

Clinical Science

Applying the National Surgical Quality Improvement Program risk calculator to patients undergoing colorectal surgery: theory vs reality



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National Surgical Quality Improvement Program; NSQIP risk calculator; Risk assessment; Surgical complications; Outcomes; Colorectal surgery

Abstract

BACKGROUND: Discussing potential morbidity and mortality is essential to informed decision-making and consent. The American College of Surgery National Surgical Quality Improvement Program developed an online risk calculator (RC) using patient-specific information to determine operative risk.

STUDY DESIGN: Colorectal procedures at our independent academic medical center from 2010 to 2011 were evaluated. The RC's predicted outcomes were compared with observed outcomes. Statistical analysis included Brier score, Wilcoxon sign rank test, and standardized event ratio.

RESULTS: There were 324 patients included. The RC's Brier score was .24 (.015–.219) for predicting mortality and morbidity, respectively. The observed event rate for surgical site infection and any complication was higher than the RC predicted (standardized event ratio 1.9 CI [1.49 to 2.39] and 1.39 CI [1.14 to 1.68], respectively). The observed length of stay was longer than predicted (5.6 vs 6.6 days, $P < .001$).

CONCLUSIONS: The RC underestimated the surgical site infection and overall complication rates. The RC is a valuable tool in predicting risk for adverse outcomes; however, institution-specific trends may influence actual risk. Surgeons and institutions must recognize areas where they are outliers from estimated risks and tailor risk discussions accordingly.

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Informed consent is a fundamental component of surgical care. The ability to convey the potential morbidity and mortality of a procedure equips patients with the information they need to

make decisions on whether to undergo a surgical procedure.¹⁻⁴ The predicted risks of a procedure may encourage or avert a patient from choosing surgery. Numerous risk calculators and

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The American College of Surgeons National Surgical Quality Improvement Program and the hospitals participating in the American College of Surgeons National Surgical Quality Improvement Program are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

These data were presented at the ACS NSQIP National Conference on July 28, 2014 in New York, NY.

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scoring systems have been developed to predict morbidity and mortality for specific procedures.⁵⁻⁹ These prediction models are used by surgeons to risk stratify their patients and aid in the decision to recommend a procedure vs alternatives. Risk stratification may also be used as a threshold for referral for pre-operative optimization before elective surgery.

The American College of Surgery National Surgical Quality Improvement Program (ACS NSQIP) developed an online universal risk calculator (RC) to help with procedure-specific risk prediction and aid the process of informed consent.¹⁰ Details on the development and validity of the ACS risk calculator have been described elsewhere.¹⁰ The RC accounts for patient-specific factors in determining operative risk for specific surgical procedures (Fig. 1). We hypothesized that the RC would provide an accurate risk assessment for patients undergoing colorectal surgery at a single independent academic institution.

Methods

A retrospective review of our institution's prospectively collected ACS NSQIP data for patients who underwent colorectal surgery between January 2010 and December 2011 was performed. Colectomy was defined based on primary Current Procedural Terminology (CPT) codes and included the following: 44140, 44141, 44143, 44144, 44145, 44146, 44147, 44150, 44155, 44158, 44160, 44204, 44205, 44206, 44207, 44210, 45110, 45119, 45130, 45402, and 45550. Colorectal surgery was a targeted area at our institution for ACS NSQIP data collection and as such, all

colorectal cases performed within the study time frame were reviewed. Institutional review board approval was obtained. Patient demographics required for input into the ACS NSQIP calculator were collected (Table 1). The ACS NSQIP calculator was accessed online and each patient's parameters entered.¹¹ The surgeon adjustment of risk was not applied to the calculated outcomes and therefore kept as 1—"no adjustment necessary".

The NSQIP calculator generated estimated risks for serious complication, overall complication, pneumonia, cardiac complication, surgical site infection (SSI), urinary tract infection, deep vein thrombosis (DVT), renal failure, return to operating room, and death. The generated outcomes from the RC were then compared with observed outcomes. The predicted length of stay (LOS) was also obtained and compared with the actual LOS for all patients. A subset analysis was performed for patients undergoing emergent surgery and rectal surgery.

Statistical analysis included calculation of C-statistics and Brier scores to compare the observed outcomes to predicted outcomes from the RC. The standardized event ratio and associated 95% confidence interval was also calculated for each outcome. C-statistic is a measure of how well the RC can be used to discriminate subjects having the event from subjects not having the event; a value of .5 indicates that the model is no better than chance at making a prediction of a particular outcome and a value of 1.0 indicates that the model perfectly predicts an outcome. Models are typically considered reasonable when the C-statistic is higher than .7 and strong when C-statistic

ACS NSQIP Surgical Risk Calculator Variables	
• Procedure	• Diabetes
• Other treatment options	• Hypertension requiring medication
• Age	• Previous cardiac event
• Sex	• Congestive heart failure in 30 days prior to surgery
• Functional status	• Dyspnea
• American Society of Anesthesiologists class	• Current smoker within 1 year
• Wound class	• History of severe COPD
• Steroid use for chronic condition	• Dialysis
• Ascites within 30 days prior to surgery	• Acute Renal Failure
• Systemic sepsis within 48 hours prior to surgery	• Body mass index
• Ventilator dependent	• Surgeon Adjustment of Risks
• Disseminated cancer	

Figure 1 Variables included in the American College of Surgeons National Surgical Quality Improvement Program surgical risk calculator.

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