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## A Systematic Review of Mammography Educational Interventions for Low-income Women

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### Abstract

**Objective**—We conducted a systematic review to examine the effectiveness of educational interventions in increasing mammography screening among low-income women.

**Data Sources**—Bibliographic databases, including MEDLINE, The Cochrane Central Register of Controlled Trials, The Cochrane Database of Systematic Reviews, and the ISI Web of Science, were searched for relevant articles.

**Study Inclusion and Exclusion Criteria**—Randomized, community-based trials targeting low-income women and published between January 1980 and March 2003 were included.

**Data Extraction**—The search yielded 242 studies; 24 met all inclusion criteria.

**Data Synthesis**—Three studies used mammography vans, three used low-cost vouchers or provided free mammograms, three used home visits, one used community education alone, one provided referrals, five incorporated multiple intervention strategies, two used phone calls, one used videos and print material, and five used primarily print material.

**Results**—Of nine studies that reduced barriers to care via mammography vans, cost vouchers, or home visits, eight showed statistically significant increases in mammography screening. Seven of the eight studies that used peer educators had significant increases in screening, as did four of the five studies that used multiple (intervention) components.

**Conclusions**—Interventions that used peer educators, incorporated multiple intervention strategies, or provided easy access via vans, cost vouchers, or home visits were effective in increasing screenings. Mailed letter or telephone reminders were not effective in trials involving low-income women, which is contrary to findings from middle/upper-income studies.

### Keywords

Mammography Screening; Effective Interventions; Prevention Research; Manuscript format: literature review; Primary variables: behavioral; Setting: local community; Health focus: medical self-care; Strategy: skill building/behavior change; Target population: adults and seniors; Target population circumstances: education/income level, geographic location, race/ethnicity

## OBJECTIVE

There are significant socioeconomic disparities in breast cancer morbidity and mortality, and screening mammography can potentially reduce these disparities.<sup>1</sup> We systematically reviewed randomized clinical trials of community-based educational interventions to promote the use of screening mammography to identify those most successful in reaching low-income women. Because low-income populations have higher barriers to care<sup>1</sup> and interventions often need to account for these barriers in order to be efficacious, our analysis addressed the following question: “Which community-based interventions are effective in getting low-income women to undergo mammography screening?”

## METHODS

### Data Sources

Databases that were searched for relevant studies were MEDLINE, The Cochrane Collaboration’s Database of Systematic Reviews, The Cochrane Collaboration’s Central Register of Controlled Trials, the ISI Web of Science, CANCERLIT, and the ISI cross-reference tool. We also searched reference lists of included studies. Hand searching of journals was conducted to identify additional studies as well as systematic reviews of mammography screening. All titles were exported to Endnote and checked for duplicates.

### Inclusion/Exclusion Criteria

We reviewed titles and abstracts (when available) of studies identified via the search and selected those that met the following criteria:

1. Design: Randomized controlled trial or cohort study with control
2. Group: Racial/ethnic minority or low-income women
3. Intervention: Educational, community-based interventions that measured mammography screening as the primary outcome
4. Language: English language articles from 1980 to 2003

The primary outcome of interest was mammography screening. Studies that measured, as their primary outcome, other breast cancer screening activities, such as self-examinations or clinical breast examinations, and those that measured knowledge and intentions without measuring actual mammography screening were excluded. This systematic review included only interventions that were administered in community settings (other than clinics, hospitals, and other health care facilities) because the ultimate goal was to use the information to design an educational intervention to be administered in a community setting and targeting low-income adults residing in Detroit, Michigan.

Control groups could have no active intervention; a modified, less intensive intervention; or one aimed at influencing another health behavior (e.g., Papanicolaou test adherence). Interventions included any educational program implemented by a trained individual, including physicians, nurses, health educators, and peer educators. Only population-based studies that sought to reach women living in a given community (e.g., a city, county, metropolitan area, neighborhood, public housing project) were included. Studies targeting patients in clinical settings or specific sites—hospitals, physician’s offices, or workplaces, for example—were excluded, as our focus was on the effectiveness of community-based interventions in reaching the poor and underserved, who are often uninsured and unemployed and lack a regular source of primary care. Also, only English language articles were included. Selection of articles was based on reading the full text.

## Data Extraction

The following search filter was used to search for relevant articles in MEDLINE. The filter was modified when other databases were searched, but the sequence and key search terms were maintained. Most articles meeting all criteria were from the Cochrane databases and MEDLINE.

1. mammogram or mammograms
2. breast cancer screening
3. breast neoplasm or neoplasms
4. mammography
5. education\$
6. train\$
7. teach\$
8. instruct\$
9. 1 or 2 or 3 or 4
10. 5 or 6 or 7 or 8
11. 9 and 10
12. ((behavior or behaviour) and change)
13. (random\$ or program\$ or study\$ or studies or project\$)
14. 11 and 12 and 13

Terms designating low-income status were not included in the search strategy because not all abstracts described the socioeconomic status of the targeted population. Although the use of health behavior models was also of interest, terms for such models were not included in the search strategy for the same reason.

Table 1 presents the number of articles meeting the inclusion criteria and their sources. Of the 242 articles identified by the search, 127 met the inclusion criteria when the five authors reviewed their abstracts. Fifty-four were chosen by majority consensus for full review and were read by two of the authors. A total of 25 articles, representing 24 studies, met all criteria.

## Data Synthesis

All studies identified were randomized controlled trials, with the exception of one cohort study with a control. Studies had to specify that their population was “low-income,” although most did not state whether participants were below a certain income threshold. Many studies assumed that the participants or targeted groups were low income on the basis of their area of residence. Studies of women aged 65 and older were included in this review since most seniors have fixed income levels. No articles prior to 1990 met the inclusion criteria.

## RESULTS

### Quality of the Studies

The criteria used to evaluate the methodological quality of the 24 included studies are presented in Table 2. These include randomization, sample size calculation *a priori*, rate of follow-up, outcomes of the participants who withdrew, masking, and comparability of the control and

experimental groups. Many studies did not provide complete information about each of these criteria, and the quality scores may not adequately represent the rigor of the study.

Most of the studies (78%) concealed the allocation (randomization) of the participants. Twenty-six percent reported sample size calculations. Forty percent achieved 80% or more follow-up of the original, targeted intervention group. Forty-nine percent had less than 80% follow-up, and for one study (4%), follow-up was not mentioned. Approximately half (52%) tracked the characteristics of the participants who withdrew from the study but failed to modify their analyses to account for the loss of participants. Many studies did not report the characteristics of the participants who withdrew (26%), and 17% based outcome analyses on all recruited cases. Assessors of outcomes were masked in 13% of the studies; 87% did not mention masking or stated that outcomes were not masked. Eighty-three percent of the studies had control and treatment groups with demographics that were comparable at entry. Thirteen percent did not describe the comparability of the control and treatment groups or acknowledge that the groups were not comparable. Nine percent reported small differences between the treatment and control groups but did not make adjustments for potential confounding. The majority of studies treated the control and experimental groups identically other than for the named interventions (91%). A small percentage (9%) treated the two groups differently, above and beyond the intervention.

### Effects of Interventions on Mammography Screening

The 24 included studies were multicomponent interventions. However, most used a dominant intervention strategy to educate participants. The various intervention strategies and the number of studies pertaining to each intervention type are summarized in Table 3.

Treatment of the control groups varied substantially in the included studies. Some used a control group with a minimal intervention, such as a mailed reminder notice for a mammogram, while others used a control group with a more intensive intervention, such as a general health education seminar that included a breast cancer component. More specific details about sample size, design, setting, duration, and frequency of the intervention; intervention and control components; mode of delivery; follow-up period; health behavior model; and outcome measures and outcomes with their corresponding significance levels are presented in Table 4.

**Logistical Assistance: Mammography Vans/Mobile Units, Cost Vouchers, and Home Visits**—Three studies<sup>2,6,7</sup> used a mammography van/mobile unit; two of these also included free or low-cost vouchers for mammograms,<sup>6,7</sup> and all studies reported significant ( $p < .05$ ) increases in mammography screening. Skinner et al.<sup>2</sup> provided community-based education and a mammography van through a social service organization. Rimer et al.<sup>6</sup> included a letter announcing the intervention, a letter to the participant's primary care physician, an educational program with a video, print material, group discussion, and on-site, reduced-cost mammography. Reuben et al.<sup>7</sup> provided a broad-based health education seminar with a component on breast cancer, including a pamphlet and videotape. Participants were offered a mammogram after the presentation; those who did not have one were sent a reminder 2 weeks later.

Three studies provided cost vouchers,<sup>3-5</sup> and all three studies reported significant ( $p < .05$ ) increases in mammography screening, when comparing control and experimental (intervention) groups. Slater et al.<sup>3</sup> conducted a short oral presentation about the benefits of mammography, had facilitator-led small-group discussions to motivate screening, had participants send a letter to their physicians, and provided vouchers for free mammograms and transportation, if needed. Skaer et al.<sup>4</sup> gave a voucher for a free mammogram in addition to breast cancer education. Fletcher et al.<sup>5</sup> used an array of intervention strategies, including physician training; reminders in the (participants) medical records; television, radio, and

newspaper advertisements; community group discussions; social events; and free or half-price mammograms for low-income participants.

Three of the studies that used mammography vans or cost vouchers<sup>2–4</sup> also used peer educators or bilingual nurses matched to the ethnicity and/or primary language of the target population. All reported significant results ( $p < .05$ ).

Four studies<sup>8–11</sup> used home visits as the primary intervention strategy, and three of the four studies had intervention groups with significantly increased mammography screening. Zhu et al.<sup>8</sup> offered mammography education to elderly women living in public housing; results were not statistically significant. In two studies, Champion<sup>9,10</sup> found that participants in the intervention group that included both information about the participants' beliefs and about breast cancer had higher rates of mammography screening ( $p < .05$ ) than participants in the control group. The Segura et al.<sup>11</sup> study compared three (mammography) invitation strategies: (1) a mailed message, (2) a (mailed) physician/nurse invitation with the open possibility of personal contact, or (3) a home (educational) visit. The direct (home) contact group produced higher mammography screening rates than the mailed message ( $p = .003$ ) and the mailed physician/nurse invitation ( $p = .037$ ) groups.

**Community Education Alone**—One study<sup>12</sup> used bilingual health educators to deliver a community education intervention (no other type of intervention was included). Changes in mammography screening were not statistically significant.

**Referrals**—One study<sup>13</sup> provided information about how to obtain a mammogram in addition to core education about breast cancer. There was an improvement ( $p = .029$ ) in the rate of mammography screening for the intervention group when compared with the control group.

**Multicomponent Interventions**—Five studies used multiple-component intervention strategies.<sup>14–18</sup> Four of five of these multistrategy studies<sup>14,16–18</sup> produced increases in mammography screening ( $p < .05$ ). In the Weber and Reilly<sup>14</sup> study, participants in the group that received a letter from their physician, a telephone call and home visit for the key educational message, and logistical help in getting the mammogram were more likely ( $p < .001$ ) to get a mammogram than were participants in the control group. The health educator was always a peer (African-American). In the Burack et al.<sup>15</sup> study, the mammography rates of participants who received core education, an opportunity to schedule a mammogram, elimination of out-of-pocket costs, a reminder in the medical record, and a direct patient reminder did not differ ( $p > .05$ ) from those of participants in the control group. Clover et al.<sup>16</sup> conducted two trials in two regions. One trial examined the effectiveness of community screening and appointment facilitation vs. media promotion efforts. The region randomized to community participation had significantly higher screening rates ( $p < .01$ ) than did the region that received promotion efforts only. The other trial examined the effectiveness of family practitioner education, including a medical record mammography reminder vs. community participation. The family practitioner intervention produced greater mammography screening rates, but the difference was significant in only one of the two regions. Champion et al.<sup>17</sup> compared various tailored vs. nontailored counseling methods (letters and face-to-face counseling). All the combinations of interventions produced higher mammography screening rates ( $p < .001$ ) than usual care (postcard reminder for mammogram). Lauver et al.<sup>18</sup> used (tailored and nontailored) pamphlet mailings and phone calls to disseminate information about screening. Barriers were also measured in this study; tailored messages were particularly effective for women with high barriers. Also noteworthy is that mammography rates increased in the second postintervention time period. We do not include information on significance values for this study because these are not provided in the studies we reviewed.

**Telephone Calls**—Two studies<sup>19,20</sup> used telephone calls as the primary means of delivering mammography information and education. Only the Calle and Miracle-McMahill<sup>20</sup> study, which recruited women within the community to deliver a health message about the importance of mammography screening to five friends (peers), significantly improved mammography screening rates ( $p < .01$ ). The Crane et al.<sup>19</sup> study addressed barriers as part of outcalls to women residing in a low-income minority neighborhood, without statistically significant results.

**Video and Print Material**—One study<sup>21</sup> used four different types of videos in its intervention: gain framed (message emphasizes positive aspects of engaging in health behavior), loss framed (message emphasizes perils of not engaging in any one health behavior), multicultural, and ethnically targeted. Corresponding printed materials were also given to the respective groups. Significant findings ( $p < .05$ ) were obtained for all four groups from baseline to follow-up, although results were not as robust for African-American women as for whites and Hispanics. Messages that were loss framed and multicultural were particularly effective.

**Printed Materials**—Five studies provided print materials as the primary intervention.<sup>22–26</sup> Two of these studies<sup>23,26</sup> proved efficacious in terms of significantly increased mammography screening. In the Fox et al.<sup>23</sup> study, participants who received mailed letters informing Medicare beneficiaries of Medicare-subsidized mammograms and educational information about breast cancer had higher rates of mammography screening ( $p < .05$ ) than controls (no letter sent). Segnan et al.<sup>26</sup> compared various invitation strategies signed either by the general practitioner or program coordinator with either a prefixed or no fixed appointment date. The letter signed by the general practitioner with a prefixed appointment date produced a greater change in terms of mammography screening than did the other letter strategies ( $p < .05$ ). The results of the Newell et al.<sup>22</sup> study, an intervention in Australia that provided participants with a “Better Health” booklet and diary, were not significant. Simon et al.<sup>24</sup> compared a mailed letter prompting participants to visit their primary care physician vs. a prompt to contact the mammography site directly; neither improved mammography rates over the control group, which received no letter. The Skinner et al.<sup>25</sup> study used a tailored letter sent by the woman’s family practitioner and measured progression through stages of change. More African-American and lower-income women moved from lower to higher stages of behavior adoption than white and higher-income women, although mammography screening results were not significant.

**Peer-led Interventions vs. Non-Peer-led Interventions**—Eight of the 24 studies used peer educators to increase mammography screening. Seven,<sup>3,4,6,13,14,16,20</sup> or 88%, reported significant changes in rates of mammography screening. Of the remaining 16 studies that did not use peer educators, only five, or 31%, reported significant changes.

## DISCUSSION

The most effective program for increasing mammography screening among low-income women uses peer educators as the primary means of delivering the health message.<sup>3,4,6,13,14,16,20</sup> Seven of eight peer-led studies proved efficacious. For example, one study provided peer education (about mammography) in low-income housing complexes<sup>3</sup>; another recruited women within the target population area to contact five friends who were candidates for mammography.<sup>20</sup> A study by Zhu et al.<sup>8</sup> was the only peer-led intervention that did not produce statistically significant changes in screening mammography rates. The authors postulate that depression among the single, elderly, low-income, African-American participants, as well as their limited means to build a social network, affected results. Thus, given the potentially debilitating effects of depression, it may be important to screen for depression in mammography education programs for low-income women.

There is intuitive appeal in the notion that peer-led programs may be effective in changing behaviors. Peer educators, as members of the target population, are more likely to understand the life circumstances of program participants and may thus more readily identify barriers to optimal health behavior.<sup>27,28</sup> Furthermore, racial/ethnic minority groups may be wary of those outside their communities, particularly researchers.<sup>29</sup> Familiarity with the people delivering the intervention is likely to produce a greater sense of trust, which is important when attempting to change behavior.<sup>30,31</sup>

Incorporating logistical assistance (e.g., on-site mammograms, free or low-cost mammography) also seemed to promote efficacious interventions. For example, the study published by Skaer et al.<sup>4</sup> had remarkable changes in mammography screening rates, which seem to be attributable to vouchers for free mammograms. This study, in a Latino community, also used (peer) bilingual nurses. Likewise, the studies by Fletcher et al.,<sup>5</sup> Rimer et al.,<sup>6</sup> and Reuben et al.<sup>7</sup> used various approaches, but each made free or low-cost mammograms available, sometimes directly following a presentation. Such interventions provide an immediate opportunity for participants to change their behavior and to overcome the difficulties of locating and scheduling a mammogram. It is not surprising that programs that address such well-documented barriers to health care<sup>32,33</sup> are more effective than those that do not.

The effectiveness of multifaceted interventions for increasing mammography screening among low-income women is another theme that emerges in this review; four of the five multifaceted studies reported significantly improved mammography rates. This could be because such interventions increase the types of messages as well as the exposure that individuals have to them. One consideration in these studies is that the effectiveness of the intervention as a whole is being assessed, and the contribution of specific (intervention) components cannot be easily estimated. This may be problematic in terms of replicability.

The findings of this review, on the basis of studies of low-income women who are disproportionately women of color, stand in sharp contrast to studies that include predominantly white, middle- and upper-income women. A meta-analysis of mammography interventions<sup>34</sup> not restricted to low-income women found that very different types of interventions were effective. For example, in that review, mailed letters of invitation were highly effective in increasing screening mammography. Also effective were letters of invitation and a phone call, or phone calls alone. In contrast, the present review suggests that such interventions are not as effective with low-income groups. Instead, the results indicate that an educational message targeting low-income women is most effective if given directly, preferably by a member of the participant's peer group. Furthermore, for low-income women, interventions that provide logistical assistance, such as cost vouchers, home visits, or on-site mammography, appear to increase the likelihood of participants' engagement in a program. This finding is consistent with research on barriers to access to health services among low-income individuals.<sup>1</sup> Finally, although strategies such as home visits were not found to be effective in the meta-analysis not restricted to low-income women,<sup>34</sup> the present review found that direct (home) contact interventions had considerable success with low-income women.

The findings of this review support and extend those of Legler et al.,<sup>35</sup> whose systematic review of mammography interventions found that access-enhancing interventions, such as the use of vouchers or mammography vans, and individual-directed approaches, such as one-on-one counseling or tailored messages, were most effective in increasing screening mammography among low-income women. The Legler review did not exclude quasi-experimental studies, however; using the more rigorous inclusion criterion of randomization, the present review found similar types of interventions to be efficacious among low-income women.

## Limitations

For a variety of reasons, it was often difficult to assess the methodological quality of some of the studies included in this review. For example, details about those participants who withdrew from a study were not always reported; it is unclear whether such omissions were significant. Nevertheless, with one exception (a cohort study with a control), all studies were randomized controlled trials, and most had control and treatment groups that were comparable prior to randomization, increasing the likelihood that any observed changes in mammography screening were due to the intervention(s). However, the question of what constitutes a “control group” is a challenging one, particularly in multifaceted community interventions where researchers have an ethical obligation to improve the health of all individuals who encounter the program. In fact, most of the studies included in this review did not have a true control group with no active intervention. Many had control groups with general education about breast cancer or another health behavior but lacked some other key component of the “intervention.” This strategy would tend to understate a given program’s effect, as the “control” group may have gained increased knowledge of mammography benefits or increased sensitivity to health in general, which could increase the likelihood of an individual seeking a mammogram.

Likewise, the use of various interventions within each study makes it difficult to attribute change in screening mammography to any one strategy. However, most studies used one dominant intervention strategy that was supported by other intervention components (e.g., a mammography van with follow-up reminder cards).

Finally, our results, and those of other systematic reviews, may be biased toward favorable findings because studies that show interventions to be effective are more likely to be published than studies with ineffective programs. We speculate that if findings from the latter studies were published more frequently, the review would point to a larger number of ineffective programs. If this were the case, special attention would have to be paid to the actual activities of the effective interventions in order to carefully discriminate those that are effective from those that are ineffective. Unfortunately, unless such findings are disseminated, many ineffective interventions will be unexposed, and the field’s knowledge on this topic will remain inadequately understood.

## CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

The findings of this systematic review suggest that the most efficacious interventions for increasing screening mammography among low-income women are those that are peer led and that provide logistical assistance. Specifically, mammography vans, vouchers, and home visits appear to increase the use of screening. In addition, interventions that use multiple strategies appear to obtain more success in terms of improved screening rates. The findings of this review also highlight the need for additional research on the kinds of interventions that are efficacious in reducing persistent socioeconomic and racial/ethnic health disparities. This is especially pertinent in light of the differences found between those interventions that are most efficacious in low-income vs. middle/upper-income women. It would be of great utility to further understand the role that peer-led, access-enhancing, and tailored messages, among other strategies, have in reaching underserved populations.

### **SO WHAT? Implications for Health Promotion Practitioners and Researchers**

This study provides strong support for the use of barrier-reducing strategies and peer educators in mammography screening interventions for low-income women. Mammography vans, cost vouchers, and home visits appear to increase screening by facilitating access to mammograms and information about the benefits of mammograms. Interventions with multiple strategies also appear to increase mammography screening. The



use of peer educators was also associated with higher screening rates. These findings are contrary to other community trials with middle- and upper-income women where less intensive strategies were associated with higher screening rates (e.g., mailed letter or telephone reminders). If these assertions hold true, health promotion practitioners and researchers may want to focus on (1) a full understanding of barriers in their particular low-income population and (2) strategies that effectively reduce or eliminate those barriers. Future research could also focus on combining results if a sufficient number of studies are produced that are comparable in methodology.

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**Table 1**  
Databases Searched and Number of Articles Identified

<b>Database</b>	<b>No. of Titles Identified Through Search Terms</b>	<b>No. of Abstracts Identified as Relevant on the Basis of the Review of Titles</b>	<b>No. of Articles Included in the Evidence Table</b>
MEDLINE, ISI Web of Science, CCRCT, CDSR	178	111	17
ISI cross-reference search	64 (identified through reference lists)	16	8
Total articles	242	127	25

Table 2

Methodological Quality by Study

Study	Concealed Randomization*	N†	Follow-up‡	Attrition Follow-up§	Masking//	Group Comparability¶	Intervention vs. Control#
Skinner et al. <sup>2</sup>	2	0	2	1	0	2	1
Slater et al. <sup>3</sup>	0	0	1	1	0	0	1
Mishra et al. <sup>12</sup>	2	0	1	1	2	2	1
Navarro et al. <sup>13</sup>	1	0	1	1	0	2	0
Weber and Reilly <sup>14</sup>	2	1	1	1	1	2	1
Skaer et al. <sup>4</sup>	2	0	2	2	0	2	1
Burack et al. <sup>15</sup>	0	1	2	1	0	2	1
Fletcher et al. <sup>5</sup>	0	0	1	0	1	0	1
Rimer et al. <sup>6</sup>	2	0	2	1	0	0	1
Crane et al. <sup>19</sup>	2	0	1	1	0	2	1
Newell et al. <sup>22</sup>	2	0	1	0	0	2	1
Reuben et al. <sup>7</sup>	0	1	2	1	1	1	1
Zhu et al. <sup>8</sup>	2	0	2	1	0	1	1
Champion <sup>9,10</sup>	2	0	2	1	0	1	1
Calle and Miracle-McMahill <sup>20</sup>	0	0	1	1	1	Unclear	1
Segura et al. <sup>11</sup>	1	1	1	1	0	2	1
Fox et al. <sup>23</sup>	1	0	1	1	0	2	1
Simon et al. <sup>24</sup>	2	1	2	1	0	1	1
Clover et al. <sup>16</sup>	1	0	1	2	0	2	1
Skinner et al. <sup>25</sup>	0	0	2	1	0	2	1
Champion et al. <sup>17</sup>	2	0	2	0	0	2	1
Lauver et al. <sup>18</sup>	1	1	2	1	0	2	1
Segnan et al. <sup>26</sup>	2	0	N/A	0	0	2	1
Schneider et al. <sup>21</sup>	0	0	1	0	0	2	1

\* Was randomization of the participants concealed? 0 = not concealed; 1 = concealed; 2 = unclear.

§ Was a calculation of sample size undertaken? 0 = no/not mentioned; 1 = yes.

¶ Was relatively complete follow-up achieved (≥80%)? 1 = <80%; 2 = ≥80%.

§ Were the outcomes of the people who withdrew described and included in the analysis? 0 = not mentioned; 1 = states numbers and reasons for withdrawal but analysis unmodified; 2 = primary analysis based on all recruited cases.

// Were those assessing outcomes masked to the treatment allocation? 0 = not mentioned/not done; 1 = action taken to blind assessors or outcomes so that bias was unlikely.

¶¶ Were the control and treatment groups comparable at entry? 0 = large potential for confounding or not discussed; 1 = confounding small-mentioned but not adjusted for; 2 = unconfounded study —good comparability of groups or confounding adjusted for.

# Were the groups treated identifiably other than for the named interventions? 0 = no/not mentioned; 1 = yes.

**Table 3**

## Summary of Types of Interventions

Type of Intervention	No. of Studies	References
Logistical assistance		
Mammogram vans/mobile units	3	2, 6, 7
+ Free or low-cost vouchers	2	6, 7
Cost vouchers	3	3–5
Home visits	3	8–11
Community education alone	1	12
Referrals	1	13
Multicomponent interventions	5	14–18
Phone calls	2	19, 20
Video and print	1	21
Print only	5	22–26

Table 4

\* Summaries of Studies by Type of Intervention

Author and Year	Population and Setting	Sample Size	Intervention Components, Duration, and Mode of Delivery	Follow-up Period	Outcome Measures	Outcomes
Skinner et al. <sup>2</sup>	Low-income elderly, mostly African-Americans Senior center, St. Louis	N = 240	(1) Community-based education (2) Done through an urban social service organization Half d, one time taught by health professionals Control = core education (no van) (1) Letter from retirement community medical director announcing education session and mobile mammography unit (2) Letter to primary care physician (3) Educational program with video, print materials, group discussion, opportunity to schedule mammography appointment (4) Reduced cost mammography Duration not stated; conducted by health workers Control = baseline interview, posters and materials to promote availability of \$40 vouchers (with \$10 copy) for mammography Educational sessions about breast cancer, mammography, stroke prevention, and effect of exercise on arthritic joints. Participants were given the following and sent reminder 2 wks post: (1) Health education pamphlet (2) Educational videotape (3) Directory of community-based mammography sites 1.5 h, one time; conducted by health education facilitators Control = health education only (1) 10 minute oral presentation about benefits of mammography (2) Facilitator led small group discussions to motivate screening (3) Physician prompting to order a mammogram (eg subjects sent letters to their doctors) (4) Free mammogram for under or uninsured 1 h, one time conducted by health professionals and peers in public housing Control = no treatment initially, received intervention afterwards	2 and 3 y	Breast cancer knowledge, mammography benefits/barriers, stage of adoption, mammography rates	Control: Baseline = 57% y 2 = 52% Experimental: Baseline = 49% y 2 = 68% ( $p = 0.001$ ) Control = 12% Experimental = 45% ( $p = 0.001$ )
Rimer et al. <sup>6</sup>	Elderly in 8 retirement communities, Philadelphia	N = 412		3 mo	Mammography rates	
Reuben et al. <sup>7</sup>	Older women, mostly low-income 60 Los Angeles community based meal sites, senior centers and clubs	N = 463		3 mo	Mammography use	Control = 40% Experimental = 55% ( $p < 0.001$ )
Slater et al. <sup>3</sup>	Low-income women in public housing	N = 314		6–18 mo	Mammogram within the last 15 mo	Control = 52% Experimental = 64% ( $p = 0.04$ )

Author and Year	Population and Setting	Sample Size	Intervention Components, Duration, and Mode of Delivery	Follow-up Period	Outcome Measures	Outcomes
Skaer et al. <sup>4</sup>	Hispanic migrants, low income; Non-profit, rural, migrant clinics in Washington State	N = 160	(1) Standard clinical education about breast cancer and importance of screening (2) Free voucher for mammography. Controls had standard clinical education only 4 wk; taught by bilingual nurses	4 wk	Mammography completion	Control = 18% Experimental = 88% ( $p = 0.0001$ )
Fletcher et al. <sup>5</sup>	Broad community North Carolina rural communities	N = 970	(1) One h small group training for MDs and letter to MDs (2) Prompting system in medical record (3) TV and radio advertisements; 29 newspaper articles (4) Community groups were addressed (5) Minority task force coordinated media and social events (6) Free or half price mammograms for low SES subjects Control = comparison community without any intervention 1–2 h over the course of 1 y; Media and MDs provided health messages	2 y	Knowledge, Attitude and Behavior survey mammogram use	Control = 30–40% Experimental = 35–55% ( $p = 0.03$ ) African Americans had lower % increase in mammography adherence
Zhu et al. <sup>8</sup>	African Americans without spouses; 10 public housing complexes in Tennessee	N = 540	(1) Education focusing on women's cognition, psychological adjustment, significant other's role in assisting the subject (2) Lay health educator did one on one teaching. (3) Messages were culturally and educationally appropriate Control = received nothing Assuming about 1 h; taught by health educators Guided script individualized according to responses to questions about stage of adoption for mammography 2 in-home interviews conducted by graduate nurse research assistants	1 and 2 y	Clinical and breast self exam, mammography, Breast health knowledge, attitudes and behavior	y 1: Control = 53% Experimental = 55% ( $p > 0.50$ ) y 2: Control = 68% Experimental = 66% ( $p > 0.50$ )
Champion <sup>9</sup>	Income not stated, Midwest metropolitan area	N = 301	Guided script individualized according to responses to questions about stage of adoption for mammography 2 in-home interviews conducted by graduate nurse research assistants	2 y	Mammography rates	Belief vs. Control OR = 1.83 ( $p = 0.12$ ) Information vs. Control OR = 1.47 ( $p = 0.32$ ) Belief/Information vs. Control OR = 3.75 ( $p = 0.004$ )
Champion <sup>10</sup>	Income not stated, mostly Euro-American Midwest metropolitan area	N = 405	Guided script individualized according to responses to questions about stage of adoption for mammography. Group 1 = control received nothing; Group 2 = belief information;	1 y	Mammography rates and stage of adoption	Belief vs. Control OR = 1.96 ( $p = 0.05$ ) Information vs. Control = 1.50 ( $p = 0.22$ )

Author and Year	Population and Setting	Sample Size	Intervention Components, Duration, and Mode of Delivery	Follow-up Period	Outcome Measures	Outcomes
Segura et al. <sup>11</sup>	Mixed SES but mostly low SES	N = 1507	Group 3 = informational intervention; Group 4 = belief/informational 1 in-home interview conducted by graduate nurse assistants. Women were received an invitation to participate via: (1) Mailing from research staff; (2) Mailing from family doctor and program nursing staff or; (3) Home visit explaining benefits of early detection, screening process, and how to obtain a mammogram Compared 3 invitation strategies One time contact via mail or home direct contact; conducted by non health professionals	2-3 mo	Response rate to 3 invitation types	Belief/Information vs. Control OR = 2.26 ( $p = 0.02$ )  Mailed letter = 52.1% ( $p = 0.003$ ) Primary health care team invitation = 55.6% ( $p = 0.037$ ) Direct contact = 63.5% $p$ values refer to the comparison of mailed or primary health invitation vs. direct contact invitation
<b>Type of intervention: community education alone</b> Mishra et al. <sup>12</sup>	Low-income Latinas, Orange County, California 2 community and 1 university affiliated organization	N = 88	(1) Question and answer with health educator (2) Solutions for breast cancer control. (3) Breast cancer control modules (empowerment, knowledge, breast cancer detection tools, how to perform breast self-exam) 2 wks, 4 education sessions, twice per wk (each 2 h); taught by health educators Control = received nothing	Immediate and 6 wk post intervention	Knowledge, self-efficacy, attitudes, breast self-exam skills, and mammography use	Control: Baseline = 0% 6 wk post = 11% Experimental: Baseline = 0% 6 wk post = 10% ( $p = 0.25$ )
<b>Type of intervention: referrals</b> Navarro et al. <sup>13</sup>	Low-income Latinas San Diego, California	N = 364	(1) Breast and cervical cancer early detection (2) Importance of screening tests, nutrition (3) Skills training in breast self-exam (4) Obtaining services 12 wk; taught by peer educators (consejeras) Control = received "Community Living Skills" which is health information but not specific to cancer prevention and treatment	2 y	Percentage of women who had breast and cervical cancer screening tests within the past y	Control = 7% Experimental = 21% ( $p = 0.029$ )
<b>Type of intervention: multi-component</b> Weber et al. <sup>14</sup>	Urban poor Rochester, New York	N = 217	(1) Reminder letter from MD (2) Standardized case management protocol (another letter, phone call, home visits, logistical help in getting woman to mammography screening) 3 mo; conducted by community health educator	1 y	Mammography completion, mammography results, and incremental intervention cost effectiveness	Control = 14% Experimental = 41% ( $p < 0.001$ )



Author and Year	Population and Setting	Sample Size	Intervention Components, Duration, and Mode of Delivery	Follow-up Period	Outcome Measures	Outcomes
Burack et al. <sup>15</sup>	Innecity women, Detroit. Innecity Health Department, HMO, or private hospital	N = 2725	Control = usual primary care plus reminder letter. (1) MD and staff breast cancer control education (2) Facilitated mammography appointment scheduling (3) Elimination of out-of-pocket patient cost for mammography in medical record (5) Patient reminders for mammography Duration: approximately 2 h; MD-delivered messages and appointment, staff-placed reminders	1 y	Mammography rates	18% increase from base-line to 12-mo follow-up ( $p = 0.348$ )
Clover et al. <sup>16</sup>	Lower income and educational attainment. Australians. 2 matched small and 2 matched large rural towns per trial (2 trials)	N = 16,884	Control was items 1–3 above. Two trials: trial 1 = media vs. community participation (CP); trial 2 = CP vs. Family Practitioner (FP) CP (9–18 d duration): Formation of committee of representatives; promotion of screening service visit by community committee through local networks; and implementation of appointment system FP (duration, 2 mo): mammogram recommendation by MD; ancillary promotion including peer (MD) support, reminder in medical record Media: Newspaper and radio advertisements and other publicity Control was media group. (1) Tailored telephone counseling (2) Tailored in-person counseling letter signed by PCP (4) Tailored telephone counseling plus nontailored MD recommendation letter (5) Tailored in-person counseling plus nontailored MD recommendation letter (5) Tailored in-person counseling plus nontailored MD recommendation letter Both sites included a free mammogram. One time (approx. 20–30 min); taught by graduate nurse research assistants	3 mo	Mammography rate and various process measures	Trial 1: CP (both towns) = 63% and 51% vs. media = 34% and 34% ( $p < 0.01$ ) Trial 2: FP (one town) = 68% vs. CP = 51% ( $p < 0.01$ ) FP (other town) = 68% vs. CP = 58% ( $p = 0.11$ )
Champion et al. <sup>17</sup>	Primarily African-American indigent patients in GM clinic. HMO for upper SES group; General Medicine clinic for lower SES group	N = 773	Control was media group. (1) Tailored telephone counseling (2) Tailored in-person counseling letter signed by PCP (4) Tailored telephone counseling plus nontailored MD recommendation letter (5) Tailored in-person counseling plus nontailored MD recommendation letter (5) Tailored in-person counseling plus nontailored MD recommendation letter Both sites included a free mammogram. One time (approx. 20–30 min); taught by graduate nurse research assistants	2, 4, 6 mo	Mammography rates	At 6 mo: usual care = 26%; phone = 41%; person = 51%; MD letter = 40%; phone and MD letter = 49%; person and MD letter = 55% ( $p < 0.001$ )

Author and Year	Population and Setting	Sample Size	Intervention Components, Duration, and Mode of Delivery	Follow-up Period	Outcome Measures	Outcomes
Lauver et al. <sup>18</sup>	Mostly white with sub-sample of African-Americans, Midwest	N = 728	Control (standard care) was general postcard reminder to schedule a mammogram. (1) Phone call with screening recommendations plus a nontailored pamphlet mailed after the phone call (2) Phone call with screening recommendations plus tailored discussion (on beliefs, feelings, costs, and access) and tailored pamphlet mailed after the phone call One-time call and pamphlet mailing; advanced practice nurses made the calls Control: No message at all.	3–6 mo and 13–16 mo	Mammography rates	3–6 mo: control = 21% recomm + nontailored message = 29%; recomm + tailored message = 29%. 13–16 mo: control = 47%; recomm + nontailored message = 47%; recomm + tailored message = 57%. No <i>p</i> values provided
<b>Type of intervention: phone calls</b> Crane et al. <sup>19</sup>	Low income. Colorado low-income and minority neighborhoods	N = 3080	(1) Outcall promoting mammography screening (2) Outcall preceded by a mailed invitation to participate in the program (3) Control received nothing Duration: not stated; trained callers did education and invitations Up to 3 phone calls peer educators made to 5 of the 10 friends they listed as candidates for mammography. Control = nothing. Up to 3 phone calls over a 3-mo period; taught by peer educators	6 mo and 2 y	Mammography rates	6-mo follow-up: control = 21%; outcall only = 20%; advance invite and outcall = 21% ( <i>p</i> > 0.05)
Calle and Miracle-McMahill <sup>20</sup>	Low- and middle-income women, Jacksonville and Orlando, Florida	N = 594	Women randomized to view one of four videos with corresponding flyer: (1) Gain-framed message (positive outcomes of obtaining a mammogram) (2) Loss-framed message (dangers of not obtaining a mammogram) (3) Multiculturally targeted (4) Ethnically targeted No real control (groups just compared to one another), 10-min video plus questionnaire time; conducted by research assistants	2–8 mo after phone calls	Mammography rates	Control = 34%; experimental = 49% ( <i>p</i> < 0.01)
<b>Type of intervention: video and print</b> Schneider et al. <sup>21</sup>	Low-income women, mostly African-American and Hispanic community health clinics and public housing developments	N = 752	Women randomized to view one of four videos with corresponding flyer: (1) Gain-framed message (positive outcomes of obtaining a mammogram) (2) Loss-framed message (dangers of not obtaining a mammogram) (3) Multiculturally targeted (4) Ethnically targeted No real control (groups just compared to one another), 10-min video plus questionnaire time; conducted by research assistants	6 and 12 mo	Mammography adherence rate	At 6-mo follow-up: whites 3.04 times more likely to report receiving a mammogram when message was loss framed vs. gain framed ( <i>p</i> < 0.01); Latinas 7.67 times more likely to report receiving a mammogram when message loss framed vs. gain framed ( <i>p</i> < 0.001); no difference for AA ( <i>p</i> > 0.10); overall, 1.81 OR ( <i>p</i> < 0.01)

**Type of intervention: print only**

Author and Year	Population and Setting	Sample Size	Intervention Components, Duration, and Mode of Delivery	Follow-up Period	Outcome Measures	Outcomes
Newell et al. <sup>22</sup>	Small town, low-income Australia small, rural towns	N = 47,989	(1) Media campaign 10 d before booklets mailed (2) Explanatory letter (3) Gender-specific better health booklet (4) Gender-specific better health diary Mailed booklets once Control = nothing Letter mailed to Medicare beneficiaries notifying of Medicare-subsidized mammograms (plus other educational and referral information) One-time letter mailed out; letter to participants 3 groups: (1) Letter mailed to prompt MD visit (2) Letter mailed instructing participants to contact the mammography site directly to obtain a mammogram (3) No letter mailed = control Also, out-of-pocket costs eliminated and automatic reminder in patient record as part of another CDC intervention for all participants One-time letter mailed out Tailored letter sent by FP of patient Control = standard letter sent by FP of patient. One-time letter	3 and 12 mo	Papnicolaou test rate, mammography rates, skin operations	10 sets of expected/observed ratios; combined ( $p = 0.73$ )
Fox et al. <sup>23</sup>	Elderly white, African-Americans and Hispanic women, California	N = 917		2 y	Mammography rates	African-Americans OR = 1.97 (vs. control; $p < 0.05$ ) Hispanics OR = 2.33 (vs. control; $p < 0.05$ )
Simon et al. <sup>24</sup>	Mostly African-Americans; 2 innercity health departments in Detroit	N = 1966		1 y	Mammography rates	Site 1: letter to visit MD = 19%; letter to contact mammography site = 20%; control = 17% ( $p = 0.743$ ). Site 2: letter to visit MD = 11%; letter to contact mammography site = 14%; control = 11% ( $p = 0.376$ )
Skinner et al. <sup>25</sup>	African-Americans and whites, North Carolina	N = 435		8 mo	Stage of adoption, mammography rates	All women: baseline = 64%; follow-up = 68%. For those due for screening at baseline having mammograms at follow-up; tailored = 44%; standard = 31% ( $p = 0.116$ ) At 12-mo follow-up: Grp 1: RR = 1; Grp 2: RR = 0.72 (CI, 0.67–0.78); Grp 3: RR = 0.88 (CI, 0.83–0.95); Grp 4: RR = 1.02 (CI, 0.95–1.10)
Segnan et al. <sup>26</sup>	Lower-educational-level women in Italy; Turin, Italy	N = 8069	4 groups: (1) Personal invitation letter signed by the GP with a prefixed appointment date for a mammogram (2) Open-ended personal invitation letter signed by the GP prompting women to contact the screening center within 3 wk to arrange for an appointment (3) Personal invitation letter signed by the program coordinator with prefixed appointment for screening (4) Personal invitation letter with extended text focusing on the	12 mo	Attendance at mammography appointment	

Author and Year	Population and Setting	Sample Size	Intervention Components, Duration, and Mode of Delivery	Follow-up Period	Outcome Measures	Outcomes
			women's health signed by the GP with a pre-fixed mammography appointment Group 1 used as reference group (no real control). One-time mailing (no one-on-one contact); letter sent to participants			

\* SES indicates socioeconomic status; PCP, primary care physician; recomm, recommendations; AA, African-American; MD, medical doctor; RR, relative risk; OR, odds ratio; CI, confidence interval; GP, general practitioner; and FP, family practitioner.