

# How Many Endoscopies Are Performed for Colorectal Cancer Screening? Results From CDC's Survey of Endoscopic Capacity

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See editorial on page 1841.

**Background & Aims:** Estimates of the current number of endoscopic colorectal cancer screening and follow-up examinations being performed are limited. A national study was therefore conducted among US physician practices. **Methods:** Approximately 1800 medical practices were surveyed from a list of all practices known to have purchased or leased lower endoscopic equipment between 1996 and 2000. Questions were asked regarding the current number of lower endoscopic procedures performed and the potential maximum number that could be performed. **Results:** In 2002, a total of 8207 practices reported performing flexible sigmoidoscopy or colonoscopy in the United States. Gastroenterologists performed 43.7% (95% confidence interval [CI], 37.2–50.2) of all sigmoidoscopies and 82.5% (95% CI, 80.3–84.7) of all colonoscopies. Primary care physicians performed 24.9% (95% CI, 20.3–29.5) of all sigmoidoscopies and 2.0% (95% CI, 1.4–2.6) of all colonoscopies. All physicians combined performed approximately 2.8 million (95% CI, 2.4–3.1) flexible sigmoidoscopies and 14.2 million (95% CI, 12.1–16.4) colonoscopies but reported that they could increase to approximately 9.5 million flexible sigmoidoscopies (95% CI, 8.4–10.5) and 22.4 million colonoscopies (95% CI, 20.1–24.8) in 1 year. **Conclusions:** Approximately 2.8 million flexible sigmoidoscopies and 14.2 million colonoscopies were estimated to have been performed in 2002. Physicians reported that they could perform an additional 6.7 million flexible sigmoidoscopies and 8.2 million colonoscopies in 1 year. These additional procedures could be used for the unscreened population and should be considered in the estimate of the national capacity to provide colorectal cancer screening to all eligible persons in the United States.

Although regular use of screening tests reduces incidence and mortality from colorectal cancer,<sup>1–7</sup> only approximately one half of the US population has been screened according to currently recommended guide-

lines.<sup>8–12</sup> Of the 4 recommended screening tests (fecal occult blood test, flexible sigmoidoscopy, colonoscopy, and double-contrast barium enema),<sup>10–12</sup> flexible sigmoidoscopy and colonoscopy play particularly important roles because they can both be used to detect and remove suspicious colorectal lesions and because all positive fecal occult blood tests, flexible sigmoidoscopies, and double-contrast barium enemas are typically followed by a diagnostic colonoscopy.

In planning for widespread colorectal cancer screening in the United States, several important resource questions must be answered. (1) What is the current capacity for endoscopic screening and follow-up examinations in the United States? (2) What is the size of the currently unscreened population in the United States? (3) Can sufficient screening and follow-up examinations be provided to the unscreened population with the current endoscopic capacity? By comparing capacity with test need, an assessment can be made of the current ability to provide endoscopic screening and follow-up examinations for all eligible persons in the United States.

The Centers for Disease Control and Prevention conducted the national Survey of Endoscopic Capacity (SECAP) to determine the current number of lower endoscopic procedures performed and the potential number that could be performed by US physician practices and facilities known to own or lease lower endoscopic equipment. The purpose of this survey was to provide an estimate of the current capacity for endoscopic screening and follow-up examinations in the United States.

*Abbreviations used in this paper:* AEC, ambulatory endoscopy/surgery center; CI, confidence interval; NCI, National Cancer Institute; SECAP, Survey of Endoscopic Capacity.

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## Materials and Methods

### Sampling Frame

The sampling frame included all US medical facilities known to have purchased or leased lower endoscopic (sigmoidoscopy and colonoscopy) equipment between January 1, 1996, and December 31, 2000. We obtained lists of these customers from the 4 leading US endoscopic equipment manufacturers: Fujinon Inc, Olympus America, Pentax Precision Instruments Inc, and Welch-Allyn. We also obtained a list of all single-specialty and multispecialty ambulatory endoscopy/surgery centers (AECs) in the United States from AmSurg Corp, a company that owns and manages AECs. These AECs are relatively few in number but are important sites for colorectal cancer screening, where high numbers of procedures are performed.<sup>13</sup> Data provided by the companies included the type of equipment purchased or leased, the date of purchase or lease, and the ship-to name, address, and phone number of the purchasers or lessees. Neither the specialty of the purchasing physician nor the type of medical facility (eg, private practice, hospital) was available in the sales data provided to the Centers for Disease Control and Prevention by the companies. The sales lists and AEC lists are protected by legal agreements as proprietary and sensitive business information.

The 4 manufacturer lists were merged and sorted by ZIP code, city, and purchaser name. Duplicate addresses were removed to create a sampling frame that represented a single record for each practice. The AEC list was sorted by ZIP code, city, and purchaser name and maintained in a separate file to allow for oversampling. Urban/rural practice locations were classified using a ZIP code version of the rural-urban commuting area coding scheme.<sup>14</sup> To yield a rural-urban dichotomy, rural-urban commuting area codes 1 (urban core census tract) through 3 (census tract weakly tied to urban core) were considered urban, and codes 4 (large town census tract) through 10 (isolated small rural census tract) were considered rural.

### Survey Design and Administration

A telephone screening questionnaire and a self-administered mail survey were developed for the study. Draft questionnaires, which were reviewed by external practicing endoscopists of all specialties and by recognized colorectal cancer screening experts, were pretested and approved by the Centers for Disease Control and Prevention Institutional Review Board for Protection of Human Subjects and the US Office of Management and Budget under the Paperwork Reduction Act.

The telephone screening questionnaire was administered to confirm study eligibility (ie, the practice still performs flexible sigmoidoscopy or colonoscopy to detect colorectal cancer in adults) and to identify the physician in charge of endoscopy. During questionnaire review by endoscopists and content experts, it was suggested that the physician in charge of endoscopy was the most appropriate person at the practice site best able to describe the volume of endoscopic procedures performed by the practice as a whole. Unlike other colorectal cancer surveys in which physicians were asked to estimate their

individual procedural volume,<sup>15</sup> we asked respondents to provide an estimate of the total number of lower endoscopic procedures performed by all endoscopists at the practice site as well as the number of endoscopists by specialty. An earlier study of mammography capacity likewise collected facility-level rather than individual physician-level data, and our unit of analysis was modeled on that study.<sup>16</sup> When the screening call was placed, respondents were asked to identify their facility as a private practice, AEC, or hospital. If a facility was identified as a hospital, the call was directed to the head nurse in the endoscopy suite of the gastroenterology department. He or she provided the caller with a complete list of where within that hospital endoscopies are performed (eg, gastroenterology department, internal medicine department, family practice department, surgery department, in an operating room, and so on), and one of those sites was then randomly selected to receive a screening call and a survey.

The self-administered questionnaire was then sent by Federal Express to the person identified by the practice with a personalized cover letter, a postage-paid return envelope, and a \$40.00 cash reimbursement for time spent answering the survey. Respondents were asked to provide responses that reflected procedures performed only at the practice site where the survey was received. The term "practice site" was defined as a single hospital department, division, or clinic; an endoscopy suite; a solo or group physician practice; or an AEC. Survey responses from hospitals were requested from the department, division, or clinic where the survey was received and not from the entire hospital. Similarly, survey responses from physician practices with multiple geographic locations were requested only from the single location at which the survey was received.

Surveys were sent continuously over a 6-month period (April to September 2002). Efforts to increase response rates included a thank-you/reminder postcard sent within 3 weeks of the initial mailing, a telephone call 3 weeks after mailing the postcard reminder, and 2 additional reminder calls 3 weeks apart.

### Response Rate

Surveys were mailed to 1809 practices, and 1346 (74.4%) completed surveys were returned. Of the returned surveys, 78 were ineligible; 1268 surveys were analyzed.

### Nonresponse Analysis

Several variables were analyzed for their potential association with nonresponse and eligibility. The response rate was higher among facilities identified from the manufacturers' list (72%) than among those selected from the AEC list (63%) and higher among rural facilities (79%) than urban facilities (68%). The number of endoscopes owned or leased by a practice did not affect the likelihood of response.

### Eligibility

The sampling frame contained several facilities that did not meet the study eligibility criteria (they currently do

not perform lower gastrointestinal endoscopic procedures in adults or an address or phone number could not be identified). Urban practices were more likely than rural practices to be ineligible. Practices identified from the manufacturers' list were more likely to be ineligible than those identified from the AEC list. Facilities that had purchased only one endoscope were more likely to be ineligible than facilities that had purchased more than one.

### Sample Selection and Weighting

The sampling frame for the study was obtained from 2 sources: the manufacturers' list and the AEC list. The lists could not be stratified by facility type, size, or physician specialty because this information was not available. Each list was stratified by US census region and by urban/rural location. A stratified random sample of facilities was selected from the 2 lists to ensure that all census regions and urban and rural locations were represented. Because AECs (which perform higher volumes of colonoscopy than practices obtained from the manufacturers' list) and rural practices were relatively few in number, they were oversampled.

Once data collection was completed, the eligibility rate for the sampled facilities was applied to each stratum to produce a total number of possible practices in each stratum. Sampling weights were computed by dividing the total number of practices in each stratum by the total number of completed surveys in those strata. The sampling weights adjusted for differences in the probability of being selected and response rates across cells. We then multiplied each survey response by the corresponding survey weight to obtain an estimate of the total number of facilities in the United States that perform flexible sigmoidoscopy and colonoscopy, the total number of procedures that are currently being performed, and the maximum number of procedures that could be performed given current resources. These estimates are generalizable to the population of all US health care practices that use lower gastrointestinal flexible endoscopic equipment for the detection of colorectal cancer in adults. The weighted national weekly estimates were then multiplied by the number of workweeks per year to obtain national annual estimates. We assumed a 46-week working year across all practice specialties and facility types to account for vacations, professional travel, and nonprocedural time.

### Analysis and Treatment of Missing Data

The survey data were analyzed and 95% confidence intervals (CIs) were calculated using Stata<sup>17</sup> to adjust for sampling design effects. For the estimation of endoscopic capacity, 2 survey questions were critical to the analysis: the number of procedures currently performed and the maximum number of procedures that could be performed. These data items were imputed when missing (40 surveys were missing current endoscopic volume data and 290 were missing potential endoscopic volume data) using a variation of the hot-deck method.<sup>18</sup> For surveys with missing current volume data, a current volume estimate was randomly selected from among

all surveys with known current volume estimates and used as a replacement for the missing current volume value. For surveys with missing potential maximum volume data, a ratio of current volume to potential volume was randomly selected from among all surveys with known current and potential volume estimates, multiplied by the current volume estimate, and used as a replacement for the missing potential volume value.

### Designation of Practice Specialty

Although survey respondents were asked to identify their practice as a private practice, an AEC, or a hospital, responses to these questions were inconsistent, making it difficult to classify facilities by facility type. Facility types frequently coexist as one practice, as when an ambulatory center is associated with a private practice or embedded within a hospital. For the purpose of analysis, we therefore classified facilities according to practice specialty based on the types of physicians that perform the majority of lower endoscopic procedures at the facility. If  $\geq 75\%$  of the procedures were performed by gastroenterologists, the facility was classified as a gastroenterology practice; if  $\geq 75\%$  of the procedures were performed by family practitioners, general practitioners, and/or internists, the facility was classified as a primary care practice; and if  $\geq 75\%$  of the procedures were performed by colorectal and/or general surgeons, the facility was classified as a surgical practice. If there was no dominant physician specialist or if the dominant physician specialist differed for flexible sigmoidoscopy and colonoscopy, the facility was classified as a mixed practice.

### Determination of Capacity

Survey respondents were asked to estimate the weekly number of flexible sigmoidoscopies performed by the practice ("During a typical week, how many flexible sigmoidoscopies are performed by all physician and non-physician endoscopists in this practice site?") and the weekly potential maximum number the practice could perform ("If the demand for colorectal cancer screening were to increase substantially, what is the maximum number of flexible sigmoidoscopies that could be provided at this practice site per week with no other investment of resources?"). The same questions were asked about colonoscopy volume. Available capacity was then determined by taking the difference between the current and the potential volume.

## Results

Survey respondents identified themselves as physicians (81.6%), nurses (5.7%), and "other" (12.7%), which included administrators. Responding physicians identified their practice specialties as gastroenterology (49.0%), internal medicine (21.5%), surgery (16.9%), and family or general practice (12.0%).

Surveys were classified by practice specialty according to the type of physicians performing the majority of

**Table 1.** Number and Specialty of US Practice Sites That Perform Flexible Sigmoidoscopy and Colonoscopy, by Region, 2002

Procedure	Total (95% CI)	Gastroenterology practices (95% CI)	Primary care practices (95% CI)	Surgical practices (95% CI)	Mixed practices (95% CI)
<b>Any lower endoscopy</b>					
Total	8207 <sup>a</sup>	3800 (3582–4017)	1644 (1456–1832)	988 (838–1138)	1775 (1585–1965)
Northeast	1611 (1604–1618)	970 (874–1066)	195 (128–262)	154 (95–213)	292 (215–369)
South	2890 (2878–2901)	1417 (1287–1547)	542 (435–649)	429 (332–526)	502 (398–606)
Midwest	2082 (2074–2090)	678 (574–782)	463 (363–563)	257 (180–334)	684 (574–794)
West	1624 (1615–1634)	734 (633–835)	444 (345–543)	149 (87–211)	297 (211–383)
<b>Flexible sigmoidoscopy<sup>b</sup></b>					
Total	6732 (6557–6907)	2851 (2644–3058)	1583 (1397–1769)	708 (577–839)	1590 (1408–1772)
Northeast	1363 (1292–1434)	756 (658–854)	195 (128–262)	147 (89–205)	265 (190–340)
South	2292 (2184–2400)	1046 (922–1170)	513 (409–617)	329 (242–416)	404 (309–499)
Midwest	1752 (1667–1837)	508 (414–602)	456 (357–555)	141 (82–200)	647 (539–755)
West	1325 (1243–1407)	541 (445–637)	420 (323–517)	91 (40–142)	273 (190–356)
<b>Colonoscopy<sup>b</sup></b>					
Total	6214 (6016–6412)	3373 (3158–3588)	300 (211–389)	822 (684–960)	1719 (1532–1906)
Northeast	1217 (1130–1304)	825 (727–923)	13 (0–32)	94 (47–235)	285 (209–361)
South	2230 (2118–2342)	1266 (1138–1394)	128 (71–185)	360 (270–450)	475 (373–577)
Midwest	1602 (1505–1699)	596 (495–697)	109 (56–162)	228 (156–300)	669 (561–777)
West	1165 (1065–1265)	686 (586–786)	49 (12–86)	140 (80–200)	289 (204–374)

<sup>a</sup>Total number of practice sites that perform flexible sigmoidoscopy and colonoscopy.

<sup>b</sup>Not mutually exclusive categories.

endoscopic procedures (gastroenterology, primary care, surgery, or mixed). For mixed practices that perform flexible sigmoidoscopy, 43% of the physicians performing the procedure were primary care physicians, 21% were gastroenterologists, 16% were nonphysician endoscopists, and 10% were surgeons. For mixed practices that perform colonoscopy, 68% of the physicians performing the procedure were gastroenterologists, 20% were surgeons, and 5% were primary care physicians.

Numbers of procedures reported reflected endoscopies performed by all of the providers at a given practice site. A total of 8207 practice sites across the country performed flexible sigmoidoscopy or colonoscopy for colorectal cancer screening and follow-up (Table 1). Of these, 6732 (82%) performed flexible sigmoidoscopy and 6214 (76%) performed colonoscopy. A total of 3800 gastroenterology practices accounted for 46% of the practices performing any endoscopy, followed by mixed practices (1775 or 22%), primary care practices (1644 or 20%), and surgical practices (988 or 12%). More gastroenterology practices performed colonoscopy than flexible sigmoidoscopy, while more primary care practices performed flexible sigmoidoscopy than colonoscopy. Similar numbers of surgical practices performed each procedure. In the Northeast and South, many more gastroenterology than primary care practices performed flexible sigmoidoscopy; in the Midwest and West, similar numbers of gastroenterology and primary care practices performed the procedure. More gastroenterology practices performed colonoscopy than any other practice type in all regions except the Midwest, where more mixed practices

performed colonoscopy. Only 300 of the 6214 total practices (5%) performing colonoscopy were primary care practices.

Survey respondents were asked to estimate the percentage of all lower endoscopies performed at their practice site by provider specialty (Table 2). Of all flexible sigmoidoscopies performed, the greatest percentage (~44%) was by gastroenterologists, followed by primary care physicians, surgeons, and nonphysician endoscopists. Of all colonoscopies performed, most (~83%) were

**Table 2.** Percentage of All Flexible Sigmoidoscopies and Colonoscopies Performed by Physician Specialty, 2002

Physician specialty	Flexible sigmoidoscopy, % (95% CI)	Colonoscopy, % (95% CI)
Gastroenterologist	43.7 (37.2–50.2)	82.5 (80.3–84.7)
Primary care physician	24.9 (20.3–29.5)	2.0 (1.4–2.6)
General practitioner	1.8 (1.0–2.6)	0.2 (0.1–0.3)
Internist	13.3 (10.0–16.6)	1.0 (0.6–1.4)
Family practitioner	9.8 (7.4–12.2)	0.8 (0.5–1.1)
Surgeon	20.5 (14.2–26.8)	10.8 (9.2–12.4)
General surgeon	5.1 (3.9–6.3)	7.2 (6.2–8.2)
Colorectal surgeon	15.4 (8.9–21.9)	3.5 (2.5–4.5)
Resident with supervising physician in attendance	1.4 (0.2–2.6)	0.2 (0.1–0.3)
Fellow with supervising physician in attendance	2.5 (1.3–3.7)	4.3 (2.1–6.7)
Nonphysician endoscopist	6.1 (2.1–10.1)	0.0 (0–0.1)
Other	0.7 (0–1.9)	0.1 (0–0.2)

**Table 3.** Number of Flexible Sigmoidoscopies and Colonoscopies Performed by Week by Practices That Own or Lease Lower Endoscopic Equipment, per Practice, by Practice Specialty, 2002

Procedure	Gastroenterology practices (95% CI)	Primary care practices (95% CI)	Surgical practices (95% CI)	Mixed practices (95% CI)
<b>Flexible sigmoidoscopy</b>				
Percentage of practices that perform	76.0 (72.5–79.5)	96.3 (93.8–98.8)	72.7 (65.2–80.2)	89.6 (85.8–93.4)
Current number (mean) <sup>a</sup>	9.0 (7.0–11.0)	5.0 (4.1–5.9)	14.4 (8.9–19.9)	10.1 (7.8–12.4)
Performed for screening (%) <sup>a</sup>	38.0 (34.5–41.5)	78.6 (75.1–82.1)	43.9 (36.4–51.4)	61.9 (57.3–66.5)
Potential maximum number (mean) <sup>a</sup>	37.7 (31.0–44.4)	14.3 (12.6–16)	34.6 (26.2–43)	11.0 (9.0–13.0)
<b>Colonoscopy</b>				
Percentage of practices that perform	88.8 (86.2–91.4)	18.6 (13.6–23.6)	83.2 (77.1–89.3)	97.6 (95.7–99.5)
Current number (mean) <sup>a</sup>	65.5 (52.8–78.2)	8.3 (6.5–10.1)	15.8 (13.1–18.5)	42.6 (36.4–48.8)
Performed for screening (%) <sup>a</sup>	45.6 (43.5–47.7)	52.3 (44.6–60)	48.3 (42.5–54.1)	46.9 (43.7–50.1)
Potential maximum number (mean) <sup>a</sup>	100.0 (86.3–113.7)	19.7 (15.7–23.7)	32.9 (26.9–38.9)	68.6 (59.5–77.7)

<sup>a</sup>Among those practices that own endoscopic equipment and perform the procedure.

by gastroenterologists, followed by surgeons. Only about 2% were performed by primary care physicians and <1% by nonphysician endoscopists.

Respondents estimated the current weekly number of flexible sigmoidoscopies and colonoscopies performed by their practice, the percentage of the current volume performed for colorectal cancer screening, and the potential maximum weekly number that could be performed with current resources (Table 3). The mean numbers of procedures presented here only represent practices that own or lease lower endoscopic equipment and perform lower endoscopy. Gastroenterology practices performed a mean of 9.0 (95% CI, 7.0–11.0) flexible sigmoidoscopies per week, 38% for screening, but estimated that they could quadruple that number with their current resources. They performed a mean of 65.5 (95% CI, 52.8–78.2) colonoscopies per week, 45.6% for screening, but estimated that they could increase this volume by approximately 50%. Primary care practices performed fewer flexible sigmoidoscopies per week than gastroenterology practices but more for screening. Primary care practices estimated that they could almost triple their current flexible sigmoidoscopy volume and more than double their current colonoscopy volume. Surgery practices performed 15.8 (95% CI, 13.1–18.5) colonoscopies per week, one half for screening, and estimated that they could double their current volume with their current resources. Across all practice specialties, 53.8% (95% CI, 51.4–56.2) of flexible sigmoidoscopies and 46.7% (95% CI, 45–48.4) of colonoscopies were performed for screening.

Survey responses were weighted to determine national estimates for current and potential capacity to provide endoscopy in this country, assuming that the sampling frame represented all practice sites across the United States that own or lease and perform endoscopy. In 2002, approximately 2.8 (95% CI, 2.4–3.1) million flexible

sigmoidoscopies and 14.2 (95% CI, 12.1–16.4) million colonoscopies were performed (Table 4). Survey respondents reported that they could increase their flexible sigmoidoscopy volume to 9.5 (95% CI, 8.4–10.5) million procedures annually, an increase of 29%, and could increase their colonoscopy volume to 22.4 (95% CI, 20.1–24.8) million annually, an increase of 63%.

In a separate survey question, respondents were asked what changes their practice would consider making to accommodate an increased demand for procedures (Table 5). For all specialties combined and for both endoscopic procedures, the most common response was that physicians would increase the proportion of their workday allocated to procedures. Gastroenterology practices were next most likely to purchase more equipment, hire more nurses to assist with procedures, or establish larger screening units. Primary care physicians were more likely

**Table 4.** Current Volume, Potential Volume, and Available Capacity for Annual<sup>a</sup> Flexible Sigmoidoscopies and Colonoscopies by Region (in Millions), 2002

	Current volume (95% CI)	Potential volume (95% CI)	Available capacity <sup>b</sup>
<b>Flexible sigmoidoscopy</b>			
All regions	2.8 (2.4–3.1)	9.5 (8.4–10.5)	6.7
Northeast	0.7 (0.6–0.9)	2.5 (1.7–3.2)	1.8
Midwest	0.7 (0.6–0.9)	2.2 (1.8–2.7)	1.5
South	0.8 (0.6–0.9)	3.2 (2.8–3.6)	2.4
West	0.6 (0.4–0.7)	1.6 (1.3–1.9)	1.0
<b>Colonoscopy</b>			
All regions	14.2 (12.1–16.4)	22.4 (20.1–24.8)	8.2
Northeast	4.2 (2.2–6.1)	5.9 (3.9–7.8)	1.7
Midwest	3.1 (2.6–3.7)	5.1 (4.4–5.9)	2.0
South	4.8 (4.3–5.4)	8.0 (7.1–8.9)	3.2
West	2.1 (1.8–2.5)	3.5 (2.9–4.0)	1.4

<sup>a</sup>Assuming 46 workweeks per year.

<sup>b</sup>Difference between current and potential volume.

**Table 5.** Measures to Address Increased Demand for Flexible Sigmoidoscopy and Colonoscopy Among Practices That Perform the Procedures, by Practice Specialty

	All specialties, % (95% CI)		Gastroenterology practices, % (95% CI)		Primary care practices, % (95% CI)		Surgical practices, % (95% CI)		Mixed practices, % (95% CI)	
	FS	Col	FS	Col	FS	Col	FS	Col	FS	Col
Increase proportion of workday allocated to procedures	67.6 (64.6–70.6)	78.0 (75.3–80.7)	65.3 (60.4–70.2)	77.2 (73.4–81.0)	70.5 (64.3–76.7)	84.9 (73.7–96.1)	71.3 (62.2–80.4)	72.0 (63.7–80.3)	66.8 (61.0–72.62)	81.0 (76.3–85.7)
Purchase more equipment	61.9 (58.8–65)	74.6 (71.7–77.5)	60.8 (55.8–65.8)	73.6 (69.6–77.6)	46.9 (40.1–53.7)	54.3 (38.5–70.1)	77.4 (69–77.8)	71.3 (63.0–79.6)	70.5 (64.8–76.2)	80.6 (75.8–85.4)
Increase nursing staff to assist with procedures	53.2 (50–56.4)	76.0 (73.2–78.8)	57.6 (52.6–62.6)	76.5 (72.6–80.4)	34.8 (28.3–41.3)	66.2 (51.1–81.3)	56.1 (46.1–66.1)	63.0 (54.1–71.9)	61.9 (55.8–68.0)	82.2 (77.6–86.8)
Establish larger screening unit/more procedure rooms	39.9 (36.7–43.1)	63.9 (60.7–67.1)	44.9 (39.8–50.0)	65.1 (60.8–69.4)	20.9 (15.3–26.5)	41.6 (25.9–57.3)	37.2 (27.5–46.9)	59.2 (50.1–68.3)	50.6 (44.3–56.9)	67.1 (61.4–72.8)
Increase physician staff	30.0 (27.0–33.0)	55.8 (52.6–59.0)	38.0 (33.1–42.9)	62.1 (57.7–66.5)	17.5 (12.4–22.6)	28.5 (14.1–42.9)	32.3 (22.9–41.7)	46.4 (37.1–55.7)	28.6 (22.9–34.3)	53.4 (47.4–59.0)
Refer patient to other practices	24.4 (21.6–27.2)	14.3 (12–16.6)	10.1 (7–13.2)	10.1 (7.4–12.8)	55.9 (49.1–62.7)	41.9 (26.2–57.6)	20.2 (12.1–28.3)	15.5 (8.8–22.2)	18.6 (13.7–23.5)	16.8 (12.3–21.3)
Increase/hire nonphysician endoscopists to do procedures	15.7 (13.4–18.0)	5.3 (3.8–6.8)	20.2 (16.1–24.3)	5.0 (3.0–7.0)	10.6 (6.4–14.8)	8.0 (0–16.6)	7.3 (2.1–12.5)	5.3 (1.2–9.4)	16.9 (12.2–21.6)	5.3 (2.6–8.0)

Col, colonoscopy; FS, flexible sigmoidoscopy.

than other specialists to refer patients to other practices for procedures. Gastroenterology and mixed practices would be more likely than primary care and surgical practices to hire nonphysician endoscopists to perform flexible sigmoidoscopy.

## Discussion

This report presents new information on the number of practices in the United States performing flexible sigmoidoscopy and colonoscopy, the physician specialists performing the procedures, and the current and potential volume of lower endoscopic procedures nationally and regionally.

Of all specialists who responded to our survey, gastroenterologists performed most of the flexible sigmoidoscopies and colonoscopies, although primary care physicians and surgeons performed a substantial proportion of the flexible sigmoidoscopies. Few primary care physicians performed colonoscopy, and few nonphysician endoscopists performed flexible sigmoidoscopies or colonoscopies.

Approximately 2.8 million flexible sigmoidoscopies and 14.2 million colonoscopies were estimated to have been performed in 2002, approximately one half of them for screening. This estimate represents 29%–63% of the volume of lower endoscopic procedures that respondents reported could be done with their current resources. Although we describe a greater available capacity for sigmoidoscopy than colonoscopy, this may not translate into more sigmoidoscopies being performed than

colonoscopies, because other issues including reimbursement and physician and patient preferences will also influence the choice of endoscopic procedure.

Our data show an available capacity for both sigmoidoscopy and colonoscopy that could be used for colorectal screening for the unscreened population. This available capacity estimate relies on the strength of both the current and potential volume estimates; while an important strength of these data is that they are nationally representative, they were collected by survey and are therefore subject to the biases associated with self-reported data. These data have not been externally validated, but our findings are consistent with other known data sources. Our estimates of colonoscopies performed per week by gastroenterologists reported in the SECAP are similar to numbers of colonoscopies performed per week among gastroenterologists included in the Clinical Outcomes Research Initiative, a sample registry of endoscopic procedures performed by gastroenterology practices across the United States (personal communication, David Lieberman, February 2004). Our estimates are also consistent with Medicare claims filed for colonoscopies in 2002 (personal communication, Carrie Klabunde/Martin Brown). In 2002, approximately 5 million Medicare claims were filed for colonoscopies performed in patients aged older than 64 years (personal communication, Carrie Klabunde/Martin Brown, February 2004), and data from the Clinical Outcomes Research Initiative suggest that one third of colonoscopies are being performed in this age group. This is consistent with the SECAP-

estimated 14.2 million colonoscopies in 2002, which reflect examinations performed in patients aged 50 years and older and may include examinations performed in younger patients.

There is no method to validate the potential number of examinations that respondents reported they could do because we were asking respondents to speculate. However, our survey respondents were primarily physicians in charge of endoscopy and were identified by their practices as being best able to describe endoscopy at their practice. The survey was designed to capture the potential maximum volume that practices could perform with currently available resources, but we cannot be certain that responses were provided with this in mind. We do not know whether practices would be able to increase their volume of both sigmoidoscopy and colonoscopy or if an increase in one procedure would preclude an increase in the other. Increases are likely to be mutually exclusive, although this would only impact our capacity estimates for programs that used both screening sigmoidoscopy and screening colonoscopy. Even if the available capacity estimate reported here were accurate, it may not be practical to assume that it could be used entirely for colorectal cancer screening. This might require a shift in resources that would force clinicians to abandon other clinical duties.

Our results for current endoscopic volume differ from those in a recently published study of endoscopic capacity from the National Cancer Institute (NCI).<sup>15</sup> The NCI capacity study, which was part of a larger effort to assess physician attitudes and practices toward colorectal screening, found that in 1999/2000, approximately 5 million sigmoidoscopies and 4 million colonoscopies were performed annually. Fundamental differences between the design of the NCI study and ours make it difficult to truly compare our results. The NCI study obtained results at the individual physician level, not at the practice level, used a smaller sample size of persons who perform endoscopy, and did not include colorectal surgeons in their sample. Additionally, the NCI capacity assessment provided broad ranges of endoscopy volume from which respondents selected; this may have limited the ability to estimate endoscopy volume for those physicians performing high numbers of procedures. Another important difference between the 2 studies is the timing of survey administration. The NCI survey was administered 3 years before the SECAP. Colorectal cancer screening is undergoing rapid change, and our data may reflect a true practice shift away from sigmoidoscopy and toward more colonoscopies.<sup>19,20</sup>

Our sampling frame included practices that purchased or leased equipment between 1996 and 2000; practices

that used equipment purchased before 1996 or between 2000 and 2002 are not included in the frame. Because larger practices are likely to update their equipment regularly and it is most likely smaller practices performing low numbers of procedures that would have only purchased equipment before 1996, we believe that these SECAP results may only slightly underestimate the true volume of procedures performed in 2002.

If physicians were to make practice changes to accommodate an increase in endoscopic demand, they reported that they would be most likely to increase the proportion of their workday allocated to procedures. The feasibility of these proposed measures to increase endoscopic volume has not been examined, although several of these measures have been suggested as potential means by which endoscopic capacity could be increased.<sup>21</sup>

Safety, quality, and cost of these endoscopic procedures were not addressed in the SECAP; these issues will need to be factored into any discussion of capacity and would need to be considered in the planning for widespread colorectal cancer screening. Additionally, these reported estimates are time sensitive and therefore will need to be recalculated periodically.

Several state health departments and metropolitan areas are beginning to plan and implement organized colorectal cancer screening. The Centers for Disease Control and Prevention is currently assisting 15 states in making state- and substate-level capacity estimates to be used for state-level planning.<sup>22</sup> It is possible that the state and local assessments may produce capacity estimates different from the national capacity assessment.

Our results provide critical information needed for the determination of the capacity to screen the entire eligible US population for colorectal cancer: the current numbers of lower endoscopies being performed and the potential numbers of procedures physicians report they could do. To fully describe the capacity for widespread screening, these results are compared with current estimates of unmet need, assuming different proportions of the available capacity are used for colorectal cancer screening, reported in an associated paper.<sup>23</sup> The results of these 2 studies should together provide a foundation on which planning for national colorectal cancer screening can occur.

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