Implementation and process evaluation of three interventions to promote screening mammograms delivered for 4 years in a large primary care population

Roger Luckmann ,¹ Mary Jo White,¹ Mary E. Costanza,² Christine F. Frisard,¹ Caroline Cranos,² Susan Sama,³ Robert Yood⁴

¹Department of Family Medicine and Community Health, University of Massachusetts Medical School, 55 Lave Ave. N, Worcester, MA 01655, USA

²Department of Medicine, University of Massachusetts Medical School, Worcester, MA 01605, USA

³Reliant Medical Group Research Department, 640 Lincoln Street, Worcester, MA 01605, USA

⁴Reliant Medical Group, 425 N Lake Ave, Worcester, MA 01609, USA

Correspondence to: R Luckmann
LuckmanR@ummc.org

Cite this as: *TBM* 2017;7:547–556
doi: 10.1007/s13142-017-0497-x

© Society of Behavioral Medicine 2017

Abstract

The optimal form of outreach to promote repeated, on time screening mammograms in primary care has not been established. The purpose of this study is to assess the implementation process and process outcomes for three interventions for promoting biannual screening mammography in a randomized trial. In a large urban primary care practice over a 4-year period, we randomized women aged 40–85 and eligible for mammograms to three interventions: reminder letter only (LO), reminder letter + reminder call (RC), and reminder letter + counseling call (CC). We tracked information system development, staff training, patient and provider recruitment, reach, dose delivered and received, fidelity, and context measures. Ninety-three of 95 providers approved participation by 80% (23,999) of age-eligible patients, of whom only 207 (0.9%) opted not to receive any intervention. Of 9161 initial reminder letters mailed to women coming due or overdue for mammograms, 0.8% were undeliverable. Of women in the RC and CC arms unresponsive to the first reminder letter ($n = 3982$), 71.4% were called and reached, and of those, 49.1% scheduled a mammogram. Only 33.4% of women reached in the CC arm received full counseling, and women in the CC arm were less likely to schedule a mammogram than those in the RC arm. Implementing mail and telephone mammography reminders is feasible and acceptable in a large urban practice and reaches a majority of patients. Many schedule a mammogram when reached. A reminder letter followed by a simple reminder call if needed may be the optimal approach to promoting screening mammograms.

Keywords

Mammogram, Reminder system, Breast cancer, Screening, Telephone counseling

INTRODUCTION

Annual or biannual screening mammograms have been promoted by national organizations for more than 30 years for the early detection of breast cancer. Screening mammograms have been shown to improve breast cancer survival [1]. A 2012 national survey found that the percentages of women with a mammogram in the last 24 months varied from 64.8% for

Implications

Practice: In populations with high rates of mammography adherence, outreach calls that involve only the offer to schedule a mammogram may be as or more effective in scheduling patients than more complex counseling calls.

Policy: Policies are needed to incentivize the development of low-cost, interoperable information systems to support outreach in primary care.

Research: Research is needed to identify effective approaches for increasing patient response to primary care outreach efforts, such as publicizing and seeking patient buy-in to outreach programs.

40–49 year olds to 79.2% for 60–64 year olds with the 50–59 and ≥ 65 year olds at 76.9% [2]. The *Healthy People 2020* target is 81.1% for women age 50–74 [3]. Most studies assessing the effectiveness of reminder interventions for screening mammograms have reported one-time adherence, but repeated biannual screenings are necessary to significantly reduce breast cancer mortality [4–7]. Because breast cancer screening rates remain suboptimal and because of the need for studies on repeated interventions, we implemented a 4-year randomized trial that compared three methods to encourage women overdue or coming due for screening to get a mammogram.

Research has established that process and quality control measures play an essential role in interpreting the success or failure of interventions and study limitations [8]. We use six measures developed by Stickler and Linnan [9] to assess implementation of the three interventions: (1) context (aspects of the larger social, political, and economic environment that may influence intervention implementation), (2) reach (proportion of the target audience participating in an intervention), (3) dose delivered (number of units of each intervention delivered), (4) dose received (extent to which participants actively engage with interventions), (5) fidelity (extent to which the intervention was

Table 1 | Contents and definitions of doses of the study interventions**Letter only (LO) arm****Delivery protocol**1. *Reminder letter*

- Primary intervention: mailed when no mammogram in the last 18 months
- Booster interventions: mailed when:
 - a. 12 months after the primary intervention and after any booster interventions if no mammogram in past 12 months and none scheduled or
 - b. 18 months after a mammogram is completed following a primary intervention if no mammogram scheduled

Letter contents: “Our records show that it has been 18 months or more since you have had a mammogram...Reliant Medical Group providers recommend that you get a mammogram every 1–2 years. Mammograms are the best way to find breast cancers that are very small and curable. Most women do not have breast cancer. Having a normal mammogram will give you and your family peace of mind” (PCP signature)

Reminder call (RC) arm**Delivery protocol**

1. *Reminder letter:* mailed as LO arm above for primary and booster interventions
2. *Reminder call:* 2 weeks after reminder letter sent if no mammogram scheduled
 - Up to 5 call attempts on different dates and at different times with 2 voicemail messages requesting a call back “about a test that is coming due”

Reminder call contents

- Confirmation that patient is due for a mammogram
- Invitation to call the study office to schedule a mammogram

Counseling call (CC) arm**Delivery protocol**

1. *Reminder letter:* mailed as LO arm above for primary and booster interventions
2. *Second letter and educational booklet:* mailed 2 weeks after primary or booster reminder letter if no mammogram scheduled (in year 2 booklet was replaced by shorter brochure)
3. *Counseling call:* 1 week after second reminder letter sent if no mammogram scheduled
 - Up to 5 call attempts on different dates and at different times with 2 voicemail messages requesting a call back “about a test that is coming due”

Letters, booklet/pamphlet, counseling call contents

- *Reminder letter:* same as in LO Arm above
- *Second mailing:*
 - **Letter text:** “I am concerned that you have not had a mammogram since <date of last mammogram>. Getting regular mammograms is very important. Maybe you have questions or concerns that are holding you back. All women are at risk for getting breast cancer. Some are at greater risk than others. Mammograms are the best way to find cancers when they are very small and curable. I strongly recommend that you do two things: 1) read the enclosed booklet on breast health and mammograms, and 2) schedule a mammogram now by calling. If you do not call to schedule a mammogram, a Reliant Medical Group Breast Health Educator will call you within the next 7–10 days. She will go over the booklet with you and answer any questions that you have. She can make a mammography appointment for you.”
 - **Booklet:** risk of breast cancer, effectiveness of mammograms in identifying small cancers and reducing mortality, the mammogram procedure, recommended screening interval
 - **Brochure:** Similar to booklet
- *Counseling call:*
 - If patient is engaged in tailored education/counseling, she receives education and motivational interviewing tailored to stage of readiness for a mammogram, followed by an invitation to schedule a mammogram.
 - If patient does not engage in tailored education/counseling, she receives only an offer to schedule a mammogram.

delivered as planned), and (6) recruitment (procedures used to attract participants). In the context assessment, we included the development and implementation of information systems that supported the interventions.

MATERIALS AND METHODS**Study description***Eligibility criteria*

The study was implemented from 2010 to 2014 and included women age 50–84 in year 1 and in years 2–4 women age 40–84 who: (1) were patients of primary care providers (PCP) at Fallon Clinic (later renamed

the Reliant Medical Group (RMG)) in central Massachusetts, (2) were members of Fallon Community Health Plan (later renamed Fallon Health (FH)) for 24 months or longer, and (3) had not had a bilateral mastectomy. Women remained active in the study for up to 4 years as long as they continued to meet eligibility criteria. Costanza et al. have described the study design and methods in detail [10].

Interventions

Women were randomized to one of three interventions when they became eligible for the study (See Table 1 for details):

1. Letter only (LO)—A reminder letter was sent to women without a mammogram in the last 18 months at baseline. If no mammogram was completed, a woman received a “booster” reminder every 12 months until she obtained a mammogram. Women who got a mammogram received a repeat reminder if 18 months passed since her last mammogram.
2. Letter + Reminder Call (RC): Women received a letter as in the LO condition, and then if no mammogram was scheduled within 2 weeks, a reminder call with facilitated scheduling.
3. Letters + Counseling Call (CC): Women received a letter as in the LO condition, and then if no mammogram was scheduled within 2 weeks, a second letter with educational materials and then if needed, a call in 1 week including facilitated scheduling and an effort to engage them in tailored education/counseling to encourage them to get a mammogram.

Theoretical frameworks

The precaution adoption process model (PAPM) [11] was the theoretical framework for the CC intervention. PAPM is a stage-based model that classifies people according to their adoption of a new health protective behavior and has been widely used to tailor counseling to subjects' stages of readiness to adopt the health behavior [12–15]. Depending on PAPM stage

(unaware to planning), counselors could provide scripted tailored education aimed at encouraging on-time regular mammograms and/or motivational interviewing (MI) [16] to help women identify and enhance their motivations to have a mammogram, to highlight the discrepancy between a woman's health values and nonadherence to mammography screening, and to help women explore and resolve their ambivalence about mammography [13]. Barrier counseling was offered to women reporting logistical challenges to getting a mammogram.

Process evaluation measures

Context

Over the course of the study, RMG and FH implemented changes in systems in response to new state [17] and federal [18] policies and programs. To understand and monitor relevant new policies, protocols, and interventions, we had annual meetings with RMG and FH leaders. The project was supported by a complex information system (IS), the mammography reminder and counseling system (MRCS) (see Fig. 1). The development and ongoing technical support of the MRCS was tracked through notes on regular meetings and on communications with the software developer, RMG IS administrators, and consultants.

Reach

The denominator of the reached proportion is the number of age-eligible women with an RMG PCP

Fig 1 | Mammography reminder and counseling system (MRCS) cylinders represent databases. Arrows show direction of data flow

who were enrolled in FH for ≥ 24 months at any time during the 4 years of the study. The numerator is the number of these women not excluded by their PCP or opting out of the study at the time they were invited to participate.

Dose, dose delivered, and dose received

The content of doses of the interventions, the delivery protocols, and the definitions of dose delivered and received are shown in Table 1. In this report, we include process measures only for the initial outreach, not for the “boosters.” The average duration of completed calls was based on seven daily samples of RC and CC calls obtained 2–3 times yearly from 2011 to 2013.

Fidelity

The 25-h RC arm training included review of the study goals, basic information on breast cancer and mammography, and training in using the MRCS, the computer-assisted telephone interview (CATT) system, and the RMG mammography scheduling system. Telephone counselors received 40 h of training that included the basic training received by the schedulers as well as education on breast cancer risk factors and treatment, barriers to getting mammograms, and guidelines for mammography screening. Training in MI included discussion and role playing in techniques for conversing with women nonjudgmentally to encourage them to discuss their ambivalence about and reasons for not getting a mammogram.

Ongoing training for all interventionists included recording calls 1 week per month, followed by a meeting with a principal investigator (PI), study managers, and an interventionist trainer to listen to the calls and complete checklists of the required components of call protocols. Interventionists straying from the protocol received refresher sessions. Counselors met periodically with the study psychologist to practice MI skills and discuss challenging calls.

PCP recruitment

The PIs met with RMG PCPs to review the study, which was also described in a newsletter that came from the RMG Medical Director and in emails from the RMG PI, who encouraged PCPs to allow their patients to participate.

Patient recruitment

Potentially eligible women received a letter introducing the study and directing them to call the study office if they did not want to participate. Women who did not opt out became eligible for an intervention. Women were asked to provide verbal consent for the recording of calls and for collection of data for study purposes.

They could also choose to opt out at any time they received a call.

Process outcome measures

The process outcome measures were the proportion of women eligible for outreach who were reached by phone and of those reached the proportion that scheduled a mammogram. In the CC arm additional outcomes included willingness to engage in tailored education/counseling and of those counseled the proportion that changed stage of readiness to receive a mammogram. In year 3, counselors recorded reasons women in the CC arm were not engaged in tailored education/counseling. They did this on a consecutive sample of women who ended the call before completing the protocol and who declined to schedule a mammogram. Commonly reported reasons were grouped into themes.

IRB approval

The RMG/FH Institutional Review Board (IRB) approved the study.

RESULTS

Context

Healthcare policy context

A number of economic, policy, and legislative changes at the state and national levels had the potential to affect the study. Healthcare systems and providers were coming under increasing pressure from payers to contain costs and improve performance on quality measures. The public debate occurring before and during the study over the balance between benefits and harms of breast cancer screening had the potential to affect PCPs and women's interest in mammograms.

Healthcare system context

During the study, patients making visits to RMG PCPs were given “report cards” on their adherence to recommended preventive measures. PCPs also received an electronic reminder of patients' mammogram status at visits. The RMG Radiology Department started a program to decrease the no-show rate for mammograms. They sent confirmation letters to women age 50–74 who had scheduled a mammogram, reminder letters 2 weeks before scheduled mammograms and provided automated phone calls 2 days before. This initiative decreased no-show rates to less than 8%. The Department also asked women to make annual return appointments at mammogram visits. These initiatives likely affected the intervention arms equally. FH agreed to suspend routine mammogram reminder letters to all women eligible for the study while the interventions were taking place but continued to

publicize mammograms through newsletters and mailings at open enrollment.

Information technology context

Figure 1 shows the components of the MRCS: (1) the RMG database, which held data extracted daily from the RMG electronic medical record (EPIC); (2) a staging database that daily received data on new and enrolled subjects for uploading to the tracking database; (3) a tracking database that interacted with multiple applications and data feeds and in turn fed data to the analytic system, which also received input of FH claims data; and (4) a CATI application that provided support to the callers.

Development, implementation, and cost of software applications—The development of the MRCS was supervised by a senior database developer on staff, assisted by a contract consultant. The study timeline called for completion of IS development over 6 months, but because of design and programming challenges and limited resources, it took 18 months. Although the system ultimately provided the expected support, numerous issues related to data field definition, bugs in applications, and changes in the RMG data processes continued to appear throughout the study and required the ongoing support of technologists all 4 years. System development and implementation cost \$144,070. Ongoing support cost \$51,840. These costs do not include time spent by RMG IS employees or the cost of hardware.

IRB context

The IRB approved a passive consent process for patients. Patients eligible for the study received a letter describing the interventions and instructing them to contact the study office if they did not want to participate. Patients in the CC arm were required to provide verbal consent to data collection during counseling. This requirement interrupted the counseling flow and had the potential to reduce the effectiveness of the CC intervention.

Reach

Figure 2 shows the number of women, by study arm, ever eligible based on age, health plan, and provider criteria, and the number who were excluded by their PCPs or opted out through the passive consent process or later. The mean age of those excluded by PCPs was 65.8 years (range 40 to 85 years). Upon entry into the study during years 1–4, 20,994 (69.6%) women had received a mammogram in the last 24 months. Of all women enrolled in the study over 4 years, 4.7% were nonwhite, 73.3% white, and 21.9% did not have race/ethnicity on record. Five percent were covered by a FH Medicaid plan. Figure 2 also shows the number of women who were mailed a first reminder letter and each of three possible “booster” reminders over the 4 years of the study. The term “wave” in Fig. 2 refers to the first reminder (wave 1) and subsequent repeat

reminders (waves 2–4) delivered as described in the “Study description” section. Over 4 years of the study, women could become eligible and active in the study and later ineligible and inactive (i.e., removed from the population eligible for intervention). The number of women active in the study and potentially eligible for an intervention ranged from a low of 10,623 in year 4 to a high of 19,065 in year 2.

Dose delivered and received

First reminder letter dose delivered and received

Of 9161 first reminder letters mailed, only 69 were returned because of wrong addresses (dose delivered rate 99.2%). Outcomes of incoming calls to the study office from women receiving a first reminder letter are shown in Table 2. Most women called in to schedule a mammogram. The likely cause for the difference in the number of women calling in across study arms is that those receiving an outgoing intervention call in the RC and CC arms would no longer have a reason to call in.

Reminder call (RC) and counseling call (CC) doses delivered and received

Figure 3 shows the outcomes of outgoing calls to women in the RC and CC arms by age. In the RC arm, 72.5% of women who were called were reached and received a dose of the RC intervention compared to 70.3% in the CC arm with 23.5% receiving a full CC dose (i.e., completed the full tailored education/counseling protocol) and 46.8% a partial dose (i.e., invitation to schedule a mammogram only). Only about 6% of women in the call arms had an incorrect phone number. Younger women were more likely to be unreachable compared to older women. About 59% of women reached in the RC arm scheduled a mammogram compared to about 38% of women in the CC arm. The average time for a completed RC call was 4 min and 53 s and for a CC call 6 min and 10 s. In the RC arm, the cost per completed call was \$7.80 and per scheduled mammogram \$9.81 compared to \$11.15 and \$47.36 in the CC arm.

Detailed outcomes in call arm

Scheduling in call arms

Of all women in the RC arm sent a first reminder letter, 162 (5.3%) called in to the study office to schedule a mammogram and an additional 812 (26.5%) did not get a reminder call because they had already scheduled a mammogram by calling radiology scheduling directly or had become ineligible after the letter was sent and before a follow-up reminder call was due. In the CC arm, 228 (7.3%) women called into the study office to schedule a mammogram, and 997 (32.0%) did not receive a counseling call for the same reasons some women in the RC arm did not get a call. About 34% of women in the RC arm scheduled a mammogram on a call or

Fig 2 | Women randomized, excluded, opted out, and sent reminders over 4 years by study arm. Wave 1 refers to the first reminder sent to any subject. Subsequent “waves” are repeat reminders for nonadherent women every 12 months until a mammogram is received and to women adherent women who are coming due for a second mammogram (i.e., 18 months since last mammogram)

by calling the study office compared to about 24% in the CC arm ($p < .0001$). We tracked mammogram scheduling only for women who called into the study office or received an RC or CC call, not for those who called radiology scheduling directly. So we cannot estimate the total number of mammograms scheduled from the time of mailing of the reminder letter and completion of all call efforts.

Detailed outcomes in CC arm

Figure 4 shows the outcome of the CC calls in more detail. Only 33.4% of women reached received a full dose of the CC-tailored education/counseling protocol, although the percentage was higher among older women. Of those completing the protocol, about 54% scheduled a mammogram as did about 19% of women reached who were not engaged in the protocol. For

Table 2 | Outcomes of incoming calls in response to first reminder letter

Outcomes	Study arm		
	Letter only n (%)	Reminder call n (%)	Counseling call n (%)
Scheduled mammogram only	254 (90.4%)	162 (93.0%)	228 (88.0%)
Opted out of the program, declined reminders	2 (0.7%)	0 (0.0%)	6 (2.3%)
Reported already scheduled after reminder letter	14 (5.0%)	1 (0.6%)	3 (1.2%)
Ineligible—bilateral mastectomy, dementia, deceased	6 (2.1%)	2 (1.2%)	7 (2.7%)
Other (corrected date last mammogram, declined mammogram)	5 (1.8%)	9 (5.2%)	15 (5.8%)
Total	281 (100%)	174 (100%)	259 (100%)

117 women who declined scheduling and did not engage in the counseling protocol, the most commonly cited reasons for ending the call early were lack of time, lack of interest in talking about or getting mammograms, being too old to get a mammogram, and family or personal illness. Table 3 shows the end stage following completion of the protocol in the CC arm by beginning stage. Those who reported decided no, never at the beginning stage were least likely to advance to planning or scheduling.

Fidelity

Over 4 years, three different schedulers and five different counselors were involved in the study, with one scheduler and two counselors working at any one time. Checklists for 54 scheduler and 50 telephone counselor calls were completed and reviewed by the interventionist, a project PI, and study managers. In most

cases, there was general agreement on the checklist items. When there was disagreement, the group discussed the item and came to an agreement. Deviations from the scripted protocols were rare and included minor omissions such as failing to properly code the PAPM stage of readiness before or after counseling.

Recruitment

Primary care providers

Over the 4-year study period, only two of 95 providers refused to participate. In these cases, the RMG PI took responsibility for the patients' participation in the study. Only 37 of the 93 PCPs (39%) reviewed and returned their patient eligibility lists. Patients on lists not returned within 1 month were considered passively approved.

Reminder Call Arm (N=2095)

Counseling Call Arm (N=1887)

Fig 3 | First telephone call outcomes by intervention call arm and by age

Fig 4 | Call outcomes for counseling call arm for those who accepted the call ($N = 1326$)

Patients

Only 0.7% of women opted out of the study after receiving the introductory invitation letter. There was no formal assessment of patient satisfaction with calls. The interventionists reported little negative feedback from women.

DISCUSSION AND CONCLUSIONS

Context

We documented some relevant changes in national, state, and local health care delivery environments during the study that could have had an impact on mammography utilization in all arms. Development and maintenance of the MRCS required more resources and time than anticipated. The evolution of the

functionality of EHRs and other applications to support population health and reminder functions may lower the cost of implementing reminder systems.

Reach and recruitment

The reach into the eligible population was excellent with only 0.9% of women opting out of the study and all but two PCPs participating. PCPs excluded only 20.4% of patients from the interventions. A key factor in achieving excellent reach was the use of passive consent for PCPs and patients, which allowed us to include an unbiased sample of patients. On the other hand, requiring active consent likely would target a population more responsive to interventions, thus improving efficiency, but potentially missing opportunities to engage some women open to screening. Future

Table 3 | Beginning and end stages for counseling calls ($N = 427$)

Beginning stage	End stage				Total <i>n</i> (col %)
	Decided Nor for Now <i>n</i> (row %)	Decided Nor Never <i>n</i> (row %)	Planning <i>n</i> (row %)	Scheduled <i>n</i> (row %)	
Unaware/ unengaged	1 (20.0%)	0 (0%)	1 (20%)	3 (60.0%)	5 (1.2%)
Undecided	18 (48.6%)	1 (2.7%)	5 (13.5%)	13 (35.1%)	37 (8.7%)
Decided no for now	51 (81.0%)	2 (3.2%)	2 (3.2%)	8 (12.7%)	63 (14.8%)
Decided no never	5 (10.6%)	42 (89.4%)	0 (0%)	0 (0%)	47 (11.0%)
Planning	0 (0%)	0 (0%)	66 (25.8%)	190 (74.2%)	256 (60.0%)
Scheduled	0 (0%)	0 (0%)	1 (5.3%)	18 (94.7%)	19 (4.4%)
Total	75 (17.6%)	45 (10.5%)	75 (17.6%)	232 (54.3%)	427 (100%)

Data missing on beginning and/or end stage for 16 subjects

studies should address this issue. We did not systematically identify reasons that PCPs did not respond to our requests to exclude patients for whom screening for breast cancer was inappropriate such as women with limited life expectancy. Possible reasons include the time required to review patient lists and records, uncertainty about exclusion criteria, and concern about missed diagnoses of breast cancer among excluded women. Ideally, especially for women age 40–49 and 75 and older, PCPs would routinely engage patients in shared decision-making about screening mammograms and document their decisions. A possible consequence of including women inappropriate for screening in the intervention is encouraging women to receive mammograms that could possibly cause more harm than benefit.

Dose delivered/received and impact of letters

The mailing to women in all arms had excellent reach (99.4% of letters delivered). In the two call arms, about 70% of eligible women were reached, and wrong numbers were uncommon (<6%). The reach rate varied by age, from about 56% for 40–49 year olds in the RC arm to nearly 90% for women age 75–84 in the CC arm. This difference across age groups may be partially explained by age-related differences in time spent at home, greater interest in mammograms among women age 50–74 because of strong recommendations by authorities and PCPs, and age-related differences in call monitoring, which allows women to selectively avoid taking calls. A key to increasing responsiveness of women 40–49 may be increasing their awareness that they should be seriously considering screening mammograms by weighing pros and cons even though the balance of benefits and harms may not be as favorable as in older women. Overall, the letter and call dose delivery rates we found were comparable to rates reported by others [19, 20]. This suggests that a call sanctioned by one's health care provider remains a viable channel for the delivery of health care interventions. However, designers of telephone outreach programs should expect variation in dose delivery by age.

Scheduling outcomes

In response to the letter, 5.3% of women in the RC arm called the study office to schedule mammogram i and 7.3% in the CC arm. Because other women called radiology scheduling directly for a mammogram and we did not track these women, the estimates of the letter effect on scheduling may be lower than rates that included scheduling by women who did not call our staff. Other studies of mailed reminders for mammography have reported similar modest outcomes [21, 22]. More women in the CC arm scheduled before the first call likely because of the second letter and/or the longer interval between the first letter and the call. However, because women in the CC arm were much less likely to schedule on a call than women in the RC arm, the overall measured scheduling based on the number of women sent a first reminder letter was

substantially lower in the CC arm (24 vs. 34% in the RC arm). Most of the difference is due to lower CC arm scheduling on a call (38 vs. 59% in the RC arm).

The analysis of CC arm call responses suggests that the main cause of the lower rate of scheduling was that the initial conversation with the counselors was less effective in promoting scheduling than the simple, immediate offer to schedule a mammogram provided in the RC arm. CC arm counselors opened the call with a query about the booklet or brochure mailed to women followed by a discussion of the information in the print material if women had read it. This was followed by a general invitation to engage in a discussion about “breast health.” At that point, many women reported lack of time, limited interest in talking about mammograms, and having no intention to get a mammogram as reasons for cutting short the call before they received the tailored education/counseling intervention. These women did receive an offer to schedule a mammogram and some scheduled, but most did not. Based on the higher rate of scheduling in the RC arm, we believe that others in the CC arm might have scheduled, but were more invested in ending the call than in responding to an invitation to schedule a mammogram. Perhaps they felt the call was an unwanted intrusion and/or became impatient with counselors' efforts to open a discussion about mammograms. We cannot exclude an effect related to other differences between the RC schedulers and the CC counselors, but given the fidelity of callers to the protocols, we think this is unlikely. We conclude that for women potentially open to mammogram screening receiving a telephone intervention involving a caller not known to them, efforts to engage them in a discussion about mammograms may be counterproductive, compared to a simple offer to facilitate scheduling of a mammogram.

Fidelity

Monitoring of the fidelity and quality of the interventionists' work revealed some minor deviations from protocols and scripts that we were able to address with additional training of staff. The fact that we did identify and correct some protocol deviations is evidence that monitoring to assure fidelity is critical when an intervention is delivered over a long period with periodic changes in intervention personnel because of staff attrition.

Limitations

The small number of women of color and women receiving Medicaid (a marker for limited income) is a significant limitation. All women in the study had a PCP and the majority was up-to-date with mammography at baseline. Thus, our findings may not be generalizable to underinsured women and to those of lower socioeconomic status. The limited response of PCPs to the request to identify women inappropriate for mammograms meant that attempts were made to contact some women with good reasons to avoid calls and to decline scheduling.

Conclusions

We demonstrated the feasibility and acceptability to patients and providers of a combined mail and phone outreach to promote screening mammograms that successfully reached a large majority of patients. Most women who are willing to accept a reminder call are also willing to schedule a mammogram. Our finding of a reduced rate of scheduling in the CC arm suggests that attempting to engage patients in tailored education/counseling may have a negative impact on their willingness to schedule a mammogram.

Acknowledgements: We thank Devi Sundaresan for her data management support and Kathleen Allain, Ariel Berk, Meaghan Fair, Belinda James, Brenda Kniskern, and Kathleen Matthews for their assistance in implementing the intervention programs. We thank the RMG Information Services leadership and staff for their dedication to meeting our challenging IT needs and the RMG and FCHP administration for providing access to their systems and patients.

Compliance with ethical standards• The findings reported have not been previously published and this manuscript is not being simultaneously submitted elsewhere.

- The authors have full control of all primary data and agree to allow the journal to review their data if requested.
- There are no actual or potential conflicts of interest with the organization that sponsored the research.
- This work was supported by Grant R01CA132935 from the National Cancer Institute.
- All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.
- Informed consent was obtained from all individual participants included in the study. The informed consent process was involved passive consent as stated in the manuscript.
- The study was approved by the Reliant Medical Group/Fallon Health Institutional Review Board (IRB).

1. <http://www.cancer.org/treatment/understandingyourdiagnosis/examsandtestdescriptions/mammogramsandotherbreastimagingprocedures/mammograms-and-other-breast-imaging-procedures-types-of-mammograms> Accessed 30 July 2015.
2. <https://www.cdc.gov/brfss/brfssprevalence/>. Accessed 19 July 2015.
3. <http://www.healthypeople.gov/2020/topics-objectives/topic/cancer/objectives> Accessed 30 July 2015.
4. Halabi, S., Skinner, C. S., Samsa, G. P., Strigo, T. S., Crawford, Y. S., & Rimer, B. K. (2000). Factors associated with repeat mammography screening. *The Journal of Family Practice*, 49, 1104–1112.
5. Mandelblatt, J. S., Cronin, K. A., Bailey, S., Berry, D. A., et al. (2009). Breast Cancer Working Group of the Cancer Intervention and Surveillance Modeling Network (CISNET). Effects of mammography screening under different screening schedules: model estimates of potential benefits and harms. *Annals of Internal Medicine*, 151, 738–747.

6. Mandelblatt, J. S., Cronin, K. A., Berry, D. A., et al. (2011). Modeling the impact of population screening on breast cancer mortality in the United States. *Breast*, 20(Suppl 3), S75–S81. doi:10.1016/S0960-9776(11)70299-5.
7. van Ravesteyn, N. T., Heijnsdijk, E. A., Draisma, G., & de Koning, H. J. (2011). Prediction of higher mortality reduction for the UK Breast Screening Frequency Trial: a model-based approach on screening intervals. *British Journal of Cancer*, 105, 1082–1088.
8. Graham Moore, G., Audrey, S., Barker, M., Bond, L., et al. (2014). Process evaluation in complex public health intervention studies: the need for guidance. *Journal of Epidemiology and Community Health*, 68, 590.
9. Linnan, L., & Steckler, A. (2002). Process evaluation for public health interventions and research: an overview. In A. Steckler & L. Linnan (Eds.), *Process evaluation for public health interventions and research* (pp. 1–23). San Francisco: Published by Josey-Bass A Wiley Imprint.
10. Costanza, M. E., Luckmann, R., White, M. J., Rosal, M. C., Cranos, C., Reed, G., Clark, R., Sama, S., Yood, R. (2011). Design and methods for a randomized clinical trial comparing three outreach efforts to improve screening mammography adherence. *BMC Health Services Research*, 11, 145.
11. Weinstein, N. D., & Sandman, P. M. (1992). A model of the precaution adoption process: evidence from home radon testing. *Health Psychology*, 11, 170–180.
12. Costanza, M. E., Stoddard, A. M., Luckmann, R., White, M. J. P., Avrunin, J. S., & Clemow, L. (2000). Promoting mammography: a randomized trial of telephone counseling and a medical practice intervention. *American Journal of Preventive Medicine*, 19, 39–46.
13. Luckmann, R., Savageau, J. A., Clemow, L., Stoddard, A. M., & Costanza, M. E. (2003). A randomized trial of telephone counseling to promote screening mammography in two HMOs. *Cancer Detection and Prevention*, 27, 442–450.
14. White, M. J., Stark, J. R., Luckmann, R., Rosal, M. C., Clemow, L., & Costanza, M. E. (2006). Implementing a computer-assisted telephone interview (CATI) system to increase colorectal cancer screening: a process evaluation. *Patient Education and Counseling*, 67, 419–428.
15. Costanza, M. E., Luckmann, R., Stoddard, A. M., White, M. J., Stark, J. R., Avrunin, J. S., Rosal, M. C., & Clemow, L. (2007). Using tailored telephone counseling to accelerate the adoption of colorectal cancer screening. *Ca Detect Prev*, 31(3), 191–198.
16. Rubak, S., Sandbek, A., Lauritzen, T., Christensen, B. (2005). Motivational interviewing: a systematic review and meta-analysis. *The British Journal of General Practice*, 55 305–312.
17. http://masshealthpolicyforum.brandeis.edu/forums/Documents/Issue%20Brief_ConnorCenter.pdf Accessed 30 Jan 2015.
18. <http://www.hhs.gov/healthcare/rights/> Accessed 30 Jan 2015.
19. Rakowski, W., Lipkus, I. M., Clark, M. A., Rimer, B. K., Ehrich, B., Lyna, P. R., & Kornguth, P. J. (2003). Reminder letter, tailored stepped-care, and self-choice comparison for repeat mammography. *American Journal of Preventive Medicine*, 25, 308–314.
20. Hegenscheid, K., Hoffmann, W., Fochler, S., Domin, M., Weiss, S., Hartmann, B., Bick, U., & Hosten, N. (2011). Telephone counseling and attendance in a national mammography-screening program a randomized controlled trial. *American Journal of Preventive Medicine*, 41, 421–427.
21. Gierisch, J. M., DeFrank, J. T., Bowling, J. M., Rimer, B. K., Matuszewski, J. M., Farrell, D., & Skinner, C. S. (2010). Finding the minimal intervention needed for sustained mammography adherence. *American Journal of Preventive Medicine*, 39, 334–344.
22. Page, A., Morrell, S., Chiu, C., Taylor, R., & Tewson, R. (2006). State Co-ordination Unit Recruitment to mammography screening: a randomized trial and meta-analysis of invitation letters and telephone calls. *Australian and New Zealand Journal of Public Health*, 30, 111–118.