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# Real time compliance monitoring with NSQIP: Successful method for enhanced recovery pathway implementation☆

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ABSTRACT

*Background:* Compliance with Enhanced Recovery Pathway (ERP) variables improves clinical outcomes. The National Surgery Quality Improvement Program (NSQIP) database includes ERP variables. We wish to determine if modifying NSQIP workstation workflow would increase compliance with ERP and improve outcomes following gastrointestinal surgery.

*Methods:* NSQIP ERP variables were abstracted from patients enrolled in ERP and undergoing elective surgery within 2 weeks following surgery. The compliance was monitored and shared with a multi-disciplinary group of providers bi monthly. Clinical outcomes and patient experience was measured as a surrogate for successful implementation.

*Results:* 71 patients were entered into ERP and compared to 98 baseline patients (non-ERP). Over eight months, compliance improved from 67% to 85%. However, compliance remained lower among postoperative variables (52% - 82%). The median length of stay was educed by 2 days ($p = 0.01$). There was a trend towards reduction in readmissions, hospital acquired conditions, mean direct variable charge and an improvement in patient experience (Press Ganey) outcomes among the ERP patients compared to non-ERP patients.

*Discussion:* Real time monitoring of NSQIP ERP variables provides a structure for ERP implementation. As more programs engage in NSQIP, this workflow may become a key means for improving patient outcomes and safety.

## 1. Introduction

Enhanced Recovery Pathways (ERP) integrates best evidence principles of perioperative care to establish a multidisciplinary protocol that optimizes outcomes for the surgical patient. Fundamentally, ERPs aim to attenuate the surgical stress response and optimize recovery thereby reducing complications and length of stay[2]; these patient care improvements are best achieved when there is a high level of compliance with the ERP components.[3,4] While established core elements are consistent across most hospital ERPs, local adaption is required for effective implementation. Our pathway incorporated recommendations from several well-designed clinical trials that examined areas of patient care associated with the greatest practice variability.[1] Specifically, our ERP focused on improved pre-operative education, better glycemic control and prevention of insulin resistance, improved multi-modal pain management including regional anesthesia techniques, intraoperative use of goal directed fluid therapy and postoperative early ambulation and feeding in patients undergoing gastrointestinal surgery.

The National Surgical Quality Improvement Program (NSQIP) is a clinical registry that is considered “best in class” for measuring surgical performance, receiving the 2014 Eisenberg Award for Quality and Safety by the Joint Commission and National Quality Forum. This database, established in 2004, provides a validated, risk-adjusted, peer-reviewed, outcomes-based assessment of surgical quality, collected via chart review by certified surgical clinical reviewers (SCRs). Outcomes are monitored for 30 days after surgery and case details must be

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completed in the registry by 90 days after surgery. One of the challenges of using the NSQIP data for improvement has been the delay in obtaining performance reports – frequently providers cannot remember the patients, practices may have changed and it is challenging to maintain staff engagement.

In order to use NSQIP for more real time improvement work, our Surgery Clinical Reviewer (SCR) committed to entering all perioperative data (except 30 day outcomes) on all patients undergoing gastrointestinal surgery on ERP within 2 weeks of surgery. Furthermore, a compliance ad-hoc report was created that allowed data to be shared with providers routinely during ERP implementation. This data was reported back to the service units on a routine basis. The purpose of this study was to determine if this new workflow which allowed real time monitoring of NSQIP ERP variables increased our bi-monthly compliance to ERP. Length of stay and overall complications were evaluated as a proxy of effective ERP implementation.

## 2. Material and methods

### 2.1. Participants

From August 2015 to March 2016, patients undergoing elective laparoscopic or open major gastrointestinal surgery at Johns Hopkins Bayview Medical Center were treated with ERP. The comparison group included patients who underwent elective surgery from January 2014 to July 2015 at the same hospital by the same providers and listed under the same major abdominal small bowel and large bowel procedure codes APR DRG (All Patients Refined Diagnosis Related Groups) classification 221 (i.e., major abdominal procedures) or ICD Procedure Codes (any position): 435, 436, 4389, 4382. We did not have NSQIP outcome data available for the baseline period because the hospital only began participating in April 2015.

### 2.2. Implementation and compliance monitoring

After we implemented our program, we committed to entering the ERP variables into the NSQIP workstation within 2 weeks of undergoing surgery. ERP patients were identified in our electronic patient record (ORMIS/EPIC) by a flag that was placed on the record when the procedure was posted. This allowed for notification of all providers including the NSQIP SCR. A summary of ERP variables are outlined in Table 1. Compliance was reported as a percentage of patients whose care met the variable definition. However, if a patient factor prohibited compliance, this patient was removed from the denominator (total patients) when calculating compliance. For example, if a patient had delayed gastric emptying, then they were considered “high risk” per NSQIP definition and omitted from the patient pool when calculating compliance for the preop variable “clear liquids two hours prior to induction.” An ad-hoc compliance report was created by NSQIP which allowed us to compare our compliance to other institutions engaged in similar practices using the NSQIP database (see Table 5). Compliance rates were then shared with the multidisciplinary preoperative, intraoperative, and postoperative teams every 2 months. Our goal was to achieve greater than 75% compliance in all variables as others have shown that postoperative compliance greater than 70% is associated with improved outcomes.[5] If compliance was less than 75% in any variable, the care team engaged with this variable implemented interventions to improve compliance.

### 2.3. Outcomes

For ERP patients, number of days before tolerating oral intake, return of bowel function, and tolerating oral pain medication were recorded. Furthermore, LOS, total occurrences per patient, and readmission were evaluated every two months and shared with frontline providers. Occurrences are strictly defined wound, respiratory, infectious, renal, cardiac, neurologic and transfusion related complications outlined by ACS that occur within 30 days of the procedure. The patient characteristics of age, sex, race or type of surgery (laparoscopic vs. open) were analyzed to determine if any were associated with increased risk of poor compliance ($< 75\%$). Because we did not use NSQIP during our baseline period, we complemented this assessment of our program with analysis of administrative data. ERP and baseline pre-ERP patients were compared on the following metrics: length of stay (LOS), Maryland Hospital Acquired Conditions (MHAC), readmission rates, direct variable charges per patient and patient experience. LOS was defined as admission date to discharge date. Maryland Hospital Acquired Conditions (MHAC) rate was determined by the number of patients with one or more conditions divided by the total number of patients. Readmissions were measured within 30 days of discharge. Direct variable charges were defined as hospital costs related directly to patient care (direct cost) that were dependent on patient volume (variable cost). Patient experience scores were obtained from the hospital database and percentages of “top box” (i.e., highest possible) responses were compared between the baseline pre-ERP and ERP groups. Only questions relevant to ERP were included in the analysis (Table 7).

### 2.4. Statistical analysis

Comparisons were assessed for significance using Fisher’s Exact t-test and chi-square for parametric data and Mann-Whitney for non-parametric data. For the regression analysis, the odds ratio was reported using laparoscopic surgery as the main comparison group. Age was dichotomized to $< 65$ or $\geq 65$ and the $\geq 65$ age groups was used as the main comparison group. Female was used as the main comparison group for gender. Race was normalized to the Caucasian group.

## 3. Theory

There is no consensus on best implementation methodology for the ERP. Since NSQIP contains several ERP variables that matched the guidelines set forth by national societies, we chose to modify our NSQIP workflow in order to provide a economical and reliable resource for monitoring compliance. We chose to use improved clinical outcomes and patient experience as a proxy for successful implementation.

## 4. Results

### 4.1. Patient characteristics

From August 2015 to March 2016, 71 patients undergoing elective major gastrointestinal surgery were enrolled into the Johns Hopkins Bayview ERP program. For comparison, 98 patients underwent elective major gastrointestinal surgery from January 2014 to July 2015 and were considered our baseline pre-ERP cohort. The mean age was similar two cohorts (see Table 2). There was no difference in sex or race. There were more patients undergoing laparoscopic surgery in the ERP cohort than in the non-ERP cohort, however, this did not reach statistical significance (42% vs. 31%, respectively). The distribution of procedure types was similar between both groups.

### 4.2. Compliance monitoring

Table 3 demonstrates compliance rates for all NSQIP variables measured at 2 month intervals in our ERP program. Overall compliance improved from 73% during the first interval to 85% for the last interval, with all but 4 variables achieving $\geq 75\%$ compliance. Preoperative compliance rates were steady during the time periods shown. Similarly, intra-operative compliance variables were high with the exception of the use of regional analgesia. However, the Transverse Abdominis Plane (TAP) blocks commonly performed for our laparoscopic procedures are not officially included in the NSQIP database definition of regional