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Sound**Seattle, Wash**Eff Clin Pract. 2000;4:213-220.*

Cost-Effectiveness of Strategies To Enhance Mammography Use

OBJECTIVE. To estimate the cost-effectiveness of three strategies to increase breast cancer screening with mammography (reminder postcard, reminder telephone call, and motivational telephone call).

DESIGN. Cost accounting for each strategy followed by cost-effectiveness analysis.

DATA SOURCE FOR EFFECTIVENESS. Randomized trial of three strategies conducted at Group Health Cooperative of Puget Sound (GHC).

TARGET POPULATION. Women 50 to 79 years of age who were enrolled in GHC's breast cancer screening program who did not schedule screening mammography within 2 months after it was recommended by letter.

PERSPECTIVE. Health plan.

OUTCOME MEASURE. Marginal cost-effectiveness of each additional woman screened.

RESULTS OF BASE-CASE ANALYSIS. Because of its high cost (about \$26 per call) and intermediate effectiveness, the motivational call was the least cost-effective strategy. If it was assumed that 50% of the women who scheduled mammography after receiving the reminder postcard would have scheduled mammography within 10 months even without it, marginal cost-effectiveness for the postcard among all women was \$22 per woman screened versus \$92 for the reminder call. Among women with no previous mammography, the marginal cost-effectiveness for the postcard was \$70 versus \$100 for the reminder call.

RESULTS OF SENSITIVITY ANALYSIS. Among women with no previous mammography, the choice between the reminder postcard and the reminder call was sensitive to assumptions about the percentage of women expected to receive mammography in the absence of other promotional strategies.

CONCLUSIONS. A simple reminder postcard is the most cost-effective way to increase mammography. Choices about how to promote mammography will ultimately depend on plan values and willingness to invest in promotional strategies that increase participation at higher unit costs.

For women 50 to 69 years of age, evidence clearly supports the effectiveness of mammography as a breast cancer screening tool. Randomized trials have demonstrated that mammographic screening in this age group can decrease breast cancer mortality rates by approximately 25% to 30% within 5 or 6 years.¹ Breast cancer mortality rates have decreased since 1990, perhaps in part because of widespread screening.²⁻⁴ These benefits highlight the need to increase awareness and promotion of mammography. With the growth of managed care in the United States, the opportunity to use the health plan to promote mammography as a breast cancer screening tool has increased. However, health plans face the challenge of finding cost-effective ways to increase women's participation in screening programs.

This paper is available at ecp.acponline.org.

Edited by William C. Black, MD

**See related editorial on
pages 250-252.**

Health benefits are sufficient incentive for health plans to find ways to increase participation, but the health care market also prompts plans to improve delivery of all preventive services. So-called “report cards,” such as the Health Plan Employer Data Information Set (HEDIS) measures produced by the National Committee on Quality Assurance, include mammography participation in women 52 to 69 years of age as one of the elements on which managed health plans are evaluated. Many health insurance purchasers will not contract with plans that fail to meet HEDIS or other report card standards.

Little research exists on the costs associated with alternative strategies for breast cancer screening recruitment. Most cost analyses have focused on the value of mammographic screening, and the results of these studies have contributed to widespread adoption of such screening for women 50 years of age and older.⁵ The National Cancer Institute, the American Cancer Society, the U.S. Preventive Services Task Force, and other groups in the United States and other countries recommend screening mammography for women in this age group, in part because of demonstrated reductions in mortality rate.^{5,6}

In one of the few economic analyses of alternative recruitment strategies for mammographic screening, Hurley and colleagues⁷ found that personal promotional strategies were more cost-effective than community and public promotion efforts because they produced significantly greater participation at a lower cost per mammogram. This strategy was a personalized letter sent to women identified through voter registration rolls. Community-based strategies involved advertisements in local newspapers and notices in public places frequented by mammography candidates. The cost per woman recruited through a personalized letter without a specific appointment date was \$8.28 in 1990 U.S. dollars versus \$17.31 and \$83.39, respectively, for newspaper and community promotion strategies.

In this paper, we use the results of a recent randomized trial⁸ to examine the cost-effectiveness of three strategies to encourage participation in mammographic screening (reminder postcard, reminder telephone call, and motivational telephone call).

Methods

Overview

We report the estimated cost-effectiveness of alternative strategies to increase mammography use in women 50 to 79 years of age. Our data are based on a recent trial conducted at Group Health Cooperative of Puget Sound (GHC). Our goal was to provide health plans with

information about the cost-effectiveness of a reminder postcard, reminder telephone call, and motivational telephone call in increasing enrollees' participation in screening programs. The outcome of interest, based on the anticipated needs of health plan decision makers, was the marginal or incremental cost per participant screened for each promotional strategy.

Setting

Our analysis is from the perspective of GHC, a mixed-model HMO serving more than 500,000 enrollees in western Washington State. In terms of ethnicity and socioeconomic status, the GHC population is similar to the communities in which it provides care.⁵ Although GHC has an ongoing breast cancer screening program, we did not consider the fixed costs associated with developing and maintaining this program in our analysis.

Effectiveness: The Randomized Trial

Effectiveness data for our analysis were based on a randomized trial⁸ that evaluated alternative strategies to improve participation in GHC's breast cancer screening program. Participants were recruited for the trial from a random sample of 11,570 women aged 50 to 79 years who were due to receive mammography in GHC's breast cancer screening program.

Figure 1 shows the flow of patients into the randomized trial. Women who completed a survey were sent a letter recommending mammography. Those who did not schedule a mammogram within 2 months after receiving the letter were randomly assigned to one of three groups. Women in the first group received a postcard reminding them of the importance of screening and inviting them to schedule a mammogram. The other two groups received telephone calls that 1) acknowledged that they had not scheduled a mammogram and that the opportunity still existed (reminder call) or 2) engaged the woman in a discussion that addressed affect, attitude, facilitating conditions, and perceived breast cancer risk (motivational call). Different staff members were involved in the reminder and motivational calls. Callers in both telephone-based strategies were trained in delivering the relevant message and in using the appointment system for the GHC screening program. Personnel conducting the telephone interventions had access to the screening program's scheduling system and offered to schedule an appointment at the time of contact. Women were asked to contact their health care providers if they had specific questions about breast cancer and mammography. Details on the telephone call groups of the intervention are available elsewhere.⁹

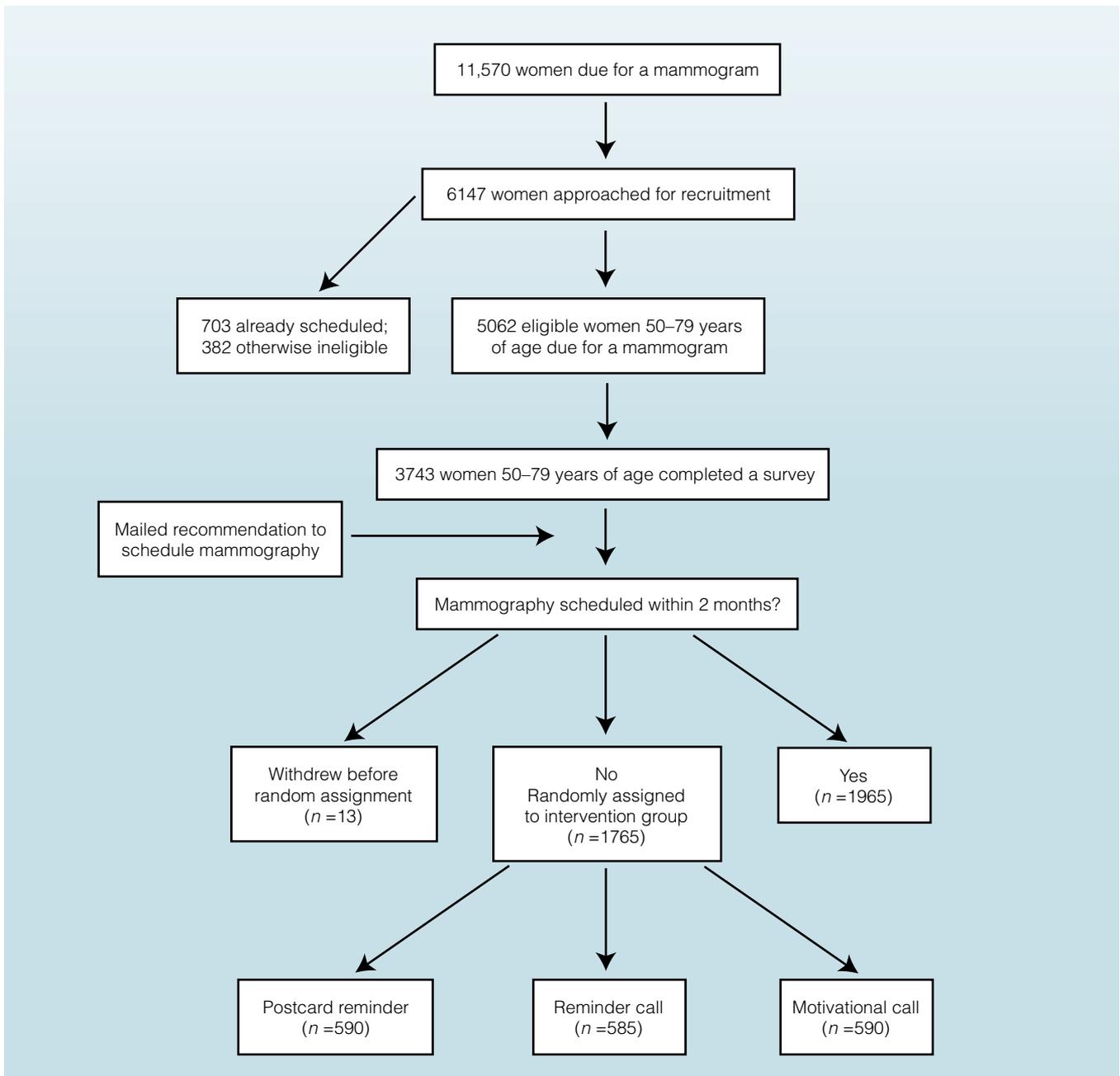


FIGURE 1. Design of the randomized trial of effectiveness.

Descriptive data on the women in each intervention group are given in **Table 1**. **Figure 2** shows the primary results of the trial. At 12 months, women in the two telephone groups were significantly more likely to have scheduled a mammogram than were women who received the postcard; however, no statistically significant difference was seen between the two telephone groups.

Cost: Accounting Methods

Overview

Cost assignment for each strategy is based on the project team's report of resources used to deliver the interven-

tion. Our cost model includes any office space or equipment from GHC's screening program that was used but not paid for by the trial. GHC allowed the research team to use some existing screening program resources (e.g., office space, telephones, computers) without charge. However, we estimated the overhead expenses needed for each intervention group by assuming that the health plan incurred all of the additional expenditures required to implement each promotional strategy.

Dollar values for resources used in the trial were 1998 local market costs for personnel, office space, furnishings, and equipment. We do not use GHC's costs because they may reflect idiosyncrasies of GHC's pur-

TABLE 1
Characteristics of Participants in the Randomized Trial

VARIABLE	PROMOTIONAL STRATEGY		
	REMINDER POSTCARD (n = 590)	REMINDER CALL (n = 585)	MOTIVATIONAL CALL (n = 590)
Mean age ± SD, yr	61.7 ± 9.3	62.2 ± 8.8	61.9 ± 9.1
Ethnicity			
White	90%	89%	88%
Hispanic	<1%	1%	1%
Black	4%	4%	4%
Asian or Pacific Islander	3%	4%	4%
Other	3%	2%	3%
Participants who had previous mammograms	72%	73%	72%

chasing or human resource policies. The cost model includes all personnel, hardware, and material necessary to implement and conduct the promotional strategies, except building and maintaining the screening program information system. Total costs for each fixed and variable resource used in each strategy were allocated on a per-participant basis. Average fixed cost elements necessary for each promotional strategy, such as office space, telephone lines, and computers, were allocated to all women randomly assigned to that strategy.

Reminder Postcard

Costs for the postcard group include development of the text used on the postcard as well as its design, pro-

duction, and mailing. Production and mailing costs are based on bulk mailing charges, and we assume that all relevant personal information for eligible women was available from the existing health plan database. Costs included an analyst (to abstract screening program information on eligible women), equipment, and office space needed to complete these tasks.

Reminder and Motivational Telephone Calls

The most significant variable cost in both telephone-based strategies was time spent on the telephone. Callers in both telephone groups collected data on the length of the telephone calls, and costs were allocated on the basis of average cost per minute of contact time. Staff deliver-

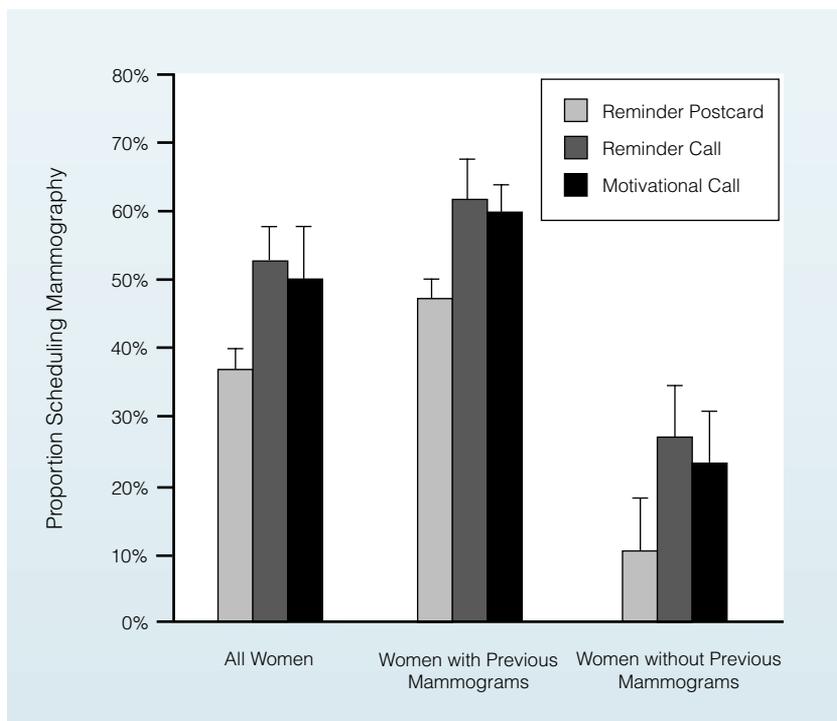


FIGURE 2. Effectiveness of the promotional strategies. Error bars represent the upper bound of 95% CIs.

ing the motivational call required greater skills and received more training and a higher wage than staff delivering the reminder call. Callers also met periodically with a supervisor for quality control purposes; however, we excluded any quality control time and supervisor follow-up that was conducted exclusively for the research and evaluation components of the project.

Cost-Effectiveness

We computed the marginal or incremental cost-effectiveness for each strategy as the change in cost with respect to the change in strategy effectiveness, where marginal effectiveness is defined as the incremental likelihood that a woman receives mammography under each successively more intensive intervention. Marginal cost-effectiveness was calculated by dividing the change in cost by the change in effectiveness and was determined for the postcard relative to the initial letter recommending mammography, for the reminder call relative to the postcard, and for the motivational call relative to the reminder call.

Analysis

The base-case analysis assumes that 50% of the women who scheduled mammography after receiving the reminder postcard would have done so within 10 months even without it. We tested the sensitivity of our results to this assumption by varying the percentage from 0% to 80%. We also examined whether cost-effectiveness estimates were sensitive to mammography history by estimating these values for all women and

according to previous mammography experience. These analyses were conducted by using program effectiveness and per-unit costs that were relevant for these specific groups. Our analysis follows an intention-to-treat approach; women who were randomly assigned to the telephone groups but were not contacted were included in the analysis. Callers were unable to reach 18% of the women assigned to the reminder call and 17% of those assigned to the motivational call.

Results

Costs

A summary of per-participant unit costs is given in **Table 2**. The same unit costs for identifying women who did not schedule mammography and for generating the recommendation letter were applied to each strategy. The reference case—the initial recommendation letter without any additional reminder—cost \$2.07 per participant. The reminder postcard cost \$3.95, bringing the total cost of this strategy to \$6.02 per participant.

The combination of office space, caller training, and time made the telephone calls more expensive. Callers spent threefold more time with women during the motivational call than during the reminder call (7.8 minutes vs. 2.4 minutes). Training telephone counselors and ensuring quality control for the motivational call also took more time because the intervention was more complex. These differences account for the higher unit cost of the motivational call. Unit costs for the two telephone groups were recalculated to reflect that mean

TABLE 2
Unit Costs

VARIABLE	INITIAL LETTER RECOMMENDING MAMMOGRAPHY	PROMOTIONAL STRATEGY		
		REMINDER POSTCARD	REMINDER CALL	MOTIVATIONAL CALL
Overhead*	\$0.89	\$2.64	\$12.29	\$11.51
Materials†	\$0.74	\$0.83	‡	‡
Personnel	\$0.44	\$0.48	\$6.86	\$12.41
Subtotal for unit costs	\$2.07	\$3.95	\$19.15	\$23.92
Cost of recommendation letter	—	\$2.07	\$2.07	\$2.07
Total cost of strategy per participant	\$2.07	\$6.02	\$21.22	\$25.99

*Includes office space and furnishings, computer workstations, network hookup, and telephone lines (assuming 100% overhead assignments).

†Includes stationery for postcards/invitation letters, labels, and printer ribbons.

‡Included in overhead.

telephone call length varied with women's history of mammography. Compared with women who had had mammography, women who had not had mammography had marginally longer reminder calls (2.5 minutes vs. 2.2 minutes), but motivational calls were significantly longer (9.6 minutes vs. 7.0 minutes).

Cost-Effectiveness

Cost-effectiveness estimates are reported in **Table 3**. Among all women, the cost per woman screened (the total cost for each strategy divided by the number of women screened) was approximately \$17 for the reminder postcard and \$40 and \$52 for the reminder and motivational calls, respectively. Marginal cost-effectiveness was \$22 for the postcard and \$92 for the reminder call. The motivational call is dominated—meaning that it was more expensive and less effective in promoting mammography than the reminder call.

The postcard was more cost-effective than the telephone strategies regardless of mammography experience. The motivational call was always dominated. However, the magnitude of the postcard's advantage over the reminder call was affected by the woman's experience with mammography. The marginal cost-effectiveness of the postcard was one fifth that of the reminder call among women who had previous mammography and two thirds that of the reminder call for those who had not. Therefore, although the postcard was always more cost-effective than the reminder call, this advantage was less significant among women who had never had mammography.

Sensitivity Analysis

We tested the sensitivity of our results to alternative assumptions about the percentage of women likely to have screening mammography without receiving the promotional strategies. Our base-case assumption was that 50% of women who scheduled a mammogram within 10 months after receiving the postcard would have done so without any prompting. In the sensitivity analysis, we varied this assumption from a low of 0% to a high of 80%. Varying this assumption affected the marginal cost-effectiveness of the reminder postcard but not the marginal cost-effectiveness of the reminder call (the motivational call was always dominated).

As shown in **Figure 3**, our results were sensitive to alternative assumptions about the percentage of women likely to receive mammography without receiving the postcard only among those who had not had previous mammography. The reminder call became more cost-effective than the postcard if 68% or more of those who scheduled mammography after the postcard would have done so without prompting.

Discussion

We analyzed the cost-effectiveness of three alternative strategies—a postcard reminder, a reminder telephone call, and a motivational telephone call—in increasing participation in a mammography screening program. In a randomized trial of women aged 50 to 79 years who had not scheduled a mammogram since their last screening, we found that the cost per woman screened

TABLE 3
Calculation of Cost-Effectiveness

VARIABLE	COST	MARGINAL COST	EFFECTIVENESS	MARGINAL EFFECTIVENESS	MARGINAL COST-EFFECTIVENESS
All women					
Initial recommendation letter	\$2.07		0.1805		
Reminder postcard	\$6.02	\$3.95	0.361	0.1805	\$21.88
Reminder call	\$21.22	\$15.20	0.526	0.165	\$92.12
Motivational call	\$25.99	\$4.77	0.503	-0.023	Dominated
Women with previous mammography					
Initial recommendation letter	\$2.07		0.2275		
Reminder postcard	\$6.02	\$3.95	0.455	0.2275	\$17.36
Reminder call	\$21.24	\$15.22	0.625	0.17	\$89.53
Motivational call	\$25.76	\$4.52	0.604	-0.021	Dominated
Women without previous mammography					
Initial recommendation letter	\$2.07		0.0565		
Reminder postcard	\$6.02	\$3.95	0.113	0.0565	\$69.91
Reminder call	\$21.19	\$15.17	0.265	0.152	\$99.80
Motivational call	\$26.51	\$5.32	0.24	-0.025	Dominated

was \$17 with the reminder postcard, \$40 with the reminder call, and \$52 with the motivational call. The marginal cost-effectiveness was \$22 for the postcard and \$92 for the reminder call, and the motivational call was dominated.

The motivational call was not a cost-effective strategy because it was more expensive and no more effective than the reminder call in all women regardless of mammography experience. Although the reminder call was more effective than the postcard, our analysis showed that the reminder call's greater unit cost outweighed its greater relative effectiveness; therefore, the postcard was more cost-effective as a promotional strategy.

We found that the relative cost-effectiveness of the postcard and reminder call strategies was affected by previous mammography. Although the postcard is generally more cost-effective than the reminder call, this advantage decreased among women who had never had mammography. Health plans may use this information to target promotional strategies to specific populations of women. We found that the postcard was appropriate in women who had previous mammography, but health plans may find that the investment in the reminder call is justified for those who have not. In future screening rounds, women who were successfully recruited via the reminder call may require only the postcard to encourage their participation. Although the reminder call is still less cost-effective than the postcard, health plans may place a high enough value on the associated increased participation to warrant the additional expense.

Health plans must consider the costs imposed on health care delivery when implementing any promotional strategy. The most important of these is the con-

sequences of missed mammography appointments. Mammographic screening facilities are valuable, and having them sit idle is a substantial waste of resources. Although women who received telephone calls could schedule mammography immediately, 12.7% of those in the reminder group and 15% of those in the motivational group did not keep their appointments. We did not include the cost of missed appointments in our analysis because we did not have these data for the women who received a postcard. Because it is unlikely that a greater percentage of women in the postcard group did not keep their appointments, we do not believe that excluding these costs had any effect on our conclusions.

Our results are limited by relying on effectiveness data collected from a randomized trial conducted at a single health plan. The promotional strategies may be more or less effective in other health plans or in settings that have different experiences with breast cancer screening or other preventive health programs. Although we did not rely on health plan-specific costs, we must recognize the implications of relying exclusively on the GHC population for effectiveness data.

In addition, our analysis could not address the issue of whether the value of the postcard deteriorates over time. The relative cost-effectiveness of the postcard may decrease if this method becomes less powerful in motivating women with previous mammography to schedule appointments. Future research should evaluate the cost and effectiveness of promotional strategies over time as women gain more experience with screening mammography.

All three of the strategies studied increased mammography use at different average and marginal costs.

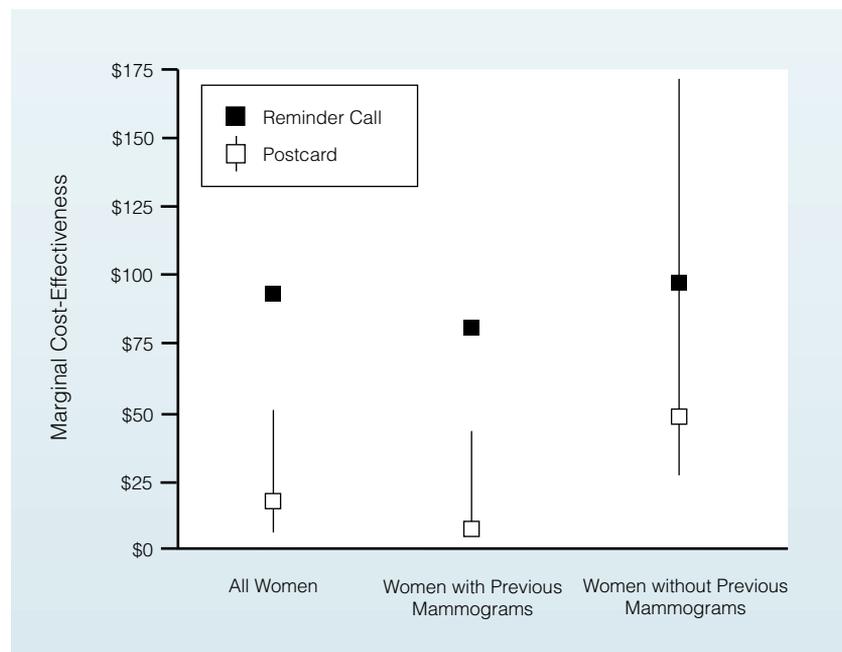


FIGURE 3. Sensitivity analysis examining assumptions about the percentage of women likely to schedule mammography without receiving the postcard. The black line indicates the range of cost-effectiveness ratios for the postcard.

Choices about how to promote mammography will ultimately depend on plan values and willingness to invest in promotional strategies that increase mammographic participation at higher unit costs. Mammography's value as a breast cancer screening tool for women 50 years of age and older has been clearly demonstrated. In response, health plans must develop screening programs and encourage their enrollees' participation. Our analysis shows that cost-effective options for increasing participation exist and that health plans may be able to find an optimal strategy by using women's previous experience with mammography to target implementation.

Take-Home Points

- **Although screening mammography has been shown to reduce breast cancer mortality rates, not all women participate in breast cancer screening programs.**
- **Using the findings of a recent randomized trial, we estimated the cost-effectiveness of three strategies to increase screening mammography: a reminder postcard, a reminder telephone call, and a motivational telephone call.**
- **The motivational call was the most expensive strategy and was less effective than the simple reminder call.**
- **The postcard was the least expensive strategy and had a marginal cost-effectiveness among all women of \$22 per woman screened versus \$92 for the reminder call.**
- **The cost-effectiveness ratios were influenced by whether women previously had mammography.**

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Grant Support

By a grant from the National Cancer Institute.

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