

Screening for Colorectal Cancer with Flexible Sigmoidoscopy by Nonphysician Endoscopists

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PURPOSE: Screening with sigmoidoscopy reduces the risk of death from colorectal cancer. Only 30% of eligible patients have undergone sigmoidoscopy, in part because of a limited supply of endoscopists. We evaluated the performance and safety of screening sigmoidoscopic examinations by trained nonphysician endoscopists in comparison with board-certified gastroenterologists.

SUBJECTS AND METHODS: Asymptomatic patients 50 years or older without evidence of fecal occult blood and no personal history or family history of a first-degree relative with colorectal cancer under age 55 years were offered sigmoidoscopy. All examinations were performed either by a gastroenterologist or a trained nonphysician endoscopist at a staff model health maintenance organization. Outcomes included the depth of examination, number and histology of polyps, and complications.

RESULTS: Nonphysicians performed 2,323 sigmoidoscopic examinations, and physicians performed 1,378 examinations.

The mean (\pm SD) depth of sigmoidoscopy examinations performed by nonphysicians was 52 ± 10 cm compared with 55 ± 9 cm ($P < 0.001$) in physicians. Nonphysicians detected neoplastic polyps in a greater proportion of patients (7.8%) than physicians (5.8%), but this difference was not significant after adjusting for differences in the age, sex, and family history of the patients ($P = 0.35$). No major complications occurred. The cost per examination, including the nonphysician training cost, was lower for nonphysicians (\$186 per examination) than for physicians (\$283 per examination).

CONCLUSIONS: Appropriately trained nonphysicians may be capable of performing safe and effective screening for colorectal cancer with flexible sigmoidoscopy. An increased use of nonphysicians to perform sigmoidoscopy may increase the availability and reduce the cost of the procedure. *Am J Med.* 1999;107:214–218. ©1999 by Excerpta Medica, Inc.

Several studies have demonstrated that screening reduces mortality from colorectal cancer (1–4). One recommended method of screening average-risk patients for colorectal cancer involves the use of flexible sigmoidoscopy to detect neoplastic (adenomatous or cancerous) polyps. Several organizations, including the US Preventive Services Task Force and the American Cancer Society, have recommended that asymptomatic patients 50 years of age and older be screened for colorectal cancer using fecal occult blood testing and flexible sigmoidoscopy. This method has become the standard of practice in many centers in the United States (5–7).

Despite its effectiveness, less than 10% of the US population had been screened for colorectal cancer with flexible sigmoidoscopy in the early 1990s (8), although a more recent study suggests this may have increased to approximately 30% (9). The reasons may include an inadequate supply of trained endoscopists, patient fear or embarrassment, and insufficient public awareness. The demand for screening is likely to increase as a result of the

approval of Medicare reimbursement for colorectal cancer screening, including sigmoidoscopy, increased attention being focused on the issue by national health organizations, and the advancing age of the “baby boom” cohort.

Several studies have suggested that adequately trained nonphysician endoscopists can perform screening sigmoidoscopy competently (10–15). We describe the ability of nonphysicians to perform screening sigmoidoscopy, as measured by the depth of examination, rate of polyp detection, and rate of complications, in a large cohort of patients.

MATERIAL AND METHODS

The study was conducted at the outpatient colorectal cancer screening program of Harvard Vanguard Medical Associates, a staff model health maintenance organization covering approximately 300,000 lives. All data were collected prospectively on a standardized form. Patients referred by their primary care provider for screening flexible sigmoidoscopy were contacted by phone and asked about demographic characteristics and risk factors for colorectal cancer, including personal or family history of colorectal cancer or polyps, aspirin and multivitamin use, and rectal bleeding. If a fecal occult blood test had not been performed, test cards were mailed. Patients were eligible for screening sigmoidoscopy if they were 50 years of age or older, had

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Manuscript submitted January 19, 1999, and accepted in revised form May 17, 1999.

no new lower gastrointestinal symptoms, had no acute cardiopulmonary disease, had negative fecal occult blood tests, and had no first-degree relative with colorectal cancer at 55 years of age or younger. A nurse-coordinator assigned all eligible patients to an endoscopist (physician or nonphysician) according to daily staffing assignments and patient time preference. Preferences for a physician or nonphysician were not solicited from the patients.

Patients were instructed to take two phosphate soda enemas on the day of the examination, which was performed in an outpatient endoscopy center. At least one room was staffed by a gastroenterologist and the other room by a nonphysician trained to perform sigmoidoscopy. During the examination, physician endoscopists were available within the unit to assist nonphysicians if an examination was incomplete. Physicians were also present whenever a biopsy or excision of a polyp was performed by the nonphysician.

Three nonphysicians (one nurse practitioner and two physician assistants) were trained to perform flexible sigmoidoscopy. First, they practiced withdrawal of the endoscope after physician insertion. They then performed a minimum of 100 examinations under the direct supervision of a physician until both the physician and nonphysician determined that they could perform examinations independently. The data recorded includes only those examinations performed after the training period.

A total of 15 physicians performed sigmoidoscopy during the study period. All physicians completed 2- or 3-year fellowships and were board certified in gastroenterology. Each physician had previously performed at least 1,000 lower endoscopic examinations at a rate of at least 300 such examinations per year. The physicians had been in practice for a median of 14 years (range, 4 to 25 years).

Physicians and nonphysicians were each allotted 30 minutes per examination. During sigmoidoscopy, the location, size, and character (sessile vs pedunculated) of all polyps were recorded. Polyp size was measured by placing an open biopsy forceps of known size immediately adjacent to the polyp. All polyps 10 mm in size or less were biopsied. Larger polyps were either biopsied or the patient was referred directly for colonoscopy. All patients with adenomatous polyps detected by sigmoidoscopic screening were offered colonoscopy. The histologic type (hyperplastic, adenoma, or carcinoma) of each polyp was recorded. Depth of examination (in centimeters) was recorded based on the standardized markings on the shaft of the sigmoidoscope when it was thought to be in a straight position. Limitations to the examination (as a result of angulation, pain, poor preparation), other mucosal findings (diverticulosis, colitis, arteriovenous malformations), and any major (perforation or bleeding requiring transfusion) or mi-

Table 1. Characteristics of Patients Undergoing Sigmoidoscopy by Gastroenterologists and Nonphysician Endoscopists

	Number (percent) or Mean ± SD		P Value
	Physicians (n = 1,378)	Nonphysicians (n = 2,323)	
Age (years)	57 (13)	60 (10)	<0.001
Male sex	730 (53)	1,140 (49)	0.02
Previous flexible sigmoidoscopy	199 (14)	377 (16)	0.16
Minor family history of colorectal cancer*	128 (10)	150 (7)	0.001
Family history of polyps	107 (8)	141 (6)	0.05

* A minor family history includes a first-degree relative with colorectal cancer after age 55 years, or a second-degree relative with colorectal cancer.

nor (transient hypotension or bleeding) complications were also noted.

Direct and indirect costs for sigmoidoscopic examinations were estimated by the Harvard Vanguard Medical Associates central medical specialties accounting office. These included salary and benefits for the endoscopists, pathology costs, support staff, equipment, and supplies (Appendix). Statistical analysis was performed using SAS software version 6.12 (SAS Inc, Cary, North Carolina). Categorical variables were compared using the chi-square test and continuous variables using Student's *t* test. Because the depth of examination was not normally distributed, it was also evaluated after logarithmic transformation. A multivariate linear model was used to evaluate the association of clinician type (physician vs nonphysician) with depth of examination and the logarithm of the depth. A logistic regression model was used to evaluate categorical outcomes, including examination depth of greater than 40 cm or 50 cm, detection of polyps, and occurrence of complications. Continuous predictors, such as age, were modeled with both linear and quadratic functions. All reported *P* values and odds ratios reflect the multivariate model predictions after adjusting for confounders. Statistical significance was set at *P* < 0.05 (two sided). Continuous values are reported as means ± SD.

RESULTS

Screening flexible sigmoidoscopy was performed on 3,701 patients between 1995 and 1997. Of these, 1,378 examinations were performed by 1 of 15 gastroenterologists, and 2,323 by the 3 nonphysicians (n = 726, 791, and 806 for each endoscopist). The baseline demographic characteristics of the patients are shown in Table 1. Compared with the patients examined by non-

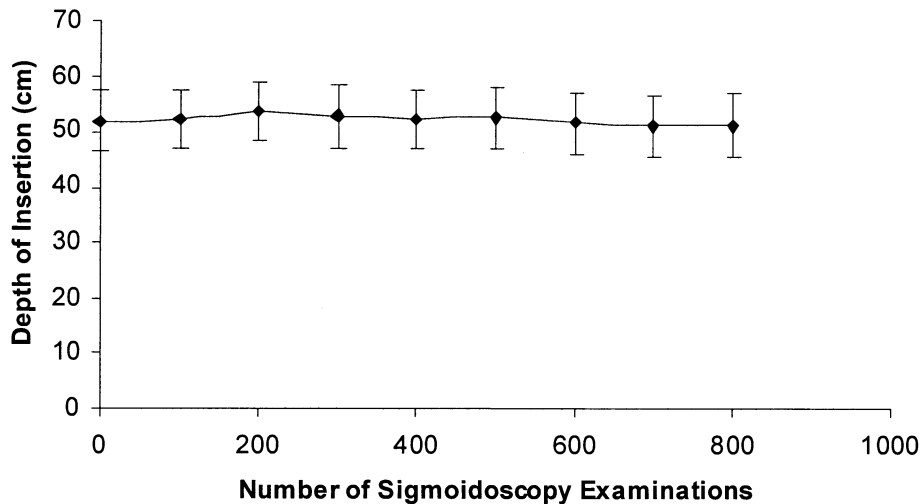


Figure. Depth of examination by the cumulative number of examinations performed by nonphysician endoscopists. **Error bars** indicate standard deviation.

physicians, those examined by physicians were younger, more likely to be male, and more likely to have a minor family history of colorectal cancer (a first-degree relative older than 55 years of age or a second-degree relative) or a family history of polyps.

After the initial 100 examinations, the 3 nonphysicians (1 nurse practitioner and 2 physician assistants) achieved a mean depth of examination of 52 ± 10 cm, which did not change during the 2 years of study (Figure). The length of the colon examined when a physician performed the sigmoidoscopy was 55 ± 9 cm. This 3-cm difference remained statistically significant ($P < 0.001$) after adjusting for differences in the age, sex, and family history of the patients. The mean depths of examination for the 3 nonphysicians were 53 ± 9 cm, 49 ± 11 cm, and 55 ± 9 cm. Physicians achieved a depth of at least 40 cm in 94% of examinations, compared with 92% of examinations by nonphysicians ($P = 0.07$). Physicians achieved a depth of at least 50 cm in 84% of examinations, compared with 73% of nonphysician examinations ($P < 0.001$). Physicians were no more likely to achieve a depth greater than 40 cm than nonphysicians after adjusting for baseline differences, including the age and sex of the patients (Table 2).

Table 2. Independent Predictors of Having a Sigmoidoscopic Examination Depth Greater Than 40 cm

Variable	Odds Ratio	95% Confidence Interval	P Value
Nonphysician examination	0.73	0.56–1.02	0.07
Age >65 years	0.73	0.55–0.98	0.04
Female sex	0.58	0.44–0.76	<0.001

There were no differences in the rates of detection of polyps by physicians and nonphysicians. Polyps were detected in 321 (23%) of the examinations by physicians and in 619 (27%) of the examinations by nonphysicians ($P = 0.34$). Neoplastic polyps were detected in 80 (6%) of the examinations by physicians and in 180 (8%) of the examinations by nonphysicians ($P = 0.35$). Women were less likely to have a neoplastic polyp detected than were men (Table 3).

During the study period, no malpractice claims or disciplinary actions were initiated against the nonphysicians or physicians, and no major complications, including death, perforation, or bleeding requiring blood transfu-

Table 3. Independent Predictors of Detecting a Neoplastic Polyp During Screening Sigmoidoscopy

Variable	Odds Ratio	95% Confidence Interval	P Value
Nonphysician examination	1.16	0.85–1.59	0.35
Age >65 years	1.17	0.85–1.62	0.33
Multivitamin use	0.93	0.69–1.25	0.62
Female sex	0.69	0.51–0.93	0.01
Aspirin use*	1.04	0.93–1.17	0.51
Minor family history of colorectal cancer [†]	0.99	0.53–1.83	0.96
Family history of polyps	0.83	0.42–1.61	0.57
Depth of examination (per 10 cm)	1.00	0.87–1.15	0.99

* Aspirin use was categorized as 0–5, 6–10, 11–15, or >15 tablets per month; the odds ratio is per one unit increase in these categories.

[†] See Table 1 for definition of family history.

sion occurred. Physicians were asked to assist the nonphysicians in less than 5% of examinations and did not substantially advance the depth of examination beyond that of the nonphysicians.

The total cost per examination, including salary, benefits, malpractice insurance, pathology, equipment, and office overhead, was \$283 per examination for physicians and \$186 per examination for nonphysicians.

DISCUSSION

In comparison with gastroenterologists, trained nonphysician endoscopists perform screening flexible sigmoidoscopy with similar accuracy and safety, but at lower cost. After adjusting for baseline differences in patient age and sex, nonphysicians had a slightly shorter depth of examination, but this did not result in a reduction in the rate of detection of neoplastic polyps, the primary purpose of screening. No major complications were observed in more than 3,000 examinations.

Schroy et al (12) evaluated videotaped sigmoidoscopies by nurse practitioners and compared the nurses' reported findings with those of a physicians' review of the videotape as the gold standard. Nurses were found to have a sensitivity of 75% and a specificity of 94% for the detection of polyps. The nurses in that study did not undergo any systematic training in the performance of sigmoidoscopy and had performed only 25 examinations before being evaluated.

Our results are remarkably similar to those of Maule (11), who studied more than 1,800 examinations by 2 registered nurses and 2 licensed practical nurses. In that study, depth of examination was 2 cm less for nurses than physicians (46 vs 48 cm), but there was no difference in the detection of neoplastic polyps. A recent study found a difference of 1 to 4 cm in the depth of examination by nurse endoscopists compared with general surgeons and gastroenterology fellows, but no difference in polyp detection. Patient satisfaction was similar for all endoscopists (15).

Patients in this study were not randomly assigned to examination by either a physician or nonphysician. This resulted in small differences in the age and sex of the patients in the two groups, although we were able to adjust for these differences with multivariate modeling. Because all patients with risk factors for colorectal cancer were excluded, there were no baseline differences in these parameters. Nonphysicians and physicians examined different patients. Thus, the proportions of patients with polyps detected by each type of endoscopist cannot be compared directly. The similar prevalences detected by physicians and nonphysicians suggests, but does not prove, that the two groups are equally proficient at detecting polyps. The strengths of this study include the

large sample size, prospective data collection, and its conduct as part of an institutional colorectal cancer screening program. Thus, we believe these results are generalizable to other similar programs.

Despite its effectiveness, there are many obstacles to implementing sigmoidoscopic screening for colorectal cancer. By the year 2000, there will be more than 50 million people in the United States older than 50 years who are eligible for screening (8). The most expensive aspect of screening sigmoidoscopy is the professional fee (16). However, Medicare coverage for colorectal cancer screening, including flexible sigmoidoscopy, covers only examinations performed by physicians.

The American Society of Gastrointestinal Endoscopy, the British Society of Gastroenterology, and the US Society of Gastrointestinal Nurses and Associates have endorsed sigmoidoscopic screening by trained nurses (17–19). The boards of nursing in 25 states explicitly approve the performance of sigmoidoscopy by nurse practitioners (20). The results of this and other studies suggest that appropriately trained nonphysician endoscopists are capable of safely and effectively screening for colorectal cancer using flexible sigmoidoscopy. Policy initiatives that encourage training and implementation of nonphysician endoscopists are likely to increase the utilization and decrease the cost of colorectal cancer screening. More importantly, expanded availability of trained endoscopists may reduce the incidence of, and mortality from, colorectal cancer.

ACKNOWLEDGMENT

We would like to thank the gastroenterology staff of Harvard Vanguard Medical Associates for their efforts in data collection, and Jean Killiam, RN, Andrew Wallace, MD, Fran Cook, PhD, and Robert Fletcher, MD, for their assistance in preparation of the manuscript.

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APPENDIX

Basis of Cost Estimates*

Item	Cost per Physician Examination (\$)	Cost per Nonphysician Examination (\$)
Salary of endoscopist	112	30
Pathology	18	18
Nursing support	28	28
Medical assistant support	18	18
Secretary	9	9
Benefits	44	26
Supplies	13	13
Malpractice	3	3
Equipment maintenance	3	3
Equipment depreciation	13	13
Rent/building overhead	10	10
Division/corporate service charge	12	12
Total	283	183

* In 1998 US dollars, assuming 2,000 procedures per year.