Implementation of Enhanced Recovery After Surgery in a Community Hospital: An Evidence-Based Approach

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Purpose: *Enhanced recovery after surgery (ERAS) is an evidence-based practice protocol that has been shown to reduce cost, decrease length of stay (LOS), and improve surgical outcomes.*
Design: *An evidence-based practice improvement project with a multidisciplinary team translated the ERAS protocol into practice at a community hospital. The evidence-based practice improvement design allows integration of evidence into projects to improve clinical outcomes for patients.*
Methods: *Small tests of change using the Plan-Act-Study-Do methodology were used to evaluate the process of implementing one surgical service at a time to ensure effective outcomes. After the process was determined to be effective, patient outcomes (eg, LOS) were measured.*
Findings: *On average, LOS was decreased from 3.2 to 1.7 days. Surgical readmission rate decreased from 3% to 1%. There has been positive feedback and nursing workload has decreased with consistent processes.*
Conclusions: *The ERAS order set continues to be modified based on the evidence and feedback from anesthesia and registered nurses. Monthly reports ensure consistency.*

Keywords: *enhanced recovery after surgery, preoperative and postoperative care, postanesthesia recovery, robotic surgery, laparoscopy.*

TRADITIONAL PREOPERATIVE and postoperative care includes nothing by mouth after midnight, opioid pain medication, and bed rest until discharge from the postanesthesia care unit (PACU). Before this evidence-based practice (EBP) project, these traditions defined practice at our community hospital. Enhanced recovery after surgery (ERAS) is a new evidence-based standard of care that embraces technology and surgical advancements to refocus many surgical procedures including colorectal to an ambulatory setting and decrease inpatient length of stay (LOS).[1] In addition, ERAS has demonstrated improvement in patients' experiences during the recovery process

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through improving pain management, postoperative nausea and vomiting (PONV), and mobility (Fig 1).[2]

Before this project, our hospital's average LOS for postoperative patients was 3.2 days providing an opportunity for improvement through an EBP project.[3] An anesthesiologist and colorectal surgeon were interested in evaluating the ERAS protocol for laparoscopic and robotic colorectal cases. Because the ERAS protocol fundamentally changes preoperative and postoperative care, its implementation involved not only the operating room (OR) procedure but also changes in the administration of anesthesia, preoperative education, PACU practices, and analgesia medication options. A multidisciplinary team was needed for a successful culture change for the preoperative and postoperative care processes. Therefore, this team was formed to coordinate an EBP improvement project to review the ERAS protocol, discuss implementation strategies, and evaluate how we could improve our patients' LOS and surgical experience.

Literature Review

The nurse educator led the multidisciplinary team through an evidence search of electronic databases (eg, PubMEd and SCOPUS) to address the purpose of our project. Because we identified that the ERAS protocol was to be our EBP intervention, the search terms "enhanced recovery after surgery," "ERAS," "preoperative care," "perioperative care," "postoperative care," and "post anesthesia recovery" were used for the search. Limits included English language and the previous 10 years. As there were multiple articles identified in the initial search we focused our search on retrieving systematic reviews or clinical practice guidelines to identify the highest level of evidence to support the project. We identified a meta-analysis,[4] the clinical practice guidelines from the ERAS society,[1,5] and multiple research articles supporting the implementation of the ERAS protocol in colorectal surgery and its positive effect on patient outcomes.[3,5-9]

The ERAS protocol is internationally used to manage colorectal, gynecologic, thoracic, and other complex surgeries.[10] Developed by the nonprofit ERAS society, the protocol provides an EBP perioperative care pathway with recommendations for patient care during the preoperative, intraoperative, and postoperative phases.[1] A key component of the protocol is interventions designed to reduce the patient's surgical stress response. Surgical stress is the activation of the sympathetic nervous system in response to the injury caused by the surgery.[11] Although surgical stress is an adaptive response, if the patient does not receive optimal physiological support, recovery can be delayed because of the catabolic state and insulin resistance that characterize the response.[12] In addition, the traditional practice of fasting overnight inhibits insulin secretion and promotes the release of glucagon and cortisol.[7] In a patient with a pre-existing metabolic comorbidity (eg, diabetes), overnight fasting can significantly challenge homeostasis and add to an

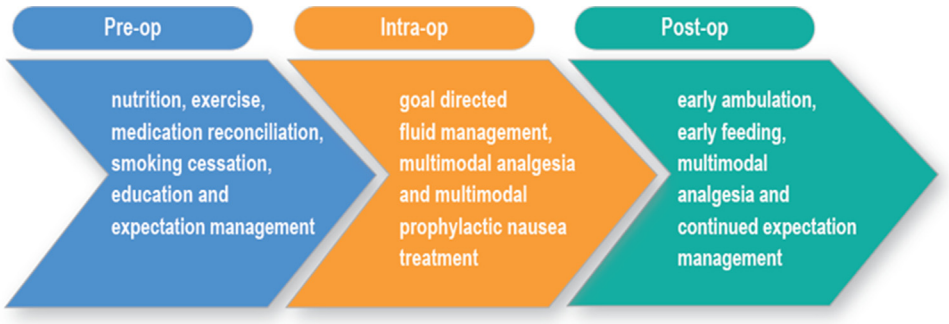

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Figure 1. ERAS protocol. ERAS, enhanced recovery after surgery; Intra-op, intraoperative; Post-op, postoperative; Pre-op, preoperative.Used with permission from MEDNAX Health Solutions Partner. This image is available in color online at www.jopan.org.

increase in catabolism and insulin resistance.[13] An optimal nutrition state is an important precondition to provide successful postoperative outcomes through providing metabolic support to decrease the surgical stress response. Preoperative carbohydrate loading increases insulin levels, which in turn can reduce postoperative insulin resistance, maintain glycogen reserves, decrease protein breakdown, and decreases the catabolic response.[14] The ERAS protocol limits the surgical stress response through a multimodal approach to preoperative, intraoperative, and postoperative management.

Preoperative Management

The preoperative components of the ERAS protocol involve evaluation and optimization of the patient's nutrition. Key components of this optimization include minimizing preoperative fasting and patient and family education about the protocol. Carbohydrate loading is associated with a slightly earlier return of intestinal function and a decreased catabolic state.[1] The patient should carbohydrate load the night before surgery and 2 to 3 hours before anesthesia with a nutrition supplement of complex carbohydrates.[7] In addition, two systematic reviews identify that allowing patients to drink fluids 2 to 3 hours preoperatively does not increase the risk of regurgitation or aspiration compared with the traditional practice of nothing by mouth after midnight.[15,16] Decreased fasting time also appears to prevent complications, decrease the chance of postoperative infections, and promote recovery.[17]

Patient and family education is essential to optimize nutrition and support adherence to the ERAS protocol. Nothing by mouth after midnight is a well-established tradition that patients and families have come to expect as part of preparing for surgery. Without clear explanations of why it is acceptable to drink fluids up to 2 hours before surgery there may be confusion between current and previous education.[18] Preoperative education includes explanations of why carbohydrate loading of fluids up to 2 hours before surgery is the key to maintaining the patient's hydration balance. The whole team needs to provide consistent messages about what types of fluids can be ingested and the timing of those prescribed fluids.[7] Exercise for a few weeks preoperatively is important to prepare them to improve their postoperative recovery. Smoking and alcohol consumption should be stopped 4 weeks before surgery to improve outcomes.[1] A healthy, well-hydrated, and well-informed patient is the goal.

Intraoperative Management

The intraoperative component of the ERAS protocol focuses on perioperative management of anesthesia, analgesia, goal-directed fluid therapy, and minimally invasive techniques. Intraoperative anesthetic agents consist of short acting inhalation and intravenous (IV) fluids to minimize postoperative recovery time. A neuromuscular tap block is done in the abdominal region to aide with the pain control postoperatively.[1] A tap block is a peripheral nerve block that anesthetizes the nerves supplying the anterior abdominal wall.[19] The use of tap block supports early mobilization because pain is better controlled and the patient retains sensation and mobility in the lower extremities. A decision was made by the Chief of Anesthesiology to add to the ERAS protocol by irrigating the surgical wound with bupivacaine liposome at the conclusion of the case to provide local anesthetic for 24 to 96 hours of pain relief.

Traditionally, IV fluids have been used without specific clinical parameters to determine the appropriate amount of fluid required, which resulted in wide variations in fluid administration. The ERAS protocol standardizes administration with goal-directed boluses of IV solutions to maintain a near-zero fluid balance. Fluid is administered using changes in stroke volume to optimize the patient on the Frank–Starling curve.[7] One method to determine the amount of fluid needed to optimally manage the intraoperative care is a noninvasive fluid monitor. The noninvasive fluid monitor provides hemodynamic parameters to make informed decisions regarding volume administration.[1] This allows administration of fewer fluids during the procedure while maintaining a euvolemic state. Objective clinical data (eg, stroke volume, stroke volume variation, cardiac output, systemic vascular resistance, and continuous blood pressure) are provided by the noninvasive fluid monitor.

Postoperative Management

The postoperative elements of the ERAS protocol are build on the optimized preoperative and intraoperative care. Successful implementation of the preoperative and intraoperative elements of the ERAS protocol enables the patient to mobilize and eat on the day of surgery, improving recovery.[1,5] The key components of the postoperative ERAS protocol are preoperative evaluation to prevent PONV and ileus, encourage early nutrition, and early ambulation. At our institution, anesthesia completes PONV risk assessment to determine prophylaxis. Postoperative LOS also decreases with compliance from the protocol. Postoperatively, fluids are administered through goal-directed therapy, with close monitoring of the patient's hydration status to achieve optimal fluid balance. In general, postoperative patients only require IV fluids be administered at 40 mL/h until tolerating 600 mL by mouth.

Postoperative administration of nonopioid analgesia provides improved pain control without the adverse effects of opioid medications.[7] In addition, nonpharmacologic interventions are encouraged for patient comfort. Interventions that decrease pain include warm blankets on the abdomen, sitting up at the side of the bed before ambulation, music with low tones, and distraction. Excellent patient-centered nursing care in the PACU is essential to support nonpharmacologic interventions' effectiveness. The method of anesthesia, the tap block, also decreases postoperative pain. The tap block typically has a lasting local anesthesia effect of approximately 96 hours. Other analgesia focused medications for the ERAS protocol are gabapentin, tramadol, acetaminophen, and ketorolac tromethamine administered around the clock for the first 24 hours postoperatively along with ondansetron for PONV prevention. This approach provides comprehensive comfort measures to enhance recovery.[1,5,7] Opioid analgesics (eg, oxycodone hydrochloride and hydromorphone) are also available for a pain score greater than 7 on a 0 to 10 numeric scale, however are not administered until the other comfort measures have been unsuccessful.

The third key component, ambulation, begins in the PACU. Using a standardized ambulation assessment as soon as the patient arrives in the PACU provides consistency and increases patient safety.[20] After conducting an evaluation of the available mobility assessments, the Banner Mobility Assessment tool (BMAT) was chosen because of its ease of administration and easy integration into the PACU routine.[21] The BMAT is a four level assessment that identifies a patient's ability to come to a sitting position, rise to a standing position, and safely move legs for walking.

Methods

At our hospital, we use the evidence-based practice improvement (EBPI) model developed by Levin et al[23] as our method of EBP to improve clinical outcomes for the patients served. The EBPI model combines the best of the EBP and performance improvement paradigms. The EBPI model gives direction to our methods for implementing the EBP change. Through small tests of change (STC) using Plan-Do-Study-Act cycles[22] we evaluate each aspect of a proposed improvement before a large pilot or organization wide implementation. The EBPI model allows for process refinement, particularly paying attention to system issues, or educational enhancements that need to be addressed before the implementation of full project.[23] After the team reviewed the evidence, a gap analysis was performed to identify areas where our current practice was not consistent with the ERAS protocol. On the basis of the gap analysis, the team developed an implementation plan to develop procedures, internal protocols, and education to implement the ERAS protocol to the units involved in colorectal surgical procedures.

Implementation

STAKEHOLDER EDUCATION. The first step for successful implementation was to identify and educate the stakeholders about the importance of the ERAS protocol. The key stakeholders identified for project success included the nursing staff from the ambulatory surgery unit (ASU), OR, PACU, and surgical inpatient unit, unlicensed assistive personnel, physical therapy, hospitalists, anesthesia, nursing leadership, pharmacy, nurse educators, and the informatics team. One colorectal surgeon was the champion for implementing the ERAS protocol and proved essential in educating and communicating with other

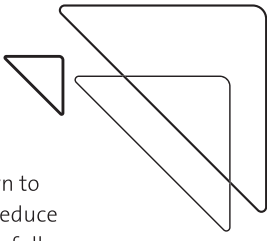
surgeons and anesthesia providers, whose engagement was essential for success. Nursing leadership (eg, Unit Managers) support not only for the education but also for planning the implementation process facilitated staff training and adherence to the protocol. The stakeholder education used STC with real-time debriefing and refinement. STC allows for evaluation of each implementation step for maximum efficiency and effectiveness, and incorporates stakeholder feedback. This facilitated the development and success of the ERAS protocol implementation.

The ERAS protocol education consisted of small group sessions offered on all shifts for 100% of the staff on the units involved with care of the colorectal patients. A PowerPoint reviewed the key components of the protocol, how the ERAS was different than our traditional practice, and included screenshots of the electronic medical record. Because adherence to the protocol is essential for success[9] we focused on maximal buy-in with key stakeholders focusing on better patient outcomes with ERAS. In addition, contact hours were provided for attending the education sessions. When the staff had concerns about the protocol, every effort was made to address their concerns with evidence. For example, in the ERAS protocol patients may drink up to 2 hours before surgery. Although allowing drinking is a positive patient-centered intervention, there was concern about PONV and aspiration based on traditional knowledge. On the basis of the stakeholder concerns, the current evidence[16,19] related to nothing by mouth status was added to the protocol education to support stakeholder acceptance for the change in nothing by mouth status.

A champion model was decided on as a resource for staff questions about the ERAS protocol and implementation process. Each unit identified at least two nurses to be ERAS champions on both the day and night shifts. The champions were the "super users" of the ERAS protocol and served as the unit expert to answer clinical questions. The champions were also used to help disseminate updates in the protocol and implementation process to unit staff. The staff nurse champions were mentored by an expert nurse educator. The educational rollout was started in the ASU, PACU, and the inpatient surgical unit. During education sessions, the ASU identified that separate sessions were needed for the preadmission testing (PAT) nurses who call the patients 1 to 2 days before surgery for assessment, education, and scheduling. The feedback from the staff drove this specific education session and established that team feedback would be used to improve the process. This feedback also informed our education of all the nursing staff. Although providing the evidence to support the implementation of the protocol, the key components that were priorities in a specific practice area were emphasized. For example, the changes in multimodal pain management were shared by the PACU and inpatient unit nurses, but the inpatient nurses needed to also focus on encouraging the patient to eat on the same day of surgery.

During the education with the PAT nurses, they identified that a patient teaching handout was needed to not only guide their discussion but also to be provided to the patient before their call. As a result, preoperative teaching sheet for the surgeons' office was developed to provide to the patients at the preoperative visit (Fig 2). The nurse educator developed the tool with input from the surgeons, anesthesiology, and the recommendations from the ERAS Society. The anesthesia coordinator is responsible for distribution among all the surgeons and anesthesia offices to ensure the team is congruent in providing education for the best outcomes of the program. The teaching sheet has important speaking points for what the patient needs to do to prepare for surgery as an ERAS candidate and other key preoperative education. Smoking cessation was incorporated into the tool to decrease the risk of complications postoperatively. The patient's daily medications must also be reviewed with the surgeon before surgery to determine which ones may need to be stopped and in what time frame before surgery, so this point was added in the tool. The educational tool has since evolved when brought to other service lines as the program has grown.

In addition to educating the OR nurses about the ERAS protocol, the anesthesia clinicians required training on new methods of intraoperative management of sedation and pain control. The patient will receive a preoperative anesthetic tap block in the holding area before going into the OR for the surgical procedure.



Enhanced Recovery After Surgery (Colorectal)

Preparation in advance of your surgical procedure has been shown to improve outcomes. In an effort to optimize your procedure and reduce you period of disability please read the following instructions carefully.

Exercise

- Improving your exercise tolerance in the weeks preceding your procedure will improve your recovery. Something as simple as walking or riding a bike will do the job. Your goal should be a 10% increase per day.
- If you have received an incentive spirometer please begin using it at least 1 week before surgery. 20 repetitions 2-3 times per day is the goal.

Nutrition

- A nutritional supplement for 5-7 days before surgery can help reduce your risk of postoperative infectious complications. Nestle's Impact Advance Recovery is an excellent choice. 8 oz 2-3 x per day (available on Amazon).
- There is no limit to the amount of clear fluids you can drink the day before your procedure. Fluids high in carbohydrates are preferable. **Remember to drink at lease 16 oz just prior to leaving for the hospital the day of your procedure** (Gatorade,apple juice, orange juice without pulp).

Smoking

- Smoking cessation is critical to reducing pulmonary complications.

Medications

- Discontinue all NSAIDs 1 week prior to your procedure (Ibuprofen, Advil, Motrin, Aleve, Naprosyn, aspirin).
- Review your medications with your primary care physician at your preop visit.

Call your surgeon with any questions.

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Figure 2. Preoperative teaching sheet. NSAID, nonsteroidal anti-inflammatory drug.

As each education session was completed, the clinicians identified additional questions with the team keeping a running list of the questions. The questions were about key ERAS interventions (eg, the change in nothing by mouth) and processes (eg, ambulation in the PACU). After the team discussed the questions and identified answers, this information was sent to the unit champions and subsequently disseminated to the clinical staff. In addition, reference binders were made for all units to use as the program was implemented. The binders were updated with each STC as needed to ensure consistent practice.

ERAS PROTOCOL PROCESS SUPPORT. A key component of a successful EBP project implementation is building in processes to support the protocol. Attention to these processes helps ensure that caregivers have the supplies and support they needed to implement the protocol effectively and consistently. To ensure effective implementation, the ERAS protocol was rolled out as an STC with one surgeon and one patient to start on day 1. The ERAS champions on all the involved units were assigned to work that day and were scheduled to care for the patient. The nurse educator followed the patient through the units, to be a

resource to the staff, to answer questions, and identify process issues that might not have been identified in our implementation plan. One of the process issues identified with the first patient was the lack of one of the multimodal pain medications (ie, gabapentin) stocked in the PACU medication dispensary machine. The nurse educator and unit champion identified the unavailability of the medication, which resulted in the patient not receiving the medication at the appropriate time. The issue was escalated and addressed in real time, and when the medication was late, the process issue was addressed. These issues led to an assessment of all the medication dispensary machines to ensure that the ERAS prescribed medications were available.

As discussed previously, a key component of the ERAS protocol is the oral carbohydrate loading up to 2 hours before surgery. If the patient's surgical time was delayed we needed to make sure a supply of a complex carbohydrate beverage was available, and that the nurses in PAT and ASU and the patient support staff understood that patients could continue to ingest fluids before surgery to maintain ERAS protocol. Another preoperative process that needed support was educating the surgeons' office staff about the ERAS protocol, distribution of the ERAS teaching tool, and how to book the OR case of an ERAS patient. The office staff and hospital schedulers needed to know how to label the case on the OR booking sheet as an ERAS case. In addition, the communication handoff from the ASU to OR to PACU to the inpatient unit needed to be established.

Intraoperative support processes for goal-directed fluid management were needed. A noninvasive fluid monitor was purchased to measure the patient's fluid volume status during surgery. This piece of equipment was purchased after discussion of the management process and identified as essential for effective implementation of the ERAS protocol's fluid management guidelines. After the purchase, the anesthesia staff received education of how to use the equipment.

In the PACU, pain management is a priority and the goal in our PACU was to maintain pain at a score of 0 to 2 on a 0 to 10 scale. Opioids were the primary method of pain management and the PACU nurses prided themselves on effective pain management. Although the ERAS does effectively manage patient pain, the goal is comfort not complete elimination of postoperative pain, therefore the PACU nurses needed support to reframe their approach to pain management to incorporate multimodal interventions.

A key component of the ERAS protocol is early mobilization. This intervention proposed a significant challenge for our team. As a result, the team needed to develop a method to assess our patients' ability to ambulate and support early and safe ambulation. An additional literature search was initiated to find a PACU specific tool, but with feedback from the unit champions the mobility assessment used on the inpatient floors was suggested. The BMAT is part of our inpatient fall prevention program, and it incorporates safe patient handling equipment into the level of mobility that assessed for each patient. Using the same assessment tool in the PACU allowed for standardization of the mobility assessment and provided consistent language for the PACU nursing staff to use during handoffs to the floor nurses. The BMAT identifies safe patient handling equipment, therefore this equipment needed to be purchased to safely mobilize the patients if needed. The previous PACU unit had certain limitations because of space in the PACU bays that limited the ability of the registered nurses (RNs) to get the patients up to stand and ambulate. The new PACU, which opened during the launch of this program, had much more space to make it feasible to ambulate the patients safely. As part of the patient-centered philosophy family members are encouraged to visit the patient in the PACU to provide additional support to lessen anxiety.

Daily rounding on the ERAS patients by the nurse educators on both the day and night shifts was imperative to ensure the sustainability of the program until it became second nature to the bedside clinicians. The rounds focused on the patient's status, the nurses' questions about the protocol, and enthusiastic acknowledgment for consistent practice following the protocol. By continuous rounding and having a good pulse on what was going on made it a seamless transition into practice. This also helped support the staff in understanding

the program and the importance in following the developed protocol. Currently, there are four service lines, colorectal, gynecologic, orthopaedic, and breast, involved in ERAS program with 17 surgeons following the protocol for correctly identified patients.

IMPLEMENTATION TIMELINE. A planned implementation process over 18 months supported a successful rollout. Starting with team development and meetings in January 2016, protocol and infrastructure development (eg, meeting with the first surgeon to build the order set and building the documentation in the electronic medical record) led to the initial education roll out in February 2016. The program was started with one colorectal surgeon and one patient in the first week of March 2016. Using the EBPI STC model, we deliberately planned to implement the protocol one patient and one surgeon at a time to evaluate the process before adding additional colorectal surgeons and patients (Fig 3). The program was expanded to include three more surgeons after the first month and successful process evaluation. Re-education via emails to the ERAS champions and educator rounding supported the addition of one surgeon from the gynecologic service line in July 2016. We again deliberately started with one patient and one surgeon from a new service to ensure the ERAS process was successfully followed in the new patient population (gynecologic). Seeing the success of the implementation, five more surgeons began to use the ERAS protocol shortly thereafter. As the team communicated the successful results more service lines began to use the protocol. The education process was repeated using the ERAS champions and nurse educator rounding as orthopaedics added the protocol in November 2016 and a breast reconstructive surgeon in May 2017. With each additional service line, the champions and nurse educator rounding ensured the outcomes and sustainability of the program were maintained by adhering to the protocol.

Results

The positive results of the ERAS protocol implementation include a decrease in average LOS for colorectal surgery patients from 3.2 to 1.7 days. For all procedures on the ERAS protocol, the average LOS has decreased from 3 to 2 days (Fig 3). In addition, the staff identify that the ERAS protocol provides consistent care and predictability in patient management. The nurses report an increased sense of control over their patient care procedures and feel confident that they are providing the highest quality of pain management for their patients. The ERAS protocol also has a positive financial impact with a decrease in the cost of surgical care of 1.3 million dollars. The surgical readmission rate has also decreased from 3% for patients not on the ERAS protocol to 1% for patients on the ERAS protocol.

Sustainability

The interprofessional team continues to meet and the champions monitor the implementation of the protocol. The focus on effective and efficient process has resulted in a team of professional who support consistent EBP to improve surgical patient

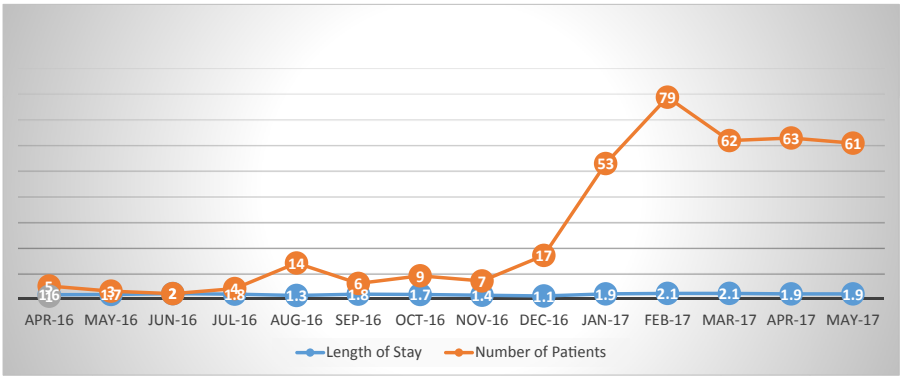

Figure 3. ERAS length of stay and patient volume. ERAS, enhanced recovery after surgery. This image is available in color online at www.jopan.org.

Table 1. Follow-Up Phone Call Results

ERAS Question	Number of Responses	Responses, n (%)			
ERAS anesthesiologist explanations	319	Always 301 (94)	Usually 14 (4)	Sometimes 2 (1)	Never 2 (1)
How well was your pain controlled throughout recovery?	319	Excellent 263 (82)	Good 50 (16)	Fair 6 (2)	
Regional block pain controlled?	309	Excellent 274 (89)	Good 28 (9)	Fair 5 (2)	Poor 2 (1)
Were your expectations met for early eating, ambulations, discharge	319	Definitely yes 295 (92)	Probably yes 21 (7)	Probably no 3 (1)	

care. To ensure sustainability, the team reviews data from follow-up phone calls made to the patients who were on the ERAS protocol (Table 1). The follow-up calls evaluate not only the patient experienced outcomes of early ambulation, pain management, and discharge, but also the communication with the staff. Of 319 follow-up phone call responses, 263 (82%) patients responded that they had excellent pain control throughout recovery and 295 (92%) patients identified that their expectations were met for being able to begin eating and ambulating early in their postoperative recovery. The team reviews and communicates these results to the staff caring for patients on the ERAS protocol as part of continuous quality processes.

Conclusions

An interprofessional team implemented the evidence-based ERAS protocol to improve the quality of patient care preoperatively, intraoperatively, and postoperatively. Through stakeholder education, planned staged implementation using STCs, real-time feedback, and debriefing, the protocol was successfully implemented and decreased LOS and postoperative complications. The program has grown from one surgeon in one service line to multiple surgeons in multiple service lines. Process supports were built into the implementation to ensure the effectiveness and sustainability of the EBP project.

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