Colorectal Cancer Screening by Primary Care Physicians

Recommendations and Practices, 2006–2007

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Background: Primary care physicians (hereafter, physicians) play a critical role in the delivery of colorectal cancer (CRC) screening in the U.S. This study describes the CRC screening recommendations and practices of U.S. physicians and compares them to findings from a 1999–2000 national provider survey.

Methods: Data from 1266 physicians responding to the 2006–2007 National Survey of Primary Care Physicians' Recommendations and Practices for Breast, Cervical, Colorectal, and Lung Cancer Screening (cooperation rate=75%) were analyzed in 2008. Descriptive statistics were used to examine physicians' CRC screening recommendations and practices as well as the office systems used to support screening activities. Sample weights were applied in the analyses to obtain national estimates.

Results: Ninety-five percent of physicians routinely recommend screening colonoscopy to asymptomatic, average-risk patients; 80% recommend fecal occult blood testing (FOBT). Only a minority recommend sigmoidoscopy, double-contrast barium enema, computed tomographic colonography, or fecal DNA testing. Fifty-six percent recommend two screening modalities; 17% recommend one. Nearly all physicians who recommend endoscopy refer their patients for the procedure. Four percent perform sigmoidoscopy, a 25-percentage-point decline from 1999–2000. Although 61% of physicians reported that their practice had guidelines for CRC screening, only 30% use provider reminders; 15% use patient reminders.

Conclusions: Physicians' CRC screening recommendations and practices have changed substantially since 1999–2000. Colonoscopy is now the most frequently recommended test. Most physicians do not recommend the full menu of test options prescribed in national guidelines. Few perform sigmoidoscopy. Office systems to support CRC screening are lacking in many physicians' practices. Given ongoing changes in CRC screening technologies and guidelines, the continued monitoring of physicians' CRC screening recommendations and practices is imperative.

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Introduction

Colorectal cancer (CRC) is the second leading cause of cancer death in the U.S.[1] Screening for CRC is recommended by national expert groups for average-risk adults aged ≥50 years[2,3] and has been designated as a high-priority preventive service because of its substantial potential impact on disease burden and its cost effectiveness.[4] Screening options recommended by the U.S. Preventive Services Task Force (USPSTF) include annual fecal occult blood testing (FOBT); sigmoidoscopy every 5 years; or colonoscopy every 10 years.[3] In 2005, 50% of adults aged ≥50 years in the U.S. had been screened according to these recommendations.[5] This rate is notably lower than that of other recommended adult preventive services.[6–8]

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Most cancer screening in the U.S. occurs within routine medical practice, especially primary care. By recommending CRC screening tests, performing them, or referring patients for them, primary care physicians (hereafter, physicians) play a critical role in implementing guidelines and achieving public health targets for CRC screening. Accordingly, physician recommendation has been shown to be a strong correlate of whether or not patients undergo CRC screening.[9–11] Practice-level systems to support the translation of physicians' recommendations into clinical delivery are also recognized as an important influence on the utilization of CRC screening.[11–13]

An earlier study[14] used data from a nationally representative survey conducted in 1999–2000 to assess physicians' recommendations for and means of conducting CRC screening in their clinical practices. The study found that 98% of physicians recommended CRC screening to patients, most often with FOBT, flexible sigmoidoscopy, or both, and that many recommended screening at nonstandard starting ages or too-frequent intervals. Subsequent to that study, several major developments in national policies related to CRC screening occurred. These include the expansion of coverage by the Medicare program to include screening colonoscopy for average-risk beneficiaries in 2001,[15] the addition of colonoscopy and double-contrast barium enema (DCBE) to updated guidelines by the USPSTF in 2002,[16] and the adoption of CRC screening as a Health Plan Employer Data and Information Set performance measure by the National Committee for Quality Assurance[17] in 2003. Physicians' CRC screening recommendations and practices may have been influenced, altered, or both, by these and other developments in the rapidly evolving CRC screening field.

To assess physicians' current knowledge, attitudes, recommendations, and practices regarding CRC and three other types of cancer screening, the National Cancer Institute (NCI)—in collaboration with the Agency for Healthcare Research and Quality and the CDC—fielded in 2006–2007 the National Survey of Primary Care Physicians' Recommendations and Practices for Breast, Cervical, Colorectal, and Lung Cancer Screening (healthservices.cancer.gov/surveys/screening_rp/). The current study uses data from the new survey to characterize U.S. physicians' CRC screening recommendations and practices. Results are compared to selected findings from the earlier, 1999–2000 survey.[14] The practice-level systems that physicians report having in place to support CRC screening activities, about which there is limited information at the national level, are also described.

Methods

Sampling Methodology

Between September 2006 and May 2007, a nationally representative sample of physicians was surveyed. The American Medical Association's Physician Masterfile, which contains demographic and practice information on all allopathic and nearly all osteopathic physicians in the U.S., was used as the sampling frame. Eligible respondents were nonfederal, office-based family physicians, general practitioners, general internists, and obstetrician/gynecologists aged ≤75 years with patient care as their major activity. Physicians who were listed as retired, deceased, or with an address outside the U.S. were considered ineligible. Because of the complexity of the topic of cancer screening and the need for fielding relatively brief questionnaires, one half of physicians received a questionnaire on breast and cervical cancer screening and the other half a questionnaire on colorectal and lung cancer screening.

For the colorectal/lung cancer survey, a systematic, stratified random sample of 2576 physicians was selected, using the four specialty types as the sampling strata. Sampling was designed to provide national estimates of physicians' cancer-screening knowledge, attitudes, recommendations, and practices for the four specialties combined with a margin of error of ±3% at a 95% CI. The sample was selected after sorting the sampling-frame database by physicians' age group, gender, urban versus rural practice location, U.S. census region, and age in single-year increments.

Survey Methodology

Of the 2576 physicians in the sample, 92 had requested on the Masterfile that they not be contacted and therefore were excluded from survey procedures, leaving 2484 potential respondents. Several online and directory-assistance resources were searched to obtain current contact information for approximately one third of the sample. In August 2006, telephone calls were placed by trained interviewers to the offices of physicians in the sample to verify physicians' eligibility for participation in the survey and the accuracy of contact information. Physicians were reclassified as ineligible if it was reported during these calls that they did not provide primary care, provided clinical care for <1 day per week, practiced in a federal healthcare facility, or were located outside the U.S. Despite tracing and telephone efforts, valid contact information could not be obtained for 7% of the sample.

In September 2006, a total of 1975 physicians were sent by express mail a packet containing a questionnaire; a cover letter from the NCI describing the study and requesting participation; a fact sheet with additional information about the survey; a letter of support from the American Academy of Family Physicians, the American Society of General Internal Medicine, or the American College of Obstetricians and Gynecologists, depending on the physician's specialty; a $50 honorarium check; and a postage-paid return envelope. Approximately 3 weeks later, a second mailing of the questionnaire was sent to eligible nonrespondents. Follow-up telephone calls were placed to the offices of physicians who were sent the second mailing to verify receipt of the mailed package and to encourage participation in the survey. Physicians were offered the option of completing a telephone interview; only three did so. Additional telephone calls were placed to the offices of nonresponding physicians. In February 2007, a third mailing of the questionnaire was sent by express mail to a sample of 341 nonresponding physicians. Follow-up telephone calls were placed to the offices of those

physicians a few days after the mailing and continued through March 2007.

The questionnaire required about 20 minutes to complete. Items asking about physicians' CRC screening recommendations and practices were specific to asymptomatic, average-risk patients and included FOBT, sigmoidoscopy, colonoscopy, DCBE, computed tomographic (CT) colonography, and fecal DNA testing. Items assessing perceived test effectiveness were measured with a 4-point Likert scale and the categories *very effective, somewhat effective, not effective*, and *don't know*. Physicians were asked whether they routinely recommended to their patients a specific modality as a CRC screening strategy and, if so, their policies on starting age, test frequency, and stopping age. For sigmoidoscopy and colonoscopy, they were asked whether they performed the procedure or referred patients to another provider for it. Physicians also were asked about the types of systems available in their practices to support cancer-screening activities. These questions included whether the practice had implemented CRC screening guidelines, used reminder systems for CRC screening, provided reports to the physician on his or her CRC screening rates, and the type of medical-record system used. The survey instrumentation is available at healthservices.cancer.gov/surveys/screening_rp/.

Data Analysis

Descriptive statistics were used to examine physicians' CRC screening recommendations and practices as well as the office systems available in their practices to support CRC screening activities. Physicians' modality-specific CRC screening recommendations and practices were compared to national data from a survey conducted in 1999–2000.[14] A sample weight that adjusts for undercoverage, nonresponse to telephone-screener calls, and survey nonresponse was assigned to each respondent. Sample weights were applied in the statistical analyses to obtain national estimates. SAS version 9.1.3 was used to obtain unweighted sample sizes. SUDAAN version 9.0.1 was used in calculating percentages and 95% CIs to account for the complex survey design. The analyses were conducted in 2008.

Results

Description of Respondents

A total of 1266 physicians responded to the survey. The absolute response rate was 69.3%. The cooperation rate, which excludes physicians lacking valid contact information, was 75%. Nearly half of the respondents were family physicians or general practitioners (Table 1). Approximately half were aged <50 years. The majority were men, non-Hispanic white, board-certified, graduates of U.S. medical schools, full or part owners of their practices, and without a medical school faculty appointment. More than three quarters spent ≥90% of their professional time providing patient care. The practices of most respondents were in urban locations, comprised five or fewer physicians, and were single-specialty.

Physicians' Perceptions of Test Effectiveness and Modality-Specific CRC Screening Recommendations

Ninety-five percent of respondents expressed the belief that colonoscopy is very effective in reducing CRC mortality (Table 2). Only a minority perceived as very effective guaiac-based FOBT (12%); sigmoidoscopy (16%); DCBE (17%); CT colonography (23%); or fecal DNA testing (7%). In contrast, in 1999–2000, 86% (95% CI=83.9, 87.8) of physicians perceived colonoscopy to be very effective, while FOBT was perceived as very effective by 28% (95% CI=25.6, 30.6); sigmoidoscopy by 49% (95% CI=46.5, 52.0); and DCBE by 33% (95% CI=30.1, 35.3). The 1999–2000 survey did not collect information on CT colonography or fecal DNA testing.

Of the six CRC screening modalities included in the 2006–2007 survey, colonoscopy was routinely recommended to asymptomatic, average-risk patients by the highest percentage of physicians (95%), followed by FOBT (80%); sigmoidoscopy (26%); DCBE (9%); CT colonography (5%); and fecal DNA testing (5%; Table 2). These results contrast sharply with the 1999–2000 national survey, which showed FOBT to be the modality recommended by most physicians (95%); followed by sigmoidoscopy (78%); colonoscopy (38%); and DCBE (14%; Figure 1).

With respect to the age at which physicians recommend that asymptomatic, average-risk patients begin screening with the modality, the 2006–2007 data show that for all of the tests, the majority specify age 50 years (Table 2). However, the percentage who do so is slightly lower for FOBT (58%) and fecal DNA testing (57%) than for the other tests; nearly 30% of physicians who indicated that they recommend FOBT or fecal DNA testing to patients mentioned 40 years as their recommended starting age. In 1999–2000, the percentages of physicians recommending that screening begin at age 50 years were lower for two of the tests: FOBT (46%; 95% CI=42.8, 48.6) and colonoscopy (76%; 95% CI=71.9, 79.8).

The most commonly mentioned frequencies at which physicians recommended that their patients undergo screening with the modality were every year for FOBT (87%) and fecal DNA testing (50%); once every 5 years for sigmoidoscopy (65%), DCBE (56%), and CT colonography (37%); and once every 10 years for colonoscopy (54%; Table 2). Variation in recommended frequencies for applying each of the tests is evident. In 1999–2000, the percentages of physicians recommending guideline-consistent frequencies were lower for sigmoidoscopy (48%; 95% CI=44.5, 50.9) and colonoscopy (17%; 95% CI=14.0, 20.9).

One third or fewer of the physicians who recommended a specific modality for CRC screening indicated that they have a stopping age at which they no

Table 1. Characteristics of primary care physicians and their practice settings, 2006–2007 (n=1266)

	Unweighted *n*	Weighted %
PHYSICIAN CHARACTERISTICS		
Specialty		
Family medicine/general practice	547	45.2
General internal medicine	415	36.9
Obstetrics/gynecology	304	17.9
Gender		
Male	866	68.8
Female	400	31.2
Age (years)		
<40	251	20.1
40–49	385	30.7
50–59	398	31.9
≥60	232	17.4
Race/ethnicity		
Non-Hispanic white	925	72.1
Non-Hispanic black	46	3.9
Hispanic	66	5.5
Asian	184	14.7
Other[a]	45	3.8
Board certified		
Yes	999	80.2
No	267	19.8
International medical graduate		
No	1001	78.3
Yes	265	21.7
Medical school affiliation		
No	818	64.3
Yes	441	35.1
Missing	7	0.5
Primary practice arrangement		
Full/part owner of practice	702	54.8
Employee, physician-owned practice	125	9.7
Employee, large medical group, HMO, or healthcare system	197	16.5
Employee, university hospital/clinic	76	5.6
Employee, other hospital/clinic	130	10.5
Other/missing	36	2.9
Time in patient care (%)		
<75	111	8.8
75–89	150	12.1
≥90	997	78.5
Missing	8	0.6
PRACTICE CHARACTERISTICS		
Geographic location		
Urban[b]	1032	81.8
Large rural city/town[c]	133	10.2
Small/isolated rural town[d]	101	8.0
Size (# physicians)		
1	328	26.0
2–5	511	40.7
6–15	274	21.4
≥16	145	11.2
Missing	8	0.7
Practice type		
Single-specialty	916	72.1
Multi-specialty	300	24.1
Other/missing	50	3.8
Patients who are uninsured (%)		
0–5	759	60.3
6–25	366	28.8
≥26	82	6.4
Don't know/missing	59	4.5
Patients with Medicaid coverage (%)		
0–5	490	39.5
6–25	452	34.9
26–50	175	13.7
≥50	88	6.9
Don't know/missing	61	5.0

Data source: National Survey of Primary Care Physicians' Recommendations and Practices for Breast, Cervical, Colorectal, and Lung Cancer Screening
[a]Includes American Indian/Alaska Native, Native Hawaiian/other Pacific Islander, multiple races, other race, and unknown
[b]Rural–urban commuting area 2 codes: 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 7.1
[c]Rural–urban commuting area 2 codes: 4.0, 4.2, 5.0, 5.2, 6.0
[d]Rural–urban commuting area 2 codes: 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 9.0, 9.1, 10.0, 10.2, 10.4, 10.5, 10.6

longer recommend screening with that test to healthy patients (Table 2). In 1999–2000, lower percentages of physicians reported having a stopping age for three of the CRC screening tests: 13% (95% CI=11.3, 15.2) for FOBT; 23% (95% CI=20.7, 26.0) for sigmoidoscopy; and 19% (95% CI=15.9, 23.1) for colonoscopy. In both surveys, 80 years was the most commonly mentioned stopping age.

Physicians' CRC Screening Practice Models

Fewer than 1% of physicians reported that they do not routinely recommend CRC screening with any of the six modalities included in the survey (Table 3). The most frequent practice is to recommend two modalities (56%), with FOBT and colonoscopy the most commonly recommended tests (50%). The second most-frequent practice is to recommend three modalities (20%); FOBT, sigmoidoscopy, and colonoscopy are the most-often recommended tests in this practice model (14%). Seventeen percent of physicians recommend a single modality, with colonoscopy the most commonly recommended test (15%). Only 1% of physicians recommend FOBT and no other modalities. Approximately 7% of physicians recommend four or more modalities: FOBT, sigmoidoscopy, colonoscopy, and DCBE or CT colonography or fecal DNA testing.

Of the physicians who recommend sigmoidoscopy, colonoscopy, or both (98%), the great majority refer their patients to another provider for the procedure. Only 4% reported that they perform sigmoidoscopy; 3% perform colonoscopy, and 0.5% indicated that they perform both procedures. The colonoscopy results are very similar to those of the 1999–2000 national survey, but the sigmoidoscopy results differ markedly: in 1999–

Table 2. Primary care physicians' perceptions of test effectiveness and modality-specific recommendations for CRC screening, 2006–2007 (n=1266)

	FOBT[a]	Sigmoidoscopy	Colonoscopy	DCBE	CT colonography	Fecal DNA testing
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Perceive this modality as very effective in reducing CRC mortality						
	11.9 (10.1, 13.9)	15.8 (13.9, 17.9)	95.3 (94.0, 96.4)	17.1 (15.0, 19.4)	22.6 (20.3, 25.2)	7.4 (6.1, 8.9)
Routinely recommend this modality						
	80.3 (77.7, 82.7)	25.7 (23.0, 28.6)	94.8 (93.3, 96.0)	8.6 (7.2, 10.2)	4.8 (3.7, 6.2)	4.7 (3.6, 6.1)
Starting age[b] (years)						
<40	6.2 (4.8, 7.9)	1.5 (0.6, 3.6)	0.6 (0.2, 1.4)	3.8 (0.8, 16.8)	1.8 (0.3, 10.8)	9.5 (3.7, 22.0)
40	29.4 (26.8, 32.1)	5.4 (3.3, 8.6)	1.8 (1.2, 2.9)	4.7 (1.7, 12.3)	12.8 (6.6, 23.3)	28.6 (18.9, 40.8)
41–49	5.5 (4.1, 7.1)	3.6 (2.1, 6.1)	1.0 (0.6, 1.7)	0.9 (0.1, 6.2)	0.0	0.0
50	57.7 (54.9, 60.4)	85.9 (81.4, 89.4)	93.5 (92.1, 94.6)	76.8 (66.0, 84.9)	77.4 (65.1, 86.2)	57.1 (44.7, 68.6)
55–70	0.8 (0.4, 1.5)	2.5 (1.3, 5.0)	2.8 (1.9, 3.9)	3.1 (1.2, 8.0)	3.0 (0.8, 11.0)	1.6 (0.2, 11.3)
Missing	0.5 (0.2, 1.5)	1.2 (0.5, 2.8)	0.5 (0.2, 1.0)	9.8 (4.6, 19.7)	5.1 (1.9, 12.8)	3.3 (1.0, 9.8)
Frequency[b] (year[s])						
Every 1	87.0 (85.0, 88.7)					49.7 (37.4, 62.0)
Every 2	7.1 (5.7, 8.8)					24.0 (15.4, 35.5)
Every >2	4.1 (3.0, 5.5)					16.6 (9.2, 28.1)
<3		5.8 (3.6, 9.2)	3.1 (2.2, 4.2)	6.0 (2.8, 12.6)	13.8 (7.3, 24.7)	
3		13.5 (10.0, 18.0)	3.2 (2.2, 4.5)	10.0 (5.0, 19.1)	10.5 (4.5, 22.9)	
4		3.0 (1.6, 5.5)	1.3 (0.7, 2.3)	1.5 (0.4, 6.5)	3.5 (0.8, 13.7)	
5		65.4 (59.5, 70.9)	27.7 (25.5, 30.1)	56.0 (44.9, 66.6)	37.0 (25.4, 50.4)	
6–9		1.4 (0.5, 3.8)	7.8 (6.4, 9.5)	1.9 (0.4, 7.8)	1.8 (0.3, 11.0)	
10		7.6 (5.0, 11.4)	54.2 (51.5, 56.8)	13.1 (8.2, 20.3)	24.0 (14.3, 37.5)	
Other	0.2 (0.0, 0.8)					1.8 (0.3, 10.9)
Missing	1.7 (0.9, 2.9)	3.1 (1.8, 5.4)	2.7 (2.0, 3.6)	11.5 (6.1, 20.5)	9.3 (4.0, 20.1)	7.9 (3.5, 17.2)
No longer screen with this modality when patient reaches a certain age[b]						
	18.3 (16.9, 22.0)	31.4 (26.2, 37.0)	33.6 (30.7, 36.6)	25.3 (16.7, 36.3)	24.4 (15.7, 36.0)	29.3 (17.0, 45.5)
Stopping age[c,d] (years)						
75	9.0 (5.9, 13.6)	10.6 (6.3, 17.2)	10.2 (7.6, 13.6)			
80	32.6 (27.5, 38.2)	28.2 (21.6, 35.9)	35.2 (30.7, 39.9)			
85	17.4 (12.5, 23.6)	12.4 (7.7, 19.5)	15.5 (12.1, 19.6)			
Other	19.2 (14.6, 24.7)	19.7 (13.8, 27.4)	20.1 (16.5, 24.4)			
Missing	21.8 (17.0, 27.5)	29.1 (22.0, 37.3)	19.0 (15.9, 22.6)			

Data source: National Survey of Primary Care Physicians' Recommendations and Practices for Breast, Cervical, Colorectal, and Lung Cancer Screening
[a]Guaiac-based FOBT
[b]Among physicians who reported that they routinely recommend this modality
[c]Among physicians who reported that they no longer screen with the modality when patients reach a certain age
[d]Stopping ages are not listed for DCBE, CT colonography, or fecal DNA testing due to small sample sizes
CRC, colorectal cancer; CT, computed tomographic; DCBE, double-contrast barium enema; FOBT, fecal occult blood testing

2000, 29% of U.S. physicians reported that they performed sigmoidoscopy.[14]

Practice-Level Systems to Support CRC Screening

Nearly two thirds of physicians (61%) reported that their practice had implemented guidelines for CRC screening (Table 4). Paper charts (56%) were the predominant type of medical-record system used in physicians' practices; 18% had full electronic medical records (EMRs), 10% had partial EMRs, and 16% were in transition from paper charts to EMRs. Reminder systems were relatively uncommon: 30% of physicians indicated that their practice has a mechanism such as a flag in patients' charts, computer prompt, or flow sheet to remind the physician or other members of the care team that a patient is due for CRC screening; 15% reported that their practice uses mechanisms such as the U.S. mail, telephone calls, e-mail, or personalized web pages to remind patients that they are due for CRC screening. Few physicians (12%) indicated that they receive reports of CRC screening rates for their patient panel.

Discussion

This study used data from a nationally representative survey of physicians conducted in 2006–2007 and compared them to selected results from an earlier national survey[14] to show that physicians' CRC screening recommendations and practices have changed substantially over a 7-year period. Colonoscopy is now the most frequently recommended test; in 1999–2000, it was FOBT. Moreover, despite national guidelines that list

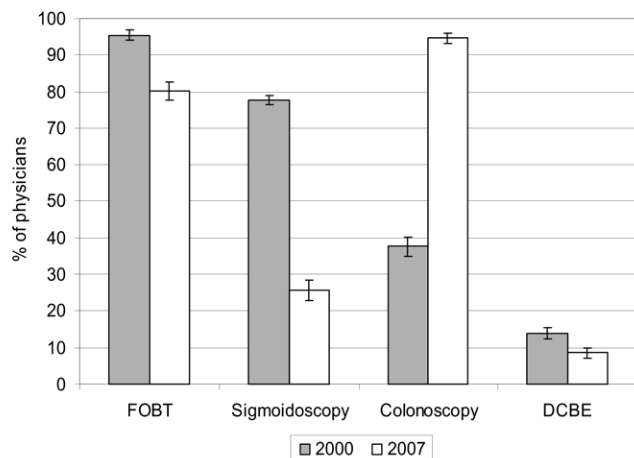

Figure 1. Primary care physicians' recommendations for colorectal cancer screening in asymptomatic, average-risk patients
Note: Error bars denote 95% CIs around point estimates.
Data sources: National Survey of Primary Care Physicians' Recommendations and Practices for Breast, Cervical, Colorectal, and Lung Cancer Screening (2007); Survey of Colorectal Cancer Screening Practices in Health Care Organizations (2000)
DCBE, double-contrast barium enema; FOBT, fecal occult blood testing

multiple test options for CRC screening and that promote the precept of patient choice in deciding on an acceptable screening strategy,[18] this study documents declines in the percentages of physicians who routinely recommend FOBT, sigmoidoscopy, and DCBE, with the most dramatic decline for sigmoidoscopy. The patterns of and trends in physician recommendation reported in this study parallel those for CRC test use as documented in the general population and among Medicare beneficiaries.[19–21]

Another notable finding is that, consistent with physicians' reduced propensity to recommend FOBT, sigmoidoscopy, and DCBE, considerably fewer in 2006–2007 than in 1999–2000 perceived these tests to be very effective in reducing CRC mortality, even though no new evidence has been published in the last 7 years indicating that the tests have less effectiveness than previously established. In contrast, the percentage of physicians who believe that colonoscopy is very effective in reducing CRC mortality increased by nearly ten percentage points between 1999–2000 and 2006–2007.

Although national guidelines in place at the time of this study[16,22,23] specified four different tests as acceptable CRC screening options (i.e., FOBT, sigmoidoscopy, colonoscopy, and DCBE) and recommended that physicians present those test options to patients in an informed/shared decision-making process, study results indicate that in practice most physicians are applying the guidelines selectively. More than 50% routinely recommend two tests (and no others), while 17% recommend only one test. Fewer than 10% routinely recommend all four test modalities. These findings are noteworthy in light of research showing that patients have distinct preferences for CRC screening tests[24–28] and that, in practices where only one CRC screening test is offered, many patients do not follow through to obtain screening because of concerns about the test.[29] Moreover, a growing body of work indicates that patient preferences for CRC screening tests vary according to the information provided about costs and procedure risks as well as by income level and race/ethnicity.[30–32]

Another practice change documented by this study is a dramatic decline in the percentage of physicians who perform sigmoidoscopy. In 1999–2000, 29% of U.S. physicians reported that they performed this procedure

Table 3. Practice models for CRC screening reported by primary care physicians, 2006–2007 (n=1266)

	Unweighted *n*	Weighted % (95% CI)
Does not routinely recommend any modality	11	0.7 (0.4, 1.3)
Recommends one modality	210	16.5 (14.2, 18.9)
FOBT	15	1.2 (0.7, 2.0)
Sigmoidoscopy	3	0.3 (0.1, 0.9)
Colonoscopy	192	15.0 (12.9, 17.4)
Recommends two modalities	706	56.2 (53.5, 58.9)
FOBT and sigmoidoscopy	30	2.6 (1.7, 3.7)
FOBT and colonoscopy	631	50.3 (47.3, 53.3)
Sigmoidoscopy and colonoscopy	29	2.1 (1.4, 3.0)
Colonoscopy and other	15	1.1 (0.6, 1.7)
FOBT and other	1	0.2 (0.0, 1.7)
Recommends three modalities	255	19.9 (17.7, 22.2)
FOBT, sigmoidoscopy, colonoscopy	178	13.9 (12.1, 16.0)
FOBT, sigmoidoscopy, other	2	0.2 (0.1, 0.8)
FOBT, colonoscopy, other	68	5.2 (4.2, 6.5)
Sigmoidoscopy, colonoscopy, other	7	0.6 (0.3, 1.2)
Recommends four or more modalities	84	6.7 (5.4, 8.4)
FOBT, sigmoidoscopy, colonoscopy, DCBE, and/or fecal DNA	50	4.1 (3.1, 5.5)
FOBT, sigmoidoscopy, colonoscopy, DCBE, CT colonography, and/or fecal DNA	15	1.1 (0.7, 1.8)
FOBT, sigmoidoscopy, colonoscopy, CT colonography, and/or fecal DNA	12	1.0 (0.5, 1.9)
FOBT, sigmoidoscopy, colonoscopy, fecal DNA	7	0.5 (0.3, 1.1)

Data source: National Survey of Primary Care Physicians' Recommendations and Practices for Breast, Cervical, Colorectal, and Lung Cancer Screening
CRC, colorectal cancer; CT, computed tomographic; DCBE, double-contrast barium enema; FOBT, fecal occult blood testing

Table 4. Practice-level systems to support CRC screening reported by primary care physicians, 2006–2007 (n=1266)

	Unweighted *n*	Weighted % (95% CI)
Practice has implemented CRC screening guidelines		
Yes	763	61.5 (58.8, 64.1)
No	492	37.8 (35.2, 40.4)
Missing	11	0.8 (0.4, 1.6)
Guidelines are accessed electronically by the primary care physician[a]		
Yes, at the point of care	48	6.6 (4.9, 8.8)
Yes, away from the point of care (i.e., at a desk or work station)	262	34.7 (31.1, 38.4)
Yes, both at point of care and away from the point of care	175	22.9 (20.1, 26.0)
No, not accessible electronically	262	34.0 (30.3, 37.9)
Missing	16	1.9 (1.1, 3.1)
Type of medical-record system used in the practice		
Paper charts	709	55.7 (52.6, 58.8)
Transitioning from paper to EMR	196	15.5 (13.6, 17.6)
Partial EMR	133	10.3 (8.6, 12.2)
Full EMR	218	17.7 (15.5, 20.1)
Missing	10	0.8 (0.4, 1.6)
Uses physician-reminder system[b] for CRC screening		
Yes	363	30.0 (27.6, 32.5)
No	903	70.0 (67.5, 72.4)
Uses patient-reminder system[c] for CRC screening		
Yes	186	15.1 (13.2, 17.3)
No	1080	84.9 (82.7, 86.8)
Practice provides reports to physician on CRC screening rates		
Yes	146	11.9 (10.2, 13.8)
No	1104	87.0 (84.9, 88.8)
Missing	16	1.2 (0.7, 2.0)

Data source: National Survey of Primary Care Physicians' Recommendations and Practices for Breast, Cervical, Colorectal, and Lung Cancer Screening
[a]Among primary care physicians who reported that their practice has implemented CRC screening guidelines
[b]Physician-reminder system includes flag in medical record, computer prompt, flow sheet, or other mechanism
[c]Patient-reminder system includes U.S. mail, telephone call, e-mail or personalized web page, or other mechanism
CRC, colorectal cancer; EMR, electronic medical record

in their practices.[14] The present study shows that only 4% do so. This is a large decline over a relatively short time period. This finding provides important context for interpreting data from national surveys of the general population and the Medicare program, which show substantially reduced sigmoidoscopy use since 2000.[19–21] Highly publicized editorials and a 2000 American College of Gastroenterology guideline advocating colonoscopy as the preferred CRC screening strategy may have motivated many physicians to stop performing sigmoidoscopies.[33,34] Few studies have examined physicians' specific reasons for performing or not performing this procedure. Low procedure volumes, inadequate reimbursement, and lack of time and support staff have been documented as barriers to physicians' provision of sigmoidoscopy in their practices.[14,35,36]

Survey results from 1999–2000 showed that many U.S. physicians had adopted nonstandard CRC screening practices such as recommending screening at earlier starting ages or shorter intervals—or both—for asymptomatic, average-risk patients.[14] The present study indicates modest improvements in the percentages of physicians who identify guideline-consistent starting ages and test intervals for the CRC screening modalities that they routinely recommend. Nevertheless, many physicians continue to recommend that screening begin at age <50 years or be repeated at too-frequent intervals. This is particularly true for colonoscopy, with 43% of physicians who recommend it indicating that they believe patients should undergo the procedure at intervals more frequent than once every 10 years. The propensity of endoscopists to recommend repeat colonoscopy at too-frequent intervals also has been documented.[37,38] The overuse of colonoscopy has implications for patients' exposure to procedure risks as well as for national capacity to achieve higher levels of CRC screening and follow-up among age-eligible adults. Future work will examine factors associated with physicians who report nonguideline-consistent CRC screening practices.

Another important study finding is that many physicians' practices lack office systems to support CRC screening. Slightly more than 60% reported that their practice had implemented CRC screening guidelines, and 28% indicated that their office uses a full or partial EMR. Fewer than one third indicated that their practice has a reminder system to prompt the physician about CRC screening, while fewer than a quarter use reminders to prompt patients. Few physicians receive reports on CRC screening rates for their patient panel. The importance of office systems to increasing CRC screening rates in practice is well established.[12,13,39–41] In particular, the great potential of EMRs in promoting appropriate screening within primary care practices has been noted.[42] Given the heavy reliance of physicians on referral to other providers for endoscopy and the limited office systems to support CRC screening recommendations/activities documented by this study, it is not surprising that gaps remain between high levels of physician recommendation and actual CRC screening rates.[5]

A limitation of this study is that it is based on physicians' reports of their recommendations and practices; self-reported data were not validated with other data sources such as medical records or claims. Medical-record and claims data, however, may not be entirely accurate sources of information about physicians' CRC

screening recommendations and practices; underascertainment of screening practices in these data sources has been documented.[43,44] Another limitation is that, for physicians who recommended more than one test modality, the precise patterns of use of the multiple modalities (e.g., FOBT or colonoscopy versus FOBT and colonoscopy) are unknown. This is because the survey items ascertaining physicians' recommendations did not ask about test combinations or preferences for one test over others.

Study strengths include the use of a nationally representative survey with a large sample size and high response rate. Moreover, surveys such as this one can provide more detailed information about physicians' recommendations and practices than is typically available in medical-record or claims data.

Raising CRC screening rates remains a public health challenge. Modeling has shown that CRC mortality in the U.S. could be reduced by 50% within the next decade, largely through increased screening uptake.[45] Yet national surveys of the general population continue to show suboptimal screening use, along with lack of awareness of the need for screening and lack of recommendation from a doctor to obtain it. These continue to be noted as key reasons why many age-eligible adults are not screened.[5] At a time when many physicians offer patients only one or two of the screening options (e.g., colonoscopy and FOBT), one updated guideline has expanded the menu of recommended test options to include CT colonography and fecal DNA testing[2]; another states that patients may no longer need screening when they become aged 75 or 85 years.[3] How physicians might operationalize these new guidelines in practice, particularly the more extensive test menu and suggested stopping ages, requires future study.

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References

1. American Cancer Society. Cancer facts and figures 2008. Atlanta GA: American Cancer Society, 2008.
2. Levin B, Lieberman DA, McFarland B, et al. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the U.S. Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. Gastroenterology 2008;134:1570–95.
3. U.S. Preventive Services Task Force. Screening for colorectal cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2008;149:627–37.
4. Maciosek MV, Coffield AB, Edwards NM, et al. Priorities among effective clinical preventive services: results of a systematic review and analysis. Am J Prev Med 2006;31:52–61.
5. Shapiro JA, Seeff LC, Thompson TD, et al. Colorectal cancer test use from the 2005 National Health Interview Survey. Cancer Epidemiol Biomarkers Prev 2008;17:1623–30.
6. Breen N, Cronin KA, Meissner HI, et al. Reported drop in mammography: is this cause for concern? Cancer 2007;109:2405–9.
7. Solomon D, Breen N, McNeel T. Cervical cancer screening in the U.S. and the potential impact of implementation of screening guidelines. CA Cancer J Clin 2007;57:105–11.
8. Klabunde CN, Meissner HI, Wooten KG, et al. Comparing colorectal cancer screening and immunization status in older Americans. Am J Prev Med 2007;33:1–8.
9. Subramanian S, Klosterman M, Amonkar MM, Hunt TL. Adherence with colorectal cancer screening guidelines: a review. Prev Med 2004;38:536–50.
10. Brawarsky P, Brooks DR, Mucci LA, Wood PA. Effect of physician recommendation and patient adherence on rates of colorectal cancer testing. Cancer Detect Prev 2004;28:260–8.
11. Janz NK, Wren PA, Schottenfeld D, Guire KE. Colorectal cancer screening attitudes and behavior: a population-based study. Prev Med 2003;627–34.
12. Hudson SV, Ohman-Strickland P, Cunningham R, et al. The effects of teamwork and system support on colorectal cancer screening in primary care practices. Cancer Detect Prev 2007;31:417–23.
13. Sarfaty M, Wender R. How to increase colorectal cancer screening rates in practice. CA Cancer J Clin 2007;57:354–66.
14. Klabunde CN, Frame PS, Meadow A, et al. A national survey of primary care physicians' colorectal cancer screening recommendations and practices. Prev Med 2003;36:352–62.
15. Centers for Medicare & Medicaid Services. Colorectal cancer screening: overview. www.cms.hhs.gov/ColorectalCancerScreening/.
16. U.S. Preventive Services Task Force. Screening for colorectal cancer: recommendation and rationale. Ann Intern Med 2002;137:129–31.
17. National Committee for Quality Assurance. HEDIS & quality measurement, HEDIS archives, HEDIS 2004. Washington DC: National Committee for Quality Assurance. www.ncqa.org/tabid/346/Default.aspx.
18. Pignone M, Rich M, Teutsch SM, Berg AO, Lohr KN. Screening for colorectal cancer in adults at average risk: a summary of the evidence for the U.S. Preventive Services Task Force. Ann Intern Med 2002;137:132–41.
19. Meissner HI, Breen N, Klabunde CN, Vernon SW. Patterns of colorectal cancer screening uptake among men and women in the U.S. Cancer Epidemiol Biomarkers Prev 2006;15:389–94.
20. Schenck AP, Peacock S, Klabunde CN, et al. Trends in colorectal cancer test use in the Medicare population, 1998–2005. Am J Prev Med 2009;37(1):XXX–XXX.
21. Chen X, White MC, Peipens LA, Seeff LC. Increase in screening for colorectal cancer in older Americans: results from a national survey. J Am Geriatr Soc 2008;56:1511–6.
22. Smith RA, Cokkinides V, von Eschenbach AC, et al. American Cancer Society guidelines for the early detection of cancer. CA Cancer J Clin 2002;52:8–22.
23. Winawer S, Fletcher R, Rex D, et al. Colorectal cancer screening and surveillance: clinical guidelines and rationale—update based on new evidence. Gastroenterology 2003;124:544–60.
24. Griffith JM, Lewis CL, Brenner AR, Pignone MP. The effect of offering different numbers of colorectal cancer screening test options in a decision aid: a pilot randomized trial. BMC Med Inform Decis Mak 2008;8:4.
25. Marshall DA, Johnson FR, Phillips KA, et al. Measuring patient preferences for colorectal cancer screening using a choice-format survey. Value Health 2007;10:415–30.
26. Janz NK, Lakhani I, Vijan S, et al. Determinants of colorectal cancer screening use, attempts, and non-use. Prev Med 2007;44:452–8.
27. Wolf RL, Basch CE, Brouse CH, Shmukler C, Shea S. Patient preferences and adherence to colorectal cancer screening in an urban population. Am J Public Health 2006;96:809–11.
28. Dolan JG. Patient priorities in colorectal cancer screening decisions. Health Expect 2005;8:34–44.
29. Denberg TD, Melhado TV, Coombes JM, et al. Predictors of nonadherence to screening colonoscopy. J Gen Intern Med 2005;20:989–95.
30. Pignone M, Bucholtz D, Harris R. Patient preferences for colon cancer screening. J Gen Intern Med 1999;14:432–7.

31. Katsumura Y, Yasunaga H, Imamura T, Ohe K, Oyama H. Relationship between risk information on total colonoscopy and patient preferences for colorectal cancer screening options: analysis using the analytic hierarchy process. BMC Health Serv Res 2008;8:106.
32. DeBourcy AC, Lichtenberger S, Felton S, et al. Community-based preferences for stool cards versus colonoscopy in colorectal cancer screening. J Gen Intern Med 2007;23:169–74.
33. Podolsky DK. Going the distance: the case for true colorectal cancer screening. New Eng J Med 2000;343:207–8.
34. Rex DK, Johnson DA, Lieberman DA, Burt RW, Sonnenberg A. Colorectal cancer prevention 2000: screening recommendations of the American College of Gastroenterology. Am J Gastroenterol 2000;95:868–77.
35. Lewis JD, Asch DA. Barriers to office-based screening sigmoidoscopy: does reimbursement cover costs? Ann Intern Med 1999;130:525–30.
36. Lewis JD, Asch DA, Ginsberg GG, et al. Primary care physicians' decisions to perform flexible sigmoidoscopy. J Gen Intern Med 1999; 14:297–302.
37. Krist AH, Jones RM, Woolf SH, et al. Timing of repeat colonoscopy: disparity between guidelines and endoscopists' recommendation. Am J Prev Med 2007;33:471–8.
38. Mysliwiec PA, Brown ML, Klabunde CN, Ransohoff DF. Are physicians doing too much colonoscopy? A national survey of colorectal surveillance after polypectomy. Ann Intern Med 2004;141:264–71.
39. Guerra CE, Schwartz JS, Armstrong K, et al. Barriers of and facilitators to physician recommendation of colorectal cancer screening. J Gen Intern Med 2007;22:1681–8.
40. Levy BT, Nordin T, Sinift S, Rosenbaum M, James PA. Why hasn't this patient been screened for colon cancer? An Iowa Research Network Study. J Am Board Fam Med 2007;20:458–68.
41. Wei EK, Ryan CT, Dietrich AJ, Colditz GA. Improving colorectal cancer screening by targeting office systems in primary care practices: disseminating research results into clinical practice. Arch Intern Med 2005;165:661–6.
42. Vogt T. Improving CRC screening requires innovative approaches: can electronic medical records help? Am J Prev Med 2008;35:317–8.
43. Schenck AP, Klabunde CN, Warren JL, et al. Data sources for measuring colorectal endoscopy use among Medicare enrollees. Cancer Epidemiol Biomarkers Prev 2007;16:2118–27.
44. Schenck AP, Klabunde CN, Warren JL, et al. Evaluation of self-report, claims, and medical records for measuring fecal occult blood testing among Medicare enrollees in fee-for-service. Cancer Epidemiol Biomarkers Prev 2008;17:799–804.
45. Vogelaar I, van Ballegooijen M, Schrag D, et al. How much can current interventions reduce colorectal cancer mortality in the U.S.? Mortality projections for risk-factor modification, screening, and treatment. Cancer 2006;107:1624–33.