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Tailored Interventions to Promote Mammography Screening: A Meta-Analytic Review

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Abstract

Objective—To evaluate the effectiveness of tailored interventions, designed to reach one specific person based on her unique characteristics, for promoting mammography use.

Method—This systematic review used meta-analytic techniques to aggregate the effect size of 28 studies published from 1997 through 2005. Potential study-level moderators of outcomes (sample, intervention, and methodological characteristics) were also examined.

Results—A small but significant aggregate odds ratio effect size of 1.42 indicated that women exposed to tailored interventions were significantly more likely to get a mammogram ($p < 0.001$). The type of population recruited and participants' pre-intervention level of mammography adherence did not significantly influence this effect. Tailored interventions that used the Health Belief Model and included a physician recommendation produced the strongest effects. Interventions delivered in person, by telephone, or in print were similarly effective. Finally, defining adherence as a single recent mammogram as opposed to regular or repeated mammograms yielded higher effect sizes.

Conclusion— Tailored interventions, particularly those that employ the Health Belief Model and use a physician recommendation, are effective in promoting mammography screening. Future investigations should strive to use more standardized definitions of tailoring and assessments of mammography outcomes.

Keywords

Behavioral medicine; Mammography; Intervention studies; Prevention and control; Breast cancer

Introduction

Although one in eight women will develop breast cancer during their lives, only one in thirty-three will die from this disease (American Cancer Society, 2006). Early detection of breast cancer through mammography screening is partially responsible for decreasing breast cancer mortality rates (Humphrey et al., 2002). Mammograms are recommended either every year (American Cancer Society, 2006) or every 1 to 2 years after the age of 40 (National Cancer Institute, 2006) and more frequently and beginning at an earlier age for women with a family history of breast cancer (American Cancer Society, 2006). Mammography screening has

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Precis
A meta-analysis of 28 tailored interventions for promoting mammography use indicated that tailored interventions, particularly those that use the Health Belief model or employ a physician recommendation, are effective.

increased from approximately 30% in 1987 to 70% in 2003 for both White and African American women (Smigal et al., 2006). A variety of interventions have been designed to promote breast cancer screening (Ryan et al., 2001). Recently, tailored interventions, designed to reach an individual based on her unique characteristics, have shown promise (Rimer, 1999).

Tailored interventions have assessment-based individually-focused messages (Kreuter et al., 1999). The assessment involves a closed-ended measure of individual differences. This enables the message, tailored to an individual's answers, to be pre-established. This scripted message can then be delivered by a person (not necessarily a health professional), a letter, or a computer. Although the communication may involve in-person contact, it is not interactive. Thus, tailored interventions are not limited by the number and cost of trained professionals (Kreuter et al., 1999), but some information important to a participant could be lost by the closed-ended format for assessment and feedback.

Tailored interventions are distinct from personalized and targeted interventions. Personalized interventions can be as simple as directing a generic letter to a specific person by using their name (Kreuter et al., 1999). Targeted interventions are directed at a particular population as opposed to a particular individual, and thus involve less personally relevant content. Tailoring's effectiveness is explained by the elaboration likelihood model, which proposes that messages are more actively processed if they are considered personally applicable (Kreuter and Wray, 2003; Petty and Cacioppo, 1986). Such messages "are more likely to be read and remembered, rated as attention catching, saved and discussed with others" (Kreuter and Wray, 2003, p. S229).

Interventions are tailored to a variety of characteristics such as age, ethnicity, risk, and barriers to care, or according to theoretical models. Three theoretical models commonly used are the Health Belief Model (HBM); the Transtheoretical Model (TTM), sometimes referred to as the stages of change model; and the concepts related to motivational interviewing. The HBM proposes that perceptions of risk, benefits, severity, barriers, cues to action and self-efficacy are related to behavior such as getting a mammogram (Becker, 1974; Glanz et al., 1997). The TTM proposes that a series of stages is involved in changing behavior (precontemplation, contemplation, preparation, action, maintenance, and relapse and that effective messages take these stages into account (Prochaska et al.,1992). Motivational interviewing is patient-centered and bases the information transmitted on what they are motivated to receive (Miller and Rollnick, 1991).

Prior reviews of tailored interventions promoting mammography screening suggest that they are effective. (Legler et al., 2002; Skinner et al., 1999; Stoddard et al., 2002; Wagner 1998). However they have been limited by their narrative approach (Skinner et al.,1999) grouping tailored and non-tailored interventions together (Legler et al., 2002), or considering interventions implemented in print or by telephone exclusively. (Skinner et al.,1999; Stoddard et al., 2002; Wagner, 1998). These reviews also did not examine moderators of tailored interventions' effectiveness. The current systematic review of tailored interventions to promote mammography screening comprises more recent research (published since 1997 where the most recent review left off); includes interventions implemented in person, by telephone, and in print; and uses meta-analytic techniques. It considers potential moderators related to sample and intervention characteristics and outcome assessment.

Variability in Sample characteristics

Type of population—The income and ethnicity of the women studied may influence the effectiveness of interventions. Low-income and minority women have historically lower rates of mammography (Legler et al., 2002). Because of the array of reasons for this disparity, we

hypothesize that directing an intervention to women in these groups will result in a lower effect size.

Pre-intervention level of adherence—Some studies specifically recruit nonadherent women whereas others include adherent and nonadherent women. Women who have had at least one mammogram before are more readily influenced by mammography-promoting interventions (Champion et al., 2003). Including regularly adherent women could leave little room for improvement, but we expect that it is more likely that women who are nonadherent or have never had a mammogram before will be especially difficult to influence.

Intervention Characteristics

Variables for which the intervention is tailored—Some interventions are individualized by demographic variables (age, ethnicity, risk factors), whereas others are based on psychological variables such as barriers to care, or those included in the HBM, TTM, or motivational interviewing. Since the success of tailoring is theoretically based on how relevant information is to a recipient (Kreuter and Wray, 2003) we expect that the more individualized a message is, the greater will be its effect. Although tailoring by demographic variables may make messages relevant, we hypothesize that interventions tailored by psychological variables will be more likely to influence behavior.

Mode of implementation—Tailored interventions vary in the level of personal contact involved in their implementation. For example, delivering a message in person involves more personal contact than by telephone or in print. Participants prefer face-to-face contact (Cohen et al., 2005) and it can positively influence their level of compliance (Spittaels et al., 2006). We hypothesize that the more personal contact involved, the more effective the intervention will be.

Whether or not a physician recommendation is included—Physician recommendations are influential in promoting mammography adherence (Legler et al., 2002). This ability to persuade patients based on their trust in authority is referred to as “expert power” (Elder et al.,1999). We hypothesize that, consistent with previous interventions to promote mammography screening, incorporating a physician’s recommendation will improve the effectiveness of tailored interventions.

The treatment received by the control group—Some studies compare the outcome of an intervention to a no-treatment control, while others use an active control, such as non-tailored information or a reminder phone call (Lipkus et al., 2000; Valanis et al., 2004). We hypothesize that there will be a larger effect size when interventions are compared to a no treatment control than to an active control.

Variability in Outcome Assessment

Definition of mammography adherence—*Repeat* and *regular* mammography screenings are conceptually different outcomes from *recent* mammography adherence. According to Stoddard and colleagues (2002), a woman’s mammography adherence is regular “if she reported a mammogram within 24 months of the survey and a prior mammogram within 24 months of the most recent mammogram” and recent “if she had had a mammogram within 24 months of the survey but had not had a prior mammogram within 24 months of the most recent.” This classification is used by the Breast Cancer Screening Consortium Anderson et al., 2000; Costanza et al., 2000; Duan et al., 2000; Lipkus et al., 2000; Messina et al., 2002; Stockdale et al., 2000), but not by others (Rakowski et al., 2003). Despite this variation, we hypothesize that repeat/regular mammography is a more stringent outcome than recent mammography, that will result in lower effect sizes.

Mode of adherence assessment—Mammography adherence is typically measured by self-report, a review of medical records, or both. Self-report is easily accessible, and is generally thought to be accurate (Kreuter et al., 2005; Rimer et al., 2002; Saywell et al., 1999). Studies found that over 90% of women accurately reported their mammography screening in the past 12 months as validated by medical records (Barrat et al., 2000; King et al., 1990). However, this consistency is less evident in older age groups, low income households, different ethnicities, or participants with co-morbid conditions (Bancej et al., 2004; Champion et al., 1998; Lawrence et al., 1999). Conversely, medical records may not be up-to-date, making this measure less accurate (Jibaja-Weiss et al., 2003). Due to inconclusive support for the superiority of either method, we hypothesize that there will be no systematic difference between the two methods.

Methods

Study Selection

This meta-analysis included publicly available reports in English on tailored interventions to promote mammography screening. Potentially eligible studies were identified by searching PubMed, PsycINFO, and Dissertation Abstracts International using the keywords *mammography*, *psychology*, *adherence*, *intervention*, *screen*, and *tailored*. Because it was the most common source of identified studies, the journal, *Preventive Medicine*, was hand searched for overlooked studies.

Examining the articles' titles generated a preliminary list of 190 reports. Abstracts were then scanned to determine if the research met these criteria: (1) the intervention aimed to increase use of mammography screening, either exclusively or in addition to other health behaviors, (2) outcomes were based on an individual's adherence to mammography screening, documented either by self-report or in a medical record, (3) the study used an experimental or quasi-experimental design, (4) the intervention included a tailored component, and (5) the study was reported between the years 1997–2005. Reference sections from the resulting 53 reports were also reviewed.

Of these 53 studies, 16 were excluded. Four investigations did not include enough information to calculate an effect size; 5 did not have a control group; 4 called an intervention that was merely targeted, "tailored;" and 3 had a counseling component that was open-ended rather than pre-determined. In addition, 9 publications reported on the same sample as another that was already included. All of the dissertations considered (n = 4) were excluded.

Study Coding

A coding form and manual were used to systematically capture aspects of each study. As in a prior review (Legler et al., 2002) for studies that compared two or more intervention groups to one control group (n = 11), the intervention that was the most involved or with the most components was considered. Two independent raters coded moderator variables and discrepancies were resolved by discussion. The average kappa for closed-ended coding was sufficient, .72. The average percent agreement for open-ended coding and for closed-ended coding where kappa could not be calculated because the raters did not use the same set of responses was also sufficient, 84%.

Analyses

Odds ratio effect sizes were calculated from cell frequencies or abstracted from study reports. Authors of articles not including enough information to calculate an effect size were contacted. Effect size calculations were checked by a second investigator.

Analyses were computed using Comprehensive Meta-Analysis Version 2 (Biostat, Inc., Englewood/NJ, 2005). Effect sizes were examined for heterogeneity and the mean weighted aggregate effect size was computed, adopting a fixed-effects model in the case of a homogeneous distribution of effect sizes and a random-effects model in the case of a heterogeneous distribution. Correlations among study-level moderators were determined with the phi coefficient. For moderator analyses, we used an analogue to ANOVA procedure appropriate for effect size data. A fixed-effects model was used when the factors adequately explained the heterogeneity. When additional heterogeneity remained, a mixed-effects model was used.

Results

The final sample comprised 28 independent study populations (see Table 1). The mean age of participants was 60.05 years (*SD* = 5.51). The samples were mostly not from underserved populations and were both nonadherent or mixed samples of women. The most commonly applied targets of tailoring were barriers to care and the TTM. Telephone and print were more frequently used than was in-person delivery. Physician recommendations were only included in 5 of the interventions. Active versus no-treatment control groups were used similarly often. Recent rather than repeat/regular screening was more likely to be used as an outcome. Medical records were used as often as self-report.

Since study features tend to cluster together (Lipsey and Wilson, 2001), we examined the intercorrelations among the moderators. The associations (significant at alpha = .01) indicated that interventions that used the HBM were often delivered in person ($\phi = .53$, $p < 0.01$) and included a physician recommendation ($\phi = .67$, $p < 0.001$). Interventions delivered by phone were often tailored by barriers to care ($\phi = .63$, $p < 0.01$) and printed materials were often tailored by age ($\phi = .63$, $p < 0.01$).

The mean weighted aggregate odds ratio [OR] was very small, 1.42, although significant, $p < 0.001$, with a 95% confidence interval [CI] that did not include one (1.27–1.60). There was significant heterogeneity among the effect sizes, $Q(27) = 107.96$, $p < 0.001$, suggesting that conducting moderator analyses to explain this variability would be appropriate.

Sample Characteristics

As shown in Table 2, directing an intervention to an underserved population did not significantly impact the effect size and there was no systematic variation due to differences in the level of adherence of the sample recruited.

Intervention Characteristics

The effectiveness of the different tailoring methods is shown in Table 3. Tailoring an intervention according to the recipients' ethnicity was significantly *less* effective than not doing so, and tailoring according to the HBM was more effective than not doing so. It was unexpected that interventions that tailored messages according to the TTM were not more effective than those that did not. We thus examined studies that included both models. A mixed-effect analogue to ANOVA comparing the four groups (HBM, TTM, both the HBM and the TTM, or neither model) was significant (OR = 1.39; $Q = 31.75$, $p < 0.001$). The weighted aggregate odds ratio for studies that included interventions tailored according to the HBM exclusively was 3.33, the TTM exclusively was 1.32, the HBM and TTM combined was 2.04, and neither theoretical model was 1.25.

Table 3 also shows the ways in which the tailored interventions were delivered. There were no differences among in person, telephone, or print delivery. We then examined if they differed

in the small group of studies that compared these modalities directly within the same study. Consistent with the meta-analytic results, 3 studies that compared a tailored in-person intervention to a tailored telephone intervention found them to be no different (OR = 1.06; $Q = 5.56$; $p = 0.06$), as did the two studies that compared a tailored telephone intervention to a tailored print intervention (OR = 1.05; $Q = 0.66$; $p = 0.42$). Three interventions comparing tailored print plus tailored telephone counseling to tailored print alone also found no significant differences (OR = 1.35; $Q = 0.26$; $p = 0.88$).

Finally, we conducted analyses to ensure that the effect size obtained for each study involved a comparison between two treatments that were different only with respect to the *tailored* component of the implementation. This revealed no significant difference between interventions with or without extra ingredients (OR = 1.38; $Q = 2.83$; $p = 0.09$). However, the mean aggregate odds ratios suggested that the extra ingredients may have slightly strengthened the interventions (OR = 1.74, $n = 9$ versus OR = 1.33, $n = 19$).

Consistent with previous studies, a physician recommendation was significantly influential (Table 3). There was no difference in the size of effect seen for interventions that were compared to an active control versus a no intervention control group.

Outcome Assessment

As shown in Table 4, measuring adherence with recent mammography resulted in higher effect sizes than with repeat/regular mammography. Whether the study outcomes were confirmed by medical records or measured only by self-report did not influence the effect size found.

Publication Bias

We examined the likelihood of publication bias by plotting the standard error by the natural logarithm of the logged odds ratio for the 28 effect sizes. The funnel plot appeared slightly asymmetrical. The fail-safe *n*, however, indicated that 764 non-significant studies would be necessary to show that tailored interventions to promote mammography screening have no effect on mammography adherence, making the aggregate result from this analysis fairly robust.

Discussion

The results of this meta-analysis supported the notion that tailored interventions are an effective method of promoting mammography adherence. The very small aggregate effect size is similar to effect sizes found from meta-analyses of patient letter reminders for cervical cancer screening (OR = 1.64; Tseng et al., 2001) and of tailored self-help materials promoting smoking cessation (OR = 1.42; Lancaster and Stead, 2006). The small size may be due to an increase in mammography rates in the general population (Legler, 2002). Even a small effect size is noteworthy when considering the potential to improve the prognosis of the approximately 200,000 US women who are diagnosed with breast cancer each year (American Cancer Society, 2006).

Interventions directed at women of minority ethnicities and/or low incomes were no more effective than those that were not. This implies that tailored interventions may work equally well in populations with lower rates of mammography screening as they do in the general population. Women who regularly followed mammography screening guidelines were similarly influenced by the tailored interventions as women who did not. There may still be a subpopulation of the nonadherent group who has *never* had a mammogram that may be especially difficult to influence, however (Champion et al., 2003).

Our prediction that the more individualized a tailored message is, the more effective it will be, was partially supported. Of the factors age, ethnicity, barriers to care, risk factors, the HBM, the TTM, and/or motivational interviewing, only interventions that tailored by the HBM were found to be more effective. The HBM model involves tailoring to perceptions of risk, benefits, severity, barriers, cues to action and self-efficacy, whereas tailoring to just barriers or the stage of change is more limited.

Another consideration is that the TTM was operationally defined in a variety of ways and was applied in interventions that varied in their level of elaborateness. For example, the maintenance stage was defined as receiving mammograms two years in a row (Prochaska et al., 2005), and as receiving two mammograms in four years (Messina et al., 2002). One study simply mailed a different packet of information to participants based on their stage of change (Prochaska et al., 2005). In contrast, another study applied the TTM by using computer-assisted telephone interviewing and adjusted responses based on the participant's stage of change, in addition to sending a follow-up mailing according to participant's new stage of change after the intervention (Crane et al., 1998b). Variation in use of the TTM to promote cancer screening behaviors is discussed in greater detail in a recent review (Spencer et al., 2005). Similarly, the content included in the motivational interviewing interventions also varied.

Tailoring an intervention by ethnicity was significantly *worse* than not tailoring by ethnicity. The four studies that did so did not explicitly define what the tailoring entailed. One implied that ethnicity was included in calculating risk (Jibaja-Weiss et al., 2003) and another reported that it used "ethnicity-appropriate" art (Rimer et al., 1999). The interventions were tailored to various ethnicities including African-American, Asian-American, Mexican-American, and non-Hispanic white women, and also by a variety of additional factors (i.e., age, risk factors, barriers, the TTM, motivational interviewing), so it is difficult to explain why they were less effective. The authors of the study with the lowest effect size, which may have driven the significantly negative aggregate result, suggested that the content of their message about cancer risk may have been too overwhelming (Jibaja-Weiss et al., 2003).

To interpret the effects of mode of implementation and variables for which the interventions were tailored, one needs to consider how these moderators were related. The fact that interventions delivered in-person were likely to use the HBM and that interventions that used the HBM often included a physician recommendation, makes it difficult to interpret which of these aspects of the interventions may be driving the effect. Our hypothesis that the more personal contact involved the more effective an intervention would be was not supported. However, additional non-tailored modalities included in some interventions may have played a role.

Consistent with our hypothesis and previous investigations (Legler et al., 2002; Jepson et al., 2000), including a physician recommendation in the intervention significantly increased the effect size. Clearly, the authority of a physician has a powerful impact on a woman's adherence to mammography screening guidelines and should be incorporated into tailored interventions whenever possible.

Our expectation that having an active control group would result in lower effect sizes, compared to having a no-treatment control group, was not supported. Although one might expect that there would be a greater difference if the control group was given no intervention, it is likely that even women in this condition encountered some mammography information.

The result that studies using recent mammography to define adherence had higher effect sizes than those that used repeat/regular mammograms conformed to our prediction. The use of the repeat/regular mammography as an index of adherence is relatively new, and is considered superior because repeat screening is expected to have the greatest impact on breast cancer

mortality (Rakowski et al., 2003). Determining the overall number of women who receive repeat or regular mammography screening is a challenge, however, because of the variety of definitions that have been used (Clark et al., 2002).

Consistent with our expectations, the other outcome moderator, whether the study outcomes were confirmed by medical records or measured by self-report, did not significantly influence the effect size. Therefore, although there has been some skepticism regarding the validity of self-reports (Lawrence et al., 1999), this finding, lends more support for the reliability of self-report methods to assess mammography use.

Study Limitations

One limitation of this meta-analysis is the small number of studies compared to draw conclusions for some of the moderators. For example, there were only four studies that delivered their interventions in-person. Therefore, although the weighted aggregate odds ratio was considerably higher than those for the other modes of implementation, there was little power to detect an effect that may have been present. As the field develops and more studies in this area become available, it may be valuable to repeat these analyses.

The correlations among some of the moderators made it difficult to distinguish among the most effective characteristics. Therefore, further research may need to tease apart if using the HBM and a physician recommendation are both effective aspects of a tailored intervention to promote mammography screening, or if one of these characteristics can be isolated as the most important.

Future Implications

Since tailoring interventions was demonstrated to be an effective method of promoting mammography screening, we encourage investigators to continue applying this method, while improving the standardization of the definitions of tailored interventions used and the outcomes measured. Some studies we reviewed stated that they were *culturally tailored* when they were actually only targeted to a cultural group (Gotay et al., 2000; Kim, 2001). *Culturally targeted* interventions use a single version of the intervention that is the same for a group of people, but take important characteristics of this group into account. *Culturally tailored* interventions consider important characteristics of a specific group, but tailor to individuals within these groups based on how they vary on these characteristics (Kreuter et al., 2003). Also, repeat/regular mammography adherence should be regarded as the new standard of measuring mammography adherence in future work. Until there is a consensus on the screening recommendations, the definition used by the BCSC (Stoddard et al., 2002) considering a woman's mammography as regular if she has two screenings in four years would be inclusive of women following any guidelines.

In addition, although this meta-analysis is the first to explore the effectiveness of multiple forms of tailored interventions in detail, perhaps measuring mammography adherence alone does not capture the full impact of tailored information. For example, participants may be more confident about having a mammogram when they are more informed about the procedure. One of the studies included in this meta-analysis conducted by Rimer et al. (2001) found that the combination of tailored print communication with tailored telephone counseling was significantly beneficial for contributing to knowledge and accuracy of risk perceptions. Rimer suggested that there is more stress surrounding mammography utilization following the recent controversy over age recommendations, creating a great need for interventions to aid women in mammography decision making. Finally, future research could apply findings from interventions used to promote mammography screening to creating interventions to encourage following-up with a physician after screening results (Bish et al., 2005).

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Table 1

Characteristics of tailored interventions and effect sizes for investigations that assessed recent versus repeat screening

#	Study	Tailored modalities	Additional modalities	Tailored by	*N*	OR
			Recent Screening			
1.	Allen et al. 2005	a. Telephone	Print	Barriers to care	354	1.42
		b. --	Usual care	--		
2.	Bastani et al. 1999	a. Print	Print	Age, risk factors	753	1.37
		b. --	Print	--		
3.	Carney et al. 2005[a]	a. Telephone		Barriers to care, TTM, motivational interviewing	258	1.31
		b. --	Print	--		
4.	Champion et al. 2000	a. In person, print		Barriers to care, HBM, TTM	278	1.25
		b. --	Usual care	--		
5.	Champion et al. 2003	a. In-person	Physician letter, print	Barriers to care, HBM, TTM	267	3.58
		b. Telephone	Physician letter, print	Barriers to care, HBM, TTM		2.81
		c. In-person	Print	Barriers to care, HBM, TTM		3.03
		d. Telephone	Print	Barriers to care, HBM, TTM		1.99
		e. --	Physician letter	--		
		f. --	Print	--		
6.	Crane et al. 1998[a] Crane et al. 1998 Crane et al. 2000	a. Telephone	Print	Barriers to care, TTM, motivational interviewing	1218	1.44
		b. Telephone	--	Barriers to care, TTM, motivational interviewing		
		c. --	Control	--		
7.	Davis et al. 1997[a]	a. Telephone	Print	Barriers to care	264	2.22
		b. --	Print	--		
		c. --	Print	--		
8.	Duan et al. 2000[a] Stockdale et al. 2000 Derose et al. 2000	a. Telephone	Print	Barriers to care, screening status	813	1.33
		b. --	Usual care	--		
9.	Janz et al. 1997[a]	a. Telephone	Print	Barriers, HBM	460	3.33
		b. --	Usual care	--		
10.	Jibaja-Weiss et al. 2003	a. Print	--	Age, ethnicity, risk factors	500	−0.57
		b. --	Print	--		
		c. --	Usual care	--		
11.	Kreuter, et al. 2005	a. Print	--	Age, barriers to care, risk factors, knowledge, HBM, TTM, religiosity, collectivism, racial pride, time orientation	100	2.58
		b. Print	--	Age, barriers to care, risk factors, knowledge, HBM, TTM		
		c. Print	--	Age, religiosity, collectivism, racial pride, time orientation		
		d. --	Usual care	--		
12.	Lauver et al. 2003	a. Telephone, print	--	Barriers to care, beliefs, feelings	472	1.46
		b. --	Telephone, print	--		
		c. --	Usual care	--		
13.	Luckmann et al. 2003	a. Telephone	Print	Barriers to care, time since last mammogram	12905	1.10
		b. --	Print	--		
14.	McCaul et al. 2002	a. Print	Brochure	Barriers to care	2941	1.09
		b. --	Personalized print	--		
		c. --	Print	--		
		d.--	Usual care	--		
15.	Rakowski et al. 1998	a.. Print	--	Age, TTM	918	1.43
		b. --	Print	--		

#	Study	Tailored modalities	Additional modalities	Tailored by	*N*	OR
		c.--	Usual care	--		
16.	Rimer et al. 1999	a. Telephone, print	Provider prompt	Age, ethnicity, barriers to care, time since last mammography, TTM	256	−0.94
		b. Print	Provider prompt	Barriers to care, time since last mammography, TTM		
		c. --	Provider prompt	--		
17.	Rimer et al. 2001 Rimer et al. 2002	a. Telephone, print	--	Age, barriers to care, risk factors, TTM, precaution adoption process model	735	1.30
		b. Print	--	Age, barriers to care, risk factors, TTM, precaution adoption process model		
		c. Usual care	--	--		
18.	Saywell et al. 1999 Saywell et al. 2003	a. In person	Physician letter, print	Barriers to care, HBM	222	3.34
		b. In person	Print	Barriers to care, HBM		
		c. Telephone	Print	Barriers to care, HBM		
		d. --	Physician letter	--		
		e. --	Usual care	--		
19.	Saywell et al. 2004	a. Telephone, print	--	Age, barriers to care, risk factors, HBM, TTM, self-efficacy	528	2.01
		b. Telephone	--	Age, barriers to care, risk factors, HBM, TTM, self-efficacy		
		c. Print	--	Age, barriers to care, risk factors, HBM, TTM, self-efficacy		
		d. Usual care	--	--		
20.	Taplin et al. 2000	e. Telephone	Print	Barriers to care, motivational interviewing	1180	1.81
		--	Telephone	--		
		--	Print	--		
21.	Valanis et al. 2002 Valanis et al. 2003 Lynch et al. 2004	a. In person, telephone, print	--	Age, ethnicity, barriers to care, motivational interviewing	252	1.52
		b. In person	--	Barriers, motivational interviewing		
		c. Telephone, print	--	Age, ethnicity, barriers to care, motivational interviewing		
		d. --	Print	--		
22.	Andersen et al. 2000[a] Andersen et al. 2002	a. Telephone	Print	Barriers to care	3299	1.08
		b. Telephone	Community activities, print	Barriers to care		
		c. --				
		d. --	Community activities, print	--		
		e. --	Usual care	--		
23.	Clark et al. 2002	a. Print	--	TTM	677	1.42
		b. --	Print	--		
		c. --	Usual care	--		
24.	Costanza et al. 2000[a]	a. Telephone	Print	Barriers to care	1068	1.09
		b. --	Print, physician education	--		
		c. --	Print	--		
25a	Lipkus et al. 2000	a. Telephone	Print	Barriers to care, TTM	668	1.09
		b. Print	Print	Barriers to care, TTM		
		c. --	Print	--		
26.	Messina et al. 2002[a]	a. Telephone	Print	Barriers to care, TTM	202	1.71
		b. --	Usual care	--		
27.	Rakowski et al. 2003	a. Telephone, print	10-month follow-up	Barriers to care, ethnicity, education, income, TTM, knowledge	805	1.02
		b. Telephone, print	2-month follow-up	Barriers to care, ethnicity, education, income, TTM, knowledge		
		c. --	Print	--		
28.	Prochaska et al. 2005	a. Print	--	TTM	844	1.73

#	Study	Tailored modalities	Additional modalities	Tailored by	*N*	OR
		b. --	Usual care	--		

[a] Interventions were not described as *tailored* by the authors, but, because they were scripted, the study was included.

OR, odds ratio; HBM, Health Belief Model; TTM, Transtheoretical Model

Table 2

Sample characteristics

	N **Yes**	**OR Yes**	**OR No**	***Q*-value**	***P*-value**
Directed to an underserved population	9	1.46	1.41	0.04	0.84
Recruited a non-adherent sample	15	1.48	1.33	0.89	0.35

OR, odds ratio

Table 3

Intervention characteristics

	N Yes	OR Yes	OR No	*Q*-value	*P*-value
Tailored to					
Age	8	1.33	1.47	0.42	0.52
Ethnicity	4	0.96	1.51	4.84	0.03*
Risk	5	1.34	1.45	0.12	0.73
Barriers	23	1.48	1.26	0.99	0.32
HBM	6	2.51	1.27	14.99	0.00**
TTM	14	1.47	1.40	0.15	0.70
MI	4	1.59	1.42	1.23	0.27
Mode of implementation					
In-person	4	2.18	1.35	2.99	0.08
Telephone	18	1.39	1.54	0.45	0.50
Print	14	1.31	1.57	2.20	0.14
Physician recommendation included	5	2.46	1.29	9.19	0.00**
Active control	13	1.37	1.50	0.53	0.47

* $p < 0.05$,

** $p < 0.01$

OR, odds ratio; HBM, Health Belief Model; TTM, Transtheoretical Model;

MI, motivational interviewing.

Table 4

Outcome assessments

	N **Yes**	**OR Yes**	**OR No**	***Q*-value**	***P*-value**
Outcome of recent screening	21	1.53	1.17	6.94	0.01*
Outcome assessed with medical records	14	1.54	1.32	1.57	0.21

* $p < 0.05$

OR, odds ratio