the patient on activities of daily living (ADLs) focusing on pain and function after total knee replacement (TKR) (Dawson & Fitzpatrick, 2016). The WOMAC, or Western Ontario and McMaster Universities Osteoarthritis Index, is a standalone or comprised of another assessment scale, self-reported by the patient focusing on pain and function with ADLs for a patient with pain from arthritic knees and hips (Riddle & Perera, 2020). This study contained a sample size of 775 patients, 392 for UTKA and 383 for BTKA (Agarwala et al., 2020). The emphasis is on the measured outcomes from a tertiary care center (Agarwala et al., 2020). Agarwala et al. (2020) noted that their study had limitations in that there was no comparative group, but it was not doable then. In hindsight, a randomized control trial (RCT) with ERAS and

non-ERAS groups would significantly improve the study's strength (Agarwala et al., 2020). Based on levels of evidence from Melnyk and Fineout-Overholt (2019), this study provides a moderate level of evidence as a level III study.

Deng et al. (2018) performed a systematic review and meta-analysis evaluating the effectiveness of ERAS implementation in joint surgeries. The joint surgeries at focus include THA and TKA. The study conducted by Deng et al. (2018) had 16,699 patients over 25 individual studies. Compared to traditional methods, ERAS showed greater significance in patients undergoing joint surgeries (Deng et al., 2018). The study focused on several factors, including LOS, postoperative mortality rate, transfusions, postoperative range of motion (ROM), and 30-day readmission postoperative complications (Deng et al., 2018). ERAS showed the LOS (mean difference (MD) −2.03, 95% CI −2.64 to −1.42) and additionally included rate of mortality (relative risk (RR) 0.48, 95% CI 0.27 to 0.85), rate of transfusions (RR 0.43, 95% CI 0.37 to 0.51), complications (RR 0.74, 95% CI 0.62 to 0.87) (Deng et al., 2018). The study by Deng et al. (2018) also reports no reduction in ROM or increased 30-day readmissions, which favors using ERAS; implementing this guideline doesn't negatively affect the patients. The authors mentioned a few study limitations that include. One was due to an implicit performance bias based on the RCTs lacking an explanation of using a double-blind manner to assess biases. Another referring to the word "randomization" was used loosely without an official description of its use. The last, a pooled analysis could not be utilized for the data on LOS, 30-readmission, and ROM (Deng et al., 2018).

Heymans et al. (2022) conducted a systematic review and meta-analysis reinforcing the safety and efficacy facts of enhanced recovery pathways (ERPs) compared to non-ERPs for patients undergoing THA or TKA. Heymans et al. (2022) systematic review of the data included

40 studies: 34 in meta-analysis and 40 in qualitative analysis. The authors also noted that of the 40 studies, five were RCTs, and 35 were observational (Heymans et al., 2022). More than 2 million individuals were included in the study, either having a THA or TKA, of which 66% were females with a mean age of 66. ERPs resulted in decreased LOS [average days being 6.5 (0.3-9.5)], readmission rates with a [relative risk (RR) 0.8, 95% confidence interval (CI) 0.7-1]: lower severe adverse events (RR: 0.9, 95% CI: 0.8-1) and better patient-reported outcome (PROMs) and patient functional restoration (Heymans et al., 2022). Based on the analysis, readmission rates were vastly different, supporting the TKA patients in the ERP (P = 0.01) (Heymans et al., 2022). Lastly, the authors of this study also pointed out the cost-effectiveness of the ERP across the many studies reviewed; the savings ranged anywhere from $109 to $20573 (Heymans et al., 2022). A strength of the study was due to the overall retrieval design and the massive population size (Heymans et al., 2022). There was one reported conflict of interest where an author was a paid consultant (Heymans et al., 2022). A few other weaknesses of the study included high heterogeneity and the lack of description for ERP and common pathways, which made the comparison more difficult (Heymans et al., 2022).

Ripollés-Melchor et al. (2020) conducted a significant cohort study that focused on patient management for patients undergoing THA and TKA in ERAS versus non-ERAS guidelines. The study included 6,146 subjects from 131 hospitals (Ripollés-Melchor et al., 2020). Of the 6,146 subjects, (3580 were females [58.2%], with a median age of 71 years [interquartile range (IQR), 63-76] years) (Ripollés-Melchor et al., 2020). Only 680 individuals presented with postoperative complications like deep vein thrombosis, pulmonary embolism, infection, acute kidney injury, and pneumonia, to name a few (Ripollés-Melchor et al., 2020). Ripollés-Melchor et al. (2020) mentioned that between ERAS and non-ERAS groups, the postoperative

complications (163 [10.2%] vs. 517 [11.4%]; odds ratio [OR], 0.89; 95% CI, 0.74-1.07; P = .22) were not statistically different. Ripollés-Melchor et al. (2020) also stated that with severe issues, fewer were witnessed in the ERAS group patients (73[4.6%] vs. 279 [6.1%]; OR, 0.74; 95% CI 0.56-.96; P = .02). The study results suggested that although ERAS compliance is lower at an overall 50% (IQR, 43.8%-62.5%) adherence rate, adherence was greatest at 68.8% in the ERAS facilities versus 50% (IQR, 37.5%-56.2%) in non-ERAS facilities (P < .001) (Ripollés-Melchor et al., 2020). Ripollés-Melchor et al. (2020) also reported that those with the highest quartiles of adherence showed to have fewer complications in general (144 [10.6%] vs. 270 [13.0%]; OR, 0.80; 95% CI, 0.64-0.99; P < .001) and moderate to most significant postoperative complications (59 [4.4%] vs. 143 [6.9%]; OR, 0.62; 95% CI, 0.45-0.84; P < .001) as well as a shorter median length of hospital stay (4 [IQR, 3-5] vs. 5 [IQR, 4-6] days; OR, 0.97; 95% CI, 0.96-0.99; P < .001). The analysis from this study truly signifies the importance of facilities incorporating an ERAS guideline for orthopedic patients, as well as the correlation between guideline adherence and the many outcomes like LOS and complications (Ripollés-Melchor et al., 2020). The article mentioned resistance to change, financing issues, decreased support by the administration, high staff turnover, poor documentation, and lack of time as reasons for the lack of adherence (Ripollés-Melchor et al., 2020).

The strengths of this study include many facilities and no biases in the selection process (Ripollés-Melchor et al., 2020). This study's sole intention showed a case report that differentiated between ERAS and non-ERAS facilities and analyzed the variables included in the ERAS guideline (Ripollés-Melchor et al., 2020). A few noted limitations in the study: the study was solely observational, early mobilization as an exposure factor or an outcome based upon some patients having complications cannot mobilize, and the incorporate items in the ERAS

guideline based on expert advice (Ripollés-Melchor et al., 2020). Compared to non-ERPs, ERPs delivered excellent statistical value (Heymans et al., 2022).

Vendittoli et al. (2019) produced a small study incorporating a prospective and retrospective cohort study assessing LOS, pain level, complications, satisfaction, and clinical scores, to name a few. They also evaluated and compared the healthcare cost of the two groups (Vendittoli et al., 2019). This study compared a constructed THA and TKA ERAS short-stay guideline and a standard procedure control group (Vendittoli et al., 2019). The ERAS short-stay group had 114 and 150 in the control group (Vendittoli et al., 2019). The control group had a mean age slightly younger than the ERAS group (54 vs. 58, $p = 0.002$) (Vendittoli et al., 2019). The control group had 68 male and 82 female patients, while the ERAS group had 59 male and 55 female patients (Vendittoli et al., 2019). The study's findings reported when compared to the standard group, the ERAS short-stay group for THA patients decreased length of stay by 2.8 days (0.1 vs. 2.9 days, $p < 0.001$) and 3.9 days for TKA patients (1.0 vs. 4.9 days, $p < 0.001$) (Vendittoli et al., 2019). The findings also reflected the implemented short-stay ERAS guideline had a more significant reduction in Grade 1 and 2 complications based on the Clavien-Dindo Classification than for patients in the standard group (mean 0.8, vs. 3.0, $p < 0.001$) (Vendittoli et al., 2019). According to Vendittoli et al. (2019), in the Clavien-Dindo Classification, a Grade 1 complication is a minor issue with no intervention, and a Grade 2 complication needs treatment through medications.

Vendittoli et al. (2019) divulged a few limitations in their study. The noted limitations included potential selection bias based on historical comparisons in a cohort study. They also noted complications' frequency, intensity, and duration were never recorded (Vendittoli et al., 2019).

Zhang et al. (2020) conducted an umbrella study analyzing current meta-analyses and systematic reviews that assessed various clinical outcomes from an ERAS guideline on numerous surgery types, including orthopedic, liver, colorectal, gastric, and bariatric. The study employed a double-extraction method to identify and accept reviewed data for analysis (Zhang et al., 2020). The umbrella study by Zhang et al. (2020) incorporated 23 meta-analyses for their research after searching nearly 600 articles. The 23 meta-analyses measured the length of stay, morbidity and mortality, reoperation, and secondary outcomes (Zhang et al., 2020). The umbrella study suggested that ERAS guidelines overall drastically reduced length of stay (MD: –2.349; –2.740 to –1.958), hospital cost (MD: –639.06; –933.85 to –344.28), and morbidity (RR: 0.620; 0.545 to 0.704) without affecting mortality and readmission rates (Zhang et al., 2020). With a further in-depth breakdown by Zhang et al. (2020), the effects of ERAS guidelines on orthopedic surgery reflect lessened mortality and morbidity by 60% and 30% (RR: 0.40, 0.23 to 0.67; 0.70, 0.64 to 0.78) including LOS of 2.03 (–2.64 to –1.42) days. Zhang et al. (2020) point out that ERAS was effective for all surgery patients, decreasing LOS and cutting hospital costs. The authors also noted that orthopedic surgeries benefited the most, including THA and TKA surgeries (Zhang et al., 2020). Decreasing costs and hospital stay is a benefit to all patients.

The last notable study, a systematic review and meta-analysis conducted by Zhu et al. (2017) assessed ERAS guidelines' postoperative impact on patients who underwent THA and TKA. The study included only RCTs and clinical control trials (CCTs) (Zhu et al., 2017). Ten published studies were accepted, accounting for 9,936 cases (Zhu et al., 2017). The authors subdivided the 9,936 cases into ones receiving ERAS guidelines which included 4,205 and traditional (non-ERAS) recovery totaling 5,731 cases (Zhu et al., 2017). This meta-analysis proved that by implementing ERAS, there was a LOS reduction ($p < 0.01$) and fewer

complications (p=0.03) without affecting 30-day readmission rates compared to the non-ERAS group (p=0.18) (Zhu et al., 2017). One study by Zhu et al. (2017) reported that ERAS significantly shortened LOS between the ERAS and control groups (SMD=−0.85, 95% CI=−1.24 to −0.45, p=0.01). The reported incidence of complications by ERAS vs. non-ERAS was (OR=0.77, 95% CI 0.61 to 0.98; p=0.03) (Zhu et al., 2017). Last, Zhu et al. (2017) reported a lack of difference between the two groups in their 30-day readmissions (OR=0.84, 95% CI 0.65 to 1.08, p=0.18). While not as large a study as some, Zhu et al. (2017) delivered much information supporting ERAS guidelines' significance in THA and TKA patients. The authors noted limitations for language restrictions that only allowed for English articles so that bias might exist. They also pointed out that the number of high-quality studies might have been too small, potentially resulting in study result biases (Zhu et al., 2017). The authors made no mention of funding or conflict of interest issues.

The seven studies scrutinized above delivered a monumental amount of supporting data for recommending the immediate use of ERAS guidelines in the total joint arthroplasty patient. The supporting data strongly implies that implementing an ERAS guideline is cost-effective, complication-limiting, and ultimately decreases the patient's hospital stay. The implementation process and complete ERAS guidelines are supported by anesthesia, and compliance is required for favorable patient outcomes.

Quality Improvement Project

Plan-Do-Study-Act (PDSA) Cycle

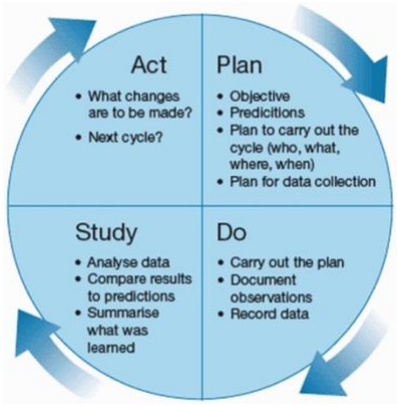
The quality improvement framework for this project is the Plan-Do-Study-Act (PDSA) (Moran et al., 2020). Over the years, PDSA model use has been extensively recognized and incorporated in projects revolving around evidence-based practice (EBP) and quality

improvement (QI) models (Moran et al., 2020). The PDSA cycle model consists of four rapid, continuous improvement stages until an ideal method is discovered (Moran et al., 2020). The four-stage model will be integrated into the DNP Project to assist with the creation of an evaluation tool based on EBP data. The PDSA model fits the requirements of this project as it allows for small-scale implementation and testing (Moran et al., 2020). The PDSA model allows for constantly trialing new proposals based on a singular theme (Moran et al., 2020). Moran et al. (2020) suggest having more opportunities for testing on a modest level; therefore, the more chances a proposal can be applied with even greater success when finally trialed on a broader level. Listed below is an outline of the four-stage cycle model:

1. **P**LAN: Plan the redesign and review.
2. **D**O: Trial the redesign in a minor fashion.
3. **S**TUDY: Examine the information and discover the findings.
4. **A**CT: Alter the redesign from the discovered findings and repeat the trial.

Figure 1

Plan-Do-Study-Act Cycle



Note. This figure explains and demonstrates the four stages of the PDSA cycle, including the model's continuous, cyclical nature (Crowfoot & Prasad, 2017, Figure 1).

PDSA Cycle: PLAN

"Plan," the initial stage in the PDSA cycle model, suggests creating a theory, identifying a goal or intention, or defining improvement metrics (The W. Edward Deming Institute, n.d.). Laying the groundwork begins in this stage. Deciding on a location of interest to base this theoretical FSP project takes place. An explanation of the study site and the reason for the study will be provided. Also, the EBP results will be revealed to support the plan in this stage. The supporting cast, who will assist throughout the study, is shown. Any predictions can be made about what will happen and why in this study.

PDSA Cycle: DO

"Do," the second stage of the PDSA cycle, requires the developed elements of the plan to be implemented (The W. Edward Deming Institute, n.d.). The crucial part of this stage is observing the implemented features and what reactions occur (Agency for Healthcare Research and Quality [AHRQ], 2015). Any unexpected problems or observations will be documented and promptly followed up in this stage. Data analysis can begin at the commencement of this stage, which will transition us into the “study” stage.

PDSA Cycle: STUDY

The trial results are reviewed in the "study" stage once the implementation phase has concluded (AHRQ, 2015). A complete analysis will be utilized during this stage. The data will then be compared to our predictions and the data gathered from the literature search and synthesis. Then, a reflection will summarize what was learned from the study results.

PDSA Cycle: ACT

In the final stage of the PDSA Cycle, the "Act" stage closes and completes the continuous cycle (The W. Edward Deming Institute, n.d.). In this stage, the knowledge and information

gained throughout the process allow one to modify goals, methods, or ideas (The W. Edward Deming Institute, n.d.). The PDSA cycle is designed to be repeated as often as necessary for research and development purposes (The W. Edward Deming Institute, n.d.). This model's cyclical and continuous nature makes it practical to implement for all.

Methods

Project Design

The sole intent of this DNP Final Scholarly Project is to recommend an ERAS guideline for patients undergoing total joint arthroplasty. According to Maruzek-Melnyk & Fineout-Overholt (2019), this project utilizes quality improvement and describes QI as a commonly used methodology that frequently uses the PDSA model. Maruzek-Melnyk and Fineout-Overholt (2019) also note that if a healthcare problem is discovered, the PDSA model continually guides system practices and enhances results. The PDSA, as outlined previously, provides a structure for carrying out the following methods from planning through the action stages. The initial section is the planning stage of the PDSA model, where the design for the intended recommendation of an ERAS guideline occurs. This section encompasses the following: the focused population and clinical background, project model plan, interventions, stakeholders, timeline with a proposed budget, and barriers.

The Population of Focus and Clinical Background

This FSP occurs in a large, level-1 trauma hospital in the heart of a major midwestern metropolitan city. This large trauma center supports a significantly sized orthopedic surgery center. The surgery center performs several thousand orthopedic surgeries yearly, including total joint arthroplasties. According to Lang et al. (2020), the single highest cost of medical utilization is just for a hospital stay alone, which costs $11,700. The results from implementing an ERAS

guideline for orthopedic procedures have been shown to decrease hospital length of stay (Agarwala et al., 2020; Deng et al., 2018; Heymans et al., 2022; Ripollés-Melchor et al., 2020; Vendittoli et al., 2019; Zhang et al., 2020; Zhu et al., 2017). The project focus and target population are designed to be broad since this is an initial focus area project. The involved patient populations are adults aged 18-90 with varying ethnic backgrounds undergoing total joint arthroplasty. The population for these types of procedures is increasingly occurring at younger ages. Future scholarly projects can decide to narrow down age ranges and identify a specific ethnic group of focus.

Key Personnel and Stakeholders

For this QI project, key personnel and stakeholders include the anesthesia department, pharmacy, perioperative nursing staff, quality improvement leadership, billing and finance, and the project team members. The project team leader served as the project's Principal Investigator (PI) and assisted the rest of the project team, the DNP student Associate Investigator (AI), in every part of the scholarly QI project. The stakeholders are crucial figures in the implementation of the ERAS guideline.

Implementing a QI project of this nature can significantly impact the stakeholders at the hospital facility partaking in the project. The patients will ultimately see the most benefit from the success of this QI project through a decreased hospital length of stay secondary to fewer adverse events, improved postoperative pain, and lower costs. The hospital facility undertaking the QI project can also benefit from reduced costs per patient receiving care by effectively increasing patient turnover. As a result of this QI project's success, an ERAS guideline can be confidently recommended in other specialty areas where no guideline exists.

Project Plan

This project recommends that executive leadership at the hospital focus on an ERAS guideline for patients undergoing total joint arthroplasty. This DNP FSP is a QI project seeking to assess the current state of total joint arthroplasty length of stay at the hospital of focus. The literature data is to provide support as a solid background and then create a plan for implementation and evaluation. The project team members will meet weekly with the project team leader to provide project progress, updates, and concerns.

This project will only need the University Institutional Review Board (IRB) approval, not the hospital facility (IRB). The intent of this project is for learning purposes, completing the DNP degree requirements, and it is all theoretical. In pursuing future scholarly consideration for facility implementation, the facility IRB must be included and approached for their approval.

Implementation

PDSA Cycle: PLAN

Following the QI project introduction of PDSA, the "Plan" stage of the QI project led by the project team began after reports from stakeholders that patients undergoing total joint arthroplasties had a prolonged stay at a local midwestern, inner-city, level-one trauma hospital. The lengthy stays led to an in-depth review of policies and procedures and revealed a lack of ERAS guidelines for this surgical population. Following discovering this problem, the project team performed a literature review. The literature review revealed data reflecting the significance and correlation of ERAS guideline use and decreased hospital length of stay. ERAS has been around for over two decades and has been shown to reduce the length of stay and readmissions in orthopedic surgeries and expedite recovery (Salamanna et al., 2022). Over time, the reductions from ERAS use have proven to be cost-cutting and resulted in fewer complications (Salamanna

et al., 2022). Heymans et al. (2022) report enhanced recovery guideline savings ranging from $109 to $20,573. Based on these significant findings, the time to endorse ERAS use is evident.

PDSA Cycle: DO

In the "Do" stage of the PDSA cycle, the project team pinpointed regional anesthesia as the critical component of the ERAS guideline to study. Regional anesthesia is a technique to control pain by injecting medication into specific areas of the body you want to numb through pain signal pathway interruption to the brain (American Society of Anesthesiologists [ASA], n.d.). Due to the vast amount of regional anesthesia techniques, the project team chose to narrow down the techniques like peripheral nerve blocks, which include adductor canal block, infiltration between popliteal artery and capsule of the knee (IPACK), interscalene block, and spinal anesthesia. Based on the extensive literature review, these techniques were the most performed.

Patients targeted for this study must fall in the age range of 18-90 years of age. They must be undergoing a total joint arthroplasty. The selected patients cannot have an active infection because this can delay recovery and must have a functional status of METS >4. Exclusion factors include ages outside the specified age range and patients with outstanding concurrent medical issues that constantly threaten life, like congestive heart failure, end-stage liver or renal failure, active cancers, and severe lung diseases. Each patient will be placed individually in the ERAS or non-ERAS group based on their predetermined surgery date. The ERAS group is randomly selected for each month's first and third weeks. Patients having total joint surgery during those weeks will be linked to the ERAS group. The weeks opposite of the ERAS group, the second and fourth weeks, patients having surgery those weeks will be in the non-ERAS group. Unbeknownst to the patients, a project like this will be occurring. The ERAS

group patients will each receive a specific regional anesthetic block for their procedure. Patients will receive an interscalene block for total shoulder replacement, and a spinal anesthesia block will be performed on patients undergoing total hip arthroplasty. They will receive an adductor canal block and an IPACK block for total knee replacement. The anesthesia team will perform all blocks.

PDSA Cycle: STUDY

In the "Study" stage, the project team will assess the overall outcomes from ERAS and non-ERAS groups. In coordination with the perioperative nurses, the anesthesia team will lead the study by evaluating the outcomes of each patient. The anesthesia team is a crucial stakeholder because their interventions can occur at any stage of the patient's perioperative journey. The outcomes will be collected from a developed follow-up form where the data collector will precisely follow up with the PACU nurse about the patient's time in the PACU and a phone call follow-up with the patient.

It is the sole responsibility of anesthesia providers to follow up on each one of their patients in either the ERAS or non-ERAS group. The importance of the follow-up will be to determine the effectiveness of the ERAS group compared to the non-ERAS. The anesthesia providers will follow up with each patient and the PACU nurses using the listed QI follow-up survey found in Appendix A. The survey has validity and reliability for all the questions in Appendix A.

PDSA Cycle: ACT

In the "Act" stage, the final stage of the QI model reveals the QI project results and recommendations. With all the stakeholders present, the project team will provide a formal presentation to communicate the results. The results will be available to all QI department

leadership and the Nurse Anesthesia Program leadership. If the results are not desirable, an announcement will be made to all to provide transparency and an update on the future project modifications to occur in hopes of delivering desirable results to recommend an ERAS guideline for patients undergoing total joint arthroplasty. Proposals will be offered based on the SWOT analysis assessment tool. The focus of a SWOT analysis aims to address a project's strengths, weaknesses, opportunities, and threats (Moran et al., 2020). Overall, the uniqueness of the PDSA cycle is that it provides future opportunities for QI and EBP projects in other parts of the healthcare facility.

Outcome Analysis Plan

Instruments, Data Collection and Data Analysis

Data Collection

Based on random selection, each patient selected to the ERAS or non-ERAS groups results in this QI project are recorded using the Appendix A survey uploaded into EPIC. The project member is assigned to contact and gather the question data. The questions in the survey were adapted from an already utilized survey proven by validity and reliability. The study adopted data collection points of focus which are listed below:

1. Highest PACU pain score (out of 10 scale; specify location & characteristics)
2. Total PACU narcotics administered (intravenous or oral)
3. First ambulation time
4. Total PACU time
5. Adverse PACU events (nausea, vomiting, local anesthetic toxicity, extremity numbness, bleeding, uncontrolled postoperative pain)
6. Time of first significant breakthrough pain (date and time)

7. Pain score once block wore off (out of 10 scale; location of pain)
8. Home adverse events (bleeding, dizziness, nausea, vomiting, etc.)
9. Motor function return (yes or no)
10. Paresthesia or skin numbness after block wore off (yes or no)

The data gathered from both groups will be compared by comparative analysis. The goal is to assess for similarities and differences, including analyzing their significance to the project. All collected data will be input into a secure computer for future analysis.

Data Analysis

The best way to determine the overall effectiveness of the implemented ERAS guideline is by comparing the outcomes from the Appendix A survey on both ERAS and non-ERAS groups. Although the study was only implemented over three months, additional time may be needed to fully understand the impact the study had on the patients and the facility. The three-month trial period was intended to be an initial trial period to see if an outcome could be determined. Unexpected issues or obstacles that hindered the implementation and evaluation will be addressed after meeting with the assisting staff. The project team will stay in constant contact with the stakeholders in billing and finance to assess the impact the guideline would have on the hospital.

The success of the recommended ERAS guideline for patients undergoing total joint arthroplasty and implementation is intended to reduce the overall hospital length of stay without increasing complications by revealing significant decreases in length of stay compared to non-ERAS, and additional support of improved patient satisfaction, improved pain scores, and earlier mobilization. The data analysis, however, could provide results that show minimal to no difference in length of stay between the two groups, ERAS and non-ERAS, or a drastic increase

in complication rates from the ERAS group. If that's the case, an extensive review of the guideline focal points and assessment tool, including another in-depth literature review and synthesis, will occur again. The project team will utilize a collaborative approach to determine what changes need to be made to the overall project or if another method should be considered.

Project Timeline and Budget

Timeline

Once the discovery of the clinical problem and topic approval, the scholarly project began in September 2022. After project initiation and research, project planning, development, implementation, and evaluation will occur over twelve months from January 2022 – January 2023. The first three months, months one through three, are for QI project design and how to implement the QI ERAS guideline. The following three months, months four through six, are for project implementation. During this time, the survey in Appendix A will be incorporated, and data collection will begin. Months seven through nine are used for the analysis of the data. The final three months, months ten through twelve, are for presenting the data to hospital executives for hospital-wide adoption if the project successfully produces significant data support using the ERAS guideline. These three months will be used for project redesign and reimplementation if unsuccessful.

Budget

The proposed budget for this scholarly project is based on medications and equipment to perform the regional anesthesia portion assessed in the ERAS guideline. $23,748.70 is the estimated budget for potential future use by the prospective project site. The hypothetical hospital is a level 1 trauma center with an EPIC charting system and ultrasound equipment. The addition of one ultrasound machine is included in the total budget for this project if the hospital

facility would like to have one solely used for ERAS regional anesthesia. A budget breakdown over the three-month implementation phase, six out of the twelve weeks are dedicated to ERAS implementation. The total projected regional nerve blocks performed is 330. Spinal blocks for total hip arthroplasty are estimated to be 30. Each week, five are estimated to be completed. The medication cost for the specific concentration of local anesthetic use in spinal blocks is $2.15 per spinal, which amounts to $64.50 (S. Jordan, personal communication, October 5, 2022). Interscalene blocks for total shoulder arthroplasty are projected to have 60 blocks performed at $4.18 totaling $250.80 (S. Jordan, personal communication, October 5, 2022). Patients undergoing total knee arthroplasty will receive two blocks, an adductor canal block and an IPACK block. The project team estimates to administer 240 regional anesthesia nerve blocks. The adductor canal and IPACK block have the exact local anesthetic unit cost of $2.39 (S. Jordan, personal communication, October 5, 2022). The total amount for all 240 blocks for total knee arthroplasties is $280.60.

The accessories include the optional SonoSite ultrasound machine assigned only for regional anesthesia costs $16,000 (Universal Diagnostic Solutions, n.d.). The spinal needle used will be a 22-gauge Quincke spinal needle. Each spinal needle costs $1.61, and 30 will be needed, which comes to a total cost of $48.30 (*Spinal Needles*, n.d.). A 22-gauge Stimuplex Ultra Echogenic needle for the other peripheral nerve blocks will be used. The Stimuplex Echogenic needles come in 25 at $564.22 per box (*Stimuplex Ultra 360 Insulated Echogenic Needles with 30° Bevel and Extension Set*, n.d.). An estimation of 12 boxes will be required, costing $7,068.60. Lastly, the ultrasound gel, which is necessary to aid in capturing the best picture for regional anesthesia, costs $3.59 per bottle, and ten are estimated to total $35.90 (Bio-Medical Instruments, n.d.). The estimated project budget does not include communication costs for using

facility telephones, facility computers with EPIC charting, and personal devices. The data will all be recorded electronically in EPIC. If the project outcomes are successful and further system-wide implementation is guaranteed, expect costs to fluctuate with market value.

The personal time the project team uses is not included in the budget. The predicted time spent on all project phases is around 10 hours weekly. This projected time encapsulates all the researching, communicating with, updating the project team leader, reaching out to stakeholders, interpreting the data, and writing the report.

Barriers

Potential barriers to the recommendation and implementation of this scholarly QI project include cultural, educational, communication, technological, and financial. The cultural barriers are the unwillingness to allow change to occur. The facility or staff may be skeptical of the idea and impact ERAS can genuinely have on patient length of stay and overall outcomes. Setting aside time to teach and communicate the importance of ERAS and the potential cost-saving benefits supported by the literature, education, and communication can treat the skepticism. Educational opportunities can arise after assessing the provider's skills in using ultrasound and administering regional anesthesia. A solid academic and clinical background utilizing these skills is highly pertinent to the success of the ERAS guideline. The facility's lack of equipment and resources can present a technological barrier. The equipment is the ultrasound machine, needles, and gel. An absence of the appropriate equipment will severely hinder, if not render, the project unimplementable, seeking alternatives. One of the most significant barriers is the financial aspect. Financial barriers may encompass unwillingness to invest in the technology of the future. Regional anesthesia use is here to stay, and the advances that have come from it have made ERAS possible. Other financial barriers might include the inability to make the ERAS billable or

having doubts about whether the cost to implement will be more than what is reimbursed by insurance. To overcome the barriers mentioned in successfully implementing the ERAS guideline, the stakeholders, project team, and implementing staff must have an open line of communication with effective communication.

Ethical Considerations

Ethical considerations are examined thoroughly to protect the study participants. Data collected will be stored securely on the facility's EPIC charting system like any other procedure. All patients linked to the study will have a notification in their EPIC profile alerting any staff in the patient's chart. The rules set by Health Insurance Portability and Accountability Act (HIPAA) are still followed and are taken seriously. No private health information (PHI) will be revealed to anyone outside the individuals collecting the data, all of which are bound by the same rules. All the PHI and identifiable material will be removed if any information must be shared.

Conclusion

The literature overwhelmingly supports that implementing an ERAS guideline in orthopedic procedures, specifically total joint arthroplasty decreases the patient's length of stay while producing fewer complications and decreasing costs. The significant burden hindering the potential effectiveness of ERAS in this surgical population is the lack of consistent use (Melnyk et al., 2011). Despite the evidence supporting ERAS guideline, a procedural review pointed out a local midwestern, inner-city, level-one trauma hospital lacks consistent ERAS guideline utilization and support from every surgeon for patients undergoing total joint arthroplasty.

With the implementation of this scholarly DNP project, the goal is to yield favorable results to present to orthopedic surgeons and hospital executives. By consistent ERAS utilization, the patients are reaping the benefits, and so is the hospital through quicker patient turnover,

decreased patient stay costs, and fewer adverse events. This scholarly project can be considered the groundwork for consistently delivering the most up-to-date and helpful guidelines to benefit patients having total joint arthroplasties. Additionally, the creation of potential future projects for other specialties can now arise within the hospital system utilizing EBP to guide QI projects integrating an ERAS guideline based on the success of this project.

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Appendix A

QI ERAS Postoperative Follow-Up Survey

***(For non-ERAS patients, place N/A over sections that do not apply)**

Type of Regional Anesthesia: _____

Medication(s) Used: _____

PACU Follow-up

Highest PACU Pain Score: __/10 _____ (Specify location & characteristics)

Total PACU Narcotics Administered

Intravenous: _____ **Oral:** _____

First Ambulation Time: _____ **Total PACU Time:** _____

Adverse PACU Events: _____

Next-Day Follow-Up Call

Time of First Significant Breakthrough Pain: _____ (Date & Time)

Pain Score Once Block Wore Off: __/10 **Location of Pain:** _____

Home Adverse Events: _____ (bleeding, dizziness, nausea, vomiting, etc.)

Motor Function Return: YES / NO (circle one)

Paresthesia or Skin Numbness after Block Wore Off: YES / NO (circle one)