Comparisons of Tailored Mammography Interventions at Two Months Postintervention

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ABSTRACT

The recent decrease in breast cancer mortality has been linked in part to increased breast cancer screening. Although the percentage of women screened once is rising, rate of continued adherence is poor. The purpose of this article is to assess the effects of tailored mammography interventions implemented prospectively in a factorial design contrasting groups receiving either (a) usual care (no intervention), (b) tailored telephone counseling for mammography, (c) tailored mailed materials promoting mammography, or (d) a combination of tailored mail and telephone counseling. This prospective, randomized study with a 2 × 2 factorial design included women 51 years and older (N = 1,367) who were not adherent with mammography at baseline. The intervention is based on integration of the Transtheoretical and Health Belief Models. Participants were enrolled in one of two health maintenance organizations or seen in a university-related primary care clinic. Baseline data were collected on mammography history and beliefs and knowledge related to mammography. Data were collected via telephone interviews using previously developed scales. The follow-up interviewers were conducted with 976 women. The sample was 41% White, 56% African American, and 3% other. Mean age at baseline was 66.5. Logistic regression indicates that postintervention mammography status in all three intervention groups was significantly better than usual care, with odds ratios ranging from 1.66 (telephone only) to 2.16 (telephone plus mail).

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INTRODUCTION

Breast cancer mortality has begun to decrease slightly, but the disease is still estimated to claim the lives of more than 40,000 women each year (1). Although the proportion of women who have had at least one mammogram is increasing (2), further mortality benefit will almost certainly depend on the routine interval screening that has still not been achieved. Recent reviews of a national mammography survey indicated that 59% of women had been screened in the past 2 years, but only 27% had the age-appropriate number of repeat screening mammograms (3). Our biggest challenge is to find cost-effective and easily implemented methods of increasing continued mammography adherence. This article assesses the effects of mammography interventions implemented prospectively in a factorial design. Contrasting groups received either (a) usual care (no intervention), (b) tailored telephone counseling for mammography, (c) tailored mailed intervention promoting mammography, or (d) a combination of tailored mail and tailored telephone counseling.

BACKGROUND

Interventions to increase mammography screening have been reported for at least a decade. A meta-analysis (4) indicated that patient reminders are effective in increasing mammography screening. Such reminders have varied from generic to personal. For example, Davis, Nash, Bailey, Lewis, Rimer, and Koplan (5) randomized women to receive a birthday card reminder, a personalized letter, or a multicomponent call incorporating counseling and scheduling. Postintervention, women who had received the telephone intervention were more likely to have had mammograms (28%), followed by those who received the birthday card (15%), and those who received the mailed intervention (9%).

Tailored interventions—those developed for one specific recipient based on her particular characteristics (6,7)—have shown great promise for increasing mammography (8–15). Tailored interventions have been delivered in person, in print, and via telephone. Champion and Huster (13) demonstrated that

personal counseling tailored according to individual beliefs effectively increased mammography adherence (odds ratio = 5.27). Other studies suggest the strengths of such face-to-face individualized interventions can be approximated by telephone. King, Rimer, Seay, Balshem, and Engstrom (14) and Marcus et al. (15) delivered tailored counseling interventions by telephone and found significant increases in mammography use. Some intervention trials have used computer-generated print materials created specifically for individual recipients based on their responses to communications (11,16,17). Skinner, Campbell, Rimer, Curry, and Prochaska (11) found that among low-income women not adherent at baseline but considering a mammogram, those who received tailored print communications were much more likely to have had a mammogram at follow-up than were those whose print communications were not tailored (75% vs. 32%). Tailoring messages to beliefs and stage of mammography adherence provides information to address specific needs of individuals, thus increasing relevancy (7). Tailoring also can be done on demographic characteristics. Previous studies have shown mammography use is related to race, age, and education (18–24). Women who are older, have lower incomes, and are of minority status have been found to have lower screening rates than other women. Thus, tailored interventions have been designed to address these demographic variables. A few studies have examined the relationships between marital status and mammography use but have not found significant relationships (25).

THEORETICAL FRAMEWORK

Two major theories have provided the background for many tailoring studies. The first is the Health Belief Model (HBM), which includes predictors of behavior to be perceived risk, barriers, benefits, and self-efficacy. HBM borrowed from learning theories such as the Stimulus Response Theory (26) and Cognitive Theory (27) in delineating predictors of health behavior. The second major theory used to tailor mammography screening interventions, the Transtheoretical Model (TTM), explains behavior through a series of stages ranging from not thinking about a behavior (precontemplation) to considering a behavioral change (contemplation) to actually engaging in the behavior (action) (28). The balance of pros versus cons has been found to predict stage of behavior adoption. The TTM and HBM have a subset of similar constructs; benefits and barriers from the HBM are conceptually similar to the TTM's pros and cons. Our tailored interventions addressed benefits and barriers as well as perceived risk and self-efficacy (HBM) constructs and mammography stage of adoption.

Combining TTM and HBM allowed us to tailor materials to not only cognitive belief variables but also stage of adoption—a strategy with promise for women who have had previous mammograms but who were not interval adherent. Each theory yields unique constructs that have the potential to increase intervention effectiveness thus having an additive effect. Several reports have indicated that HBM constructs do indeed vary by stage of mammography compliance (29,30). Rimer et al. (7) provide a cogent argument for combining theories by pointing out that the complexity of human behavior demands a multilevel approach. A woman's past mammogram use was reinforced in her intervention, as well as the need to repeat mammography at recommended intervals. For women who had not had mammograms, tailored interventions "walked them through" the mammography process and gave them information about facilities close to them.

Interventions that demonstrate promise for increasing mammography adherence have varied in intensity, method of delivery, and tailoring variables. It is now important to find the most efficacious method of delivering tailored interventions. In a randomized prospective clinical trial, we compare tailored mailed, tailored telephone counseling, and the combination of tailored mailed and telephone counseling among a sample of women 51 years and older who were not adherent to determine if any intervention is significantly better than usual care and, if so, whether any intervention is significantly better than another. We did not hypothesize that any one intervention would be better than another, although we had some reason to believe that an additive effect might occur such that the combination group would be the strongest (31). Additionally, we wanted to see if telephone counseling effects would be increased if women had a paper copy of messages for referral.

The study targeted women who, at baseline, had no personal history of breast cancer and had not had a mammogram in the past 15 months. Eligible women were 51 years and older and therefore should receive yearly mammograms.

Research questions were as follows:

1. Do intervention groups have significantly more mammography adherence compared with the control group at 2 months postintervention?
2. Does mammography adherence at follow-up differ significantly by intervention group?
3. Does intervention effect differ significantly by site, age, race, education, or living status?

METHODS

Sample

A total of 1,390 study participants were recruited from two sites in the Midwest. St. Louis women ($n = 732$; response rate = 72%) were recruited from a general medicine clinic serving the indigent at Washington University's Barnes-Jewish Hospital. The St. Louis sample, which was 83% African American, tended to have less education than the Indiana population ($p \leq .001$). Among the St. Louis sample, 52% had less than a high school education, 27% were high school graduates, 17% had some college or a technical degree, and only 4% had college degrees. Only 23% of the St. Louis sample were from households with annual incomes of more than $15,000; 90% of the women were not currently working. Approximately 82% were living without a partner, 1% were not married but living with a partner, and 17% were currently married. The St. Louis women also tended to be older (69% were older than 65 years of age).

Participants from the Indiana University site ($n = 658$; response rate = 44%) were recruited from two health maintenance organizations (HMOs), were 77% White, and reported higher

education than the St. Louis population. Only 18% had less than a high school education, 36% were high school graduates, 28% had some college or a technical degree, and 18% were college graduates. Half were employed; fewer than one quarter were from households with annual incomes below $15,000. A total of 39% of the Indianapolis sample was currently married, 2% were not married but living with a partner, and 59% were living without a partner. The Indianapolis sample was younger; 61% were younger than 65 years of age. Sample characteristics are presented in Table 1.

Procedures

Eligible women (i.e., no history of breast cancer, no mammogram in 15 months, and 51 years of age or older) were identified through computer lists from the medicine clinic in St. Louis and the HMOs in Indianapolis. A letter and brochure were mailed to women introducing the study and telling them that a research assistant would call and further explain involvement. Women who agreed to participate completed baseline telephone interviews—either at the time of the initial call or at a later scheduled time. Institutional review board approval was obtained before initiating the study. Verbal informed consent was obtained before baseline interviews. The essential components such as freedom to withdraw or not participate were included on the mailed brochure. Women who agreed to participate were randomized by site to one of four groups: (a) usual care (no intervention), (b) tailored telephone counseling, (c) tailored mailing, and (d) combination of tailored mailing and telephone counseling. At 2 months postintervention, women were reinterviewed by telephone. For all telephone interviews, women not

reached initially were redialed at least 10 times during various times of the day and on various days of the week.

Instruments

The belief variables of perceived susceptibility, benefits, barriers, and self-efficacy were measured before intervention delivery and used to develop tailored interventions. Instruments were based on previously developed scales (32,33) using 5-point Likert responses from 5 (*strongly agree*) to 1 (*strongly disagree*). All scales were tested for construct validity by factor analysis and by testing theoretical relationships. Using exploratory factor analysis scales, items were factored onto specific scales of susceptibility, benefits, barriers, and self-efficacy. Scales also predicted mammography adherence as theoretically specified. The internal consistency coefficient for the current data is listed with each measurement. Items were given in the referenced articles.

Perceived susceptibility was measured with three items assessing perceived likelihood of getting breast cancer in the next few years. Reliability for this sample was 0.74.

Benefits were measured by seven items assigned to a 5-point Likert scale and addressed such issues as finding breast cancer early, decreasing chances of dying, and "putting your mind at ease." Reliability of this scale was 0.84.

Barriers were measured via 14 items with 5-point Likert-type responses. Items addressed issues such as fear, pain, embarrassment, and others identified via previous research. Cronbach's alpha was 0.79. Each barrier was addressed as a separate item.

TABLE 1
Sample Characteristics of the Population

	Total[a]	*Indpls. HMO*[b]	*St. Louis Clinic*[c]	*p*
Age (*M/SD*)	65.7/10.44	63.74/10.73	67.41/9.87	< .001*
Race				
African American	54%	21%	83%	
White	44%	77%	15%	< .001†
Income				
Less than 15,000 annually	52%	24%	77%	
15,000 or more annually	48%	76%	23%	< .001†
Education				
Less than high school	36%	18%	52%	
High school	31%	36%	27%	< .001†
Tech/Some college	22%	28%	17%	
College degree or graduate	11%	18%	4%	
Employment				
Currently employed	28%	50%	10%	
Not currently employed	72%	50%	90%	< .001†
Living status				
Currently married	27%	39%	17%	< .001†
Partner but not married	2%	2%	1%	
No partner	71%	59%	82%	

Note. Indpls. = Indianapolis; HMO = health maintenance organization.
[a]*n* = 367. [b]*n* = 636. [c]*n* = 731.
*Using two-sided *t* test. †Using chi-square test.

Self-efficacy addressed perceived confidence to get a mammogram. A total of 10 items with responses on a 5-point Likert scale were generated. Cronbach's alpha of 0.81 was calculated for this population. Items asked about perceptions that the women could complete steps required to obtain a mammogram. Items such as "I feel confident I could get a mammogram" were included.

Mammography adherence was assessed from self-reported date of last mammogram. All women were not adherent at baseline (i.e., none reported mammogram in the previous 15 months). Women were categorized as adherent if they had a mammogram postintervention.

Stages of mammography adoption were determined via an algorithm response form using a series of questions. At baseline, algorithms were developed from the past work of Rakowski, Fulton, and Feldman (34). At baseline, all participants were in one of these four stages:

1. Precontemplation: Never had a mammogram; not planning on having one in next 12 months.
2. Contemplation: Never had a mammogram; planning on having one in next 12 months.
3. Relapse Precontemplation: Had one or more mammograms; last was more than 1 year ago; not planning mammogram in next 12 months.
4. Relapse Contemplation: Had one or more mammograms; last was more than 1 year ago; planning to have a mammogram in the next 12 months.

Intervention

A computer-tailoring program (35) was developed by People Designs of Durham, North Carolina, to assemble combinations of messages drafted by the investigators. HBM variables of perceived breast cancer susceptibility, mammography benefits and barriers, and perceived self-efficacy for obtaining a mammogram were assessed, and messages were delivered as appropriate. Additionally, messages were tailored on recipients' family history, age, and stage of adoption. Women in the three experimental groups received the intervention approximately 4 weeks after the baseline interview.

As we have previously described (36), there were three parts to the tailored print intervention. The first was a cover page in which individual messages addressed the recipient's age, breast cancer family history, and stage of mammography adoption. This cover page was in the form of a letter addressing the woman by name and closing with the digitized signature of the physician she identified as her primary care provider. The second component was tailored information addressing the recipient's perceived risk, benefits, and barriers to mammography. Some messages varied depending on composite benefits and barriers scores; others addressed particular benefits and barriers and were included based on responses to specific benefit and barrier items. Table 2 gives a sample of messages and the interview items on which they were based. Computer-tailoring algorithms used womens' responses to risk, benefits, and barrier items to select messages. For instance, if a woman agreed that mammography pain would keep her from having a mammogram, a specific message addressing pain was delivered.

A third component was included for women who had a self-efficacy score below the mean, which indicated they were not confident they could complete the mammography procedure. These mailings contained text and graphics detailing how to set up a mammography appointment, where to go, what to wear, and so forth.

The tailored telephone counseling was, of course, delivered through a different medium and could not include graphics but was otherwise similar in content to the tailored mailing. Coun-

TABLE 2
Tailored Messages Based on Health Belief Model and by Concept

Interview Items	Tailored Message
Susceptibility	
Q: I am likely to get breast cancer in the next 10 years. A: Strongly disagree.	There are many things that can increase your risk for breast cancer, but none compare with the fact that you are a woman and getting older. Even if you do not have other risk factors, breast cancer can happen to you. You can't change being a woman or getting older but you can protect yourself through breast cancer screening.
Benefits	
Q: A mammogram can find a breast lump before it is big enough to feel. A: Strongly disagree.	Did you know that mammograms can find breast cancer about 2 years before it can even be felt by your doctor? Mammograms are the only way to find cancer this small. So, instead of waiting for the cancer to grow until it can be felt, women can get early treatment and be on the road to recovery.
Barrier	
Q: You are afraid to have a mammogram because it might show a problem. A: Agree.	Have you put off having a mammogram because it might show a problem? Most women have normal results that make them feel good. If something is found, chances are it's not cancer. Even if it were cancer, if it's found early, your chances for full recovery would be great. Either way, having a mammogram can reduce your worries.

seling included messages on perceived risk, perceived benefit, perceived barriers, and perceived self-efficacy if the baseline responses indicated a need. If a woman had not previously had a mammogram, the counselor verbally "walked her through" the procedure. Counselors were trained in a 2-day session that included review of the research protocol, intervention training, and role playing. The telephone counselors based their counseling on the printed letters the women would have received had they been assigned to the tailored mailing group (or that they did receive, if they were in the tailored mail and telephone counseling group). The tailored telephone counseling call averaged about 15 min.

RESULTS

Data analyses were completed using SAS, version 6.12 (37). For this analysis, mammography adherence was defined as having had a mammogram 2 months after intervention. Overall, one third of the sample became adherent whereas two thirds remained not adherent.

Intervention Groups Versus Usual Care

To answer Research Question 1, which asked whether adherence in the intervention groups would differ from the usual care group, we ran a logistic regression model with mammography adherence at Time 2 as the response variable. Each of the three intervention groups was compared with the usual care group. Odds ratios with the 95% confidence intervals are presented in Table 3. Odds ratios for all three intervention groups (tailored telephone, tailored mailing, and mail plus telephone) were significant when compared with usual care. All three interventions led to significantly better adherence rates, with the combination intervention having the highest odds. The odds ratio of 2.1 indicates that women in the combined tailored intervention group were more than twice as likely to have mammograms as those in the usual care group.

Differences Among Intervention Groups

For Research Question 2, logistic regression results showed that adherence outcomes for the mailed and telephone interventions were not different from each other nor was the combined intervention different from either single intervention.

Intervention Differences
by Other Characteristics

Previous studies have found links between demographic variables and mammography adherence. We therefore assessed

intervention effect by site, age, race, education, and living status, including covariates along with the intervention group in the logistic regression model. We conducted preliminary analyses by including site, age, race, education, and living status individually in the model. Women were categorized into three age groups: 50–64, 65–74, and ≥ 75 years. Education level was categorized as in Table 1 (less than high school, high school, technical/some degree, and college degree or more). Living status was dichotomized as with or without a partner. Effects of race, age, and educational status were not significantly related to mammography adherence. Tables 4 and 5 show the effect of site and living status.

Intervention effects were different by site. Women at the Indianapolis site were 1.4 times as likely as women at the St. Louis site to obtain a mammogram following intervention. Similarly, women with partners were almost 1.5 times as likely as women without partners to be adherent after intervention. Given the differences in demographic characteristics at the two sites, we chose to further investigate the data by looking at adherence at each site separately.

As shown in Table 4, adherence rate in the tailored telephone group was significantly better than usual care. However, when the four groups were compared separately within each site, the effect of the tailored telephone counseling alone was not significant at either site (Tables 6 and 7). This can be attributed to the fact that, within each site, the smaller sample size does not provide sufficient power to detect a difference in adherence rates. The strongest intervention (the combination) was significant for both sites even though the sample size was small.

As Tables 8 and 9 show, none of the interventions had a significant effect on mammography adherence among women with

TABLE 4
Adherence by Group and Site

Group	β	Odds Ratio	p	95% CI
Tailored telephone	0.50	1.66	0.012	1.12, 2.46
Tailored mailing	0.54	1.72	0.0048	1.18, 2.52
Telephone + Mailing	0.77	2.16	0.0001	1.46, 3.19
Site (IU)	0.34	1.41	0.0142	1.07, 1.84

Note. CI = confidence interval; IU = Indiana University.

TABLE 5
Adherence by Group and Marital Status

Group	β	Odds Ratio	p	95% CI
Tailored telephone	0.51	1.66	0.0123	1.12, 2.46
Tailored mailing	0.54	1.71	0.0055	1.17, 2.5
Telephone + mailing	0.76	2.15	0.0001	1.45, 3.17
Marital status [with partner]	0.33	1.4	0.0217	1.05, 1.86

Note. CI = confidence interval.

TABLE 3
Adherence at Time 2 by Group

Group	n	β	Odds Ratio	p	95% CI
Tailored telephone	223	0.50	1.66	0.012	1.12, 2.46
Tailored mailing	263	0.54	1.72	0.0048	1.18, 2.52
Telephone + mailing	221	0.77	2.16	0.0001	1.46, 3.19

Note. N = 976. CI = confidence interval.

TABLE 6
Adherence by Group: Indiana University

Group	n	ß	Odds Ratio	p	95% CI
Tailored telephone	126	0.47	1.59	0.085	0.94, 271
Tailored mailing	125	0.65	1.91	0.016	1.13, 3.23
Telephone + mailing	107	0.78	2.17	0.005	1.26, 3.74

Note.   *N* = 490. CI = confidence interval.

TABLE 7
Adherence by Group: Washington University

Group	n	ß	Odds Ratio	p	95% CI
Tailored telephone	97	0.51	1.67	0.092	0.92, 3.02
Tailored mailing	138	0.45	1.57	0.105	0.91, 2.73
Telephone + mailing	114	0.78	2.17	0.007	1.24, 3.8

Note.   *N* = 486. CI = confidence interval.

TABLE 8
Adherence for Each Group by Marital Status With Partner

Group	n	ß	Odds Ratio	p	95% CI
Tailored telephone	70	0.41	1.5	0.24	0.76, 2.96
Tailored mailing	84	0.52	1.69	0.11	0.88, 3.22
Telephone + mailing	71	0.38	1.47	0.27	0.75, 2.88

Note.   *N* = 303. CI = confidence interval.

TABLE 9
Adherence for Each Group by Marital Status Without Partner

Group	n	ß	Odds Ratio	p	95% CI
Tailored telephone	152	0.56	1.74	0.026	1.07, 2.84
Tailored mailing	179	0.54	1.72	0.024	1.07, 2.75
Telephone + mailing	150	0.95	2.59	0.0001	1.61, 4.17

Note.   *N* = 674. CI = confidence interval.

partners, whereas mammography use among women without partners increased significantly after all three interventions. Overall adherence percentages in these two groups were 30.5% (205/672) for women without partners and 38.3% (116/303) for women with partners. The usual care group for women with partners had a higher rate of adherence and may have resulted in nonsignificant differences for this group.

DISCUSSION

It is clear that as early as 2 months postintervention, the tailored interventions worked significantly better than usual care

for promoting mammography adherence among women who were previously not adherent. Further, although all three tailored interventions increased mammography use significantly. Separate analysis by site demonstrated that the combination (telephone plus mailing) was more effective than either telephone or mail alone. The combination intervention group had more than twice as many women who received mammograms by follow-up than did the usual care group.

Although it does not seem surprising that *some* tailored intervention resulted in more adherence than usual care, it is worth noting that this was not the case at both sites and has not always been the case in other studies. For example, Rimer et al. (7) found that tailored print interventions alone resulted in no higher rate of mammography adherence than usual care for the short-term impact of a mammography decision-making intervention for women in their 40s and 50s. Although the two studies differ in that the tailored intervention delivered by Rimer was a more nondirective decision aid and no group received telephone counseling alone, the variation in findings indicates a need for further study of tailored print and telephone mammography interventions.

Perhaps our study's lack of difference between mail and telephone interventions stems from the two interventions' similarity in content. As described under Interventions, the tailored mail that the women would have received (if they had been in the tailored mail group) or that they did receive (if they were in the combined intervention group) served as the counseling guide for the telephone intervention. In this way, we tested the difference in message delivery channel rather than the message content per se. In the Indianapolis site, we found no difference between these message delivery channels but the expanded intervention "dose" of telephone plus mail did seem to have an advantage of doubling the intervention dose. Given the lack of difference between mail and telephone counseling only, a similar effect could have been achieved by adding a second tailored mailing rather than "doubling the dose" via telephone counseling.

Results from multivariate analyses entering several variables as covariates with intervention group showed no significant differences in intervention effects by age, race, or education, but there were significant differences by site (Indianapolis vs. St. Louis). Women in the Indianapolis sample were almost one and one half times more likely than women from the St. Louis sample to become adherent after intervention. Rather than being a geographical issue, these differences probably stem from variations related more to health care issues. Indianapolis women were members of HMOs; St. Louis women were seen in a university-hospital-based indigent-care general medicine clinic. The combination intervention (telephone plus mailing) had significant effects in both the St. Louis and Indianapolis samples, but the effect of tailored mailing without telephone counseling was significant only for the Indianapolis sample. Because these results are in sharp contrast to Skinner, Strecher, and Hospers (10) and Skinner et al. (11) who found only low-income women and African Americans benefited significantly from tailored mammography recommendation letters, differing strength of telephone versus print interventions for various recipient

groups should be further investigated. The fact that African American women in both the Indianapolis and St. Louis samples were not adherent at baseline may explain the difference in findings of this versus previous studies. Skinner et al. (10) suggested that the lack of difference by intervention group among White women might have stemmed from the ceiling effect created by initially high adherence rates at baseline. Clearly, it will be important to continue to test such interventions among African American and White women and begin to understand the mechanisms by which various tailored interventions are and are not effective within each group.

We also found that intervention effect varied by whether women were living with or without a partner (Table 8). For women with a partner, each intervention increased adherence, although not significantly. The usual care group had an adherence rate of 31% versus 39% to 42% for intervention group. For women without partners, usual care group adherence rate was lower (21%) at baseline, and intervention group adherence was 31 to 41% in intervention groups. The lower baseline rate may have allowed significance to surface. Such differences by marital or living status are not commonly cited in the literature. One possible explanation is that for women with partners, simply being enrolled in the study and participating in the interviews spurred adherence. Although only 21% of women without partners in the usual care group became adherent, almost 40% of women without partners in the telephone-plus-mail group had mammograms. Perhaps the most important finding is that for women without partners, all forms of tailored intervention made a significant difference.

CONCLUSIONS

Several limitations indicate the need for caution when developing conclusions. First, as with many research studies, the sample was limited to women who agreed to participate. This of course creates the possibility that participants were more motivated to comply than women who declined study participation. Just being in the study and responding to telephone questions might have encouraged thoughts or behaviors that would not have occurred without study participation. The response rate for the Indianapolis sample was only 44%. However, given that participation required a 2-year commitment, participation cannot be compared with one-time survey results. Another limitation is reliance on self-report mammography rates, although self-report mammography rates have been reported as accurate (38). Considering these limitations, the significant effect of tailored interventions as early as 2 months after intervention is encouraging. At least initially, the mail-plus-telephone intervention led to more reported mammography use than did either tailored medium alone. Study findings also support that interventions may be differentially effective depending on sample characteristics, demonstrated in this study by site and living status. It is important to further identify types of populations that most benefit from particular interventions. As Skinner et al. (10) pointed out, it will be important to identify intervention methods that are most cost effective within population subsets. From these preliminary re-

sults, however, it is evident that the combination of telephone counseling and mailing was most effective across all groups. Further recommendations must await continued follow-up and cost-effective analysis.

REFERENCES

(1) Landis SH, Murray T, Bolden S, Wingo P: Cancer Statistics. *Cancer Journal for Clinicians.* 2000, *50:*7–34.

(2) Morbidity and Mortality Weekly Report: Center for Disease Control and Prevention. *Morbidity and Mortality Weekly Report.* 1997, *46:*937–941.

(3) Phillips KA, Kerlikowske K, Baker LC, Chang SW, Brown ML: Factors associated with women's adherence to mammography screening guidelines. *Health Services Research.* 1998, *33:*29–53.

(4) Wagner TH: The effectiveness of mailed patient reminders on mammography screening: A meta-analysis. *American Journal of Preventive Medicine.* 1998, *14:*64–70.

(5) Davis NA, Nash E, Bailey C, et al.: Evaluation of three methods for improving mammography rates in a managed care plan. *American Journal of Preventive Medicine.* 1997, *13:*298–302.

(6) Kreuter M, Skinner C: Tailoring: What's in a name. *Health Education Research.* 2000, *15:*1–4.

(7) Rimer BK, Halabi S, Skinner C, et al.: The short-term impact of tailored mammography decision-making interventions. *Patient Education and Counseling.* 2001, *43:*269–285.

(8) Campbell MK, DeVellis BM, Strecher VJ, et al.: Improving dietary behavior: the effectiveness of tailored messages in primary care settings. *American Journal of Public Health.* 1994, *84:*783–787.

(9) Champion VL: Strategies to increase mammography utilization. *Medical Care.* 1994, *32:*118–129.

(10) Skinner CS, Strecher VJ, Hospers H: Physicians' recommendations for mammography: Do tailored messages make a difference? [see comments]. *American Journal of Public Health.* 1994, *84:*12–13, 43–49.

(11) Skinner CS, Campbell MK, Rimer BK, Curry S, Prochaska JO: How effective is tailored print communication? *Annals of Behavioral Medicine.* 1999, *21:*290–298.

(12) Strecher VJ, Kreuter M, Den Boer DJ, et al.: The effects of computer-tailored smoking cessation messages in family practice settings. *Journal of Family Practice.* 1994, *39:*262–270.

(13) Champion VL, Huster G: Effect of interventions on stage of mammography adoption. *Journal of Behavioral Medicine.* 1995, *18:*169–187.

(14) King ES, Rimer BK, Seay J, Balshem A, Engstrom PF: Promoting mammography use through progressive interventions: Is it effective? *American Journal of Public Health.* 1994, *84:*104–106.

(15) Marcus AC, Bastani R, Reardon K, et al.: Proactive screening mammography counseling within the Cancer Information Service: Results from a randomized trial. *Journal of the National Cancer Institute Monographs.* 1993, *14:*119–129.

(16) Lipkus IM, Rimer BK, Halabi S, Strigo TS: Can tailored interventions increase mammography use among HMO women? *American Journal of Preventive Medicine.* 2000, *18:*1–10.

(17) Rakowski W, Ehrich B, Goldstein MG, et al.: Increasing mammography among women aged 40–74 by use of a stage-matched, tailored intervention. *Preventive Medicine.* 1998, *27:*748–756.

(18) Breen N, Kessler L: Trends in cancer screening—United States, 1987 and 1992. *Oncology (Huntington).* 1996, *10:*328–330.

(19) Chevarley F, White E: Recent trends in breast cancer mortality among white and black US women. *American Journal of Public Health.* 1997, *87:*775–781.

(20) Burns RB, McCarthy EP, Freund KM, et al.: Variability in mammography use among older women. *Journal of the American Geriatrics Society.* 1996, *44:*922–926.

(21) Mickey RM, Durski J, Worden JK, Danigelis NL: Breast cancer screening and associated factors or low-income African-American women. *Preventive Medicine.* 1995, *24:*467–476.

(22) Ruchlin HS: Prevalence and correlates of breast and cervical cancer screening among older women. *Obstetrics & Gynecology.* 1997, *90:*16–21.

(23) Suarez L, Nicholas D, Roche R, et al.: Knowledge, behavior, and fears concerning breast and cervical cancer among older low- income Mexican-American women. *American Journal of Preventive Medicine.* 1997, *13:*137–142.

(24) Bush RA, Langer RD: The effects of insurance coverage and ethnicity on mammography utilization in a postmenopausal population. *Western Journal of Medicine.* 1998, *168:*236–240.

(25) Tudiver F, Fuller-Thomson E: Who has screening mammography? Results from the 1994–1995 National Population Health Survey. *Canadian Family Physician.* 1999, *45:*1901–1907.

(26) Hull CL: *Principles of Behavior.* Englewood Cliffs, NJ: Appleton-Century-Crofts, 1943.

(27) Lewin K: Field theory and learning. In Cartwright D (ed), *Field Theory in Social Science: Select Theoretical Papers.* New York: Harper Collins, 1951 (1942).

(28) Prochaska JO, Velicer WF: The Transtheoretical Model of health behavior. *American Journal of Health Promotion.* 1997, *12:*38–48.

(29) Skinner CS, Champion VL, Gonin R, Hanna M: Do perceived barriers and benefits vary by mammography stage? *Psychology, Health & Medicine.* 1997, *2:*65–75.

(30) Champion VL, Skinner CS, Foster JL: The effects of standard care counseling or telephone/in-person counseling on beliefs, knowledge, and behavior related to mammography screening. *Oncology Nursing Forum.* 2000, *27:*1565–1571.

(31) Saywell Jr. RM, Champion VL, Skinner CS, et al.: Cost-effectiveness comparison of five interventions to increase mammography screening. *Preventive Medicine.* 1999, *29:*374–382.

(32) Champion VL: Instrument refinement for breast cancer screening behaviors. *Nursing Research.* 1993, *42:*139–143.

(33) Champion VL: Revised susceptibility, benefits, and barriers scale for mammography screening. *Research in Nursing & Health.* 1999, *22:*341–8.

(34) Rakowski W, Fulton JP, Feldman JP: Women's decision making about mammography: A replication of the relationship between stages of adoption and decisional balance. *Health Psychology.* 1993, *12:*209–214.

(35) Kreuter MW, Farrell D, Olevitch L, Brennan L: *Tailoring Health Messages: Customizing Communication with Computer Technology.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc., 2000.

(36) Ryan GL, Skinner CS, Farrell D, Champion VL: Examining the boundaries of tailoring: The utility of tailoring versus targeting mammography interventions for two distinct populations. Manuscript submitted for publication.

(37) SAS Institute Inc.: *SAS/STAT User's Guide, Version 6.12* (4th Ed., Vol. 2). Cary, NC: SAS Institute Inc., 1990.

(38) Barratt A, Cockburn J, Smith D, Redman S: Reliability and validity of women's recall of mammographic screening. *Australian & New Zealand Journal of Public Health.* 1999, *24:*79–81.