

Current Capacity for Endoscopic Colorectal Cancer Screening in the United States: Data from the National Cancer Institute Survey of Colorectal Cancer Screening Practices

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PURPOSE: There is a national goal in the United States to increase the level of colorectal cancer screening, but there is currently little information on resources for the delivery of endoscopic screening and follow-up diagnostic and surveillance procedures. The purpose of this study was to provide nationally representative data on endoscopic resources at the provider level.

METHODS: A nationally representative survey of primary care physicians, general surgeons, and gastroenterologists that was conducted during 1999 to 2000 provided data from survey responses by 1235 primary care physicians, 349 gastroenterologists, and 316 general surgeons.

RESULTS: We estimated that 65% of all sigmoidoscopy procedures were performed by primary care physicians, 25% by gastroenterologists, and 10% by general surgeons. Only 30% of all

primary care physicians performed any procedures, and average volume among those who did was relatively low (seven per month). Gastroenterologists performed two thirds of all colonoscopy procedures, with most of the remainder performed by general surgeons.

CONCLUSION: There is potential to increase the capacity to perform screening sigmoidoscopy procedures through primary care delivery. However, without careful consideration of organizational factors, this could result in increased cost and quality control problems. Increasing the capacity for screening colonoscopy is feasible, but will require attention to other problems, such as avoiding overfrequent (e.g., annual or biennial) procedures in low-risk patients. *Am J Med.* 2003;115:129–133. ©2003 by Excerpta Medica Inc.

Increasing the number of older persons in the United States who undergo colorectal cancer screening is a stated goal of Healthy People 2010 (1), the key preventive health policy document of the U.S. Department of Health and Human Services. Clinical guidelines recommend several methods for colorectal cancer screening (2–4), all of which are covered under the Medicare program (5). Although there has been a gradual increase in colorectal cancer screening over the last decade, national rates of use are similar to the level of mammography achieved in the mid-1980s (6). There have been relatively few attempts to examine the availability of national resources for delivering endoscopic procedures associated with colorectal cancer screening and to determine how these resources would respond if population levels of colorectal cancer screening were to increase to the current level for mammography (7–9).

In this paper we report the results of the Survey of Colorectal Cancer Screening Practices, conducted during 1999 to 2000, including what types of physicians performed endoscopy procedures associated with colorectal

cancer screening and at what volume. We compare, at the national level, the current capacity for the delivery of these procedures with the capacity that would be required if the demand for colorectal cancer screening were to approximate current levels of screening mammography.

METHODS

Survey

We used data from the primary care and gastroenterology/general surgery components of the Survey of Colorectal Cancer Screening Practices, collected between November 1999 and April 2000. We focused on factors related to endoscopy procedures because double-contrast barium enema is used rarely for screening or diagnostic follow-up in current practice (10,11). The survey samples of 1630 primary care physicians, 467 gastroenterologists, and 467 general surgeons were obtained from the American Medical Association's Physician Masterfile.

Topics covered by the survey questionnaires included cancer screening beliefs and practices, attitudes toward and training in colorectal cancer screening, practices and procedures related to specific screening, diagnostic and surveillance modalities, and characteristics of the responding physician and practice. We used items from the primary care and gastroenterologist/general surgeon questionnaires that asked about the volume of sigmoidoscopy and colonoscopy procedures performed in a typ-

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Table 1. Characteristics of Respondents and Their Practice Settings, Survey of Colorectal Cancer Screening Practices, 1999–2000

Characteristic	Primary Care (n = 1235)	Gastroenterologists (n = 349)	General Surgeons (n = 316)
	Number (%)		
Male sex	960 (77.7)	324 (92.8)	294 (93.0)
White, non-Hispanic race	894 (72.4)	279 (79.8)	256 (81.1)
Board-certified	921 (74.6)	325 (93.1)	249 (78.8)
International medical graduate	277 (22.4)	72 (20.6)	74 (23.4)
Medical school affiliation	463 (37.5)	168 (48.1)	104 (32.9)
Age \geq 50 years	589 (47.7)	109 (31.2)	164 (51.9)
Metropolitan location of practice	751 (60.8)	252 (72.2)	181 (57.3)
Practice type			
Solo	316 (25.6)	78 (22.0)	126 (39.8)
Single-specialty group	508 (41.1)	168 (48.2)	106 (33.7)
Multispecialty setting	411 (33.3)	103 (29.5)	84 (27.0)
Practice volume (per week)			
>50 patients	548 (44.4)	102 (29.2)	40 (13.0)
>100 patients	441 (35.7)	39 (11.0)	10 (3.0)
>50% of patients covered by managed care	760 (61.5)	141 (40.5)	131 (41.6)

ical month during the survey period. Screening endoscopy was defined as the use of a procedure to detect cancer or neoplasia in an asymptomatic patient; diagnostic endoscopy was defined as use in patients with symptoms or previously abnormal test results. More details of the survey design, administration, and content are available at: <http://healthservices.cancer.gov/surveys/colorectal/>.

Statistical Analysis

We calculated means, proportions, and 95% confidence intervals based on weights that reflect the probability of selection into the sample, and adjusted for known sources of respondent bias. (Because of the high response rates, weighted and unweighted results were very similar.) In addition, we used MISCAN-COLON to obtain estimates of national endoscopy requirements implied by various programmatic approaches to colorectal cancer screening. MISCAN-COLON is a microsimulation model that takes into account national population estimates and assumptions about screening test performance characteristics and screening program policy parameters, including the frequency of screening, diagnostic, and surveillance procedures (12,13). We assumed that screening of average-risk persons would occur from ages 50 to 80 years; that 70% of the population would comply with the first screening; and that if someone attended a screening, he or she had a 90% probability of attending the next screening, whereas if someone did not attend a screening, he or she had a 20% probability of attending the next screening. We further assumed a test positivity rate of 2% for fecal occult blood testing; that after discovery of a polyp \leq 5 mm, a person was returned to routine screening; and that after discovery of a polyp $>$ 5 mm, a person received sur-

veillance colonoscopy once every 5 years until no lesions were found.

RESULTS

We obtained 1235 responses to the primary care survey, a response rate of 72%, and 665 to the specialty survey (349 gastroenterologists, 316 general surgeons), a response rate of 83%. Specialty physicians were more likely than primary care physicians to be male and to be white and had fewer patients covered by managed care contracts (Table 1). Gastroenterologists tended to be younger and board certified, to have a medical school affiliation, and to be located in a metropolitan area. General surgeons were more likely to be older and in solo practice. Primary care physicians saw more patients per week than did specialty physicians.

Estimated Procedure Volume for Sigmoidoscopy and Colonoscopy

Based on survey results, although only 30% of primary care physicians reported performing any sigmoidoscopy procedures, in the aggregate, they were still responsible for almost two thirds of all sigmoidoscopy procedures performed, compared with 25% among gastroenterologists and about 10% among general surgeons (Table 2). Both primary care physicians and general surgeons performed many fewer procedures than did gastroenterologists; for example, the average volume was seven per month among primary care physicians, compared with 14 procedures per month performed by gastroenterologists. Whereas more than 30% of gastroenterologists reported performing 20 or more procedures per month,

Table 2. Reported Volume of Endoscopy Procedures by Physician Specialty

	Physician Specialty		
	Primary Care (n = 1235)	Gastroenterology (n = 346)*	General Surgery (n = 251)*
Physicians in the United States	156,605	7835	15,181
	Number (%) or Mean \pm SD		
Sigmoidoscopy procedures per month	1.9 \pm 4.3	14.2 \pm 39.3	3.1 \pm 32.6
0	871 (71)	14 (4)	86 (34)
1–5	203 (17)	47 (14)	93 (37)
6–10	95 (7)	76 (22)	43 (17)
11–20	38 (3)	88 (25)	7 (3)
>20	17 (1)	107 (31)	4 (2)
Other	11 (1)	14 (4)	18 (7)
Estimated total procedures in the United States	3,205,000 (64.8)	1,224,000 (24.7)	518,000 (10.5)
Screening colonoscopy procedures per month	0.1 \pm 1.1	12.4 \pm 40.2	3.2 \pm 35.0
0	1182 (96)	19 (5)	110 (44)
1–5	30 (2)	71 (21)	74 (30)
6–10		83 (24)	39 (16)
11–20		74 (21)	11 (4)
>20		89 (26)	4 (2)
Other	23 (2)	10 (3)	13 (5)
Total procedures in the United States	9100 (0.6)	1,071,000 (66.3)	535,000 (33.1)
Diagnostic colonoscopy procedures per month		19.5 \pm 33.0	4.4 \pm 42.7
0		8 (2)	103 (41)
1–5		11 (3)	65 (26)
6–10		29 (8)	43 (17)
11–20		97 (28)	26 (10)
>20		193 (56)	6 (2)
Other		8 (2)	8 (3)
Total procedures in the United States		1,678,000 (69.6)	731,000 (30.4)

* Based on specialists who reported performing colorectal screening or diagnostic procedures.

this was true of less than 2% of primary care physicians. In addition, only 39% of primary care physicians who performed sigmoidoscopy reported performing a biopsy when they identified a polyp. Based on reported average procedure volume and the number of practicing physicians in the United States, we estimate that slightly more than 5 million sigmoidoscopy procedures were performed in 2000 by these three groups of physicians.

Only about 4% of primary care physicians reported performing any colonoscopy procedures, and they were responsible for less than 1% of screening colonoscopy procedures (Table 2). As with sigmoidoscopy, colonoscopy procedure volume was also low for general surgeons. On average, general surgeons performed about eight colonoscopy procedures per month, compared with about 32 procedures per month for gastroenterologists. For both specialties, the majority of procedures reported were for diagnostic rather than screening purposes (58% for general surgeons and 61% of gastroenterologists). We estimate that about 4 million colonoscopy procedures were performed in the United States in 2000, including about 1.6 million screening examinations. Although colonoscopy procedure volume was relatively low for

general surgeons, surgeons still accounted for one third of all procedures performed.

Although we did not have data on the specific reasons that colonoscopy procedures were performed, we did ask physicians about their practice regarding colonoscopic surveillance following initial discovery of a noncancerous polyp. The preponderance of surgeons and a minority of gastroenterologists recommended colonoscopic surveillance at frequencies of at least once every 3 years. We cannot determine whether these procedures were classified as diagnostic or screening when physicians responded to the question about procedure volume.

Current Capacity Compared with Projected National Requirements

We estimated national requirements for endoscopy associated with programs of colorectal cancer screening based on fecal occult blood testing, with or without sigmoidoscopy or colonoscopy, as the primary screening method under the counterfactual assumption that population usage levels of colorectal cancer screening were similar to current rates for screening mammography of 70% of eligible women. Under this assumption, screening based

on sigmoidoscopy once every 5 years would require the delivery of almost 10 million flexible sigmoidoscopy procedures in 2000, about twice the number of sigmoidoscopy procedures currently performed. Screening with colonoscopy performed once every 10 years would require, under very conservative assumptions, the delivery of 4.8 million screening and surveillance colonoscopy procedures in 2000.

DISCUSSION

We used nationally representative data about the activities of the main physician specialties that perform colorectal cancer screening procedures to generate estimates of the total number of endoscopic colorectal procedures performed in the United States. Although we did not validate these self-reported data against administrative or clinical records, our estimates are remarkably consistent with those generated from other sources. For example, Rex and Lieberman reported that about 4.4 million colonoscopy procedures were conducted in 1999 (9), almost identical to our estimate for 2000. Although some additional colorectal endoscopy procedures may be conducted by physician groups that we did not sample, we believe that this source of underestimation is small. Our survey instrument also did not ask primary care physicians about sigmoidoscopy procedures conducted for nonscreening purposes, assuming that patients would generally be referred to a specialist for such procedures. This may have resulted in a modest underestimate of total sigmoidoscopy volume for primary care physicians.

Our results indicate that the current capacity to perform sigmoidoscopy in the United States falls well short of what would be required to support a national screening policy based on sigmoidoscopy as the primary screening method. Primary care physicians perform the majority of sigmoidoscopy procedures, but the average volume of these procedures that they perform is low. As Lewis and Asch have shown (14), this low volume has adverse implications in terms of cost; it may also have adverse implications for quality. Most primary care physicians would have to perform at least 75 procedures per year to operate at a cost that was less than the Medicare reimbursement of \$88 in 1998. Less than 40% of the primary care physicians who reported performing any sigmoidoscopy procedures in our survey achieved this level of volume, and only a few percent operated above the volume of 20 procedures per month required for optimal efficiency in the primary care setting (14).

The cost of performing sigmoidoscopy with a biopsy almost doubles the cost in the primary care setting, and fewer than half of primary care practitioners who perform sigmoidoscopies also perform biopsies of polyps. However, increasing the volume of sigmoidoscopy pro-

cedures will not result in a financial benefit to primary care physicians if they operate under contractual arrangements with managed care organizations, such as fixed capitation payments, which do not take such economies into account. Of primary care physicians in our sample, 62% report that more than 50% of their patients were covered by managed care contracts, but we did not have any information on the specific reimbursement formulas specified by these contracts.

Given the high cost associated with low procedure volume, it would make sense for physicians who already practice sigmoidoscopy at low volume to increase their volume, resulting in a lower average cost per procedure. Another approach would involve increasing the number of dedicated endoscopy facilities, staffed by gastroenterologists, other physician endoscopists, and nonphysician endoscopists. The Colon Cancer Prevention Program at Northern California Kaiser (15), operating along these lines, achieves monthly sigmoidoscopy volumes ranging from 36 to 140 procedures per endoscopist and volumes of several hundred procedures per month per endoscopy suite (Joe V. Selby, MD, MPH, written communication, Northern California Kaiser Division of Research, Capacity and Resource Cost of Providing Screening Sigmoidoscopy Services in the Context of an Organized Screening Program. Final Report to the National Cancer Institute, March 2001). Channeling new demand to higher-volume providers would depend on the existence or establishment of appropriate referral mechanisms. In more open network systems, the efficiency of larger-scale sigmoidoscopy delivery needs to be weighed against the increased transaction costs associated with external referral and the increased inconvenience and time costs to the patient.

We estimated that a national program of colorectal cancer screening based on colonoscopy would have required about 4.8 million procedures in 2000, about 20% more than the estimated 4 million procedures that were performed for all purposes in 2000. Alternatively, a screening program operating at the same level of population use based on annual fecal occult blood testing would have required the delivery of 1.2 million diagnostic and surveillance colonoscopies; sigmoidoscopy once every 5 years would have required 1.6 million colonoscopy procedures; and a program of combined fecal occult blood testing and sigmoidoscopy would have required about 2.6 million procedures in 2000.

There are several ways, short of increasing the supply of gastroenterologists, to close the gap between the colonoscopy resources that would be required for a full-scale screening program and those available for this purpose. For example, a substantial proportion of gastroenterologists currently perform procedures at relatively low levels of volume; this is even more true among those general surgeons who perform colonoscopy. As suggested recently (9), improving efficiency in the delivery of proce-

dures by existing colonoscopists through investment in facilities and resources, along with reducing the performance of low-yield procedures, including overfrequent surveillance, would also increase the capacity for screening colonoscopy.

Several national efforts are underway to increase the level of colorectal cancer screening in the United States. Ensuring that there are sufficient endoscopy resources to accommodate increases in the demand presents several challenges. First, the composition of resources associated with various approaches to screening is different. For example, given current practice patterns, a different constellation of resources would be needed for a program based on screening colonoscopy instead of screening sigmoidoscopy. Continuing uncertainty about the preferred method of colorectal cancer screening makes long-term investment in these resources problematic. Second, our projections of capacity requirements assume an efficient use of screening resources in accordance with current guidelines, initiation of screening in average-risk persons beginning at age 50 years (16), and delivery of surveillance colonoscopy at a frequency of once every 5 years. Current practice patterns often deviate from these guidelines. Data from our surveys indicate that many physicians endorse initiating screening at ages less than 50 years (11), and conducting screening and surveillance procedures at higher frequencies than indicated by current guidelines. Indeed, about 20% of all screening endoscopy procedures are performed in people between the age of 40 and 49 years (17), and a recent analysis of Medicare data indicates that surveillance colonoscopy is often performed on an annual or biennial basis (18), contrary to current guidelines (19). If these practice patterns continue as overall demand for screening increases, capacity constraints will become even greater. Third, different strategies for accommodating increased screening demand may have different implications for cost as well as for monitoring quality (20). Each of these concerns would be mitigated by the establishment of dedicated and coordinated screening centers capable of accommodating alternative approaches to screening.

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