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Implementation of an Enhanced Recovery After Surgery Protocol for Orthopedic Total Joint Arthroplasties

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DISCLAIMER: Due to the impact of the COVID19 Pandemic, 2020 graduates of the Daniel K. Inouye Graduate School of Nursing were deemed critical to the mission of caring for the health of the nation. All phases of the DNP Project were complete, and met the standards and rigors of a quality DNP Project with an abbreviated dissemination timeframe.

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Abstract

Phase II Site: David Grant Medical Center, Travis Air Force Base

DNP Project Title: Implementation of an Enhanced Recovery After Surgery Protocol for Orthopedic Total Joint Arthroplasties

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Background or Problem/Issue: Surgical and anesthesia staff developed an enhanced recovery after surgery (ERAS) pathway at David Grant Medical Center (DGMC), but there was no implementation strategy in place. The uptake of ERAS into healthcare institutions remained slow and inconsistent due to the complexity of implementing numerous interventions among many providers and across hospital services.

Clinical Question or Purpose: For total knee arthroplasties (TKAs) and total hip arthroplasties (THAs) at DGMC (P), does implementing a standardized ERAS order-set (I) compare to standard order-set (C) change order-set usage (O)?

Project Design: The design was a process improvement project that measured the utilization of a standardized ERAS order-set for TKAs and THAs in DGMC's orthopedic surgery department.

Analysis of the Results: The standard ERAS order-set and implementation had no impact on practice change or patient outcomes at DGMC. The loss of the lead orthopedic stakeholder influenced provider resistance to not utilize a standardized ERAS order-set for TKAs and THAs during a four-week implementation period.

Organizational Impact/Implications for Practice: This ERAS order-set creation and implementation had no impact on practice change at DGMC. However, site-specific barriers have been identified, and recommendations have been made for overcoming these barriers to aid in successful implementation of future ERAS order-sets.

Introduction

Enhanced Recovery After Surgery (ERAS) guidelines are perioperative pathways consisting of evidence-based interventions designed to promote early recovery in patients undergoing specific surgical procedures. The ERAS guidelines bring patient safety and financial benefits to participating institutions. The implementation of ERAS leads to improved patient satisfaction, length of stay (LOS), readmissions, morbidity, mortality, and decreased complications (Polle et al., 2007). Also, ERAS implementation supports the Institute of Medicine's (IOM) roundtable EBP goal that by 2020, 90% of clinical decisions are supported and reflect best possible evidence (McClellan, McGinnis, Nabel, & Olsen, 2008). Healthcare providers have implemented ERAS guidelines in facilities of varying treatment capacities throughout the United States (i.e., Veterans Affairs hospitals), Europe, and Canada (Alvis et al., 2017; Conn et al., 2015; Gramlich et al., 2017). Currently, DGMC at Travis Air Force Base lacks a current standardized ERAS order-set for TKAs and THAs. Ultimately, the literature suggests that patients and staff have the potential to benefit from a successful ERAS implementation.

Significance of the Problem

The uptake of ERAS into healthcare institutions remains slow and inconsistent due to the complexity of implementing numerous interventions among many providers and across hospital services (Conn et al., 2015). Currently, DGMC's perioperative management of patients undergoing TKAs and THAs are inconsistent and provider specific. Prior to our arrival at DGMC, leadership expressed a desire for a current standardized ERAS order-set for orthopedic procedures. The Uniformed Services University (USU) Student Registered Nurse Anesthetists (SRNAs) graduated class of 2019 reported an assessment of the common barriers to ERAS

protocol implementation. Additionally, the graduated class evaluated the current treatment modalities for TKAs and THAs specific to DGMC. Our team finalized an ERAS order-set for the orthopedic department that correlated with current EBP guidelines. The steps to implement the ERAS protocol for TKAs and THAs at DGMC required support from the hospital stakeholders and the utilization of ERAS from the multidisciplinary teams (i.e., pre-operative and PACU team, anesthesia, orthopedic providers, physical therapy (PT), information technology (IT), and pharmacy).

There was an increased demand for TKAs and THAs alongside a primary focus on delivering high-quality care. The proposed solution was to implement an ERAS protocol to be utilized by all multidisciplinary personnel throughout a patient's perioperative stay. The evidence supported utilizing a multidisciplinary team of ERAS champions (i.e., subject matter experts) to guide, train, and oversee assigned unit personnel (Gramlich et al., 2017; Stone et al., 2016). The ERAS champion group were comprised of EBP savvy personnel, such as clinical nurse specialists, transdisciplinary clinicians or baccalaureate-prepared RNs from each unit. The ERAS champions worked directly with point of care staff to implement the ERAS protocol (Melnyk et al., 2011). We came to this decision by conducting a review of the literature for successful implementation of ERAS within medical institutions. Rather than denoting one specific implementation strategy, a combination of implementation methods (i.e., stakeholder support, utilization of a champion group, and assigning a designated project facilitator) to enhance success and sustainability at treatment facilities were suggested throughout the literature (Conn et al., 2015; Gramlich et al., 2017).

The implementation of ERAS into the military health system (MHS) has the potential benefit of reducing costs and aligns with the MHS Quadruple Aim model (i.e., better care, better

health, and better cost to maximize readiness). Addressing problems related to ERAS benefits both the patients and the health system. According to Nanavati and Prabhakar (2016), with successful ERAS implementation, hospital LOS was reduced by 35 to 45 percent. Ultimately, patients receiving ERAS experience a 0.6-day reduction in stay following TKAs, resulting in $539 savings per case. Also, ERAS has shown to have a 0.4-day reduction of inpatient hospital stay with THAs, mounting a cost savings of $1019 per case (Arana, Harper, Qin, & Mabrey, 2017). Applying these numbers to the average number of TKAs (111) and THAs (93) performed at DGMC annually would account for a reduction of patient-days by 85.8 days and a savings of $102,000.

The IOM identifies the importance of nursing as the driving force for change (Battie, 2013). For the implementation of ERAS to work, it requires an established team knowledgeable about the protocol. Advanced Practice Registered Nurses (APRNs) are part of the core team involved in many aspects of ERAS care. It is an advantage to the institution to include the various nurse specialties in preoperative clinics, surgical areas, and post-anesthesia care units, which allows the team to view the barriers to implementation through different perspectives. The IOM highlights the nursing profession as a key role in patient advocacy and nurses can address the unique needs of patients as it relates to their perioperative experiences (Battie, 2013).

Clinical Question

For total knee arthroplasties (TKAs) and total hip arthroplasties (THAs) at DGMC (P), does implementing a standardized ERAS order-set (I) compare to standard order-set (C) change order-set usage (O)?

Focus Areas

There were four primary focus areas for protocol implementation success: gathering pre-implementation data, creating a multidisciplinary champion team, training the champion teams and unit personnel, and implementation alongside gathering post-implementation data. First, our team conducted a literature search to establish the most current EBP ERAS guidelines for TKAs and THAs for orthopedic surgery to implement as a current standardized order-set at DGMC. Next, we created a multidisciplinary champion team comprised of personnel from departments involved in the perioperative care of TKA and THA patients. After the champion team was identified, they were introduced to the updated standardized orthopedic ERAS order-sets. The champion team was responsible for training their respective unit personnel. Finally, the ERAS order-set was implemented over a four-week period and evaluated to assess the utilization from orthopedic providers.

Relevance to Military Nursing

The global impact of ERAS implementation was to determine if the Iowa Model of Evidence-Based Practice to Promote Quality Care could successfully overcome DGMC's barriers to implementing an updated orthopedic ERAS order-set into a Military Treatment Facility (MTF). Thus, a successful implementation within DGMC under a supported EBP model as the guiding framework could be used to implement future surgical ERAS order-sets at DGMC or other MTFs. Furthermore, the Iowa Model's long-term goals focused on decreasing hospital expenditures and improving patient outcomes. These long-term goals aligned with the MHS Quadruple Aim model (i.e., better care, better health, and better cost to maximize readiness) further supporting the potential global impact within the military.

Organizing Framework

Our group utilized the Iowa Model as a framework to organize and guide the implementation of an ERAS order-set for TKAs and THAs (Appendix F). The Iowa Model guides nurses and other clinicians in making decisions about clinical and administrative practices that affect patient outcomes (Melnyk & Fineout-Overholt, 2015). Also, the Iowa Model is based on problem-solving steps for scientific processes and is known for its ease and applicability by multidisciplinary healthcare teams (Melnyk & Fineout-Overholt, 2015). As DGMC leadership accepts a culture of change, the barriers and strengths are more easily identified surrounding a problem to implementation of EBP into the organization. Using the outline of the Iowa Model, our team identified multidisciplinary professionals to assist in the implementation of the EBP project.

Project Design

Evidence Evaluation

We utilized PubMed, CINHAL, and Embase to discover articles and abstracts for inclusion in the literature review regarding implementation strategies for ERAS. The following search terms were enhanced, recovery, surgery, eras, enhanced recovery after surgery, implement, implementation. Boolean operators (AND, OR), quotations, truncations, and asterisks were used to enhance the search output to meet desired article criteria. Also, the title (TI) and title and abstract (tiab) were utilized to ensure the terms were in the title and abstract of articles in all three literature databases. Using the same search strategies, CINAHL accessed nursing and allied health literature, and Embase collected international MEDLINE journals not included in PubMed as of 25 January 2018. The literature search was limited to articles published in the last ten years and only in English. As of 25 January 2018, the search design

generated 540 articles and abstracts. We initiated an updated literature search using the key terms above for PubMed, CINHAL, and Embase with the limitation being 1 January 2018 through December 2018. In continuation of the class of 2019's EBP project, the authors utilized components of their completed EBP project (i.e., meta-analysis, systematic reviews, and evidence table within their literature search) to finalize a current ERAS order-set with the orthopedic surgery department supported by EBP.

The inclusion criteria were articles that discussed the strategy or method of implementing an ERAS protocol. Exclusion criteria were articles that focused on patient outcomes after implementing ERAS, articles that discussed only what items to include in a specific ERAS protocol, articles only demonstrating the benefits of ERAS, and articles that evaluated the feasibility of ERAS implementation within a facility. After 273 duplicates were removed, 267 titles and abstracts were reviewed for inclusion and exclusion criteria and 18 remained for final evaluation. Of these 18 remaining articles, an additional 13 were removed because they were identified as literature review articles that focused on background rather than the implementation of ERAS, which left 5 final articles for appraisal (Appendix G).

Using a combination of the John Hopkins and Melnyk & Fineout-Overholt, 5 articles were appraised (Appendix H). Overall, there was one high, two medium, and two lower level of quality with one III, three IV, and one VII hierarchy of evidence ratings.

Our literature search showed common themes amongst the articles that yielded successful implementation of ERAS. These common themes included a designated "champion team," ERAS project facilitator, or consult team responsible for facilitating the implementation process.

The project facilitators and champion team were designated as subject matter experts responsible for training, implementing, and enabling change through facility specific tools. Training included dissemination of the education, face-to-face teaching, and organizing meetings. Implementing included coordinating the care of the patient throughout the perioperative stages, overseeing medical management, assessing protocol compliance, and allowing for adjustments throughout this implementation process. Tools fostered the merging of the ERAS protocol into the facility's current computer system, creating order-sets, monitoring, and auditing. Additionally, the final theme included key institutional support for initiation of ERAS and staff motivation. These articles demonstrated program success and sustainability with the utilization of these themes as a combined strategy for ERAS implementation.

General Approach

The authors' project was a process improvement design that determined if ERAS could be successfully implemented using the Iowa Model of Evidence-Based Practice to Promote Quality Care. Our general approach was to implement an ERAS bundle for TKAs and THAs at DGMC. The potential barriers to implementing an ERAS protocol were changing provider practice, lack of administrative support, an order-set modification, and limited case numbers to train staff (Conn et al., 2015). To address case volume, we chose TKAs and THAs for ERAS implementation due to larger case numbers and opportunities to impact patients and providers. Our team obtained administrative support at multiple levels, as well as buy-in from the orthopedic surgeons to support ERAS implementation. To limit barriers associated with the electronic medical record, the IT department and the approval committees were included in the

development process to prevent delays in implementation as the facility merged from Essentris to MHS Genesis.

Setting

The project took place at DGMC at Travis Air Force Base. This hospital is a large MTF located near Sacramento, California and serves more the 500,000 TRICARE and Department of Veterans Affairs Northern California Health Care Systems beneficiaries (60th Medical Group, n.d.). Roughly, 111 TKAs and 93 THAs are performed annually at DGMC.

Procedural Steps

The authors utilized the steps outlined in the Iowa Model of Evidence-Based Practice (Appendix F) to guide the implementation of ERAS protocols for TKAs and THAs at DGMC.

Iowa model of evidence-based practice.

The seven procedural steps (i.e., identify "triggers", clinical applications, organizational priorities, forming a team, piloting a practice change, evaluating the pilot, and evaluating practice changes and dissemination of results) of the Iowa Model outlined the change process that was the organizational framework for implementing the ERAS order-set at DGMC (Appendix I).

1. Identify "triggers."

The DGMC leadership and orthopedic surgeons expressed the desire to have an updated standardized ERAS order-set, but the facility lacked an implementation strategy to enact the protocols (i.e., problem-focused trigger). In addition, the IOM is strongly pushing for 90 percent of clinical decisions to be supported and reflected with the best possible evidence by 2020 (i.e., knowledge-focused trigger).

2. Clinical applications.

The second step of the Iowa Model worked on addressing the clinically relevant questions within developing the ERAS order-set. The USU SRNA graduated class of 2019 reported an assessment of the common barriers to ERAS implementation. This left the authors to implement the standardized ERAS order-set into DGMC. The authors worked with DGMC's orthopedic surgeons to finalize a standardized evidence-based ERAS order-set to implement into DGMC.

3. Organizational priorities.

The authors started with the third step of the Iowa model (i.e., organizational priorities) that drove for a system-wide change to implement an ERAS order-set. At DGMC, the hospital Commander, Chief Nurse, Medical Director, orthopedic surgeons, and Squadron Commander supported this EBP project.

4. Forming a team.

The fourth step was to identify the unit EBP mentors that facilitated ERAS order-set implementation. The authors assumed the role of the "Project Facilitator" to oversee the implementation, assess utilization, and advocate for sustainment. The EBP project mentorship team included Colonel Shawna Greiner as the Master Clinician at DGMC, Lieutenant Colonel Adeleke Oyemade as our site director, and Major Julie Petsche as our assistant site director at DGMC. The project champion team also included the orthopedic surgery providers, PT, and IT.

Next, forming a team envelopes the ERAS educational components. The Iowa Model's fourth step included the dissemination of the ERAS order-set amongst the unit champions. The champions bridge the communication allowing hospital staff to voice concerns and primes partnerships amongst the multidisciplinary teams. In this phase, the authors finalized the ERAS

order-set components with the orthopedic providers and disseminated logistics (i.e., MHS Genesis). Our goal was to ease and streamline the transition of the new ERAS order-set as Essentris merged to MHS Genesis.

5. Piloting a practice change.

The Iowa model's fifth step was an essential step of the ERAS implementation and took into account the work behind enacting ERAS into new practice at DGMC. This step depends on the champions establishing support from respective department heads to prevent under-utilization of the ERAS protocol (Conn et al., 2015). The ERAS implementation was tested on a full-scale four-week period. The official four-week project implementation date (i.e., beta test) was initiated on 20 January 2020 and completed on 14 February 2020. The orthopedic physician assistant (PA) was appointed as the designated provider in charge of ordering all ERAS order-sets for total joint arthroplasties amongst the orthopedic team of surgeons throughout this four-week beta test implementation. The finalized ERAS order-set additions were acetaminophen 975 milligram by mouth (PO) and PT within two to six hours postoperatively. The orthopedic surgeons unanimously rejected the proposed addition of gabapentin into the standardized ERAS order-set. Overall, the initial four-week implementation identified the utilization as well as the unforeseen barriers.

6. ***Evaluating the pilot and practice changes and dissemination of results.***

On 18 February 2020, the authors communicated with the orthopedic PA to obtain the final numbers for ERAS utilization. During this phase of the Iowa Model, the orthopedic surgery department identified all patients undergoing TKAs and THAs. In addition, the authors identified with the orthopedic PA whether the ERAS order-set was utilized amongst the patients undergoing TKAs and THAs. These results would determine the success of the initial ERAS

implementation to assess the need for modification of the implementation process or the formulated DGMC ERAS order-set. The results of this EBP project will be presented to the DGMC stakeholders to determine if this facility will move forward with an ERAS order-set using the authors' recommendations to overcome site specific barriers. Additionally, the authors will present the ERAS EBP project findings to faculty and peers at USU during research week in May 2020.

HIPAA Concerns

The authors' Doctorate of Nursing Practice (DNP) project was to implement an evidence-based orthopedic ERAS order-set at DGMC. This was a process improvement design that directly interacted with the healthcare personnel as a system-wide change and did not involve human subject research or consent. The authors did not collect personal identifiable information (PII) or protected health information (PHI) in the completion of our project. Furthermore, since the authors did not collect patient data, therefore did not have to submit for an Institutional Review Board (IRB) and Privacy Board exemption. The authors did not access patient records. The protocol implementation followed alongside the standard hospital Health Insurance Portability and Accountability Act of 1996 (HIPAA) guidelines.

Project Results

Success of this EBP project was determined by the complete adoption and use of the ERAS orthopedic order-set by the champions and stakeholders. The authors' results concluded that this EBP project was unsuccessfully adopted by the orthopedic stakeholders. As a result, the ERAS protocol and implementation had no impact on practice change or patient outcomes at DGMC. After completion of the four-week implementation period, final utilization results were disseminated from the orthopedic PA (i.e., POC responsible for writing the perioperative orders)

to the authors as the "Project Facilitators." The results concluded a resistance to change within the orthopedic department that deferred the new standardized orthopedic ERAS order-set from the beginning of the four-week implementation period. The orthopedic providers maintained their respective order-sets. None of the 23 orthopedic cases (i.e., 15 TKAs and eight THAs) received every component of the newly standardized ERAS order-set for the orthopedic department (Appendix I). None of the patients received acetaminophen by mouth (PO) preoperatively. However, nineteen of the 23 patients were followed by PT within six hours postoperatively and ambulated per the order-set guidelines.

Analysis of the Results

During the implementation of this EBP project, the site barriers at DGMC remained a consistent challenge to ERAS implementation. Resistance to change was the greatest barrier to implementing the standardized ERAS order-set for TKAs and THAs, even though the authors established a standardized ERAS order-set with the orthopedic providers at DGMC. Incidentally, the unforeseen six-month delay for DGMC's EBP council to approve the project greatly hindered the project implementation timeline and site impact. During the delay, the authors lost the lead orthopedic stakeholder that supported the standardized ERAS order-set to deployment. Thus, the lack of continuity and motivation influenced orthopedic provider resistance to forgo utilization of the standardized ERAS order-set. As a result, none of the patients received PO acetaminophen during the preoperative phase leading to inconsistent intravenous (IV) acetaminophen administration that was left to the discretion of the anesthesia provider. However, PT was able to meet the postoperative goal of patient ambulation within two to six hours for 19 of the 23 patients. The limited duty hours of PT personnel hindered the

department's ability to ambulate more than two postoperative TKA or THA patients each day within six hours.

Organizational Impact/ Implications to Practice and Policy

A standardized ERAS order-set is proven beneficial for specialties that supersede orthopedics. As the authors were unsuccessful at implementing a standardized ERAS order-set amongst one specialty, there still yields potential benefits with its' integration throughout an entire healthcare facility. For future DNP classes, the DGMC EBP approval process needs to be streamlined to prevent delays in project start dates and potential loss of current project stakeholder support. Additionally, DGMC's PT department could explore personnel options to cover all postoperative evaluations for TKAs and THAs that would move the practice towards same day discharge currently used at neighboring civilian healthcare institutions. Lastly, the respective units (i.e., IT, orthopedic providers, and anesthesia) should collaborate to transition to PO acetaminophen and decrease provider inconsistency, prevent duplicate dosing for patients, and enhance cost savings.

Future Directions for Research and Practice

Significant barriers the authors encountered were staff turnover (i.e., deployment), staff buy-in, technology, and department staffing limitations. During the planning phase of the EBP project, the components of the ERAS order-set were developed in conjunction with the head of the orthopedic surgery department. Prior to the implementation phase, that provider was tasked with a deployment, which negatively impacted staff buy-in and support. Additionally, during the four-week implementation, the orthopedic PA responsible for ordering the ERAS order-set in the electronic health record (EHR) had a family emergency and was absent the last half of the implementation phase. Given the frequent staff turnover and unanticipated deployments that

occur at military healthcare facilities, the authors would recommend officially designating alternates to key stakeholder roles. Appointing an alternate and including them throughout the planning and implementation phase will help to maintain continuity, and likely overall compliance and success, if any of the primary stakeholders or champions move or deploy.

None of the 23 patients had all components of the ERAS order-set ordered. This was due to the order for PO acetaminophen being omitted from the order-set. While provider preference played a role in omitting the PO acetaminophen, concern was expressed over the potential for patients to receive acetaminophen doses too close together. Prior to the ERAS implementation phase, the standard practice was for Anesthesia to administer IV acetaminophen intraoperatively. With a change to PO acetaminophen being administered by preoperative staff, if the anesthesia provider is unaware the patient already received acetaminophen, it would be possible for the patient to receive an additional dose of acetaminophen inadvertently. Additionally, between the planning and implementation phase of the ERAS EBP project, the facility underwent a transition to a new EHR system. This change added to the concern over additional acetaminophen doses since staff are less familiar with the new system and may not recognize that a dose of medication had already been given. In order to prevent this type of concern for future attempts at ERAS implementation, the authors would recommend holding multidisciplinary meetings to discuss the order-set components as opposed to meeting with departments in isolation. Although logistically more challenging, multidisciplinary meetings would help foster teamwork, improve communication and collaboration, identify concerns, and improve chances of implementation success.

Regarding early ambulation, 19 of the 23 patients received a PT evaluation and ambulated within two to six hours postoperatively. There is currently one physical therapist in

the PT department at DGMC that is capable of evaluating the first two THA or TKA patients within two to six hours postoperatively. When there are more than two TKA or THA patients, by the time the third patient arrives to the inpatient unit, the PT clinic is closed, and therefore cannot evaluate that patient until postoperative day one. The physical therapist must evaluate the patient before discharge. However, it is not a policy that a physical therapist must be the first person to ambulate the patient postoperatively. In the future, the order-set could be written to direct the inpatient nursing staff to get the patient out of bed within the prescribed time window if physical therapy is unavailable. If the facility desires to strive towards same-day surgery for TKAs and THAs in the future, it would likely require an additional therapist to support the increase in time-sensitive workload.

Conclusion

Enhanced Recovery After Surgery is a patient-centered approach that utilizes evidence-based interventions with the goal of improving patient satisfaction as well as patient outcomes. After ERAS was initially created for use in major abdominal surgeries, it has been adapted to many different types of surgeries, including TKAs and THAs. Despite the potential benefits of ERAS order-sets, there has not been widespread implementation because of the many barriers encountered with system-wide, multidisciplinary process improvement. The aim of the author's EBP project was to implement an ERAS order-set for TKAs and THAs at DGMC. Similar to many of the experiences reported in the ERAS literature, the authors encountered many barriers in the process of implementing the ERAS order-set, that ultimately resulted in failure to achieve complete adoption and use of the ERAS orthopedic order-set by the champions and stakeholders. Although the authors were unsuccessful at achieving the desired goal, there were many identified site-specific barriers as a result of the four-week implementation. These barriers highlighted

further process improvement requirements needed to successfully enact change into this MTF. If DGMC continues to desire to have an ERAS order-set for TKAs and THAs, the authors recommend addressing the barriers with site-specific solutions to improve the likelihood of future ERAS success.

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Timeline

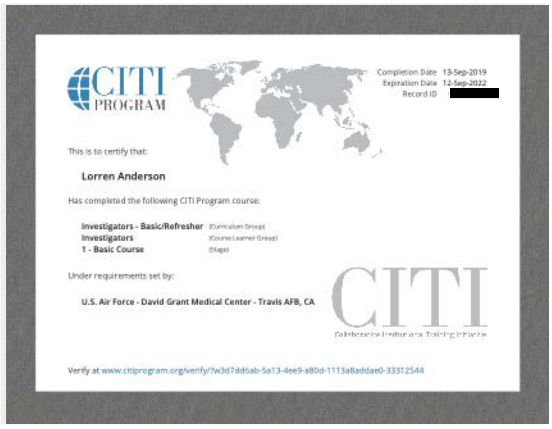
Project Year 1 (2018)												
Activity/Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Identify Current THA & TKA Practices											X	
Site IRB Submission and Approval												X
USUHS VPR Submission and Approval												X
Inform Hospital Leadership												X
Project Planning				X	X	X	X	X	X	X	X	
Project Implementation/Data Collection												
Data Analysis												
Dissemination												

Project Year 2 (2019)												
Activity/Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
USUHS VPR Submission and Approval												
Site IRB Submission and Approval												
Project Planning	X	X	X									
Project Implementation/Data Collection				X	X	X						
Data Analysis							X	X				
Dissemination									X	X	X	X

Project Year 3 (2020)												
Activity/Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
USUHS VPR Submission and Approval												
Site IRB Submission and Approval												
Project Planning												
Project Implementation/Data Collection												
Data Analysis												
Dissemination	X	X	X	X								

Appendix A

CITI Certifications



Appendix B

USU Form 3202N

USUHS FORM 3202N
DANIEL K. INOUYE GRADUATE SCHOOL OF NURSING
EVIDENCE-BASED PRACTICE/PERFORMANCE IMPROVEMENT PROPOSAL

VPR Date Stamp

Project Number: _____ (VPR will assign)

Project Title: **Implementation of an Enhanced Recovery After Surgery Protocol for Orthopedic Total Joint Arthoplasties**

SECTION A: STUDENT POC INFORMATION

1. Name (Last, First, MI): **Haines, Melissa, S. Capt USAF** Student E-mail: **melissa.haines@usuhs.edu**
2. Home Address: [redacted]

SECTION B: COMMITTEE CHAIR / SENIOR MENTOR INFORMATION

3. Name (Last, First, MI): **Oyemade, Adeleke, A. Lt Col, DNP, CRNA, USAF**
4. Telephone: **707-423-5527** Fax: E-mail: **adeleke.a.oyemade.mil@mail.mil**
5. USUHS Building/ Room No.: **David Grant Medical Center, Travis Air Force Base**

SECTION C: PROJECT INFORMATION

6. Attach the Abstract for the proposal, including the following sections: Site Location of the Project, Title, Authors, Background or Problem/Issue, Clinical Question/Purpose, Project Design, Anticipated Organizational Impact/Implications for Practice and also include the Proposed Timeline. Single space the abstract and use Times New Roman font, size 12.
7. Is this proposal related to an active research project of the Chair/Senior Mentor identified in Section B? ☐ Yes ☒ No
   If yes, complete below; if no, proceed to Part 8.
   Project Number: _____
   Project Title: _____
   Project Start Date: _____ Project End Date: _____
8. Anticipated period of performance: Project Start Date: **August 2017** Project End Date: **May 2020**
9. Performance Site(s): **David Grant Medical Center, Travis Air Force Base**
10. Does this project involve any classified information? (Contact the USUHS Security Office for guidance) ☐ Yes ☒ No
11. Do you have a funding source for this project? ☐ Yes ☐ No ☒ NA
    If yes, specify the funding agency and the amount provided:

SECTION D: SIGNATURES

The following signatures attest to the validity of the above information:

HAINES.MELISSA.S. [redacted]	OYEMADE.ADELEKE.A. [redacted]
Student (Project Point of Contact for t[redacted]	Chair/Senior Mentor (Signature and Date)
WALLACE.JERROL.BLAGRO VE. [redacted]	
Chair/Program Director (Signature and Date)	Chair/Program Director (Signature and Date)
DNP Project Director or PhD Director (Signature and Date)	Associate Dean for Academic Affairs, GSN (Signature and Date)
Associate Dean for Research, GSN (Signature and Date)	Dean, DKI Graduate School of Nursing (Signature and Date)

In light of the above signatures, the project is approved.

USUHS Vice President for Research Date

USUHS Form 3202N (VPR) - Revised Sep 2015 v1.2
Previous versions are obsolete

Appendix C

Letter of Determination

Subject: FDG20180002 - AFMRA/SGE-C EDO Determination of Not Research Involving Human Subjects

SUBJECT: Air Force Research Oversight and Compliance (AFMRA/SGE-C) Exempt Determination Official (EDO) Review of FDG20190002, "Implementation of an Enhanced Recovery After Surgery Protocol for Orthopedic Total Joint Arthroplasties" submitted by Maj Anderson, Maj Crissman, Capt Haines, and Maj Petsche, 60 MDG, Fairfield, California, submission version dated 1 December 2019

References: (a) DoDI3216.02_AFI40-402, 10 September 2014, Protection of Human Subjects and Adherence to Ethical Standards in Air Force Supported Research
(b) 32 CFR 219, 19 January 2017, Protection of Human Subjects

1. AFMRA/SGE-C EDO has reviewed and determined in accordance with Enclosure 2, Section 10d of Reference (a) that FDG20190028N does not qualify as research involving human subjects.

2. The activity is limited to introducing an Enhanced Recovery After Surgery (ERAS) order-set for the adult population undergoing total knee arthroplasties (TKAs) and total hip arthroplasties (THAs) at David Grant Medical Center. The team will survey champions and stake holders to determine if they are using the new ERAS order-set. The project will be deemed a success if the ERAS orders-set is adopted and used by the champions and stakeholders. The AFMRA/SGE-C EDO determined that the project is not research involving human subjects because the activity has no intent to contribute to generalizable knowledge as defined by Section 219.102(l) of Reference (b).

3. The project may proceed with no further requirement for review by the EDO. No further life cycle actions are required for this protocol unless there are significant changes to the study design which would impact the EDO determination.

4. For questions regarding this memorandum, please contact Mr. Peter Marshall (E-mail: peter.j.marshall.civ@mail.mil/phone: 703-681-6277/DSN 761), or usaf.pentagon.af-sg.mbx.afmsa-sge-c@mail.mil.

Peter Marshall, CIP
Program Manager, AF Research Oversight & Compliance Division Air Force Medical Readiness Agency (AFMRA/SGE-C)
7700 Arlington Boulevard Falls Church, VA 22042 (703) 681-6277/DSN 761
peter.j.marshall.civ@mail.mil

Appendix D

USU NOPA

USU
Uniformed Services University

OFFICE OF RESEARCH
4301 JONES BRIDGE ROAD
BETHESDA, MAYLAND 20814
PHONE: (301) 295-3303; FAX: (301) 295-6771

NOTICE OF PROJECT APPROVAL
Change Number: Original

VPR Site Number:	GSN-61-10698
Principal Investigator:	Haines, Melissa
Department:	Graduate School of Nursing
Project Type:	Student
Project Title:	Implementation of an Enhanced Recovery After Surgery Protocol for Orthopedic Total Joint Arthoplasties
Project Period:	8/1/2017 to 5/31/2020

Assurance and Progress Report Information:

Name	Sup	Approval Type	Status	Approved On	Forms Received
Progress Report	0			To be Submitted	N/A

Remarks:
This Notice of Project Approval has been reviewed and approved. Please remember that you must submit a final Progress Report (Form 3210) upon completion of this project.

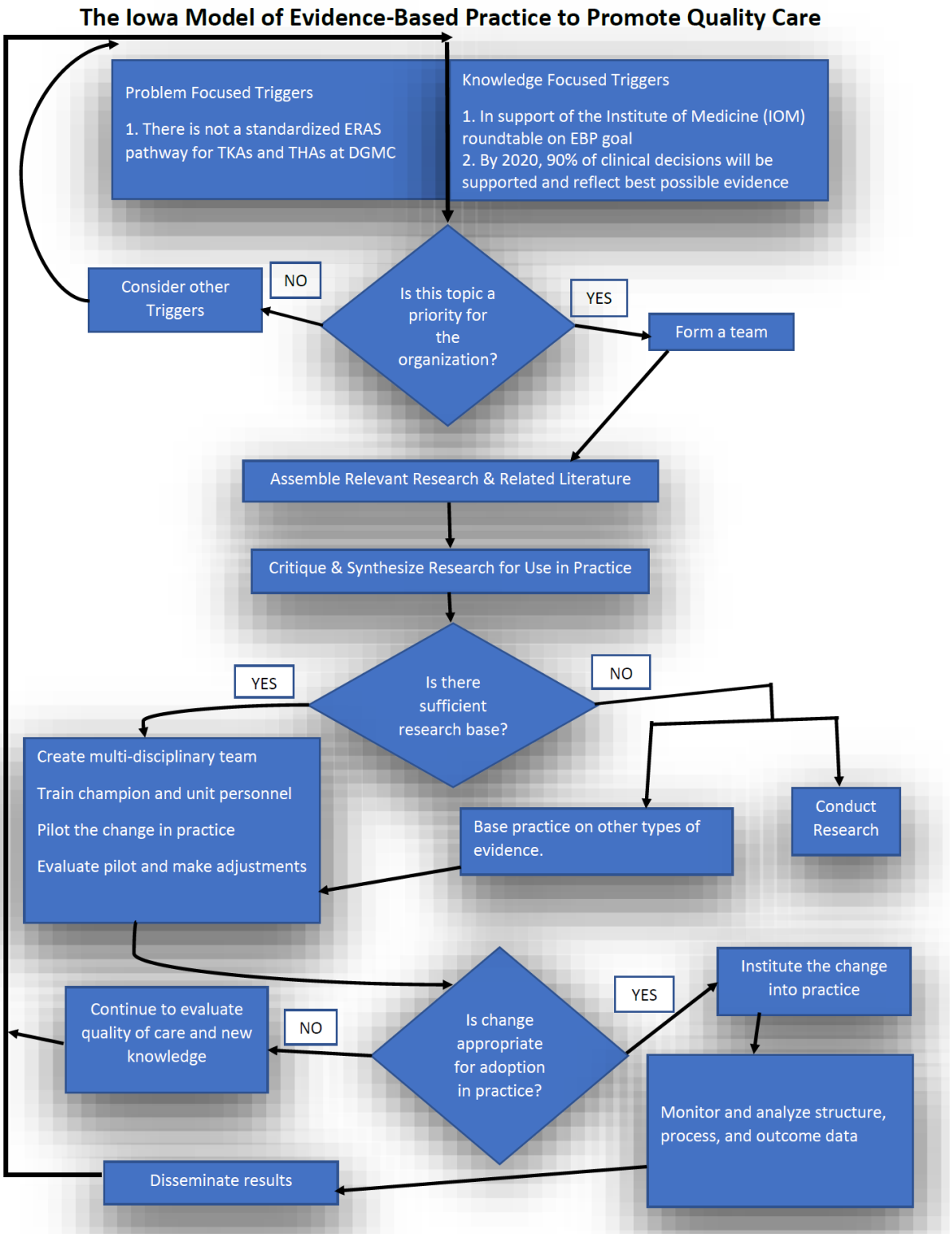
Questions regarding this approval should be directed to the following person in the Office of Research:
Sharon McIver, (301) 295-9814.

[redacted]
Yvonne T. Maddox, Ph.D. Date 2 July 2019
Vice President for Research
Uniformed Services University of the Health Sciences

cc: Haines, Melissa
File

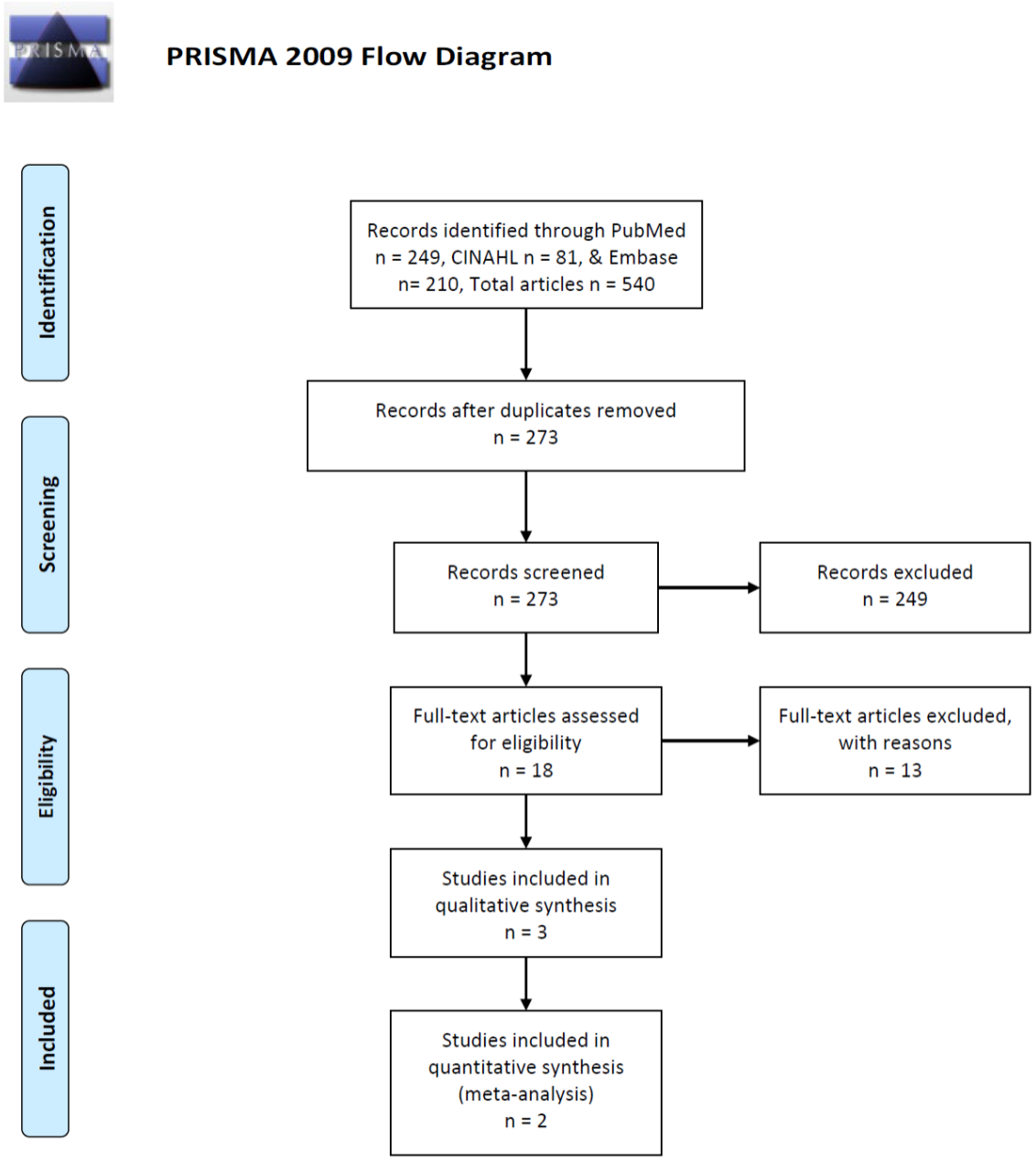
Appendix E

Iowa Model of Evidence-Based Change



Appendix F

PRISMA Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Appendix G

Evidence Table

Title	purpose	# of subjects analyzed	Design/quality	Conclusion	Recommendations	Theme	How were the intervention and outcomes operationalized/ ie. Teams or checklist
Creation and Execution of a Novel Anesthesia Perioperative Care Service at a Veterans Affairs Hospital (2017) *Anesthesia Analgesia* Alvis, B. D., King, A. B., Pandharipande, P. P., Weavind, L. M., Avila, K., Leisy, P. J., . . . Hughes, C. G.	Describes the creation and execution of a perioperative care service (PCS) at a VA medical center that combine elements of perioperative surgical home (PSH) model and ERAS pathways and provide preliminary outcome data from its implementation.	136	Descriptive IV/High	Complete ERAS Compliance 86-87% for TKA, THA, Spine surgery patients. Preop pain medication most common deviation from EARS pathways for all services. MIVF highest compliance rate. Once patient out of PACU adherence 100%. The VA-PCS shortened LOS by 1 day for all patients, ensured compliance to ERAS pathway and coordinated comprehensive care for each patient in perioperative period.	Continue to support and build PCS using the PSH model because of how effective it is maintaining ERAS compliance and coordinating comprehensive medical care of each patient in the perioperative period.	ERAS pathways Multidisciplinary selected; Face to face teaching led by Medical Director	-Teams: The VA-PCS provides continuous coverage by NPs with a supervising CCA attending and collaborates with surgical teams, social workers, pharmacists, and physical therapists. - Pathways were created with the involvement of VA-PCS attendings and NPs, anesthesiologists, surgeons, physical therapists, pharmacists, and social workers. these pathways focus not only on multimodal perioperative pain management, but also on preoperative nutrition, physical therapy, smoking cessation, perioperative anticoagulation, perioperative antibiotics, intraoperative fluid management with balanced solutions, early ambulation, early refeeding, removal of indwelling catheters, and other important perioperative initiatives. -Creation and execution of a Perioperative Care Service (PCS)
Introducing an enhanced recovery after surgery program in colorectal surgery: a single center experience (2014) *World journal of gastroenterology* Bona, Molteni, Rosati, Elmore, Bagnoli, Monzani, Caravaca, Montorsi	Determine impact of ERAS protocol implementation from pilot to standard of care on postop LOS, readmission, compliance, and morbidity	Pilot: 47 Shared protocol: 143	single center cohort study. IV/Medium	Introduction of ERAS protocol for colorectal surgery results in shorter post op length of stay. Pilot study had high compliance (93%) which resulted in shorter LOS. It was a small unit specialized in protocol driven care Implementation challenging, as already widely demonstrated in the literature, particularly in the progressive stages of transition from an experience	A selected staff of surgeons, anesthetists and nurses who cooperate in a day surgery setting, where enhanced recovery pathways are routinely used for surgical procedures of low-medium impact, can improve the start-up of these protocols into daily practice.	Use of specialized ERAS team resulted in higher compliance rates and improved outcomes	Pilot group: multidisciplinary team constituted by two surgeons, two anesthetists and two nurses trained in high-turnover clinical pathways pertaining to Day Surgery Unit. Shared Protocol group: surgeons belonging to the Colorectal Disease Unit, by anesthesiologists of two divisions (of which only one specialized in standardized care pathways aiming to short hospitalization) and by nurses of two operating blocks and of two dedicated wards.

				concerning a limited number of patients and a selected medical staff to standard of care for a particular patient population and for the whole of the professionals of the divisions involved. There is a correlation between compliance with ERAS protocol and outcomes			
Consensus on Training and Implementation of Enhanced Recovery After Surgery: A Delphi Study (2018) *World Journal of Sugery* Francis, N. K., Walker, T., Carter, F., Hubner, M., Balfour, A., Jakobsen, D. H., Ljungqvist, O.	Draw consensus from an expert panel on key elements of ERAS training curriculum and how such a curriculum should be delivered, key factors for successful implementation of ERAS, the optimal method of assessment of ERAS training and the criteria to identify center of excellence in ERAS training.	58 expert panel email surveyed x3 / 12 person focus group questioned at conference	Modified Delphi Study VII/Low	Training course must cover evidence based principles of ERAS with team oriented training, Successful implementation requires strong leadership, ERAS facilitator and multidisciplinary team, Effectiveness of training measured by improved compliance to ERAS protocol, Excellent training centers should show willingness to teach and demonstrate teamwork	Develop face to face multidiscplinary team based learning methods. Training should include most up to date evidence based principles of ERAS, audit criterion, feedback processes and integrating whole patient experience into training. The patient should also be informed about ERAS pathway. Dedicated ERAS facilitator to perform audits and data collection that promotes awareness and prompt feedback of ERAS to whole surgical team. Strong leadership that pushes vision of multidiscplinary team training, meeting and collaborative development of ERAS pathways.	Face to Face training, Multidisciplinary, strong leadership, ERAS facilitator	Multidisciplinary team- surgeon, anesthesia, administrator, Team, readmissions, LOS, Mobilization after surgery, diet after surgery, protocol compliance, readiness for discharge.

Development of an Enhanced Recovery After Surgery Guideline and Implementation Strategy Based on the Knowledge-to-action Cycle (2015) *Annals of Surgery* McLeod, Aarts, Chung, Eskicioglu, Forbes, Conn, McCluskey, McKenzie, Morningstar, Nadler, Okrainec, Pearsall, Sawyer, Siddique, Wood	To develop and implement an ERAS clinical practice guideline (CPG) at multiple hospitals	Quantitative: N=336 Qualitative: Surgeons/ surgical residents, anesthesia, and patient education and nursing teams at the 8 university affiliated teaching hospitals	One group quasi-experimental study systematic review to identify all published ERAS guidelines, protocols, and trials III/Low	Preliminary evidence suggests successful implementation of ERAS protocol. The process was labor intensive and it took almost 4 years from the initial meta-analysis to completion and implementation of the guideline. Will require ongoing reevaluation database to collect data. Audit and feedback has been an essential part of the program. However, development of the database required significant resources which may impact on sustainability.	Implementation should include an ERAS guideline by a multidisciplinary group, communities of practice led by multidiscipline champions (surgeons, anesthesiologists, and nurses) both provincially and locally, educational tools, and clinical pathways as well as audit and feedback tools.	Team, coordinators (Nurse, Surgeon, and Anesthesiologist Champions), audits, database, Strategies to Facilitate Communication and Share Best Practices Among All Disciplines and Centers, Printed and Electronic Standardized Materials	They use several different strategies including: seminars, printed materials, and an APP to disseminate the guidelines and information, as well as Creating standardized pre/post op order sets, posters, reminder cards, and slide decks for use as teaching tools and reminders to follow the ERAS protocol
Early implementation of Enhanced Recovery After Surgery (ERAS(R)) protocol - Compliance improves outcomes: A prospective cohort study (2015) *International Journal of Surgery* Pedziwiatr, Kisialeuski, Wierdak, Stanek, Natkaniec, Matlok, Major, Malczak, Budzynski	To analyze the course of implementation of the ERAS protocol into daily practice on the basis of adherence to the protocol	92	Single Center Cohort Study IV/Medium	The introduction of the ERAS protocol is a gradual process, and its compliance at the level of 80% or more requires at least 30 patients and the period of about 6 months.The average compliance with the protocol differed significantly between groups and was 65% in group 1, 83.9% in group 2 and 89.6% in group 3 ($p < 0.0001$). The median LOS in group 1 was 5 days; in group 2 was 5 days; in group 3 was 3 days. Statistically significant differences were found between the groups ($p = 0.014$). Readmission was necessary in a total of 9 patients (9.8%) (in 3, 4, and 2 patients in groups 1, 2 and 3 respectively). No significant differences between the groups were observed in this regard ($p = 0,5712$).	Particular emphasis in the initial stage should be put on continuous training of personnel of all specialties and continuous evaluation of the results. Using own observations and results, combined with other research studies and their presentation during regular multidisciplinary meetings can influence the attitudes of staff and accelerate the adoption of the changes.	Constant auditing and analysis of the results; meetings allowed for educational opportunities; frequent training; patient education and preparation; creation of a multidisciplinary ERAS team	Independent ERAS coordinator, ERAS nurse (other team members 5 surgeons, 2 anesthetists, 2 nurses, physiotherapist and a dietician)

Appendix H

ERAS Order-Set

Implementation of an Enhanced Recovery After Surgery Protocol for Orthopedic Total Joint Arthroplasties	
(Ortho / Clinic Lab)	
- NPO (Nothing to eat or drink by mouth): After Midnight before day of surgery	
- Labs: Coags, Chem10, T&S, CBC, UA (at least 2 weeks prior to procedure)	
- Hibiclens: (provide soap and instruction on use. Wash surgical extremity/area 1 day prior and the -morning of surgery).	
Preop (Day of Surgery)	
- Place IV (saline lock)	
- Lactate Ringers 1 Liter IV bolus x1: if patient receiving spinal anesthesia (exceptions ESRD, CHF)	
- Vancomycin 1gm IV	
- Celebrex 200mg PO	
- Oxycontin (10mg)	
- Tylenol 1 gm PO (IV Tylenol no longer given intraoperatively)	No longer give Ofimev 1g IV intraop d/t provider variable practices and cost. Instead, give preoperatively that meets multimodal pain control recommendations.
- Gabapentin 300mg PO	Recommendation for multimodal pain control / cont postop 300mg PO BID x5 days

- Thigh High TED hose and SCD to non- operative extremity	
- Adductor Canal Block for TKA - Anesthesia treatment	
IntraOp	
- Spinal Anesthetic	
- Ancef 1gm IV	
- Tranexamic Acid 1gm IV x2	
- Propofol infusion sedation	
- Zofran 4mg IV	
- Lactate Ringers	
- Forced Air warming	
Post Op	
- CBC POD 1/2/3	
- CHEM 7 POD 1	
- Patient is weight bearing as tolerated	
- Cryocuff to operative extremity	
- Knee Immobilized at night	
- Ambulate with PT within 2-6 hrs post op day 0 as permitted by patient stability	Early mobilization. Prolonged bed rest postoperatively is associated with increased risk of thromboembolism, pulmonary complications, insulin resistance, and delayed wound healing. Early mobilization and physical therapy are key elements of successful a ERAS protocol. Physical therapy is recommended on day 0 and as early as 2–6 hours postoperatively as permitted by patient stability.
- OOBTC with Assistance on night of surgery	
- When not in CPM Knee in Extension	
- CPM orders: start day of surgery	

- Overhead frame with trapeze	
- Raised toilet seat	
- Physical Therapy consults	
- Occupational Therapy consults	
- LR 1000ml rate 50ml and saline lock with tolerating PO fluids	
- Knee Xray AP and LAT	
- Hip Xray low AP and LAT	
- TED hose/SCD bilat lower extremity	
- Titrate Oxygen SaO2 > 92%	
- DC Foley Catheter x1 post op day 1	
- Incentive Spirometer q 1 hr while awake	
- Diet Regular	
- Gabapentin 300mg PO BID x 5 days	Recommended multimodal pain control modality
- Ancef 2gm IV q8 hrs x3	
- Vancomycin 1gm IV q12 hrs x2	
- Oxycodone PO	
- Hydrocodone PO	
- ASA 81mg PO	
- Lovenox 40mg SQ beginning am post op day	
- Xarelto 10mg PO	
- Celebrex 200mg PO	
- Zofran 4mg IV	
- Phenergan 25mg PO	
- Colace 100mg PO	
- Dulcolax 5mg PO	
- Senokot 2 tabs PO	
- Ambien 5mg PO	

Appendix I

Order-Set Evidence Table

Study	Year	Study Type	Surgery	LOS	Complications	30 Day	**PreOp Phase:** Teaching, Nutrition, Anasthetics & Analgesics, DVT	**IntraOp Phase:** Anesthesia Technique, Temp Control, Fluid Balance & Management	**PostOp Phase:** Opioid Sparing Analgesic
Auyong et al.	2015	RCT	TKA	↓	NE	No Change	TKA education class (for patients); Care companion; No preop fasting guidelines; No DVT guidelines	Spinal anesthesia (short acting: mepivacaine); fluid management: Goal 2L of Lactated Ringers [LR] for every patient; IV Tranexamic Acid (TXA): 1 gram prior to incision, 1 gram prior to closing	Preoperative transdermal scopolamine (pts <70 yrs) plus intraoperative 4mg dexamethasone; continuous adductor canal nerve block for 48 hours; Physical therapy on day of surgery; Analgesic technique: Scheduled acetaminophen, NSAIDs, gabapentin. Oxycodone prn
Christelis et al.	2015	RCT	TKA/THA	↓	NE	NE	Nurse coordinator counselling in the orthopaedic or preadmission clinic; Preadmission review by a physiotherapist and/or dietitian; clear liquids up to 2hr before surgery with preop oral carb load; No sedative premedication (benzodiazepines, opioids or neuroleptics); Pre-emptive analgesia with paracetamol and gabapentinoids	Spinal anaesthesia; Local anaesthesia technique (surgeon-delivered local infiltration of analgesia or anaesthetic femoral nerve block); Minimal (less or equal to 10 mg) intravenous morphine intraoperatively; limit IV fluid (knee > 1 L; hip > 2 L); Active intraoperative warming (forced air warming and/or warmed intravenous fluids)	Antiemetic prophylaxis; Multimodal oral analgesia for greater than or equal to 3 days postoperatively, to include a non-steroidal anti-inflammatory drug or cyclooxygenase-2 inhibitor; oral carbohydrate supplementation in recovery room; ambulation within 24 hours; discharge in 5 days or less
Den Hertog et al.	2012	RCT	TKA	↓	NE	NE	Interventions not listed	Spinal analgesia with bupivacaine 0.5 %	Patient-controlled epidural analgesia with a solution of ropivacaine 0.15 %, fentanyl 0.1 %, and clonidine 0.02 % in NaCl for 48 h postoperatively; mobilization starting day of surgery
Kaye et al.	2019	Review Article	TKA/THA	NE	↓	↓	- Preop evaluation with surgical teams and anesthesia teams separately. - Patient participate in preoperative classes that address commonly asked questions and inform patient of the procedure. - Nutrition: ERAS recommends a carbohydrate load via a clear carbohydrate reach drink 2-3 hours before surgery. (decreases insulin resistance, reduced thirst, reduced hunger and decreased anxiety) - Preoperative anesthetics and analgesics: Multimodal approach to pain preoperatively – NSAIDS, acetaminophen, preoperative bupivacaine, adenosine, magnesium clonidine, and venlafaxine.	- Anesthesia Technique: Neuraxial anesthesia has always been preferred and considered superior to general anesthesia in ERAS protocols (associated with reduced hospital length of stay). Local infiltration analgesia more useful used in total knee arthroplasty (6-12 hrs postoperative pain relief) - Maintaining Normothermia: reduces infections, coagulopathy, blood transfusion rate and CV complications. - Optimal intraoperative fluid balance: Correction of any existing anemia preoperatively (iron or erythropoietin), hypotensive anesthesia technique to minimize blood loss, Blood salvage technique, Tranexamic acid - Perioperative fluid management: goal directed fluid replacement therapy result in less post-operative infection, organ dysfunction and transfusion requirements. Intravenous fluids should be discontinued as soon as patient can take in enough fluids by mouth.	- Multimodal opioid-sparing analgesic techniques: Epidural analgesia (continuous or patient controlled), peripheral nerve blocks (single injection or continuous), acetaminophen, NSAIDS, gabapentin, and ketamine all serve purpose. - Prevention of post-operative nausea and vomiting: best way to prevent is avoid general anesthesia and opioids all together. Dexamethasone or Zofran helps decrease. - Early mobilization. Prolonged bed rest postoperatively is associated with increased risk of thromboembolism, pulmonary complications, insulin resistance, and delayed wound healing. Early mobilization and physical therapy are key elements of successful a ERAS protocol. A detailed assessment preoperatively to identify the patient's expectations and the goals of rehabilitation is important. Physical therapy is recommended on day 0 and as early as 2–6 hours postoperatively as permitted by patient stability. - Prophylaxis against thromboembolism: unfractionated and low molecular weight heparin.
Khan et al.	2014	Retrospective Study	TKA/THA	↓	↓	↓	Patient and staff education on Enhanced Recovery principles	Anesthesia: low-dose spinal w/o any opioids with propofol +/- ketamine, and paracetamol +/- Parecoxib; TXA 15mg/kg as a slow bolus at induction; intraop infiltration of LA; judicious intraop fluid and vasopressor administration; catheters only if indicated; Surgery: epidural catheter (w/microbiological filter) placed during wound closure within joint/tunneled to exit away from wound site (dosing: levobupivicaine 20mL upon wound closure f/b 3 postop boluses at 8h/14h/24h via ambit pump delivery)	Post op: TXA; same day mobilization; Gabapentin 300mg BID x 5 days, oxycontin 5-20mg BID x2days, Tramadol 50-100mg q4-6h
Maempel et al.	2016	Cohort study	THA	↓	↓	NE	PT eval'd individual pt in preop clinic (sets pt expectations for mobilization on DOS & DC on POD3 and ID't specific pt circum). Shown how to use crutches. Given Leaflet about exercises, wound care and freq askes questions. OT eval'd for any additional home equip needs. Hgb <12 referred back to PCM for investigation or optimization and surgery delayed.	Spinal Anesthetic primary anesthetic unless failed or CI: Ceftriaxone 1gm IV x1. Peri-articular injection of 4 mg morphine, 20 ml of 0.5% bupivacaine with adrenaline (1:200 000) and 30 mg of Ketorolac made up to 50 ml volume using normal saline.	Mobilized on DOS. No patients used PCA. Pain controlled with tylenol, oxycontin. Importance of early mobilization, effective pain relief and awareness of potential impediments to mobilization pressed upon ward staff. Post-operative exercises remained unchanged and consisted of supine active hip flexion, extension and abduction on a low friction sliding board, inner range quadriceps exercises over a block, and toe and ankle pumps. Standing exercises with active hip flexion, extension and abduction. PT's dic when pain was sufficiently controlled & could mobilize independently with crutches or better, exit and enter their bed and a chair, climb stairs independently and wound dry.
Malviya et al.	2011	Observational	TKA/THA	↓	↓	↓	Information DVD is provided to every patient at the time of booking for surgery. Gabapentin (300 mg) on the night before surgery (to continue twice daily for 5 days).	- Perioperative urinary catheterization—as per clinical indication. Low-dose spinal anesthesia: - 2–3 mL of 0.25% Bupivacaine (plain) or 2 mL of 0.5% Bupivacaine (heavy). - No intrathecal opioids. - Propofol intravenous infusion (0–2.5 μg/mL) ± Ketamine (0.5 mg/kg, slow intravenous bolus). Tylenol (1 g intravenously). - Judicious intraoperative fluid and vasopressor administration. - Tranexamic acid (15 mg/kg—slow intravenous bolus at induction; withheld in cases of thromboembolic event in the last 6 months). Intraoperative infiltration of 80 mL 0.125% levobupivicaine using a standardized technique ensures wide-field infiltration to include joint capsule, muscles, fat, and skin. During closure, an epidural catheter is placed within the joint to exit away from the surgical field, through which a further 20 mL of levobupivicaine is infiltrated after closure. A microbiological filter is attached and this catheter is used to infuse 3 postoperative boluses of levobupivicaine 4–6 h postoperatively, again after a further 6-to 8-h interval, and lastly on the morning of day 1, before removal of the catheter.	Knee replacements received a single wool and crepe bandage and a Cryo-Cuff applied in recovery area (enhances & prolongs analgesia. Early postoperative mobilization started within the first 3–5 h, aiming at discharge to home once the patient was independently mobile with the help of appropriate walking aids and the standard unchanged hospital discharge criteria had been met. Postoperative analgesia included gabapentin (300 mg BID for 5 days) and oxycontin (5–20 mg twice daily for 2 days) followed by tramadol (50–100 mg every 4–6 h). Post discharge pain treatment was similar for both groups, with Tylenol, NSAIDs, and weak opioids only. The postoperative boluses of levobupivacaine consisted of 20 mL levobupivacaine (1.25 mg/mL) for total hip replacement and 40 mL levobupivacaine (1.25 mg/mL) for total knee replacement. The larger volume used for knee replacement was based upon the larger intraarticular space in the knee compared to the hip.

McDonald et al.	2012	RCT	TKA	↓	↓	NE	Oral pre-medication (2 h before surgery) 10– 20 mg Restoril 10 mg Dexamethasone 300 mg Gabapentin 1 g Tylenol	Spinal anaesthesia: 2.75–3.2 ml heavy or plain Bupivacaine (no intrathecal opioids) 2.5 g Tranexamic acid 1.5 g Ceruroxime 200ml intra-articular ropivacaine (0.2%)	300 mg Gabapentin twice daily for 5 days 1 g Tylenol 4 times daily 400 mg Ibuprofen 3 times daily 10 mg Oxycontin® 12 hourly for 3 doses 5– 10 mg Oxynorm® 2–4 hourly as required Three boluses doses of 40 ml Ropivacaine (0.2%) each via intra articular catheter at 4 h post surgery, 2300 and 0800 the following morning. Intra articular catheter then removed. Patients walking DOS accelerate rehabilitation allowing for early hospital discharge & reducing peri-operative morbidity.
Soffin & YaDeau	2016	Review Article	TKA/THA	↓	NE	NE	**Preoperative education** contributes to higher patient confidence, greater patient satisfaction, and early recovery and discharge. It is essential that a preoperative education programme should establish achievable goals for postoperative oral intake, analgesia, physical therapy, and mobilization. Watching a series of presurgery educational videos on YouTube was associated with significant improvement in generalized anxiety scores, particularly inpatients with high preoperative anxiety. Enhanced recovery after surgery consensus guidelines now permit **intake of clear fluids until 2h before induction of anaesthesia and a 6h fast for solid foods**. Enhanced recovery after surgery consensus guidelines now permit intake of clear fluids until 2h before induction of anaesthesia and a 6h fast for solid foods. The safety of a 2 h-clear/6 h-solids fast is also upheld in obese and morbidly obese cohorts and in patients with uncomplicated diabetes mellitus. A more conservative fast is recommended for diabetic patients with gastroparesis. In addition to liberalized fasting guidelines, ERAS protocols **recommend that patients consume up to 300 ml of a clear carbohydrate-rich drink 2–3h before surgery**, with the goal of presenting the patient for surgery in a metabolically 'fed' state. **Antimicorbial prophylaxis,** the Agency for Healthcare Research and Quality recommended regimen for patients undergoing primary hip and knee arthroplasty is cefazolin. Clindamycin and vancomycin should be reserved as alternative agents, if there is a cephalosporin allergy or surveillance data indicating causative organisms. Intranasal mupirocin is recommended for all patients with documented S. aureus colonization.	**Regional anaesthesia** is the optimal ERAS technique for hip and knee replacement. Reduced length of hospital stay is otherwise consistently associated with the use of a neuraxial compared with a general anaesthetic. **Postoperative nausea and vomiting (PONV)** can be more distressing than pain Risk factors include female sex, nonsmoking status, a history of motion sickness or previous PONV, and predicted requirement for postoperative opioids. The best way to manage PONV is probably to avoid general anaesthesia and to minimize opioids, as discussed elsewhere in this review. Based on the criteria of Apfel and colleagues patients at moderate risk of PONV (i.e. two risk factors) should receive prophylaxis with dexamethasone at induction or a serotonin receptor antagonist at the end of surgery. High-risk individuals (three or more factors) should receive both dexamethasone at the beginning of surgery and a serotonin receptor antagonist at the end of surgery. **Normothermia** should be targeted as part of the anaesthetic care of the joint arthroplasty patient. Maintaining perioperative normothermia with forced-air heating has been firmly established to reduce infection, cardiac complications, coagulopathy, and transfusion requirements. Aggressive warming reduced intraoperative blood loss during total hip arthroplasty and was associated with reduced opioid need and greater satisfaction after total knee arthroplasty. Active intraoperative warming before tourniquet deflation prevented subsequent hypothermia in elderly patients undergoing primary knee replacement under general anaesthesia. Prewarming the operating room before total hip or knee replacement seems to be a less effective strategy and did not prevent intraoperative hypothermia in hip or knee replacement. **Intravenous Fluid Therapy** is Goal-directed fluid therapy (GDFT) is a prominent component of ERAS protocols in multiple surgical specialties. However, in contrast to colorectal surgery, GDFT might be less important for elective joint replacement. Blood and fluid losses are likely to be low, and the chance of early oral intake likely to be high. Thus, intraoperative fluid regimens can be more restrictive for hip or knee replacement. (Unlike other surgical subspecialties, in elective joint replacement the role, type, and volume of i.v. fluids have not been investigated. The effects of i.v. fluid on postsurgical outcomes are likewise unknown). **Blood Conservation** antifibrinolytic tranexamic acid—have supplanted cell salvage techniques in recent years with multiple publications demonstrating both clinical and cost efficacy in hip, knee and bilateral total knee arthroplasty. Tranexamic acid reduces blood loss and the risk of transfusion irrespective of the route of administration (i.v. or topical). The benefits afforded by tranexamic acid are achieved without significant increase in side-effects, including DVT, PE, stroke, myocardial infarction, or seizure.	There is good evidence that **early mobilization** facilitates recovery after hip and knee arthroplasty. A recent meta-analysis shows a significant reduction in length of stay (by 1.8 days) when patients ambulatewithin 24 h of surgery. Early mobilization after knee arthroplasty is also associated with improved functional recovery and lower incidence of DVT. **Venous thromboemblolism prophylaxis**
Stambough et al.	2015	RCT	THA	↓	NE	NE	Mandatory classes, meeting with anesthesia provider, and comprehensive pamphlet to set expectations	Anesthesia: Patient specific spinal dosing and scheduled anti-emetic; Pain: intraop IV ketorolac, Acetaminophen, elimination of preop oral narcotics	OOB and ambulate on POD#0 coordinated with PT, OT and RN; charge RN overseeing patient care delivery and immediately sets expectation for patient upon arrival to unit
Stowers et al.	2016	Cohort study	TKA/THA	↓	↓	↓	This article did not delinate specific ERAS perioperative interventions.		

Appendix J

Order-Set Synthesis Table

Source	Length of Stay	Post-op Complications	30 day readmissions
Auyong et al.	Decreased	Decreased	Decreased
Christelis et al.	Decreased	Decreased	Decreased
Den Hertog et al.	Decreased	Decreased	
Maempel et al.	Decreased	Decreased	
Malviya et al.	Decreased	Decreased	Decreased
McDonald et al.	Decreased	Decreased	
Scott et al.	No Change		
Stambough et al.	Decreased		
Stowers et al.	Decreased	Decreased	Decreased
Talboys et al.	Increased		

Appendix K

DNP Project Completion Verification Form

Appendix G: Daniel K. Inouye Graduate School of Nursing
DNP Project Completion Verification Form

DOCTOR OF NURSING PRACTICE PROJECT
Completion Verification Form

The DNP Project titled: Implementation of an Enhanced Recovery After Surgery Protocol for Orthopedic Total Joint Arthroplasties was completed at David Grant Medical Center, Travis Air Force Base, CA by the following student(s):

(type student name)	*(signature)*	*(date)*
Maj Lorren Anderson	[redacted]	25 Mar 2020
Maj Kyle Crissman		25 Mar 2020
Capt Melissa Haines		25 Mar 2020

The DNP Practice Project Team verifies that the following components of the DNP project, accomplished by the above students, is of sufficient rigor and demonstrates doctoral level scholarship to meet the requirements for USUHS GSN graduation:

- Presentation of DNP project to the leadership/stakeholders at the Phase II Site,
- Abstract/Impact Statement (*Appendix F*), and
- DNP Project written report.

Verified by:

(type name)	*(signature)*	*(date)*	
Lt Col Adeleke Oyemade	[redacted]	25 Mar 2020	Senior Mentor & Phase II Site Director
Maj Julie Petsche		25 Mar 2020	Senior Mentor & Phase II Site Director

For RNA Students only *- add the following additional signature for final verification of project completion:*

CDR Ken Radford, PhD, CRNA	[redacted]	
RNA Project Director *(type name)*	*(Signature)*	*(Date)*

Form Version: 26 Aug 2017