

Cancer Screening by Primary Care Physicians

Can We Explain the Differences?

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Background. Physicians perform cancer screening tests less often than recommended.

Methods. Forty primary care physicians were surveyed to assess their knowledge, attitudes, and experiences regarding cancer and cancer screening, and patients' medical records were reviewed to measure physicians' screening rates.

Results. Over 80% of physicians believed doctors should urge screening. On average, 23% of their patient visits were scheduled primarily for preventive care interventions. Screening performance scores expressed the percentage of compliance with the American Cancer Society's recommendations and demonstrated the low levels of compliance for six out of seven tests; however, there was substantial variance in performance

among physicians. The best predictors of screening performance were (1) the percentage of visits scheduled primarily for prevention (mammography, and pelvic and breast examinations [$P < .05$]); and (2) the number of medical journals read regularly (stool occult blood test [$P < .01$], sigmoidoscopy [$P < .01$], and Papanicolaou smear [$P < .02$]). Also, female physicians performed more Papanicolaou smears ($P < .05$) and scheduled more visits for preventive care ($P < .001$).

Conclusions. A small group of predictors explain large portions of the variance in cancer screening performance.

Key words. Mass screening, neoplasms, preventive health services, preventive medicine. *J Fam Pract* 1991; 32:465-471.

Many studies have reported performance rates for cancer screening, such as the Papanicolaou smear and mammography screening, by primary care physicians.¹⁻⁸ Others have examined primary care physicians' attitudes and beliefs, and behaviors such as personal health habits, practice characteristics, and professional activities,⁹⁻¹² and some have explored the relationships between the characteristics of physicians and their preventive-care orientation or performance of prevention activities.^{6,13-16} Few such studies, however, have used medical record data rather than self-reports to measure preventive-care performance.¹⁶⁻¹⁸

This paper describes an exploratory study of cancer screening test performance among 40 primary care physicians in northern California. The purpose of the study was to identify those physician characteristics related to

the performance of cancer screening, and to use these findings to suggest alternative hypotheses for future research. In this paper, we first identify the best set of predictors of the sample physicians' cancer screening performance. Drawing on the literature and our data analyses, we then consider each predictor as a possible indicator of broader alternative areas of influence. Finally, we suggest the development and testing of alternative hypotheses in order to design appropriate interventions for promoting physicians' cancer screening performance.

The analysis was based on the preintervention screening test performance data from a 3-year randomized controlled trial of interventions designed to promote cancer prevention activities.

Methods

The subjects of the study were 40 primary care physicians, recruited from approximately 300 clinical faculty members of the Departments of Medicine and of Family and Community Medicine at the University of California, San Francisco. Clinical faculty physicians receive nonsalaried ap-

Submitted, revised, October 31, 1990.

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pointments in recognition of their service as volunteer preceptors for medical students. Although more likely to be board certified (85% as compared with 59%) and younger (83% vs 63% <45 years of age) than nonfaculty physicians, their professional lives bear a greater resemblance to those of other primary care physicians in the San Francisco Bay Area than to those of regular faculty. For example, the 40 physicians recruited were all in full-time, private-office, fee-for-service practices.

In an earlier study, the clinical faculty reported interest in collaborative research.¹⁹ For this study, we surveyed all clinical faculty physicians regarding their interest in participation. Eligibility criteria included being in solo or small-group private practice and a willingness to have a computerized cancer-prevention reminder system installed and implemented in their offices. Except for the provision that only one physician from each practice would be accepted into the study, we enrolled all eligible physicians who were willing to use the reminder system.

Sources of Data

We collected data through self-administered questionnaires and medical record audits. The questionnaire, administered at the time the physicians were enrolled in the study, included items drawn from a large-sample survey that had proven reliability and internal consistency.¹⁰ Other questions, written by the primary author, were pre-tested on a sample of clinical faculty members who were ineligible to be study participants. The final instrument included 143 multiple-choice items in five categories: (1) demographic information, (2) personal health behavior, (3) attitudes and beliefs regarding prevention, (4) current medical practice characteristics, and (5) professional activities. All 40 physicians completed the questionnaire.

For each physician, we audited the medical records of a random sample ($n = 60$) of patients over the age of 40 years. From these audits, we measured the physician's prior-year performance of stool occult blood tests, rectal examinations, sigmoidoscopies, Papanicolaou smears, pelvic examinations, breast examinations, and mammographies. Physicians were credited with a test performed even when the record indicated the test had been done by another physician.

To calculate physicians' individual screening performance scores, we used as reference standards the age and screening intervals recommended by the American Cancer Society (ACS) and the National Cancer Institute (NCI). For tests recommended annually, the performance score equaled the percentage of eligible patients (according to age and sex) tested during the previous year. (For the Papanicolaou smear, we used a 3-year interval as the minimum standard. Therefore, scores greater than

100% indicated that the physician performed Papanicolaou smears more frequently than once every 3 years.)^{5,8}

Data Analytic Techniques

For each of the seven screening tests, the best predictors of screening performance were identified through a series of multiple regression equations. As a first step, we constructed separate equations for each of the five categories of physician characteristics. In the second set of equations, we entered the statistically significant variables from all categories. A final set of equations, which included only those characteristics that remained significant, produced estimates of the best predictors.

Results

Demographics. The mean age of the physicians was 48 years; the mean year of medical school graduation was 1969. Three quarters of the physicians were men. Of the 40 physicians, 30 were family physicians, and 10 were general internists. All were educated in the United States.

Personal health habits. Sixty-five percent of the physicians performed aerobic exercise more than twice weekly. All but one were nonsmokers. Of the 92% who consumed alcohol, three fourths did so no more than 3 to 4 times per week and 95% reported having no more than two alcoholic drinks at a time. Sixty-five percent considered their body weight to be average; 80% knew their own serum cholesterol level (of these 32 physicians, 20 reported levels lower than 200 mg/dL). All had their blood pressure taken within the past year, and all were normotensive. Only one third (32%), however, had had a complete physical examination during the last year; another one third (30%) reported that their last complete physical examination had been more than 5 years before. Three of the nine women physicians did not practice monthly breast self-examination.

Attitudes. Table 1 is a summary of the physicians' attitudes. While a large majority agreed with the prevention-oriented statements, only 48% strongly agreed that lack of preventive care could be dangerous to one's health. Also, only one third strongly agreed that patients are interested in preventive care and that more of a physician's time should be spent on prevention.

Beliefs. At least two thirds of physicians believed that mammography (65%) and Papanicolaou smears (75%) are very effective in early detection of cancer. Only about one half (52%) believed that stool occult blood testing is very effective, and few (15%) believed clinical breast examinations were very effective.

Current practice characteristics. Slightly more than

Table 1. Physicians (N = 40) Who Agreed with Attitudinal Statements About Prevention

Attitude	Strongly Agree (%)	Somewhat Agree (%)
For some patients, a periodic program of prevention could have significant consequences	85	13
Physicians have a right to urge patients to have screening	80	15
Educating patients is a challenging and enjoyable part of my practice	63	35
More formal instruction on preventive medicine should be required in medical school	55	43
Not receiving appropriate preventive care is dangerous to one's health	48	45
Lack of insurance reimbursement is one of the major obstacles to the practice of preventive medicine	40	45
Physicians should spend more of their time providing preventive services to their patients	38	58
Patients are interested in receiving preventive care	33	63
It is difficult to practice preventive medicine	5	38

one half of the physicians (55%) were in solo practice. Patient office hours ranged from 20 to 50 hours per week, with a mean of 31.8 ± 2.6 hours (95% confidence interval [CI]). Two thirds (65%) scheduled more than 15% of patient visits for preventive care activities, and about two thirds (63%) said they spent 10 minutes or more on patient education during preventive check-ups.

Other professional activities. About two thirds of the physicians had had preventive medicine training in medical school or had taken a continuing medical education (CME) course in preventive medicine. Overall, they reported completing a median of 50 hours of CME in the previous year, and attending three CME meetings in the last 3 years. On average, they read three medical journals regularly.

Medical record audits. Physicians' screening performance scores varied considerably across tests. The followings were the mean rates of compliance (and standard deviations) with ACS and NCI standards: stool occult blood tests, 32% (16%); rectal examination, 38% (16%); sigmoidoscopy, 26% (34%); Papanicolaou smear, 112% (45%); pelvic examination, 43% (14%); breast examination, 49% (17%); and mammography, 29% (14%).

Multiple Regression Analysis

There was substantial variance in performance among physicians. In the multiple regression analyses that included only sociodemographic and personal health behavior variables, only sex explained a significant portion of this variance (two screening tests).

Among 24 attitude and belief items, only four were related to higher screening performance rates: (1) lack of prevention can be dangerous, (2) patients are skeptical about new preventive medicine practices, (3) three or more of the following are very effective: stool occult blood test, sigmoidoscopy, Papanicolaou smear, breast examination, and mammography, and (4) I could have personally prevented a death or major illness from cancer.

Of eight practice characteristics, only two contributed to screening performance scores: (1) for Papanicolaou smear and pelvic examination, being in family medicine practice rather than internal medicine practice, and (2) for four tests (Papanicolaou smear, pelvic and breast examinations, and mammography), the percentage of patient visits scheduled for preventive care.

Five of seven professional activity variables were related to screening performance, and two of these were related to more than one screening test score: the number of professional journals that physicians read regularly (four test scores), and primary care courses taken in medical school (two test scores).

Effects of physicians' characteristics on cancer screening performance

The best predictors of each performance score are presented in Table 2. From 15% to 33% of the variance in test performance scores was explained by one to four variables. However, no single variable made a significant contribution to every equation.

The best predictors of colorectal screening were the number of medical journals physicians read regularly, the belief that lack of preventive care is dangerous to one's health, and physicians' satisfaction with sigmoidoscopy training.

For Papanicolaou smear screening, the strongest predictors were physicians' sex and having taken primary care courses in medical school. The number of medical journals read was again an important factor. For pelvic examination, belief in patients' skepticism, and being in family practice were the strongest predictors.

For breast screening, the best direct predictors were the percentage of visits scheduled for prevention and the belief that patients are skeptical about new preventive practices.

The percentage of visits scheduled for preventive

Table 2. Best Predictors of Physicians' Cancer Screening Performance Using Multiple Regression Analysis

Predictors	Stool Occult Blood *b(P)	Rectal Examination b(P)	Sigmoidoscopy b(P)	Papanicolaou Smear b(P)	Pelvic Examination b(P)	Breast Examination b(P)	Mammography b(P)
Demographic							
Sex (female)	—	—	—	31.7 (<.05)	—	—	—
Attitudes and beliefs							
Lack of prevention dangerous	—	12.6 (<.01)	—	—	—	—	—
Could have prevented illness or death	—	-10.7 (<0.5)	—	—	—	—	—
Very satisfied with sigmoidoscopy training	—	—	20.8 (<.05)	—	—	—	—
Believe patients skeptical	—	—	—	—	11.2 (<.01)	—	10.9 (<.01)
Belief in screening effectiveness (summary)	—	—	—	—	8.1 (<.05)	—	—
Current practice							
Visits for prevention (%)	—	—	—	—	0.3 (<.05)	0.4 (<.05)	0.3 (<.02)
Family practice	—	—	—	—	11.8 (<.02)	—	—
Other professional activities							
Medical journals (N)	3.5 (<.01)	—	6.6 (<.01)	9.3 (<.02)	—	—	—
Primary care course in medical school	—	—	—	37.6 (<.02)	—	—	—
CME meetings (N)	—	—	—	-6.8 (<.05)	—	—	—
Constant (intercept)	19.8 (<.001)	37.2 (<.001)	-9.6 (<.35)	94.7 (<.001)	18.9 (<.01)	40.9 (<.001)	17.6 (<.001)
Adjusted R ₂	.15	.21	.21	.33	.33	.25	.26

*b—unstandardized coefficient; (P)—probability level.

care and the number of medical journals physicians read were predominant predictors in that they each made significant contributions in three equations. However, sex (female physicians) was highly correlated with the percentage of visits for prevention ($r = 0.63$; $P < .001$). Thus, sex not only had a direct effect on Papanicolaou smear scores, but also had an indirect effect (through the intervening variable, percentage of preventive-care visits) on pelvic examination, breast examination, and mammography scores (the three tests positively associated with scheduling prevention visits).

Clinical Significance

The clinical significance of the findings may best be understood by examining the differences between the mean performance scores of one subgroup of physicians and those of the counterpart group. Table 3 presents

such comparisons for the three major predictors, as follows: (1) male vs female physicians, (2) low (<5) vs high (≥ 5) volume readers of medical journals, and (3) physicians with small (<15) vs large (≥ 15) percentages of patient visits devoted primarily to preventive care. The average difference in mean performance scores between groups is 16.0 points, and the better score in each comparison is, on average, 26.3% higher than the poorer score.

Discussion

The first purpose of this analysis was to identify physician and practice characteristics that might improve the specificity and predictive value of prevention models. The predominant predictors of physicians' screening performance were the number of medical journals physicians read on a regular basis, the percentage of visits they

Table 3. Mean Compliance Scores, by Physicians' Sex, Number of Medical Journals, and Percentage of Prevention Visits

Screening Procedure	Sex		Number of Journals Read		Visits for Prevention	
	Male	Female	0-4	5-10	<15%	>15%
Stool occult blood test	—	—	29.3	40.5	—	—
Sigmoidoscopy	—	—	19.4	30.2	—	—
Papanicolaou smear	97.9	138.1	102.4	116.1	—	—
Pelvic examination	—	—	—	—	34.3	47.7
Breast examination	—	—	—	—	39.4	54.1
Mammography	—	—	—	—	24.2	31.9

scheduled for preventive care, and the physician's sex. Other important factors suggested by the analysis are physicians' strong commitments to prevention, and their satisfaction with their training in potentially risky technical procedures, such as sigmoidoscopy.

Several physician characteristics that one might expect to influence screening are: the recommendations they make for the frequency of checkups, the belief that preventive medicine is as interesting as diagnosis and treatment, the time spent educating patients, and CME experience. All of these failed to predict screening performance scores, either directly or indirectly. Moreover, although some respondents mentioned that their experience with cancer in patients or family members was a powerful motivator for screening, these statements were not supported by the data.

The second purpose of the research was to determine if the findings suggested new hypotheses to be tested on larger populations. While journal reading, scheduling of preventive care visits, and physician sex may simply be discrete factors of influence, our analyses and review of the literature suggest these characteristics may be indicators of broader conceptual spheres of influence.

For example, Battista found that involvement in research had a positive effect on practice of preventive care. He suggests that this involvement may be an indicator of physicians' level of knowledge, or that research interests may reflect attitudes regarding the nature of the physician's role and the practice of medicine.¹³ The number of medical journals physicians read on a regular basis may also reflect their medical knowledge (although the temporal sequence of these variables remains an empirical question). Alternatively, extensive journal reading may reflect particular role perceptions and attitudes regarding professional motivation and goals.

Drawing on the work of Green and others, we have categorized *role perception* as a "physician predisposing

factor" and *knowledge* as a "physician enabling factor" of screening performance.²⁰ That journal reading was a strong predictor of screening in this study raises a question: which of the two factors, predisposing or enabling, was the salient predictor? Using multiple indicators of each concept, it is possible to frame a series of hypotheses for testing and comparing the relative effects of role perceptions and knowledge. The outcomes will help to choose between emphases when designing interventions to increase cancer screening performance (eg, should the intervention focus on professional role orientation or on education regarding the efficacy of screening?).

Organizational factors have been found to be associated with preventive practices.¹³ Thus, the percentage of visits scheduled for prevention could be an outcome of more general structural or organizational factors. We found no significant correlation, however, between the percentage of visits scheduled for preventive care and any of the following: the number of hours physicians see patients ($r = .18$), type of practice (solo vs group, $r = -.11$), or presence of a nurse practitioner ($r = -.15$).

Instead, we found that sex was highly associated with preventive care visits. Female physicians scheduled a far higher percentage of visits for prevention than did male physicians (42% vs 17%, $P < .001$), a finding in accord with other evidence of greater preventive care and patient orientation among female physicians.¹⁵ This finding, coupled with the finding that the percentage of prevention visits made significant contributions only in the equations for breast and cervical cancer screening, suggests several contextual meanings of physician's sex.

The physician's sex may be relevant to preventive care because it is easier to accomplish breast and cervical cancer screening with sex concordance between physician and patient.²¹ Female physicians may be more attentive to preventive care because of their perceived personal susceptibility to cancer or because of their involvement in women's health issues. Yet another explanation may be

that female physicians reject some traditional assumptions. Traditionally, many male physicians have not approached doctor-patient relationships from the standpoint of collaboration, but rather from the position of one who enjoys and expects considerable autonomy and power in his professional role. But cancer screening requires physician-patient interaction and collaboration.⁸ Women physicians may be more willing to enter into this kind of collaborative doctor-patient situation. In fact, a recent study found that among physicians in fee-for-service practice, women were more likely than men to value the psychosocial factors of patient care, health counseling, and patient education.¹⁵ Also, results from the National Ambulatory Care Survey show that female physicians spend more time than male physicians spend with their patients (an average of 17 minutes vs 13 minutes per visit).²² Whether sex reflected subjective attitudes, sex concordance, or role perceptions is a critical question, since change or accommodation may be more difficult in one area than in another. Again, for each concept there are many possible indicators; thus, several hypotheses can be developed to test and compare the influence of each.

There were several limitations to this study; hence, some caution should be taken in interpreting the results. First, the physician subjects were not randomly selected, and the sample was small. Because of self-selection, subjects might perform more screening than other physicians and therefore not be representative of a larger population. Nevertheless, although the overall screening rates in our sample were not exceptional, we do not claim that the descriptive statistics are representative of a larger population. Rather, we have focused on explaining the considerable variance within the sample as a means for generating useful new hypotheses. Because of sample size, type II errors may have masked actual differences among physicians. For example, some studies have shown differences in practice behaviors between internal medicine and family practice physicians, while we detected such a difference only for performance of pelvic examination.²³⁻²⁶

Another limitation was that physicians may not reliably record data for pelvic, rectal, and breast examinations in their medical records. However, the rates of screening performance based on the medical records appear to be similar to national rates.²⁷

Third, we used cross-sectional data to measure physician characteristics and conducted retrospective chart reviews to obtain outcome data. Clearly, attitudes and beliefs could have changed during the 1-year medical-record-review period, but we suspect physicians' professional views may be somewhat more stable than their views of more general matters, such as political issues.

Finally, in testing the significance of a large number of items, we realize that several findings may be statistically significant simply by chance alone. Because of the risk of chance associations, we focused our analysis on variables that were significant for more than one screening test.

Despite these limitations, this study is one of very few to use medical records rather than physician self-reports as the source of screening test performance data, and then to examine the relationship between these data and physicians' personal and professional characteristics.⁵ The analysis identified a small group of predictors that explain relatively large proportions of the variance in cancer screening performance. The findings raise provocative theoretical issues and suggest three specific questions for future research: (1) Do physicians' predispositions (eg, role perceptions) have a greater influence on physicians' cancer screening performance than enabling factors (eg, knowledge of screening recommendations and screening efficacy)? (2) Do factors other than sex influence the percentage of visits that are scheduled for preventive care? and (3) Why do female physicians schedule more visits for preventive care than male physicians and, consequently, do more cervical and breast cancer screening? Answers to questions such as these are needed to determine the appropriate focus of interventions for promoting physicians' cancer screening performance.

Acknowledgment

This research was supported by grant SRC(68) 5 R01 CA46020 from the National Cancer Institute, Department of Health and Human Services.

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