
Improving Outcomes in Colorectal Surgery by Sequential Implementation of Multiple Standardized Care Programs



Jeffrey E Keenan, MD, Paul J Speicher, MD, MHS_c, Daniel P Nussbaum, MD, Mohamed Abdelgadir Adam, MD, Timothy E Miller, MB ChB, FRCA, Christopher R Mantyh, MD, FACS, FASCRS, Julie KM Thacker, MD, FACS, FASCRS

BACKGROUND: The purpose of this study was to examine the impact of the sequential implementation of the enhanced recovery program (ERP) and surgical site infection bundle (SSIB) on short-term outcomes in colorectal surgery (CRS) to determine if the presence of multiple standardized care programs provides additive benefit.

STUDY DESIGN: Institutional ACS-NSQIP data were used to identify patients who underwent elective CRS from September 2006 to March 2013. The cohort was stratified into 3 groups relative to implementation of the ERP (February 1, 2010) and SSIB (July 1, 2011). Unadjusted characteristics and 30-day outcomes were assessed, and inverse proportional weighting was then used to determine the adjusted effect of these programs.

RESULTS: There were 787 patients included: 337, 165, and 285 in the pre-ERP/SSIB, post-ERP/pre-SSIB, and post-ERP/SSIB periods, respectively. After inverse probability weighting (IPW) adjustment, groups were balanced with respect to patient and procedural characteristics considered. Compared with the pre-ERP/SSIB group, the post-ERP/pre-SSIB group had significantly reduced length of hospitalization (8.3 vs 6.6 days, $p = 0.01$) but did not differ with respect to postoperative wound complications and sepsis. Subsequent introduction of the SSIB then resulted in a significant decrease in superficial SSI (16.1% vs 6.3%, $p < 0.01$) and postoperative sepsis (11.2% vs 1.8%, $p < 0.01$). Finally, inflation-adjusted mean hospital cost for a CRS admission fell from \$31,926 in 2008 to \$22,044 in 2013 ($p < 0.01$).

CONCLUSIONS: Sequential implementation of the ERP and SSIB provided incremental improvements in CRS outcomes while controlling hospital costs, supporting their combined use as an effective strategy toward improving the quality of patient care. (J Am Coll Surg 2015;221:404–414. © 2015 by the American College of Surgeons)

Surgeons are increasingly driving quality improvement efforts with the primary objective of improving patient safety and surgical outcomes.^{1,2} Furthermore, public

reporting of hospital and surgeon outcomes data and pay-for-performance reimbursement schemes have added to the impetus to improve health care quality.³⁻⁵ In colorectal surgery (CRS), engaged surgeons have focused on implementing systems of care designed to reliably provide evidence-supported practices as a mechanism to improve postoperative outcomes.⁶ Two prominent systems of care are the enhanced recovery pathway (ERP)^{7,8} and the preventive surgical site infection bundle (SSIB). The ERP is a comprehensive perioperative CRS care pathway that has been shown to reduce postoperative morbidity and length of hospitalization.⁹⁻¹⁷ Similarly, the SSIB is a perioperative care program that systematically provides evidence-supported measures for surgical wound infection prevention and has been shown to reduce the rate of postoperative wound infection.¹⁸⁻²²

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From the Departments of Surgery (Keenan, Speicher, Nussbaum, Adam, Mantyh, Thacker) and Anesthesiology (Miller), Duke University Medical Center, Durham, NC.

Correspondence address: Julie KM Thacker, MD, FACS, FASCRS, Department of Surgery, Duke University Medical Center, Box 2829, Durham, NC 27710. email: julie.thacker@dm.duke.edu

Abbreviations and Acronyms

ASA = American Society of Anesthesiologists
 CRS = colorectal surgery
 ERP = enhanced recovery program
 IPW = inverse probability weighting
 LOS = length of stay
 SSIB = surgical site infection bundle
 UTI = urinary tract infection
 VTE = venous thromboembolism

Although both the ERP and SSIB have individually been shown to improve outcomes after CRS, the effect of their combined presence has not, to our knowledge, previously been reported in the literature. The colorectal surgery service at our institution sequentially implemented the ERP in February 2010, followed by the SSIB in July 2011; together they have profoundly altered the practice of CRS at our institution. Previously, we had specifically evaluated the impact of SSIB on postoperative infection at our institution and found a significant reduction in the rate of SSI.²² In this study, we sought to build on this previous work by comprehensively evaluating the combined effect of the ERP and SSIB on the relevant short-term outcomes included in the American College of Surgeons (ACS) NSQIP in order to determine if the presence of these standardized care programs improved the quality and value of CRS care at our institution.

METHODS

Patient selection and data collection

This was a retrospective cohort study approved by the Institutional Review Board at Duke University Medical Center. Institutional ACS-NSQIP data files were used to identify a sample group of patients who underwent major CRS at Duke University Medical Center from September 1, 2006 through March 31, 2013 (Fig. 1). Participation in ACS-NSQIP provides institutions with data on a systematically sampled set of operations to serve as a vehicle for quality improvement.^{1,23,24} Specifically, every eighth operative day, demographic and clinical

variables and 30-day outcomes on surgical patients are abstracted from the medical record by a trained surgical-clinical reviewer. The ACS-NSQIP system of data sampling has been validated, and data abstraction is routinely audited by outside surgical-clinical reviewers to ensure accuracy and consistency in data collection.

Procedures included in this study were low anterior resection, abdominoperineal resection, partial or total abdominal colectomy with or without proctectomy, proctectomy, pelvic exenteration, or Hartmann type procedure (CPT codes as follows: 44147, 44150–44151, 44160, 44204–44208, 44210, 44155–44158, 44211–44212, 45110–45114, 45116, 45119, 45120–45121, 45123, 45126, 45130, 45135, 45160, 45395, 45397, 45402, 45550). Both open and laparoscopic cases were included. Nonelective cases were excluded because the ERP was not commonly used in the urgent or emergent setting. Because the ERP and SSIB were used by the colorectal surgery group during the study period but not by other surgeons, only operations performed by board certified colorectal surgeons were included. During the study period, all procedures were performed by a total of 4 board certified colorectal surgeons who were part of a shared practice in 1 inpatient care facility, and all had 5 or more years of experience as attending surgeons at the starting point of their participation in the study.

Clinical data, including patient demographics, preoperative characteristics, operative factors, and 30-day outcomes, were determined using ACS-NSQIP institutional data files. Data for 30-day readmission as well as chemotherapy within 30 days of surgery were obtained by additional chart review because many of these data were missing due to changes in ACS-NSQIP data abstraction for these variables over the course of the study period. Data on compliance to specific components of the ERP were obtained from a prospectively maintained institutional database of patients treated under the ERP. Cost data, obtained from Duke University Hospital Finance, became available in 2008.

Quality improvement programs

During the study period, the ERP was introduced into practice by the colorectal surgery service on February 1,

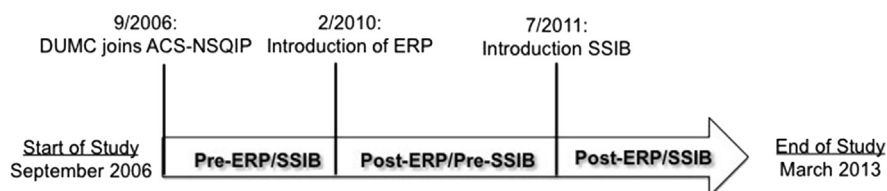


Figure 1. Schematic of the study period with key dates noted. DUMC, Duke University Medical Center; ACS NSQIP, American College of Surgeons National Surgery Quality Improvement Program; ERP, enhanced recovery pathway; SSIB, preventive surgical site infection bundle.

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