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Predictors of guideline concordance for surveillance colonoscopy recommendations in patients at a safety-net health system

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Abstract

Purpose—Appropriate surveillance intervals for colorectal cancer (CRC) screening is one of the Centers for Medicare and Medicaid Services 2014 physician quality reporting system measures. Appropriateness of surveillance intervals will continue to be monitored closely, particularly as reimbursements become tied to quality measures.

Aims—Quantify and identify predictors for guideline-concordant surveillance recommendations after adenoma polypectomy.

Methods—We conducted a retrospective cohort study of patients who had colonoscopy with polypectomy at a safety-net health system between June 2011 and December 2013. Surveillance recommendations shorter and longer than guideline recommendations were defined as potential overuse and underuse. We used multivariate logistic regression to identify correlates of guideline-concordant surveillance recommendations, overuse, and underuse.

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Ben Kahn and Zachary Freeland have contributed equally to this work and are co-first authors.

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Compliance with ethical standards

Conflicts of interest None of the authors have any conflicts of interest to declare.

Results—Among 1,822 patients with polypectomy, 1,329 had 1 adenoma. Surveillance interval recommendations were guideline-concordant in 1,410 (77.4 %) patients, potential overuse in 263 (14.4 %), potential underuse in 85 (4.7 %), and missing in 64 (3.5 %) patients. Predictors of guideline-concordant recommendations in multivariate analyses included age >65 years (OR 1.36, 95 % CI 1.02–1.80), incomplete resection (OR 3.58, 95 % CI 1.41–9.09), and good/excellent prep quality (OR 2.22, 95 % CI 1.72–2.86). Underuse recommendations were more likely in patients with 3 adenomas; overuse recommendations were more likely in patients with high-grade dysplasia or fair prep quality and less likely in those with piecemeal resection, 3 adenomas, age>65, or Hispanic ethnicity.

Conclusions—Surveillance recommendations are not concordant with guidelines in one of four cases. Interventions to improve prep quality and guideline concordance of surveillance recommendations can improve cost-effectiveness of CRC screening.

Keywords

Colon cancer; Screening; Prep quality; Colonoscopy; Surveillance; Colorectal adenomas

Introduction

Colorectal cancer (CRC) is the second leading cause of cancer-related death in the USA, with over 50,000 deaths per year [1]. CRC screening has been associated with a significant reduction in CRC mortality and is endorsed by multiple national guidelines, including those of the United States Preventive Services Task Force (USPSTF) [2, 3]. Colonoscopy may be the most effective screening modality, as it allows direct visualization of the entire colon and simultaneous removal of any polyps. Monitoring with surveillance colonoscopy is recommended in all patients with a history of polyps given the risk of recurrent polyps and cancer [4]. Accordingly, surveillance colonoscopy accounts for nearly one-quarter of all colonoscopies performed in the USA [5, 6].

The effectiveness of colonoscopy as a CRC screening strategy is largely dependent on appropriate intervals for surveillance, as underuse of surveillance colonoscopy can lead to higher rates of interval cancers and cancer-related mortality [7, 8]. However, prior studies have suggested high rates of both overuse and underuse of colonoscopy [9–11]. For example, one study among patients in the Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer screening trial found that nearly one-half of patients with adenomas failed to receive a surveillance colonoscopy within 5 years, placing them at higher risk of interval cancers [11]. There were also high rates of surveillance overuse, with one-fourth of patients without an adenoma undergoing surveillance endoscopy within 5 years and 10 % having two surveillance examinations within 7 years. Overuse of surveillance colonoscopy can be associated with unnecessary costs, places patients at increased risk of potential harms, and further limits endoscopic capacity for other patients requiring colonoscopy [12, 13]. Inappropriate surveillance intervals can be related to several factors, such as lack of knowledge about guidelines, fear of missed lesions or interval cancers, and/or financial incentives [14].

Accordingly, increasing guideline concordance rates for surveillance intervals has become a major focus of health care reform in Gastroenterology. Use of appropriate surveillance intervals for CRC screening is one of the Centers for Medicare and Medicaid Services (CMS) Physician Quality Reporting System (PQRS) measures and included in the American Gastroenterological Association's (AGA) *Choosing Wisely* campaign. In an era where reimbursements are becoming linked to quality measures, the use of guideline-concordant recommendations for surveillance colonoscopy will likely continue to be an issue of central importance.

Most data characterizing surveillance recommendations have been derived from survey studies or focused primarily on non-academic community practices [14–16]. There are fewer data regarding surveillance colonoscopy recommendations for patients followed at academic centers or among underserved populations. Therefore, the aims of our study were to a) characterize surveillance colonoscopy recommendations after polypectomy among a large cohort of patients seen at an academic safety-net health system, and b) identify predictors of guideline-concordant surveillance colonoscopy recommendations as well as those that would lead to potential overuse or underuse of surveillance colonoscopy.

Methods

Study setting and population

We conducted a retrospective cohort study of consecutive patients who underwent colonoscopy with polypectomy at Parkland Health and Hospital System (PHHS) between June 2011 and December 2013. Parkland is the sole safety-net health system for Dallas County and is staffed by faculty of the University of Texas Southwestern (UTSW) Medical Center. Although PHHS cares for a high proportion of uninsured and underinsured individuals, these patients are able to access medical care, including CRC screening and surveillance, through a county-funded insurance-subsidy program.

Parkland has a four-room endoscopy unit, which performs approximately 1,500–2,000 colonoscopies per year. Gastroenterology fellows perform the colonoscopies under direct supervision by UTSW faculty. For all patients who undergo polypectomy, the Gastroenterology fellow makes recommendations for surveillance colonoscopy after the polyp pathology is available, with input from the Gastroenterology faculty as needed.

We included consecutive patients who underwent colonoscopy with polypectomy between June 2011 and December 2013. We included patients after June 2011 as this follows institution of Provation MD, the current endoscopic reporting system used at PHHS. We did not include patients seen after December 2013, as this date corresponds to the implementation of a new decision support system to increase guideline concordance of surveillance recommendations. We excluded patients with a history of colorectal cancer, hereditary polyposis syndromes, inflammatory bowel disease, prior colectomy, incomplete colonoscopy (defined as failure to intubate the cecum), poor prep quality (typically defined as inadequate visualization of polyps <5 mm in size), and those in whom the polyp could not be retrieved. The study was approved by the Institutional Review Board at UT Southwestern Medical Center.

Data collection

Patient demographics, clinical history, endoscopic findings, and pathology data were obtained from review of the electronic medical record. Two authors (B.K. and Z.F.) abstracted information using standardized forms, with a third investigator (A.G.S.) available to resolve any discrepancies. Patient demographics of interest included age, gender, race/ethnicity, and preferred language of communication. We recorded American Society of Anesthesiology (ASA) classification and whether the patient had a personal or family history of colon polyps and/or cancer. Endoscopic data were extracted from the electronic colonoscopy reporting system and included physicians who performed the procedure (and thereby responsible for surveillance recommendations), prep quality (as determined by endoscopist at time of procedure), cecal intubation, number of polyps removed, largest polyp size, method of polyp removal (e.g., forceps, cold snare, hot snare), and completeness of removal. Other process measures, such as withdrawal time, were not routinely recorded during the entire study period so were not part of planned chart abstraction. Pathology data included polyp type (hyperplastic, adenomatous, or sessile serrated polyp), the presence of high-grade dysplasia, and the presence of villous features.

Data on surveillance interval recommendations were manually abstracted from colonoscopy results letters sent to patients and providers after endoscopists reviewed final polyp pathology. The colonoscopy results letters are created and stored through the electronic medical record. For cases in which a pathology-based recommendation letter was not available, guideline concordance was determined using recommendations from the initial colonoscopy report. Recommendations were compared to the United States Multi-Society Task Force on Colorectal Cancer 2012 guidelines (Supplemental Table) for classification as guideline-concordant or guideline-inconsistent [4]. Recommendations that were not concordant with national guidelines were further categorized as leading to potential overuse or underuse. Surveillance intervals shorter and longer than guideline recommendations were defined as potential overuse and underuse, respectively.

Statistical analysis

Our primary outcome of interest was guideline concordance of surveillance recommendations, which was recorded as a dichotomous outcome (guideline-concordant vs. guideline-inconsistent). We used Chi-square and two-sample *t* tests for categorical and continuous variables, respectively, to identify covariates associated with guideline concordance. Multivariate logistic regression was then performed using variables significant on univariate analysis as well as variables of a priori clinical importance (e.g., prep quality). As a secondary analysis, among those with recommendations that were not concordant with guidelines, we used Chi-square, *t* tests, and multivariate logistic regression to identify correlates of potential overuse and underuse. For these analyses, guideline concordance was considered as the reference group. Statistical significance was defined as $p \leq 0.10$ for univariate and $p < 0.05$ for multivariate analyses. All data analysis was conducted using Stata 11.0 (College Station, TX).

Results

Patient characteristics

Between June 2011 and December 2013, 2,286 patients underwent colonoscopy with polypectomy at PHHS. A total of 464 were excluded: 147 had poor prep quality; 282 had colon cancer, hereditary polyposis syndrome, or inflammatory bowel disease; 25 had a polyp that could not be retrieved, precluding final histologic diagnosis; and 10 patients had an incomplete colonoscopy (Supplemental Figure). Characteristics of the remaining 1,822 patients who constituted the final study cohort are shown in Table 1. Median patient age was 58 (range 18–85) years, with 85 (4.7 %) being over the age of 75 years. A little more than half (54 %) of the cohort was female. The population was racially diverse, with 39.6 % blacks, 31.9 % Hispanics, and 23.7 % whites. Prep quality was good or excellent in the majority of cases, although 419 (23.0 %) had only fair prep quality. All patients had at least one polyp removed, with 740 (40.6 %) having one polyp removed, 415 (22.8 %) having two polyps removed, and 667 (36.6 %) having three or more polyps removed. Of these patients, 493 (27.1 %) had no adenomas, 963 (52.8 %) had 1–2 adenomas, and 366 (20.1 %) had three or more adenomas.

Among the 1,822 patients, 1,641 (90.1 %) were sent a letter providing pathology findings and recommendations for surveillance colonoscopy. Of the 181 patients without a colonoscopy results letter with pathology-based recommendations, surveillance recommendations were available in the initial colonoscopy report for 117 patients; however, 64 patients were never given any surveillance recommendations for follow-up endoscopy. Given the absence of guideline-concordant recommendations in these patients, they were categorized as non-concordant for all analyses. As expected, guideline concordance of surveillance recommendations from pathology-based letters was significantly higher than recommendations from the colonoscopy reports (81.5 vs. 61.5 %, $p < 0.001$).

Concordance of surveillance recommendations to national guidelines

Overall, 77.4 % (1,410 of 1,822) of surveillance recommendations were guideline-concordant. Recommendations were guideline-concordant in 63.1 % of patients without adenomas, 84.9 % among patients with 1–2 small (<10 mm) adenomas, 76.3 % among patients with 1–2 adenomas with largest ≥ 10 mm, and 80.6 % among patients with three or more adenomas (Fig. 1). In univariate analysis, guideline-concordant surveillance recommendations were significantly associated with age > 65 years ($p = 0.02$), good/excellent prep quality ($p < 0.001$), and incomplete polyp resection ($p = 0.005$). Guideline concordance rates did not differ by patient race, ASA class, family history of CRC, piecemeal resection, or personal history of prior adenomas. Similarly, we found no significant variation in guideline concordance rates by providers (Gastroenterology faculty or fellow). Among faculty members with at least 100 colonoscopy examinations, guideline-concordant recommendation rates varied from 72 to 80 %. In multivariate analyses, surveillance recommendations were significantly more likely to be guideline-concordant in patients older than 65 years (OR 1.36, 95 % CI 1.02–1.80) and those who underwent incomplete polyp resection (OR 3.58, 95 % CI 1.41–9.09). Surveillance recommendations were significantly less likely to be guideline-concordant among patients with fair prep

quality (OR 0.45, 95 % CI 0.35–0.58) (Table 2). Guideline-concordant recommendations were provided in 81.4 % of patients older than 65 years, compared to 76.2 % of younger patients. Similarly, rates of guideline concordance were approximately 15 % more likely among patients with incomplete polyp resection during the colonoscopy (91.9 vs. 76.9 %). Finally, patients with fair prep quality received guideline-concordant recommendations in 65.9 % of cases, compared to surveillance-concordant recommendations in 80.8 % of cases with good or excellent prep quality.

Among the 412 patients with surveillance recommendations that were not guideline-concordant, 85 (20.6 %) were classified as potential “underuse” because recommended surveillance intervals were longer than guideline recommendations, and 263 (63.8 %) deemed potential “overuse” because surveillance intervals were shorter than guideline recommendations. An additional 64 (15.5 %) patients were not provided any surveillance recommendations. Demographics of patients with guideline-inconsistent recommendations are detailed in Table 3. Among potential overuse recommendations, 124 (47 %) were 1–2 years shorter, 113 (43 %) were 3–5 years shorter, and 26 (10 %) were >5 years shorter than guideline recommendations. Among potential underuse recommendations, 54 (63 %) were 1–2 years longer, 26 (31 %) were 3–5 years longer, and five (6 %) were >5 years longer than guideline recommendations.

In multivariate analysis, potential overuse of colonoscopy was significantly associated with the presence of high-grade dysplasia (OR 9.6, 95 % CI 3.5–26.6) and fair prep (OR 3.3, 95 % CI 2.5–4.4). Potential overuse was inversely associated with piecemeal resection (OR 0.19, 95 % CI 0.04–0.80), three or more adenomas (OR 0.44, 95 % CI 0.28–0.68), age >65 years (OR 0.63, 95 % CI 0.44–0.90), and Hispanic ethnicity (OR 0.68, 95 % CI 0.50–0.92). Higher potential for underuse of surveillance colonoscopy was associated with the presence of more than three adenomas (OR 3.43, 95 % CI 2.18–5.40) (Supplemental Table 2).

Discussion

Most literature evaluating surveillance colonoscopy has been based on survey studies, with limitations of recall and response biases, or clinical trials such as the PLCO trial, which can be limited by the Hawthorne effect [11, 14, 16, 17]. Our study is unique in that we assessed surveillance recommendations among patients in a large county safety-net health system staffed by academic faculty members. In our study of 1,882 consecutive colonoscopies performed in an underserved population, we found surveillance recommendations are guideline-concordant in three-fourths of patients. However, surveillance recommendations are not concordant with national guidelines in nearly one of four cases, with potential for both overuse and underuse of surveillance colonoscopy.

Our findings were not consistent with several prior studies. For example, Krist and colleagues found guideline-concordant recommendations in a minority of patients followed in community primary care clinics [15]. Goodwin and colleagues reported overuse of colonoscopy among Medicare patients with a normal colonoscopy, and Cooper et al. [9, 10] demonstrated underuse of surveillance colonoscopy in more than 50 % of Medicare patients with prior polypectomy. However, our findings are consistent with those of Menees and

colleagues, who reported guideline-concordant surveillance recommendations in more than 90 % of patients with 1–2 small adenomas who were seen in an academic medical setting [18]. The higher rates of guideline concordance in our study and the one by Menees et al may be related to enhanced provider awareness about surveillance guidelines in academic centers. Alternatively, our findings of less potential overuse may be influenced by the finite endoscopic capacity in our health system and/or the absence of financial incentive for higher procedure rates.

We also found prep quality was a major driver of guideline concordance, with significantly higher rates of overuse among those with fair prep quality. Surveillance recommendations were not guideline-concordant in nearly one in three patients who had fair prep quality, compared to only one in five among those with good or excellent prep quality. Although these preps were regarded as providing “adequate” visualization, shorter than recommended intervals may reflect endoscopists’ concerns for missed lesions and interval cancers related to less-than-perfect prep quality. However, as we move toward a system in which reimbursements are tied to guidelines, it is unclear whether these “overuse” colonoscopies will be consistently reimbursed in the future [19]. Interventions to improve prep quality appear to be crucial to optimize colonoscopy effectiveness and reduce rates of surveillance colonoscopy overuse [20].

Other reasons for non-concordance with guidelines are likely multifactorial and may differ between overuse and underuse of surveillance colonoscopy. While both may in part be driven by suboptimal knowledge of guidelines, overuse may also be driven by concern about interval cancers, fear of legal liability, or financial gain [14, 21]. Underuse may be driven by concerns about the risk–benefit ratio for surveillance endoscopy, particularly in elderly patients or those with comorbid conditions. In our study, underuse was not significantly associated with patient age or ASA class. Of concern, we found the highest rates of potential underuse among patients with high-risk features for interval and/or future cancers, including personal history of polyps, multiple polyps, and piecemeal resection. Electronic medical record (EMR)-based decision support systems may be one way to improve guideline concordance of surveillance recommendations. For example, the Parkland-UT Southwestern Colonoscopy reporting system (CoRS) helps providers pair colonoscopy and biopsy findings with guideline-concordant surveillance recommendations [22]. However, studies are needed to better understand factors contributing to overuse and underuse of surveillance colonoscopy that can inform future intervention strategies to improve guideline concordance.

Prior studies have also highlighted the importance of provider-level factors, with higher guideline awareness and adherence among academic providers, younger providers, and high-volume endoscopists [23, 24]. Guideline adherence may also be driven by an endoscopist’s fear of missing cancer, particularly in patients with fair prep quality, and disagreement with guidelines regarding a patient’s perceived risk [24]. In contrast, guideline concordance in our study was primarily driven by patient-level factors, with no significant variation between Gastroenterology faculty or fellows. The lack of association between provider-level factors and guideline concordance in our study may relate to the homogeneity among our endoscopy staff. All faculties were UT Southwestern Medical Center staff with frequent

exposure to educational activities regarding CRC surveillance guidelines and high-volume endoscopy practices.

Several limitations of this study are worth acknowledging. Our study was conducted in a single safety-net health system, and the results may not be generalized to other settings. As discussed above, drivers of financial gain and endoscopic capacity vary between institutions and may influence rates of guideline-concordant recommendations. Although Gastroenterology fellows made most surveillance recommendations in our study, there was direct supervision and input by UTSW faculty. Further, understanding surveillance patterns of this cohort is important, as they will form the next generation of endoscopists. Given its retrospective nature, our study was also limited by missing data and potential confounders, such as patient preferences or limited life expectancy that might have been undocumented drivers of surveillance recommendations. Furthermore, there is potential measurement bias with factors such as bowel prep quality. Given the study's retrospective nature, we could not confirm whether all cases with fair were truly inadequate and required shorter follow-up. Third, we used the 2012 multi-society task force guidelines because they are the most applicable to current practice; however, patient enrollment started the prior year. The effect of retroactively applying these guidelines to patients from 2011 was negligible given the primary difference compared to prior guidelines was adding a more defined surveillance interval for serrated polyposis syndrome. Finally, we assessed guideline concordance based on endoscopist recommendations, not when surveillance examinations actually were scheduled or performed. We believe an outcome of surveillance recommendations is still informative because primary care providers in our health system heavily depend on endoscopist recommendation for timing of follow-up colonoscopy referrals. We believe these limitations are outweighed by the strengths of this study including its large cohort and fact this is one of the first descriptions of surveillance recommendations in a safety-net academic setting.

In summary, we found three-quarters of patients receive guideline-concordant surveillance recommendations. However, surveillance recommendations are not concordant with national guidelines in nearly 25 % of cases, with potential for both overuse and underuse of surveillance colonoscopy. Interventions to improve underuse, particularly among patients with high-risk features for future cancers, can improve CRC screening effectiveness, while interventions to improve overuse may reduce costs associated with unnecessary surveillance examinations. Because reasons for overuse and underuse of surveillance colonoscopy are different, future interventions will likely need to target different root causes. For example, our findings suggest that efforts to decrease overuse should target prep quality. Given the growing policy focus on quality measures of colonoscopy for both public-reporting and determining financial penalties, further research evaluating how best to improve guideline concordance of surveillance colonoscopy recommendations is crucial.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1.
Concordance of surveillance recommendations to guidelines stratified by pathology

Table 1Patient demographics ($n = 1,822$)

Variable	Guideline-concordant recommendation ($n = 1,410$)	Guideline-inconsistent recommendation ($n = 412$)	<i>p</i> value
Age (years)	58.6 ± 9.0	56.5 ± 10.6	0.0001
Gender (% male)	646 (45.8 %)	192 (46.6 %)	0.78
Race/ethnicity			0.45
White	319 (22.6 %)	108 (26.2 %)	
Black	564 (40.0 %)	157 (38.1 %)	
Hispanic	461 (32.7 %)	121 (29.4 %)	
Personal history of adenomas	293 (20.8 %)	84 (20.4 %)	0.86
Family history of colon cancer	78 (5.5 %)	24 (5.8 %)	0.82
ASA class			0.72
Class I	83 (5.9 %)	24 (5.8 %)	
Class II	809 (57.4 %)	242 (58.7 %)	
Class III	512 (36.3 %)	144 (35.0 %)	
Colonoscopy indication			0.98
Screening	397 (28.2 %)	114 (27.7 %)	
Surveillance	251 (17.8 %)	74 (18.0 %)	
Diagnostic	762 (54.0 %)	224 (54.4 %)	
Prep quality			<0.001
Good/excellent	1,134 (80.4 %)	269 (65.3 %)	
Fair	276 (19.6 %)	143 (34.7 %)	
Number of polyps	2.6 ± 2.2	2.7 ± 2.5	0.25
Number of adenomas	1.7 ± 1.9	1.2 ± 1.6	<0.001
Largest polyp size	6.5 ± 6.0	6.8 ± 6.1	0.33
Piecemeal resection	61 (4.3 %)	11 (2.7 %)	0.13
Incomplete resection	57 (4.0 %)	5 (1.2 %)	0.005

Table 2Predictors of guideline-concordant surveillance recommendations ($n = 1,822$)

Variable	Univariate analysis OR (95 % CI)	Multivariate analysis OR (95 % CI)	Rates of guideline-concordant recommendations
Patient age >65 years	1.37 (1.04–1.81)	1.36 (1.02–1.80)	81.4 versus 76.2 %
Incomplete polyp resection	3.43 (1.37–8.61)	3.58 (1.41–9.09)	91.9 versus 76.9 %
Fair prep quality	0.46 (0.36–0.58)	0.45 (0.35–0.58)	65.9 versus 80.8 %
3 or more adenomas	1.27 (0.95–1.69)	1.14 (0.85–1.53)	80.6 versus 76.6 %

OR odds ratio; *CI* confidence intervals

Table 3

Patient demographics for patients with guideline-inconsistent surveillance recommendations

Variable	Potential overuse recommendation (n = 263)	Potential underuse recommendation (n = 85)	No surveillance recommendation (n = 64)
Age (years)	56.5 ± 9.1	59.9 ± 10.7	52.0 ± 14.3
Gender (% male)	120	36	36
Race/ethnicity			
White	75	20	13
Black	107	32	18
Hispanic	67	27	27
Personal history of adenomas	55	27	2
Family history of colon cancer	18	5	1
ASA class			
Class I	13	3	8
Class II	158	49	35
Class III	91	33	20
Colonoscopy indication			
Screening	81	25	8
Surveillance	49	24	1
Diagnostic	133	36	55
Prep quality			
Good/excellent	147	75	47
Fair	116	10	17
Number of polyps	2.8 ± 2.4	3.1 ± 3.3	1.7 ± 1.2
Number of adenomas	1.1 ± 1.7	2.2 ± 1.5	0.5 ± 0.8
Largest polyp size	7.1 ± 6.0	7.2 ± 5.6	5.5 ± 7.0
Piecemeal resection	2	8	1
Incomplete resection	0	4	1