Physician Compliance With Mammography Guidelines: Barriers And Enhancers

Mary E. Costanza, M.D., Anne M. Stoddard, Sc.D., Jane G. Zapka, Sc.D., Victoria P. Gaw, M.A., R.N., and Robin Barth, M.Ed.

Abstract: ***Background:*** **Primary care physicians are increasingly the gatekeepers to clinical preventive services including mammography utilization. Moreover, lack of physician recommendation is a major reason for patient failure to obtain screening. A study was designed to examine the attitudes, beliefs, and practices with regard to breast cancer screening as self-reported by primary care physicians. The variables associated with compliance or lack of compliance with screening guidelines are emphasized.**

Methods: **One hundred sixteen primary care physicians practicing in two New England communities responded to a mailed survey. The survey included questions on attitudes and beliefs about breast cancer screening, as well as questions about perceived barriers and actual screening practices.**

Results: **Fifty-seven percent of the respondents reported ordering annual mammograms for their female patients aged 50 to 75 years. An additional 21 percent reported ordering biannual mammograms for women in this age group. Strongly associated with ordering annual mammograms were beliefs in the benefits of mammography and the perception of community consensus regarding breast cancer screening. A strong positive association of practicing in a group setting and mammography guideline compliance was documented. Middle-aged physicians in solo practice reported the poorest screening compliance.**

Conclusions: **The level of physician compliance with the standard of annual mammography screening is low (57 percent). The three most important determinants of annual screening suggest ways to improve physician compliance: improve physician attitudes about the benefits of mammography, build further on the medical community's consensus regarding the appropriateness and importance of the annual guidelines, target the poorest compliers with special messages or programs. (J Am Board Fam Pract 1992; 5:143-52.)**

Breast cancer will affect 1 in 9 American women and is the second leading cause of cancer mortality among women.[1] Regular mammography can lead to a significant decrease in breast cancer mortality among women aged 50 years and older.[2-4] Despite national guidelines recommending annual mammography for women aged 50 years and older,[5] surveys show a majority of physicians do not recommend regular mammograms for their patients, and the majority of women are not receiving them. In 1984 only 11 percent of Los Angeles area physicians reported compliance with screening guidelines.[6] By 1987 between 48 percent and 70 percent of physicians surveyed in four regions of the country reported ordering annual mammograms.[7-10] By contrast, in the same year only 29 percent of women aged 50 and older reported that they had had a screening mammogram within the last year.[11]

In two national surveys (1984, 1989) by the American Cancer Society (ACS)[12,13] it was found that physician compliance with ACS mammography guidelines for women aged 40 to 49 years had risen from 11 percent to 37 percent. Thus while the national trend is positive, there is still a majority of physicians who do not follow mammography guidelines.

The more common reasons physicians state for failing to follow the mammography guidelines include patient resistance,[6,8,10,14,15] cost to the patient,[6-8,10,12,15] exposure to unnecessary radiation,[10,12] reliability of the test,[12] equivocal reports,[7-9] and low yield.[6,12] At the same time, studies of women's experiences, beliefs, and opinions show the importance of physicians' advocacy for mammography. Women are reported to be more likely to have mammography if they per-

Submitted, revised, 2 October 1991.

From the Department of Medicine, University of Massachusetts Medical School, Worcester, and School of Public Health, University of Massachusetts, Amherst. Address reprint requests to Mary E. Costanza, M.D., Department of Medicine, University of Massachusetts Medical Center, 55 Lake Avenue North, Worcester, MA 01655.

ceive their physician strongly recommends the examination.[7,8,16-20]

Primary care physicians increasingly function as gatekeepers to care. A majority of mammography facilities require a physician's referral. Such policies can hinder access to mammography if primary care physicians do not routinely refer for screening. Additionally, physicians should proactively recommend screening because most women who have never had a mammogram do not believe they need one[7,8,16-20] or have not had a mammogram recommended by the physician. On the other hand, 83 percent of all women have responded they were very sure they would get a mammogram in the next year if their physician recommended it.[19] Clearly, there is a need to identify factors related to physician compliance with mammography guidelines so that methods can be developed to improve compliance.

The study reported here is part of a project funded by the National Cancer Institute (NCI) undertaken by a consortium of six investigator groups. The project consisted of a series of community interventions aimed at improving the quantity and quality of screening for breast cancer. At the time this study was undertaken (1987), the influential guidelines for breast cancer screening were those of the NCI and the ACS, who recommended annual clinical breast examination and annual mammography of women aged 50 years and older. Our study has been based on the preintervention survey of primary care physicians.

The purpose of this report is to characterize attitudes, beliefs, and screening practices of primary care physicians regarding breast cancer and to describe variables that are associated with physician compliance with screening guidelines for women aged 50 to 75 years. Implications for developing strategies to improve physician compliance with the guidelines are discussed.

Methods

In 1987 surveys were mailed to 189 primary care physicians in two Northeastern urban areas comprising six towns. All primary care internists, family or general practitioners, and gynecologists with staff privileges at one or more of the five local hospitals in the geographic area were included. Questionnaires were mailed with a letter of introduction and a postage-paid return envelope. All physicians were sent $5 in the first mailing as an incentive to participate. Up to two follow-up mailings were sent to nonrespondents. Those not responding after the third mailing received a telephone reminder. A 61 percent response rate was achieved, yielding a sample of 116 physicians.

To understand better physician screening behavior, we conceptualized survey questions according to a framework adapted from Aday and Anderson[21] and Green, et al.[22] The framework identifies predisposing, enabling, and reinforcing factors that affect behavior. Predisposing factors are those social and psychological forces that motivate an individual, including knowledge, attitudes, and beliefs. Enabling factors refer to the availability and accessibility of specific resources and skills that enhance or inhibit a certain action. Reinforcing factors are related to colleagues, patients, and other significant persons who encourage or discourage certain activities. Our analysis focused on several predisposing factors suggested by the Health Belief Model,[23] notably perceived barriers to and benefits of screening, elements of social learning theory,[24] such as practice experience, and the reinforcing factor of perceived social norms.

The dependent variable in the study was the annual mammography screening interval for women aged 50 years and older. Independent variables were beliefs and attitudes related to screening frequency of breast cancer experience in practice in addition to physician characteristics.

Screening-related beliefs and attitudes were explored by single items and by summary variables. Single items, rated on a 7-point Likert-type scale (strongly disagree to strongly agree), included the following: (1) attitude toward the benefit of screening mammography (whether mammography can reduce mortality), (2) attitude toward self-referral (whether it is appropriate for women to request mammography), and (3) acknowledgment of reinforcing factors (whether community or national consensus regarding screening intervals exists). Physicians were asked about factors that might hinder or enhance their ordering screening. Respondents were asked to rate on a 7-point scale how much certain factors affected their ordering screening mammograms (1 = affects not at all, 7 = affects ordering a great deal). There were nine such single items, which included concern about radiation exposure, patient discomfort, difficulty in interpreting equivocal radiology reports, and patient at low risk.

Other single items asked about the frequency with which certain events had occurred in the physician's practice in the last year, such as having a patient with breast cancer, having a patient with breast cancer discovered by mammography, and having a patient request mammography.

Three summary variables relating to physician attitudes and beliefs about mammography also were created for analysis. The construction of the variables was determined by the theoretical models and confirmed through factor analysis.[25] The resulting variables were the unweighted sum of the items that weighted most heavily in the corresponding factors. Scores on negatively worded items were reversed. Interitem reliability was assessed by Cronbach's alpha. (Details of this analysis are available from the authors.)

The variable "mammography barriers" included responses to nine items regarding concerns about price, cost to the patient, patient pain, radiation exposure, difficulty in mammogram interpretation, equivocal mammography reports, unnecessary biopsies, and patient at low risk for breast cancer. This scale had a reliability coefficient of 0.84, indicating good interitem reliability. The variable "mammography benefits" was computed from scores reflecting agreement with three items: that mammography reduces mortality, that mammography improves breast cancer prognosis, and that ordering mammography protects physicians legally. Cronbach's alpha for this scale was 0.69, indicating adequate reliability. The variable "norm perceptions" consisted of responses to four items: physicians' perceptions of whether there was a community consensus regarding screening guidelines, their belief about the proportion of primary care physicians who order regular screening mammograms, their agreement that expert guidelines about breast physical examinations are helpful, and their agreement that expert guidelines regarding mammography are helpful. This scale had adequate reliability, with Cronbach's alpha equal to 0.63.

A fourth summary variable, "negative mammography experience," comprised three items about the physicians' experience in receiving an inappropriately ambiguous mammography report, spending a long time explaining mammography results, and patient resistance to mammography. A high value on this scale reflected more of these negative experiences.

Data were obtained on physician characteristics for year of graduation, sex, specialty, practice setting, and health maintenance organization or independent practice association (HMO or IPA) affiliation. The relations among physicians' demographic characteristics, attitudes, beliefs and their self-reported screening practices were assessed to determine what factors, if any, were significantly associated. Associations between screening interval and categorical variables were evaluated with the chi-square test of homogeneity. Differences in means were tested with the one-way analysis of variance.

Multiple logistic regression analysis was used to evaluate associations with screening practices.[26] Self-reported screening interval was collapsed to two categories, annual and all other intervals, and regressed on the potential explanatory variables. A model was fit with all variables that were significantly associated with screening practices bivariately. The remaining variables were then considered in a stepwise manner to see whether they were significantly associated with screening interval after the initial set of variables was controlled. A variable was added to the equation if the *P* value for the F-to-enter was 0.05 or less. This method was used to investigate the independence of the associations identified in the bivariate analysis rather than to estimate a definitive model to explain physician screening behavior.

Results

There were 116 respondents, a response rate of 61 percent. Because of missing answers on individual items, some analyses were based on 114 physicians.

Adherence to Guidelines

The majority of physicians (93 percent) reported following NCI or ACS guidelines by performing annual clinical breast examinations. When asked to describe their practice of ordering screening mammograms for women aged 50 to 75 years, only 57 percent of physicians reported ordering annual mammograms. An additional 22 percent reported ordering them biannually.

Beliefs and Attitudes about Mammography

There was strong agreement that breast cancer warrants screening, that screening mammograms improve prognosis, that physicians should initiate

a discussion of breast cancer screening, and that expert guidelines are helpful (Table 1).

Table 2 presents responses (those checking 6 or 7 on a 7-point scale) to the nine individual items that made up the summary variable "mammography barriers." Thirty percent of physicians reported that cost to patients because of lack of insurance would affect their ordering a great deal. A smaller percentage of physicians reported that difficulty interpreting equivocal mammography reports and that the possibility of unnecessary biopsies would affect their ordering practices a great deal (7 and 4 percent, respectively).

Variables Associated with Reported Compliance

Table 3 shows the relations between cancer-related events in physicians' practices in the last year and their beliefs in relation to their self-reported mammography screening practices. The numbers given represent mean scores for the selected variables. The footnotes explain the meaning of a lower score. There is a strong association between having a breast cancer patient or finding a breast cancer by mammography and annual ordering of mammography. The strongest association is that physicians who reported ordering annual mammograms had the strongest beliefs in mammography benefits. In addition, physicians who agreed most strongly in the presence of and benefit of screening norms were significantly more likely to recommend annual screening. Finally, physicians who perceived the fewest mammography barriers were more likely to order annual mammography.

Table 1. Physician Attitudes and Beliefs for Selected Variables about Breast Cancer Screening (n = 116).

Variables	Very Strongly Agree or Strongly Agree* (Percent)
Breast cancer is common enough to warrant screening	85
Screening mammograms improve prognosis in women aged 50 years and older	69
Physicians should initiate discussion of breast cancer screening with patients	63
Recommendations about mammography screening by "expert groups" are helpful	56
Ordering mammograms protects me legally	41
Women should be allowed to self-refer for screening mammograms	40

*Ranking 1 or 2 on a 7-point scale.

Table 2. Physician Attitudes and Beliefs about Individual Items that Comprise "Mammography Barriers" (n = 116).

Mammography Barriers	Affects Ordering a Great Deal* (Percent)
Financial cost to patient because of lack of insurance coverage	30
High price of mammography	14
Difficulty in interpreting equivocal radiology reports	7
Patient at low risk	5
Possibility of unnecessary biopsies	4
Patient discomfort or pain	3
Not cost effective	3
Concern about unnecessary radiation exposure	2
Too much time and effort in discussing mammography	2

*Ranking 6 or 7 on a 7-point scale.

Demographic Factors Associated with Compliance

Table 4 shows a clear relation between type of practice and mammography ordering, with physicians in group practice significantly more likely to report annual screening. No other physician characteristic was significantly related to mammography utilization.

There was, however, a dramatic shift from individual to group practice in the youngest graduates (1977–1983), with 76 percent in group practice compared with 36 to 39 percent for the two older cohorts. Annual mammography ordering was the highest in the two most recent groups of graduates in group practice (data not shown).

Additional analysis (data not shown) found that perceived mammography barriers and benefits, as well as physician experience detecting a patient's breast cancer by mammography, were not related to practice type, specialty, or year of graduation from medical school.

Multivariate Analysis

As described above, multiple logistic regression analysis was used to explore further the associations with screening practice. Screening behavior was collapsed to two categories: annual screening and all other intervals. The independent variables included in the first equation were those significantly associated with screening in bivariate analysis: practice type, perceived benefits of mammography, perceived barriers to mammography, norm perceptions, and the experience of finding a breast cancer with

Table 3. Physician Attitudes and Beliefs for Selected Variables Associated with Self-Reported Mammography Screening for Women Aged 50 to 74 Years (n = 114).

Variables	Range	Screening Interval (Mean Scores)			*P* Value
		Annual (n = 65)	Every 2 Yrs. (n = 25)	Other (n = 24)	
Practice Experience					
Patient requests mammogram	0–1*	0.48	0.52	0.43	0.84
Found a breast cancer with mammography	0–1*	0.80	0.88	0.57	0.02
Has a breast cancer patient	0–1*	0.88	0.96	0.91	0.05
Screening Beliefs					
Doctor to initiate	1–7†	2.12	2.40	1.92	0.36
Women should self-refer	1–7†	3.78	3.67	3.72	0.72
Breast cancer is common enough to screen	1–7†	1.40	1.96	1.71	0.07
Scaled Experience and Beliefs					
Mammography barriers‡	9–63	21.50	26.84	24.59	0.04
Negative mammography experience§	4–12	6.85	7.40	6.09	0.11
Mammography benefits‖	3–21	6.30	8.46	9.32	0.0001
Normal perceptions‖	4–20	7.94	9.90	10.38	0.002

*0 = no; 1 = yes.
†1 = strongly agree; 7 = strongly disagree.
‡Low score indicates lesser agreement with the construct.
§Low score indicates least amount of negative experience.
‖Low score indicates greater agreement with the construct.

mammography. Because year of medical school graduation was associated with practice type, we also included that variable and its interaction with practice type. All other variables were considered for inclusion in the model in a stepwise fashion. The final equation results are displayed in Table 5.

Greater perception of mammogram benefits and greater perception of screening norms remained significantly associated with annual screening in the multivariate analysis. Perceived barriers and positive experience were no longer statistically significant when other variables were controlled. We found a significant association of practice type and year of graduation with screening practice. For physicians who graduated between 1966 and 1976, those in group practice were significantly more likely to order annual mammograms, and those in individual practice were significantly less likely to order annual mammograms than other physicians. Of the omitted variables, only HMO or IPA affiliation was significantly associated with mammogram screening after the above variables were controlled. Physicians with HMO or IPA affiliation were more likely to order annual mammograms than physi-

Table 4. Physician Demographics Associated with Self-Reported Mammography Screening Interval for Women Aged 50 to 74 Years (n = 114).

Demographics	Total No. (%)	Screening Interval			*P* Value
		Annual No. (%)	Every 2 Yrs. No. (%)	Other No. (%)	
Year graduated					0.13
1941–1965	39 (34)	24 (62)	8 (21)	7 (18)	
1966–1976	35 (31)	15 (42)	12 (33)	9 (25)	
1977–1983	40 (35)	26 (65)	5 (12)	9 (23)	
Sex					0.37
Men	93 (82)	55 (59)	18 (19)	20 (22)	
Women	21 (18)	10 (48)	7 (33)	4 (19)	
Specialty					0.83
Internal medicine	60 (53)	32 (53)	15 (26)	13 (22)	
General or family practice	28 (24)	18 (64)	4 (14)	6 (21)	
Gynecology	26 (23)	15 (58)	6 (23)	5 (19)	
Practice settings					0.04
Individual or solo	58 (51)	26 (45)	18 (31)	4 (24)	
Group or clinic	56 (49)	39 (70)	7 (13)	10 (18)	
Health maintenance organization or independent practice association					0.33
Yes	81 (71)	50 (62)	15 (19)	7 (20)	
No	33 (29)	16 (49)	10 (30)	7 (21)	

Table 5. Results of Multiple Logistic Regression Analysis on Physician Self-Reported Screening Behavior (n = 88).

Variables	Coefficient	Standard Error	*P* Value
Year of graduation			
1966–1976	−2.27	1.13	0.05
1977–1983	0.38	1.36	0.78
Group practice interaction	−0.94	1.13	0.41
1966–1976 graduates	5.07	1.66	0.002
1977–1983 graduates	1.91	1.68	0.25
Barriers	−0.02	0.04	0.58
Benefits	−0.47	0.13	0.0006
Norm perceptions	−0.32	0.12	0.007
Found cancer	0.33	0.80	0.67
Health maintenance organization or independent practice association	2.07	0.83	0.01
Constant	7.60	1.99	

Note: Hosmer-Lemeshow goodness-of-fit $\chi^2 = 10.6$, $df = 8$, $P = 0.22$.

cians without such an affiliation even when practice type and year of graduation were controlled.

Discussion

Limitations of the Study

Several limitations of this study should be kept in mind while interpreting the results. As with many physician behavior studies, this study relies on self-report data. We suspect that physicians tend to overreport screening practices. Women, on the other hand, appear to be more accurate when reporting mammography experiences.[27]

Our 1987 companion random digit dial telephone survey of 1164 women from the same geographic area has provided evidence about physician overreporting. In that survey, 63 percent of women between 50 and 65 years of age and 45 percent of women aged 65 to 75 years reported that their physician had ever advised them to have a mammogram. The two most common reasons given by women for never having had a mammogram were that they did not know they needed it and that their physician never suggested it.[19,20] In our 1989 survey of the same community, only 45 percent of women had had a minimum of two mammograms in their lifetime, and only 20 percent had had a minimum of two annual mammograms.[28] This fact makes it difficult to accept physician reports at face value.

Another limitation is the response rate. The only information available on nonresponders is that of specialty. Seventy-five percent of general practitioners and family physicians returned surveys, as did 83 percent of the obstetricians and gynecologists and 64 percent of the internal medicine physicians. Only 46 percent of the internal medicine-subspecialty physicians responded. Perhaps many in this latter group do not see women for general primary care. It is difficult to estimate nonresponse bias in the data from this profile.

Compliance

Keeping in mind the limitation of self-reported physician behavior, our study does indicate a level of screening practice that is more compliant with annual screening guidelines when compared with results from previous studies.[6-9,12,13]

Our emphasis on an annual mammography interval for women aged 50 years old and older is based on the recommendation of the NCI and the ACS. At the time our survey was conducted (1987), the accepted guidelines for complete breast examination and mammography were those of the NCI and ACS. In 1989, 2 years after this study was undertaken, the US Preventive Health Task Force[29] published their recommendations for annual complete breast examination and annual or biannual mammography for women aged 50 years and more.

In 1991, the goals published in *Healthy People 2000*[30] were for the nation to achieve biannual complete breast examination and mammography in at least 60 percent of women aged 50 years and older. At first glance, it appears that our physician group was exceeding that goal in 1987; however, we believe there was substantial physician overreporting. Our 1989 women's survey indicated that only 45 percent have had more than one mammogram in their lifetime.[28]

Major Determinants of Ordering Mammography

Table 3 shows the relation of various individual and summary variables with self-reported mammography ordering. Significant findings include

physician experience with breast cancer, having found a breast cancer by mammography, or having a patient with breast cancer. Among the summary variables, the most significant determinant of annual mammography ordering was a positive view about the mammography benefits. Physicians who had intermediate views about mammography benefit were more likely to order mammograms biannually. Positive belief in norms was associated with the annual screening. Again, an intermediate view was associated with biannual screening. These factors remained significant in the multivariate analysis. Whereas there was a significant negative association in the bivariate analysis between the perception of mammography barriers and annual ordering, this significance was not found in the multivariate analysis. Because we do not know whether there is a causal link between the mammography benefit and barrier variables or whether they overlap and measure the same thing, we would do well to continue education efforts to improve physician attitudes regarding mammography benefits and work toward decreasing those issues that lead to increased perception of barriers.

Compliance and Physician Characteristics

We examined the associations of sex, year of graduation, practice setting, and practice specialty with mammography utilization (Table 4). The only significant association was with practice setting. We found a positive association between group practice setting and compliance with screening guidelines, a finding previously reported by Bassett, et al.[6] This study does not confirm the positive association between younger age of physician and compliance with screening guidelines reported by Bassett, et al. Our present study has not supported the findings of others that women physicians[15] or gynecologists are more likely to order screening mammograms.[6,8,10] Although this study shows a nonsignificant trend in performance of gynecologists, our women's survey did find that having a gynecologist as a primary care provider was significantly associated with having more mammograms.[19]

Because a particular type of primary care physician may influence mammography ordering, and because practice type and year of graduation may be related to payment mechanisms, such as HMO or IPA, logistic regression analysis was performed. This analysis provided insight into the interrelations among physician attitudes, beliefs, practice characteristics, and mammography ordering. Once controlling for differences in mammography benefits and mammography barriers (variables that were associated with mammography utilization), three practice or physician characteristics were now significantly associated with mammography utilization: type of practice setting, HMO or IPA affiliation, and year of medical school graduation. We found that significantly lower mammography utilization was apparent among middle-aged physicians in solo practice. When we controlled for age and type of practice, physicians with HMO or IPA affiliation were more likely to order annual mammograms.

Implications for Intervention

Our results suggest a strategy to improve compliance among primary care physicians. Intervention could take three pathways: increasing compliance enhancers, decreasing compliance barriers, targeting certain physicians. We believe all three are potentially valuable approaches to improve mammography screening practices.

Compliance Enhancers

In our study, among the important enhancers of compliance were physician experiences with breast cancer (having had a patient's breast cancer discovered by mammography or having a patient with breast cancer). While we can do little to alter these experiences, the summary variable "mammography benefits" has components that do permit intervention. Two components (mammography improves breast cancer prognosis and decreases mortality) are the usual subjects of didactic teaching. The third component is the belief that ordering screening mammograms protects the physician legally. Forty-one percent of physicians in our sample were strongly concerned about the legal ramifications of screening (Table 1). Because they agreed strongly that ordering mammograms was legally protective, and this was positively related to mammography ordering, a new focus for continuing monitoring, research, and intervention can be suggested. Concerns about legal issues in medicine are growing given the current litigious climate and the escalating cost of malpractice insurance. An intervention

that helps physicians understand that legal vulnerability can be decreased by complying with national screening guidelines should in turn have a positive impact on their screening practices. Recent commentary has focused on the increasing interrelation of practice and the contemporary litigious environment.[31]

The summary variable "norm perception" also was significantly associated with annual screening. This variable comprised four individual variables, each of which can be addressed: the belief in a community consensus regarding guidelines, the helpfulness of expert recommendations about breast examination and about mammography, and the belief about the proportion of primary care physicians who order regular mammograms. The positive association between the belief that a community consensus regarding screening exists and screening practice is consistent with the previous reports that local professional opinion is one of the most important factors in physicians changing their practice behavior.[32] Reinforcing these strongly positive associations has the potential to improve physician ordering. For example, publicizing the recent endorsements of the screening guidelines by the American Academy of Family Physicians, the American College of Physicians, and the American Medical Association should improve screening practices. A related strategy would be to obtain cosponsorship of continuing medical education programs on breast cancer screening from state and local medical societies. Note that one-half of the physicians whom we surveyed already have positive attitudes about expert recommendation.

Compliance Barriers

In this survey, the summary variable "mammography barriers" was negatively associated with annual ordering. Among the constituent variables of mammography barriers was cost to the patient. This finding is interesting because in our women's survey[19] and in the experience of others,[20] cost was not reported as a major barrier for women themselves. It might well be that physicians responded to cost questions by imagining yearly costs. Because women in our accompanying survey had an average of fewer than two mammograms, we speculate that they could have been less aware of costs than had they had annual examinations. Recent data suggest that costs have now become a concern for women as well as for physicians.[33] Recently, several states have enacted legislation requiring insurance plans to pay for screening mammograms.[34] Medicare now pays up to $55 for biannual screening mammography in women aged 65 years and older. With these changes and the hope that the cost of screening mammography will decrease, cost could become a less-important factor in the future. Informing physicians of insurance coverage should decrease this barrier component.

Items that appeared infrequently (Table 2) (difficulty in interpreting equivocal reports, too many unnecessary biopsies, and radiation exposure) nevertheless are components of the mammography barriers variable. The significant negative impact of ambiguous mammography reports and unnecessary biopsies and radiation exposure on ordering mammograms should be addressed, as should concerns about the reliability and low yield of mammography. These concerns have been shown to be more common in other surveys.[6,14] Two strategies could be useful. One could be aimed at giving primary care physicians a realistic understanding of the strengths and limitations of screening mammography, such as the expected false-positive rate and biopsy experience at major mammography centers. The other could target radiologists to help them improve and clarify their recommendations for follow-up of abnormal or suggestive findings on mammograms, using, for example, continuing education programs featuring expert mammographers. These issues can be addressed in formal didactic sessions, through discussions with radiologists, and even by such techniques as academic detailing (the one-on-one targeting of a physician by a screening advocate).

Physician Targeting

While we cannot alter the demographic characteristics of physicians, we can target subgroups whose practice is least compliant. According to our analysis, practicing solo was associated with the poorest guideline compliance. We and others have found that the nature of group practice and organizational and insurance policies are important structural factors that positively enhance compliance with screening guidelines.[35,36] Efforts to improve physician performance therefore could be targeted to the middle group (middle-

aged) physicians who do not practice in group settings, since this group was least compliant in the multivariate analysis. Academic detailing is ideally suited for persons in this group. Another less-intense avenue for intervention might be to use general reinforcing factors, such as increasing peer pressure through grand rounds or departmental meetings or through publicizing national guidelines and standards of practice. Whatever the media, the message needs to be targeted to each middle-aged solo practitioner.

Summary

Our data suggest essential topics to be considered in public health and medical education efforts aimed at increasing regular breast cancer screening. These topics are best addressed through various channels and intervention strategies to reinforce messages and to help achieve a professional community norm that emphasizes the importance of screening.

We are grateful to Harry L. Greene, M.D., for comments on survey questions and to Diane Spotts, Nanda Setlur, and Leila Maul for assistance in data analysis.

References

1. Cancer facts and figures, 1989. Atlanta: American Cancer Society 1991:10.
2. Seidman H, Gelb SK, Silverberg E, Laverda N, Lubera JA. Survival experience in the Breast Cancer Detection Demonstration Project. CA 1987; 37: 258-90.
3. Shapiro S, Strax P, Venet W, Venet L, Roeser R. Ten-to fourteen-year effect of screening on breast cancer mortality. J Natl Cancer Inst 1982; 69:349-55.
4. Tabar L, Fagerberg CJ, Gad A, Baldetorp L, Holmberg LH, Grontoft O, et al. Reduction in mortality from breast cancer after mass screening with mammography. Randomised trial from the Breast Cancer Screening Working Group of the Swedish National Board of Health and Welfare. Lancet 1985; 1: 829-32.
5. Vanchieri C. Medical groups' message to women: if 40 or older, get regular mammograms. J Natl Cancer Inst 1989; 81:1126-8.
6. Bassett LW, Bunnell DH, Cerny JA, Gold RH. Screening mammography: referral practices of Los Angeles physicians. Am J Roentgenol 1986; 147:689-92.
7. Fox SA, Murata PJ, Stein JA. The impact of physician compliance on screening mammography for older women. Arch Intern Med 1991; 151:50-6.
8. Lane DS, Burg MA. Breast cancer screening. Changing physician practices and specialty variation. NY State J Med 1990; 90:288-92.
9. Rimer BK, Trock B, Balshem A, Engstrom PF, Rosan J, Lerman C. Breast screening practices among primary care physicians: reality and potential. J Am Board Fam Pract 1990; 3:26-34.
10. Slenker SE, Weright JW. A survey of physician beliefs and practices concerning routine mammography. Ohio Med 1988; 84:476-81.
11. Trends in screening mammograms for women 50 years of age or older—Behavioral Risk Factor Surveillance System, 1987. MMWR 1989; 38: 137-40.
12. Survey of physicians' attitudes and practices in early cancer detection. CA 1985; 35:197-213.
13. 1989 survey of physicians' attitude and practices in early cancer detection. CA 1990; 40:77-101.
14. Cummings KM, Funch DP, Mettlin C, Jennings E. Family physicians' beliefs about breast cancer screening by mammography. J Fam Pract 1983; 17:1029-34.
15. Ogle K, Myrick F. Screening mammography in a primary care setting. Fam Community Health 1990; 13(3):27-34.
16. Rimer BK, Davis SW, Engstrom PF, Myers RE, Rosan JR. Some reasons for compliance and noncompliance in a health maintenance organization breast cancer screening program. J Compliance Health Care 1988; 3:103-14.
17. Rimer BK, Keintz MK, Kessler HB, Engstrom PF, Rosan JR. Why women resist screening mammography: patient-related barriers. Radiology 1989; 172:243-6.
18. Slenker SE, Grant MC. Attitudes, beliefs, and knowledge about mammography among women over forty years of age. J Cancer Educ 1989; 4:61-5.
19. Zapka JG, Stoddard AM, Costanza ME, Greene HL. Breast cancer screening by mammography: utilization and associated factors. Am J Public Health 1989; 79:1499-502.
20. Screening mammography: a missed clinical opportunity? Results of the NCI Breast Cancer Screening Consortium and National Health Interview Survey Studies. JAMA 1990; 264:54-8.
21. Aday LA, Anderson R. A framework for the study of access to medical care. Health Serv Res 1974; 9: 208-20.
22. Green LW, Kreuter ME, Deeds SG, Partridge KB. Health education planning: a diagnostic approach. Pala Alto, CA: Mayfield Publishing, 1980.
23. Janz NK, Becker MH. The health belief model: a decade later. Health Educ Q 1984; 11:1-47.
24. Bandura A. Social foundations of thought and action: a social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall, 1986.
25. Carmines EG, Zeller RA. Reliability and validity assessment. Beverly Hills, CA: Sage, 1979.
26. Hosmer DW, Lemeshow S. Applied logistic regression. New York: John Wiley & Sons, 1989.

27. King ES, Rimer BK, Trock B, Balshem A, Engstrom P. How valid are mammography self-reports? Am J Public Health 1990; 80:1386-8.
28. Zapka JG, Stoddard A, Maul L, Costanza ME. Interval adherence to mammography screening guidelines. Med Care 1991; 29(8):697-707.
29. US Preventive Services Task Force. Guide to clinical preventive services: an assessment of the effectiveness of 169 interventions. Baltimore: Williams & Wilkins, 1989.
30. Healthy people 2000. National health promotion and disease prevention objectives. Washington, DC: Department of Health and Human Services, 1991. Public Health Service publication No. 91-50213.
31. Kapp MB. Cookbook medicine. A legal perspective. Arch Intern Med 1990; 150:496-500.
32. Geertsma RH, Parker RC Jr, Whitbourne SK. How physicians view the process of change in their practice behavior. J Med Educ 1982; 57: 752-61.
33. Use of mammography in the United States, 1990. MMWR 1990; 39:621,627-30.
34. Thompson GB, Kessler LG, Boss LP. Breast cancer screening legislation in the United States. Am J Public Health 1989; 79:1541-3.
35. Zapka JG, Stoddard A, Barth R, Costanza ME, Mas E. Breast cancer screening utilization by Latina community health center clients. Health Educ Res 1989; 4:461-8.
36. Shapiro S. From research on efficacy to implementation and evaluation of effectiveness. HMO Pract 1988; 2(4):166-76.