Effectiveness and Cost-Effectiveness of Multiple Outcalls to Promote Mammography among Low-Income Women[1]

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Abstract

A multiple outcall approach based on the Transtheoretical Model was used to encourage mammography behavior in low-income women in the state of Colorado. Women ($n = 983$) were recruited in person at grocery and discount stores and were then called over the telephone to receive the multiple outcall intervention. These women were compared with 3,080 women who were recruited by telephone and randomly assigned to three study groups: health survey only (control); single outcall; or advance card + single outcall. Subsequent mammography behavior was assessed through a telephone interview conducted 6 months after initiation of the protocol. After controlling for baseline differences between groups in age, education, income, health status, and previous mammography behavior, the multiple outcall intervention was significantly related to mammography behavior among women nonadherent at baseline (odds ratio, 2.58; 95% confidence interval, 1.45–4.60). Furthermore, women who received the multiple outcall intervention had higher "stage of change" at follow-up and more positive attitudes toward mammography. Cost-effectiveness analysis indicated that although the multiple outcall intervention was more costly to deliver ($14.84 per subject compared with about $7.00 for the single outcall interventions), it cost considerably less per subject converted from nonadherent to adherent. Despite study design limitations, the multiple outcall intervention appears to be an effective method of promoting mammography among previously nonadherent women. The results suggest that a combined approach, in which nonadherent women receive multiple calls promoting screening behavior, followed by single calls at the appropriate intervals to promote repeat screening, may be a useful strategy in defined populations.

Introduction

Routine screening mammography is the best known method for reducing mortality from breast cancer in women >50 years old. The National Cancer Institute recommends that all women >40 years old have routine screening mammograms every 1–2 years (1). The last decade has seen dramatic increases in acceptance of this procedure by women in the United States. For example, the 1987 National Health Interview Survey reported that 28.7% of women >40 years old had received a mammogram in the last 2 years, whereas the 1994 National Health Interview Survey reported this statistic to be 60.9% (2). Mammography rates by state ranged from 63.0% (Nebraska) to 79.7% (Massachusetts) in 1995 (3). Low-income and minority women are less likely to receive routine mammography screening and are more likely to be diagnosed with cancer at a later stage (4–6). Although recent studies suggest that the gap between white and black women may have disappeared, Hispanic women and lower-income women continue to lag behind in this important behavior (3).

Recently reported longitudinal data for the time period 1994–1997 indicate that mammography adherence rates have been stable at ~70% among low-income, older women in the state of Colorado (7). Although these rates are impressive when compared with the national rates reported for the late 1980s (20–30%), there seems to be a group of women resistant to mammography. According to diffusion of innovation theory, a new innovation sequentially diffuses into a population via five adopter categories: "innovators," "early adopters," "early majority adopters," "late majority adopters," and "laggards" (8, 9). The relatively high and stable rate of 70% suggests that diffusion of screening mammography in the state of Colorado has reached all but the late majority adopters and/or laggards. It has been suggested that intensive interventions directly addressing barriers are necessary to move such individuals to adopt a new behavior (9).

In 1997, we completed a randomized trial in which low-income women aged 50+ in the state of Colorado were offered telephone counseling about mammography in a 15-min (average) telephone call delivered by telephone information specialists of the National Cancer Institute's CIS[3] (7, 10). Households were randomly selected to participate in the study using commercially available direct marketing lists; thus, the "outcalls" were proactive. The intervention was based on the Transtheoretical Model (11, 12) and incorporated the concepts of motivational interviewing (13). Two intervention conditions were

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[3] The abbreviation used is: CIS, Cancer Information Service.

compared with a control group, which completed an interview about health practices, access to care, and sources of health information. The two intervention conditions were the outcall alone and the outcall preceded by a mailed card that invited participation and mentioned the importance of mammography. The results of this trial indicated that the interventions resulted in some attitude change but no behavior change in a 6-month follow-up period among women in early stages of change (*e.g.*, precontemplators; Ref. 7). For those who were in action or maintenance at baseline, results indicated a small increase in adherence attributable to the interventions at 2-year follow-up. The advance card + outcall condition appeared to promote slightly more change than the outcall alone.

Concurrent with the above-mentioned study, we received funding from the Department of Defense Breast Cancer Research Program to test a multiple outcall approach, in which women received not just one but a series of calls promoting screening mammography. The assumption was that if behavior change occurs in stages as suggested by the Transtheoretical Model, an incremental intervention that moves women more gradually toward behavior change would be superior to a single outcall approach. Furthermore, given that about 70% of eligible women in the state of Colorado were adherent to mammography screening guidelines, a more intensive intervention would be needed to promote screening in the remaining laggards. A similar strategy used to promote cervical cancer screening was successful in convincing 46% of inadequately screened women to make an appointment (14).

The main hypothesis of the present study was that the proportion of women receiving a screening mammogram during a 6-month follow-up period would be higher in the multiple outcall group compared with all of the other groups. Furthermore, we hypothesized that the average "stage of change" for mammography behavior would be higher among women in the multiple outcall group than in all of the other groups.

In addition to testing the effectiveness of the multiple outcall strategy compared with the single outcall, we sought to compare the costs involved in both approaches. We reasoned that although the multiple outcalls would require greater resources, if behavior change was greater, the multiple outcall strategy might be more cost-effective.

Materials and Methods

This study involves the comparison of a multiple outcall strategy promoting screening mammography with strategies involving a single outcall alone, an advance card + single outcall, and no intervention. Data for the three comparison groups come from a study reported previously (7). The original plan for the multiple outcall study was to recruit women over the telephone using commercially available direct marketing lists as in the single outcall study. However, Department of Defense funding required that written informed consent be obtained before telephone counseling. A pilot study indicated that it would be very difficult to accomplish the consent requirement with telephone recruitment, so an in-person recruitment plan was devised. Thus, the study design comparing the multiple outcall to the single outcall intervention became quasi-experimental, because of the different recruitment strategy and resulting baseline differences in the study group characteristics. Additionally, outcalls for the single outcall study were conducted from August 1994 to June 1995, whereas outcalls for the multiple outcall study were conducted ~1 year later, from September 1995 to July 1996. The effect of the interventions on mammography behavior was determined through telephone interviews with subjects, conducted 6 months after enrollment into the study.

Sampling and Recruitment

Sampling and recruitment for the single outcall study have been reported in detail elsewhere (10). Briefly, a commercially available database, INFORUM, was used to identify low-income and minority neighborhoods throughout the state of Colorado. Sampling was stratified such that 30% of households would come from low-income white neighborhoods, 30% from low-income mixed or Hispanic neighborhoods, and 40% from African-American neighborhoods throughout the state of Colorado. Residential lists were then purchased from the regional telephone company, and households were randomly assigned to three study groups: control, single outcall, or advance card + single outcall. Recruitment was over the phone, during the same call in which the experimental protocol was delivered. Using this strategy, 16% of the households contacted yielded an eligible, enrolled woman. Forty-eight percent of households reported no eligible woman. The response rate (completed baseline call) among households presumed to have an eligible woman was ~50%.

For the multiple outcall study, participants were recruited on-site from stores in low-income and/or minority neighborhoods throughout Colorado. Colorado census data were examined to generate a list of potential communities that reflected the urban/rural, income, and racial/ethnic mix attained in the telephone recruitment study. Cities that had not been included in the original study (with one exception) were eliminated to have comparable subject pools. The single exception to this was one small, low-income town with a large Hispanic population. It was selected because of the efficiency with which Hispanic women could be recruited there. The Chamber of Commerce in each location was contacted and asked to identify stores serving low-income and minority populations in the area. The zip codes of the recommended stores were then matched against census data to confirm they were in neighborhoods classified as low income and/or minority.

Over an 8-month period, two health educators traveled to the selected sites throughout Colorado. Recruiting trips were scheduled around the first of the month to take advantage of the large volume of older shoppers who receive their Social Security checks at that time. The health educators spent 1 to 2 days per site, where they set up a table in a central, prominent place in the store. All of the women passing the table were approached for participation if there appeared to be any possibility that they were >50 years old. The health educators explained the study and enrolled participants by having them complete the written informed consent statement. The health educators specifically avoided promoting mammography during recruitment. Light refreshments and brochures on 5-a-day fruits and vegetables and sun protection were provided at the table. There were no incentives for participation.

Inclusion Criteria

Women were eligible for the studies if they were >50 years old, spoke English, had not previously had breast cancer, and had no current symptoms of breast cancer. For women recruited at shopping sites, assessment of breast cancer status occurred during the outcalls rather than at the site of contact in the store. Mammography adherence status was not a criterion for eligibility. More than 95% of the Hispanic population in Colorado speaks English.

Description of Outcall Intervention

The multiple outcall intervention was based on the Stages of Change Model, developed by Prochaska and DiClemente (11) and extended to mammography by Rakowski *et al.* (15) as well as the concepts embodied in motivational interviewing (13). The outcall intervention began with an assessment of each woman's personal stage of change according to the model. Assessment was followed by a loosely scripted interactive barriers counseling intervention that addressed each woman's own concerns about mammography and aimed to move her closer to adoption of routine screening. Before the conclusion of the outcall intervention, the health educator again assessed the stage of change of the individual, to determine the immediate impact of the intervention and if appropriate, to deliver intervention components relevant to the new stage.

All of the women who were not presently adherent with National Cancer Institute screening recommendations, not planning to maintain adherence, or simply due for a mammogram in the next 6 months were asked for permission to be contacted again, in ~2 weeks, so that the caller could answer any additional questions that might arise subsequent to the call. Women who agreed were called again by the same caller, up to a total of five calls, as necessary to achieve adherence to guidelines. Thus, these calls continued until either: (*a*) the woman reported that she had a mammogram; or (*b*) a total of five calls had been completed. Each call followed the basic format of the first call: assess stage of change, elicit barriers, counsel according to existing barriers, and reassess stage of change. If a call concluded with a commitment by the woman to make an appointment for a mammogram, the following call focused on whether the appointment had been made and if so, whether there were any barriers to keeping the appointment. At the point that a woman reported she had a mammogram, the call focused on promoting maintenance of routine screening according to guidelines. At any time, the woman could refuse to receive any additional calls.

The single outcall protocol was very similar in content to the multiple outcall protocol, but because no additional calls would be made to the woman, information not immediately relevant was not reserved for subsequent calls. For example, in the single outcall protocol, all of the women were offered information on locations of mammography facilities, whereas in the multiple outcall protocol, this information was saved for subsequent calls if the woman was not yet ready to make an appointment. For the advance card + single outcall, households were mailed an "invitation card" that invited any woman >50 years old living in the household to participate in the program. The card explained that the household would be called in about 2 weeks to complete an interview. It also mentioned the importance of mammography.

Implementation

In the single outcall study, calls were made by a staff of 11 information specialists of the CIS. The CIS was established in 1975 by the National Cancer Institute to provide up-to-date cancer information to cancer patients, relatives and friends of cancer patients, health care professionals, and the general public. Because of the recruitment and consent requirements of the multiple outcall study, two health educators located at AMC Cancer Research Center made calls for the multiple outcall study. These two individuals also implemented the in-person recruitment and consent for the study. Both individuals were involved with the original study and had direct experience with the implementation of the single outcall protocol. However, their counseling approaches may have been somewhat different from those used by the broader range of individuals who implemented the single outcall study.

A computer-assisted telephone interviewing system was used to computerize the protocols for ease in administering the outcalls. Advancement to different branches of the protocol was automated to provide for the highest level of standardization between callers.

Follow-Up Assessment

To determine the efficacy of the proposed outcall intervention in increasing adherence to mammography guidelines, subjects in all of the four study groups completed a follow-up interview ~6 months after receipt of the initial outcall. Similar to the initial outcall, this interview included questions determining the stage of change for mammography according to the Prochaska and DiClemente model (16). In addition, knowledge of mammography and screening guidelines, attitudes toward mammography, perceived barriers to and supports for mammography, and current adherence to National Cancer Institute recommendations were assessed. All of the respondents were asked a series of process evaluation questions related to the intervention, including how they felt about the multiple outcall procedure (*e.g.,* intrusive) and whether they thought that it changed their attitudes or behavior related to mammography.

Measurement of Key Variables

Assessment of Mammography Status and Stage of Change. Women were asked for the month and year of their most recent mammogram for screening (routine) or diagnostic purposes and their intentions for getting future mammograms (7). In accordance with the National Cancer Institute's recommendation, women were considered "adherent" if they had received a mammogram in the previous 2 years. They were considered "nonadherent" if they had a mammogram >2 years before the interview date or had never had a mammogram. Past mammography behavior and future intentions were combined to define their "stages" according to the Transtheoretical Model as described by Rakowski *et al.* (16). The five stages of adoption were as follows: precontemplation (no prior mammogram and no plan for one in the coming 6 months); contemplation (no mammogram in the past 2 years but planning one in the coming 6 months); action (one prior mammogram and planning one in the coming 1–2 years); maintenance (more than one prior mammogram and planning one in the coming 1–2 years); and relapse (at least one prior mammogram but >2 years ago *or* a mammogram within 2 years but not planning another mammogram). For analyses requiring ordering of the stages, relapse was ranked between precontemplation and contemplation, because these individuals lacked intentions to get a mammogram (similar to precontemplators) and had decisional balance scores (see below) comparable with precontemplators. The woman's adherence status and stage of change were determined at baseline and again at 6-month follow-up.

Decisional Balance. Consistent with the decisional balance construct of the Transtheoretical Model, Rakowski *et al.* (17) have identified cognitive "pros" and "cons" to mammography that are predictive of women's stages of change. On the basis of the work of Rakowski *et al.*, a decisional balance scale with 13 items was developed for administration over the telephone in this study (see Ref. 7 for details about scale development). Internal consistency of this scale (Cronbach's α) was 0.81. Scores could range from 13 (an "antimammography" stance) to

39 (a "promammography" stance). The scale was not administered during baseline because of a concern about sensitizing the control group to mammography.

Outcome Evaluation

The main question to be answered by the outcome evaluation of this project was as follows: Is the multiple outcall strategy superior to a single outcall strategy in moving women through the continuum of the stages of change toward adoption of routine mammography screening? Data to answer this question were drawn from two sources: the baseline assessment and the 6-month follow-up survey. Because of differences in recruitment between the study group and the comparison groups, analysis required controlling for baseline differences between the groups. Two techniques were used to accomplish this: stratification and statistical controlling using multiple logistic regression. Three variables were considered as outcomes: receipt of a mammogram since the baseline interview (a dichotomous "yes/no" variable), stage of change at follow-up (a five-level ordinal variable), and decisional balance (a continuous measure representing attitudes toward mammography).

Cost Analysis

Cost analyses used computer recorded times for delivery of the computerized outcalls as well as logs of time spent preparing mailings to subjects in the "advance card" group. Printing and postage costs were actual per-item costs. Personnel costs used the nationwide average hourly wage of CIS telephone information specialists in 1994 ($13/h) plus a fringe benefits rate of 26% ($3.50/h) and overhead/indirect cost rate of 45% ($7.50/h).

Results

Recruitment of Subjects. Of 2667 women approached to be part of the study, 34.3% refused, 24.1% were ineligible, and 41.6% (1111) were enrolled. Most refusals were because of the woman's being "too busy." Only 1% of the refusals occurred after the woman was provided the consent form to review and sign. The ineligible women were primarily <50 years old (65%), were not Colorado residents (18%), or had breast cancer or symptoms of breast cancer (8%). Of the 1111 enrolled in person, 983 (88.5%) completed the initial outcall. The response rate to the 6-month follow-up interview was 80% ($n = 783$) for the multiple outcall study and 75% ($n = 2212$) for the single outcall study.

Characteristics of Subjects. Table 1 compares the baseline age, race/ethnicity, education, income, self-reported health status, stage of change, and adherence status of the subjects who completed the 6-month follow-up interviews for the two studies. The on-site recruitment method for the multiple outcall study yielded women who were younger, more highly educated, had higher income, and had slightly higher self-reported health status compared with recruitment via telephone calls to low-income neighborhoods. Also, participants in the multiple outcall group tended to be more adherent to mammography screening guidelines at baseline. Stratified analyses indicated that this difference in adherence was not attributable to the younger age of the multiple outcall group; differences in adherence by age typically seen in the literature were minimal in this study sample (3). Racial and ethnic distributions of the two studies were almost identical.

Process Evaluation. All of the calls were completed by the same staff that recruited subjects. The mean length of the initial outcall was 18.3 min. Individualized barriers counseling was offered to each woman as part of the initial outcall; ~55% of subjects reported one or more barriers to mammography. The most commonly addressed questions or issues about mammography screening were cost (21%), concern about pain (8%), having a family history of breast cancer (8%), being a procrastinator (8%), not having symptoms (6%), concern about false negatives/accuracy of mammograms (5%), lack of physician's recommendation (4%), and not having time to get a mammogram (4%).

Three hundred sixty-one women were offered additional calls on the basis of their mammography history. Of these, 57% agreed. Thus, 82% of respondents received only the first call. The proportion that received additional calls varied by baseline stage of change. Forty-three percent of those in precontemplation, 56% of those in relapse, 71% of those in contemplation, 11% of those in action, and 1.5% of those in maintenance completed additional calls. Calls 2–4 ranged from 9- to14-min average length. The vast majority completed the intervention within three calls. Only four participants received the fifth call, which averaged 5 min in length.

In the 6-month follow-up interviews, participants were

Table 1 Baseline demographic characteristics, "stage of change," and adherence profile of participants of multiple outcall study and original study

	Multiple outcall study $n = 783$ (%)	Original study $n = 2219$ (%)
Age (yr)[a]		
50–54	18.2	11.7
55–59	18.2	14.8
60–64	18.5	15.7
65–69	17.6	16.9
70–74	15.3	16.6
75–79	7.8	12.5
80+	4.4	11.8
Race/Ethnicity		
White	80.5	78.6
Hispanic	10.4	10.9
Black	6.4	7.6
Other	2.6	2.9
Income[a,b]		
<$15,000	25.0	37.4
$15,000–24,999	19.7	24.2
$25,000–39,999	32.5	24.6
$40,000+	22.9	13.8
Education[a]		
0–8 yr	7.4	11.8
9–11 yr	9.9	13.6
12 yr	39.9	38.5
13–15 yr	24.3	23.2
16+ yr	18.6	12.9
Stage of change[a]		
Precontemplation	6.9	13.2
Relapse	9.3	14.8
Contemplation	9.1	8.6
Action	7.8	7.4
Maintenance	66.9	56.1
Adherence Level[a]		
Had a mammogram within the last 2 yr	76.2	72.0
Had last mammogram more than 2 yr ago	14.5	14.8
Never had a mammogram	9.3	16.0

[a] $P < 0.001$.
[b] Income data were missing for 95 subjects in the multiple outcall study and 374 subjects in the original study.

Table 2 Percent who had a mammogram since baseline by study group and baseline adherence level

Adherence status at baseline	Percent had mammogram during 6-month follow-up[a]				
	Control	Single outcall	Card + single outcall	Multiple outcalls	P^b
All	35.0 (695)	34.0 (746)	34.0 (771)	37.6 (782)	0.40
Adherent at baseline	45.9 (477)	42.4 (509)	41.8 (543)	40.8 (596)	0.38
Nonadherent at baseline	11.0 (218)	16.0 (237)	15.4 (228)	27.4 (186)	<0.001

[a] Numbers in parentheses are denominators.
[b] P based on χ^2 statistic.

Table 3 Logistic regression testing effect of group on having a mammogram since baseline, stratified by adherence level at baseline[a]

Predictor	Adherent at baseline (n = 2125)		Nonadherent at baseline (n = 870)	
	OR	95% CI	OR	95% CI
Age (yr)	0.99	0.98–1.01	0.98	0.96–1.00
Income				
<$15,000	1.00		1.00	
$15,000–24,999	0.86	0.66–1.12	0.91	0.54–1.55
$25,000+	1.00	0.78–1.29	1.27	0.78–2.06
Education (yr)	1.02	0.98–1.06	1.01	0.94–1.10
Health Status	0.97	0.89–1.06	0.79	0.67–0.95
Control condition	1.00		1.00	
Single outcall	1.01	0.77–1.34	1.45	0.80–2.62
Card + single outcall	0.93	0.71–1.22	1.38	0.76–2.50
Multiple outcalls	0.84	0.64–1.09	2.58	1.45–4.60

[a] Percent had a mammogram during 6-month follow-up.

asked about the outcall process. All of the participants reported that they were treated courteously, that the caller seemed knowledgeable about breast cancer and mammography, and that the caller listened carefully to what they had to say. Ninety-six percent said the caller seemed to really care about whether she got a mammogram. Ninety-five percent were glad they got the call(s). Thirty-eight percent said the call made them more likely to get a mammogram, but only 14% reported that they learned something new from the call.

Receipt of a Mammogram during the 6-Month Follow-Up Period. Table 2 reports the proportion of women in each study group who reported at follow-up that they had had a mammogram since the baseline assessment. The proportions are reported for all of the women combined and stratified by baseline mammography adherence, because the study groups differed significantly on this baseline variable. There was no significant difference among women who were adherent at baseline. However, among women nonadherent at baseline, significantly more women in the multiple outcall group reported having had a mammogram at follow-up (27%) compared with the other three groups (11–16%; $P < 0.001$). Those receiving the single outcall or advance card + single outcall appeared to be somewhat more likely that those in the control group to have had a mammogram at follow-up, but the difference was not statistically significant (15–16% *versus* 11% in the control group).

Within the multiple outcall group, the relationship between number of calls received and follow-up adherence was examined. Among those nonadherent at baseline, those who received more than one call were significantly more likely to be adherent at follow-up than those who received only one call (36.8% *versus* 11.4%, $P < 0.001$).

Because of baseline differences between the study groups in age, income, education, and self-reported health status, multiple logistic regression analyses were conducted so that these variables could be controlled for simultaneously. As indicated in Table 3, the demographic variables for which the groups differed at baseline appeared to have little or no relationship to adherence at follow-up. Self-reported health status had a slightly negative impact on adherence among those nonadherent at baseline, with those reporting higher health status being less likely to get a mammogram. Among women adherent at baseline, there remained no intervention effect after controlling for these variables. Within the group nonadherent at baseline, the multiple outcall condition was a strong predictor of getting a mammogram, with an odds ratio of 2.58. The two single outcall interventions appeared to have no significant effect on behavior.

Stage of Change at 6-Month Follow-Up. Stage of change at follow-up by study group for those nonadherent at baseline is shown in Table 4. There is a statistically significant trend indicating that as the intensity of the intervention increases, fewer women are in precontemplation and relapse, and more women are in contemplation, action, and maintenance.

Decisional Balance at 6-Month Follow-Up. Table 5 reports mean decisional balance at 6-month follow-up by study group, stratified by baseline adherence status. One-way ANOVA indicated a small but statistically significant difference between groups among both adherent and nonadherent respondents. For each comparison, the multiple outcall group had significantly higher decisional balance scores, indicating greater acceptance of the benefits of mammography.

Cost-Effectiveness Analysis. The goal of this analysis was to determine the costs of delivering the interventions per unit of behavior change and to assess whether the multiple outcall intervention was more cost-effective than the single outcall interventions. (Costs of recruitment were similar for the two studies—$11.72 per subject for the telephone recruitment and

Table 4 Stage of change at follow-up by study group among women nonadherent at baseline

Stage of change at follow-up	Control $n = 218$ (%)	Outcall $n = 237$ (%)	Card + single outcall $n = 243$ (%)	Multiple outcalls $n = 195$ (%)	P
Precontemplation	44.0	32.9	23.7	19.9	<0.001[a]
Relapse	20.6	21.1	24.6	16.1	
Contemplation	26.1	32.5	38.2	38.2	
Action	8.3	9.3	9.6	17.7	
Maintenance	0.9	4.2	3.9	8.1	

[a] Based on χ^2 statistic.

Table 5 Mean decisional balance scores at 6-month follow-up, by study group and baseline adherence[a]

	Decisional balance scores				
	Control	Single outcall	Card + single outcall	Multiple outcall	P^b
All	34.07 ± 5.24 (681)	34.41 ± 4.86 (730)	34.93 ± 4.74 (755)	35.99 ± 4.05 (775)	<0.001
Adherent at baseline	35.95 ± 4.13 (470)	35.92 ± 3.97 (500)	36.26 ± 3.76 (539)	36.92 ± 3.19 (590)	<0.001
Nonadherent at baseline	29.87 ± 5.03 (211)	31.13 ± 5.00 (230)	31.62 ± 5.29 (216)	33.04 ± 5.00 (185)	<0.001

[a] Values are means ± SD, with n in parentheses.
[b] P based on analysis of variance. Bonferroni comparisons indicate that the multiple outcall group was significantly different from all of the other groups ($P < 0.05$) in all stratifications.

$13.28 for the in-person recruitment—and are not included in this analysis.) Table 6 presents the results of the cost analysis.

Costs associated with intervention delivery were calculated by computing the cost of health educator time to deliver the intervention over the phone, plus the cost of sending the advance card (advance card group only). Per-subject costs have been calculated separately for women adherent and nonadherent at baseline. For the single outcall interventions, the time indicated is the simple mean time for all of the calls. For the multiple outcall intervention, the mean time to deliver each of the five calls is multiplied by the number of individuals receiving each of the five calls, the products are added, and the total number of minutes is divided by the total number of individuals. The proportion of individuals whose mammograms can be attributed to each intervention is calculated as the proportion of previously nonadherent women who received a mammogram in each study group minus the proportion who received a mammogram in the control group (see Table 2).

Program costs are calculated for two baseline nonadherence rates, 40% and 100%, to determine a range of projected costs, depending on the mammography behavior of the specific target population. When 40% of the population is nonadherent at baseline, the costs of delivering the program to 1000 participants are $5,768, $6,868, and $10,088 for the single outcall, advance card + single outcall, and multiple outcall interventions, respectively. The costs per participant who changed are $288, $390, and $154, respectively. When costs are calculated for a population that is 100% nonadherent at baseline (which might occur if participants were recruited on the basis of their medical records rather than from a community setting), the overall costs of program delivery increase, but the costs per participant who changed are reduced considerably, to $131, $177, and $90, respectively. The multiple outcall intervention is consistently the most cost-effective intervention of the three.

Discussion

The results of this quasi-experimental evaluation suggest that a multiple outcall approach can be successful for promoting cancer screening behavior in women previously nonadherent to screening guidelines. The Transtheoretical Model posits that an individual moves through several stages before action is taken. It appears that the repeated telephone calls allowed women the opportunity to consider the merits of mammography and then gave them the impetus to overcome any barriers preventing them from the action necessary to receive a mammogram. In addition to behavior change, the results suggest that as the outcall intervention increased in intensity (from single outcall to advance card + single outcall to multiple outcalls), there was increasing change in stage of readiness for mammography. There also appeared to be a gradient toward higher decisional balance scores with increasing intensity of the intervention, indicating that mammography attitudes moved in a positive direction as a result of the interventions.

Taken together with the results of the randomized trial reported previously (7), this research provides two possible avenues for mammography promotion. The single outcall approach, especially with an advance card, appears to be somewhat successful in promoting repeat mammography among women who are already adherent and appears to promote positive attitudinal (but little behavioral) change among women who are nonadherent. In contrast, the multiple outcall approach appears to be successful in promoting mammography among previously nonadherent women. The greater effect for nonadherent women is consistent with earlier studies (18), and indeed, this is the group for whom the counseling was designed.

Because mammography is not a "one-shot" behavior but must be continued on an interval basis to be maximally effective in reducing breast cancer mortality, approaches are needed that encourage both types of behavior: getting a first mammogram and continuing to get mammograms according to an age-appropriate schedule. A combined approach, therefore, in which nonadherent women receive multiple calls promoting screening behavior, followed by single calls at the appropriate intervals to promote repeat screening, may be a useful strategy in defined populations. It is important to note that our results indicate that ~86% of women presently adherent will get another mammogram in the next 2 years without an intervention. However, the single outcall + advance card raised this rate to ~92% (7), which indicates that almost half of the women who would not have gotten another mammogram were stimu-

Table 6 Calculation of costs and cost-effectiveness for three interventions

	Single outcall	Advance card + single outcall	Multiple outcalls
Mean call time per participant	14.3 min	15.2 min	[18.3 min(783) + 13.6 min(177) + 13.0 min(83) + 9.7 min(17) + 4.8 min(4)]/783 = 23.0 min
Adherent	13.1 min	14.0 min	17.3 min
Nonadherent	16.4 min	17.8 min	37.1 min
Mean advance card time per participant	NA[a]	0.4 min	NA
Personnel cost at $24/h[b] per participant	$5.72	$6.24	$9.20
Adherent	$5.24	$5.76	$6.92
Nonadherent	$6.56	$7.28	$14.84
Cost of printing and postage for advance card per participant	NA	$0.50	NA
Total cost of delivery per participant	$5.72	$6.74	$9.20
Adherent	$5.24	$6.26	$6.92
Nonadherent	$6.56	$7.78	$14.84
Increase in adherence among those nonadherent at baseline	5.0%	4.4%	16.4%
Cost of program delivered to 1000 participants if 40% are nonadherent at baseline	$5,768	$6,868	$10,088
Number changed to adherent out of 1000 if 40% nonadherent at baseline	20	17.6	65.6
Cost per changed participant (at 40%)	$288.40	$390.23	$153.78
Cost of program delivered to 1000 participants if 100% are nonadherent at baseline	$6,560	$7,780	$14,840
Number changed to adherent out of 1000 if 100% nonadherent at baseline	50	44	164
Cost per changed participant (at 100%)	$131.20	$176.82	$90.49

[a] NA, not applicable.
[b] $24/h is used as per-hour figure for salaried health educator. It is calculated as $13 hourly wage + $3.50 fringe benefits per hour + $7.50 overhead/indirect costs.

lated to do so by the intervention. Thus, although the mammography return rate is encouragingly high, it does not appear to have hit a ceiling, and there is room for improvement through interventions. Stepped interventions, in which more intensive interventions such as telephone counseling are reserved for those who are nonresponsive to less intensive interventions (such as mailed reminders), would seem a logical choice for encouraging repeat mammography. Previously, this approach has been used successfully (18, 19).

Among women adherent at baseline, all of the three outcall interventions appeared to have a slight negative effect on mammography behavior in the subsequent 6-month period. One possible explanation for this effect is that the outcall intervention may have inadvertently discouraged annual mammography. At the time this study was conducted, mammograms were generally recommended *every 1 to 2 years* for women >50 years old. However, the majority of the women who were adherent at baseline reported that they were getting annual mammograms. Thus, some women may have switched to a schedule of every 2 years in response to the intervention, resulting in a decrease in the mammography rate at 6 months. Results of the 2-year follow-up conducted for the randomized trial (7) suggest that any negative effect at 6 months did not carry over to 2 years, because women who were adherent and nonadherent at baseline had slightly higher mammography rates at 2 years when they received an intervention. These results suggest that outcall interventions may be used to encourage appropriate screening behavior and to discourage overscreening.

The cost analysis indicates that delivering outcall interventions ranged in cost from $5.24 to $14.84 per participant, depending on the intensity of the intervention and baseline adherence status. Cost-effectiveness analysis indicates that the multiple outcall intervention was more cost-effective, with costs per participant converted to adherence ranging from $90.49 to $153.78, depending on the proportion of the population nonadherent at baseline. This compares favorably to costs per participant converted to adherence ranging from $131.20 to $390.23 for the single outcall interventions. We did not include training costs because they can vary greatly depending on prior training and experience of those delivering the intervention. We also did not include recruitment costs, because any number of recruitment strategies could be used to formulate a group on which to intervene using telephone outcalls.

There are a handful of published studies that report cost-effectiveness ratios for mammography promotion programs ranging from $0.96 to $106 (20–24). However, most cannot be compared directly with our results because either they did not include overhead costs (we estimated them at 45%; Refs. 20–22) or they estimated the cost per screened woman without removing those who would have been screened regardless of the intervention, as estimated by the screening rate of the control group (21, 23) or they estimated the cost per percent increase in mammography rate rather than the cost per women screened (20). Only one article was identified that used a similar approach to ours. This study, conducted in Australia by Hurley *et al.* (24), found costs per woman screened of $22 using local newspaper articles, $106 for community promotion, $11 for an invitation letter without an appointment, and $20 for an invitation letter with an appointment. These figures are in 1988–1989 Australian dollars, and the cost in U.S. dollars would be ~80%. Lower overhead costs, lower hourly salaries,

and inflation favor Hurley's study over ours. Furthermore, Hurley's study was conducted in the late 1980s when mammography behavior was on the rise; ours was conducted in the mid-1990s when mammography behavior may have reached a plateau, and thus our study focused on those who had been resistant to change.

A limitation of this study was the quasi-experimental design, necessitated by the human subject consent requirements of the agency that funded the multiple outcall group. Because of a different recruitment strategy, women in the multiple outcall group were younger, better educated, healthier, and had a higher average income than women in the three arms of the original study. Because recruitment into the multiple outcall group required that women demonstrate a certain amount of mobility (*i.e.,* they were out shopping), it is possible that women in the multiple outcall group may not have been hindered to the same extent by such barriers as transportation difficulties or poor health as women in the other three groups.

One might expect, therefore, to see the higher rates of screening in the multiple outcall group. Two strategies were used to control for these differences between the groups. First, analyses were stratified by previous mammography behavior, which has consistently been shown to be an important predictor of future mammography behavior (7). Furthermore, multiple logistic regression was used to control for differences between groups in age, income, education, and self-reported general health status. After using these statistical techniques, women nonadherent at baseline in the multiple outcall group had 2.58 times higher odds of getting a mammogram during the follow-up period than the control group. Call records also suggest that health status and transportation difficulties were not responsible for differences between groups observed in subsequent mammography behavior. Fewer than 2% of those in both studies discussed transportation difficulties during the outcalls, and overriding health problems were discussed as barriers in only 3.5% of the multiple outcall group and 5.0% of the single outcall + advance letter groups. Although the income difference is significant between the two groups (see Table 1), income was not a significant predictor of mammography behavior in this analysis, or in the analysis of the original study (7).

Another potential limitation of this study lies in differences in delivery of the interventions between the single and multiple outcall groups. The control, single outcall, and advance card + single outcall conditions were delivered by a staff of 11 telephone information specialists of the CIS. These individuals generally spent ~20% of their time delivering the study protocols, whereas the majority of their time was spent responding to telephone inquiries regarding cancer prevention, screening, detection, and treatment issues. The multiple outcall intervention was delivered by two health educators who had both been involved in the implementation of the single outcall study but, in contrast, spent almost all of their time on the multiple outcall project, both recruiting subjects at retail locations and delivering the multiple outcalls. Their call times were somewhat longer for the initial call (18.3 *versus* 14.3–15.2 min for the single outcall group), and their belief in and commitment to the project may have been greater. The apparent effect of the intervention may, therefore, not be attributable to the offering of multiple calls but to these other factors. Another potential alternative explanation for the findings may be the method of recruitment. Although care was taken *not* to promote mammography during the in-person recruitment for the multiple outcall group, the addition of personal contact with the health educators before the telephone intervention may have given a "face" to the counseling protocol, which may have increased its efficacy. Thus, we cannot conclude that it was the multiple outcalls *per se* that led to the success of this protocol; the success may have been attributable to personal contact and/or greater motivation on the part of the health educators.

A final limitation is the time lag (1 year) between implementation of the original study (1994–1995) and the multiple outcall study (1995–1996). Temporal trends in mammography adoption could account for higher adherence rates in the multiple outcall group. However, as we reported previously for the state of Colorado (7), mammography rates among low-income women appear to have been stable at ~70% for the period 1994–1997.

In conclusion, this quasi-experimental study provides evidence for the effectiveness of a fairly intensive multiple contact intervention (including face-to-face recruitment and multiple telephone calls) to promote screening mammography among low-income, previously nonadherent women. Cost analysis indicates that this intervention is cost-effective in comparison to a telephone recruitment + single outcall approach. In the future, more attention should be paid to the question of what strategies should be used to promote initial cancer screening as well as maintenance of the behavior over time.

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