Evaluating the Quality of Colorectal Cancer Care in the State of Florida: Results From the Florida Initiative for Quality Cancer Care

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Abstract

Purpose: The Florida Initiative for Quality Cancer Care (FIQCC) was established to evaluate the quality of cancer care at the regional level across the state of Florida. This study assessed adherence to validated quality indicators in colorectal cancer (CRC) and the variability in adherence by practice site, volume, and patient age.

Methods: The FIQCC is a consortium of 11 medical oncology practices in Florida. Medical record reviews were conducted for 507 patients diagnosed with CRC and seen as new medical oncology patients in 2006. Thirty-five indicators were evaluated individually and categorized across clinical domains and components of care.

Results: The mean adherence for 19 of 35 individual indicators was > 85%. Pathology reports were compliant on reporting depth of tumor invasion (96%; range, 86% to 100%), grade

(93%; range, 72% to 100%), and status of proximal and distal surgical resection margins (97%; range, 86% to 100%); however, documentation of lymphovascular and perineural invasion did not meet adherence standards (76%; range, 53% to 100% and 39%; range, 5% to 83%, respectively). Among patients with nonmetastatic rectal cancer, documentation of the status of surgical radial margins was consistently low across sites (42%; range, 0% to 100%; $P = .19$). Documentation of planned treatment regimens for adjuvant chemotherapy was noted in only 58% of eligible patients.

Conclusion: In this large regional initiative, we found high levels of adherence to more than half of the established quality indicators. Although the quality of care delivered within FIQCC practices seems to be high, several components of care were identified that warrant further scrutiny on both a systemic level and at individual centers.

Introduction

In 2011, it was estimated that more than 148,810 individuals would be diagnosed with colorectal cancer (CRC) in the United States, and approximately 49,380 would die as a result of CRC. CRC is the second leading cause of cancer death among men and women combined,¹ and survival depends on stage at diagnosis.^{1,2} Patients with nonmetastatic CRC have the potential to achieve long-term survival; however, the quality of cancer care they receive may affect their outcomes.^{3,4}

The importance of quality of care for patients with cancer was highlighted by the Institute of Medicine report recommending that cancer care quality be monitored using a core set of quality of care indicators (QCI).⁵ QCIs can encompass structural, process, and outcome measures⁵; however, process QCIs have several advantages, such as being closely related to outcome, easily modifiable, and providing clear guidance for quality improvement efforts.⁶ The American Society for Clinical Oncology (ASCO) established the National Initiative for Cancer Care Quality

(NICCQ) to develop and test a validated set of core process QCIs^{7,8} and the Quality Oncology Practice Initiative (QOPI) to conduct ongoing assessments of these QCIs within individual practices.⁹⁻¹³ The NICCQ validated 25 CRC-specific QCIs, with adherence ranging between 57% and 93%.⁸ QOPI assessed 11 QCIs at two time points 6 months apart, and improved performance was observed for several measures, with the greatest improvement seen in initially low-performing practices.¹²

Although QOPI has been successful in improving performance within QOPI sites, improvement of cancer care outside of QOPI may require local or regional efforts that are physician or practice driven.⁵ To that end, we established the Florida Initiative for Quality Cancer Care (FIQCC) consortium with the overall goal of evaluating and improving the quality of cancer care at the regional level in Florida.¹⁴⁻¹⁸ This study reports adherence to 35 validated QCIs among 507 patients with CRC and the variability in adherence by practice site, volume, and patient age.

Methods

Study Sites

The FIQCC is a consortium of 11 medical oncology practices in Florida,¹⁹ three of which are associated with academic centers (Appendix Fig A1, online only). Ethics committee approval and a waiver of consent were obtained to conduct this retrospective limited review of medical records. To maintain patient privacy, all records were coded with a unique identifier before transmission to Moffitt Cancer Center (Tampa, FL).

Selection of Quality Indicators

A panel of CRC medical and surgical oncology experts from Moffitt identified 35 CRC QCI from validated quality indicators provided by ASCO,²⁰ the National Comprehensive Cancer Network (NCCN),²¹⁻²³ NCCQ,⁸ QOPI,¹³ the National Quality Forum,²⁴ and the American College of Surgeons.²⁵ These indicators were reviewed and approved by FIQCC study coinvestigators and collaborative site primary investigators before data collection. QCI and sources are listed in Appendix Table A1 (online only).

Medical Record Selection and Review

Medical record reviews were conducted for all patients diagnosed with CRC with a medical oncology appointment in 2006. Patients age ≤ 18 years or those diagnosed with anal/recto-sigmoid carcinoma, synchronous, or nonadenocarcinoma malignancies were excluded. Record review and quality control procedures were conducted throughout the study as reported.¹⁷⁻¹⁹ In brief, the chief medical record abstractor conducted on-site training of data abstractors at each site using the comprehensive abstraction manual. Abstraction did not begin until inter-rater agreement of 70% was reached in five consecutive patient cases. The number of patient cases reviewed across sites ranged from 18 to 97.

Statistical Analyses

QCI that measure similar clinical functions or components of care were combined to generate five unique clinical domains (diagnostic evaluation, surgery-related pathology, adjuvant chemotherapy, adjuvant radiotherapy, and post-treatment surveillance) and seven components of care (testing, pathology, documentation, treatment considerations, timing of care, receipt of treatment/services, and technical quality).⁸ Appendix Table A1 (online only) outlines which QCI were included in each clinical domain and component of care. Mean percent adherence for each domain/component was calculated as the sum of adherence scores (ie, total number of yes answers) divided by the total number of eligible QCI questions within each domain/component. Patients who were not eligible for all QCI within a domain/component were excluded from the mean percent adherence calculation for that domain/component. Descriptive statistics and graphical illustrations summarize all QCI.

Compliance proportions and 95% CIs were calculated based on the exact binomial distribution. On the basis of NCCQ,⁸

we predetermined a threshold of 85% as compliant. Statistical comparisons of adherence across sites were performed using the exact Pearson χ^2 test, with Monte Carlo estimation. Logistic regression models evaluated effects of practice site volume (low *v* high) and patient age (< 70 *v* ≥ 70 years) on each QCI by estimating an odds ratio (OR) and 95% CI. All analyses used two-tailed tests, with a significance level of $P < .05$, and were performed using SAS (SAS 9.2; SAS Institute, Cary, NC).

Results

Patient Characteristics

Table 1 lists the characteristics of the 507 patients with CRC (391 with colon and 116 with rectal cancers) evaluated in this study. A majority of the patients were between the ages of 56 and 75 years (54%), male (53%), and white (90%).

Quality of Care by Clinical Domains and Components of Care

QCI were grouped into five clinical domains and seven components of care (Appendix Table A1, online only). Adherence was highest for the surgery-related pathology and adjuvant radiotherapy clinical domains (mean adherence, 91%; 95% CI, 89% to 93% and 90%; 95% CI, 86% to 94%, respectively; Table 2). The remaining clinical domains had an average adherence of 80%. High quality of care ($> 85\%$) was observed for three components of care (ie, treatment considerations, technical quality of treatment, and pathology).

Individual Quality Indicators and Variation Across Practice Sites

Rates of adherence to individual QCI were evaluated and presented as surgery/pathology, medical oncology, and radiation oncology (Table 3). Overall, 19 of 35 indicators had adherence rates $\geq 85\%$.

Surgical and pathology indicators. Of the 507 patient records reviewed, 93% were compliant for documentation of tumor stage, (American Joint Committee on Cancer, Dukes, or TNM status); however, compliance varied significantly by site (range, 77% to 100%; $P < .002$). To rule out synchronous lesions, a barium enema or colonoscopy is recommended within 6 months before or after surgical resection^{22,23}; this had an average adherence of 87% and varied across sites (range, 63% to 100%; $P < .001$).

Medical oncology practices were highly compliant (98%) in maintaining copies of the surgical pathology reports confirming malignancy in their office records. Pathology reports consistently documented depth of tumor invasion, grade, and status of resection margins (Table 3). Conversely, reporting of lymphovascular (LVI) and perineural invasion (PNI) did not meet adherence standards (76%; range, 53% to 100% and 39%; range, 5% to 83%, respectively) and varied significantly across sites ($P < .001$; Appendix Figs 2A and 2B, online only). Notably, among the 64 patients with nonmetastatic rectal cancer who had surgery and pathology reports, reporting of radial mar-

Table 1. Demographic and Clinical Characteristics of Patients With Colorectal Cancer (N = 507)

Characteristic	No.*	%
Age, years		
≤ 55	118	24.8
56-65	123	25.8
66-75	134	28.2
> 75	100	21.1
Sex		
Male	267	52.7
Female	240	47.3
Race		
White	398	89.0
Black	43	9.6
Asian or Pacific Islander	6	1.4
Payer		
Medicare	257	52.0
Medicaid	17	3.4
Private	195	39.4
Self-pay	16	3.2
Charity	10	2.0
Pathologic stage†		
Colon		
0/I	23	6.1
II	80	21.3
III	151	40.3
IV	121	30.4
Rectal		
0/I	11	11.6
II or III	56	58.9
IV	28	29.5

* Numbers for some characteristics may not add up to 507 because of missing data.

† Pathology reports and stage were missing for 37 patients.

gin status was consistently low across all sites (42%; range, 0% to 100%; $P = .19$). High compliance (97% to 100%) was documented for all but one QCI focusing on lymph node (LN) evaluation. Consistently across all 11 sites, there was low compliance with the assessment of ≥ 12 LNs (72%; range, 53% to 88%; $P = .26$; Appendix Fig 2C, online only) among patients with nonmetastatic colon cancer.

Among patients with nonmetastatic CRC who had surgery ($n = 321$), we observed significantly variable assessment of carcinoembryonic antigen (CEA) before treatment, with 35% (four of 11) of the sites adhering at $\geq 85\%$. Adherence was slightly better for CEA assessment 6 months after treatment (82%; range, 50% to 95%), although compliance varied by site ($P < .007$), and only five sites (45%) adhered $\geq 85\%$. Assessment of CEA before and after treatment was inconsistent within individual medical oncology practices, with only one site consistently adherent to both measures (data not shown).

Medical oncology indicators. There was documentation in the medical records that medical oncologists considered 95% of

Table 2. Quality Adherence Across Clinical Domains and Components of Care

Measure	No. of QCs	Eligible Patients	Adherence*	
			Mean (%)	95% CI
Clinical domain				
Diagnostic evaluation	6	507	80	77 to 82
Surgery-related pathology	8	316	91	89 to 93
Adjuvant chemotherapy	10	412	80	78 to 82
Adjuvant radiotherapy	5	56	90	86 to 94
Post-treatment surveillance	2	321	80	77 to 83
Component of care				
Testing	3	414	83	80 to 85
Pathology	11	316	86	84 to 88
Documentation	6	507	83	80 to 85
Treatment consideration	2	436	99	99 to 100
Timing of care	3	204	75	70 to 80
Receipt of treatment	3	204	83	79 to 88
Technical quality	7	321	87	85 to 89

Abbreviation: QCI, quality of care indicator.

* Mean percent adherence for each domain/component was calculated as the sum of adherence scores (ie, total of number of yes answers) divided by the total number of eligible QCI questions within each domain/component.

eligible patients for chemotherapy treatment (92% of those with nonmetastatic and 100% of those metastatic disease). Among patients with CRC who received chemotherapy treatment ($n = 321$), compliance was 99% for documenting body-surface area, 86% for having chemotherapy flow sheets, and 69% for signed/documented informed consent for treatment. Compliance with the latter two indicators varied significantly across practice sites ($P = .002$ and $P = .001$, respectively). Patient planned treatment regimen was documented in 58% of medical records (eg, name of drug and number of cycles; range, 10% to 83%; $P < .001$). Planned chemotherapy dosages fell within a range consistent with recommended regimens in 65% of patient cases (71 of 110). Among patients with nonmetastatic CRC receiving adjuvant chemotherapy ($n = 196$), 83% (range, 70% to 95%) were treated with a recommended regimen, and 66% (range, 33% to 89%) were treated within 8 weeks postsurgery. Recommended drug regimens were administered in 31% of patients with rectal cancer receiving neoadjuvant chemotherapy, and 88% of patients initiated treatment within 8 weeks of a positive biopsy.

Radiation oncology indicators. All patients with locally advanced rectal cancer (T3 and/or node positive) who had surgery ($n = 56$) were referred for and received radiation treatment. However, the sequence of radiation treatment, either before or after definitive surgery, varied across sites, with 54% of patients exclusively treated before or after surgery (data not shown). Across all sites, adherence standards were not met for delivery of a recommended radiation therapy regimen.

Table 3. Adherence to CRC QCI by Surgery/Pathology, Medical Oncology, and Radiation Oncology in 2006

Indicator No.*	QC†	Eligible Patients	Adherence (%)		P‡
			Rate	Range	
Surgery/pathology					
1	CRC detection by screening	507	14	0-25	< .01
2	Documentation of staging	507	93	77-100	< .01
3	Barium enema or colonoscopy within 6 months	414	87	63-100	< .01
4	Copy of pathology report in record	321	98	93-100	.54
5	Depth of invasion (T level)	316	96	86-100	.32
6	LVI	316	76	53-100	< .01
7	PNI	316	39	5-83	< .01
8	Tumor differentiation (grade)	316	93	72-100	< .01
9	Radial margin for rectal cancer	64	42	0-100	.21
10	Distal and proximal margin status	316	97	86-100	.02
11	Removal of LNs	316	97	82-100	.01
12	Examination of LNs	305	100	100-100	
13	No. of LNs examined	305	100	100-100	
14	≥ 12 LNs examined for nonmetastatic colon cancer	250	72	53-88	.26
15	Involvement of LNs (N level)	305	100	100-100	
17	Serum CEA before treatment for nonmetastatic CRC	321	78	47-100	< .01
18	Serum CEA post-treatment for nonmetastatic CRC	321	82	50-95	< .06
Medical oncology					
19	Consideration of adjuvant chemotherapy (all stages)	436	95	77-100	< .01
20	Explanation for not considering for treatment (all stages)	23	96	50-100	.14
21	Consent for chemotherapy	321	69	38-100	< .01
22	Flow sheet for chemotherapy	321	86	63-100	< .01
23	Documented planned adjuvant chemotherapy dose	321	58	5-83	< .01
24	Compliance of planned dose with accepted regimens (nonmetastatic)	110	65	0-100	.33
25	Documentation of BSA	321	99	92-100	.27
26	Accepted regimen of adjuvant chemotherapy (nonmetastatic)	196	83	70-95	.50
27	Adjuvant chemotherapy within 8 weeks (nonmetastatic)	196	66	33-89	.02
28	Accepted regimen of neoadjuvant chemotherapy (nonmetastatic rectal cancer)	32	31	0-100	.07
29	Receipt of neoadjuvant chemotherapy within 8 weeks of diagnosis (nonmetastatic rectal cancer)	32	88	0-100	.02
Radiation oncology for rectal cancer					
30	Consideration of radiation therapy	56	100	100-100	
32	Consultation with radiation oncologist	56	93	67-100	.78
33	Accepted dosage of radiation treatment	52	71	38-100	.39
34	Receipt of neoadjuvant radiation treatment	52	73	0-100	.01
35	Receipt of adjuvant radiation treatment	52	29	0-100	.02

Abbreviations: BSA, body-surface area; CEA, carcinoembryonic antigen; CRC, colorectal cancer; LN, lymph node; LVI, lymphovascular invasion; PNI, perineural invasion; QCI, quality of care indicator.

* Complete QCIs and indicator numbers can be found in Appendix Table A1 (online only). Indicator numbers included here for reference.

† Indicators < 85% in bold font.

‡ P for variance across sites.

Quality Indicators by Volume and Age

Because patient volumes can affect delivery of health care,²⁶ practice sites were categorized into those with low (< 50 medical records for patients with CRC; seven sites) or high (≥ 50 medical records for patients with CRC; four sites) patient volume. A significant relationship between QCI adherence and

practice volume was found for four indicators. Documentation of PNI was more likely to occur at high-volume practices (OR, 1.92; 95% CI, 1.2 to 3.1), as was documentation of a clinical trial discussion (OR, 1.83; 95% CI, 1.2 to 2.9), presence of chemotherapy flow sheets (OR, 2.36; 95% CI, 1.2 to 4.6), and documentation of planned dose (OR, 1.73; 95% CI, 1.1 to

2.7). Quality of CRC treatment has been suggested to be poorer among older patients; therefore, we evaluated quality of care according to patient age (< 70 v ≥ 70 years). Significant results were found for two indicators. Patients age ≥ 70 years were less likely to be offered participation in clinical trials (OR, 0.5; 95% CI, 0.3 to 0.8), whereas documentation of consent for treatment was more likely to be present for elderly patients (OR, 1.87; 95% CI, 1.1 to 3.3).

Discussion

This study applied and evaluated 35 QCIs among 507 patients with CRC treated in 11 different medical oncology practices across Florida. High overall concordance rates were noted for 54% of indicators. By summarizing individual indicators in clinical domains and components of care, this study evaluated the quality of care across similar processes and identified broad target areas for improvement. Furthermore, although significant variability in adherence across practice sites was observed, adherence was rarely associated with clinical volume or patient age.

In our study, adherence to pathology indicators was high, with the exception of reporting LVI and PNI. LVI represents early manifestations of the multistep metastatic process,²⁷ and its presence has been associated with poor prognosis in various cancer types independent of TNM staging.²⁸⁻³¹ Similarly, PNI seems to be an important predictor of prognosis.³² Our data are consistent with the College of American Pathologists program that reported LVI (47%) and PNI (19%) as common missing elements in pathology reports.³³ Conversely, documentation of LVI within the NCCQ study was $> 85\%$.⁸ Documentation of LVI and PNI has been recommended since 1999, when the College of American Pathologists established a list of validated pathology elements,³⁴ and in 2004, LVI became a required element.^{35,36} In 2006, pathologists should have been aware of the need to document LVI as well as PNI. Auditing and monitoring the completeness of pathology reports have been reported to improve report quality.^{33,37-39} Therefore, it is possible that the monitoring completed as part of FIQCC may have an impact on pathology report quality after 2006 within FIQCC sites, especially among sites that communicated results to their pathologists, some of whom are members of external pathology services.

The adequate harvest of LNs among patients with colon cancer improves staging and leads to improved outcomes.^{34,40} Although the significance of the 12-node benchmark remains controversial,^{41,42} the National Quality Forum has supported this cut point as a QCI.²⁴ Overall, FIQCC practice sites documented the removal and examination of ≥ 12 LNs in 72% of patient cases, with 18% of practice sites (two of 11) achieving 85%. In contrast, the NCCN reported 92% adherence,⁴³ and Vergara-Fernandez et al reported 88% in 2006, which was a significant increase from 2002 (49%).⁴ It is unclear why the FIQCC sites lacked adherence to this QCI. It has been shown that use of synoptic pathology reporting improves LVI and PNI reporting, and it has been linked to an increase in LNs per specimen evaluated.^{44,45} The use of synoptic reports by FIQCC site pathologists was not recorded as part of this study, but this

provides an avenue for quality improvement efforts. Improvement efforts for pathology indicators will involve multidisciplinary input from surgeons, oncologists, and pathologists.⁴¹

Medical oncologists failed to document planned chemotherapy regimen in their notes for $\geq 85\%$ of their patients, which is consistent with previous reports.^{8,12} Possible explanations include: perceptions that treatment dose and cycle are implied when the planned regimen is documented, inconsistent documentation of both the drug name and number of cycles, and/or lack of standardized documentation forms. Data are unavailable to determine the exact explanation for the lack of documentation; however, the latter explanation is unlikely, because standardized chemotherapy flow sheets were used at most sites. FIQCC has raised awareness among participating sites regarding the importance of complete documentation within the medical record, which can prevent clinical errors.

The treatment of CRC has improved as a result of targeted therapy and/or discovery of treatment response markers (eg, *KRAS/BRAF* mutations).^{46,47} Stage-specific chemotherapy guidelines (eg, NCCN guidelines) assist physicians in determining optimal treatment regimens and recommended dosages, and following these guidelines is a QCI. Among FIQCC practices that documented chemotherapy regimens, our data demonstrate moderate compliance with providing recommended chemotherapy drugs and poor compliance for use of recommended dose, dose per cycle, and number of cycles within recommended ranges. Furthermore, providing treatment within the recommended timeframe among FIQCC practice sites was lower than among NCCQ sites (79%)⁸ and another National Cancer Institute–designated cancer center (90%).⁴³ Potential reasons for delayed treatment (eg, surgical complications, significant comorbid disease) in our patient cases were not available. There is evidence that delivering the recommended chemotherapy dose results in sustained improvements in outcomes among patients with potentially curable disease⁴⁸; therefore, efforts to improve adherence to chemotherapy guidelines are warranted.

The treatment of rectal cancer differs in complexity from that of colon cancer because of the frequent addition of radiotherapy.^{22,23,49} Neoadjuvant chemoradiotherapy is the preferred recommended approach for locally advanced rectal cancer where possible.^{23,49} Within FIQCC, 73% of eligible patients received neoadjuvant radiation; however, only 31% received the recommended neoadjuvant chemotherapy treatment regimens. A higher percentage of patients with nonmetastatic rectal cancer received recommended chemotherapy regimens when considering both neoadjuvant and adjuvant treatment (86%), similar to the rate within NCCQ (83%).⁸ Rectal radial margin status is highly predictive of local recurrence⁵⁰ and a key QCI. In contrast to previous reports,⁴ we observed poor documentation of radial margin status. The complexity of treating rectal cancer may explain, in part, the poor adherence within FIQCC; thus, quality improvement efforts that improve the understanding of rectal cancer management are needed.

Serum CEA is a well-established tumor marker used in the surveillance of nonmetastatic CRC.²⁰ Among FIQCC sites, there was significant variability in CEA measurement before (78%) or after treatment (82%). Adherence rates were similar, if not better, for assessment of pretreatment CEA compared with post-treatment assessment for all but one site. Our results are similar to those of QOPI, which reported 88% of patients having CEA measured within 9 months of resection.¹² Viehl et al⁵¹ reported 32.8% adherence to baseline CEA measurement.

This study presents a large regional assessment of the quality of CRC care among 11 diverse medical oncology practices (ie, patient volume, geographic location, and community/academic status). We evaluated a comprehensive set of 35 validated QCIs. Medical record abstractions were systematically conducted by trained abstractors, and data collection was audited. Along with these strengths, there are some limitations that should be considered. Although CRC patient cases from 2006 may not represent current practice patterns, all QCIs were specific for that year 2006 (eg, recommended treatment regimens). The restriction to medical oncology records may have skewed the results toward lower adherence for surgical, pathologic, and/or radiation indicators; however, patient care by medical oncologists requires documentation from these specialists, and assessment of QCIs within medical oncology records is warranted. The small sample size for some indicators may have influenced the interpretation of compliance, especially for patients with rectal cancer. The findings of this study may not be generalizable to the care of all racial groups, because we were unable to assess differences by patient race or ethnicity, which should be the focus of additional quality assessment endeavors.

Although FIQCC monitors and reports on adherence to QCIs for each site, the individual practice sites have taken the lead on quality improvement efforts. As part of biannual FIQCC investigator meetings, results were provided to each of the participating sites and then reviewed in blinded fashion, with each individual site providing its site code (Appendix Fig A2, online only). Sites shared the quality data with respective institutional quality review committees (either established or inaugural) to address the issues that were raised. Each institution prioritized the identified deficits in compliance with QCIs and developed action plans for improvement. Each practice site reported a variety of quality improvement activities that were initiated after disclosure of FIQCC results from the previous retreat, such as development of treatment consent processes, altering pathology reporting to include missing elements, or improving CEA testing. A resampling of patient cases after these activities is ongoing and will help determine the effectiveness of site-initiated improvement efforts. These practice site-initiated activities seem to have improved quality when comparing a small set of QCIs among four practice sites with data from 2004¹⁴ and 2006. For example, increases in compliance were observed for CEA before surgery (from 57% to 80%; $P < .001$) and evaluation of the colon within 6 months of treatment (from 46% to 89%; $P < .001$). The dissemination of results obtained within FIQCC to consortium members has improved the quality of CRC care across the state of Florida.

Overall, CRC represents a disease with substantial burden to society, and the quality of care provided after diagnosis is critical. We have successfully translated published CRC QCIs into practice within community and academic medical oncology centers across the state of Florida. Although the quality of care delivered within FIQCC practices seemed to be high, several components of care were identified that warrant further scrutiny on both a systemic level and at individual centers. The FIQCC consortium provides an excellent model of a sustainable collaboration for the assessment of cancer care quality within other hospital networks across the United States.

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Appendix

Table A1. QCI for Patients With Colorectal Cancer

Indicator No.	QCI		Clinical Domain	Component of Care	Source
	Complete	Abbreviated			
1	Was "colorectal cancer detected by screening?"	CRC detection by screening			a
2	Was "there an explicit statement of the patient's staging according to the AJCC or Dukes systems?" Or, for patients who do not have an explicit statement of staging in their medical record, is "the tumor size, lymph node status, and metastatic status documented in the medical chart?"	Documentation of staging	Diagnostic	Documentation	b,c
3	For patients who had surgical resection, was "a barium enema or colonoscopy performed within 6 mo before or 6 mo after surgery?"	Barium enema or colonoscopy within 6 months	Diagnostic	Testing	d
4	For patients with nonmetastatic colon or rectal disease, was "there a copy of the surgical pathology report confirming malignancy in the medical oncology office chart?"	Copy of pathology report in medical record		Documentation	b,e
5	For patients with nonmetastatic colon or rectal disease, did "the surgical pathology report state the depth of invasion of the tumor?"	Depth of invasion (T level)	Diagnostic	Pathology	b,e
6	For patients with nonmetastatic colon or rectal disease, did "the surgical pathology report state the presence or absence of lymphovascular invasion?"	LVI	Diagnostic	Pathology	b,c
7	For patients with nonmetastatic colon or rectal disease, did "the surgical pathology report state the presence or absence of perineural invasion?"	PNI	Diagnostic	Pathology	b
8	For patients with nonmetastatic colon or rectal disease, did "the surgical pathology report state the differentiation of the tumor as well, moderate, or poor?"	Tumor differentiation (grade)	Diagnostic	Pathology	b
9	For patients with nonmetastatic rectal disease, did "the surgical pathology report document that the radial margin of the surgical specimen is free of tumor?"	Radial margin for rectal cancer	Surgery-related pathology	Pathology, quality of treatment	b,c
10	For patients with nonmetastatic colon or rectal disease, did "the surgical pathology report comment on the presence or absence of microscopic tumor cells at the resection margin?"	Distal and proximal margin status	Surgery-related pathology	Pathology, quality of treatment	b,c
11	For patients with nonmetastatic colon or rectal disease, did "the surgical pathology report indicate that the patient had the lymph nodes removed?"	Removal of LNs	Surgery-related pathology	Pathology	b,c
12	For patients with nonmetastatic colon or rectal disease who had LNs removed, did "the surgical pathology report state whether or not the lymph nodes were examined?"	Examination of LNs	Surgery-related pathology	Pathology, quality of treatment	b
13	For patients with nonmetastatic colon or rectal disease whose pathology report stated whether LNs were examined, did "the surgical pathology report state the number of lymph nodes examined?"	Number of LNs examined	Surgery-related pathology	Pathology, quality of treatment	b
14	For patients with nonmetastatic colon disease whose pathology report stated the number of LNs examined, "how many lymph nodes were examined?"	≥ 12 LNs examined for nonmetastatic colon cancer		Pathology, quality of treatment	b,f
15	For patients with nonmetastatic colon or rectal disease who had LNs removed, did "the surgical pathology report state whether or not the tumor involves lymph nodes?"	Involvement of LNs (N level)	Surgery-related pathology	Pathology	b,c
16	For patients with nonmetastatic colon or rectal disease whose pathology report stated whether the tumor involved LNs, did "the surgical pathology report state the number of lymph nodes involved?"		Surgery-related pathology	Pathology	b
17	For patients with nonmetastatic colon or rectal cancer, was "there a blood test for CEA at least once prior to surgery or chemotherapy treatment?"	Serum CEA before treatment for nonmetastatic CRC	Post-treatment surveillance	Testing	d,g

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Table A1. (Continued)

Indicator No.	QCI		Clinical Domain	Component of Care	Source
	Complete	Abbreviated			
18	For patients with nonmetastatic colon or rectal cancer, was "there a blood test for CEA at least once within 6 mo after the last treatment, either surgery or chemotherapy?"	Serum CEA after treatment for nonmetastatic CRC	Post-treatment surveillance	Testing	c,g
19	For patients for whom guidelines recommend use of chemotherapy, did "the physician discuss, recommend, or refer for adjuvant chemotherapy?" ^{h,i}	Consideration of adjuvant chemotherapy (all stages)	Chemotherapy	Treatment consideration	c,d
20	For patients for whom guidelines recommend use of chemotherapy but who were not referred for adjuvant chemotherapy, was "there an explicit note in the medical chart explaining why the physician did not discuss, recommend, or refer for adjuvant chemotherapy?" ^{h,i}	Explanation for not considering for treatment (all stages)	Chemotherapy	Treatment consideration	c,d
21	For patients who received chemotherapy, was "there a signed consent for treatment in the chart or a practitioner's note that treatment was discussed and patient consented to treatment?"	Consent for chemotherapy	Chemotherapy	Documentation	e
22	For patients who received chemotherapy, was "there a flow sheet with chemotherapy notes and blood counts?"	Flow sheet for chemotherapy	Chemotherapy	Documentation	e
23	For patients who received chemotherapy, was "the patient's planned dose of chemotherapy documented in the medical oncology note?"	Documented planned adjuvant chemotherapy dose	Chemotherapy	Documentation	c
24	For nonmetastatic patients who received chemotherapy and whose planned dose was documented, did "the patient's planned dose of chemotherapy, dose per cycle, and number of cycles fall within a range that is consistent with published regimens?"	Compliance of planned dose with accepted regimens (nonmetastatic)	Chemotherapy	Quality of treatment	c,d
25	For patients who received chemotherapy, was "the patient's body-surface area (BSA) documented?"	Documentation of BSA	Chemotherapy	Documentation	c
26	For patients with stage II/III colon cancer or stage II/III rectal cancer who received chemotherapy, did "the patient receive adjuvant chemotherapy with a regimen listed below?" Or was "the patient in a clinical trial of a chemotherapy agent or regimen?" ^j	Accepted regimen of adjuvant chemotherapy (nonmetastatic)	Chemotherapy	Receipt of treatment	c,d
27	For patients with stage II/III colon cancer or stage II/III rectal cancer who received chemotherapy, did "the patient start adjuvant chemotherapy within 8 wk after surgical resection?" ^j	Adjuvant chemotherapy within 8 weeks (nonmetastatic)	Chemotherapy	Timing of care	c
28	For patients with stage II/III rectal cancer who received chemotherapy before surgical resection, did "the patient receive neoadjuvant chemotherapy with a regimen listed below?"	Accepted regimen of neoadjuvant chemotherapy (nonmetastatic rectal cancer)	Chemotherapy	Receipt of treatment	c,d
29	For patients with stage II/III rectal cancer who received neoadjuvant chemotherapy, did "the patient start neoadjuvant chemotherapy within 8 wk after first positive biopsy?"	Receipt of neoadjuvant chemotherapy within 8 weeks of diagnosis (nonmetastatic rectal cancer)	Chemotherapy	Timing of care	c
30	For patients with stage II/III rectal cancer, did "the physician discuss, recommend, or refer for radiation?"	Consideration of radiation therapy	Radiation	Treatment consideration	c
31	For patients with stage II/III rectal cancer who were not referred for radiation, was "there an explicit note in the medical chart explaining why the physician did not discuss, recommend, or refer for radiation?"		Radiation	Treatment consideration	c
32	For patients with stage II/III rectal cancer, did "the patient have a consultation with a radiation oncologist?"	Consultation with radiation oncologist	Radiation	Treatment consideration	
33	For patients with stage II/III rectal cancer who received radiation, did "the patient receive a radiation regimen that included at least 45 Gray (Gy) over a period of 5 wk?" Or was "the patient in a clinical trial for radiation therapy?"	Accepted dosage of radiation treatment	Radiation	Receipt of treatment, quality of treatment	d

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Table A1. (Continued)

Indicator No.	QCI		Clinical Domain	Component of Care	Source
	Complete	Abbreviated			
34	For patients with stage II/III rectal cancer who received radiation, did "the patient receive radiation therapy before definitive surgical excision?"	Receipt of neoadjuvant radiation treatment	Radiation	Timing of care	^c
35	For patients with stage II/III rectal cancer who received radiation, did "the patient receive radiation therapy after definitive surgical excision?"	Receipt of adjuvant radiation treatment	Radiation	Timing of care	^c

Abbreviations: AJCC, American Joint Committee on Cancer; BSA, body-surface area; CEA, carcinoembryonic antigen; CRC, colorectal cancer; LN, lymph node; LVI, lymphovascular invasion; NCCN, National Comprehensive Cancer Network; PNI, perineural invasion; QCI, quality of care indicator.

^a www.ahrq.gov/clinic/uspstfix.htm.

^b O'Leary J: J Oncol Manag 12:7, 2003.

^c Malin JL, Schneider EC, Epstein AM, et al: J Clin Oncol 24:626-634, 2006.

^d Desch CE, McNiff KK, Schneider EC, et al: J Clin Oncol 26:3631-3637, 2008; Engstrom PF, Benson AB 3rd, Chen YJ, et al: J Natl Compr Canc Netw 3:468-491, 2005; Engstrom PF, Benson AB 3rd, Chen YJ, et al: J Natl Compr Canc Netw 3:492-508, 2005.

^e Neuss MN, Desch CE, McNiff KK, et al: J Clin Oncol 23:6233-6239, 2005.

^f www.qualityforum.org/MeasureDetails.aspx?SubmissionId=455#k=colon+cancer.

^g Desch CE, Benson AB 3rd, Somerfield MR, et al: J Clin Oncol 23:8512-8519, 2005.

^h NCCN guidelines recommend patients with stages II to IV colon cancer and stages II to IV rectal cancer receive treatment with chemotherapy.

ⁱ Discussion, recommendation, and referral for patients with stage III colon cancer must have occurred within 4 months of diagnosis.

^j Restricted to stage II colon cancer with features that increase risk of recurrence, including obstruction, perforation, T4 lesions, poorly differentiated adenocarcinoma, or LVI.

Figure A1. The Florida Initiative for Quality Cancer Care is a consortium of 11 medical oncology practices across the state of Florida. Reprinted with permission.¹⁸

Figure A2. Adherence to pathologic quality of care indicators of (A) lymphovascular (LVI), (B) perineural invasion (PNI), and (C) examination of ≥ 12 lymph nodes (LNs). Variable adherence was observed across sites for documentation of LVI (76%; range, 53% to 100%) and PNI (39%; range, 5% to 83%) in 316 patients with nonmetastatic colorectal cancer who had surgery ($P < .001$). Adherence to the examination of ≥ 12 LNs was consistently low (72%; range, 52% to 88%; $P = .26$) for patients with nonmetastatic colon cancer ($n = 250$).