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# Cancer Occurrence and Screening in Family Practice

## A 20-Year Experience

Gerard N. Kiernan and Paul S. Frame, MD

Rochester and Cohocton, New York

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**Background.** This article is a sequel to a previously published article describing the occurrence of cancer in a rural family practice and the contribution of screening to the diagnosis of breast, colorectal, and cervical cancer. Together, the two articles describe a 20-year family practice experience in diagnosing and screening for cancer.

**Methods.** The study is a retrospective chart review of all cancers diagnosed in a family practice from January 1985 through December 1994. Records of a regional tumor registry were reviewed to validate and ensure completeness of the cancer diagnoses.

**Results.** One hundred twenty-one cancers were identified during the 10-year study period in a population of approximately 4000 patients. Screening by fecal occult blood testing identified 11 of 20 colorectal cancers,

mammography and physician examination identified 9 of 12 breast cancers, and a program of biannual Papanicolaou smears resulted in the diagnosis of 3 of 3 cervical cancers. Only 3 melanomas, 3 ovarian cancers, and 1 testicular cancer were diagnosed in this practice during the entire 20 years of the combined studies.

**Conclusions.** The five most common cancers—skin, colorectal, lung, breast, and prostate—accounted for 71% of the cancers diagnosed. A high rate of provider and patient compliance with screening was achieved. Screening detected a majority of breast and colorectal cancers. Annual Papanicolaou smear screening would have provided no incremental benefit over the biannual screening used in this practice.

**Key words.** Disease; primary prevention; screening; cancer; family practice. (*J Fam Pract* 1996; 43:49-55)

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Cancer is the second leading cause of death in the United States, making prevention, early detection, and effective treatment of cancer a high priority for the nation and for primary care physicians. Several groups have published screening recommendations for a number of cancers.<sup>1</sup> Studies of physician performance in implementing these recommendations, carried out in both academic<sup>2,3</sup> and community<sup>4</sup> settings, have shown low rates of offering recommended screening tests.

Although population-based data on cancer incidence are readily available,<sup>5</sup> less is known about the occurrence

of cancer in the practice populations of individual primary care physicians. Studies have shown that provider compliance with offering cancer prevention tests can be improved using various strategies,<sup>6-8</sup> and that patient compliance with offered procedures can be improved. There is little published information, however, that screening leads to a significant proportion of cancer diagnoses in the community setting.

One of the authors (P.S.F.) has had an interest in cancer screening since 1972 and has actively implemented a health maintenance program in the same location (Cohocton, New York) since 1974. In 1987, a description of cancers detected in the Cohocton practice during a 10-year interval (1974 to 1984) was published,<sup>9</sup> reporting 69 cancer diagnoses in a patient population of approximately 3000 patients. Table 1 summarizes the result of that study. In the 1987 Cohocton study, 40% of the colorectal, breast, and cervical cancers potentially detectable by

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From the University of Rochester School of Medicine and Dentistry (G.N.K.), and the Family Medicine Department, University of Rochester School of Medicine and Dentistry (P.S.F.), Rochester; and Tri-County Family Medicine (P.S.F.), Cohocton, New York. Gerard N. Kiernan is a 4th-year medical student. Requests for reprints should be addressed to Paul S. Frame, MD, Tri-County Family Medicine, 25 Park Ave, Cohocton, NY 14826.

Table 1. Age Distribution and Involvement in the Screening Program of Patients with Diagnosed Cancer [1974-1984]

Cancer Location	Age Range of Patients When Cancer Diagnosed (in years)	Number of Cancers Diagnosed	Number of Patients in Screening Program*	Number of Patients Not in Screening Program
Colon and rectum	41-83	11	7	4
Lung	52-74	11	3	8
Breast	58-76	11	8	3
Skin	63-87	10	6	4
Prostate	68-87	6	3	3
Other gastrointestinal	64-88	6	3	3
Lymphoma and leukemia	39-82	4	2	2
Uterine cervix	42-63	3	3	0
Ovary	45-49	2	1	1
Other respiratory	72-77	2	0	2
Unknown primary	81-82	2	0	2
Bladder	75 (1 case)	1	1	0
Total		69	37 (54%)	32 (46%)

\*Participation in the screening program means the patient complied with at least some screening during the past 10 years. It does not mean the cancer was detected by screening. Screening was offered for only breast, colon, and cervical cancer.

From Berner JS, Frame PS, Dickinson JC. Ten years of screening for cancer in a family practice. *J Fam Pract* 1987; 24:249-52.

screening were diagnosed in patients not participating in or not compliant with the practice's screening protocol, suggesting that a large number of unscreened patients was a major obstacle to early detection and treatment of cancer. In that study, 2 of 11 patients with colorectal cancer, 2 of 11 patients with breast cancer, and 2 of 3 patients with cervical cancer had their cancers detected by screening while they were asymptomatic.

A recent prospective study found that 116 new cancer diagnoses (3.7 per provider) were made during a 1-year interval by 31 family physicians and physician assistants who are members of the Michigan Research Network (MIRNET).<sup>10</sup> In the MIRNET study, 3 of 15 colorectal cancers, 7 of 20 breast cancers, and 1 of 1 cervical cancer were detected by screening in patients who were asymptomatic. Both the 1987 Cohocton study and the MIRNET study suggest that although screening is effective for cervical cancer, most breast and colorectal cancers are diagnosed in the course of symptom evaluation rather than as a result of screening.

We conducted a second 10-year study of cancers detected from January 1985 through December 1994 in the same practice as the 1987 Cohocton study using a similar methodology. The purposes of the present study were: (1) to compare the occurrence of cancer in the same practice from one 10-year interval to another, and (2) to compare the impact of screening on the diagnosis of colorectal, breast, and cervical cancers between the two 10-year intervals.

## Methods

The study was conducted in the Cohocton office of Tri-County Family Medicine, a not-for-profit family practice

group that operates five offices in rural western New York State. This office participates with several health maintenance organizations, but functions essentially as a fee-for-service practice without an explicitly defined panel of patients. Patient turnover is approximately 10% per year. Cohocton is a rural community located 65 miles south of Rochester, NY, and the study site is staffed by a full-time family physician (P.S.F) and a full-time physician assistant. The practice's staffing has not changed since 1974, and the same physician and physician assistant have worked together there since 1978. In 1995, the practice had approximately 4000 patients, an increase of 33% since the time of the previous study.

The age and sex profile of the practice population parallels US census age and sex projections for 1995. The patient population is largely white and lower middle class. Forty-six percent graduated from high school, and only 8% completed 4 years of college. The most common occupations for male patients are craftsman and factory operative. The most common occupations among female patients are homemaker and clerical worker.

The practice has had a health maintenance protocol in effect since 1975 that has included screening for breast, colorectal, and cervical cancers. Women between the ages of 40 and 50 were urged to have a physician breast examination every 2 years. Women over age 50 were urged to have yearly physician breast examinations and mammograms. In June 1993, the practice mammography protocol was changed to recommend mammograms only every 2 years for women over age 50. Women younger than 70 years are urged to have a Papanicolaou (Pap) smear for cervical cancer every 2 years. All patients over the age of 50 are urged to have an annual six-slide, three-bowel-

movement fecal occult blood test (FOBT). Until June 1993, when the recommendation was discontinued, patients between the ages of 40 and 50 were urged to have an FOBT every 2 years. Sigmoidoscopy and screening serum prostate-specific antigen (PSA) testing were not routinely recommended. Rectal examination was not part of the screening protocol for either colorectal or prostate cancer.

Provider offering of health maintenance was tracked using a manual flow chart-based system until January 1993, when a computerized tracking system<sup>8,11</sup> was introduced.

This study is a retrospective case-series analysis of all cancers diagnosed in the Cohocton practice from January 1985 through December 1994. Cancer diagnoses were recorded by providers on an encounter form at each patient visit and were stored in the practice billing system computer. In anticipation of this study, providers were careful to accurately code all cancers. Cancer diagnoses were retrieved from the practice billing computer by generating a list of all patients for whom an initial diagnostic code for a malignancy had been entered during the interval starting January 1, 1985, and ending December 31, 1994. Diagnostic coding was done using the International Classification of Health Problems in Primary Care (ICHPPC-1) during the years 1985 and 1986, and the International Classification of Diseases, 9th Revision (ICD-9) codes in the years 1987 through 1994. Charts of all patients for whom a malignancy was coded were reviewed.

To validate the data from the practice's records and to ensure that no cancers were missed, the computerized files of the Rochester Regional Tumor Registry were used in generating a list of cancers in people listed as patients of the Cohocton practice. The Rochester Regional Tumor Registry collects demographic data as well as tumor staging, treatment, and recurrence information about cancers diagnosed or treated in the Rochester area.

Patients were included in the study if (1) chart review confirmed a diagnosis of malignancy during the study period, (2) the patient was a member of an active family at the time of diagnosis, and (3) the patient had been seen at least once before the cancer diagnosis. An active family was defined as a family in which at least one member had been seen at the practice in the preceding 2 years. By these criteria, a patient was included in the study even if the cancer was diagnosed elsewhere, if the patient was a member of an active family in the Cohocton practice at the time of diagnosis. Patients were not included in the study if their cancer was diagnosed elsewhere prior to their first visit to the Cohocton practice. Patients with a diagnosis of cervical dysplasia or other premalignant lesions were not included in the study. Information about premalignant

lesions was not available from either our diagnostic coding system or the Rochester Regional Tumor Registry.

Charts of patients in the study were reviewed for the following information: (1) patient sex and age at the time of diagnosis, (2) smoking history, (3) type of cancer, (4) stage of cancer at diagnosis, (5) whether the cancer was detected asymptotically as part of health maintenance screening, (6) patient outcomes, if available, and (7) participation in the health maintenance program.

Charts of patients in whom colorectal, breast, or cervical cancer was diagnosed were additionally reviewed for compliance with the specific screening recommendations targeted at those cancers. Patients were considered to have participated in screening if they had participated at any time in the 10 years before the cancer diagnosis. Patients were considered compliant with the screening program if they were less than 6 months overdue for recommended screening procedures. Participation in and compliance with the health maintenance screening program were assessed by examining the flow charts and computer-generated reminders in patient charts as well as laboratory reports of completed cancer screening tests.

## Results

Two hundred fifty-nine preliminary cancer diagnoses were coded and retrieved from the practice computer system. The records of the Rochester Regional Tumor Registry yielded an additional six cancer diagnoses, and one diagnosis was recalled by office staff. Five patients for whom charts were not available were excluded from the study. Chart review eliminated 89 patients without malignancy after workup, 42 with cancer diagnosed before or after the study period, 11 patients who were not members of active families at the time of diagnosis, and 3 patients who joined the practice after receiving a cancer diagnosis elsewhere. The remaining 116 patients comprise the study group and account for the 121 malignancies included in the study (Table 2).

The locations of the malignancies, the range of patients' ages at time of diagnosis, and whether the patients participated in the health maintenance screening program are shown in Table 2. Ninety-three percent of the patients had participated in the health maintenance program when their malignancies were diagnosed. While older adults accounted for the vast majority of cancer diagnoses, there were two malignancies diagnosed in younger persons, a rare Merkel cell skin cancer and a thyroid cancer. In five patients, multiple cancers were diagnosed, including the following combinations: breast/lung, thyroid/kidney, larynx/colon, colon/mesothelioma, and basal cell/chronic lymphocytic leukemia.

Table 2. Cancer Diagnoses, January 1985–December 1994

Cancer Location	Age Range of Patients When Cancer Diagnosed, y	Number of Cancers Diagnosed	Number of Patients in Screening Program*	Number of Patients Not in Screening Program
Colon and rectum	42–84	20	19	1
Skin (non-melanoma)	20–97	19	17	2
Lung	40–79	18	18	0
Prostate	60–85	17	16	1
Breast	40–89	12	12	0
Lymphoma and leukemia	29–82	9	9	0
Other gastrointestinal	59–86	5	4	1
Uterine cervix	35–42	3	2	1
Endometrium	48–63	3	3	0
Thyroid	15–75	3	2	1
Kidney	48–74	3	3	0
Soft tissue	62–75	3	3	0
Skin (melanoma)	55–57	2	2	0
Ovary	64 (1 case)	1	1	0
Testicle	49	1	1	0
Other respiratory	63	1	1	0
Unknown primary	93	1	1	0
Total		121	113 (93%)	8 (7%)

\*Participation in the screening program means the patient complied with at least some screening during the past 10 years. It does not mean the cancer was detected by screening. Screening was offered for only breast, colon, and cervical cancer.

The relationships between patient compliance with screening recommendations, method of cancer detection, and cancer stage for colorectal cancers are summarized in Figure 1. Nineteen of the 20 patients with colorectal cancer had participated in periodic FOBTs. Staging information was available for 18 of 20 colorectal tumors, with 10 of the 18 diagnosed in Dukes stage A or B.

Of the 19 patients participating in FOBT screening,

16 were compliant with the screening recommendations. Eleven of the 16 cancers in patients compliant with the screening protocol were detected by FOBT while the patients were asymptomatic. Only one of the four Dukes stage C cancers detected by FOBT was in the descending colon, sigmoid, or rectum and thus was potentially within reach of the flexible sigmoidoscope. The other five patients with colorectal cancers who were compliant with

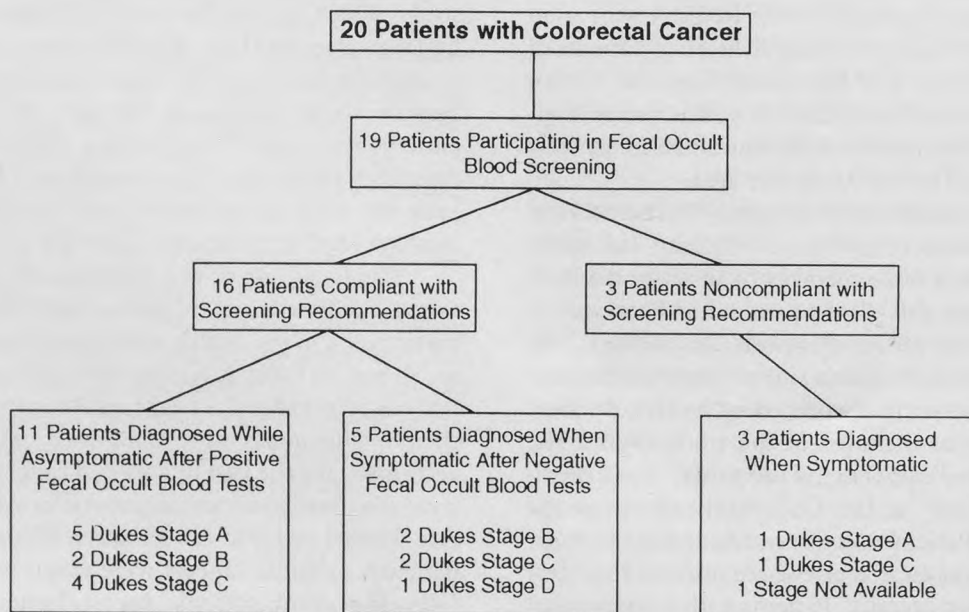


Figure 1. Contribution of screening to the diagnosis of colorectal cancer.

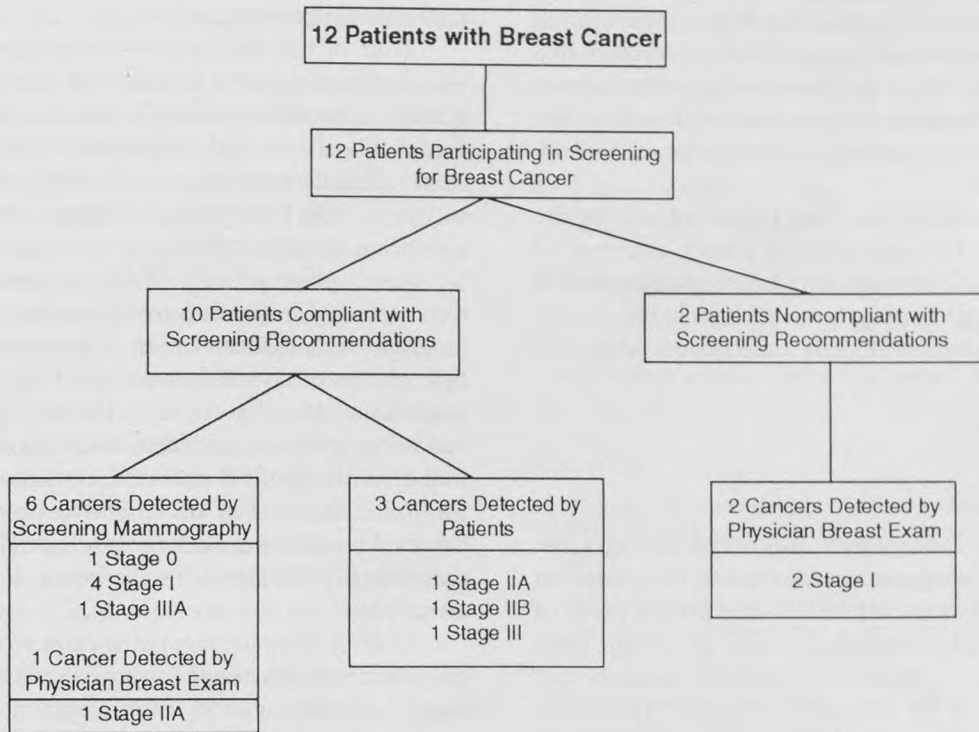


Figure 2. Contribution of screening to the diagnosis of breast cancer.

the screening recommendations had their cancers detected after they were symptomatic, qualifying as false-negative FOBTs. Four of those five cancers were anatomically potentially detectable by screening flexible sigmoidoscopy. All four patients in whom asymptomatic Duke's stage C cancers were diagnosed by FOBT had had at least one previous negative FOBT.

The three participating but noncompliant patients had cancers diagnosed after the onset of symptoms. The single patient not participating in the screening program was a sporadic attender who received much of his care elsewhere. The stage at diagnosis of his cancer was not available from the chart.

The relationships between patient compliance with screening recommendations, method of cancer detection, and tumor stage at diagnosis for breast cancers are summarized in Figure 2. All 12 patients in whom breast cancer was diagnosed were participating in the screening program of physician breast examinations and mammography after age 50. Ten of 12 patients were compliant with screening recommendations at the time of diagnosis. Among the patients compliant with the screening protocol, six cancers were detected by screening mammography, three were self-reported by patients, and one was detected by a physician breast examination. Both cancers diagnosed in noncompliant patients were detected by

screening physician breast examination in asymptomatic patients. Thus, screening detected 9 of 12 breast cancers. We were not able to determine whether the three cancers discovered by patients were the result of systematic breast self-examination or were discovered at other times.

One breast cancer was detected in stage 0, six were detected in stage I, and three in stage IIA or IIB. Two cancers were detected in stage III, both in women compliant with the screening protocol. One of the two stage III cancers had been noted on two prior mammograms but the patient refused workup until she felt a lump. The second stage III cancer was detected as a palpable lump by the patient. The two women noncompliant with screening were noncompliant with both physician breast examination and mammography. Two of the 12 breast cancers were diagnosed in women under age 50.

Three cases of cervical cancer were diagnosed, all by Pap smear testing. Two patients participated in screening and were compliant with screening recommendations at the time of diagnosis. Both patients had stage 0 (CIN III) cervical cancer that was removed by local ablation. The third patient had not participated in screening and had abnormal cells noted on her first Pap smear. She had a stage IA1 tumor that was treated by total abdominal hysterectomy. All three women are alive without cancer recurrence with follow-up of 3, 8, and 4 years, respectively.

Prostate cancer was diagnosed in 17 patients. Only one case was detected by a screening PSA test performed elsewhere; this was the only prostate cancer detected in a man younger than 70 years. Fourteen prostate cancers were detected subsequent to symptoms of dysuria or hematuria, and one case was detected by a bone scan subsequent to bone pain.

Lung cancer was diagnosed in 18 patients during the study period. All 18 cases of lung cancer occurred in smokers. All 18 patients with lung cancer participated in the health maintenance program, which included screening for tobacco use every 4 years and encouragement to quit.

## Discussion

In this study, 121 cancers were diagnosed during a 10-year interval. In the aggregate, cancer was diagnosed an average of once or twice per month in a patient panel of approximately 4000. Converting this to an average individual practitioner panel of 2000 patients suggests that about 6 cancers will be diagnosed per year. The corresponding number from the 1987 study was 4.6 cancers per year, compared with the 3.7 cancers diagnosed per practitioner in the MIRNET study.<sup>10</sup>

The five most common cancers accounted for 71% of the diagnoses, occurring at rates ranging from 1.2 to 2.0 diagnoses per year. The other cancer diagnoses (29%) were of rarer cancers, with cell types or locations diagnosed three or fewer times in 10 years. The finding that the diagnosis of an uncommon cancer is a common occurrence in family practice is consistent with the results from the prior study in this practice and with the results of the MIRNET study.<sup>10</sup>

The infrequent occurrence of ovarian cancer, melanoma, and testicular cancer in family practice has important implications for establishing screening priorities. Screening for each of these cancers is recommended by the American Cancer Society<sup>12</sup> but is not recommended by the US Preventive Services Task Force.<sup>13</sup> In 20 years, the Cohocton practice of between 3000 and 4000 patients diagnosed three ovarian cancers, one testicular cancer, and three melanomas. Thus, even if all other screening criteria were met, which is not the case, screening for these cancers would have a very low yield.

The present study found a greater contribution of screening to the diagnosis of colorectal and breast cancer than was found either in the 1987 study<sup>9</sup> or the MIRNET study.<sup>10</sup> In this study, 11 of 20 (55%) colorectal cancers were detected by screening, in contrast to 18% and 20% in the prior Cohocton study and the MIRNET study, respectively. As would be expected, cancers detected by

screening tended to be at an earlier stage than those detected in symptomatic patients.

Four of the five patients compliant with screening who had false-negative FOBTs had cancers that were potentially detectable by flexible sigmoidoscopy, as did one compliant patient with a positive FOBT but a stage C tumor. This finding suggests that adding flexible sigmoidoscopy to FOBT screening for colon cancer might have a significant incremental benefit.

Seventy-five percent of breast cancers in the study were detected in asymptomatic women, either by mammography or physician breast examination. This proportion compares favorably with the 18% detected asymptotically in the earlier 10-year interval, before mammography was added to the screening protocol, as well as with the 35% detected asymptotically in the MIRNET study. Ten of 12 (83%) breast cancers were detected at early stages (stages 0, I, or II), which reflects that nonpalpable tumors were being detected by mammography.

During 20 years of experience in screening for cervical cancer with *biannual* Pap smears, six cases of in situ or stage I invasive cancer were diagnosed. All of these women were cured of cancer, and only two required hysterectomy. The diagnosis and treatment of dysplasia was not specifically examined. In this population, a program of annual rather than biannual Pap smear screening would have provided minimal or no incremental benefit while greatly increasing screening costs.

There are several limitations to this study. It is a descriptive study in a single practice. The experience of this practice may not be generalizable to other practices or populations. It is reassuring that the age and sex distribution of the practice is similar to that of the United States as a whole, but the ethnic and socioeconomic composition is not necessarily typical. The average annual incidence of malignancies diagnosed in our practice population was about 12 per 4000 patients, or 300 per 100,000 population. This rate is lower than the national incidence of 476 cancers per 100,000 population but is similar to the rate of 273 per 100,000 for this same practice in the prior 10-year interval. The incidence of colorectal cancer and incidence of cervical cancer were similar to the national rates, but the incidence of breast cancer was less than one-half the national rate.

The practice is also atypical in that the providers have had an intense interest in prevention and screening for the past 20 years. In the first 10-year study, provider compliance with offering FOBT, Pap smears, and physician breast examinations was 76%, 77%, and 80%, respectively. An audit of the practice performed in 1995 found increased provider compliance with offering FOBT (80%), Pap smears (92%), and mammography (81%). Thus, with

respect to office-based prevention, this practice might be thought of more as an ideal model than an example of a typical practice.

With the exception of women in whom cervical cancer had been diagnosed, outcome data were not a part of this study. With the small sample size and lack of a control population, it is impossible to draw any conclusions about whether screening decreased morbidity and mortality from colorectal or breast cancer. The earlier stage cancers diagnosed by screening could be due to lead time or length bias rather than improved outcome.

Large randomized controlled trials have demonstrated the efficacy of screening for colorectal<sup>14</sup> and breast<sup>15,16</sup> cancer in a research setting, but less is known about whether this research efficacy translates to effectiveness at the community level. This study does not prove the effectiveness of screening for breast and colorectal cancer but is certainly more encouraging than the results of the first 10-year study or of the MIRNET study with respect to whether at least these cancers can be detected by screening before symptoms occur.

How can one explain the improved contribution of screening to cancer diagnosis in the second 10-year interval compared with the first? The answer may lie in part with the definition of participation in screening: having complied with screening procedures at least once in the past 10 years. The practice was formed in 1972, and thus, in the early part of the first 10-year study, there was little opportunity to have complied in the past 10 years. Also the Hawthorne effect of paying closer attention to prevention may have improved compliance in the second decade. An attractive hypothesis is that *both* a high level of provider compliance with screening and an adequate period of time to educate patients about and to engage them in the preventive program are necessary to achieve meaningful results.

Effective secondary prevention of melanoma and ovarian cancer has not been demonstrated by controlled trials, and the low incidence of these cancers suggests that even if screening were effective, the cost would be enormous. Testicular cancer is 90% curable in the absence of screening and is uncommon in primary care (one case in 20 years). Secondary prevention efforts to detect these cancers would be expensive and unlikely to succeed.

Screening for prostate cancer is controversial because, although it is clear that many cases can be detected by screening, it is not clear that detecting and treating these cases results in more good than harm.<sup>13</sup> In 20 years, the only case of prostate cancer in a man younger than 68 years old in this practice was a localized PSA-detected lesion of unknown significance.

In contrast, office-based screening can have a signif-

icant impact on the diagnosis of breast and colorectal cancer. Screening for cervical cancer is very effective and does not need to be done on an annual basis. Lung cancer can be prevented by avoiding tobacco. The preventive efforts of primary care physicians should be focused on these cancers for which decreasing morbidity and mortality is a realistic goal.

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