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Adherence to recommended intervals for surveillance colonoscopy in average-risk patients with 1 to 2 small (< 1 cm) polyps on screening colonoscopy

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Abstract

Background—Among average-risk patients, repeat colonoscopy in 5 years is recommended after 1 to 2 small (< 1 cm) adenomas are found on screening colonoscopy or in 10 years if hyperplastic polyps are found. However, sparse quantitative data are available about adherence to these recommendations or factors that may improve adherence.

Objective—To quantify adherence to recommended intervals and to identify factors associated with lack of adherence.

Design—Retrospective endoscopic database analysis.

Setting—Tertiary-care institution and Veterans Affairs Health System.

Patients—Average-risk individuals undergoing screening colonoscopy found to have 1 to 2 small polyps on screening colonoscopy.

Main Outcome Measurements—Frequency of recommending repeat colonoscopy in 5 years if 1 to 2 small adenomas are found and in 10 years if hyperplastic polyps are found.

Results—Of 922 outpatient screening colonoscopies with 1 to 2 small polyps found, 90.2% received appropriate recommendations for timing of repeat colonoscopy. Eighty-four percent of patients with 1 to 2 small adenomas and 94% of patients with 1 to 2 hyperplastic polyps received recommendations that were consistent with guidelines. Based on logistic regression analysis, patients aged > 70 years (odds ratio [OR] 2.4, 95% confidence interval [CI], 1.0–5.7), fair bowel preparation (OR 12.7; 95% CI, 7.3–22.4), poor bowel preparation (OR 10.0; 95% CI, 4.3–23.6),

and the presence of 2 small adenomas versus 1 small adenoma (OR 3.6; 95% CI, 2.2-6.0) were factors associated with “overuse” or recommendations inconsistent with guidelines.

Limitations—Retrospective study design.

Conclusion—More than 90% of endoscopists’ recommendations for timing of surveillance colonoscopy in average-risk patients with 1 to 2 small polyps are consistent with guideline recommendations. Quality of preparation is strongly associated with deviation from guideline recommendations.

The quality of colorectal cancer (CRC) screening with colonoscopy is primarily dependent on high-quality baseline examinations, whereas cost-effectiveness of CRC screening is partly dependent on adherence to guideline recommendations for timing of repeat screening and surveillance colonoscopy.^{1,2} Guideline recommendations should be followed in most, but not all, patients. Endoscopists may occasionally vary from guidelines, which state that average-risk patients with 1 to 2 small (< 1 cm) adenomas on screening colonoscopy should be told to get surveillance colonoscopy in 5 years or 5 to 10 years or to get repeat colonoscopy in 10 years if only 1 to 2 small hyperplastic polyps are found.³⁻⁵ However, the frequency of endoscopists’ overuse of colonoscopy (ie, recommending repeat colonoscopy sooner than recommended by guidelines) will be scrutinized closely in the coming years as different components of the Affordable Care Act are enacted.

The aim of our study is to quantify frequency of recommending repeat colonoscopy at an appropriate interval after 1 to 2 polyps are found during screening colonoscopy in average-risk patients. In addition, we aim to identify factors associated with adherence to guideline recommendations, including bowel preparation quality, demographic factors, and procedural factors.

BACKGROUND

Currently, endoscopists are asked to report different quality indicators, such as cecal intubation, to Centers for Medicare & Medicaid Services (CMS) through the Physician Quality Reporting System.⁶ When endoscopists report quality indicators for colonoscopy, they receive a small bonus in Medicare payments. In 2014, failure to report will result in a small reduction in Medicare payments. This system does not account for the actual quality of performance of colonoscopy, but, in 2015, a value-based quality index is to be enacted in which endoscopists’ success at meeting quality indicators will be quantified, and payments for colonoscopy will be adjusted based on this to-be-determined formula. CMS has not offered guidance about the target for guideline adherence for recommendations about timing of repeat colonoscopy after 1 to 2 small polyps are found. However, the academic gastroenterology societies, including the American Society for Gastrointestinal Endoscopy, are proactively developing a new “quality indicators for colonoscopy” document, which will recommend an appropriate target or benchmark for adherence to this guideline recommendation.

What should be the target for recommending a 5-year or 5 to 10-year interval after 1 to 2 small adenomas are found at screening colonoscopy or for recommending a 10-year interval when 1 to 2 small hyperplastic polyps are found at screening colonoscopy? Over 80% of

cases? Over 90%? Quantifiable data will be needed to set appropriate numerical targets. Also, factors associated with overuse of colonoscopy or recommending repeat colonoscopy sooner than indicated by guidelines should be identified so that these factors may be addressed in quality improvement programs.

Lack of knowledge about guideline recommendations is not associated with overuse of colonoscopy based on survey studies.^{5,7} However, endoscopists vary from guideline recommendations when bowel preparation is suboptimal, and they are concerned that adenomas could be missed. This is an understandable concern.⁸⁻¹¹ Based on survey studies that used hypothetical patient scenarios and photographs of bowel preparation, increasingly shorter intervals for repeat colonoscopy are recommended for worse categories of bowel cleansing.^{12,13} However, this research reflects “self-reported” practices and may be prone to response bias,¹⁴⁻¹⁶ although it does support the rationale that quality of bowel preparation impacts adherence to guideline recommendations.¹⁷ Based on our review, there is no published database study specifically assessing frequency of adherence to recommendations for timing of repeat colonoscopy after the finding of 1 to 2 small polyps and assessing factors associated with this.

METHODS

Study design

This is a retrospective database study supplemented by chart review from the University of Michigan in-hospital medical procedure unit, 2 University of Michigan outpatient ambulatory surgery centers (Livonia, Michigan and Ann Arbor, MI), and the Ann Arbor Veterans Affairs Health Care System (VAHCS) in-hospital endoscopy suite. Medical records of consecutive average-risk patients aged ≥ 50 years undergoing colonoscopy for CRC screening between January 1, 2009 and December 31, 2009 were reviewed. These dates were specifically chosen because they preceded institution of afternoon and/or morning split-dose bowel preparation protocols at our institutions.

Therefore, these data reflect outcomes with afternoon-only bowel preparation protocols, whereas upcoming research will re-assess these questions when afternoon and/or morning split-dose bowel preparation was used. Inclusion criteria were average-risk outpatients referred for CRC screening colonoscopy with 1 to 2 small polyps identified during colonoscopy. Participants were excluded for concurrent GI symptoms (ie, one of the indications for colonoscopy was listed as anemia, overt or obscure GI blood loss, abdominal pain, diarrhea, unexplained weight loss); family history of CRC; personal history of CRC, colon polyps, hereditary CRC syndrome, inflammatory bowel disease; detection of any colon polyps during colonoscopy, detection of mucosal abnormalities during colonoscopy that required biopsy, or incomplete colonoscopies (ie, failure to visualize the appendiceal orifice and cecum). Patients with follow-up recommendations for barium enema or discontinue due to age were excluded. Institutional Review Board approval was obtained at the Ann Arbor VAHCS and University of Michigan before study initiation.

Protocol for bowel preparation and definition of bowel preparation quality

If the laxative was polyethylene glycol, HalfLyte (Braintree Laboratories, Braintree, Mass), MoviPrep (Salix Pharmaceuticals, Raleigh, NC), NuLyte (Braintree Laboratories, Braintree, Mass), or TriLyte (Kremers Urban Pharmaceuticals, Seymour, Ind), the patients were instructed to follow U.S. Food and Drug Administration–approved instructions for consuming the bowel preparation by using an afternoon-only protocol. For MiraLAX (MSD, Whitehouse Station, NJ)/Gatorade (PepsiCo, Purchase, NY), patients took 2 tablets of bisacodyl between 12:00 PM and 6:00 PM, followed 4 hours later by consumption of 238 g of MiraLAX mixed in 64 ounces of Gatorade.

Bowel preparation quality and other endoscopic data were reported via the ProVation Medical Systems version 42 and version 5.0 (ProVation, Minneapolis, Minn) at the Ann Arbor VAHCS and University of Michigan endoscopy sites, respectively, by using the Aronchick scale, which categorizes bowel cleansing as excellent: >95% of mucosa visualized, good: 90% to 95% of mucosa visualized, fair: 80% to 90% of mucosa visualized, and poor: <80% mucosal visualization.¹⁸ We collapsed excellent and good categories for simplicity into a category called *optimal* because the clinical importance of 90% to 95% versus >95% visualization of the mucosa is unclear.

Intravenous conscious sedation with fentanyl and midazolam and an automated flushing pump were used routinely, but retroflex in the cecum was not performed routinely.

Endoscopist recommendation intervals

Data on the endoscopists' recommendations for follow-up colonoscopy were abstracted from patient colonoscopy report forms and from letters sent to patients after pathology reports were reviewed by the endoscopists. Recommendations consistent with guidelines were defined as follow-up in 10 years if hyperplastic polyps were identified or 5 years or 5 to 10 years if 1 to 2 small adenomas were found and bowel cleansing was excellent, good, or fair. If bowel preparation was poor, then appropriate recommendation was to repeat colonoscopy within 1 year.^{19–23} If no pathology-based recommendation letter was sent to the patient, adherence to guideline recommendations was determined by recommendations issued in the endoscopists' colonoscopy reports.

Participant and procedure data

Data were collected on age, sex, body mass index (BMI), race and/or ethnicity, concurrent narcotics usage, concurrent tricyclic antidepressant use, presence and/or absence of diabetes, age > 70 years, type of bowel preparation agent used, whether a gastroenterology fellow participated, endoscopist categorization of procedure difficulty, and cecal intubation. Specific endoscopist characteristics, including withdrawal time, were not collected because of privacy issues raised by our institutional review board, which stated that all endoscopists would need to provide informed consent even if they no longer practiced at the University of Michigan, because collection of these data might be used to retrospectively assess the performance of individual endoscopists.

Statistical analysis

Recommendation appropriateness was a dichotomous variable: consistent with guideline recommendations versus inconsistent with guideline recommendations. Chi-square tests and *t* tests were used to assess study population differences based on whether or not their recommendations were consistent with guidelines. Similar analyses were performed based on bowel preparation quality. Colinearity across potential predictors was assessed before we arrived at the final logistic regression model to ensure assessment of independent predictors of adherence to guideline recommendations. For continuous predictors of age and BMI, their functional relationships with adherence to guideline recommendations were examined by using polynomials and linear splines. Adjusted odds ratios (ORs) and 95% confidence limits were derived from the final model estimates. Database management and statistical analyses were performed by using Stata 12.0 (StataCorp LP, College Station, Tex).

RESULTS

Demographic data

Between January 1, 2009 and December 31, 2009, 4527 outpatient colonoscopies were performed for an indications of “average-risk” and “screening” at the University of Michigan and at the Ann Arbor VAHCS. After we applied exclusion criteria, 922 colonoscopies with 1 to 2 small polyps remained for analysis. Ninety-three (10.1%) colonoscopies did not have an associated letter describing the histology of polyps, and adherence to guideline recommendations was based on recommendations made in the endoscopists’ colonoscopy reports. The mean ($\pm$ standard deviation [SD]) age of participants was 57.1 years ($\pm$ 7.0 years) and the mean BMI was 29.3 ($\pm$ 6.2). Participants were predominantly white (80.8%) and male (62.2%). Bowel preparation was classified as optimal in 85.0%, fair in 11.2%, and poor in 3.8% of colonoscopies.

Follow-up recommendations for repeat colonoscopy

Among 922 eligible patients who underwent colonoscopies, 837 (90.8%) received recommendations for repeat colonoscopy that were consistent with guideline recommendations. There was no difference in the rate of guideline-consistent recommendations between colonoscopies with a follow-up letter versus those without a follow-up letter and recommendation for repeat colonoscopy based on the endoscopists’ colonoscopy report. Recommendations consistent with guidelines in patients with optimal, fair, and poor bowel preparation were 95.0%, 65.0%, and 79.4%, respectively. Fair bowel preparation (OR 10.3; 95% confidence interval [CI], 6.1-17.2) and poor bowel preparation (OR 7.6; 95% CI, 3.4-17.0) (Table 1) were associated with recommendations inconsistent with guidelines. Recommendations inconsistent with guidelines also were associated with narcotics use, African American ethnicity, and number of adenomas (Table 1). The presence of gastroenterology fellows was associated with improved adherence to guideline recommendations (OR 0.4; 95% CI, 0.2-0.9).

Table 2 demonstrates the association of these factors with guideline recommendations after adjustment for all data collected. In this adjusted logistic regression analysis, recommendations inconsistent with guidelines were again more likely to occur with fair

bowel preparation (OR 12.7; 95% CI, 7.3-22.4) and with poor bowel preparation (OR 10.0; 95% CI, 4.3-23.6). The presence of 2 small polyps versus 1 small polyp (OR 3.6; 95% CI, 2.2-6.0) and patients aged > 70 years relative to patients aged ≤ 70 years (OR 2.4; 95% CI, 1.0-5.7) also were independent predictors of recommendations inconsistent with guidelines. No significant difference was found when results were stratified for patients with 1 to 2 small adenomas compared with patients with 1 to 2 small hyperplastic polyps.

Table 3 shows the distribution of interval recommendations based on bowel preparation quality, stratified by polyp histology. Overall, 84.4% of patients with 1 to 2 small adenomas and 94.3% of patients with 1 to 2 small hyperplastic polyps received a recommendation to repeat colonoscopy that was consistent with guidelines. Among patients with 1 to 2 small adenomas and an optimal bowel preparation, 90.4% received a recommendation to repeat colonoscopy in 5 years or 5 to 10 years. However, only 52.9% of these patients with fair bowel preparation received an appropriate recommendation. Among patients with 1 to 2 small hyperplastic polyps and optimal bowel preparation, 98.2% received an appropriate recommendation to repeat colonoscopy in 10 years. However, only 72.1% of these patients with fair bowel preparation received an appropriate recommendation.

DISCUSSION

This is the first multicenter endoscopic database study to quantify adherence to guidelines for timing of repeat colonoscopy after 1 to 2 small polyps are found during screening colonoscopy in average-risk patients. In our study, recommendations consistent with guidelines were provided in 90.2% of all cases. Also, 84.4% of patients with 1 to 2 small adenomas and 94.3% of patients with 1 to 2 small hyperplastic polyps received a recommendation to repeat colonoscopy that was consistent with guidelines. These findings provide a starting point to establish targets or benchmarks for frequency of adherence to guideline recommendations. This may contribute to the development of quality improvement programs and national benchmarks by organizations such as CMS. Fair bowel cleansing was strongly associated with recommendations inconsistent with guidelines. This suggests that interventions that improve the quality of bowel preparation may improve adherence to guideline recommendations.

Our study methodology differs from previous survey studies because it reflects actual practice, albeit at a limited number of centers. Although our study is retrospective, our results are not influenced by response bias or the effect of a trial on endoscopists' behavior, (Hawthorne effect).^{16,24-26} Our results suggest that 85% to 90% adherence to guideline recommendations may be an appropriate quality indicator when 1 to 2 small polyps are found. Notably, only 52.9% of patients with 1 to 2 small adenomas received a recommendation consistent with guidelines when they had fair bowel preparation. In logistic regression analysis, fair bowel cleansing was associated a 12.7-fold increase of receiving a recommendation inconsistent with guidelines compared with optimal (excellent/good) bowel cleansing. Because this study purposely reports data from a period when afternoon-only bowel preparation was the protocol, it is possible that institution of split-dose bowel preparation will improve adherence to guideline recommendations while improving quality

of bowel cleansing. Ongoing research at our institution will quantify this improvement after institution of this preferred bowel preparation protocol.

Our study provides limited data about why endoscopists recommended repeat colonoscopies sooner than indicated by guidelines, although there is a growing body of research about overuse of colonoscopy and its limitations.²⁷⁻²⁹ Endoscopists appear to overuse colonoscopy when bowel preparation is fair because they are understandably concerned that small adenomas might have been missed. Other possible reasons for overuse include repeating colonoscopy sooner than recommended if patients are at higher risk for CRC (eg, aged > 70 years)^{27,28} or if the endoscopist is concerned about the limitations of colonoscopy to prevent CRC in the right side of the colon (eg, recommend repeat colonoscopy sooner than 5 years if 2 small flat adenomas were found in the ascending colon). Some endoscopists simply may distrust research used to support guideline recommendations or be concerned about medicolegal issues.²⁸ Ultimately, a combination of qualitative research with endoscopists and quantitative database research with endoscopist-specific characteristics needs to be conducted to clarify this topic.

Our study has several potential limitations. This is a retrospective study that reflects afternoon-only dosing of bowel preparation. There also may be variability among physician reporting of bowel preparation quality that is not captured. Although a validated scale to assess quality of bowel cleansing, such as the Boston Bowel Preparation Scale, was not used, the non-validated Aronchick scale is used widely,^{18,30,31} and this may enhance the generalizability of our results. As stated earlier, future research should quantify improvement in adherence to guideline recommendations after conversion from afternoon-only bowel preparation to afternoon and/or morning split-dose bowel preparation. Lack of specific endoscopist characteristics is another important limitation. Our institutional review board instructed the investigators that all endoscopists (> 40) would need to provide informed consent, even if they no longer practiced at the University of Michigan before endoscopist-specific data could be collected. Future retrospective and prospective research should include this informed consent because endoscopist-specific characteristics (eg, withdrawal time) may be associated with overuse of colonoscopy and identify interventions to minimize overuse.

In conclusion, our study demonstrates that endoscopists make recommendations for repeat colonoscopy that are consistent with guidelines in approximately 90% of average-risk patients who have 1 to 2 small polyps found at screening colonoscopy. This includes 84% of patients with 1 to 2 small adenomas and 94% of patients with 1 to 2 small hyperplastic polyps. These are initial data to establish a quality indicator target or benchmark for adherence to guideline recommendations. In this study, fair bowel cleansing is the factor most commonly associated with recommendations to repeat colonoscopy sooner than recommended by guidelines. Future research should explore endoscopist-specific characteristics and possible interventions to minimize overuse of colonoscopy.

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Abbreviations

BMI	body mass index
CRC	colorectal cancer
CMS	Centers for Medicare & Medicaid Services
VAHCS	Veterans Affairs Health Care System

Take-home Message

- Endoscopists' recommendations for timing of surveillance colonoscopy in average-risk patients with 1 to 2 small polyps are consistent with guideline recommendations in about 90% of cases. This may be an appropriate target for quality indicators.
- Fair bowel preparation was associated with lack of adherence to guideline recommendations, so improving the quality of bowel preparation by altering protocols may be helpful for endoscopists who are not meeting this benchmark.

TABLE 1
Characteristics of average-risk patients with 1 to 2 small polyps found on screening colonoscopy, stratified by adherence to guideline recommendations for timing of repeat colonoscopy

Characteristic*	Recommendation		
	Appropriate (n = 837)	Inappropriate [†] (n = 85)	P value
Age, mean (SD), y	56.9 (6.9)	58.4 (7.6)	.07
Male, no. (%)	515 (89.9)	58 (10.1)	.23
BMI, mean (SD), kg/m ²	29.2 (6.2)	29.4 (6.3)	.78
Tricyclic antidepressant treatment, no. (%)	16 (80.0)	4 (20.0)	.10
Narcotic use, [‡] no. (%)	60 (83.3)	12 (16.7)	.03
Diabetic, no. (%)	109 (86.5)	17 (13.5)	.08
GE fellow present, no. (%)	168 (95.5)	8 (4.6)	.02
No. of adenomas, no. (%)			
1	593 (94.0)	38 (6.0)	<.001
2	244 (83.9)	47 (16.2)	
Endoscopy site, no. (%)			
Ambulatory surgery center	518 (90.4)	55 (9.6)	.38
Academic hospital unit	130 (89.0)	16 (11.0)	1.2 (0.6-2.1)
Veterans Affairs endoscopy suite	189 (93.1)	14 (6.9)	0.7 (0.4-1.3)
Bowel preparation type, no. (%)			
8 L PEG-3350	164 (92.7)	13 (7.3)	.25
4 L PEG-3350	345 (88.9)	43 (11.1)	0.6 (0.3-1.2)
MiraLAX/Gatorade [§]	172 (93.5)	12 (6.5)	0.6 (0.3-1.1)
Other	130 (89.7)	15 (10.3)	0.9 (0.5-1.7)
Bowel preparation quality, no. (%)			
Optimal (excellent/good)	745 (95.0)	39 (5.0)	1
Fair	67 (65.1)	36 (35.0)	<.001
Poor	25 (71.4)	10 (28.6)	7.6 (3.4-17.0)

OR, Odds ratio; CI, confidence interval; SD, standard deviation; BMI, body mass index; GE, gastroenterology; PEG, polyethylene glycol.

* The total number of patients for each characteristic may not add to N Z 922 because of missing data.

† Any recommendation that was not consistent with guideline recommendations or no recommendation given.

‡ Defined as narcotics use at time of colonoscopy.

§ MiraLAX (MSD, Whitehouse Station, NJ)/Gatorade (PepsiCo, Purchase, NY).

// Includes sodium phosphate/OsmoPrep (Salix Pharmaceuticals, Raleigh, NC) and Half-Lytely (Braintree Laboratories, Braintree, Mass).

TABLE 2
Adjusted ORs for predictors of lack of adherence to guideline recommendations in
average-risk patients with 1 to 2 small polyps found on screening colonoscopy

Characteristic	Adjusted OR (95% CI)
Fair bowel preparation quality (ref: optimal)	12.7 (7.3-22.4)
Poor bowel preparation quality (ref: optimal)	10.0 (4.3-23.6)
GE fellow presence	0.3 (0.1-0.7)
2 Polyps identified (ref: 1 polyp)	3.6 (2.2-6.0)
Age ≥70y (ref:<70y)	2.4 (1.0-5.7)

OR, Odds ratio; CI, confidence interval; ref, reference; GE, gastroenterology.

TABLE 3
Adherence to guideline recommendations stratified by polyp histology and bowel preparation quality for average-risk patients with 1-2 small polyps found on screening colonoscopy

Recommendation interval, y	Hyperplastic polyp, no. (%)				Adenoma, no. (%)			
	Bowel preparation quality				Bowel preparation quality			
	Optimal	Fair	Poor	Total	Optimal	Fair	Poor	Total
10	321 (98.2)	31 (72.1)	13 (76.5)	365 (94.3)	8 (2.1)	0 (0)	0 (0)	8 (1.8)
5-10	0 (0)	1 (2.3)	0 (0)	1 (0.3)	3 (0.8)	0 (0)	0 (0)	3 (0.7)
5	6 (1.8)	8 (18.6)	1 (5.9)	15 (3.9)	337 (89.6)	27 (52.9)	6 (40.0)	370 (83.7)
2-4	0 (0)	2 (4.7)	0 (0)	2 (0.5)	25 (6.7)	19 (37.3)	6 (40.0)	50 (11.3)
1	0 (0)	1 (2.3)	3 (17.7)	4 (1.0)	3 (0.8)	4 (7.8)	3 (20.0)	10 (2.3)
Missing recommendation	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.0)	0 (0)	1 (0.2)
Total	327	43	17	387	376	51	15	442