Cancer Screening and Detection in Family Practice: A MIRNET Study

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Background. The identification of effective strategies for the prevention, diagnosis, and treatment of cancer is a high priority for the nation, yet relatively little is known about how cancer is diagnosed in primary care. This study was undertaken to describe practitioner beliefs about cancer screening and to determine whether beliefs and intentions about cancer screening are associated with actual cancer detection rates among asymptomatic patients cared for by family physicians.

Methods. A self-administered questionnaire on cancer screening beliefs and practices was completed by members of the Michigan Research Network (MIRNET) in January 1990 and again in December of 1990. Thirty-one practitioners prospectively identified all patients with a new diagnosis of cancer during 1990.

Results. One hundred sixteen cancer cases were identified. Only 31% of the 77 cancers considered to be potentially detectable by routine screening were actually identified by screening. Physicians reporting more aggressive screening practices identified greater percentages of asymptomatic cancers and a greater number of breast and colon cancers.

Conclusions. Low percentages of cancers were detected in asymptomatic patients in this population. Practitioner attitudes about the need for cancer screening appear to be an important component of cancer detection.

Key words. Family medicine; cancer; diagnostic tests, routine. (*J Fam Pract 1995; 40:27-33*)

The identification of strategies for the prevention, diagnosis, and treatment of cancer is a high priority for the nation. It is estimated that $10 billion is spent each year for hospital and physician services, $25 billion represents lost income, and over two million work-years are lost because of cancer.[1] With 1990 figures from the American Cancer Society (ACS) showing approximately 37,900 new cases in Michigan alone,[2] interventions aimed at early detection and treatment of cancer are actively being sought and implemented. The primary care physician, by virtue of practice location and accessibility to a large percentage of the population, has been identified as an important link in delivering the necessary education and early diagnostic procedures.[3]

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Much of the literature on prevention of death and disability from cancer, including the ACS report on the cancer-related checkup,[4] assumes that the search for early cancer in asymptomatic individuals will afford the greatest medical benefit in a safe and practical way. Studies in various settings, however, have demonstrated that screening protocols are seldom implemented.[5–9] Patient, physician, test, and health care delivery system factors have all been cited as responsible for the failure to complete cancer screening.[10,11]

Reports of cancer detection in practice settings are few. A retrospective study of cancer diagnoses from a single family practice over a 10-year period demonstrated that 69 cancers, or approximately one new cancer diagnosis every 2 months, were identified.[12] In the study, the majority of cancers were diagnosed among patients who were participating in cancer screening; however, only 2 of 11 patients with a diagnosis of colon cancer and 2 of 11 women with a diagnosis of breast cancer were asymptomatic. To improve the frequency and effectiveness of cancer

screening by primary care physicians, more information is needed on how cancer is currently identified among their patients.

The purpose of the present study was to describe practitioner beliefs about cancer screening, early detection, and actual cancer detection rates (by both screening and case finding) in a population of patients cared for by a group of family practice physicians. It was hypothesized that the majority of cancer cases detected by these physicians would be among patients presenting with symptoms. In addition, it was hypothesized that those reporting a belief in more aggressive screening strategies would detect more asymptomatic cases and more cancers at an early stage of illness.

Methods

Subjects

Physicians who participated in this study were members of the Michigan Research Network (MIRNET), a voluntary network of Michigan practitioners interested in collaborating on primary care research projects. Twenty-nine family physicians and six physician assistants (PAs), representing 10 of the 18 MIRNET practices, participated in the study. These practices included 4 solo physician practices, 2 community-based family practice (FP) teaching faculty practices (7 physicians and 2 PAs), 1 academic FP faculty practice (four physicians), and 3 FP group practices (14 physicians and 4 PAs). Five practices were in rural locations (3 solo, 2 group practices). The 4 PAs in the group physician practices reported cases through the supervising physician rather than independently contributing information; therefore, the total number of practitioners participating in the study was 31.

Measures

A previously validated self-administered questionnaire on cancer screening practices was used with permission from Woo et al.[8] This questionnaire requested information on how often asymptomatic patients of varying ages should receive general (physical or pelvic examination) and specific (breast and/or rectal examination, fecal occult blood, sigmoidoscopy, Papanicolaou [Pap] smear, and mammography) cancer screening. Screening frequencies were reported as never, once in a lifetime, once every 10 years, every 4 to 5 years, every 2 to 3 years, or once annually. Subjects were also asked to rate themselves in general terms regarding the use of screening procedures (more, same, or less than recommended) and to list in rank order the reasons for following this approach. Information was requested on personal and family history of cancer.

A patient information card was used to identify each patient with a new diagnosis of cancer. This card was used to report the patient's name and identification number, age, sex, diagnosis, screening and diagnostic tests used to identify the cancer, and whether the patient presented with symptoms attributable to the cancer. A test or examination was considered part of screening if the patient was asymptomatic at the time of testing and the performance of the test was not prompted by the patient. A test or examination was considered diagnostic if the test was performed in response to either patient symptoms or a positive screening test. Cancers considered detectable by routine screening included breast cancer (clinical breast examination and mammography), cervical cancer (Pap smear), colorectal cancer (digital rectal examination, fecal occult blood, and sigmoidoscopy), prostate cancer (digital rectal examination with or without prostate specific antigen [PSA] test), and skin cancer (skin inspection during physical examination). The designation of these cancers as detectable was based on recommendations offered by the ACS.[4]

Procedures

At the beginning and end of the study period, all physician and PA participants were asked to complete the self-administered questionnaire. The questionnaire was mailed to each subject and follow-up telephone calls were used as reminders to nonrespondents. Practitioners were asked to prospectively identify all patients for whom a new diagnosis of cancer was made during the calendar year 1990. An information card was submitted for each patient. Medical records were requested for all patients reported to have a diagnosis of cancer. Records were reviewed for information on patient presentation, diagnosis, verification of tissue diagnosis by biopsy or surgical pathology reports, staging, and follow-up. Cases in which a diagnosis of cancer was not confirmed by pathology reports were excluded from the analysis.

Demographic data on all patients seen by the participating practitioners were maintained on weekly log sheets by office staff and submitted as a measure of the denominator of the patient population. Monthly telephone reminders to all participating practices were used to ensure full collection of both numerator and denominator data. Personal identifiers were removed from all data collected, and physicians and patients were given a unique code number to use for tracking. The study was reviewed and approved by the MIRNET scientific review committee and by the Michigan State University Institutional Review Board.

At the end of the study, a list of all reported cancer patients was provided to each practitioner to verify completeness of reporting. In addition, a list of a 1% random sample of all patients seen during the study year, stratified by age and sex, was sent to the lead practitioner at each practice site to review for missed cancer cases.

Data Analysis

Descriptive statistics were used to summarize the data. Mean screening frequencies for comparison by group were calculated as outlined by Woo et al[8]: "once in a lifetime" was considered to be equivalent to once every 70 years; "once every 2 to 3 years" was considered equivalent to 2.5 years; and "once every 4 to 5 years" was considered equivalent to 4.5 years. Recommended screening frequencies reported on the initial questionnaire were compared with those from the follow-up questionnaire using paired-sample *t* tests.

Physicians were classified as high-, average-, and low-frequency screeners according to three different methods: (1) the responses to the question on general use of screening procedures (more, same, or less than recommended); (2) percentage of agreement with ACS guidelines for screening (median split and division into three levels using one standard deviation [SD] above and below the mean); and (3) the proportion of items for which there was agreement with or screening at higher frequency than ACS guidelines (median split and division into three levels using one SD above and below the mean).

Cancers which could be detected by routine screening (ie, breast, cervical, colorectal, prostate and skin [melanoma]) were staged based on the following pathologic classifications: (1) Breast: TNM classification system of the American Joint Committee on Cancer (AJCC)[13]; (2) cervical: stages 0 to IV classification system[14]; (3) colorectal: Dukes' classification (A to D)[15]; (4) prostate: TNM classification system[16]; and (5) melanoma: AJCC classification (stages I to IV).[17] Cancer cases were dichotomized into early vs late detection based on prognosis. Early cancer detection was coded as follows: (1) breast: stage I or II; (2) cervical: stage 0 or I; (3) colorectal: Dukes' A or B; (4) prostate: stages 0 to II; and (5) melanoma: stage I.

ANOVA and Mann-Whitney *U* tests were used to compare means of cancer cases detected, asymptomatic cases detected, and cases detected at an early stage by self-reported screening practice. Items on individual screening practices were dichotomized by screening frequency: (1) equal to or greater than the frequency recommended by ACS guidelines; or (2) less than the frequency recommended by ASC guidelines. Analysis of covariance was used to investigate the impact of the number of patients seen by a practitioner on cancer detection rates within screening groups.

Table 1. Screening Procedures Recommended by ≥80% of MIRNET Practitioners

Yearly physical examinations and yearly rectal examinations for those over age 60
Yearly stool occult blood testing for those over age 50
Yearly pelvic examinations for women between the ages of 46 and 60
Yearly Pap smears for women between the ages of 36 and 65
Yearly breast examinations for women over age 40
Mammograms: Every 2 to 3 years for women 41–50 years of age Yearly over age 50

MIRNET denotes Michigan Research Network.

Results

Twenty questionnaires on cancer screening practices were returned at the beginning of the study period and 19 at the end of the study period, for a response rate of 65% and 61%, respectively. At least one questionnaire was completed by 25 of the 31 (81%) MIRNET practitioners who participated in the study. Comparing the initial questionnaire responses with those from the repeat questionnaire at 1 year (N=15), significant differences were found for only 2 of the 33 items. These differences were reflected in a more aggressive approach for a screening rectal examination for patients aged 46 to 60 years (72% vs 93% reporting performing the screening examination on an annual basis, $t=-2.2$, $P=.05$) and a less aggressive approach for obtaining Pap smears for women aged 36 to 65 (20% vs 60% reporting performing this test every 2 to 3 years rather than annually, $t=3.06$, $P=.01$). Because of the similarities in questionnaire responses, the 25 questionnaires (20 initial and 5 follow-up-only responses) were used for data analysis.

The median age of the practitioners was 35 years (range, 29 to 70) and the median year of graduation from professional school was 1980 (range, 1943 to 1986). Twenty (80%) were men. A family history of cancer was reported by 17 (68%), and 2 had a personal history of cancer.

There was strong agreement (≥80%) among MIRNET practitioners for performing the screening procedures shown in Table 1. There was the greatest disagreement (no single category with more than 45% of responses) for recommendations on physical examination for patients aged 18 to 30 years, rectal examinations for

Table 2. Recommendations for Selected Screening Procedures for MIRNET Physicians As Compared with Those of Internal Medicine Physicians (IM), US Preventive Services Task Force Guidelines (USPSTF), and American Cancer Society Guidelines (ACS)

Cancer Screening Test or Procedure	Patient Age Range, y	Mean Recommended Frequency, by Year			
		MIRNET	IM*	USPSTF†	ACS‡
History and physical examination	18–30	12.2	5.7		2.5
	31–40	4.3	4.3		2.5
	41–60	4.8	2.2		2.5
	60+	1.6	1.3		1.0
Stool occult blood	41–50	1.4	1.4		
	50+	1.0	1.1		1.0
Sigmoidoscopy	51–60	2.9			3.3
	60+	2.8			3.3
Pap smear	18–35	1.8	2.1	2.0	1.0
	36–65	1.3	2.1	2.0	1.0
	65+	1.9	3.1		1.0
Mammography	51–60	1.1	3.9	1.5	1.0
	60+	1.1	4.8	1.5§	1.0

**American Joint Committee on Cancer. Manual for staging of cancer. Philadelphia: JB Lippincott, 1988.*
†US Preventive Services Task Force. Guide to clinical preventive services: an assessment of the effectiveness of 169 interventions. Baltimore, Md: Williams & Wilkins, 1989.
‡Eddy DM. ACS report on the cancer-related health checkup. CA Cancer J Clin 1980; 30:193–240.
§Conclude at age 75.
MIRNET denotes Michigan Research Network.

those 31 to 45, sigmoidoscopy for those 51 to 60, and Pap smears for women over age 65.

Mean responses to selected screening questions are shown in Table 2. Responses for MIRNET physicians are compared with those of internists who were surveyed in 1985. MIRNET physicians reported recommending more frequent screening with mammography.

When asked to rate themselves on frequency of performing cancer screening procedures as compared with published recommendations, 4 rated themselves as performing them more frequently, 12 as about the same, and 9 as less than recommended. For those performing the procedures more frequently, the major reason reported was a belief that the frequency of screening currently being recommended was inadequate. For those reporting less frequent screening than recommended, reasons listed in descending order were expense (n=5), belief that certain screening procedures were unnecessary (n=3), belief that patients do not want screening (n=2), and insufficient amount of time available to consider screening (n=1).

There was consistency between global provider self-rating and provider responses to individual screening items. Physicians who rated themselves as high-frequency screeners (screening for cancer more frequently than is recommended) were significantly more aggressive in the use of the following screening procedures as compared with physicians in the low-frequency screening group: history and physical examination for those aged 18 to 30 years, pelvic examination for women over the age of 7 and Pap smears for women over the age of 65. There w also a trend (P=NS) toward more aggressive screeni using history and physical examination for patients age 41 to 60, stool occult blood testing for patients aged 4 to 50, and Pap smears in patients aged 18 to 65. Phys cians who judged themselves to screen for cancer at th recommended frequency were significantly more aggre sive than those in the low-frequency screening group f performing pelvic examinations (ages 31 to 45 and ov age 70) and obtaining Pap smears for women over the ag of 65.

There were no significant differences in mean practi tioner age or sex by global self-rating on screening (mor same, or less than recommended). In reviewing individu items, differences by sex were found only in recommen dations for sigmoidoscopy for patients over age 60 (mal physicians being more aggressive, with a mean recom mendation of every 2 to 3 years vs 4 to 5 years for femal providers; Mann-Whitney χ^2 approximation 3.7 P=.05), and for Pap smears for women aged 18 to 3 (female physicians being more aggressive, with a mea recommendation of yearly vs every 2 to 3 years for mal providers, Mann-Whitney χ^2 approximation 3.8 P=.05). The small number of female physicians pre cluded additional analyses. Only one difference was foun by age category, using a median split at age 35. Younge providers were more aggressive in recommending yearl pelvic examinations for women aged 61 to 75 vs every 2 t

Table 3. Types of Cancers Detected During 1990 by 31 MIRNET Practitioners

Cancer Type	No. of Cancers
Skin	32
Breast	20
Colon/rectal	15
Prostate	9
Lung	8
Lymphoma, leukemia	7
Uterus/cervix	7
Other gastrointestinal*	6
Ovary/testes	3
Thyroid	2
Other†	7
Total	116

**Bile duct, esophagus, liver, pancreas.*
†Adrenal, bladder, chordoma, connective tissue, eccrine, schwannoma.
MIRNET denotes Michigan Research Network.

3 years for practitioners over the age of 35 (Mann-Whitney χ^2 approximation 3.89, $P=.05$).

A total of 116 pathology-confirmed new cancers were identified during 1990. Individual practitioners identified between zero and 10 cases, with a mean of 3.3 cancers (and a median of 3) detected during the year. The frequencies of types of cancers are shown in Table 3. Of these cancers, 77 (66%) were of a type considered amenable to early detection through screening (breast [20], cervix [1], colon [15], prostate [9], and skin [8 melanomas, 23 basal cell, and 1 squamous cell carcinoma]). Only 24 of the potential 77 (31%) were actually discovered by screening in otherwise asymptomatic patients (Table 4).

Providers in 8 of the 10 practices saw 24,779 patients for a total of 53,457 visits during 1990. Providers in the ninth and largest practice saw 14,186 patients, but information regarding which providers saw which patients was not available. Denominator data were not available for one practice. The average number of patients seen over the year for physicians in full-time practice was 1989, and the average number of patients seen by physicians in academic faculty practices was 765.

A review of the 1% random sample for missed cancer cases was completed for all 10 practices, including 26 of the 29 physicians and the 2 PAs who reported independently. A review of 417 records revealed 3 cases (0.72%) that had not been entered into the study: 1 patient with skin cancer, 1 with bladder cancer diagnosed by a consultant, and 1 with breast cancer. Two patients with recurrent cancer were also identified but neither would have been eligible for inclusion in the study.

Physicians who rated themselves as high-frequency screeners were not found to discover more total cancers than those in the other two groups. Missing data did not allow for adjustment by numbers of patients seen. For example, of the 24 cases of breast cancer reported, information on both physician screening practice and numbers of women over age 25 seen by that provider were available for only 11 cases. Of these, only one was cared for by a provider rated as a high-frequency screener. The detection rate ranged from 1 case of breast cancer per 334 women to 1 case per 750 women.

There was a difference in the proportion of asymptomatic cancers found by high-frequency screeners as compared with practitioners in the average screening group (50% vs 14%). Dichotomizing individual screening recommendations by numbers of specific cancers detected revealed a significant difference only for the detection of colon cancer. Practitioners who reported being more aggressive in recommending sigmoidoscopy for patients over age 60 identified more colon cancers (mean 1.08 vs 0.08, Mann-Whitney $P=.01$).

The division by median split for agreement with ACS recommendations (to define high-frequency vs low-frequency screeners) was not significantly related to cancer case detection. Using three divisions, a significant relationship was found for detection of breast cancer. More breast cancers were identified by high- vs low-frequency screeners (mean, 1.75 vs 0.2; $F=3.49$; $P=.05$) and there was a trend toward more colon cancers being identified by high- vs average-frequency screeners and high- vs low-frequency screeners (mean, 1.75, 0.4, and 0.2, respectively; $F=2.79$; $P=$NS).

Likewise, for the median split by agreement with or

Table 4. Patient Characteristics and Detection for Cancers Amenable to Screening

Cancer Type	Mean Age, y (Range)	Male, %	Asymptomatic, %	Early Stage, %*
Breast (n=20)	55 (27–84)	5	35	75
Cervix (n=1)	33	0	100	100
Colon (n=15)	68 (44–87)	40	20	47
Prostate (n=9)	70 (60–86)	100	67	67
Melanoma (n=8)	56 (25–70)	88	25	62
Skin (n=24)†	67 (29–83)	46	21	N/A

**Complete staging information was not available for all cases.*
†Skin cancers other than melanoma were basal cell and squamous cell cancers.
N/A denotes not available.

more aggressive screening than ACS guidelines, there was no relationship between screening belief and cancer detection. For the three divisions, a significant difference was found for the detection of colon cancer, with high screeners identifying more cancers (mean, 1.5, 0.5, 0; Kruskal-Wallis test statistic 9.8; $P=.01$).

Discussion

Clinicians in this study population identified a new cancer case approximately every 3 to 4 months, with a range of zero to 10 cases per year per provider. These data support those reported by Berner et al[12] but may be underestimated, as the random record review revealed additional cases that had not been entered into the study. If this 0.7% missed case rate were applied to the population as a whole, the detection rate would triple. Even with a detection rate of one new cancer case every 1 to 2 months, considering the 500 or more visits that would occur over this period to a full-time family practitioner, the absolute number still appears small. With the large number of screening tests and procedures recommended to primary care practitioners, the small yield from case finding and even smaller yield from screening may make it difficult for practitioners to justify the time and expense involved, becoming another barrier to early cancer detection. This reluctance to screen was clearly voiced by those who rated themselves as low screeners in this study.

MIRNET clinicians identified some unusual types of cancer, including bile duct and adrenal tumors. The finding of uncommon cancers (11% of the total) appears to be a common occurrence and points to a need for continued vigilance on the part of primary care providers when investigating symptoms. In addition, it appears prudent that physician training include a broad exposure to different types of neoplastic disorders.

Unfortunately, the data demonstrate that most cancers are found during the evaluation of symptoms, confirming our first hypothesis. Regardless of self-reported screening belief, case detection appears to be, in large part, a matter of numbers of patients seen. High-frequency screeners, however, did identify a greater number of asymptomatic cases. This finding might be anticipated to yield higher cure rates. For colon cancer, one half of the cases were diagnosed at advanced stages (Dukes' C and D), speaking to a need for more aggressive screening. Based on the finding that practitioners who reported a belief in more aggressive screening found significantly more colon cancers and a trend toward a greater number of asymptomatic cases, it seems that efforts directed at changing physician beliefs and behaviors would likely be fruitful.

Whether detected through screening or for evaluation of a self-detected breast lump, the majority of breast cancer cases were early cancers with favorable prognoses. It is possible that the uniformly strong belief in clinical breast examinations and mammograms among study practitioners eliminated any difference that might exist by self-reported screening category. It is not known whether belief translated into screening behavior; therefore, it is possible that a greater number of asymptomatic cases could have been detected with greater adherence to guidelines. According to these data, however, greater adherence to screening guidelines would not have had a clear impact on survival. With more aggressive cancers occurring with greater frequency in younger women, for whom mammograms have a limited application, it is possible that efforts directed toward patient education and encouragement for self-breast examination would have the greatest impact on breast cancer survival. Advances in genetic mapping may improve this situation through the identification of women at risk for breast cancer for whom more aggressive screening or prophylactic mastectomy might be appropriate.

Limitations of this study include the unknown number of missed cases, the lack of complete denominator information for all the practices, and the absence of information on actual screening practices for this group of family physicians. Despite these limitations, the significant findings were in the expected direction, with high-frequency screeners identifying a greater number of selected and asymptomatic cancers. Although physicians' self-reported screening practices have been found to underestimate screening behavior,[8,10] there is no evidence that physician attitudes about screening are related to underreporting or overreporting. Several investigators have found physician attitudes and beliefs to be positively associated with actual practice.[19,20] Osborn et al[20] found that belief in screening effectiveness and a belief that lack of preventive care is dangerous to one's health were predictive of the performance of certain screening tests. Attitudes, however, were not predominant predictors of physician screening behavior in this study.

A final study limitation is that these findings may not generalize to other family physicians. This group of family physicians is relatively young, and they actively participate in a research network. Although age has not been consistently shown to have an impact on screening behavior,[11,21] participation in research may have a positive effect.[22]

This study also supports the use of practice networks as laboratories for primary care research. The difficulties encountered were primarily with breach of study protocol, such as when two practices deferred performing the weekly log entries in favor of computerized lists, only to

find that their systems were unable to provide the needed information. The use of frequent contacts (monthly telephone calls) with a lead practitioner from each practice was quite helpful in maintaining enthusiasm and steady reporting of cancer cases. Securing funding to pay an office staff member to coordinate data collection and maintain procedures may have improved completeness of data. Use of a paid coordinator in subsequent MIRNET studies has proved successful and is strongly recommended.

Family physicians and their affiliated physician assistants frequently identify cancers in their practices. While screening efforts are not likely optimal, 31% of the cancers amenable to detection by screening were detected among asymptomatic patients. Thus, screening likely prevented at least a small number of cancer-related deaths. The majority of the cancers detected, however, were diagnosed during symptom evaluation. Physician beliefs about cancer screening appear to be important in improving cancer detection rates, with more aggressive attitudes toward screening associated with higher detection rates of asymptomatic cases and selected cancers. Despite the abundance of cancer screening guidelines and protocols, early cancer detection is still relatively unsuccessful. Efforts to improve adherence to guidelines must address clinician beliefs about the usefulness of the procedures in addition to providing practical solutions with respect to time and expense.

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