Quality Indicators for Colonoscopy

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Colonoscopy is the cornerstone of colorectal cancer (CRC) prevention worldwide and in the United States (1–4). In the United States, colonoscopy is commonly used for primary CRC screening and is the first and preferred colorectal imaging test in patients presenting with symptoms, with positive screening tests other than colonoscopy (1–4), undergoing surveillance after resection of CRC or precancerous polyps (5,6), with a strong family history of CRC or advanced precancerous lesions (1), and undergoing dysplasia surveillance in ulcerative colitis (UC) and Crohn's colitis (7).

Evidence indicates colonoscopy reduces the incidence of CRC and prevents CRC mortality (8–23) (Table 1). Reduction in incidence and mortality of CRC with colonoscopy is greater in the left-sided colon than the right-sided colon (24). In the first randomized controlled trial comparing colonoscopy with no screening, patients who complied with and underwent colonoscopy (per-protocol analysis) had a 31% reduction in CRC incidence and a 50% reduction in CRC mortality (25). Several factors, including earlier than planned reporting of trial results, absence of stage shift in CRCs detected in the colonoscopy arm (suggesting symptomatic patients were enrolled in the colonoscopy arm), and lower than expected cecal intubation and adenoma detection, indicate the study may have underestimated the benefits of colonoscopy (25).

The impact of colonoscopy on CRC and other outcomes (e.g., polyp detection, assignment of screening, and surveillance intervals) is highly operator-dependent. Detection of precancerous colorectal lesions is highly variable (26–28) and is associated with the risk of developing post colonoscopy CRC (PCCRC) (21,22). In response to evidence of inconsistent performance, professional gastroenterology and endoscopy societies began an organized movement 2 decades ago to improve the quality of technical performance and reduce the operator-dependence of colonoscopy (29). This document represents the latest update of recommendations from the American College of Gastroenterology (ACG)/American Society for Gastrointestinal Endoscopy (ASGE) Quality Task Force. Previous recommendations from this task force were published in 2006 (30) and 2015 (31). This update reflects new evidence published since 2015.

High-quality colonoscopy includes adequate bowel preparation, safe colonoscope insertion to the proximal extent of the colon, detailed examination with identification of all precancerous lesions, and complete and curative resection of these lesions. The process is completed by thorough and accurate documentation of findings and assignment of any appropriate screening or surveillance follow-up at cost-effective intervals based on recommendations from the US Multi-Society Task Force (MSTF) on CRC (32). High-quality performance in 1 aspect of colonoscopy does not ensure adequate performance in others. For example, colonoscopists may be effective at detection but not resection of precancerous lesions or vice versa (33). Understanding deficiencies in performance is generally gained only through quality measurement. Given the impact of inadequate performance on critical outcomes including cancer development, failure to measure performance is unacceptable.

This document presents many quality indicators related to the technical performance of colonoscopy. Practicing colonoscopists are encouraged to make quality measurements related to all indicators, but this may not be feasible from a time, staffing, or cost perspective. Therefore, the document recommends priority

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Table 1. Evidence indicates that colonoscopy is able to reduce the incidence of CRC and prevent CRC mortality (8–23)

• Incidence of CRC is lower in patients undergoing screening fecal blood tests
• Incidence of right-sided colon cancer is lower in patients undergoing screening flexible sigmoidoscopy with liberal rules for performing colonoscopy based on flexible sigmoidoscopy findings
• CRC incidence and mortality are reduced in adenoma cohorts compared with reference populations
• CRC incidence in screening cohorts is reduced compared with reference populations
• Case-control studies in screening and nonscreening populations show reduction in incidence and mortality
• Case-control studies show reductions in right-sided CRC incidence and mortality in screening and nonscreening populations
• Evidence from US population trends
• Studies show variable prevention between endoscopists with different detection skills

CRC, colorectal cancer.

quality indicators (Table 2). These indicators were chosen based on clinical relevance, evidence of variable performance, and feasibility of measurement. Measurement of priority indicators is considered essential.

METHODOLOGY

The first version of this document was published by the ACG/ASGE Task Force on Quality in Endoscopy in 2006 (30) and was revised in 2015 (31). This current revision integrates new data relevant to existing quality indicators and introduces new indicators based on interval progress in the field. This document focuses on quality indicators unique to colonoscopy (Table 3). The indicators common to all gastrointestinal (GI) endoscopic procedures are presented in detail in a separate article (34) and are, for completeness, also listed in Table 4. Indicators common to all GI endoscopic procedures are not addressed in this document, except in some instances where discussion specific to colonoscopy is required.

As in the preceding versions, we prioritized indicators that have wide-ranging clinical implications, are associated with variation in practice and outcomes, and have been validated in clinical studies. When supportive data were absent, indicators of clinical importance were chosen by expert consensus. We have made substantial progress in measuring performance; however, feasibility and efficiency challenges remain. The task force included a limited number of highly relevant but not yet easily measurable indicators.

As stated before (30,31), quality indicators are divided into 3 time periods: preprocedure, intraprocedure, and postprocedure. Each quality indicator is classified as an outcome or process measure. Outcome measures are impactful in improving quality of care but can be difficult to measure in clinical practice. Outcome measures often require large amounts of data and/or long-term follow-up, and their measurement may be confounded by other factors. In such cases, process indicators are provided as surrogate measures of high-quality endoscopic practice. The relative value of a process indicator hinges on the evidence supporting its association with a clinically relevant outcome, and such process measures are emphasized. The measures in this document pertain to endoscopic care. The quality of care is influenced by additional factors, including those related to endoscopy centers. These structural measures are covered in a separate article dedicated to unit-level quality (35).

Table 2. Priority quality indicators for colonoscopy

• Adenoma detection rate
• Sessile serrated lesion detection rate[a]
• Rate of using recommended screening and surveillance intervals
• Bowel preparation adequacy rate[a]
• Cecal intubation rate[b]

[a]Designates a new priority indicator.
[b]Should be measured for all colonoscopists but can be measured intermittently or not at all if consistent high-level performance has been demonstrated.

For this update, the task force critically appraised existing quality indicators based on several factors, including ongoing relevance and strength of evidence. Additionally, new quality indicators were proposed and, if appropriate, were adopted by consensus based on similar considerations. For each indicator, relevant articles were identified by the authors through a systematic search of PubMed (US National Library of Medicine, National Institutes of Health) from January 2014 (the date of the last update of this document) through December 2022. The search strategies for each indicator included a combination of subject headings (MeSH in PubMed) and pertinent keywords. English language restrictions were applied. To identify additional articles, the authors reviewed PubMed's "similar articles" and manually searched reference lists of relevant articles. Searches were facilitated by health science librarians with expertise in systematic review. Based on this revised literature review, the strength of recommendation for each indicator was evaluated according to a previously used framework (Table 5). Within this framework, the strength of each quality indicator was divided across a spectrum from "1A," denoting a strong quality indicator that can be applied to most clinical settings, to "3," denoting a weak quality indicator because of a lack of evidence requiring expert opinion. The strength of recommendation grade for each indicator was established with consensus of the authors.

The process and outcome measures included in this document are attached to a performance target, and therefore each measure is considered a quality indicator. The task force selected performance targets based on published benchmarking data, informed by literature review. In the absence of available data, when expert consensus considered the failure to perform a given quality indicator a "never event," such as failure to monitor vital signs during sedation, the performance target was expressed as >98%,

Table 3. Quality indicators for colonoscopy

Quality indicator	Strength of recommendation	Measure type	Performance target (% [unless otherwise indicated])
General colonoscopy quality indicators			
Preprocedure			
1. Frequency with which colonoscopy is performed for an appropriate indication and the indication is documented	1C+	Process	≥95
2. Rate of bowel preparation adequacy[a] Percentage of patients undergoing colonoscopy with adequate bowel preparation, preferably defined as Boston Bowel Preparation Scale score ≥2 in each of 3 colon segments or by description of the preparation as excellent, good, or adequate. The recommended screening or surveillance interval should be consistent with US Multi-Society Task Force recommendations	1C	Process	≥90
Intraprocedure			
3. Cecal intubation rate[a] Percentage of patients undergoing colonoscopy with intact colons who have full intubation of the cecum with photo documentation of cecal landmarks	1C	Process	≥95
Detection indicators for colonoscopy			
4. Adenoma detection rate[a] Percentage of patients aged ≥45 yr undergoing colonoscopy for screening, surveillance, or diagnostic indications other than positive noncolonoscopy screening tests (e.g., fecal tests or CT colonography) who have ≥1 conventional adenomas detected and verified by pathology. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation	1C+	Outcome	≥35
5. Percentage of patients with positive fecal screening tests (fecal blood or mt-sDNA) with ≥1 conventional adenomas resected and documented by pathology	1C	Outcome	≥50
6. Number of conventional adenomas detected per colonoscopy in patients aged ≥45 yr with indications of screening, surveillance, or diagnosis of symptoms. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation	2C	Outcome	≥0.6
7. Sessile serrated lesion detection rate[a] Percentage of patients aged ≥45 yr undergoing screening, surveillance, or diagnostic colonoscopy for symptoms with ≥1 sessile serrated lesions removed and documented by pathology. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation	2C	Outcome	≥6
8. Average withdrawal time in normal colonoscopies without biopsy sampling or polypectomies in persons aged ≥45 yr undergoing screening, surveillance, or diagnostic colonoscopy. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation	2A	Process	≥8 min
Resection indicators			
9. Percentage of polyp resections for which the report documents the lesion size, shape, location, and method of resection	3	Process	≥98

Table 3. (*continued*)

Quality indicator	Strength of recommendation	Measure type	Performance target (% [unless otherwise indicated])
10. Percentage of 4- to 9-mm lesions that are resected using a cold snare	1A	Process	≥90
Postprocedure			
11. Use of appropriate screening and surveillance intervals[a] Frequency with which colonoscopies follow recommended postpolypectomy and post–cancer resection surveillance intervals and frequency of 10-yr intervals between screening colonoscopies in average risk patients who have negative examination results and adequate bowel cleansing	1C	Process	≥90
12. Proportion of serious adverse events (perforation, postpolypectomy bleeding, and mortality) associated with colonoscopy that are tracked, documented, and reviewed by a quality improvement committee to assess for system and clinical areas of improvement	1C	Process	≥95
Quality indicators for colonoscopy in IBD			
IBD intraprocedure colonoscopy indicators			
13. Percentage of colonoscopies performed for the indication of ulcerative colitis in which a formal assessment of disease extent and activity (Mayo Endoscopic Score, Modified Mayo Endoscopic Score, Ulcerative Colitis Endoscopic Index of Severity, or Ulcerative Colitis Colonoscopic Index of Severity) is recorded	3	Process	≥90
14. Percentage of colonoscopies performed for the indication of Crohn's disease in which a formal disease activity score (Crohn's Disease Endoscopic Index of Severity, or Simple Endoscopic Activity Score in Crohn's Disease, or Rutgeerts score) is reported	3	Process	≥90
IBD postcolonoscopy quality indicators			
15. Frequency of appropriate recommendation for a follow-up surveillance colonoscopy interval for ulcerative colitis/ indeterminate colitis patients undergoing dysplasia screening without dysplasia detected	3	Process	≥90

IBD, inflammatory bowel disease; mt-sDNA, multi-target stool DNA.
[a]Indicates priority indicator.

because only in exceptional circumstances would the quality indicator not be fulfilled.

Quality indicators are intended to serve as a framework for quality improvement efforts. The included quality indicators and associated performance targets do not necessarily reflect the standard of care, credentialing requirements, or training standards, and it is a misuse to apply any of the quality indicators in this document as such.

PRIORITY INDICATORS

The 2006 and 2015 ACG/ASGE quality documents proposed many indicators for quality measurement in the technical performance of colonoscopy (30,31). Quality measurement is relatively new and requires resources. The 2015 document proposed priority indicators that every endoscopy unit should endeavor to measure.

This current revision also proposes priority indicators (Table 2). Priority indicators reflect the strength with which they are linked to important colonoscopy outcomes, such as prevention of cancer and cancer death, the feasibility of measurement in clinical practice, evidence for variability in performance, and consensus regarding the significance of the indicator as a continuing or emerging element of high-quality technical performance of colonoscopy. The rationale for selection of priority indicators in this document (Table 2) is largely presented in the discussion of individual indicators below. We recommend that quality improvement efforts initially focus on high-priority indicators and then progress to other indicators once it is ascertained that endoscopists are performing above recommended thresholds, either at baseline or after corrective interventions.

The cecal intubation rate (CIR) remains a quality indicator for colonoscopy in this update. However, although CIR was a priority indicator in 2015 (31), its status as a priority indicator has been changed in this update (Table 2). High CIRs are associated with prevention of CRC (36), and failed intubation leads to costs and inconvenience associated with supplementary imaging and repeat attempts at colonoscopy. Thus, we continue to recommend measurement of CIRs. However, substantial evidence indicates that most gastroenterologists achieve CIRs above recommended thresholds and maintain them (37,38). Therefore, a sustained measurement of CIRs may not be an effective use of resources in units where there is no evidence of inadequate performance.

New priority indicators are designated by footnotes in Table 2. One of these is adequacy of bowel preparation, which is fundamental to cost-effective colonoscopy. The second is the sessile serrated lesion detection rate (SSLDR), which is selected based on evidence it will contribute to cancer prevention (see Indicator 7 below).

GENERAL COLONOSCOPY INDICATORS

Preprocedure indicators

Appropriate indications for colonoscopy

1. Frequency with which colonoscopy is performed for an appropriate indication and the indication is documented.
Strength of recommendation: 1C+
Performance target: ≥95%
Measure type: process

Appropriate indications for colonoscopy are listed in Table 6. Each procedure report should include an accepted indication or an explanation if the indication is considered nonstandard. Dates and findings from prior colonoscopies (e.g., cancer, advanced lesions, or nonadvanced lesions) that drive the current colonoscopy should be documented with the indication.

When colonoscopy is used for appropriate indications, there is a higher yield of clinically relevant diagnoses (39–42). List for accepted indications can be used to screen colonoscopy referrals for appropriateness (43–46).

Rate of bowel preparation adequacy (priority indicator)

2. Percentage of patients undergoing colonoscopy with adequate bowel preparation, preferably defined as Boston Bowel Preparation Scale score ≥2 in each of 3 colon segments or by description of the preparation as excellent, good, or adequate. The recommended screening or surveillance interval should be consistent with US MSTF recommendations.
Strength of recommendation: 1C
Performance target: ≥90%
Measure type: process

The ACG/ASGE Task Force on Quality Indicators for Colonoscopy relies heavily on the bowel preparation recommendations of the US MSTF (47). When bowel preparation is adequate, the subsequent recommended interval for repeat screening or surveillance colonoscopy should be consistent with the US MSTF recommendations (6,47) unless a documented indication exists for earlier colonoscopy (e.g., an inherited genetic disorder, strong family history, or a disease process such as chronic inflammatory bowel disease [IBD]).

As per the US MSTF recommendations, patients with inadequate bowel preparation should have a repeat study within 1 year (47). The US MSTF recommended in 2014 that at least 85% of outpatient colonoscopies should be accompanied by an adequate bowel preparation (47). The European Society of Gastrointestinal Endoscopy recommended a 90% target (48). The US MSTF recommendations are currently under revision, and based on continued evidence of high rates of adequate preparation in clinical trials (49), the ACG/ASGE Task Force recommends the 90% threshold. Inadequate bowel preparation substantially increases the cost of colonoscopy delivery (50) and creates risk and inconvenience for patients, thus warranting a ranking as a priority indicator.

Like the US MSTF, we recommend that the colonoscopy report in the case of adequate preparation should include descriptors of bowel preparation as "adequate," "excellent," or "good" or record a Boston Bowel Preparation Scale score of ≥2 in all 3 colon segments (51,52). Because it uses scores and explicit descriptions of what the scores mean, the Boston Bowel Preparation Scale is preferred. Further, the Boston Bowel Preparation Scale is specifically designed for use after completion of intraprocedural bowel cleaning, which is the most clinically relevant time point to assess cleansing quality. To count toward meeting the 90% compliance target, the recommended follow-up interval must be consistent with US MSTF postpolypectomy (32) or postcancer resection (53) surveillance recommendations.

Intraprocedure indicators

Cecal intubation rate (priority indicator)

3. Percentage of patients undergoing colonoscopy with intact colons who have full intubation of the cecum with photo documentation of cecal landmarks.
Strength of recommendation: 1C
Performance target: ≥95%
Measure type: process

A trained colonoscopist should achieve a high CIR with a very high level of safety. Cecal intubation is defined as passage of the colonoscope tip proximal to the ileocecal valve and fully into the cecal caput so that the appendiceal orifice can be identified and photographed and the medial wall of the cecum between the appendiceal orifice and ileocecal valve can be thoroughly examined (31). Low CIRs have been associated with higher PCCRC rates (36).

High CIRs should be achievable with extremely low rates of insertion-related perforation. Mechanical rupture of the colon can be prevented by reduction of loops and bends in the insertion tube and avoiding pushing against fixed resistance. Use of thinner, more-flexible instruments can reduce rupture risk when the colon is diseased from conditions such as severe diverticular disease, radiation injury, chronic dialysis, long-term corticosteroid use, or fixation because of pelvic surgery. Barotrauma perforations occur only in patients with severe sigmoid angulation and narrowing, primarily associated with severe diverticular disease. The risk of barotrauma should be anticipated in all patients with a complex sigmoid colon, and the colonoscopist should consider stopping gas insufflation and using water immersion until the sigmoid is traversed and the proximal colon decompressed (54).

CIRs above 95% for all indications are readily achievable by high percentages of independently practicing colonoscopists (37,55–58). All independently practicing colonoscopists should have CIRs measured until they are consistently above the recommended target. After this, continued CIR measurement is optional and can be performed intermittently or not at all in the case of a consistent track record of performance above recommended thresholds. Limited evidence of variable performance for many practicing gastroenterologists, evidence that high performance is sustained, and the obvious ceiling level of 100% justify reduction in measurement for high-level performers.

Table 4. Quality indicators common to all endoscopic procedures with associated performance targets

Quality indicator	Strength of recommendation	Measure type	Performance target (%)
Preprocedure			
1. Frequency with which endoscopy is performed for an indication that is included in a published standard list of appropriate indications and the indication is documented (priority indicator)	1C+	Process	>95
2. Frequency with which informed consent is obtained and documented	3	Process	>98
3. Frequency with which preprocedure history and directed physical examination are performed and documented	3	Process	>98
4. Frequency with which a sedation plan that includes risk for sedation-related adverse events is documented before sedation is initiated	3	Process	>98
5. Frequency with which prophylactic antibiotics are administered for appropriate indications (priority indicator)	Varies	Process	>98
6. Frequency with which management of antithrombotic therapy is formulated and documented before the procedure (priority indicator)	3	Process	>95
7. Frequency with which a team pause is performed and documented	3	Process	>98
8. Frequency with which endoscopy is performed or supervised by an individual who is fully trained and appropriately credentialed to perform that particular procedure	3	Process	>98
Intraprocedure			
9. Frequency with which photo documentation is performed	3	Process	>90
10. Frequency with which patient monitoring during sedation is performed and documented	3	Process	>98
11. Frequency with which procedure interruption and premature termination because of sedation-related issues is documented	3	Process	>98
12. Frequency with which endoscopic specimen verification is performed and documented	3	Process	>98
Postprocedure			
13. Frequency with which discharge from the endoscopy unit according to predetermined discharge criteria is documented	3	Process	>98
14. Frequency with which patient instructions are provided	3	Process	>98
15. Frequency with which endoscopic findings, pathology results, and follow-up recommendations are communicated to the patient and appropriate providers	3	Process	>98
16. Frequency with which a complete procedure report is created	3	Process	>98
17. Frequency with which adverse events are documented (priority indicator)	3	Process	>98
18. Frequency with which adverse events occur	Varies	Outcome	N/A
19. Frequency with which patient satisfaction data are collected	N/A	Outcome	N/A

N/A, not applicable.

Adenoma detection rate (priority indicator)

4. Percentage of patients aged ≥45 years undergoing colonoscopy for screening, surveillance, or diagnostic indications other than positive noncolonoscopy screening tests (e.g., fecal tests or CT colonography) who have 1 or more conventional adenomas detected and verified by pathology. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation.

Strength of recommendation: 1C+

Performance target: ≥35%

Measure type: outcome

The adenoma detection rate (ADR) is the most clinically relevant and best validated quality indicator in colonoscopy. ADR was proposed in 2002 (29) in response to evidence that adenoma detection and cancer prevention were variable in clinical practice and was defined as the percentage of patients aged ≥50 years undergoing colonoscopy for indications other than IBD or polyposis syndromes who had ≥1 conventional adenoma resected and verified by pathology. The initial proposed threshold was 20% (25% in men and 15% in women) and was arbitrarily set at a level below the mean prevalence of adenomas detected at initial screening colonoscopy studies performed in average-risk individuals (59–62). In 2006 the recommendation for ADR was changed to the fraction of patients aged ≥50 years having ≥1

Table 5. Strength of recommendations

Strength of recommendation	Clarity of benefit	Methodologic strength supporting evidence	Implications
1A	Clear	Randomized trials without important limitations	Strong recommendation; can be applied to most clinical settings
1B	Clear	Randomized trials with important limitations (inconsistent results, nonfatal methodologic flaws)	Strong recommendation; likely to apply to most practice settings
1C+	Clear	Overwhelming evidence from observational studies	Strong recommendation; can apply to most practice settings in most situations
1C	Clear	Observational studies	Intermediate-strength recommendation; may change when stronger evidence is available
2A	Unclear	Randomized trials without important limitations	Intermediate-strength recommendation; best action may differ depending on circumstances or patients' or societal values
2B	Unclear	Randomized trials with important limitations (inconsistent results, nonfatal methodologic flaws)	Weak recommendation; alternative approaches may be better under some circumstances
2C	Unclear	Observational studies	Very weak recommendation; alternative approaches are likely to be better under some circumstances
3	Unclear	Expert opinion only	Weak recommendation; likely to change as data becomes available

Adapted from Guyatt G, Sinclair J, Cook D, et al. Moving from evidence to action. Grading recommendations: A qualitative approach. In: Guyatt G, Rennie D (eds). Users' Guides to the Medical Literature. AMA Press: Chicago, IL, 2002, pp 599–608.

conventional adenoma in a first-time screening colonoscopy (30). This change acknowledged that the original target levels were derived from screening colonoscopy studies (59–62). In 2010, a large screening colonoscopy study showed that hazard ratios for PCCRC were increased 10-fold when colonoscopy was performed by colonoscopists with ADRs <20% compared with colonoscopy performed by colonoscopists with ADRs >20% (21). In 2015, the minimum acceptable thresholds were increased to 25% (30% in men and 20% in women) (31) after a large study showed further gains in protection against PCCRC with ADRs above 20% (22). Since 2015, changes in screening guidelines and new evidence support additional modifications to the ADR.

First, an increase in early-onset CRC led to reducing the recommended age to start CRC screening to 45 years (2–4,63). To keep the ADR measurement consistent with the currently recommended age to begin screening, we now recommend that the ADR should be measured in persons aged ≥45 years rather than age 50 years. Because adenoma prevalence is related primarily to age, this change might warrant a downward adjustment in the minimum acceptable threshold. However, more-recent studies found adenoma prevalence in 45- to 49-year-olds to be only slightly lower than in 50- to 54-year-olds (64–71) (Table 7). Because mean ADRs have been steadily increasing over the past decade (72) and the proportion of patients aged 45–49 years undergoing colonoscopy is still relatively small compared with persons aged ≥50 years (Table 6), we recommend no adjustment in the minimum acceptable threshold for the ADR is warranted for inclusion of 45- to 49-year-olds in the ADR measurement.

Second, several studies reported the incidence of adenomas at a second screening colonoscopy performed 10 years after an initial negative screening colonoscopy (23,68,73–76) (Table 8). Adenoma incidence at 10 years is just slightly below that identified at an initial screening colonoscopy, despite patients being 10 years older. In light of this evidence, we recommend that second and subsequent screening colonoscopies can be included in the ADR calculation without adjustment for the minimum acceptable ADR threshold.

Third, as noted above, the original definition of ADR included surveillance (colonoscopy for prior neoplasia) and diagnostic examinations (colonoscopy for symptoms) (29). The recommendation to confine the ADR measurement to screening was made in 2006 (30) because the 2002 targets had been based on screening studies. In this update, we recommend expanding the definition of a routine ADR to again include both surveillance and diagnostic examinations not performed for positive fecal tests. Given the potential for heterogeneity in adenoma prevalence based on colonoscopy indication, one logical concern is that broadening the ADR calculation to include all surveillance and diagnostic colonoscopies might introduce bias based on patient mix. However, in the aggregate, any bias introduced by heterogeneity is expected to be modest. In general, ADRs for post-polypectomy surveillance colonoscopies are approximately 7%–12% higher than ADRs for screening colonoscopies (22,67,77–84) (Table 9), whereas ADRs for diagnostic colonoscopies that do not include significant numbers of positive fecal tests are lower than those for screening colonoscopy. Thus, a combined ADR including screening, surveillance, and nonfecal test diagnostic colonoscopies is often similar to a screening ADR (82). A modeling study found that a combined ADR stratified endoscopists into high and low detectors as accurately as the screening ADR over a range of indication distributions (82).

Notably excluded from the routine ADR calculation are colonoscopies performed for positive fecal testing. Although the ADR is predictive of PCCRC in patients with positive fecal blood

Table 6. Appropriate indications for colonoscopy

1. Evaluation of unexplained GI bleeding a. Hematochezia b. Melena with upper GI cause excluded c. Presence of fecal occult blood
2. Unexplained iron deficiency anemia
3. Screening for colorectal neoplasia at recommended intervals in average-risk persons or persons with significant high-risk family histories
4. Surveillance in Lynch syndrome
5. Surveillance in patients with polyposis syndromes
6. Surveillance at recommended intervals for prior colorectal cancer or precancerous lesions
7. Surveillance at recommended intervals of cancer risk in inflammatory bowel disease
8. Assessment of disease activity in inflammatory bowel disease for purpose of assessing treatment response
9. Clinically significant diarrhea of unexplained origin
10. Evaluation of abnormal imaging of the colorectum that suggests cancer, precancerous lesions, or clinically important bowel-wall abnormalities
11. Intraoperative identification of a lesion not apparent or found at surgery
12. Treatment of bleeding lesions such as vascular malformations, ulceration, neoplasia, and postpolypectomy ulcers
13. Foreign body removal
14. Excision of polyp or early-stage colorectal cancer
15. Decompression of acute nontoxic megacolon or sigmoid volvulus
16. Treatment of stenosis
17. Palliative treatment of stenosing or bleeding neoplasm
18. Marking a neoplasm for localization
19. Positive fecal or blood-based colorectal cancer screening test

tests (85), the ADR consistently runs at least an absolute 15% higher in patients with positive fecal tests (86–90). Therefore, positive fecal tests are distinct from other diagnostic indications. The use of fecal testing varies regionally and across health practices in the United States, and therefore the fraction of colonoscopies performed for positive fecal blood tests is expected to vary substantially across practices. In settings where the proportion of examinations for a positive fecal immunochemical test (FIT) is substantial (as in organized screening programs) and FIT-positive evaluations are distributed similarly across endoscopists, FIT-positive examinations can be included in the general calculation of the ADR for purposes of internal comparisons of endoscopists (91). However, inclusion of positive fecal tests in the general ADR calculation makes comparisons of ADRs across US institutions and with international results challenging. Therefore, we recommend that ADRs in FIT-positive patients should usually be measured separately (see Indicator 5 below). Further, if detection performance is measured in inpatients, it is reasonable to exclude patients from ADRs and all other detection measures when the indication would not be reasonably expected to include polyp resection (e.g., colonoscopy for acute major lower GI hemorrhage or colonic decompression).

Finally, multiple reports indicate ADRs have risen steadily over the past decade (70,92,93). In a large registry, mean screening ADRs in US gastroenterology practices had risen to 38% by 2018 (70). In a 2014 study, the risk of PCCRC and fatal PCCRC were shown to decrease by 3% and 5%, respectively, for each 1% increase in the ADR (22). In a subsequent study, this relationship between ADR and PCCRC was shown to hold during the interval from 2010 to 2018, when ADRs were generally higher, and the relationship extended to ADRs above 40% (92). Further, the relationship holds for colonoscopy performed for non-screening indications (91,92). Improvements in ADRs in US gastroenterology practices likely reflect the emphasis on quality measurement over the past 2 decades plus the widespread availability of high-definition colonoscopes.

Given the various considerations outlined above, we recommend that ADR calculations include screening, surveillance, and diagnostic colonoscopy but exclude indications of a positive noncolonoscopy screening test (e.g., fecal blood test, multitarget stool DNA [mt-sDNA], CT colonography) and therapeutic procedures for resection or treatment of known neoplasia, genetic cancer syndromes (e.g., polyposis), and IBD. Specific recommendations for ADRs in patients with positive fecal screening tests are in the next section.

Considering that ADRs have risen progressively in screening populations (72) and that inclusion of surveillance procedures may raise ADRs by a significant extent for some colonoscopists, we now recommend a minimum threshold of 35% for the ADR (40% in men and 30% in women). We acknowledge that the actual level of ADR chosen as the minimum acceptable threshold (and therefore the fraction of endoscopists who are below the chosen threshold) carries an arbitrary element, but the considerations outlined above support this recommendation.

Colonoscopists with ADRs below 35% are recommended to undertake remedial measures to improve and to achieve acceptable performance. Because there is evidence that PCCRC risk continues to fall as ADRs move above 35%, we also recommend that all colonoscopists strive to achieve ADRs well above the minimum recommended threshold of 35%, and indeed ADRs can rise well above 40% (70,92–96).

Including more colonoscopies in the ADR measurement has potential advantages and disadvantages. Expanding the included indications results in a larger sample size, allowing benchmarking of a higher proportion of the practitioner's colonoscopies. With a higher number of included colonoscopies, the confidence interval is narrower and performance conclusions more accurate, which is particularly useful for low-volume endoscopists (97). The evidence that ADR predicts the risk of PCCRC after nonscreening examinations (22,91,92) and also in patients with positive fecal blood tests (85) supports measurement of the performance across a wider range of colonoscopy indications. Adding more examinations to the ADR measurement, however, requires more resources to review and record pathology results, particularly if the process is performed manually. Automatic data extraction eliminates this issue but is frequently not available.

For all measures related to lesion detection, we recommend (if feasible and practical in the context of local measurement programs) excluding examinations where the procedure is aborted during insertion because of inadequate preparation or the examination is complete to the cecum but is rescheduled within 1 year. In both cases, we recommend photo documentation of poor preparation to support the need for repeat examination. We also recommend excluding procedures that are incomplete to the

Table 7. ADR in those aged 45–49 year vs 50–54 years

Reference	Years of colonoscopy performance	No. of examinations in patients aged 45–49 yr	ADR in patients aged 45–49 yr (%)	ADR in patients aged 50–54 yr (%)	Examinations in patients aged 45–49 yr (%)
Karsenti et al 2019 (64)	2016	515	21.2 (19% average-risk screen)	25.2	N/A
Butterly et al 2021 (66)	2004–2018	1869	17.5	22.1	4.6
Imperiale et al 2021 (65) (multitarget stool DNA study)	2019[a]	816	31	N/A	N/A
Shaukat et al 2022 (67)	2015–2019	4841	28.4	31.1	3.1
Ladabaum et al 2022 (68)	2019–2021[a]	350	34.3	38.2	11.6
Liang et al 2022 (69) (GIQIuIC)	2010–2020	92,752	28.0	33.0	5.0
Bilal et al 2022 (70) (GIQuIC)	2014–2020	47,213	28.6	31.8	1.6
Trivedi et al 2022 (71) (AMSURG → GIQuIC)	2014–2021	79,934	32	37.7	N/A

ADR, adenoma detection rate; N/A, not available; GIQuIC, GI Quality Improvement Consortium (Bethesda, MD); AMSURG, AmSurg (Nashville, TN).
[a]All in the era after the 2018 American Cancer Society guidelines.

cecum or an ileocolic anastomosis because of abnormal colonic anatomy (e.g., marked redundancy or severe sigmoid angulation and narrowing).

ADR in patients with positive fecal screening tests

5. Percentage of patients with positive fecal screening tests (fecal blood or mt-sDNA) with 1 or more conventional adenomas resected and documented by pathology.
Strength of recommendation: 1C
Performance target: ≥50%
Measure type: outcome

We continue to recommend exclusion of colonoscopies for positive fecal screening tests from the routine ADR calculation as discussed above. This exclusion is partly because the fraction of colonoscopies performed for positive fecal screening tests varies widely. The fraction is often low in US centers where opportunistic screening is performed and can be substantially higher in healthcare systems with organized FIT-based screening (98). Thus, and because the ADR is higher in these patients, exclusion of positive fecal screening tests from routine ADR calculations allows better comparison of the ADR across healthcare systems.

In some instances, the number of colonoscopies performed for positive fecal screening tests is sufficiently high to warrant measurement of the ADR within this patient group. ADRs in the FIT-positive population do predict PCCRC risk (85). The prevalence of adenomas in FIT-positive patients is well documented and can reach as high as 70% (99). The ADR is higher when the cut-off level of hemoglobin per gram of feces for a positive test is higher (99). Like the primary screening population, adenoma prevalence in men with a positive FIT is typically 10%–15% higher than women (99). In the United States, a cut-off of 20 μg hemoglobin per gram of feces is often used in FIT assays (99).

Based on the available evidence, we recommend an ADR of 50% (55% in men and 45% in women) in FIT-positive populations where assays with a cut-off of 20 μg hemoglobin per gram of feces are used. There is less evidence regarding the expected ADR in patients with a positive mt-sDNA test (87,100–103). Although evidence is limited, we currently recommend the same threshold for ADR in mt-sDNA–positive patients as for FIT-positive patients.

Adenomas per colonoscopy

6. Number of conventional adenomas detected per colonoscopy in patients aged ≥45 years with indications of screening, surveillance, or diagnosis of symptoms. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation.
Strength of recommendation: 2C
Performance target: ≥0.6
Measure type: outcome

The ADR has strengths and weaknesses as a quality indicator. Strengths are its use as a total colon measure in which the differentiation of conventional adenomas from lesions in the serrated category by pathologists is generally straightforward with limited interobserver variation (104) as well as it being validated as a predictor of PCCRC (105). A principal weakness of the ADR is that it does not reward detection of additional adenomas after the first adenoma has been identified and resected, and many patients have multiple adenomas. This shortcoming has led to measures such as adenomas per colonoscopy (APC), which rewards detection and resection of each adenoma. Like the ADR, higher APC has been associated with a lower risk of PCCRC (106).

In general, the correlation between ADR and APC is high (107–110). Despite this correlation, instances have been documented in which an adequate ADR has been associated with low APC in important fractions of endoscopists (109,111). For example, in 1 study, 47.6% of endoscopists in the lowest quartile of APC performance had ADRs ≥25%,

Table 8. Incidence of adenomas at a second screening colonoscopy performed 10 years after an initial negative screening colonoscopy

Reference	Years	ADR at the first screening (%)	ADR at the second screening (%)
Ponugoti et al 2017 (75)	2007–2015	N/A	38
Rex et al 2018 (76)	2010–2015	32	27
Ladabaum et al 2021 (23)	2017–2020	36	29
Ladabaum et al 2022 (68)	2019–2021	43	33

ADR, adenoma detection rate; N/A, not available.

whereas none of the endoscopists in the highest quartile of APC performance had ADRs <25% (109). Based on these features, we recommend that APC can be considered as an alternative to ADR in practices where ADRs are generally high and endoscopists are seeking additional information that can identify and discriminate suboptimal performance. In this regard, a minimum threshold for APC of 0.6 is recommended (105,107–110,112,113), but levels above 1.2 are achievable (95). APC may not provide additional important information when the ADR is low.

The major downside of APC is the potential for a perceived incentive to separate adenomas into separate preservative bottles for pathologic examination. Such a practice increases costs and is not recommended to improve the accuracy of tabulating APC. An alternative approach is to record the number of individual adenomas detected as well as photographs in the procedure report. The photographs serve to support the total number of adenomas identified in the colonoscopy procedure. This approach could be used as an alternative way of counting ADR or APC with a "resect and discard" strategy. In the absence of a resect and discard practice, however, photography can still be used to document the number of adenomas identified so that submitting adenomas in separate bottles is minimized (114).

Sessile serrated lesion detection rate (priority indicator)

7. Percentage of patients ages ≥45 years undergoing screening, surveillance, or diagnostic colonoscopy for symptoms with 1 or more sessile serrated lesions (SSLs) removed and documented by pathology. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation.

Strength of recommendation: 2C

Performance target: ≥6%

Measure type: outcome

The ACG/ASGE Quality Task Force on Colonoscopy Committee considered carefully and at length whether to add a detection target directed toward serrated lesions. A survey found that many US endoscopists are still not measuring ADRs (115). Adding a separate indicator for detection of serrated lesions creates an additional measurement and resource burden for endoscopists and endoscopy units. Further, unique challenges are associated with the implementation of any serrated indicators that are not relevant to the ADR. First, substantial interobserver variation occurs among pathologists in the diagnosis of SSLs vs hyperplastic polyps (116–119). This is not an issue in the pathologic diagnosis of conventional adenomas (31). Second, a serrated indicator should ideally disincentivize the identification and resection of diminutive distal colon hyperplastic polyps, which are generally considered not to be precancerous (120). However, an indicator that relies on endoscopist localization during colonoscopy could be subject to bias and gaming in prospective use (105). Third, some measures of serrated detection have used polyp size (121). These measurements would be subject to substantial endoscopist bias and gaming in prospective use. Despite these cautionary notes, 3 recent studies found that ADR is insufficient as a sole detection indicator predicting PCCRC (121–123). In 2 trials, ADR above 25% and low serrated lesion detection were found in 13%–14% of endoscopists (122,123), whereas another 37%–45% of endoscopists had ADRs below 25% and low serrated detection. In both studies, the correlation between ADR and serrated detection was moderate (122,123).

Although a variety of serrated detection indicators has been proposed (105), the committee considered 3 (clinically significant serrated polyp, proximal serrated polyp, and SSLDR) because of

Table 9. Association of ADR and colonoscopy indication

Reference	Years of colonoscopy	All screening ADR (%)	Surveillance ADR (%)	Symptomatic or diagnostic ADR (%)	Global ADR (%)
Anderson et al 2013 (77)	2009–2011	25	37	N/A	29
Marcondes et al 2015 (78)	2009–2013	37	59	15–34	39
Boroff et al 2017 (79)	2010–2012	33	55	13–33	37
Rex and Ponugoti 2017 (80)	2010–2015	42	54	29	45
Brand et al 2017 (81)	2013–2015	33–36	45–47	N/A	36–40
Kaltenbach et al 2021 (82)	2015	49	56	38	50
Kajzrlikova et al 2021 (84)	2013–2017	46	48	36	43
Ladabaum et al 2021 (23)	2017–2020	36	44	17	N/A
Desai et al 2023 (83)	2017–2021	50	64	N/A	55–59
Shaukat et al 2022 (67)	2021	38–41	52–59	N/A	44–48

ADR, adenoma detection rate; N/A, not available.

their association with PCCRC in recent studies (121,122), and we recommend the SSLDR as the quality indicator of choice because it directly measures the precancerous serrated lesion of greatest interest and is not subject to endoscopist bias (Table 10).

We acknowledge that the SSLDR is subject to measurement and accuracy errors related to pathologist interobserver variation in differentiation of SSLs from hyperplastic polyps (116–119). Thus, the SSLDR may reflect pathologist performance and bias rather than endoscopist performance in some instances (117). This is a potentially serious flaw in endoscopy detection measures (105). However, evidence shows that SSL detection is increasing rapidly with time (124) and that part of this increase reflects improved awareness and education among community pathologists of identification of SSLs. Further, introducing the SSLDR as a detection target should incentivize endoscopists to work with their pathologists to improve pathologic identification of SSLs (125). Admittedly, any serrated detection indicator carries inherent flaws for prospective use (105).

To set the target threshold for a minimum SSLDR, we examined prevalence data on SSLs and the association of SSL detection with PCCRC. A systematic review and meta-analysis found a pooled SSL prevalence of 2.5% (126). The reported prevalence of SSLs varies between countries, and the pooled prevalence in the United States was found to be 4.6% (127). However, evidence of increasing SSL prevalence over time is clear (124), with both endoscopist and pathology factors contributing to the increase. A registry study from the United States involving more than 5.1 million colonoscopies and 3934 endoscopists found that the prevalence of 4.57% in 2014 increased to 7.14% in 2017 (124). Thus, the prevalence of SSLs as determined by colonoscopic detection is steadily rising.

Data suggest SSLDRs may not correlate closely with ADRs and that SSLDRs provide predictive data independent from ADRs, making it a worthy stand-alone quality indicator. A recent study from the Netherlands performed in FIT-positive patients showed that the proximal serrated polyp detection rate (PSPDR) and the SSLDR had similar associations with prevention of PCCRC (122). In a study from Austria, the magnitude of PCCRC mortality reduction was similar for increases in PSPDRs and SSLDRs, but the effect on mortality reduction did not reach significance for SSLDRs, probably because SSLs are less prevalent than proximal serrated polyps (123). A greater prevalence is an advantage for PSPDRs as a detection measure compared with SSLDRs, but it of note that over half of patients with serrated polyps have them only in the distal colon (123), which could subject PSPDRs to gaming with prospective use. Data from the New Hampshire Colonoscopy Registry also demonstrated that SSL detection predicts PCCRC independent of ADRs (128). The unadjusted risks of PCCRC were 1.4%, 0.6%, 0.6%, 0.4% and 0.3% with SSLDRs of <1.0%, 1%–<2.0%, 2.0%–<4.0%, 4.0%–<6.0%, and ≥6.0%, respectively. Approximately one-third of endoscopists (33.8% [50/148]) had adequate ADRs but SSLDRs <6%.

One challenge with the SSLDR is that the prevalence of SSLs is lower than that of conventional adenomas, so that substantial procedure volumes will be required for some physicians to determine with confidence if detection is clearly adequate or suboptimal. This same issue impacts the reliability of ADR measurement (97) but does not negate the value of measurement. It seems reasonable to report the SSLDR to colonoscopists, with the expectation that the confidence interval around the SSLDR will narrow with continued measurement. Assessment and reporting of SSLDR performance over longer time periods than used for the ADR may be appropriate.

Based on available evidence, we recommend a current minimum threshold for the SSLDR of 6%. This is expected to be revised upward as evidence of increasing detection occurs. Although evidence is limited, we consider that an SSLDR in FIT-positive patients of 6% (same target recommended for the SSLDR in a general population measurement) is appropriate, as there is little evidence that FIT detects serrated lesions, and few data on the yield of serrated lesions in FIT positive patients (129). mt-sDNA does detect some serrated lesions based on methylation markers included in the test, but an appropriate target for SSLDRs in this population is currently uncertain. One recent study found a 20.5% prevalence of SSLs in mt-sDNA–positive patients (130).

We recommend that as groups of endoscopists using the same pathology service begin measuring SSLDRs, they review the range of SSLDRs across the endoscopy group relative to ADRs. If SSLDRs are low across the entire group, particularly in the setting of adequate ADRs, a review of SSL diagnoses with group endoscopists and/or local pathologists is needed.

Withdrawal time

8. Average withdrawal time in normal colonoscopies without biopsy sampling or polypectomies in persons aged ≥45 years undergoing screening, surveillance, or diagnostic colonoscopy. Patients with positive noncolonoscopy screening tests, genetic cancer syndromes (e.g., polyposis), IBD, or undergoing colonoscopy for therapy of known neoplasms are excluded from the calculation.

Strength of recommendation: 2A

Performance target: ≥8 minutes

Measure type: process

Table 10. Leading candidates for serrated lesion detection indicator

Rate	Benchmark (%)	Easy to calculate?	Measures endoscopist detection	Validating data
Clinically significant serrated detection rate	9	Requires path, size, and location	Some path influence	9% associated with lowest risk for PCCRC
Proximal serrated polyp detection rate	17	Location only	Least path dependent	17.0% associated with lowest risk for PCCRC
Sessile serrated lesion detection rate	6	Path only	Most influenced by path	6.0% associated with lowest risk for PCCRC

Clinically significant serrated detection rate: Any serrated lesion (sessile serrated lesion, hyperplastic polyp, or traditional serrated adenoma) ≥10 mm or any serrated lesion >5 mm proximal to the sigmoid colon; proximal serrated polyp detection rate: fraction of colonoscopies with ≥1 serrated polyps (sessile serrated lesion, hyperplastic polyp, or traditional serrated adenoma) proximal to the splenic flexure; sessile serrated lesion detection rate: fraction of colonoscopies with ≥1 sessile serrated lesions.
PCCRC, postcolonoscopy colorectal cancer.

The recommended minimum average withdrawal time in normal colonoscopies without polypectomy, biopsy sampling, or therapy reflects the best evidence available regarding the time most colonoscopists need to apply careful and detailed inspection of the colon, from the appendiceal orifice to completion of retroflexion in the rectum. The first recommendation for withdrawal time made in 2002 (29) recommended an average of 6–10 minutes in normal colonoscopies, based on the observation of 2 physicians participating in a miss rate study who had mean withdrawal times of 8 minutes and the lowest observed miss rates among 26 endoscopists in the study (131). In 2006, the recommendation for minimum average withdrawal time was changed to 6 minutes (30) on the basis of a landmark study showing that in a group of private practice gastroenterologists performing colonoscopy, 6 minutes of withdrawal time in normal colonoscopies was associated with reasonable separation between high- and low-level detectors (26). Since 2006, but particularly since 2015, considerable evidence has demonstrated that optimal detection typically requires at least 8–9 minutes average withdrawal time in normal colonoscopies (26,83,132–146) (Table 11). This evidence includes retrospective data showing that prevention of PCCRC is optimized at withdrawal times of at least 8–9 minutes (147). Observational studies suggest that overall detection of adenomas is optimized at 8–9 minutes or longer (26,83,132–146) (Table 11), as is detection of serrated lesions (135,138,142). A parallel-design randomized trial comparing 6 with 9 minutes found 9 minutes to be superior for detection (145), as did a randomized tandem study comparing adenoma miss rates at 9 minutes vs 6 minutes (146).

Importantly, withdrawal time by itself is not an adequate measure of detection performance or skill. Rather, the primary measures of detection performance are ADR and SSLDR. Withdrawal time cannot substitute for ADR or SSLDR. Withdrawal time should be measured and recorded in clinical practice, and if ADR or SSLDR are low, an accompanying short withdrawal time suggests inadequate withdrawal technique. Corrective measures designed to improve ADR and SSLDR should focus on an optimized examination technique, which consists of systematic attempts to expose the mucosa proximal to each haustral fold, flexure, and valve in the colorectum; achieving adequate distention of the colon; and intraprocedural cleansing to expose mucosal surfaces covered by fluid collections, bubbles, or particulate debris (148,149). The point is that application of high-quality inspection techniques requires an average of at least 8–9 minutes.

There is some evidence that mucosal-exposure devices (specifically Endocuff Vision [Olympus, Center Valley, PA]) can allow faster examination during withdrawal without compromising detection (150). Additional study of this concept is needed.

The recommendation that the average minimum withdrawal time should be at least 8–9 minutes in normal colonoscopies should not be translated to mean that best practice or the standard of medical care requires that every withdrawal time should last ≥8 minutes. On the other hand, if ADR and/or SSLDR are below the minimum recommended threshold and accompanied by an average minimum withdrawal time of <8 minutes, this could be construed as evidence of an inadequate withdrawal technique. Thus, low ADR accompanied by a short average withdrawal time should be considered an indication to evaluate and correct the inspection technique.

Resection indicators

Documentation of lesion features and resection method indicator

9. Percentage of polyp resections for which the report documents the lesion size, shape, location, and method of resection.
Strength of recommendation: 3
Performance target: ≥98%
Measure type: process

Use of cold snare for 4- to 9-mm lesions

10. Percentage of 4- to 9-mm lesions that are resected using a cold snare.
Strength of recommendation: 1A
Performance target: ≥90%
Measure type: process

The US MSTF on CRC (151) and the European Society of Gastrointestinal Endoscopy (152) have created detailed recommendations for the resection of colorectal neoplasms. These recommendations cover the assessment and resection of the full range of colorectal neoplasms, including assessment and characterization of neoplasia, selection of resection methods, and optimal methodology for resection. Herein, we focus on quality measurement.

The writing committee considered a range of potential quality indicators for resection and now recommends 2 indicators that are characterized by feasibility of measurement, evidence of variable practice, and/or agreement among expert endoscopists regarding best practice. Both have substantial clinical relevance.

The first indicator asks that colonoscopists report for all polyps their size, shape, location in the colon by segment (or distance in centimeters from the anus for left-sided colon polyps), and the method of removal (i.e., cold snare, cold forceps, hot snare, hot forceps, cold EMR, hot EMR, etc), although we note that hot forceps play no role in colorectal neoplasia resection except for avulsion during hot EMR or the removal of a flat polyp overlying fibrosis in the case of a recurrence or a previously partly resected polyp.

Size. Size is an important parameter to record because it drives surveillance. The use of terms such as "small" is discouraged. Terminal digit rounding (153) is discouraged, and polyps ≥10 mm in size should be photographed with a snare of a known size fully opened and placed over and against the polyp (151). Smaller polyps can be photographed using the same technique or by placing the tip of the snare sheath (diameter of 2.4 mm) up against the polyp base. Polyps in the same colorectal segment can be recorded with a range of sizes and shapes (e.g., 4 flat and sessile polyps 2–4 mm in size removed by cold snare). Polyps ≥10 mm should be described individually. If multiple polyps ≥10 mm are removed from the same section and by the same method, with similar histologic predictions, they may be grouped together in the report. Certainly, any lesion, irrespective of size, that suggests advanced histology or endoscopic features of cancer (submucosal invasion or deeper) based on morphology or pit pattern analysis should be individually submitted for pathology and not combined in the same bottle as polyps from different segments.

Shape. With regard to polyp shape, the Paris classification is recommended (154). Use of the terms "sessile," "flat," and "pedunculated" is also acceptable. From the perspective of management of unexpected malignancy, the most important distinction is between pedunculated and nonpedunculated, because the histologic features that drive the decision for adjuvant surgical therapy vary slightly between these groups (155). Interobserver agreement in differentiation of Paris IIa from Is lesions is poor and by extension so is the differentiation of "flat" from "sessile (156)." Regardless, careful assessment of polyps for these features helps emphasize the extreme subtlety of many lesions and therefore the need for very careful inspection of the entire colorectum. Laterally spreading lesions, which grow laterally along the colon wall for >1 cm, can be described by their specific morphology (151,152). An accurate assessment of morphology, together with colorectal location (colon vs rectum), can guide decisions regarding piecemeal vs en-bloc resection (151,152).

Location. Polyp location should be recorded because it facilitates identification of polyp resection scars at surveillance, is essential when malignancy is suspected or reported unexpectedly, and is important to identify serrated polyposis syndrome.

Resection method. Reporting the resection method is essential. Resection methods, particularly in the use and type of cautery, differ in their adverse event rates. Resection methods also differ in rates of completeness and recurrence, with forceps associated with higher incomplete resection rates of lesions >3 mm and cold EMR having higher recurrence rates for adenomas ≥20 mm in size (157). Clip placement to treat or prevent hemorrhage is associated with artifacts at the follow-up examination (158). Clip artifacts can be accurately distinguished from residual polyp by high-definition imaging (159), but confirmation of a clip artifact is made easier by an accurate initial report of clip placement. Thus, all therapeutic steps of lesion resection should be described in the procedure report, including naming all specific devices and whether each resection step used electrocautery.

The second quality of resection indicator recommended is the percentage of lesions 4–9 mm in size removed by cold snare polypectomy. The first principle guiding the optimal resection of lesions in this size range is the extremely low risk of submucosally invasive cancer, which has decreased over time in successive publications (160). The advantage of cold over hot resection is the near elimination of perforation and delayed hemorrhage (161–164), which seems important for a set of lesions that are unlikely to harm patients in the near term. Indeed, the prevalence of adenomas is much higher than the lifetime risk of CRC, so that most patients with adenomas will never develop cancer. This is an important rationale for resecting lesions with a minimal risk of harm. Cold snare resection is associated with a more superficial resection plane than hot snare resection (165,166), which may underlie the higher risk of residual polyp when cold EMR is used to remove large adenomas (157). However, randomized trials have indicated that complete resection rates using cold snaring for lesions <10 mm are comparable with hot snaring (167–174). Accurate technique and snare placement are more important than the use of specialty thin wire vs standard snares (175). The indicator excludes lesions <4 mm, because evidence indicates that cold forceps and cold snaring are comparably effective for lesions up to 3 mm in size (176–182), and some practitioners prefer cold forceps. However, cold forceps are less effective than cold snaring for lesions >3 mm in size (176–182). Thus, cold snaring is the technique of choice for lesions 4–9 mm in size. Pedunculated lesions in this size range can also be removed safely and effectively by cold snaring (183,184). Despite this, many endoscopists use cold forceps for lesions >3 mm in size, indicating both substantial evidence of variable practice with regard to resection technique for lesions 4–9 mm and considerable room for improvement. Many patients have 1 or more lesions ≤3 mm and 1 or more lesions 4–9 mm in size. Use of cold snaring for the entire range of lesions <10 mm in size saves the use of cold forceps and reduces plastic waste associated with colonoscopy (185).

Inadequate lesion resection and variation in resection quality are major issues in colonoscopy quality. The committee encourages developing internal institutional programs that evaluate resection performance using polypectomy assessment tools and providing periodic feedback to endoscopists. A detailed evaluation of PCCRC suggests that a significant minority of PCCRCs result from ineffective resection of advanced lesions (186–188). Biopsy sampling of the margins of lesions that appeared to be completely resected showed that residual neoplasia may still be present and that the risk is operator-dependent. Efficacy of complete resection varied by 3-fold among operators in 1 study (189). An assessment of resection competency by blinded review of video recordings found that assessed competency also varied 3-fold, with some operators having rates of competent resection as low as 30%, and no correlation between ADR and competency of resection (33).

The best approach to assess resection competency is through real-time assessment by a monitor or by expert review of video recordings. Two scales have been validated for this purpose, including the Direct Observation of Polypectomy Skills (190) and the simpler and shorter Cold Snare Polypectomy Assessment Tool (191) for the assessment of cold snare technique only. The writing committee of the ACG/ASGE Task Force considered that a broad recommendation to systematically evaluate all US endoscopists with these tools would be challenging to implement because video recording is not widely available in the United States and the practice of real-time monitoring would be viewed as costly and impractical by many centers. Nonetheless, we encourage endoscopy centers to invest in recording equipment that can be used in monitoring of both inspection and resection quality.

In its last recommendations, the ACG/ASGE Task Force recommended that quality monitoring should evaluate the fraction of nonpedunculated lesions <2 cm that are referred for surgical resection as a quality indicator (31). This general topic is still appropriate for review in quality programs, although the method of audit can be challenging, and we are not including this indicator in this update. Endoscopic resection is the preferred method over surgical resection for all benign colorectal neoplasms regardless of size, shape, or location, with the possible exception of lesions invading the appendiceal orifice for which the entire margin cannot be exposed during colonoscopy (151). Endoscopic resection of benign neoplasms is associated with lower morbidity and mortality and lower costs than surgical resection (192–196). If feasible, one approach is to collaborate with the local pathology department to review the pathology of all surgical colorectal resections and determine whether a local issue of inappropriate referral of benign lesions for surgery exists.

Table 11. Withdrawal times associated with optimal detection at colonoscopy

Reference	Year	No. of patients	Optimal withdrawal time (min)
Barclay et al (26)	2006	2053	>6
Barclay et al (132)	2008	2325	>8
Overholt et al (133)	2010	15,955	>6
Benson et al (134)	2010	550	>6
Liang et al (135)	2012	18,003	Longer is better
Jover et al (136)	2013	4539	>8
Lee et al (137)	2013	31,088	10
Butterly et al (138)	2014	7972	9
Kashiwagi et al (139)	2017	1009	9
Yun et al (141)	2018	5370	>9
Patel et al (142)	2018	10,196	11
Cavicchi et al (143)	2019	11,682	>8
Jung et al (144)	2019	724	9
Zhao et al (145) (randomized controlled trial)	2020	1027	9
Zhao et al (146) (randomized controlled trial)	2022	733	9
Desai et al (83)	2022	1142	Increased adenoma detection rate up to 13

Postprocedure indicators

Use of appropriate screening and surveillance intervals (priority indicator)

11. Frequency with which colonoscopies follow recommended postpolypectomy and post–cancer resection surveillance intervals and frequency of 10-year intervals between screening colonoscopies in average-risk patients who have negative examination results and adequate bowel cleansing.
Strength of recommendation: 1C
Performance target: ≥90%
Type of measure: process

Optimal performance of colonoscopy means it is both effective in preventing CRC and cost-effective. Optimal results can be achieved through optimized detection and resection of neoplasia during the procedure followed by continued screening or surveillance using evidence-based intervals. Currently, a negative screening colonoscopy should be followed by repeat examinations at an interval of 10 years (1). Shorter intervals for screening are appropriate only for inadequate bowel preparation (in cases of inadequate preparation, a repeat colonoscopy with adequate preparation should be performed within 1 year) or if patients have a high-risk family history, defined as multiple first-degree relatives with CRC or advanced lesions or a first-degree relative with CRC or an advanced precancerous lesion at age <60 years, for which a 5-year interval is appropriate (1). Current recommendations for postpolypectomy surveillance (32) and post-CRC resection (53) in the United States are summarized in documents from the US MSTF. Performing high-quality colonoscopy that optimizes benefit, minimizes harm, and maximizes cost-effectiveness includes an obligation to know and follow these recommendations for screening and surveillance intervals.

Noncompliance with guidelines for screening and surveillance intervals has been a longstanding issue (197–207). A recent meta-analysis found that 17%–25.7% of screening colonoscopies are performed more frequently than indicated or without an adequate indication for early repeat (197). In community practice, there is substantial overuse of surveillance colonoscopy among low-risk subjects and underuse among subjects with high-risk precancerous lesions (197–202). Modeling indicates that surveillance contributes to reductions in CRC incidence and is cost-effective, including high-intensity surveillance in high-risk patients (208). Reasons for noncompliance with polyp surveillance guidelines have been surveyed (203–206). Rationales reported for overuse include the perception that patients have risk factors not addressed by guidelines, lack of guideline knowledge, fear of missed neoplasia, and lack of confidence about the strength of underlying research supporting recommendations (203–206). However, the evidence supporting current recommendations is substantial (32), and US recommendations include shorter and thus more-aggressive intervals than those used elsewhere in the world, which are based on review of the same evidence (209,210). Posters summarizing the postpolypectomy recommendations are available for placement in the endoscopy unit (32). Clinical decision support tools have been shown to improve compliance with guideline recommendations (211,212).

Adverse events

12. Proportion of serious adverse events (SAEs; perforation, postpolypectomy bleeding, and mortality) associated with colonoscopy that are tracked, documented, and reviewed by a quality improvement committee to assess for system and clinical areas of improvement.
Strength of recommendation: 1C
Performance target: ≥95%
Measure type: process

Adverse events in colonoscopy span a range of outcomes. For colonoscopy, SAEs include perforation, postpolypectomy bleeding, cardiovascular events related to sedation, unplanned hospitalization, and mortality (213). SAEs are reported to be under 1% across large integrated healthcare delivery systems (214). In a large integrated healthcare organization in Washington State, SAEs (perforation, bleeding, myocardial infarction, stroke, splenic injury) within 30 days after colonoscopy fluctuated between 0.2 (myocardial infarction) and 0.8 (perforation) per 1,000 screening colonoscopies and between 0.4 (myocardial infarction) and 1.1 (bleeding) per 1,000 follow-up colonoscopies (215). Most serious non-GI postcolonoscopy events are expected based on background event rates and are not attributable to the colonoscopy (216).

Endoscopy units must identify, track, and document SAEs related to colonoscopy. Although some events can be immediately identified, other events may not be evident until after discharge from the endoscopy unit. Strategies to capture delayed

SAEs include using predefined billing codes or natural language processing within an electronic health medical record, in some cases across multiple healthcare systems. A second, and more common, modality is a postprocedure phone call. Several regulatory bodies, such as The Joint Commission, require a phone call within 48 hours of a procedure with anesthesia support (217); at the same time, guidance on procedures where moderate or deep sedation is used are not available. Although the optimal timing and frequency of these phone calls is not clearly defined and is impacted by many factors such as staffing resources, endoscopy units should achieve a 98% rate of attempting to call patients within 72 hours of their colonoscopy. Finally, SAEs can have devastating consequences for patients, providers, and healthcare teams. Consequently, when they occur, a focused approach should be used to review, analyze, and develop interventions to help prevent or minimize such events from occurring in the future. An appropriate and recommended response to SAEs requires investigation, comprehensive systematic review, convening a group to conduct a root-cause analysis for identifying contributory factors, developing corrective actions in areas where improvement can be made to prevent future events, and implementing system improvements or education and remediation (218–221).

Perforation can occur during or soon after colonoscopy, with over half diagnosed by the endoscopist (222). About 5% of perforations associated with colonoscopy are fatal (223–225). Perforation is most common in the cecum and sigmoid colon (226–228). Common etiologies are barotrauma, direct mechanical injury through endoscope advancement or dilation, and thermal or electrical injury during a therapeutic maneuver (226,229). Perforation in screening examinations is lower, with a reported incidence of 0.04% (230); perforations increase to 0.016%–0.8% for diagnostic colonoscopies (231) and to 0.02%–8% for therapeutic colonoscopies (231). Patients with diverticulosis (232) and irritable bowel syndrome (233,234) as well as those taking corticosteroids are at an increased risk of perforation. Nongastroenterologists performing colonoscopy (235) and low-volume endoscopists (236,237) are associated with higher perforation rates. Polypectomy (231) with electrocautery increases the risk of perforation (238).

The factors that decrease perforation risk include not exerting force with the endoscope against fixed resistance, removing loops, using a flexible instrument (e.g., pediatric colonoscope or upper endoscope) in narrowed sigmoid colons, using cold snare polypectomy instead of cautery in the resection of diminutive polyps (162,174,238–240), insufflation with carbon dioxide (241), and submucosal injection during EMR (242). Endoscopists who recognize a perforation during the procedure should attempt closure with through-the-scope clips (243) or large clips that are mounted over the end of the endoscope (244). All perforations should be monitored by the endoscopy unit medical director and reviewed by a quality improvement committee. This approach can lead to changes in processes and opportunities for endoscopist education, which can improve practices that reduce future risk.

Bleeding is the most common adverse event of polypectomy (224,245,246). Bleeding can be immediate (during the procedure) or delayed (after release from the endoscopy unit). Risk factors include polyps >1 cm in size (246–248), high number of polyps removed (249–251), proximal colon location (252,253), certain comorbidities (251,254), and use of antiplatelet and/or anticoagulant medications (249). Older observational data on bleeding rates using fixed-power output generators found that low-power coagulation current was associated with increased delayed bleeding and less immediate, with cutting or blended current associated with more-immediate and less-delayed bleeding (255,256). A randomized trial of forced coagulation current vs an alternating cut-coagulation current (Endocut; Erbe, Stuttgart, Baden-Wurttemberg, Germany) using microprocessor-controlled generators found similar rates of delayed bleeding and higher rates of immediate bleeding with Endocut (257). Endoscopists should follow guidelines for managing anticoagulant and antiplatelet medications before and after colonoscopy (258,259). Cold snare polypectomy for small polyps (<9 mm) reduces delayed hemorrhage (162,174,239,240,260). Prophylactic clipping of resection sites should be performed when feasible for lesions >2 cm located proximal to the splenic flexure that were removed using electrocautery (all 3 criteria fulfilled) (261,262). Delayed hemorrhages requiring hospitalization, transfusion, and repeat endoscopic, radiographic, or surgical procedures to control bleeding warrant a review of the polypectomy technique, appropriate use of prophylactic measures, and other related case aspects.

Immediate bleeding should be treated by endoscopic means and rarely requires interventional radiology or operative treatment. Delayed bleeding frequently stops spontaneously (263). In-hospital observation is appropriate for ongoing bleeding or if the patient has comorbidities, resides far away, or has transportation challenges. Repeat colonoscopy is optional in patients in whom bleeding has ceased. Patients continuing to demonstrate overt GI bleeding (i.e., hematochezia or melena) require prompt repeat colonoscopy (263). Treatment can entail clip application or epinephrine injection in combination with multipolar cautery (263,264). Repeat postpolypectomy bleeding is rare once it has stopped spontaneously or has been treated with endoscopic therapy.

Most deaths directly attributable to colonoscopy are cardiopulmonary events related to anesthesia or sedation (213). Although all-cause mortality within 30 days of colonoscopy occurs in 0.07% of patients, nearly all deaths are linked to underlying comorbidities such as cardiopulmonary disease, cirrhosis, and/or neurologic diseases (213). Any death after colonoscopy warrants a detailed investigation and review by the institution's quality committee to ascertain underlying causes, determine if the death was preventable, and what improvements can be implemented moving forward.

QUALITY INDICATORS FOR COLONOSCOPY IN IBD

IBD intraprocedure colonoscopy indicators

UC disease activity scores

13. Percentage of colonoscopies performed for the indication of UC in which a formal assessment of disease extent and activity (Mayo Endoscopic Score [MES], Modified Mayo Endoscopic Score [MMES], Ulcerative Colitis Endoscopic Index of Severity [UCEIS], or Ulcerative Colitis Colonoscopic Index of Severity) is recorded.

Strength of recommendation: 3

Performance target: ≥90%

Measure type: process

Documenting the extent and severity of endoscopic inflammation in the colon in patients with UC is essential in the classification of disease severity, prognosis, and risk for future development of colorectal neoplasia (265). In general, the endoscopic extent of disease correlates with patient-reported outcomes, laboratory tests, and prognosis. In addition, disease extent and severity are important factors when choosing medical therapy. The report can specify the extent by description of involved segments or use the Montreal classification to document extent of disease (266). In the Montreal system, endoscopic disease limited to the rectum is E1, left-sided colitis is E2, and any disease proximal to the splenic flexure is E3.

Endoscopic disease activity correlates with prognosis and risk of developing colorectal neoplasia. Objective markers of endoscopic disease activity are needed because symptoms often do not correlate with endoscopic findings. In 2021, the International Organization for the Study of Inflammatory Bowel Disease updated recommendations for treatment targets in adult patients with IBD (267). Mucosal healing is now an important clinical target associated with long-term clinical remission, avoidance of colectomy, and corticosteroid-free clinical remission (268). In UC, endoscopic assessment can be performed using sigmoidoscopy or colonoscopy.

Several scoring systems are available to grade endoscopic disease activity (269). The MES, first reported in 1987 (270), is easily implemented in clinical practice and, although not validated, is commonly used and accepted by the US Food and Drug Administration. Several mucosal findings comprise the MES, including erythema, assessment of vascular pattern, presence of friability, spontaneous bleeding, erosions, or ulcerations. Scores range between 0 and 3. The MMES was introduced in 2015 to quantify the extent of colonic involvement (271). In the MMES, the colon is divided into 5 segments, and the score for each segment is added to give a modified score, which is multiplied by the maximal extent of inflammation and divided by the number of segments with active inflammation. The MMES correlates with clinical, biologic, and histologic activity and allows a better assessment of partial healing but is not validated.

An alternative endoscopic scoring system for UC first developed in 2012 is the UCEIS (272,273). For this tool, 3 endoscopic findings comprise the 8-point scale and include assessment of the vascular pattern (265,266), presence of bleeding (265–268), and erosions and/or ulcers (265,266) scored in the most severely affected part of the colon. Friability is not a component of the UCEIS. The UCEIS is validated, has satisfactory interobserver agreement, is responsive to treatment effects, and is able to predict medium- to long-term outcomes of patients in clinical remission.

The Ulcerative Colitis Colonoscopic Index of Severity was developed in 2013 and is calculated by evaluating segmental scores using 4 different variables: granularity, vascular pattern, ulceration, and bleeding and/or friability (274). Although validated and with high interobserver agreement, obtaining the final score is complex and may not be simple to use in clinical practice.

Other endoscopic scoring tools are under development to assess mucosal healing (275). Video training in the use of scales is available (269). Training programs have demonstrated improved inter-rater agreement seen with expert endoscopists (276).

An MES of 0 and 1 are both associated with positive patient outcomes in treatment trials. In STRIDE II, the MES or UCEIS were recommended to assess endoscopic activity with endoscopic healing defined as a MES of 0 and UCEIS $\leq$1 (267).

Crohn's disease activity score

14. Percentage of colonoscopies performed for the indication Crohn's disease (CD) in which a formal disease activity score (Crohn's Disease Endoscopic Index of Severity [CDEIS], Simple Endoscopic Activity Score in Crohn's Disease [SES-CD], or Rutgeerts score) is reported.

Strength of recommendation: 3

Performance target: $\geq$90%

Type of measure: process

Investigators have advocated for both symptomatic and endoscopic assessments of CD to best quantify response to therapy. Endoscopic assessment of disease activity is an essential aid to clinical practice. Although the CDEIS and SES-CD have been validated, a minimally important clinical change in score has not been defined for either instrument.

The CDEIS was developed in 1989 (277). Components include 9 separate lesions: pseudopolyps, healed ulceration, frank erythema, frankly swollen mucosa, aphthoid ulceration, superficial shallow ulceration, deep ulceration, nonulcerated stenosis, and ulcerated stenosis. CDEIS scoring is relatively complex, with total scores ranging from 0 to 44 and higher scores denoting worse disease activity. High intraclass correlation coefficients for intrarater and interrater reliability of 0.96 and 0.86, respectively, were observed for total CDEIS scores during the index development. In a second study, the intrarater correlation was 0.89 and inter-rater correlation 0.71 (278). Construct validity of the 2 ranges was from 0.75 to 0.83. Responsiveness has been measured as a correlation between changes in mean and global evaluation of disease with a correlation coefficient (r) of 0.72 (279).

The SES-CD was developed to overcome concerns associated with the complexity of the CDEIS. The components of the SES-CD include ulcer size, proportion of ulcerated surface, proportion of the surface area affected by any disease lesion, and stenosis (280). Each component is graded from 0 to 3, and a total score is calculated as the sum of the items for all segments of the colon and terminal ileum. The correlation coefficient for intrarater reliability was 0.91 for the CDEIS and 0.98 for the SES-CD (280). In a second study, the intrarater correlation was 0.91 (281). The responsiveness to change was evaluated with repeat colonoscopy at an average of 4 months after baseline, and changes measured by the 2 indices were highly correlated with an r of 0.83 (282).

Although both scoring systems are widely available for use, the SES-CD is increasingly favored for both eligibility and outcome assessment given its relative simplicity. The BRIDGe (Building Research in Inflammatory Bowel Disease Globally) group used a modified Delphi approach to identify elements of high-quality IBD endoscopy reporting (283). The panel noted that the use of the SES-CD was appropriate in clinical practice, although they recognized that the primary advantage was the use of standardized descriptive terminology of endoscopic findings rather than quantitative assessment. The first STRIDE guideline (284) recommended the absence of ulcers as an adequate endpoint in routine clinical care, but the more recent STRIDE-II guideline endorsed SES-CD. Endoscopic healing is reflected by an SES-CD $<$3 points or an SES-CD ulceration subscore of 0 (267).

The Rutgeerts score grades early neoterminal ileal lesions to predict postsurgical outcomes and identify patients for whom therapy escalation may be necessary (285). Lesions are graded on a 5-point scale of increasing severity where a grade of i0 indicates no lesions in the distal ileum, i1 indicates ≤5 aphthous lesions in the distal ileum, i2 indicates >5 aphthous lesions in the distal ileum with normal mucosa between lesions or skip areas of larger lesions or lesions confined to the ileocolonic anastomosis, i3 indicates diffuse aphthous ileitis with diffusely inflamed mucosa, and i4 indicates large ulcers with diffuse mucosal inflammation or nodules or stenosis. Endoscopic recurrence is defined as a score of ≥i2. Currently, an assessment of the reliability, responsiveness, validity, and feasibility of the Rutgeerts score is required, but the scale has proven straightforward for clinical practice.

In summary, we recommend the use of a specific scoring system to assess disease activity for both UC and CD. This is essential in optimizing accurate classification of disease severity and determining prognosis and risk of adverse events. The most used scores based on clinical experience and ease of use are shown in Table 12.

IBD postcolonoscopy quality indicators

UC surveillance colonoscopy interval

15. Frequency of appropriate recommendation for a follow-up surveillance colonoscopy interval for patients with UC and/or indeterminate colitis undergoing dysplasia screening without dysplasia detected.

Strength of recommendation: 1C

Performance target: ≥90%

Type of measure: process

Patients with UC and colonic CD have an increased risk of CRC (286). CRC associated with IBD has poorer outcomes compared with sporadic CRC, including younger age at onset and worse survival (287,288).

Routine surveillance colonoscopies are recommended for IBD patients with colonic disease extending beyond the rectum after 8 years of disease to monitor for the development of colonic dysplasia or neoplasia (265,286,289,290). For patients with IBD and concomitant primary sclerosing cholangitis, initiation of surveillance is recommended at the time of a diagnosis of primary sclerosing cholangitis (265,286,289,290). However, data supporting clinical or mortality benefits of such strategies are limited, and the quality of available evidence is low (291).

We recommend that the appropriateness of recommended surveillance intervals should be measured after colonoscopy in patients with UC or indeterminate colitis with no dysplasia. The basis for assessing appropriate intervals is presented in Table 13. The recommendations assume an examination of the entire colon with adequate bowel preparation. Uncertainty exists regarding whether dye-spray or electronic chromoendoscopy adds any benefit when using a high-definition colonoscope, and we suggest high-definition colonoscopy complemented with 1 modality of chromoendoscopy with targeted biopsy sampling of suspicious areas (265,286,289,290).

Table 13 presents a compilation of 4 clinical guidelines or clinical practice updates to develop a summary guidance (265,286,289,290). We considered that the ACG guideline had a maximum interval of 3 years (265), whereas 3 other guidelines and updates allowed up to 5 years between colonoscopies in select situations (286,289,290).

The recommendations are based on known risk factors for IBD-associated CRC including duration of disease, disease extent, age at onset, degree of inflammation, presence of colonic strictures, concomitant primary sclerosing cholangitis, family history of CRC, and male sex (292). Shorter time intervals are recommended for those with high-risk features, whereas longer time intervals can be recommended for those with limited risk and who have achieved mucosal healing (Table 13).

CORRECTION OF POOR PERFORMANCE

The primary purpose of measuring colonoscopy quality indicators is to improve patient care through identification of suboptimal performance and implementation of interventions that address deficiencies. Improvement in colonoscopy quality metrics has been documented for bowel preparation quality, polyp detection and resection, and compliance with surveillance recommendations (293–298). Improvement in the ADR is associated with a reduced risk of PCCRC and cancer-related death (299).

Although a full discussion of approaches to improve colonoscopy quality is beyond the scope of this document, key principles are discussed. Optimal adenoma detection depends on adequate bowel preparation, a withdrawal technique that maximizes mucosal exposure, high-level recognition of subtle neoplasia, and complete resection of precancerous lesions. A critical first step in colonoscopy quality assurance is the audit and feedback of individual physician performance, with most studies demonstrating feedback is associated with quality improvement (300–304). When individuals have ADRs below the recommended threshold, a variety of interventions has been found to be effective (Table 14).

Split-dose or same-day (preparation entirely the morning of the procedure) bowel preparation increased ADRs in randomized-controlled studies (305). A high-quality withdrawal technique includes cleaning pools of retained stool, fluid, and mucus; exposing hidden mucosa by systematically probing the proximal sides of folds; and achieving adequate distention of the entire colon (148,149). A second examination of the right-sided colon, with or without retroflexion, improves detection and is recommended (306,307). Distal attachment devices help expose mucosa and improve ADRs, as shown in many randomized trials (308–311). Other techniques associated with improved ADRs include water exchange during colonoscope insertion (312,313) and changing the patient's position during inspection to keep the examined segment nondependent (314,315). Adequate mucosal exposure and inspection require time, and a low ADR in combination with short average withdrawal times should be viewed as an indicator of ineffective withdrawal techniques that warrant correction.

Optimized mucosal exposure must be accompanied by training in the detection of subtle neoplasia, particularly SSLs. Randomized trials have demonstrated the effectiveness of educational interventions to improve ADRs (316–320). The task force recommends instruction in the Paris classification (321) to emphasize the importance of flat and depressed lesions and a review of photographs of flat and depressed conventional adenomas and serrated lesions (322).

Table 12. Suggested scoring systems for inflammatory bowel disease activity

Scoring scale	Disease	Scoring	Notes
Mayo Endoscopic Score	Ulcerative colitis	0: Normal or inactive colitis	
		1: Erythema, mild decrease in vascularity	
		2: Friability, marked erythema, vascular pattern absent, erosions seen	
		3: Ulcerations and spontaneous bleeding	
Simple Endoscopic Activity Score in Crohn's Disease	Crohn's disease	0: None	A score is documented from the ileum, right-sided colon, transverse, left-sided colon, and rectum
		1: Aphthous ulcers, <10% ulcerated surface, <50% affected surface, single narrowing passed	Maximum score is 12 per segment, with a total maximum of 60
		2: Larger ulcers, 10%–30% ulcerative surface, 50%–75% affected surface, multiple narrowings	
		3: Very large ulcers, >30% ulcerated surface, >75% affected surface, narrowing cannot be passed	
Rutgeerts score	Crohn's recurrence in the neoterminal ileum after surgical resection of the terminal ileum	i0: No lesions, normal-appearing neoterminal ileum	Endoscopic remission i0 or i1; recurrence is i2-i4 with i3or i4 most likely to develop clinical relapse
		i1: ≤5 aphthous ulcers in the neoterminal ileum	
		i2: >5 aphthous ulcers in the neoterminal ileum with normal-intervening mucosa or skip areas of larger lesions or lesions confined to the ileocolonic anastomosis	
		i3: Diffuse aphthous ileitis with diffusely inflamed mucosa	
		i4: Diffuse inflammation with large ulcers, nodules, and/or narrowing	

High-definition endoscopes improve ADRs (323–325) and are considered mandatory in current colonoscopy practice. Finally, technical adjuncts to improve ADRs can be considered. Electronic chromoendoscopy with second-generation narrow-band imaging (Olympus) resulted in a higher ADR than white-light colonoscopy (odds ratio, 1.28, 95% confidence interval,

Table 13. Timing of subsequent colonoscopy for patients with ulcerative/indeterminate colitis undergoing a screening colonoscopy with no dysplasia detected at the current colonoscopy

1 yr	2–3 yr	3–5 yr
• Primary sclerosing cholangitis (including after liver transplant)	• Prior resected visible dysplasia <5 yr ago	• Mucosal healing on current examination and ≥2 examinations without dysplasia
• Family history of colorectal cancer in first-degree relative aged <50 yr	• Family history of colorectal cancer (but no first-degree relative aged <50 yr)	• Overall disease extent affecting one-third or less of the colon
• Prior invisible dysplasia <5 yr ago	• Mildly active inflammation	
• Active inflammation (more than mild)	• Pseudopolyps (but not dense)	
• Dense pseudopolyps		
• Colonic stricture		

Table 14. Interventions to improve adenoma detection rate

Intervention (with selected references)
Physician report cards (300–304)
Public reporting of adenoma detection rate
Water assistance (312,313)
Second look, either retroflexion in the cecum or second forward look in the proximal colon (306,307)
Dynamic change in patient position (314,315)
High-definition endoscopes (323–325)
Distal attachment devices (308–311)
Enhanced imaging technology (e.g., narrow-band imaging, i-SCAN, linked-color imaging, blue-laser imaging, chromoendoscopy, and/or methylene blue-MMX [Cosmo Pharmaceuticals, Dublin, Ireland]) (293,326)
Computer-aided detection technologies (330–333)
Split-dose bowel preparation (305)
Nurse assigned to observe colonoscopy monitor (346)
Focused educational interventions (317–320)
Leadership training in colonoscopy technique (316)

1.05–1.56) in a meta-analysis of randomized controlled studies (326), although older versions of narrow-band imaging and electronic chromoendoscopy did not significantly improve ADRs (327). Linked-color imaging (Fujifilm, Valhalla, NY) is also associated with detection gains for both adenomas and SSLs (328,329). Artificial intelligence systems for detection of neoplasia have been recently approved in the United States with most randomized controlled studies demonstrating significant improvements in ADRs (330–332) and reductions in adenoma miss rates (333). Despite the convincing and consistent evidence from randomized trials, assessments of benefit in clinical practice settings have been negative in several instances (334–336). Generalizability to routine practice settings remains to be demonstrated convincingly. Successful programmatic colonoscopy quality assurance efforts with demonstrated improvements in patient outcomes have been outlined from the UK National Bowel Cancer Screening Proramme (337–340), the Netherlands (341), Poland (316), Germany (342), the US Veterans Administration (343), and Kaiser Permanente Northern California (344).

In summary, correction of poor performance begins with measurements of colonoscopy quality to identify specific areas of concern. Quality improvement may depend on the use of multifaceted interventions. As a last resort, removal of privileges to perform colonoscopy may be appropriate if satisfactory performance cannot be achieved, because colonoscopy quality is strongly associated with important patient outcomes, such as PCCRC incidence and mortality (21,22,92). These recommendations hold for colonoscopists in all specialties (345).

CONFLICTS OF INTEREST

Guarantor of the article: Douglas K. Rex, MD, MACG.

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