Multistrategy Health Education Program To Increase Mammography Use Among Women Ages 65 and Older

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Synopsis

Mammography use decreases with age although the risk of breast cancer increases with age. Medicare now provides biennial coverage for screening mammography. This study was designed to simulate the Medicare condition by subsidizing mammography among women in eight retirement communities in the metropolitan Philadelphia area. The study also measured the impact of health education interventions and the presence of a mobile mammography van on increased use of mammography.

Retirement communities were assigned randomly to the control (cost subsidy alone) or experimental group (cost subsidy, mammography van, and tailored health education interventions). A total of 412 women ages 65 and older who had not had mammograms in the previous year were surveyed at baseline and 3 months later. Analytic techniques reflected the cluster nature of the randomization. Women in the experimental group were significantly more likely than the control group women to have obtained mammograms. Forty-five percent of the experimental group women compared with 12 percent of the control group women subsequently had mammograms in the 3 months after the baseline interview ($P < .001$).

Logistic regression analysis for mammography use indicated an odds ratio of 6.1 associated with being in the experimental group. For women in the experimental group, a separate logistic regression for mammography use showed an odds ratio of 7.8 associated with attendance at the educational presentation. The results suggest that Medicare coverage alone will not increase mammography use sufficiently to achieve year 2000 objectives. However, the addition of access enhancing and health education interventions boosts utilization dramatically.

THE AGING of the U.S. society is now the dominant demographic phenomenon characterizing our time (*1*). The rapid increase in the proportion of older adults has important implications for both the incidence and prevalence of cancer, because cancer is primarily a disease of aging. Age is the most consistent and strongest predictor of risk for cancer and for death from cancer.

Americans ages 65 and older are 10 times more likely to develop cancer than those under age 65. Nearly 60 percent of all cancers occur in older adults, and 50 percent of breast cancers occur in women older than 65 (*2*). The incidence of breast cancer increases markedly with age, from 111 per 100,000 at age 40 to 270 per 100,000 at age 65 and 310 per 100,000 at age 75 (*3*). The growth in the

population of women older than 65 and their greater likelihood of developing breast cancer makes this disease of vital public health and clinical significance.

A number of international studies have shown that screening programs that include regular mammograms can reduce mortality from breast cancer by as much as 40 percent in women ages 50 and older (*4,5*). Although the numbers of women at the older ages in these studies are relatively small, most organizations, including the American Cancer Society and the National Cancer Institute, recommend annual mammograms and clinical breast examinations for women until at least age 75; after that, as Weinberger and colleagues (*6*) have observed, there has been little agreement in recommendations or practice. The recent year 2000 objectives identified women older than 70 as a special target because of their lower use of breast screening (*7*).

Screening for breast cancer decreases after about age 65 (*8–12*). The 1987 National Health Interview Survey indicated that 44 percent of women 50–59 compared with 31 percent of women 70–79 and 19 percent of women 80 and older report ever having had mammograms (*8*). Overall, 38 percent of women older than 60 reported having had mammograms. In the 1990 Mammography Attitudes and Usage Study it was found that while 65 percent of U.S. women reported ever having had mammograms, less than 30 percent of women 60–69 and fewer than 20 percent of women ages 70 and older are following mammography guidelines (*13*). Among older women, use rates are particularly low for single or widowed women, those with less than a high school education, and those with household incomes less than $25,000 (*8*).

A number of knowledge and belief barriers to breast cancer screening have been reported for older women. These include never having heard of mammograms, not knowing they should have one, not having a physician's recommendation, and believing that mammograms are not needed in the absence of symptoms or problems (*8*). Moreover, data from a study of physicians show that they report screening older women less often than younger women (*6*). The 1990 amendments to the Medicare legislation provide biennial coverage for screening mammograms among women covered by the Medicare Program. However, the evidence suggests that unless other steps are taken to increase use, the removal of the cost barrier alone will not be sufficient to increase use of mammography among older women (*14,15*).

A study was conducted before the changes in Medicare coverage to assess the impact of a mobile mammography unit in conjunction with health education interventions on use of screening among residents of retirement communities. The study was designed to simulate the new Medicare benefit by subsidizing payment (requiring only a $10 copayment) for both the experimental and control groups. Participating radiologists agreed to perform the mammograms for $50 each. Following national guidelines for women ages 50–75, women were defined as eligible for a mammogram if they had not been screened in more than 1 year.

Methods

Setting. The study was conducted among women who lived in one of eight retirement communities in the Philadelphia metropolitan area. The number of women residents per community ranged from 63 to 307; their median age ranged from 76 to 84. Four of the communities have religious affiliations. Five have onsite medical offices where many of the women chose to receive their medical care. All women participating in the study were living independently, although several of the communities have in-house skilled nursing facilities.

Research design, procedures, and interventions. Retirement communities that agreed to participate were assigned randomly to either the control or experimental group, four to each group. All women ages 65 and older who were living independently in apartments in the eight retirement communities were sent an advance letter notifying them of the baseline survey and requesting their participation. The letter explained the nature and purpose of the survey and indicated that the names of all participants would be entered into a raffle for $100 at each community.

Although all women were eligible to participate in the interventions, women were selected randomly at each site to participate in the baseline survey; the number of women selected at each site was based on the size of the community, and ranged from 54 to 120. At control sites, women also were randomly selected to participate in the baseline interview; subsequently, posters and promotional materials were used similarly in both the experimental and control communities to promote the availability of $40 vouchers that required only a $10 copayment to pay for the screening at approved radiology practices.

Three months later, those who had been interviewed at baseline were interviewed again, pending

their agreement. The baseline and followup interviews were the same for both groups. However, women in the experimental retirement communities received interventions tailored to older women and based on the theoretical perspectives of the Health Belief Model (HBM) (*16*) and Social Learning Theory (SLT) (*17*).

In particular, following the HBM, the interventions were designed to heighten perceived susceptibility, overcome barriers, and provide cues to action. SLT also guided the development of interventions. Specifically, modeling was used as a central strategy to motivate women to get mammograms. Thus, the interventions were informed by both an intrapersonal (HBM) and an interpersonal model (SLT). We focused primarily on the behavior of the woman, combining approaches directed at the woman herself, and the woman in her social context.

Finally, women also were offered an opportunity to obtain a mammogram on a mobile van that was brought to the retirement community. The interventions offered to women in the experimental communities were multistrategy and, in addition to reducing the cost barrier, were designed to reduce access, knowledge, and belief barriers as well. These interventions included the following:

- A letter from the medical director of the retirement community was mailed to each woman announcing the upcoming educational session and the visit of the mobile mammography unit and encouraging her to attend.
- Each woman was provided a letter to give, at her option, to her primary physician explaining the program. This strategy was intended to overcome women's potential concerns about their physicians' reactions to the program and to encourage physicians to support the program and reinforce the importance of screening mammography.
- Approximately 1 week before the mobile unit's visit, the women were invited to attend an educational program consisting of a specially created video (*A*), supporting print materials, group discussion, refreshments, introduction of an incentive (tote bag or umbrella), which was to be provided at the van, and the opportunity to schedule an appointment on the mobile unit. The video was created following focus group discussions with older women and a review of the literature.

The video and accompanying print materials highlighted these messages: older women need mammograms; physicians support mammograms for older women; women should ask their physicians about mammograms; mammograms can find breast cancer early; and getting a mammogram is not difficult. An older woman was shown getting a mammogram, because many women said they wanted to know what it would be like. Group discussion provided an opportunity for women to raise their personal concerns about mammography and to have them addressed.

- Reminder letters were sent to the women before the appointment as a cue to action.
- The visit of the mobile unit was the last intervention that distinguished the experimental from the control group and was intended to reduce access barriers. A mobile van (similar to a mobile home)

Table 1. Demographic and baseline characteristics associated with 412 subjects in the study group

Variable	Subjects eligible for mammograms: Controls (N = 199) Number	Controls (N = 199) Percent	Experimentals (N = 213) Number	Experimentals (N = 213) Percent	P
Age (years)					.738
65–74	60	29	61	30	
75–79	50	30	64	25	
80–84	59	27	58	30	
85 and older	30	14	30	15	
Education					.001
Less than high school	55	28	46	22	
High school graduate	69	35	55	26	
Some college	56	28	65	31	
College graduate	17	9	46	22	
Refused[1]	2	...	1	...	
Race					<.001
White	155	78	212	100	
Nonwhite	42	21	1	0	
Refused[1]	2	...	0	...	
Marital status					.456
Married	45	23	42	20	
Nonmarried	153	77	171	80	
Refused[1]	1	...	0	...	
Last mammogram					[2].058
Within past 2 years	55	30	76	39	
More than 2 years	22	12	30	15	
Never	108	58	91	46	
Don't know[1]	14	...	16	...	
Physician discussed having a mammogram					.003
No	105	53	81	38	
Yes	93	47	130	62	
Don't know[1]	1	...	1	...	
Belief: If healthy, do not need mammogram					.042
Not at all	81	41	108	51	
Other	118	59	103	49	

[1] Refusals and "don't know" responses are not included in chi-square analyses.
[2] Coded dichotomously (never versus ever had mammogram), the difference between study groups is significant ($P = .017$).

Table 2. Beliefs, knowledge, and concerns of 412 subjects at baseline

Variable	Number	Percent
If healthy, do not need mammogram:[1]		
Not at all	189	46
Little, somewhat	93	23
Very much	112	27
Don't know	18	4
If feel fine, mammogram not necessary:		
Not at all	130	32
Little, somewhat	103	25
Very much	151	37
Don't know	28	7
Breast cancer found early can be cured:		
Not at all	45	11
Little, somewhat	104	25
Very much	232	56
Don't know	31	8
Can have breast cancer without symptoms:		
Not at all	211	51
Little, somewhat	93	23
Very much	34	8
Don't know	74	18
Knows that women older than 65 are at greater risk:		
Yes	26	6
No	386	94
Concerned about radiation:		
Not at all	194	47
Little, somewhat, don't know	118	29
Extremely	100	24
Concerned about pain:		
Not at all	244	59
Little, somewhat, don't know	126	31
Extremely	42	10
Concerned about cost:		
Not at all	246	60
Little, somewhat, don't know	98	24
Extremely	68	17

[1] As reported in table 1, a significant difference between study groups is obtained when this variable is coded dichotomously (not at all versus other). No other significant differences between study groups were observed for variables in this table.

was brought to the door of the retirement facility. The van houses a mammography unit, changing area, and a waiting area and reception desk. Processing was completed at the end of each day at a central facility (*18*). A health aide was present to facilitate the van's use by women with ambulatory problems; however, women confined to wheelchairs could not be accommodated on the van but were given vouchers to use at a radiology facility.

Thus, the cost of a mammogram was reduced substantially for women in both the experimental and control communities. In both groups, identical promotional materials also were used to make women aware of the vouchers. With the cost barrier reduced, if not removed, the goal was to examine the impact of the tailored health education interventions and the access features of the van in reducing the other barriers, which we expected to be both psychological and access-related. These additional interventions were offered only to women in the experimental communities. Budget limitations precluded a design which would have separated the van's effects from the health education effects. Moreover, the weight of evidence suggests that a combination of interventions is superior to single strategy approaches (*19*).

Subjects sampled. Of the 752 age-eligible women randomly selected to participate in the survey, 616 interviews were completed, yielding a response rate of 82 percent; 571 (93 percent) of the interviews were administered by telephone and 45 (7 percent) were conducted in person so as not to exclude women with hearing difficulties. The response rate was 83 percent in the control group versus 81 percent in the experimental group; this difference was nonsignificant. Fourteen percent of the women refused to be interviewed; another 4 percent were unavailable during the survey period. At the followup interview, interviews were completed with 86 percent (532) of those who had been interviewed at baseline; reasons for noncompletion included deaths, refusals, unavailability during the survey period, and chronic no answers. Followup rates did not differ significantly between the experimental and control groups. Most interviews were completed in less than half an hour.

Women who were ineligible for the cost-subsidized mammogram because they reported having had a mammogram within the previous year were excluded from the analyses described in this report. Thus, the study sample of interest comprised 412 women from 65 to 98 years, with a mean age of 78. The majority (74 percent) had completed a high school education, somewhat higher than the general population. Seventy-nine percent were unmarried, and 89 percent were white. Nearly all nonwhite subjects resided at Opportunities Towers, a control site; therefore, the possible relationship of race to use of mammography cannot be controlled in this study.

Study instruments. The questionnaires developed for this study included validated items from the National Health Interview Survey Cancer Control Supplement as well as items used by the National

Cancer Institutes' Breast Screening Consortium (*9*), and questions developed especially to assess the impact of the interventions. The questions were designed to assess sociodemographic characteristics, knowledge and beliefs about breast screening, barriers and facilitators to screening, and previous breast cancer screening practices. Most questions were forced choice, with responses on a 3- or 4-point Likert scale to facilitate telephone administration. The questions were guided by the theoretical perspective of the HBM (*16*).

The use of mammography was assessed through self-report and verified through the presence of radiology reports for those women using the cost subsidy. Although in a different population, previous research by the investigators had shown self-report to be a valid measure of actual use (*20*).

Several scales were created for purposes of data analysis. "Experience with breast pathology" was derived from women's responses to items about personal history of breast pathology, including a lump, biopsy, or breast cancer, and incidence of breast cancer among family and friends. Scores ranged from 0 (no experience) to 3 (personal experience of lump and so forth) and included items such as "Have you ever had a breast biopsy?" and "Do you have any close relatives who have had breast cancer?" A summative "dependence score," ranging from 0 to 2, was formed using items that assessed whether the women needed help in daily living and whether it would be hard to get out to get a mammogram.

Finally, a 4-point "perceived susceptibility score" was derived from two items. Women responding that they believed their chances of getting breast cancer were less than average and that they were not at all likely to get breast cancer were scored low—1—on perceived susceptibility; those who indicated they believed their chances to be greater than average or that they were more susceptible received the highest scores—4—on this index.

Analysis strategy. The main study hypothesis was that women in the experimental group would be more likely to have obtained mammograms during the 3-month interval following the baseline interview than those in the control group; a subsidiary hypothesis was that participants in the educational program would be more likely to have obtained mammograms than nonparticipants. The bivariate relationship of the outcome (use of mammography during the study period) to the study group was tested using chi-square analyses of data from all 412 women. Similarly, chi-square analyses of data from the 213 women at intervention sites tested the relationship of attendance to use.

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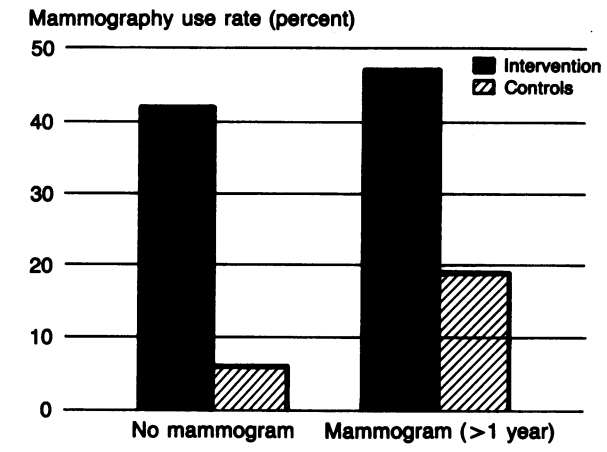
However, multivariable analyses were required to control for potentially confounding variables. These variables, measured at baseline, included demographic characteristics, past screening practices, beliefs, knowledge, barriers, and intent to obtain a mammogram. The analysis strategy reflected the cluster nature of the randomization by using analytic techniques and a program designed expressly for this purpose—PCCARP (*B*).

Chi-square analyses were used to identify any differences existing at baseline between study groups with regard to potential confounders. Similarly, the bivariate relationships of the outcome (use of mammography) to these variables were tested using chi-square analyses.

A logistic regression model was developed to predict usage: variables with associations with both study group and use significant at the .10 level were tested for multicollinearity, and redundant variables (any variable strongly related to another covariate of greater theoretical interest) were eliminated. Variables associated with utilization alone that were of theoretical interest were also considered for inclusion in the model. Variables whose independent contributions were not significant at the .05 level were removed from the model in a backwards stepwise fashion. Study group was then added as a covariate to the model to assess the effect of the interventions while controlling for possibly confounding covariates. Any two-way interaction terms between study group and the remaining covariates whose independent contribution was significant at the .05 level were included in the model.

Similarly, to estimate the effect of attending the health education presentation on subsequent use of mammography, a logistic regression model was developed which initially included as covariates variables related at least marginally ($P<.10$) to both attendance and use (as determined by chi-square analyses). Other variables of theoretical interest were also considered for inclusion. Attendance was added as a covariate after elimination of nonsignificant covariates, and two-way interaction terms between attendance and other remaining

Self-reported mammography use rates at followup by study group and previous mammography use



NOTE: Mammography use rate is defined as obtaining a mammogram within 3 months of baseline interview.

covariates were evaluated and included if significant at the .05 level.

The odds ratios and confidence intervals associated with each covariate in both final models were estimated utilizing PCCARP (copyright 1986), which accounted for the effect of randomization by cluster (retirement community) as well as for differences in sampling probabilities among the eight sites (*21,22*).

Results

The findings from baseline and postintervention followup interviews follow.

Baseline interview

Differences between study groups at baseline. In addition to race, several significant differences between the control and experimental groups existed at baseline (table 1). The experimental group was, on the whole, better educated. Also, women in the experimental group were more likely to report that their physicians had discussed mammography with them, and they were more likely to disagree with the belief that if you are healthy, you do not need a mammogram. In addition, women in the control group were more likely to report never having had a mammogram ($P = .017$); with last mammogram trichotomized, as reported in table 1, this relationship was marginally significant ($P = .058$). These four variables were all significantly intercorrelated as indicated by Spearman rank-order correlations (ρ) ranging from low (between .16 and .20 for education with each of the three other variables) through moderate ($\rho = .31$ for the health belief with whether the physician had discussed mammography; $\rho = .41$ for the health belief with last mammogram) to high ($\rho = .71$ for whether the physician discussed mammography with last mammogram).

Baseline beliefs about breast screening. Overall, women in the study manifested a number of knowledge deficits. At baseline, 94 percent of the women did not recognize that the risk of breast cancer increases with age (table 2). Fifty percent agreed at least "a little" that if you are healthy, you do not need mammograms, and 62 percent believed at least a little that if you feel fine, mammograms are not necessary. More than two-thirds expressed at least one of the concerns regarding radiation, cost, and pain. About half expressed some concern or uncertainty about radiation. While radiation was the most often cited concern, cost and pain were each concerns of about 40 percent of all women. Women identified several reasons for not having had mammograms, including not needed or not necessary, physician did not recommend, have not had any problems, have not thought about it, and their being older than 65.

Postintervention followup interview: bivariate analyses for beliefs and usage

Beliefs about breast screening. There were significant differences between the experimental and control groups in their agreement with the belief that if you feel fine, mammograms are not necessary ($P = .040$), as well as the belief that if healthy, you do not need a mammogram ($P = .002$). Thirty percent of the experimental group agreed extremely with the first belief, compared with 40 percent of the control group. Similarly, 20 percent of the experimental group, compared with 35 percent of the controls, agreed extremely with the belief that if healthy, you do not need a mammogram.

Use of mammography by study group. Forty-five percent of the experimental group women eligible for the cost subsidy reported obtaining mammograms during the 3-month study period compared with 12 percent of the eligible women at control sites. As shown in the figure, of the eligible women who had had mammograms previously, 47 percent of the experimental group women obtained mammograms during the intervention period compared with 19 percent of the women in control communities. Similarly, 42 percent of the experimental

Table 3. Baseline characteristics of 412 subjects associated with mammography use[1]

Variable	Mammogram		No mammogram		Significance		
	Number	Percent	Number	Percent	χ^2	df[2]	P
Education					9.9	3	.020
Less than high school	18	18	83	82			
High school graduate	43	35	81	65			
Some college	34	28	87	72			
College graduate	23	37	40	63			
Dependence score					6.7	2	.035
None	76	32	161	68			
Low	35	29	85	71			
High	8	15	47	85			
Last mammogram					12.0	2	.002
Within past 2 years	53	40	78	60			
More than 2 years	16	31	36	69			
Never	45	23	154	77			
Intent to get mammogram within year					39.0	2	<.001
Not at all likely	28	15	156	85			
Little, somewhat, uncertain	39	32	84	68			
Extremely likely	52	50	53	50			
Physician discussed having a mammogram					15.7	1	<.001
No	36	19	150	81			
Yes	83	37	140	63			
If healthy, do not need mammogram					20.3	2	<.001
Did not agree	76	40	113	60			
Agreed a little	18	19	75	81			
Agreed completely	22	20	90	80			
Perceived susceptibility					8.2	3	.043
Low	15	20	61	80			
Little	37	34	73	66			
Some	35	30	80	70			
High	24	42	33	58			
Personal experience with breast pathology					5.1	1	.024
No	93	27	255	73			
Yes	26	41	38	59			

[1] Defined as obtaining a mammogram within 3 months of the baseline interview.

[2] *df* = degrees of freedom.

group who reported no prior mammograms subsequently obtained them compared with 6 percent of the control group. Thus, among each of these groups, women in the experimental group reported significantly higher use of mammography 3 months after the baseline interview ($P<.001$).

Use of mammography by demographics and other potential confounders. Several variables measured at baseline were significantly associated with whether women had obtained a mammogram during the study period (table 3). To highlight some of these, women with less than a high school education were less likely to have obtained a mammogram. Women who believed that if you are healthy, you do not need a mammogram were less likely to have had them. Women with high dependence scores also had low rates of mammography use. Usage increased generally with increased perceived susceptibility. The stronger the intent expressed at baseline to get a mammogram within the next year, the more likely a woman was to obtain a mammogram during the 3-month study period. Women whose physicians had previously discussed mammography with them had higher use rates than other women. Those with personal experience with breast pathology also were more likely to have obtained mammograms. Finally, interval since last mammogram was strongly related to utilization.

Analysis of mammography use by retirement community. From 35 to 53 percent of eligible women in the retirement communities in the experimental group subsequently obtained mammograms compared with 6 percent to 19 percent in the control communities (table 4). Among those not

Table 4. Self-reported mammography use[1] rates for 412 subjects, by retirement community

Community	Control group		Experimental group		Attended presentation		Did not attend presentation	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Redeemer Village (60 subjects)	...	...	21	35	11	79	10	22
Spring House Estates (52 subjects)	...	...	25	48	10	77	15	38
Paul's Run (53 subjects)	...	...	28	53	12	86	16	41
Logan Square East (48 subjects)	...	...	21	44	12	75	9	28
Presbyterian Home (36 subjects)	7	19	...	...	...	...	...	...
Normandy Farms Estates (57 subjects)	8	14	...	...	...	...	...	...
Gloria Dei (59 subjects)	6	10	...	...	...	...	...	...
Opportunities Towers (47 subjects)	3	6	...	...	...	...	...	...

[1] Defined as obtaining a mammogram within 3 months of the baseline interview.

Table 5. Self-reported mammography use[1] rates at followup by attendance at health education presentation for women in experimental group

Variable	Mammogram		No mammogram		Significance		
	Number	Percent	Number	Percent	χ^2	df[2]	P
All eligible women ($N=213$)					37.2	1	<.001
Attended presentation	45	79	12	21			
Did not attend	50	32	106	68			
Women with no previous mammogram ($N=91$)					22.4	1	<.001
Attended presentation	23	77	7	23			
Did not attend	15	25	46	75			
Women with previous mammogram more than 1 year ago ($N=122$)					16.8	1	<.001
Attended presentation	22	81	5	19			
Did not attend	35	37	60	63			

[1] Defined as obtaining a mammogram within 3 months of the baseline interview.

[2] df = degress of freedom.

attending the educational presentation in the experimental communities, mammography rates ranged from 22 to 41 percent; rates for attenders ranged from 75 to 86 percent. Table 5 summarizes overall use by attendance. As shown, a dramatic increase in the use of mammography was associated with attendance at the presentation. Seventy-nine percent of those who attended obtained mammograms compared with 32 percent of experimental group nonattenders. Of women with no prior mammograms, 77 percent of experimental group attenders compared with 25 percent of nonattenders obtained mammograms.

Effect of sociodemographic variables and beliefs on attendance at educational programs. A total of 167 women attended the educational presentations at the four intervention sites; 66 took part in the survey and, of these, 57 (86 percent) had not had a mammogram within the past year and were therefore eligible for the cost subsidy. Women attending the session were asked to rate it: 73 percent said it was very informative, 47 percent said it was very calming, and 3 percent said it was very upsetting. Also, 53 percent said the session very much made them want to have a mammogram.

We examined whether attendance was related to demographic variables, past screening practices, or baseline knowledge, beliefs, barriers, and intent among the 213 surveyed women in the experimental group eligible for the cost subsidy. There were no differences in attendance by whether women had expressed concerns about cost, pain, radiation, or by dependence scores. Nor were there differences in educational level, age, or marital status. Fifty-four percent of the attenders versus 43 percent of the nonattenders reported never having had a mammograms; this difference was not significant. More nonattenders (54 percent) than attenders (37 percent) agreed at least a little that if you are healthy, you do not need mammograms ($P=.028$). Finally, while similar percentages of attenders (30 percent) and nonattenders (28 percent) reported that they were "extremely" likely to get a mammogram within the next year, fewer attenders (30 percent versus 49 percent) said they were "not at all" likely, and

more attenders (40 percent versus 23 percent) reported uncertainty or that they were a little or "somewhat" likely ($P = .017$). The Spearman rank order correlation between these two variables (that is, intent and the health belief) was .44.

Postintervention followup interview: multivariable analyses. A series of logistic regression analyses examined the effect of the intervention on the use of mammography, while controlling for possible confounders. Included as covariates in the initial analyses were baseline variables with significant or near significant associations to both study group and compliance (defined as whether a woman had obtained a mammogram in the intervening 3 months from the baseline interview): education, perceived susceptibility, whether a physician had discussed mammography, personal experience with breast pathology, and the belief that if you are healthy, you do not need a mammogram. To minimize problems associated with multicollinearity, last mammogram was eliminated because of its strong association with whether the physician discussed mammography ($\rho = .71$). Also included were the dependence scores, age, and marital status.

Other variables of interest also were tested to determine their value to the overall model, even though they did not meet the significance level criterion. These included the following beliefs: "If I feel fine, mammograms are not necessary"; "A woman can have breast cancer without symptoms"; "Breast cancer found early can be cured"; "Breast cancer is extremely frightening"; "Concerns (radiation, pain and cost)"; and "Number of doctor visits." None of these variables added to the predictive ability of the model.

After removal of nonsignificant terms, the resulting model indicated that disagreement with the belief that if you are healthy, you do not need a mammogram was independently and significantly associated with compliance with mammography. In addition, women with high dependence scores were less likely than other women to comply. No other variable contributed significantly to the predictive ability of this model. The effect of the intervention was then evaluated by adding the study group as a covariate to the model. As table 6 shows, eligible women at experimental sites had about six times the odds (OR = 6.1) of obtaining a mammogram as women at control sites, controlling for the health belief (OR = 2.9) and dependence score (OR = .4).

To evaluate the effect of attendance at the presentation on the use of mammography, another series of logistic regression analyses were performed using data from the 213 women at experimental sites. Intent to get a mammogram within the next year and the belief that if healthy you do not need a mammogram were the only variables measured at baseline that were found to be at least marginally related to both attendance at the presentation and to compliance. These two variables—with marital status, education, age, dependence score, whether the physician discussed mammography, experience with breast pathology, and perceived susceptibility—were included as covariates in the initial analysis. After elimination of variables with nonsignificant contributions to the model, only intent to get a mammogram within the next year remained. Attendance at the presentation was then added as a covariate. The interaction term (intent with attendance) did not contribute significantly to the model. Table 7 shows that women attending the presentation had about eight times the odds (OR = 7.8) of subsequently obtaining a mammogram as those not attending, controlling for "intent." Women who said they were extremely likely to get a mammogram in the next year had an odds ratio of 6.8, and those who were a little or somewhat likely had an odds ratio of 5.2.

'Future research should focus on minority women, rural women, and those with less than a high school education, since research consistently finds these groups to be underusers of mammography.'

Findings of breast screening. Within the 3-month period between the baseline and followup interviews, 231 women obtained mammograms through this program (that is, either on the van or from the approved radiology sites). Eleven percent of those mammograms were considered abnormal. Three of the women with abnormal mammograms refused followup studies; the others were evaluated and received various diagnostic and treatment procedures. Two breast cancers were detected. One was a metastatic infiltrating cancer, and the other was a very early breast cancer.

Discussion

There are several limitations to this study. Most important is the fact that while the retirement communities were assigned randomly to study

Table 6. Logistic regression results: evaluating effect of intervention on mammography use[1] among 412 subjects at followup

Variable	Percent	Estimated odds ratio	95 percent confidence interval	t-statistic	P
Study group:					
Intervention	52	6.1	3.4, 10.9	6.1	<.001
Controls	48	1.0	...	...	...
If healthy, do not need mammogram:					
Do not agree	46	2.9	1.8, 4.8	4.2	<.001
Other	54	1.0	...	...	...
Dependence score:					
High	13	.4	.17, 1.0	−1.92	.056
Other	87	1.0	...	...	...

[1] Defined as obtaining a mammogram within 3 months of the baseline interview.

Table 7. Logistic regression results: evaluating effect of attending presentation on mammography use[1] among 412 subjects at followup

Variable	Percent	Estimated odds ratio	95 Percent confidence interval	t-statistic	P
Attended presentation:					
Yes	27	7.8	4.3, 14.1	6.7	<.001
No	73	1.0	...	...	...
Intent to get mammogram within year:					
Not at all likely	44	1.0	...	...	...
Little, somewhat, uncertain	28	5.2	2.7, 10.2	4.8	<.001
Extremely likely	28	6.8	3.3, 14.1	5.3	<.001

[1] Defined as obtaining a mammogram within 3 months of the baseline interview.

groups, there were some significant differences between the resulting groups on variables that have been related to mammography use. However, with only eight sites, it is not likely that perfect balance would have been achieved. Among the sample of eligible women, there were differences on three key variables—race, education, and physician discussion of mammography. The paucity of black women in the experimental group is also troublesome. Additionally, cost limitations did not permit us to separate the impact of increasing access by using a mobile van from the effect of the targeted health education interventions. Nor were we able to collect data regarding physician response to the program. These concerns should be addressed in future studies.

The study results support other work by the investigators in showing that women's short-term reports of mammography use are highly valid. Here, verification was possible for women who obtained mammograms through the program; there was 95 percent agreement between these women's self-reports and information in the radiology report. Discrepancies were primarily due to failure to recall accurately the date of the mammogram.

Several characteristics and beliefs were associated with the report of having had a mammogram by followup. These findings are, in general, consistent with other research (*9,23*). Women whose physicians had discussed mammography were more likely to have obtained mammograms. Only 20 percent of the women with low perceived susceptibility obtained mammograms, and women who disagreed with the belief, "If healthy, I do not need a mammogram," also were more likely to have reported mammograms in the 3 months after the baseline interview. Women with less than a high school education and women who scored high on the dependence score (that is, they had more difficulty getting around) all were less likely to have obtained mammograms.

In this study, the conditions were created to simulate the current situation in which Medicare provides partial or complete coverage for mammograms on a biennial basis. Low rates of mammography use by the control groups suggest that cost reductions alone, even with some promotion, may not markedly increase the mammography use of older women. Similar outcomes had been found among women in an IPA-model health maintenance organization who had been offered free mammograms (*14*).

The fact that 42 percent of the experimental group women with no prior mammograms compared with 12 percent of the control group women obtained mammograms shows that tailored educational interventions to reduce knowledge and belief barriers and access-enhancing interventions, such as the mobile unit used in this study, in addition to cost reductions, are needed to motivate older women to obtain mammograms. Both the study and the measurement of impact were conducted during a very brief period. Of course, it is possible that the groups would have evened out by the end of the year, and that the study merely compressed mammography into a shorter period. But this does not seem likely.

The greatest benefit accrued in the group of study women who attended the educational intervention: 79 percent of the attenders reported mammograms at followup, and the logistic regression indicated an odds ratio of 7.8 for having attended the presentation. As is true for most voluntary health education interventions, not all women chose to participate. Of course, those women who attended the group program undoubtedly had higher levels of readiness than those who did not attend. However, within the experimental group, even the women who did not attend the presentation still had significantly higher mammography rates (32 percent) than the control group (12 percent). This finding suggests that even without the educational intervention, the combination of the mobile van and cost subsidy seemed to boost mammography dramatically. Future research should seek to sort out the incremental effects of different strategies.

The logistic regression for the effect of the intervention on compliance showed that three variables were significant in accounting for the report of a mammogram at followup. Women in the experimental group had over six times the odds of control group women of having obtained a mammogram in the intervening months. And women who disagreed at baseline with the statement that if one is healthy, she does not need a mammogram also were more likely to have had them. Women with high dependence scores were less likely to have had mammograms. This finding is important. Decisions must be made on individual cases about the appropriateness of mammography. If mammography is indicated, then, some women may need assistance in getting to their appointments. The multivariable analysis confirms the bivariate analyses in showing the impact of the interventions on subsequent mammography use. Both study group and attendance at the presentation were related strongly to women's reports of having had mammograms. In future efforts, perhaps even more attention should be devoted to motivating women to attend the educational session.

Implications

The results of this study suggest that cost reductions alone will not have a marked impact on the mammography use of older women. It may be, of course, that the minimal control group interventions may have required longer to manifest their impact. The age-tailored interventions created for this project did appear, when combined with the elimination of access barriers and cost reductions, to result in a substantial uptake in use of this service. More attention should be paid nationally to developing and tailoring interventions appropriate for older women (*24*).

Far too little attention has been paid to the special needs of this population. Future research should focus on minority women, rural women, and those with less than a high school education, since research consistently finds these groups to be underusers of mammography. This focus is essential if the year 2000 objectives are to be achieved among this population. In addition, future programs would be strengthened by adding a stronger physician component. Given the importance of physicians' recommendations, it is crucial that physicians support and reinforce the importance of breast screening, including mammography and clinical breast examination.

This study further provides guidance in the kinds of health communications that should be developed. Older women do not feel susceptible to breast cancer, so messages may need to heighten the salience of breast cancer for them. Without a certain level of concern, women may not be willing to take action (*25,26*). Both older women and their physicians should be given a clear statement about the recommended mammography and breast screening guidelines for older women. Since most cancers are minimal or regional, even in older women, this age group requires screening as often as younger women (*27*). However, the presence of co-morbid conditions is an important factor that may modify general guidelines.

Older women must be informed that age increases the likelihood of breast cancer and that their physicians support mammography for older women. Additionally, campaigns should tackle the pervasive belief found in this study—that older

women do not need mammograms if they are healthy. The strongest interventions are likely to be those that are directed at women, their physicians, and the health system and seek to reduce the many barriers to mammography use—knowledge, belief, cost, access, and economic barriers. Once abnormal results are identified, assiduous efforts must be employed to assure appropriate followup. Early detection should result in early diagnosis and early treatment.

References

1. Omenn, G. S.: Prevention and the elderly: appropriate policies? Health Aff 9: 80–93 (1990).
2. National Cancer Institute: Cancer and the population age 65 and over. Rockville, MD, 1991.
3. Stewart, J. H., and Foster, R. S.: Breast cancer and aging. Semin Oncol 16: 41–50 (1989).
4. Tabar, L., et al.: Significant reduction in advanced breast cancer: results of the first seven years of mammography screening in Kopparberg, Sweden. Diagn Imaging Clin Med 54: 158–164 (1985).
5. Shapiro, S., et al.: Selection, follow-up, and analysis in the Health Insurance Plan Study: a randomized trial with breast cancer screening. NCI Monogr 67: 65–74 (1985).
6. Weinberger, M., et al.: Breast cancer screening in older women. J Am Geriatr Soc 39: 22–29 (1990).
7. Public Health Service: Healthy people 2000: national health promotion and disease prevention objectives. DHHS Publication No. (PHS) 91–50212. U.S. Government Printing Office, Washington, DC, 1991.
8. Dawson, D. A., and Thompson, G. B.: Breast cancer risk factors and screening: United States, 1987. Vital and Health Statistics, DHHS Publication No. (PHS) 90–1500. National Center for Health Statistics, Hyattsville, MD, 1990, pp. 1–33.
9. National Cancer Institute Breast Cancer Screening Consortium: Screening mammography: a missed clinical opportunity? Results of the NCI Breast Cancer Screening Consortium and National Health Interview Survey Studies. JAMA 264: 54–58, July 4, 1990.
10. Burg, M. A., Lane, D. S., and Polednak, A. P.: Age group differences in the use of breast cancer screening tests. J Aging Health 2: 514–530 (1990).
11. Fox, S. A., Murata, P. J., and Stein, J. A.: The impact of physician compliance on screening mammography for older women. Arch Intern Med. In press.
12. Harris, R., Fletcher, S., and Gonzalez, J.: Mammography and age: are we targeting the wrong women? Cancer 65: 2010–2014 (1991).
13. Marchant, D. I., and Sutton, S. M.: Use of mammography—United States, 1990. MMWR 39: 621–630, Sept. 14, 1990.
14. Rimer, B. K., et al.: Why women resist screening mammography: patient-related barriers. Radiology 172: 243–246, July 1989.
15. Zapka, J. G., Stoddard, A., Costanza, M., and Greene, H.: Breast cancer screening by mammography: utilization and associated factors. Am J Public Health 79: 1499–1502 (1989).
16. Rosenstock, I. M.: The health belief model: explaining health behavior through expectancies. *In* Health behavior and health education: theory, research and practice, edited by K. Glanz, F. M. Lewis, and B. K. Rimer. Jossey-Bass Publishers, San Francisco, 1990, pp. 39–62.
17. Perry, C. L., Baranowski, T., and Parcel, G. S.: How individuals, environments, and health behavior interact: social learning theory. *In* Health behavior and health education: theory, research, and practice, edited by K. Glanz, F. M. Lewis, and B. K. Rimer. Jossey-Bass Publishers, San Francisco, 1990, pp. 161–186.
18. Kessler, H. B., et al.: Corporate-sponsored breast cancer screening at the work site: results of a statewide program. Radiology 179: 107–110, April 1991.
19. Green, L. W., and Kreuter, M. W.: Health promotion planning. Mayfield Publishing Company, Mountain View, CA, 1991.
20. King, E. S., et al.: How valid are mammography self-reports? Am J Public Health 80: 1386–1388, November 1990.
21. Morel, J. G.: Logistic regression under complex survey designs. Surv Methodol 15: 203–223 (1989).
22. Cochran, W. G.: Sampling techniques. Wiley, New York, 1977.
23. Lerman, C., et al.: Factors associated with repeat adherence to breast cancer screening. Prev Med 19: 279–290 (1990).
24. Bastani, R., Marcus, A. C., and Hollatz-Brown, A.: Screening mammography rates and barriers to use: a Los Angeles County survey. Prev Med 20: 350–363, May 1991.
25. Lerman, C., et al.: Psychological side effects of breast cancer screening. J Health Psychol 10: 259–267 (1991).
26. Lerman, C., et al.: Psychological and behavioral implications of abnormal mammograms. Ann Intern Med 114: 657–661, Apr. 15, 1991.
27. Fox, S. A.: Increasing the use of screening mammography for older women. Prim Care Cancer: 34–37, October 1991.

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