Implementation of a Hospital-Based Quality Assessment Program for Rectal Cancer

By Samantha Hendren, MD, MPH, Ellen McKeown, RN, Arden M. Morris, MD, MPH, Sandra L. Wong, MD, MS, Mary Oerline, MS, Lyndia Poe, RN, Darrell A. Campbell Jr, MD, and Nancy J. Birkmeyer, PhD

University of Michigan, Ann Arbor; and Munson Medical Center, Traverse City, MI

Abstract

Purpose: Quality improvement programs in Europe have had a markedly beneficial effect on the processes and outcomes of rectal cancer care. The quality of rectal cancer care in the United States is not as well understood, and scalable quality improvement programs have not been developed. The purpose of this article is to describe the implementation of a hospital-based quality assessment program for rectal cancer, targeting both community and academic hospitals.

Methods: We recruited 10 hospitals from a surgical quality improvement organization. Nurse reviewers were trained to abstract rectal cancer data from hospital medical records, and abstracts were assessed for accuracy. We conducted two surveys to assess the training program and limitations of the data abstraction. We validated data completeness and accuracy by comparing hospital medical record and tumor registry data.

Results: Nine of 10 hospitals successfully performed abstractions with $\geq 90\%$ accuracy. Experienced nurse reviewers were challenged by the technical details in operative and pathology reports. Although most variables had less than 10% missing data, outpatient testing information was lacking from some hospitals' inpatient records. This implementation project yielded a final quality assessment program consisting of 20 medical records variables and 11 tumor registry variables.

Conclusion: An innovative program linking tumor registry data to quality-improvement data for rectal cancer quality assessment was successfully implemented in 10 hospitals. This data platform and training program can serve as a template for other organizations that are interested in assessing and improving the quality of rectal cancer care.

Introduction

Rectal cancer (RC) care has been the subject of intensive quality measurement and improvement programs in Europe.¹ In European trials, surgery, pathology, and adjuvant therapy have been standardized, which has improved outcomes.²⁻⁵ For rectal cancer, the quality of surgical technique is particularly relevant. For example, a surgical quality improvement program in Norway resulted in local recurrence rates dropping from 12% to 6% and 4-year survival increasing from 60% to 73%.⁶ Population-based registries in at least eight countries have also facilitated quality assessment over time.⁷ RC registries permit comparison of processes and outcomes, as well as identification of areas for quality improvement.

By contrast, the quality of care for RC is poorly understood and more variable in the United States. Although medical aspects of RC care have been targeted for process improvement by organizations such as ASCO (via its Quality Oncology Practice Initiative) and the National Quality Forum, these programs are generally based on outpatient oncology practices and do not include the hospital-based, surgical phase of care.

However, hospital-based registries do exist for quality improvement in surgery, such as the nationwide American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP).⁸⁻¹⁰ Unfortunately, the ACS-NSQIP database does not contain any cancer-specific variables for rectal cancer. Although studies have been performed that link ACS-NSQIP

data to national tumor registry data, these studies still lack critical clinical information, such as tumor location, clinical staging tests, CEA level, surgical approach, type of anastomosis, and whether a total mesorectal excision was performed.¹¹⁻¹⁴

Regional surgical quality assessment organizations also exist, such as the Michigan Surgical Quality Collaborative (MSQC).¹⁵⁻¹⁸ Similar to ACS-NSQIP, the MSQC collects patient, surgical, and 30-day outcomes data for surgery cases. These outcomes data are then fed back to the hospitals as risk-adjusted hospital comparisons. The organization holds regular meetings of surgeons and data abstractors to share best practices and motivate process improvement. Regional collaborative organizations like MSQC have not generally focused on cancer surgery quality, but they could potentially be adapted for this purpose.

In this context, the purpose of our study was to implement a hospital-based, quality assessment program for RC in the setting of the MSQC organization. The MSQC targets both community and academic medical centers, unlike other programs based in large, tertiary cancer centers. The goals of this report are (1) to demonstrate that surgical data abstractors can accurately abstract cancer-specific data from hospital medical records, (2) to describe an innovative linkage of chart abstraction data with tumor registry data at the hospital level, (3) to share lessons learned about challenges of collecting data from hospital records, and (4) to present a final variable list that other regional

or national groups might find helpful in efforts to measure RC quality of care.

Methods

Setting

The MSQC is an organization of 52 hospitals with the coordinating center at the University of Michigan, Ann Arbor. MSQC is financially supported by Blue Cross/ Blue Shield of Michigan, a not-for-profit private health insurance company, and its mission is to promote surgical safety and quality.¹⁵⁻¹⁸

Selection of Variables

Surgeons with an interest in colorectal cancer quality of care designed and modified a set of key variables representing RC clinical features, processes of care, and outcomes. National and international publications and guidelines were reviewed, including the National Quality Forum (NQF), the National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines, the American Joint Committee on Cancer (AJCC) 2010 manual, QOPI, and the College of American Pathologists' (CAP) manual.

Ultimately, the variables were designed to allow for the following quality measures to be measured over time: lymph node procurement (an NQF and ASCO quality measure); performance of mesorectal excision (NCCN guidelines recommended process); grading of mesorectal excision (included in CAP guidelines); use of neoadjuvant chemoradiotherapy for clinical stage II/III cases (NCCN guidelines recommended process); margin positivity rate (strongly associated with local recurrence rate)³; ostomy nurse care; sphincter preservation rate among eligible patients (outcome); anastomotic leak rate (outcome); recurrence rate (outcome); and mortality (outcome).

Initial variables consisted of 44 variables to be abstracted from the medical record, plus 22 variables to be obtained from the hospital's tumor registrar. Tumor registry variables were modeled after the Facility Oncology Registry Data Standards (FORDS) manual (published by the American College of Surgeons' Commission on Cancer, 2012 edition). A standardized data abstraction manual was created, with standardized response options, diagrams, and answers to anticipated questions. Variables were pilot tested by the authors using de-identified charts from the surgeons' practices, and the final list of variables had greater than 90% inter-abstractor reliability on three test cases.

Patient Case Eligibility

RC patient cases previously captured in the MSQC database (surgery dates July 1, 2007, to June 6, 2012) were included. Eligibility criteria were cases with an International Classification of Diseases, Ninth Edition (ICD-9) diagnosis code of 154.1, and a surgical procedure code representing RC excision (44,140, 44,145, 44,146, 44,147, 44,204, 44,207, 44,208, 45,111, 45,112, 45,114, 45,119, 45,397, 45,110, 45,395, 45,123, 45,160, 45,170, 45,190, 44,141, 44,143, 44,144, and 44,206). Confirmation of the diagnosis of invasive adenocarci-

noma, and that the cancer was primary rather than a recurrence, were additional inclusion criteria.

Participating Hospitals and Data Abstractor Training

Ten MSQC hospitals that expressed interest in participating in a cancer surgery-focused "special project" were recruited to participate. Nine of 10 data abstractors were registered nurses, working full-time in their respective hospitals as trained data abstraction and quality improvement personnel for the MSQC program. This project consisted of two activities, case abstraction and work with the tumor registrar. Abstractors were offered an incentive payment (\$35 per chart). Although the abstractors were experienced surgical chart abstractors, cancer variables were unfamiliar to them. A training program was designed that included detailed variable definitions, three sample test cases, conference calls, and a final test case on which each reviewer was formally scored. A score of 90% accuracy was required.

Surveys

The abstractors were asked to complete two internet surveys designed by the authors. The first survey was performed at the conclusion of the training program, with a goal of determining whether the training program was effective from the abstractors' perspective. The second survey was performed at the end of the data abstraction, with a goal of determining which variables were problematic (data not available and/or difficult to interpret) from the viewpoint of the abstractors.

Data Analysis and Human Subjects Protection

Variables that exist in both tumor registry data and the hospital chart (or for which two hospital chart variables were complementary) were validated by calculating the concordance between the two sources. Hospital characteristics were publically available from the American Hospital Association. Descriptive statistics were used to analyze the proportion of missing data and the concordance between variables that were cross-validated. Analyses were performed using SAS for Windows and Microsoft Excel. This project was reviewed by the institution review board of the University of Michigan, and deemed institution review board exempt.

Results

Characteristics of Participating Hospitals

Ten hospitals participated in the program. Hospitals varied in their characteristics, including number of beds (five with < 400, two with 400-700, three with > 700), teaching status (six major teaching, two minor teaching, and two nonteaching), urban/rural location (nine urban, one rural), cancer center designation (three Comprehensive Community Cancer Program, one Integrated Network Cancer Program, five Academic Comprehensive Cancer Program, one National Cancer Institute Designated Comprehensive Cancer Program), and colorectal cancer surgery volume (one with < 25 Medicare colorectal

cancer patients per year, four with 25-50, four with 50-75, and one with >75).

Success of the Training Program

Data abstractors were trained during a 6-week program that began with distribution of a detailed set of definitions, abstraction of test cases, and weekly conference calls. A specialist surgeon was present on conference calls to answer questions and provide education. Test cases revealed that the most important challenges lay in understanding the technical details of operation reports and pathology reports. The training program was modified in several ways. We increased the number of conference calls, established a “frequently asked questions” document, created a mechanism for reviewers to ask questions of a specialist surgeon throughout the abstraction process, and modified definitions. This included selective use of referenced medical diagrams to help reviewers conceptualize the data elements, as well as simplification or elimination of several variables.

Nine of the 10 reviewers scored at least 90% on the final of three sample cases (range, 90% to 98%), and the 10th hospital’s reviewer scored 87%. To ensure data accuracy, the 10th hospital’s cases underwent physician review of de-identified reports. The abstractors’ satisfaction with the training program was assessed with a seven-question survey conducted online at the conclusion of the training program (response rate 100%). Reviewers’ questionnaire responses indicate they felt the training was very effective (Table 1).

Analysis of Data Completeness

Of 383 cases originally identified from the MSQC database using ICD-9 and Current Procedural Terminology (CPT) codes, 353 were eligible on the basis of chart review. Common reasons for ineligibility were squamous cell carcinoma, locally recurrent rectal cancer, or noninvasive tumors. Twenty cases were local excisions, and 333 were radical operations. The complete list of variables is presented in Table 2, along with the proportion of missing data for each variable.

There were two types of variables: those abstracted from the medical record and those obtained from each hospital’s tumor registrar. Among variables abstracted from the medical record, missing data were uncommon (< 10%, Table 2). Notable exceptions with higher frequency of missing data included distance from tumor to radial margin, total mesorectal excision grade, inter-sphincteric dissection, CEA level, preoperative clinical staging test, and number of metastatic lesions. Among the tumor registry data, only pathologic TNM stage and microsatellite instability were missing frequently.

We intentionally pilot tested several variables to determine current documentation practice, for example, rectal cancer location measurements. Among cases with a documented measurement, 257 (88.3%) used the anal verge as the point of reference, whereas 30 (10.3%) used the dentate line, and four (1.4%) used the anorectal ring.

Analysis of Data Validity

We used two methods to validate the data. For selected variables, we compared data from the tumor registry and the hospital medical records to determine the rate of discordance (or used different parts of the medical record to cross-validate variables). Second, we conducted a survey of the data abstractors (Table 1). Some variables were difficult to abstract in all participating hospitals (eg, mesorectal excision grade), whereas others were difficult to abstract in only a few hospitals.

Table 3 summarizes the cross-validation of selected variables. Low rates of discordance were found for most variables; however, 14% of cases had disagreement between the CPT procedure code and the anastomosis variable (for example, a CPT code that includes an anastomosis listed, with no anastomosis type recorded in the “anastomosis type” variable). Twelve percent of cases in which radiation therapy was documented in the medical record did not have radiation therapy recorded in tumor registry data. Because outpatient treatments may not be captured reliably in tumor registry data, the medical record data will be used as the source of truth in future abstraction.

Tumor Registry

A goal of this project was to create a link between each participating hospital’s tumor registry and our chart abstraction data. The abstractors successfully obtained tumor registry data from all 10 hospitals, and reported that all of the tumor registrars were amenable to sharing data for quality improvement.

Lessons Learned

We learned important lessons in the course of implementing this program in 10 hospitals. First, when training nurses to perform this data collection, it is important to involve clinical specialists for question-and-answer sessions, which the nurses found extremely helpful. Second, we found both positive and negative aspects of hospital-based data. The hospital medical record contains detailed pathology, surgical, and perioperative information. However, pathology and operative reports were found to be confusing, because of variation in terminology and in the level of detail included, which varied among providers. We were able to overcome these limitations with extra training, and diagrams were particularly helpful. Also, hospital medical records inconsistently reported data for studies performed in the outpatient setting (eg, CEA, transrectal ultrasound).

Final Variable List

The analyses above allowed us to establish a final list of variables that will be used for future data collection across the state of Michigan (Table 2). This includes 20 variables to be abstracted from the record (to supplement the MSQC’s usual variables), plus 11 tumor registry variables. The process for selecting the final variable list was a three-step one. The first and most important consideration was whether or not the variable was essential to our quality assessment goals (ie, the quality measures listed in the Methods section). Vari-

Table 1. Results

Training Program Evaluation Questionnaire	
Questions	Results
1. Training met my needs with respect to learning the variables and definitions.	70% strongly agree, 30% agree
2. Training provided me with sufficient opportunity to apply my knowledge to case studies.	77.8% strongly agree, 22.2% agree
3. Training was conducted in a way that allowed me sufficient opportunity to ask questions/obtain clarification.	100% strongly agree
4. The training methodology utilized (variable review + conference call, case study + conference call x 2 and graded case study with individualized feedback) was an efficient use of my time.	80% strongly agree, 20% agree
5. My expectations for the Rectal Cancer Surgery Pilot project training were met.	80% strongly agree, 20% agree
6. What aspect of the Rectal Cancer Surgery Pilot project training was of greatest value to you? (open-ended).	Comments (paraphrased): questions and answers in the conference calls; case studies; having surgeon on calls to answer questions; having someone available to call or email with questions any time
7. How would you improve the Rectal Cancer Surgery Pilot project training for the future? (open-ended).	Comments (paraphrased): a group meeting or class; decrease number of variables
Variable Abstraction Questionnaire	
Survey Question	Variable (No. of reviewers)*
1. Variables that you found to be the most challenging from a data abstraction standpoint	Distance to radial margin (5) Mesorectal excision (3) Rectal cancer location (3) Distance to distal margin (3) Bowel anastomosis type (2) Preop staging test (2) TME grade (2) Iatrogenic perforation (2) Inter-sphincteric dissection (2)
2. Variables that were not available as a result of data access issues (eg, tests in outpatient not inpatient charts)	Preoperative staging test (4) Preoperative wound ostomy nurse referral (3) Preoperative CEA (3) Ostomy marked (2) Rectal cancer location and distance (2)
3. Variables that were not available as a result of absent or inconsistent clinician documentation practices	TME grade (6) Fecal incontinence (3) Mesorectal excision (3) Mesorectal excision (2) Preoperative staging test (2) Patient preference for colostomy (2) Distance from tumor to radial margin (2)
4. Variables that were not available as a result of inconsistency of location in the medical record	Rectal cancer location/distance (5) Preoperative CEA level (2) Preoperative staging test (2)
5. Variables that you believe to be least reliable	Distance from tumor to distal margin (3) Distance from tumor to radial margin (3) Intersphincteric dissection (3) Mesorectal excision, total or partial (2) Rectal cancer location/distance (2)
6. Variables that you feel would benefit most from revisions to the definition or response options	Mesorectal excision, total or partial (5) Distance from tumor to distal margin (3) Distance from tumor to radial margin (3) Rectal cancer location (3) Preoperative staging test (ERUS/MRI) (2)

Abbreviations: CEA, carcinoembryonic antigen; ERUS, endorectal ultrasound; MRI, magnetic resonance imaging.

* Variable listed if > 1 reviewer identified difficult or unreliable abstraction.

ables essential to these measurement goals were given highest priority, even when there were missing data. The second consideration was whether the variable was accurate. The primary source of information for this was the feedback we received from the data abstractors and expert reviews of cases during initial training and later data collection. Third, the final variable list had to be parsimonious in order to be feasible. Thus, any variables that were not essential to the planned quality measures *and* were either time consuming, redundant, or frequently missing were eliminated. Elimina-

tion of redundant variables was considered acceptable, after validating them during the current analysis (Table 3).

Discussion

In September 2013, the Institute of Medicine issued a new report, *Delivering High Quality Cancer Care: Charting a New Course for a System in Crisis*. In this report, a key recommendation for quality improvement in cancer care is development of better systems for measuring the quality of care.¹⁹ The project described herein began with

Table 2. Rectal Cancer Quality Assessment Variables

Final Variables				
Category	Variables (variable type)	Response Options	Missing/Total Cases	
			No.	%
Pathology	Invasive adenocarcinoma (inclusion criterion)	Yes/no	0/353	(0)
	Pathologic stage (clinical feature)	Pathologic T stage: Tx, T0, Tis, T1, T2, T3, T4a, T4b	23/353	(6.5)
		Pathologic N stage: Nx, N0, N1, N1a, N1b, N1c, N2, N2a, N2b	29/353	(8.2)
		Pathologic M stage: Mx, M0, M1, M1a, M1b	49/353	(13.9)
	Total No. of lymph nodes examined (quality measure)	#	8/333	(2.4)
	Positive margin (quality measure)	Yes/no (simplified variable)	17/333	(5.1)
	TME grade (quality measure)	Grade 3-good	293/333	(88.0, including "not graded")
		Grade 2-moderate		
		Grade 1-poor		
		Not graded		
Surgery	Surgical approach (clinical feature)	Open	0/333	(0)
		Laparoscopic		
		Laparoscopic, hand-assisted		
		Laparoscopic, converted to open		
		Robotic		
		Robotic, converted to open		
		Laparoscopic colon mobilization with open rectal surgery		
		Laparoscopic, hand-assisted colon mobilization with open rectal surgery		
	Mesorectal excision (quality measure)	Yes/no (simplified response options)	0/333	(0)
	Bowel anastomosis (clinical feature)	Stapled with EEA stapler, end-to-end	0/333	(0)
		Stapled with EEA stapler, side-to-end		
		Stapled with EEA stapler, pouch or colooplasty		
		Stapled with GIA stapler		
		Hand sutured via the abdomen		
		Hand sutured via the anus		
	Ostomy (clinical feature)	No anastomosis	0/353	(0)
		Ileostomy		
		Colostomy		
Perioperative	Clinical presentation (risk adjustment variable)	Symptomatic/asymptomatic (simplified response options)	0/353	(0)
	CEA level/date (clinical feature)	Nanograms per milliliter	Level: 80/353	(22.7)
			Date: 83/353	(23.5)
	Preoperative staging test (clinical feature)	Transrectal ultrasound	163/353	(46.2)
		MRI		
		Both		
		Test type not documented No test/results documented		
	Clinical T/N staging (clinical feature)	Clinical T stage: Tx, T0, Tis, T1, T2, T3, T4a, T4b, unknown	173/353	(49.0)
		Clinical N stage: N1, N0, unknown	188/353	(53.3)

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Table 2. Continued

Final Variables				
Category	Variables (variable type)	Response Options	Missing/Total Cases	
			No.	%
	Metastatic cancer, preoperative (clinical feature)	Liver Lung Pelvis or retroperitoneum Other None	0/353	(0)
	Preoperative/intraoperative radiation therapy (quality measure)	Preoperative radiation Intraoperative radiation No radiation	0/353	(0)
	Preoperative WOCN referral/consultation (quality measure)	Yes/no	0/353	(0)
	Ostomy marked preoperatively (quality measure)	Yes/no	0/353	(0)
	Rectal cancer location (clinical feature)	Upper/proximal third of rectum Middle third of rectum Lower/distal third of rectum	6/62	(9.7)
Postoperative outcomes	Anastomotic leak (outcome)	None Treated with antibiotics Treated with percutaneous drainage Reoperation with new anastomosis Reoperation with proximal diversion Reoperation with end ostomy	0/353	(0)
For APR/Hartmann's procedures only	Reason for permanent colostomy documented? (clinical feature, used in assessment of the outcome: sphincter preservation rate)	Yes/No (simplified variable)	4/86	(4.4)
Tumor registry	Date of initial (colorectal cancer) diagnosis (clinical feature)	Date	11/353	(3.1)
	Derived AJCC-6 stage group (clinical feature)	0, I, IIA, IIB, IIC, IIIA, IIIB, IIIC, IVA, IVB	44/353	(12.5)
	Derived AJCC-7 stage group (clinical feature)	0, I, IIA, IIB, IIC, IIIA, IIIB, IIIC, IVA, IVB, data not available	208/353	(58.9, unavailable for earlier cases)
	Clinical stage group (clinical feature)	0, 0A, OIS, 1, 1A, 1A1, 1A2, 1B, 1B1, 1B2, 1C, IS, 2, 2A, 2A1, 2A2, 2B, 2C, 3, 3A, 3B, 3C, 3C1, 3C2, 4, 4A, 4A1, 4A2, 4B, 4C, OC, 88, 99	7/353	(2.0)
	Clinical TNM stage (clinical feature)	Clinical T stage: Tx, T0, Tis, T1, T2, T3, T4a, T4b	28/353	(7.9)
		Clinical N stage: Nx, N0, N1, N1a, N1b, N1c, N2, N2a, N2b	25/353	(7.1)
		Clinical M stage: Mx, M0, M1, M1a, M1b	37/353	(10.5)
	Date chemotherapy started (clinical feature)	Date	0/353	(0%)
	Date of first recurrence (outcome)	Date	0/353	(0%)
	Type of first recurrence (outcome)	00, 04, 06, 10, 13, 14, 15, 16, 17, 20, 21, 22, 25, 26, 27, 30, 36, 40, 46, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 62, 70, 88, 99		
	Date of last contact or death (clinical feature)	Date	9/353	(2.5)
	Vital status (outcome)	Alive/dead	9/353	(2.5)
	Cancer status (outcome)	No evidence of this tumor, evidence of this tumor, unknown	34/353	(9.6)
Variables Eliminated				
Category	Variables	Response Options	n Missing/Total Cases (%)	
Pathology	Intraoperative iatrogenic perforation	Yes/no	0/333	(0)
	Positive lymph nodes	No.	8/333	(2.4)

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Table 2. Continued

Variables Eliminated				
Category	Variables	Response Options	n Missing/Total Cases (%)	
	Positive radial margin	Yes/No	17/333	(5.1)
	Positive proximal margin	Yes/No	6/333	(1.8)
	Positive distal margin	Yes/No	6/333	(1.8)
	Distance from tumor to distal margin	Centimeters	35/333	(10.5)
	Distance from tumor to radial margin	Millimeters	143/333	(42.9)
Surgery	Inter-sphincteric dissection	Yes/No	141/333	(42.3)
	Visible residual tumor, intraoperative	Yes/No	3/353	(0.8)
	Metastatic cancer, intraoperative	Yes/No	0/333	(0)
	Tumor appears to invade other organs, intraoperative	Yes/No	0/333	(0)
	Leak test	Negative leak test	0/241	(0)
		Positive leak test		
		No leak test		
	Positive leak test response	Anastomosis repaired	0/14	(0)
		Leak diverted		
		Anastomosis repaired and leak diverted		
		Nothing done		
Perioperative	Number of metastatic lesions, preoperative	No. and site	6/21	(28.6)
		Systemic	0/353	(0)
		Regional		
		Both		
	Rectal cancer location, site of reference	Anal verge Dentate line Anorectal ring None	62/353	(17.6)
Postoperative outcomes	Rectal cancer location, distance from anal verge/dentate line/anorectal ring	Centimeters	1/291	(0.3)
	Perineal wound complication	Yes/no	0/79	(0)
Tumor registry data	Date of first contact	Date	6/353	(1.7)
	Primary site	ICD-O-3 topography code	10/353	(2.8)
	Grade/differentiation	Grade I	7/353	(2.0)
		Grade II		
		Grade III		
		Grade IV		
	Lymph-vascular invasion	Code 9	10/353	(2.8)
		0-absent		
		1-present		
		9-unknown		
	Date of surgical and diagnostic staging procedure	Date	46/353	(13.0)
	Pathologic stage group	0, 0A, OIS, 1, 1A, 1A1, 1A2, 1B, 1B1, 1B2, 1C, IS, 2, 2A, 2A1, 2A2, 2B, 2C, 3, 3A, 3B, 3C, 3C1, 3C2, 4, 4A, 4A1, 4A2, 4B, 4C, OC, 88, 99	9/353	(2.5)

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Table 2. Continued

Variables Eliminated				
Category	Variables	Response Options	n Missing/total cases (%)	
	Pathologic TNM stage	Pathologic T stage:	29/353	(8.2)
		Tx, T0, Tis, T1, T2, T3, T4a, T4b	30/353	(8.5)
		Pathologic N stage:	159/353	(45.0)
		Nx, N0, N1, N1a, N1b, N1c, N2, N2a, N2b		
		Pathologic M stage:		
		Mx, M0, M1, M1a, M1b		
	Date of most definitive surgical resection of primary site	Date	10/353	(2.8)
	Date radiation started	Date	0/353	(0)
	Date radiation ended	Date	0/353	(0)
	MSI	020-stable, 040-unstable low, 050-unstable high, 060-unstable, not stated as low or high, 999-no mention of MSI in record, 988-not a required variable	288/353	(81.6)

Abbreviations: AJCC, American Joint Committee on Cancer; CEA, carcinoembryonic antigen; EEA, end-to-end anastomosis; GIA, GI anastomosis; ICD, International Classification of Diseases; MSI, microsatellite instability; WOCN, wound ostomy and continence nurse.

the goal of designing and implementing a data platform for measuring the quality of care for RC in community and academic hospitals. Working with an existing surgical quality improvement organization, we were able to collect RC data from the hospital medical record; link that information to tumor registry data; and overcome limitations of existing databases, which have inadequate detail regarding surgical quality.

The program described here will allow for the measurement of several process and outcome quality measures. These include

lymph node procurement, margin positivity rate, performance of mesorectal excision, grading of mesorectal excision, sphincter preservation rate among eligible cases, use of neoadjuvant chemoradiotherapy for clinical stage II/III cases, ostomy nurse care, anastomotic leak rate, recurrence rate, and mortality. Although audit and feedback alone can improve physician practice, the effect size is generally small.²⁰ In the future, we plan to supplement audit and normative feedback of these quality measures with other efforts within the MSQC organization. Activities such as face-to-

Table 3. Validation of Selected Variables

Variable(s)	Data Source(s)	Discordant Cases (%)	Actions
Primary procedure	CPT codes (primary, secondary and concurrent)	10/353 (2.8%) (primary procedure coded as secondary procedure)	Include both primary and secondary codes in eligibility
Anastomosis v ostomy	CPT codes	49/353 (13.9%)	Augmented reviewer training
	Operative report	(CPT code and anastomosis discordant)	Operative report established as benchmark
		8/353 (2.3%)	
		(CPT and ostomy discordant)	
Date of surgery	Tumor registry	28/343 (8.2%)	Designated MSQC as benchmark
	MSQC database		
Clinical stage	Tumor registry clinical stage	13 (3.7%)	Established rule for staging using radiology reports and clinical notes as benchmark
	Preoperative clinical notes		For cases missing clinical data, developed algorithm for use of tumor registry variables
	Radiology reports		
Pathologic stage	Tumor registry	22 (6.2%)	Established rule for using pathology and radiology reports as benchmark
	Pathology reports		
	Radiology reports		
Preoperative radiation	Tumor registry	0/154 (0%)	Established clinical notes as benchmark
	Clinical notes	(no radiation)	
		24/199 (12.1%) (radiation given)	

Abbreviations: CPT, Current Procedural Terminology; MSQC, Michigan Surgical Quality Collaborative.

face meetings of surgeons, hospital site visits, and sharing of educational and technical resources have been conducted in the MSQC to address such problems as postoperative infection.^{16,18} Similar strategies—that may only be possible in a regional setting in which providers know and trust one another—will eventually be pursued to improve RC surgery in Michigan.

How does this project fit into the larger landscape of cancer and of surgical quality assessment programs in the United States? On a national scale, multiple organizations including ASCO, the American College of Surgeons' Commission on Cancer (ACoS CoC), NCCN, and NQF have worked separately and together to specify quality measures for cancer care and to promote quality through various mechanisms.²¹ Examples of these efforts include ASCO's QOPI registry, which is an audit and feedback system based in medical oncology practices; the NCCN Outcomes Database, which is based in a limited number of large cancer centers across the US; and the accreditation requirements of the ACoS CoC, which requires large and small cancer centers to perform local quality assessment and improvement efforts.²² However, none of these programs has attempted to measure surgical quality for RC.

As discussed above, the surgery-focused, national ACS-NSQIP program performs audit and feedback focused on 30-day complications after surgery. However, the ACS-NSQIP database does not contain any specific variables for RC, as described above. The lack of any national program that collects data sufficient to provide meaningful feedback to RC surgeons was a major motivation for this project. On the regional level, a program similar to the current project has been established in 11 medical oncology practices in Florida, and measures some of same indicators including the quality of pathology reporting for RC.²³ However, surgical detail is again absent from data collection.²³ Thus, this project is unique in the United States.

We learned lessons in this project that others may find helpful in designing hospital-based quality assessment programs. First, diagnostic testing performed in the outpatient setting may not be available in the hospital record. A solution to this problem is to work with the hospitals to improve documentation. For example, we have proposed a template for surgeons in to use when dictating operative reports that includes key information such as clinical stage and location. Second, variable definitions must be standardized and extremely clear. In training, we found that consultation with a specialist and the use of photos and diagrams were helpful. Finally, enriching hospital medical record data with tumor registry data obtained from local tumor registrars was found to be feasible.

While we are working toward scalable quality improvement, our study may be limited in its generalizability by the unique setting of the Michigan Surgical Quality Collaborative. However, we are encouraged by the existence of other regional and national organizations; a program such as this might be implemented in other infrastructures. Another potential limitation is the volunteer bias that might have made the data abstraction nurses who participated in this project more likely to succeed than data abstraction personnel at other hospitals. In fact, the participating hospitals

tended to have medium-to-large colorectal surgery volumes, and to be long-standing members of the MSQC. However, the work of these hospitals has allowed us to understand how to conduct training, and to streamline and clarify the variables; we anticipate this will allow for implementation statewide.

In conclusion, we report the successful implementation of a program for RC care quality assessment in 10 Michigan hospitals. This data platform and training program can serve as a template for other regional organizations that are interested in assessing the quality of care for RC.

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Author Contributions

Conception and design: Samantha Hendren, Darrell Campbell Jr, Nancy J. Birkmeyer

Financial support: Samantha Hendren

Administrative support: Ellen McKeown

Collection and assembly of data: Ellen McKeown, Lyndia Poe

Data analysis and interpretation: Samantha Hendren, Ellen McKeown, Arden M. Morris, Sandra L. Wong, Mary K. Oerline, Lyndia Poe, Darrell Campbell Jr

Manuscript writing: Samantha Hendren, Ellen McKeown, Arden M. Morris, Sandra L. Wong, Mary K. Oerline, Lyndia Poe, Darrell Campbell Jr, Nancy J. Birkmeyer

Final approval of manuscript: Samantha Hendren, Ellen McKeown, Arden M. Morris, Sandra L. Wong, Mary K. Oerline, Lyndia Poe, Darrell Campbell Jr, Nancy J. Birkmeyer

Corresponding author: Contact Information: Samantha Hendren, MD, MPH, University of Michigan Department of Surgery, General Surgery, 2124 Taubman Center, 1500 E. Medical Center Dr., SPC-5343, Ann Arbor, MI 48109-5343; e-mail: Hendren@med.umich.edu.

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