ORIGINAL INVESTIGATION

The Impact of Practice Guidelines in the Management of Barrett Esophagus

A National Prospective Cohort Study of Physicians

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Background: Surveillance of patients with Barrett esophagus (BE) is recommended to detect dysplasia and early cancer. In 1998, practice guidelines for the surveillance of patients with BE were developed under the auspices of the American College of Gastroenterology (ACG). Our objective is to assess physicians' awareness of agreement with and adherence to these guidelines.

Methods: A national prospective cohort study of practicing gastroenterologists who completed a self-administered questionnaire containing case studies prior to the release of the guidelines and another survey 18 months later. Analysis of adherence to the guidelines was done using the McNemar χ^2 test.

Results: Of the 154 gastroenterologists (66%) who responded to the follow-up survey, more than half (55%) were aware of the guidelines, and members of the ACG were more likely to know of their existence than nonmembers (61% vs 38%; $P=.01$). Overall, about 27% of physicians reported practicing in accordance with the guidelines at baseline; adherence increased modestly to 38% in the 18-month follow-up ($P=.04$) and was inversely related to fee-for-service reimbursement. Awareness was not associated with an increased likelihood of adherence, but agreement with the guidelines was strongly correlated with adherence ($P<.001$). The most frequent reasons for disagreement were concerns about liability, cancer risk, and inadequate evidence.

Conclusions: Awareness of the guidelines published by the ACG was low. Guideline awareness did not predict adherence. Improvement in guideline adherence will require steps beyond mere dissemination and promotion. Addressing disagreements about liability, disease risk, and scientific evidence as well as restructuring payment incentives may help achieve optimal practice.

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SUCCESSFUL implementation of clinical practice guidelines should improve quality of care by decreasing inappropriate variation.[1,2] However, several studies have suggested that guidelines have limited impact on clinical practice. These studies have examined neither prospectively the continuum of guideline adoption from dissemination, to awareness, to agreement, and finally to adherence nor the specific barriers along the way.

In 1998, practice guidelines for the surveillance of patients with Barrett esophagus (BE) (columnar epithelium replacing normal squamous epithelium as a consequence of gastroesophageal reflux disease) were developed under the auspices of the American College of Gastroenterology (ACG),[3] and drafts of the guidelines were submitted to 2 other professional associations, the American Society for Gastrointestinal Endoscopy (ASGE) and the American Gastroenterological Association (AGA), for their review and approval.[3,4] Because of the well-known association of BE with adenocarcinoma of the esophagus, regular endoscopic surveillance with biopsy has been recommended to detect dysplasia and cancer at an early stage.[5-10] The ACG guidelines included specific surveillance intervals for BE with no dysplasia, low-grade dysplasia, and high-grade dysplasia.

Adherence to guidelines such as these may depend on physicians' awareness of them after dissemination and subsequent agreement. Identification of specific barriers to physicians' adherence to guidelines will allow for the development of interventions to improve adherence to guidelines and ultimately quality of care. Therefore, we performed a national longitudinal study to assess the impact of the ACG guidelines on physicians' decisions regarding surveillance and management of

METHODS

STUDY DESIGN AND OVERVIEW

We conducted a national prospective cohort study (BE Surveillance and Treatment) of practicing gastroenterologists using a self-administered questionnaire. Physicians were eligible if they were members of the ACG, AGA, or ASGE and were not in training programs. Physicians who were retired or did not perform upper endoscopy were excluded. We used a stratified, random sampling method, with stratification based on membership in 1 of 3 gastrointestinal organizations.

SURVEY DISTRIBUTION

The baseline survey was distributed between March and June 1998; this was just prior to the publication of the BE guidelines in the *American Journal of Gastroenterology*.[3] We distributed the baseline survey and letters ensuring anonymity to the 722 gastroenterologists in our sample; 88 people (12%) had incorrect addresses and could not be contacted with directory assistance, while 79 others (11%) indicated that they did not perform upper endoscopy regularly. Of the 555 eligible respondents, we received 279 completed surveys (response rate, 50.3%). The follow-up survey was distributed to respondents of the baseline survey 18 months later between October 1999 and January 2000. We attempted to make telephone contact with all individuals who had not responded to the 2 mailed surveys. Finally, we mailed a third copy of the survey to individuals after the telephone reminder.

CONTENT OF THE QUESTIONNAIRE

The baseline and follow-up surveys included 3 case scenarios involving a patient with BE. This patient was described as

" . . . a 55 year-old white male with an eight-year history of moderately severe reflux and no other prominent symptoms or medical history. At endoscopy, he is found to have columnar-type epithelium in the distal esophagus that extends proximally about ten centimeters. Biopsies confirm the presence of specialized columnar epithelium."

In the first scenario, the pathological reading showed no dysplasia. In the second and third scenarios, the biopsy results were consistent with low-grade and high-grade dysplasia, respectively. Respondents were asked how they would manage each patient with regard to frequency of endoscopic surveillance, endoscopy technique, and surgical management.

The follow-up survey had 3 additional sections. First, to assess respondents' awareness of the published guidelines for the management of BE, we asked whether certain organizations had developed guidelines for the management of BE and if those guidelines included specific endoscopic surveillance recommendations. We included the organizations that have actually issued joint guidelines (the ACG, AGA, and ASGE) along with other organizations (local provider, health maintenance organization/local

Continued on next page

patients with BE. In particular, we asked (1) Was publication and awareness of the guidelines sufficient for adherence? (2) Did agreement with the guideline's content promote adherence? (3) What factors were associated with guideline adherence?

RESULTS

PHYSICIAN ELIGIBILITY, RESPONSE RATE, AND CHARACTERISTICS

We distributed 279 surveys; 44 people (16%) had incorrect addresses and could not be contacted with directory assistance or membership directories. Of the 235 eligible respondents who had completed the baseline survey, we received 154 completed surveys (response rate, 66%). Respondents did not differ from nonrespondents with regard to professional society membership, age, sex, academic appointment, or years since completing fellowship training. The mean age of respondents was 48.1 years; 93% were men (**Table 1**). Of the respondents, 56% had an appointment at an academic medical center. Fee for service was the most common means of reimbursement, followed by salary. About a quarter of the respondents had graduated from gastroenterology training within 8 years of the baseline survey. Nearly half of the respondents were members of all 3 societies (the ACG, AGA, and ASGE).

AWARENESS OF THE GUIDELINES FOR MANAGEMENT AND SURVEILLANCE OF BE

Of the respondents, 85 (55%) reported that the ACG had issued guidelines for the management of BE. Members of the ACG were more likely to be aware of the guidelines than nonmembers (61.2% vs 37.5%; $P=.01$). However, many respondents could not discriminate between the societies regarding guideline authorship; 51 (33%) of our respondents reported that all 3 societies have published guidelines for the management of BE. Additionally, respondents who had completed their fellowship training most recently (within 8 years of the baseline survey [27% of the respondents]) were significantly more likely to be aware of the guidelines than their more experienced counterparts (68% vs 49%, respectively; $P=.04$).

MANAGEMENT OF PATIENTS AND ADHERENCE TO THE GUIDELINES

No Dysplasia

Table 2 gives the management plans for the 3 case scenarios. For patients without dysplasia, most of the respondents indicated that they would follow the patients with regular endoscopic surveillance, with only less than 1% choosing no further action. This treatment strategy was not significantly different from the strategy pro-

insurer, the Health Care Financing Administration, and the Agency for Healthcare Research and Quality). Second, we asked physicians whether they agreed, disagreed, or were undecided with 5 statements about the recommended surveillance strategy for BE as described in the published practice guidelines.[3] The participants were asked to select the rationale for their response from a list of numbered potential reasons (medical, legal, economic, consumer, or scientific); perceived risk of cancer; medicolegal threats; cost of surveillance; patient demand for surveillance; published literature evidence; peer recommendations; and knowledge of guidelines. Third, we asked respondents whether they agreed with the concept of clinical practice guidelines and information about their demographic characteristics, practice setting, and prior experience with BE.

STATISTICAL ANALYSIS

Our main outcomes were awareness of, agreement with, and adherence to the guidelines. We calculated the proportion of respondents who were aware of the guidelines and agreed with each of its specific recommendations. We used χ^2 analysis and multiple logistic regression to identify factors associated with awareness and agreement with the guidelines.

We examined the frequency of follow-up endoscopic surveillance for patients with BE across various grades of dysplasia. We defined guideline adherence as the frequency of endoscopic surveillance within 25% of that suggested by the guidelines. The ACG guidelines recommend endoscopic surveillance every 24 to 36 months for BE with no dysplasia.[3] For BE with low-grade dysplasia, the ACG guidelines recommend endoscopic surveillance every 6 months during the first year and every 12 months thereafter.[3] For BE with high-grade dysplasia, the guidelines recommend endoscopic surveillance every 3 months or esophagectomy.[3] We then identified the respondents who were guideline adherent for each specific case scenario: no dysplasia, low-grade dysplasia, and high-grade dysplasia. Overall compliance was defined as practice in accordance with the guidelines in all 3 case scenarios: no dysplasia, low-grade dysplasia, and high-grade dysplasia.

Guideline adherence was expressed as the percentage of respondents to the baseline and follow-up surveys who were guideline adherent for each specific grade of dysplasia as well as the grades overall. To compare the proportion of respondents who were guideline adherent prior to the dissemination of the guidelines with the proportion who were adherent 18 months later, we used the McNemar χ^2 test.[11]

We used multiple logistic regression to identify factors that were independently associated with adherence to the guidelines. In addition, we performed multiple logistic regression analysis to identify factors independently associated with recommending esophagectomy for patients with high-grade dysplasia. A bootstrapping technique was used to obtain the 95% confidence intervals and SEs for the multiple logistic regression models.[12] Variables for the final logistic regression model were selected by using both stepwise- and hypothesis-driven procedures.[13] Statistical analyses were performed using Stata 6.0 (Stata Corp, College Station, Tex).

Table 1. Characteristics of 154 Respondents

Characteristic	No. (%)
Age, y*	
30-39	30 (21)
40-49	53 (37)
50-59	40 (28)
60-69	17 (12)
70-79	2 (1)
Sex†	
Male	133 (93)
Female	10 (7)
Reimbursement‡	
Fee for service	73 (53)
Salary	30 (22)
Capitation	7 (5)
Other	6 (4)
Gastroenterology society membership†§	
ACG	113 (79)
AGA	103 (72)
ASGE	122 (85)
All 3 societies	70 (45)
Academic appointment†	
Yes	80 (56)
No	63 (44)

*Ages were missing for 12 patients.
†Not all respondents answered all questions.
‡Reimbursements were assigned to a payer category if they received more than 70% of their reimbursement from that category.
§ACG indicates American College of Gastroenterology; AGA, American Gastroenterological Association; and ASGE, American Society for Gastrointestinal Endoscopy.

posed at baseline ($P=.56$). Two thirds (66%) of respondents recommended an initial surveillance frequency with esophagogastroduodenoscopy every 7 to 12 months. If findings were unchanged after the initial surveillance, 70% recommended that the follow-up interval be lengthened to 18 to 24 months.

Table 3 presents the frequencies of adherence to the guidelines for BE management and surveillance in the baseline and follow-up surveys. Compliance with practice guidelines for BE with no dysplasia was observed in 81% of the respondents at follow-up, a 9.7 percentage point increase from the baseline survey ($P=.03$).

Low-grade Dysplasia

For patients with BE having low-grade dysplasia, nearly our entire sample of physicians indicated that they would perform regular endoscopic surveillance on both the baseline and follow-up surveys. Table 2 demonstrates that the recommended interval for surveillance with esophagogastroduodenoscopy was shorter for these patients than for those without dysplasia, as 86% of the respondents selected an interval of 6 or fewer months in the follow-up survey. For subsequent surveillance, 56% of the respondents would perform another endoscopy between 7 and 12 months. In the baseline survey, about 36% of the respondents were practicing in concordance with the guideline recommendations; although the percentage in-

Table 2. Approach to Patients With Barrett Esophagus Before and After Release of Clinical Practice Guidelines*

	No Dysplasia		Low-grade Dysplasia		High-grade Dysplasia	
	Baseline, 1998	Follow-up, 1999-2000	Baseline, 1998	Follow-up, 1999-2000	Baseline, 1998	Follow-up, 1999-2000
Treatment plan						
No further action	2 (1)	1 (0.7)	0	0	0	1 (0.7)
Surveillance†	**152 (99)**	**152 (99)**	**149 (97)**	**151 (99)**	**35 (23)**	**34 (22)**
Esophagectomy	0	0	5 (3)	2 (1)	**117 (77)**	**118 (77)**
Surveillance frequency,‡ mo						
Initial						
<3	19 (16)	13 (11)	29 (20)	29 (20)	**25 (73)**	**23 (70)**
4-6	12 (10)	6 (5)	**85 (59)**	**97 (66)**	8 (23)	9 (27)
7-12	75 (61)	80 (66)	27 (19)	20 (14)	1 (3)	1 (3)
18-24	16 (13)	22 (18)	2 (1)	0	0	0
36	0	1 (0.8)	0	0	0	0
After the first surveillance if findings are unchanged						
<3	1 (0.7)	2 (1)	8 (6)	4 (3)	9 (38)	8 (40)
4-6	0	1 (0.7)	40 (30)	36 (26)	10 (42)	9 (45)
7-12	41 (28)	23 (16)	**74 (56)**	**88 (64)**	5 (21)	3 (15)
18-24	**96 (65)**	**101 (70)**	11 (8)	9 (7)	0	0
36	**8 (5)**	**12 (9)**	0	0	0	0

*Data are given as number (percentage). Boldface type indicates that the practice is consistent with the American College of Gastroenterology guideline recommendations.

†No dysplasia, $P = .56$; low-grade dysplasia, $P = .26$; and high-grade dysplasia, $P = .86$.

‡For respondents who indicated that they would perform surveillance.

creased slightly in the follow-up survey, it was not statistically significant (Table 3).

High-grade Dysplasia.

For patients with high-grade dysplasia, approximately three quarters of the respondents recommended esophagectomy, and a fourth recommended endoscopic surveillance on both the baseline and follow-up surveys. Among those who recommended surveillance, the most common surveillance interval in both surveys was 3 months or less, as was selected by 73% and 70% of the respondents in the baseline and follow-up surveys, respectively (Table 2). Hence, in the case of high-grade dysplasia, most of the respondents to both surveys were practicing in accordance with the guidelines (Table 3).

Overall Adherence

Of the respondents, 38% were practicing in accordance with the guidelines in the follow-up survey. This represents an increase of almost 11 percentage points in guideline compliance between the baseline and follow-up surveys (Table 3).

PHYSICIAN CHARACTERISTICS ASSOCIATED WITH GUIDELINE ADHERENCE

We evaluated factors that were independently associated with guideline adherence in a multivariate analysis (**Table 4**). For overall adherence (all 3 grades), physicians who were reimbursed mainly on a fee-for-service basis performed more frequent endoscopic surveillance and had an 84% lower odds of adhering to the guidelines than their counterparts reimbursed on a salary or capitated basis (odds ratio [OR], 0.16; $P = .002$). As the percentage of fee-for-service reimbursement increased, adherence to the guidelines decreased (**Figure**).

For the management of BE with no dysplasia, none of the physician characteristics was independently associated with adherence. In the multivariate model for low-grade dysplasia, physicians who were reimbursed mainly on a fee-for-service basis had a 76% lower odds of adhering to the guidelines than their counterparts (OR, 0.24; $P = .01$).

Respondents who reported that the ACG had issued guidelines for the management of BE were less likely to comply with the guidelines for BE with low-grade dysplasia (OR, 0.25; $P = .01$). Respondents who reported that the ASGE had guidelines for the management of BE were more likely to recommend esophagectomy for high-grade dysplasia (OR, 7.4; $P = .002$). Sex, academic appointment, society membership, and the number of years since completing training were all unrelated to adherence to any of the guidelines for BE.

AGREEMENT WITH THE GUIDELINES AMONG ADHERENTS AND NONADHERENTS

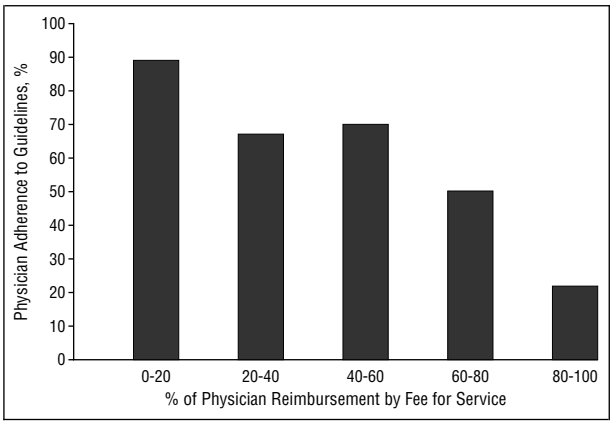
Table 5 presents the distribution of respondents' agreement with guideline recommendations for each degree of dysplasia. More than 80% of the respondents agreed with the recommendations for the management of patients with either no dysplasia or high-grade dysplasia. However, for the management of patients with low-grade dysplasia, only 63% of the respondents agreed with the recommendations.

Respondents who agreed with the guidelines for management of BE for no dysplasia and low-grade dysplasia were more than 10 times more likely to adhere to

Table 3. Adherence to Recommendations for Management and Surveillance of Barrett Esophagus by Gastroenterologists Before and After Release of Clinical Practice Guidelines*

	No. (%)		Percentage Point Difference	*P* Value†
	Baseline, 1998	Follow-up, 1999-2000		
No dysplasia	106 (71.6)	117 (81.3)	+9.7	.03
Low-grade dysplasia	46 (35.9)	58 (43.3)	+7.4	.10
High-grade dysplasia	136 (90.1)	138 (90.8)	+0.7	.83
Overall compliance‡	34 (27.4)	49 (38)	+10.6	.04

*Not all respondents answered all questions.
†McNemar χ^2 test.
‡Compliance in all 3 dysplasia grades.



Relationship of physicians' adherence to guidelines for management of Barrett esophagus to reimbursement on a fee-for-service basis (χ^2 for the trend, 6.51; *P*=.01).

Table 4. Relation Between Physician Characteristics and Management of Barrett Esophagus After Release of Clinical Practice Guidelines

	Adherence to Guidelines							
	No Dysplasia		Low-grade Dysplasia		Esophagectomy High-grade Dysplasia		All Grades*	
Characteristic	OR (95% CI)†	*P* Value	OR (95% CI)†	*P* Value	OR (95% CI)†	*P* Value	OR (95% CI)†	*P* Value
Age >45 y	0.54 (0.20-1.46)	.26	0.90 (0.38-2.13)	.82	0.20 (0.06-0.64)	.01	0.80 (0.32-1.97)	.63
Fee for service	1.70 (0.55-5.19)	.34	0.24 (0.08-0.73)	.01	0.17 (0.04-0.65)	.01	0.16 (0.05-0.50)	.002
Aware‡ ACG	0.85 (0.28-2.61)	.78	0.25 (0.08-0.76)	.01	0.34 (0.09-1.21)	.10	0.39 (0.12-1.21)	.10
Aware‡ AGA	0.73 (0.22-2.48)	.62	1.79 (0.60-5.32)	.29	2.07 (0.61-7.02)	.22	1.26 (0.42-3.76)	.68
Aware‡ ASGE	1.61 (0.54-4.79)	.39	0.58 (0.22-1.55)	.28	7.39 (2.04-26.7)	.002	0.62 (0.22-1.71)	.36

*"All grades" indicates adherence to guidelines for Barrett esophagus without dysplasia and low- and high-grade dysplasia.
†Odds ratios (OR) less than 1 indicate physicians with the characteristic were less likely to adhere to the guidelines than their counterparts without the characteristic. Odds ratios greater than 1 indicate physicians with the characteristic were more likely to adhere to the guidelines than their counterparts without the characteristic. Odds ratios are adjusted for all the variables in the model and for sex and academic appointment. CI indicates confidence interval.
‡"Aware" indicates reported awareness of existence of guidelines by a gastrointestinal society (American College of Gastroenterology [ACG], American Gastroenterological Association [AGA], and American Society for Gastrointestinal Endoscopy [ASGE]).

the guidelines on the case scenarios than the respondents who disagreed with the guidelines (*P*<.001). Similarly, respondents who agreed with esophagectomy were more likely to recommend esophagectomy (OR, 14.7; *P*<.001) than their counterparts.

REASONS FOR GUIDELINE AGREEMENT OR DISAGREEMENT

Table 6 presents the reasons for agreement or disagreement with the published guidelines for the management of BE in a multiple logistic regression model adjusted for the other reasons. For BE with no dysplasia, the most common reasons for agreeing with the guidelines were low-risk of cancer (*P*<.001) and adherence to gastrointestinal society guidelines (*P*=.008). Those respondents who disagreed with the guidelines were concerned about medicolegal liability (*P*<.001) and the lack of published evidence that supported this surveillance interval (*P*=.01).

For BE with low-grade dysplasia, the perceived risk of cancer was given as the main reason both for agreement or disagreement with the guidelines (*P*<.001), while adherence to gastrointestinal society guidelines was independently associated with agreement (*P*<.001). For BE with high-grade dysplasia, the most common reasons for agreeing with treatment with esophagectomy were (1) adequate published literature that supports the surveillance strategy (*P*=.005), (2) high risk of cancer associated with this histological stage (*P*<.001), and (3) concern about medicolegal liability (*P*=.04).

Of our respondents, 139 (91%) agreed with the concept of clinical practice guidelines. Among those who disagreed with guidelines, 10 (71%) reported that guidelines were too rigid to apply to their practice (too "cookbook"). Only 2 of our respondents reported lack of confidence in guideline developers.

COMMENT

Despite wide promulgation, guidelines have had a limited effect on changing physician behavior.[14] Prior studies have lacked a design that would allow evaluation of the continuum of guideline adoption from dissemination, to awareness, to agreement, and finally, to adherence.[15-21] To our knowledge, all have been either retrospective or cross-sectional studies. We, however, prospectively examined the impact of practice guidelines

Table 5. Adherence to American College of Gastroenterology Guidelines According to Agreement vs Disagreement With Guideline Recommendation

Grade	No. (%)				Odds Ratio*	*P* Value
	Agree	Adherence Among Those Agreeing	Disagree	Adherence Among Those Disagreeing		
Barrett esophagus, no dysplasia	126 (82)	111 (94)	18 (13)	5 (28)	43.8	<.001
Barrett esophagus, low-grade dysplasia	84 (63)	47 (56)	34 (25)	3 (9)	13.1	<.001

*Odds ratio of adhering for respondents who agree vs disagree with the guidelines.

on a cohort of gastroenterologists before and after the publication of the guidelines by the ACG. Furthermore, the present study design enabled us to document awareness of and agreement with the guidelines as well as reasons associated with agreement and disagreement.

In spite of publication of the ACG guidelines in the *American Journal of Gastroenterology* and ample citation of the guidelines in other articles,[22-25] only 55% of all respondents in our sample were aware of the guidelines 18 months after their publication. Although ACG members were more likely to be aware than nonmembers, only 61% of the former group knew of the guidelines despite uniform distribution of the journal to all society members.[3] Physicians who completed their fellowship within 8 years of the publication of the guidelines were also more likely to be aware of their existence.

The percentage of respondents who reported practicing in a manner suggested by the guidelines increased from 27% (prior to the publication of the guidelines) to 38% in the follow-up survey. Although this change was statistically significant, it is not possible to determine whether the guidelines actually had an impact on physician behavior because we did not directly evaluate individual physician practices. There was wide disparity in the degree of guideline adherence when the grade of dysplasia was considered. For the management of patients with low-grade dysplasia, the percentage of respondents who were adherent with the guidelines recommendations was low (43%). In contrast, more than 80% of respondents were in compliance with published guidelines for BE with no dysplasia and BE with high-grade dysplasia. These differences might result from the lack of understanding of the natural history of BE (particularly of low-grade dysplasia).[26,27]

Despite the significant change in overall adherence to the ACG guidelines, awareness of the guidelines was not associated with increased adherence in our study. Indeed, the 2 groups that were more likely to be aware of the guidelines (ACG members and younger physicians) were not more likely to be practicing in a manner consistent with the guidelines. The lack of association between guideline awareness and adherence in our study is consistent with a prior study that evaluated the impact of guideline publication on physician practice.[28] The investigators reported that 78% of physicians were aware of the guidelines, but only 26% of them changed their practices to adhere to the new guidelines.[28] It is clear that guideline awareness does not guarantee change in practice behavior.

Table 6. Reasons for Agreement or Disagreement With the Specific Guidelines by Dysplasia Grade on Management and Surveillance of Barrett Esophagus (BE)*

	ND	LGD	HGD
Reasons for Agreement			
	(n = 126)	(n = 97)	(n = 126)
Perceived low risk of cancer	94 (75)†	41 (42)†	113 (90)†
Published evidence supports this practice	79 (63)	52 (54)	102 (81)‡
Adhere to gastrointestinal society guidelines	73 (58)‡	43 (44)†	62 (49)
Colleagues recommend this practice	67 (53)	34 (35)	51 (40)
Patients want less frequent follow-up	17 (13)	9 (9)	0
Concerned about medicolegal liability	11 (9)	3 (3)	33 (26)‡
Low risk of surgical morbidity and mortality	. . .	. . .	31 (25)
BE surveillance costs too much	13 (10)	5 (5)	1 (0.8)
Local practice guidelines (insurer/HMO)	8 (6)	2 (2)	6 (5)
Reimbursement for EGD is inadequate	5 (4)	5 (5)	2 (1.6)
Reasons for Disagreement			
	(n = 20)	(n = 41)	(n = 12)
Risk of cancer is significant	0	20 (49)†	0
Published evidence does not support this practice	7 (35)‡	17 (41)	5 (42)
Adhere to gastrointestinal society guidelines	4 (20)	1 (2)	3 (25)
Colleagues recommend this practice	4 (20)	1 (2)	3 (25)
Patients want more frequent follow-up	5 (25)	6 (15)	0
Concerned about medicolegal liability	10 (50)†	11 (27)	0
Risk of esophagectomy is too high	. . .	. . .	5 (42)
Cost of BE surveillance is not excessive	4 (20)	3 (7)	1 (5)
Local practice guidelines (insurer/HMO)	2 (10)	0	0
Reimbursement for EGD is adequate	2 (10)	0	0

*Data are given as number (percentage). ND indicates BE with no dysplasia; LGD, BE with low-grade dysplasia; HGD, BE with high-grade dysplasia; HMO, health maintenance organization; and EGD, esophagogastroduodenoscopy. Statements referred to endoscopic frequencies for ND and LGD, and esophagectomy for HGD. Not all respondents answered all questions.
†$P<.001$.
‡$P<.05$.

In our study, agreement with the ACG recommendations was strongly associated with adherence. The most common reasons given for agreement with the guidelines were (1) perceived risk of cancer in BE patients, (2) adherence to gastrointestinal society guidelines, and (3) supportive published literature. Interestingly, the most

common reasons given for disagreement with the guidelines were (1) perceived risk of cancer, (2) concerns about medical liability, and (3) lack of published literature. Hence, the same body of existing data about the natural history and treatment of BE has been interpreted in very different ways by physicians; this has led to substantial practice variation. The risk of cancer in BE has been estimated to be high[29,30] in older studies and low in more recent ones.[31] This may account for the increased likelihood of older physicians performing more frequent surveillance for BE without dysplasia[32] or recommending esophagectomy for BE with high-grade dysplasia, as shown in our study. Variability in the estimation of cancer risk in BE may also influence guideline adherence by American physicians because of concern for missing malignancy diagnosis and the associated legal consequences. On the other hand, in other health care systems, such as in the United Kingdom, the lack of evidence on the efficacy of BE surveillance seems to be the most important factor influencing BE management.[27] Furthermore, there is no definitive trial that proves the effectiveness of endoscopic surveillance for detecting cancer in BE. There is also no study that compares various surveillance intervals for the management of BE according to various grades of dysplasia.

We identified an inverse relationship between adherence to the guidelines and fee-for-service reimbursement. Respondents who received most of their reimbursement on a fee-for-service basis were less likely to adhere to the guidelines primarily because they were more likely to recommend more frequent endoscopy than that suggested by the guidelines. Fee-for-service reimbursement has also been previously associated with more frequent surveillance for BE.[33] This implies that restructuring payment incentives may influence guideline adherence. When reimbursement is not linked to individual services rendered, such as in countries in which many physicians are salaried, the effectiveness of endoscopic surveillance may become a more important factor that will influence physician practice.[27]

How can we improve adherence to practice guidelines? The first barrier is lack of awareness.[19] Professional societies can play a major role in improving the quality of care through the creation and dissemination of practice guidelines.[34,35] The awareness rate of 61% among ACG members vs 38% among nonmembers in our study suggests that the dissemination of the guidelines to society members was relatively ineffective; additional strategies will be needed to reach all members and nonmembers. Direct mailing may also be effective in improving physician awareness, such as that performed by the National Institutes of Health for its consensus statement on osteoporosis.[36] The use of clinical alerts may also be helpful in disseminating new information and changing physician practice.[32] Guideline dissemination via pharmaceutical representatives may also increase awareness, but physicians may view the information from such sources with suspicion.[37]

The second barrier to physician adherence to guidelines is disagreement with the specific recommendations. Increasing agreement with guideline recommendations may be possible with interventions that target opinion leaders who may help shape local consensus.[38,39] Medical communities can be relatively closed systems where changes in an individual's practice are primarily influenced by colleagues and the norms and relationships of local practice.[40,41] When there is practice variability because of lack of scientific evidence, performance of well-designed studies with conclusive results may be more influential to practicing physicians than expert opinions or guidelines. Future interventions to change physician behavior should specifically address the reasons for disagreement with guidelines, such as perceived risk of disease, patient demand, and medicolegal liability. The construction and dissemination of guidelines should be an iterative process, incorporating the concerns of practicing clinicians as well as patients.

This study has several limitations. First, the follow-up survey was given to the respondents of our initial survey,[33] which constituted 50% of the original eligible list of gastroenterologists. In the follow-up survey, we obtained a response rate of 66%. Therefore, we could have started with a select group of respondents. Our nonrespondents were not significantly different from respondents with regard to age, sex, professional society membership, and academic appointment. However, there could be other important differences between respondents and nonrespondents that remain unmeasured. Second, this was a self-reported survey, and respondents might have selected answers they perceived to be correct. Finally, we sent the follow-up survey 18 months after the guidelines for BE were published, a relatively short period to fully assess the impact of the guidelines. Despite this, we were able to document changes in physicians' approach.

CONCLUSIONS

Our longitudinal study demonstrated that after guideline publication there was a significant increase in the proportion of respondents who reported using the ACG-recommended BE surveillance protocol. However, the overall guideline adherence rate was low, and lack of awareness did not seem to be the primary barrier. Similarly, society membership did not predict adherence. The strongest positive predictor of guideline adherence was agreement with the specific recommendations, while the only negative predictor was predominantly fee-for-service reimbursement. Hence, addressing specific practitioner concerns and reimbursement incentives may increase adherence to clinical guidelines. In addition, identifying the specific type of evidence that practitioners would find most useful could facilitate the design of highly relevant studies, which may increase agreement and adherence.

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