

Changes in Mammography Use: Economic, Need, and Service Factors

ABSTRACT

Objectives. The purpose of this study was to document changes in mammography use between 1987 and 1990 and assess the relationship of use to selected economic, need, and health system factors.

Methods. Independent random-digit-dialed telephone surveys of women between 52 and 75 years of age were conducted.

Results. Between 1987 and 1990, the proportion of women who had had a mammogram in the past year increased from 31% to 51%. Though income was significantly related to overall patterns of use, it was not associated with recent mammogram use in 1990. Women with a family history of breast cancer reported greater use at both times, as did women who reported having a regular physician (particularly a gynecologist or internist). When all other variables were controlled for, women were over nine times more likely to have had multiple and recent mammograms in 1990 than in 1987.

Conclusions. Mammography use dramatically increased between 1987 and 1990. There were strong relationships between the type of regular physician and mammography screening and between economic and personal history and repeated and recent mammography use. (*Am J Public Health.* 1992;82:1345-1351)

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Introduction

Breast cancer continues to be a prominent women's health problem, representing 28% of all female cancers.¹ Since reductions in mortality depend on increasing the adoption of early detection methods by physicians and by women, numerous professional organizations have endorsed screening guidelines for periodic clinical breast examinations and mammography.² If the Year 2000 Health Goals for the Nation are to be achieved, a better understanding of factors related to screening services use is needed.³

In this study we document changes in mammography utilization over a 3-year period and investigate the relationship of selected economic, need, and health system factors to mammography screening utilization to determine which subgroups of women are being screened.

Methods

Study Subjects and Data Collection

Independent random-digit-dialed surveys of English-speaking women between 52 and 75 years of age who had never had breast cancer were conducted in two Massachusetts urban areas comprising six towns. The surveys were conducted in the fall of 1987 (n = 929) and the fall of 1990 (n = 674) as part of a 3-year demonstration project, sponsored by the National Cancer Institute (NCI), designed to increase breast cancer screening.⁴ The study sample was drawn from the demonstration and comparison urban areas. The interviews, averaging 17 minutes in length, were conducted during day and evening hours, with a minimum of 10 call-backs at varying times. A refusal conversion call procedure was used, and response rates of 75.3% in 1987 and 73.9% in

1990 were achieved. The 52-year age minimum was based on professional guidelines recommending annual screening for women aged 50 years and older. Therefore, a 52-year-old woman could have adhered to the recommendation at least twice.

Study Variables

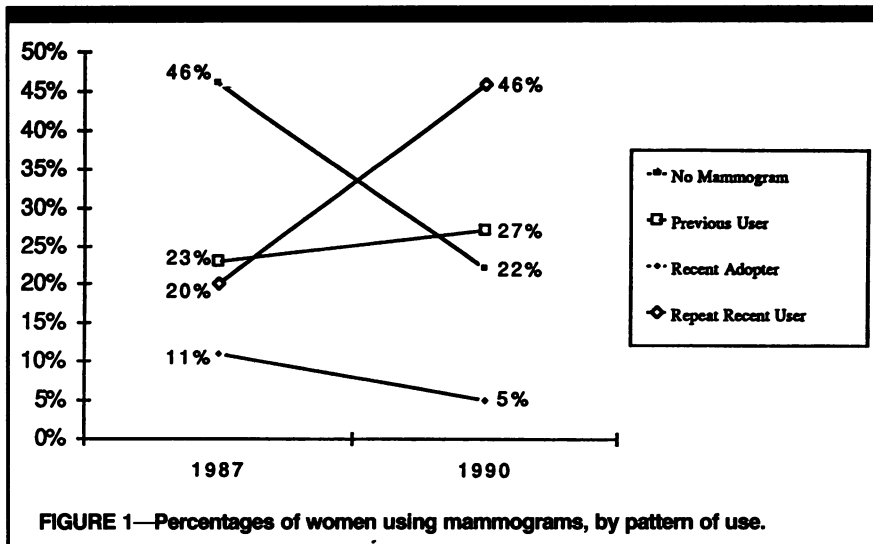
The dependent variable, mammography utilization, was defined with four categories: (1) no mammogram (never had one); (2) previous user (had had one or more mammograms, but none in the previous 12 months); (3) recent adopter (had had only one mammogram, which had occurred in the previous 12 months); and (4) repeat recent user (had had two or more mammograms, including one in the previous 12 months). This variable was designed to provide a better understanding of factors influencing periodic as well as recent utilization. For a subsequent analysis, the categories were collapsed (1 plus 2; 3 plus 4) to form a binary dependent variable, defined as having had a mammogram in the previous 12 months or not. Because of missing data, the 1987 and 1990 samples consisted of 838 and 601 women, respectively.

In the selection of study variables, which was guided by previous work,⁵⁻⁷ we focused on three groups of factors

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(economic, need, and health system enabling factors) and their relationships to screening. Economic factors included measures of income, education, and employment. Personal health need factors, such as family history of breast cancer, personal history of breast symptoms, and age, may influence use of screening by influencing women's personal perception of risk, their physicians' attention to screening recommendations, or both. Access to and interaction with health providers may facilitate or hinder mammography use. A physician's advice that a client obtain a mammogram was one health system enabling factor investigated in this study; others included having insurance coverage, having a regular physician, and having had a clinical breast exam in the past year.

Analysis

A univariate examination of the relationship between study variables and mammography use was performed for each survey. To better control for potential confounding, variables significant at the .15 level in either survey were selected as candidates for multivariate modeling. A polytomous logistic regression model was used to assess the joint effects of the variables.⁸ Likelihood ratio tests reduced the model to that subset of variables significant at the .10 alpha level in either survey. An indicator variable for city was included in all models to control for intervention effect. To check for possible shifts in effects between survey waves, a combined model was fit, and interactions between time and study variables were tested by means of likelihood ratio tests. None were significant at the 5% level. The adequacy of the poly-

tomous logistic regression model was assessed by applying logistic regression diagnostics to equivalent separate sample binary logistic regression models. In the second phase of the analysis, models employing the binary dependent variable (mammogram in the past 12 months or not) were fit to the data.

Results

Mammography Utilization

The pattern of mammography use was significantly related to study period ($\chi^2 = 151.2; P < .0001, df = 3$). The proportion of women who had had a mammogram in the past 12 months (the recent adopters plus the repeat recent users) increased from 31% in 1987 to 51% in 1990 (Figure 1); a corresponding decrease occurred in the proportion of women who had never had a mammogram, from 46% to 22%. Both shifts were statistically significant ($P < .0001$). The proportion of previous users increased from 23% to 27%; the proportion of recent adopters decreased from 11% to 5%; and the proportion of repeat recent users increased from 20% to 46%. Only the latter two shifts were statistically significant ($P \leq .0002$).

Relationship of Study Variables to Mammography Use

Economic variables. The relationship of employment status to screening use was of borderline significance in 1987, but not in 1990 (Table 1). In 1987, unemployed women were somewhat more likely to have never had a mammogram, whereas employed women were slightly more likely to be previous users. Education and income level were significantly

related to utilization at both times. Women with less than a high school education were most likely to have never had a mammogram, whereas college graduates were most likely to report the highest utilization in both surveys. Women with total household incomes of \$15 000 or less were most likely to have never had a mammogram and least likely to be previous users or recent users. More women in the lower income groups reported having had a recent mammogram in 1990 than in 1987, but their rates were still lower than those of high-income women.

Need variables. Women with a family history of breast cancer were significantly more likely to have had screening in 1987, but not in 1990 (Table 1). Women with a personal history of breast symptoms or problems were significantly more likely to be previous users and repeat recent users in both surveys. In 1987, women 65 years of age and older were more likely to have never had a mammogram, but were about as likely to have had one in the past year as younger women. By 1990, the two age groups had very similar patterns of use.

Health system enabling variables. In both 1987 and 1990, having either an internist or a gynecologist as a regular physician was related to ever having had a mammogram, as well as to being a repeat recent user (Table 1). In both surveys, women who reported being advised by a physician to have a mammogram had higher levels of use. Having had a recent clinical breast examination was significantly and consistently associated with ever having had a mammogram and with being a repeat recent user.

Insurance coverage was significantly related to mammography utilization at both times (Table 1). However, analyses of the relationship between insurance coverage and screening utilization should be interpreted with caution. Because some women had multiple sources of insurance, it was not possible to determine which plan actually provided coverage. In addition, coverage may change annually, so comparing mammography use over time with current coverage is of dubious validity. Therefore, we investigated the relationship of insurance coverage to mammogram use in the previous year (recent adopters and repeat recent users combined). Though this relationship was of borderline significance in 1987 and non-significant in 1990, certain trends are noteworthy (Figure 2). Women with no insurance were least likely to have had a mammogram in the past year in both 1987

TABLE 1—Percentage Distribution of Mammography Use for Study Variables for 1987 and 1990

	1987 (n = 838)					χ^2 P Value	1990 (n = 601)					χ^2 P Value
	No. No. (n = 385)	No Mammo- gram, % (n = 385)	Previous User, % (n = 195)	Recent Adopter, % (n = 92)	Repeat Recent User, % (n = 166)		No. No. (n = 130)	No Mammo- gram, % (n = 130)	Previous User, % (n = 162)	Recent Adopter, % (n = 32)	Repeat Recent User, % (n = 277)	
Economic factors												
Employed												
Yes	350	41.4	27.4	11.7	19.4		239	19.3	29.7	4.2	46.9	
No	488	49.2	20.3	10.5	20.1	.058	362	23.2	25.1	6.1	45.6	.365
Education												
< High school	172	59.9	16.9	10.5	12.8		142	31.0	30.3	8.5	30.3	
High school graduate	383	44.4	26.4	9.1	20.1		247	20.7	27.1	5.7	46.6	
Some college/ technical school	183	41.0	24.0	15.9	19.1		126	16.7	24.6	2.4	56.4	
College graduate +	100	37.0	21.0	10.0	32.0	<.001	84	16.7	23.8	3.6	56.0	.001
Income												
≤ \$15 000	286	58.4	18.2	12.2	11.2		177	30.5	23.2	9.6	36.7	
\$15 001–25 000	155	40.7	29.7	11.6	18.1		116	20.7	30.2	8.6	40.5	
\$25 001–35 000	110	41.8	26.4	7.3	24.6		75	20.0	28.0	1.3	50.7	
> \$35 000	165	33.3	24.2	12.7	29.7	<.001	162	16.1	32.1	2.5	49.4	.002
Need factors												
Family history of breast cancer												
Yes	92	30.4	25.0	14.1	30.4		69	18.8	20.3	7.3	53.6	
No	746	47.9	23.1	10.6	18.5	.006	532	22.0	27.8	5.1	45.1	.382
Prior breast problems												
Yes	193	18.1	38.9	7.8	35.2		167	3.6	30.5	1.2	64.7	
No	645	54.3	18.6	11.9	15.2	<.001	433	28.6	25.6	6.9	38.8	<.001
Age group												
≤ 64 y	529	41.2	26.7	9.8	22.3		374	20.3	28.3	5.1	46.3	
≥ 65 y	309	54.1	17.5	12.9	15.5	<.001	227	23.8	24.7	5.7	45.8	.657
Health system enabling factors												
Specialty of regular physician												
None	124	66.1	23.4	3.2	7.3		76	48.7	25.0	1.3	25.0	
General or family practice	242	61.2	16.5	10.7	11.6		195	26.7	31.3	6.7	35.4	
Internist	264	34.9	26.5	12.1	26.5		217	11.1	27.2	6.9	54.8	
Gynecologist	161	27.3	26.1	14.9	31.7		84	3.6	22.6	2.4	71.4	
Other	47	40.4	29.8	12.8	17.0	<.001	29	48.3	13.8	3.5	34.5	<.001
Physician advised patient to get mammogram												
Yes	468	9.4	38.9	17.7	34.0		472	6.8	30.3	6.6	56.4	
No	331	91.2	3.9	2.7	2.1	<.001	111	73.9	16.2	0.9	9.0	<.001
Last clinical breast exam												
≤ 12 mo ago	493	33.3	18.1	17.2	31.4		363	10.5	17.6	6.3	65.6	
Never/> 12 mo ago	344	64.2	30.8	2.0	2.9	<.001	238	38.7	41.2	3.8	16.4	<.001
Insurance												
None	24	83.3	8.3	8.3	0.0		15	66.7	6.7	0.0	26.7	
Entitlement only	54	64.8	11.1	9.3	14.8		90	26.7	23.3	10.0	40.0	
Entitlement + Health maintenance organization only	260	50.8	20.0	12.7	16.5		123	26.0	21.1	5.7	47.2	
Health maintenance organization + commercial	52	28.9	30.8	7.7	32.7		74	13.5	27.0	1.4	58.1	
Commercial only	42	42.9	21.4	11.9	23.8		22	9.1	36.4	9.1	45.5	
	358	40.5	26.0	10.9	22.6	<.001	204	17.2	30.4	5.9	46.6	.001

and 1990. Women with entitlements only or entitlements plus other coverage did substantially better in 1990 than in 1987. In both years, women with health maintenance organization coverage were more likely than women in any other coverage

group to have had a mammogram in the past year.

Aside from the significant relationships of the independent variables with utilization at each time point, notable changes occurred over time. For example,

more women were advised by their physicians to have a mammogram in 1990 than in 1987 (81% vs 59%). Although the proportion of women who had had a clinical breast exam in the previous year did not change (59% in 1987 and 60% in 1990),

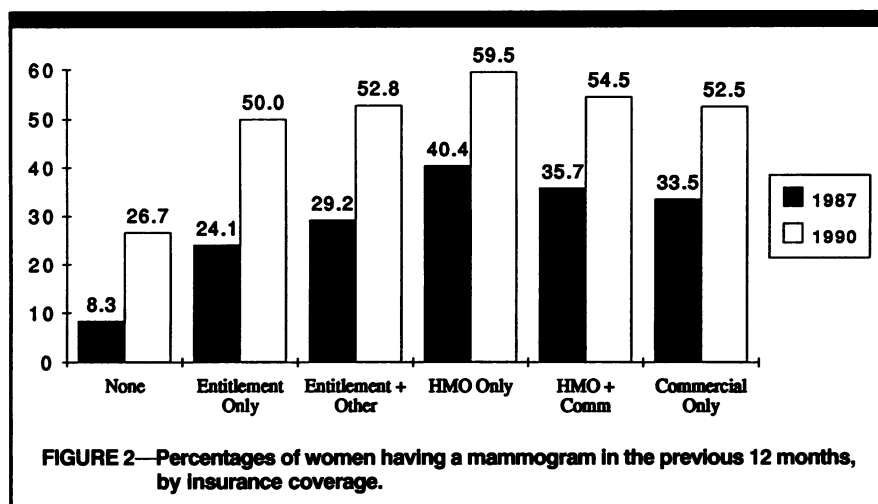


FIGURE 2—Percentages of women having a mammogram in the previous 12 months, by insurance coverage.

more women who had had such an exam reported having had a mammogram in 1990 (72%) than in 1987 (49%).

Multivariate Analyses

Multivariate analysis was used to investigate the relationship of specific variables to utilization while controlling for the effects of others. The variable "physician advised patient to get a mammogram" was not included because of its high correlation with the dependent variable. Insurance coverage was omitted because of its lack of validity with respect to utilization in other than the past year. The fitted logistic regression models are presented in Tables 2 and 3 in the form of odds ratios, obtained by exponentiating the estimated coefficients, and confidence intervals for the odds ratios.

In Table 2, odds ratios are given that compare the referent group, women who had never had a mammogram, with the three user groups: previous users, recent adopters, and repeat recent users. Consequently, for each dichotomous variable in Table 2, there are three odds ratios. For the variable "specialty of regular physician," four sets of odds ratios are given, one for each physician specialty compared with having no regular physician. The income variable was treated as continuous and the odds ratio for an increase of \$5000 is presented.

The first column of odds ratios in Table 2 reports the results of the model for the 1987 survey. When other important variables were controlled for, economic factors retained their significance. Employed women were less likely than unemployed women to be repeat recent users. Women with at least a high school education were more likely than women with less than a high school education to

be previous users. Higher income increased the likelihood of a woman's being a repeat recent user.

With regard to need factors, women who reported a family history of breast cancer were approximately three times more likely than others to be recent adopters or repeat recent users in 1987. Women who had had breast problems were more than six times as likely as others to have ever had more than one mammogram. The likelihood that a woman who had had symptoms was a recent adopter, though not significant, was nearly twice as high as the likelihood that she had never had a mammogram. Women younger than 65 years of age were twice as likely as older women to be repeat recent users.

With regard to health system enabling factors, women whose regular physician was an internist or gynecologist reported greater use than did women with no regular physician. In addition, they were almost eight times more likely than women who regularly visited a general practitioner or family physician to be repeat recent users. If a woman had had a clinical breast exam in the past 12 months, she was 12 to 18 times more likely to have had a recent mammogram. Women in the demonstration city area were less likely to report previous use than were those in the comparison city area; recent use was similar.

The same model fit to the 1990 survey data is displayed in the center columns of Table 2. Variables significant in this model included education, previous breast problems, specialty of regular physician, and recency of clinical breast exam. The overall relationships between mammography use and having had a breast problem and recency of clinical breast exam were the same as in 1987, although the odds ratios changed somewhat. Women were far

more likely to be recent adopters if they had a regular physician (21 to 22 times more likely if the physician was a gynecologist or internist, and almost 9 times more likely if the physician was a general practitioner or family physician). Women were also more likely to be repeat recent users if they reported having a regular physician (from 2 to 17 times more likely, depending on the specialty of the regular physician).

In the next stage of analysis (final columns of Table 2), we fit the same model to the combined survey data, including an indicator variable for time. In the combined model, when other significant variables were controlled for, two economic factors achieved statistical significance. Women with more than a high school education were more than twice as likely to be repeat recent users, and a \$5000 increase in income increased the likelihood that a woman would be a repeat recent user. With respect to need factors, women with a family history of breast cancer were twice as likely as other women to be repeat recent users; those with a history of breast problems were more than eight times as likely to be repeat recent users. Age was not significantly related to use when the influence of all other variables was controlled. Among the health system enabling factors, specialty of regular physician continued to be highly significant. Women whose regular physicians were gynecologists or internists were more likely to have ever had a mammogram. When all other variables were controlled for, women were more than nine times as likely to be repeat recent users in 1990 than in 1987.

Because several national reports have focused on the number of women who have had mammograms in the 12 months prior to study,^{4,9} models were fit to the dichotomous outcome variable (having had a mammogram in the past 12 months or not). The models for 1987, for 1990, and combined over time are presented in Table 3. Economic variables were not significant, except for income in 1987 and education in 1990. Having had previous breast problems was related to use in both 1987 and 1990, whereas having a family history of breast cancer was related in 1987 only; age was not related. Having as a regular physician a gynecologist (or an internist in the 1990 and combined-time models) and having had a clinical breast exam in the past 12 months were related to increased likelihood of recent use. A model that included insurance rather than income yielded similar results.

TABLE 2—Estimated Odds Ratios and 95% Confidence Intervals (CI) for Mammography Utilization in 1987, in 1990, and Combined over Time

Effect	Mammography Utilization (vs None)	1987		1990		Combined	
		Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Economic factors							
Employed (Yes vs no)	Previous user	0.95	0.59, 1.52	1.20	0.63, 2.29	1.03	0.71, 1.49
	Recent adopter	1.07	0.58, 1.99	1.20	0.41, 3.49	1.09	0.65, 1.84
	Repeat recent user	0.51	0.29, 0.90	1.11	0.56, 2.21	0.70	0.46, 1.07
Education (High school + vs < high school)	Previous user	1.92	1.04, 3.55	1.09	0.56, 2.12	1.33	0.87, 2.04
	Recent adopter	0.73	0.36, 1.46	1.31	0.50, 3.40	0.87	0.50, 1.51
	Repeat recent user	1.47	0.69, 3.16	2.89	1.42, 5.89	2.09	1.27, 3.45
Income (\$5000 increments)	Previous user	1.05	0.97, 1.13	1.09	0.99, 1.20	1.08	1.02, 1.14
	Recent adopter	1.08	0.98, 1.19	0.97	0.72, 1.03	1.02	0.93, 1.11
	Repeat recent user	1.17	1.07, 1.28	1.03	0.93, 1.14	1.12	1.04, 1.20
Need factors							
Family history (Yes vs no)	Previous user	1.83	0.85, 3.93	0.63	0.26, 1.54	1.23	0.69, 2.19
	Recent adopter	2.76	1.17, 6.54	0.76	0.21, 2.78	1.90	0.95, 3.81
	Repeat recent user	3.53	1.59, 7.85	0.88	0.37, 2.08	2.00	1.12, 3.58
Prior breast problems (Yes vs no)	Previous user	6.52	3.86, 11.03	9.31	3.65, 23.72	7.39	4.72, 11.56
	Recent adopter	1.81	0.85, 3.85	1.19	0.22, 6.46	1.67	0.85, 3.29
	Repeat recent user	7.73	4.23, 14.14	10.99	4.27, 28.24	8.63	5.34, 13.96
Age group (<65 y vs ≥65 y)	Previous user	1.62	0.96, 2.74	1.15	0.59, 2.24	1.39	0.93, 2.08
	Recent adopter	0.96	0.50, 1.85	0.95	0.35, 2.57	0.94	0.55, 1.60
	Repeat recent user	1.93	1.03, 3.60	0.84	0.43, 1.64	1.25	0.80, 1.94
Health system enabling factors							
Specialty of regular physician (General/family practice vs none)	Previous user	0.65	0.33, 1.30	2.19	1.05, 4.56	1.15	0.70, 1.88
	Recent adopter	1.42	0.44, 4.64	8.77	1.07, 71.78	2.72	1.00, 7.38
	Repeat recent user	0.88	0.29, 2.62	2.19	0.96, 4.98	1.43	0.75, 2.71
(Internist vs none)	Previous user	2.32	1.20, 4.49	5.15	2.24, 11.83	3.19	1.91, 5.33
	Recent adopter	2.60	0.79, 8.48	20.72	2.45, 175.15	5.18	1.89, 14.19
	Repeat recent user	3.01	1.05, 8.65	7.00	2.92, 16.76	4.37	2.30, 8.30
(Gynecologist vs none)	Previous user	3.27	1.53, 7.00	9.98	2.46, 40.39	4.66	2.48, 8.76
	Recent adopter	4.60	1.32, 16.05	22.22	1.46, 338.86	7.78	2.58, 23.43
	Repeat recent user	6.72	2.21, 20.40	16.91	4.07, 70.27	9.26	4.40, 19.51
(Others vs none)	Previous user	1.77	0.64, 4.91	0.42	0.11, 1.67	1.03	0.46, 2.31
	Recent adopter	1.17	0.24, 5.78	1.70	0.09, 30.89	1.50	0.39, 5.81
	Repeat recent user	1.43	0.35, 5.78	0.74	0.21, 2.59	1.21	0.48, 3.03
Last clinical breast exam (≤ 12 mo vs none or earlier)	Previous user	1.07	0.68, 1.69	1.16	0.64, 2.08	1.10	0.78, 1.56
	Recent adopter	12.36	5.35, 28.57	5.12	2.04, 12.86	7.86	4.38, 14.09
	Repeat recent user	17.76	7.95, 39.71	9.35	5.11, 17.10	10.51	6.80, 16.24
Other factors							
City (Demonstration vs comparison)	Previous user	0.64	0.42, 0.98	0.59	0.34, 1.04	0.64	0.46, 0.89
	Recent adopter	1.29	0.75, 2.22	1.10	0.46, 2.63	1.24	0.79, 1.95
	Repeat recent user	0.63	0.38, 1.05	0.98	0.55, 1.74	0.79	0.55, 1.14
Time (1990 vs 1987)	Previous user					3.52	2.47, 5.02
	Recent adopter					1.65	0.99, 2.77
	Repeat recent user					9.09	6.11, 13.51

Note. Likelihood ratio test of significance of 1987 model: 372.8 ($df = 36$); $P < .001$. Deviance = 1364.6 ($df = 1953$). Likelihood ratio test of significance of 1990 model: 278.5 ($df = 36$); $P < .001$. Deviance = 982.4 ($df = 1437$). Likelihood ratio test of significance of combined model: 713.5 ($df = 39$); $P < .001$. Deviance = 2400.3 ($df = 3489$).

Discussion

The results of this study support recently published data that document improvements in the proportion of women who have had a mammogram in the year prior to study.⁹ In addition, this study documents an increase in the proportion of women who have been screened recently

among those who have had mammograms in the past (20% in 1987 to 46% in 1990). The challenge will be to promote regular screening by new adopters, to continue to encourage the substantial proportion (approximately 25%; see Figure 1) of previous (but not recent) users to again participate in screening, and to motivate the hard-to-reach 22% who have never been screened. One

limitation of this study is the lack of representation of minority and non-English-speaking women; more than 90% of each sample was White. The study is also limited by the usual biases of random-digit-dialed surveys: only women with telephones could participate and the data were self-reported.

Among the economic factors, income was significantly related to repeat recent

TABLE 3—Estimated Odds Ratios and 95% Confidence Intervals for Recent Users of Mammography with Past or Never Users in 1987, in 1990, and Combined over Time

Effect	1987		1990		Combined	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Economic factors						
Employed (Yes vs no)	0.71	0.46, 1.10	0.97	0.59, 1.61	0.78	0.57, 1.09
Education (High school+ vs < High school)	0.84	0.48, 1.46	2.27	1.32, 3.90	1.34	0.92, 1.92
Income (\$5000 increments)	1.11	1.04, 1.19	0.96	0.88, 1.03	1.04	0.99, 1.09
Need factors						
Family history (Yes vs no)	2.36	1.29, 4.32	1.16	0.61, 2.21	1.75	1.13, 2.70
Prior breast problems (Yes vs no)	1.77	1.15, 2.73	1.69	1.06, 2.69	1.71	1.25, 2.34
Age group (<65 y vs ≥65 y)	1.18	0.73, 1.89	0.81	0.49, 1.35	0.98	0.70, 1.38
Health system enabling factors						
Specialty of regular physician (General/family practice vs none)	1.24	0.54, 2.87	1.80	0.90, 3.63	1.59	0.93, 2.70
(Internist vs none)	2.00	0.88, 4.55	3.02	1.52, 6.02	2.48	1.47, 4.19
(Gynecologist vs none)	3.42	1.45, 8.05	3.89	1.67, 9.06	3.82	2.14, 6.83
(Others vs none)	1.09	0.37, 3.20	1.11	0.38, 3.24	1.22	0.58, 2.56
Last clinical breast exam (≤ 12 mo vs none or earlier)	14.73	8.23, 26.36	7.48	4.82, 11.61	9.06	6.49, 12.65
Other factors						
City (Demonstration vs comparison)	1.03	0.70, 1.51	1.39	0.91, 2.12	1.13	0.85, 1.49
Time (1990 vs 1987)					2.91	2.17, 3.89

Note. Likelihood ratio test of significance of 1987 model: 215.1 (*df* = 12); *P* < .001. Deviance = 634.0 (*df* = 651).
Likelihood ratio test of significance of 1990 model: 163.0 (*df* = 12); *P* < .001. Deviance = 550.9 (*df* = 479).
Likelihood ratio test of significance of combined model: 397.7 (*df* = 13); *P* < .001. Deviance = 1207.5 (*df* = 1163).

mammography use in 1987 and in the combined model (Table 2); however, income was not significantly related to recent mammography use in 1990 (Table 3). This change may be due, in part, to the fact that more women with entitlements were being screened in 1990 (Figure 2).

With respect to need factors, having had breast problems was significant in all three models, whereas having a family history of breast cancer was significant only in the 1987 and combined models. Both factors were also significantly related to recent mammography use in 1987 and in the combined model (Table 3). It could be hypothesized that clinicians in 1987 were more likely to advise screening for these women because of their health history, but more recently, all women have been advised to have regular mammograms. It is not surprising that a history of breast symptoms or problems is independently related to mammography use. In both 1987 and 1990, 17% of the women re-

ported that they had had their most recent mammogram because they had had a breast problem, rather than as part of a regular checkup. It may be that these women misunderstood why the mammogram was recommended. For example, considerable anecdotal evidence suggests that mammograms are ordered to rule out problems in order to secure insurance coverage.

The bivariate relationship of age and family history to increased use in 1987 and 1990, coupled with increases in use over time, supports the notion that screening of all women is increasingly being encouraged. The relationship of income and education to use supports the recommendation that special attention be given to the underserved, that is, women with lower incomes and less education. In this regard, it is encouraging that in 1990 more women with entitlements only and more uninsured women were receiving care. However, the fact that more elderly women

were being screened provides additional evidence that factors other than income influence mammography use.¹⁰⁻¹²

With respect to health system enabling factors, this investigation demonstrates the continued profound relationships between having a regular physician and mammography use and between physician specialty and mammography use that have been documented in earlier studies.^{4,13-15} Although having a gynecologist as a regular physician continues to be important, women reporting internists as regular physicians have improved their use of mammography in recent years. Since women who indicated that their regular physician was a general practitioner reported lower use, continuing education programs might target those physicians.^{16,17} In addition, public education programs should consider encouraging women themselves to initiate discussions of mammography with their physicians.

It is also not surprising that having had a clinical breast exam in the past 12 months was related to greater use. Apparently, a woman who undergoes a physical is more likely to be encouraged to have a mammogram. However, there continues to be considerable "missed referral opportunity"²⁴: 28% of the women who had had a clinical breast exam in the previous year did not go on to get a mammogram (Table 1). In addition, many women reported not having had a clinical breast exam in the previous year (Table 1). Attention to both mammography and clinical breast exams is therefore important. Providers should continue to initiate discussion of screening and public education programs should continue to emphasize the importance of periodic checkups that include clinical breast exams and mammogram referrals, particularly for women of lower educational levels. □

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