ORIGINAL RESEARCH

Improving Breast and Colon Cancer Screening Rates: A Comparison of Letters, Automated Phone Calls, or Both

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Purpose: **Low-cost interventions to improve cancer screening among primary care patients are needed. The comparative effectiveness of personalized letters, automated telephone calls, and both on breast cancer (BC) and colorectal cancer (CRC) screening is not known.**

Methods: **A pragmatic, randomized, controlled trial was conducted in 2011 to 2012. Eligible primary care patients were women ages 50 to 74 years who were past due for mammography and men or women who were past due for mammography or CRC screening of any kind (>12 months since last fecal occult blood test, >5 years since last sigmoidoscopy/double-contrast barium enema, or >10 years since last colonoscopy), respectively. Participants were randomized to 1 of 3 interventions: personalized mailed letters, automated telephone calls, or both. The primary outcome was medical record documentation of a completed mammogram or CRC screening within 36 weeks of randomization. We estimated the costs of each intervention and calculated the marginal cost-effectiveness per person screened.**

Results: **The crude screening rates for BC were 19%, 22%, and 37% and for CRC were 17%, 14%, and 24% for the letter, automated call, and combined (letter/automated call) groups, respectively. The combined intervention group had a statistically higher screening rate ($P < .05$) compared with either of the single intervention groups (letter only or automated call) for both BC and CRC in both the crude and adjusted analyses. The combined intervention costs $5.11 per additional person screened for BC and $13.14 per additional person screened for CRC.**

Conclusion: **In a primary care practice, letters plus automated telephone calls are better than either alone in increasing cancer screening rates among patients who are overdue for screening. These findings suggest the promise of a relatively inexpensive intervention to improve cancer screening. (J Am Board Fam Med 2015;28:46–54.)**

Keywords: **Cancer Screening, Colorectal Cancer, Mammography**

Rates of screening for breast cancer (BC) and colorectal cancer (CRC) remain suboptimal, particularly among poor and minority patients.[1–3] BC screening, based on self-report of a mammogram within 2 years, was 72% in 2010, whereas self-reported rates of CRC screening were only 64%.[1,2] Performance measures for both are now included in Healthcare Effectiveness Data and Information Set quality measures for primary care.[4] Beyond strong recommendations by clinicians to patients,[5] however, which strategy or combination of strategies is most effective for improving rates is not clear.

Most cancer screening promotion studies have been conducted among patients who are recruited into and consented to participate in studies. The generalizability of the findings to real-world patient populations is uncertain, however, because the recruitment process introduces a significant consent

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bias[6,7] by excluding patients who are harder to reach because of an incorrect address or phone number, infrequent office visits, or attitudinal factors. These may be many of the same patients who are at risk for omission of screening. To address this concern, several recent studies obtaining waivers for informed consent (pragmatic randomized trials) have reported the effects of interventions to promote cancer screening.[8–14] Together, these findings suggest that personal letters from physicians,[8,15] mailed fecal occult blood testing (FOBT) kits,[10,11,16] and phone counseling (often following a letter),[9,12,13,15] improve BC and CRC screening rates.

High-cost, personnel-intense interventions (eg, live phone calls to patients) may not be affordable in many primary practices. Lower-cost interventions such as automated phone calls and letters may be more feasible. We identified only 2 randomized trials of standard automated phone calls.[14,17] One showed improvement in CRC screening rates[14] and the other showed improvement in BC screening rates.[17] Interestingly, a study using voice recognition to tailor the recommended CRC screening modality showed no effect.[18] A systematic review confirmed the benefit of mailed reminders for BC and CRC screening.[19] Our own research suggests that multimodal interventions are effective,[20,21] but which component(s) of the interventions really prompted increases in screening rates is unclear from prior studies.

The goal of this study was to understand the differential effects of low-cost automated telephone and mailed interventions on cancer screening rates in a primary care practice. A pragmatic randomized trial design was used to mimic real-world clinical circumstances. We specifically compared the effectiveness and costs of mailed personalized letters, personalized automated telephone calls, or both on rates of cancer screening among primary care patients "past due" for mammography or CRC screening. We hypothesized that the combined intervention would be more effective than either alone. Samples of letters to participants are available upon request from the corresponding author.

Methods

Practice Setting

We chose a mixed urban–suburban family medicine practice in which to conduct this trial. The hospital-owned, nonacademic practice consisted of 6 physicians (3.4 full-time equivalents) caring for about 5000 patients. At the time of the study (2011 to 2012) the US Preventive Services Task Force had just updated mammogram guidelines to recommend starting screening at age 50 years,[22] so outreach focused on women 50 to 74 years old. Colorectal screening assessment was done for all men and women 50 to 74 years old. Before the intervention, cancer screening promotion consisted of provider referral and recommendation in the context of a visit. Baseline screening rates in the practice were 67% for BC screening and 54% for CRC screening. While these are lower than national self-reported rates,[1,2] self-reports tend to overestimate rates of screening compared with claims data.[23,24]

Participants

We identified potentially eligible patients using a 2-step process. First, the practice queried their electronic practice management system based on age, sex, and last visit to the practice. Next, data were manually reviewed to ascertain the date and type(s) of the last cancer screening(s). Participant eligibility criteria for enrollment in the study included (1) being a registered patient at the study clinic; (2) being an active patient at the practice (having at least 1 visit to the practice in the past 2 years); (3) being 50 to 74 years old; and (5) being past due for mammography or CRC screening based on medical record documentation. We defined "past due for mammography" as >30 months from the last mammogram. We defined "past due for CRC screening" as >10 years from the last colonoscopy (unless recommended earlier by the consultant performing the procedure) or, in the absence of colonoscopy results, >12 months from past guaiac FOBT or fecal immunochemical test (FIT) or >5 years from the last double-contrast barium enema or flexible sigmoidoscopy. Women could be enrolled based on either (or both) BC or CRC screening criteria. All patients meeting the criteria were included in the study; the institutional review board waived informed consent (see the *Informed Consent* section below) to allow results to be more generalizable to practice.

Patients were excluded from the study if they were deemed to be at higher risk for cancer by physician experts on the team or were uninsured. Our previous research showed that interventions caused smaller absolute increases in screening among uninsured pa-

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tients.[20,21] The conditions indicating a higher risk of cancer based on chart data abstraction included prior cancer, premalignant conditions (eg, ulcerative colitis, familial polyposis), inadequately evaluated breast masses, positive FOBT/FIT result at last testing, or a first-degree relative with a previous diagnosis of BC or CRC. Higher-risk patients and those without insurance who were past due were not randomized but were given the most intensive intervention, that is, both a letter and an automated phone call, and were not analyzed.

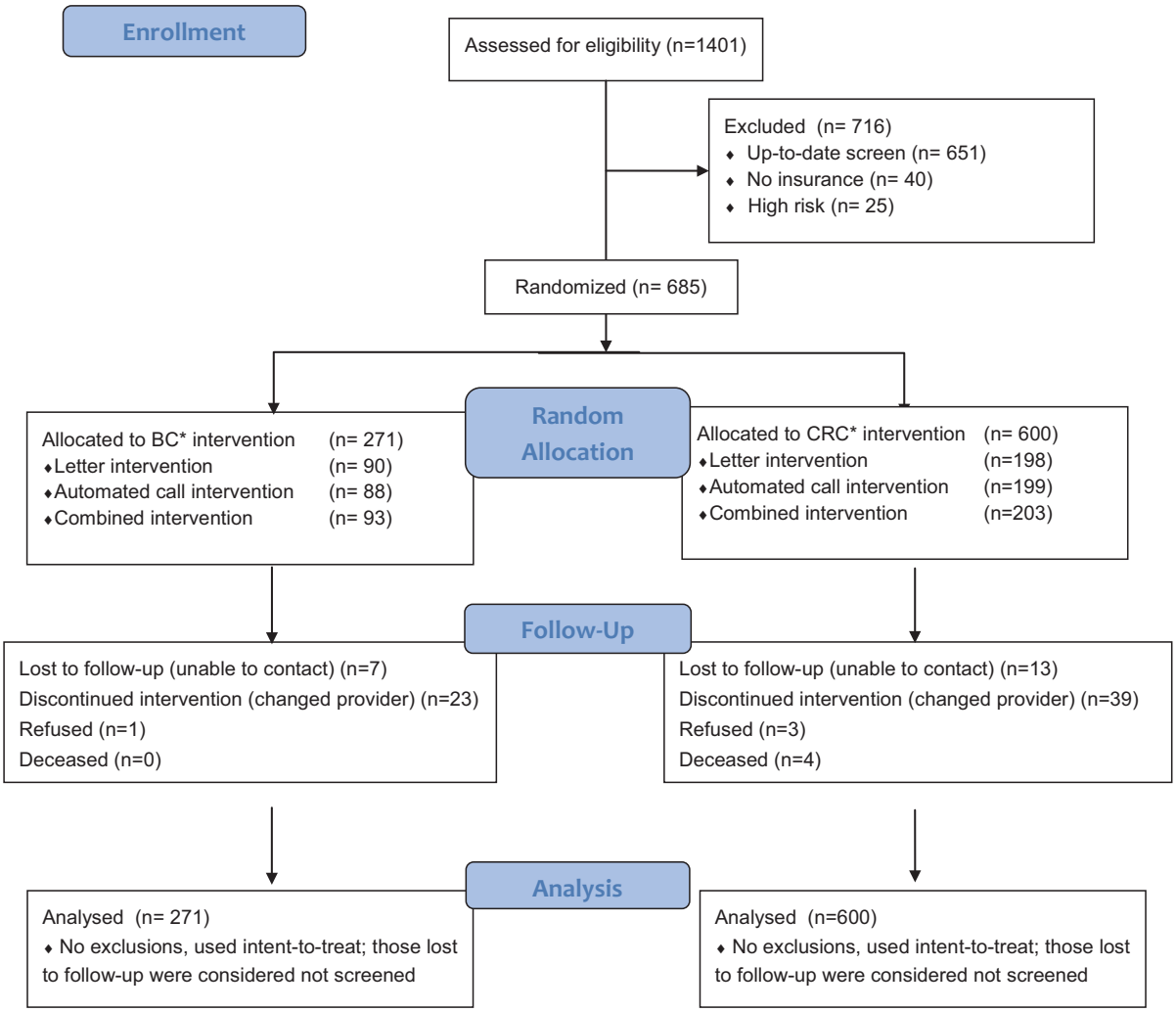
Intervention

Figure 1 describes the participant flow and timeline for the 3 intervention groups. All interventions were delivered solely in English.

Group 1

Participants were sent a personalized letter, signed by the patient's physician, explaining that (1) the patient was past due for cancer screening; (2) the importance of cancer screening; (3) how to schedule the screening; (4) the name and telephone number of the outreach worker available to assist patients with arranging screening; and (5) the availability of free mammography and CRC screening (FIT) for the uninsured/underinsured through a state-sponsored program, which was included to address underinsurance, and for patients who might have become uninsured following randomization. This content was based on our preliminary work and input from the patient community advi-

Figure 1. Study flow diagram.



* 186 subjects received both the BC and CRC interventions.

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sory board. If still unscreened at 10 weeks, participants received a second letter and FIT kit with a stamped and preaddressed envelope.

Group 2

Participants received automated telephone calls in up to 3 waves through a commercial vendor. Automated telephone calls were attempted at varying times (up to 5 times) until a person or an answering machine responded during the first wave (week 1). These calls were repeated during the second wave (week 5). Patients who remained unscreened following a reassessment of screening (week 10) received a third wave (weeks 12 to 14). The automated messages contained content similar to that in the letter, including a number to call if they wanted a FIT kit to be mailed.

Group 3

Participants received both of the interventions described above. Women eligible for both interventions received 1 letter indicating they were past due for both screenings and/or 2 separate automated calls indicating they were past due for mammography and CRC screening (to avoid longer, complex automated calls).

Informed Consent

The protocol was approved the University of Rochester Institutional Review Board, which waived informed consent by patients. This waiver, similar to those obtained in previous trials of pragmatic cancer screening reminders, is based on the use of standard quality improvement interventions that involve minimal risk to participants and the inability to conduct a pragmatic trial of these interventions in the absence of such a waiver. The study is registered at www.clinicaltrials.gov (identifier NCT00818857).

Measures

Covariates

Trained research assistants abstracted the following data from the electronic health record: patient's age, sex, race/ethnicity, payment/insurance type, number of current medications (as a proxy for comorbidity), and ZIP code of residence, which was converted to median household income based on data from the 2000 US Census.

Primary Outcome

The primary outcome was medical record documentation (based on manual abstraction of electronic health records) of completed mammography or CRC screening 36 weeks after randomization (approximately 3 months after the end of interventions). Research assistants, who were blinded to the intervention, abstracted data (screening date and results available by week 36). Patients were considered "screened" for BC based on the presence of a mammography report or for CRC based on the presence of a FOBT, FIT, colonoscopy, flexible sigmoidoscopy, or double-contrast barium enema report.

Costs

We considered all costs involved in implementing each of these interventions, including both the costs of the materials (Article, printing, postage, vendor cost for automated telephone calls) and personnel time involved in preparing lists, letters, and mailing kits. We did not include the study costs of data abstraction.

Randomization and Blinding

After confirming eligibility through medical record abstraction, each participant was assigned a unique study identification number. A statistician, who was offsite and blinded to the patients' identities, assigned participants equally to 1 of the 3 intervention groups using a computer-generated random number algorithm. Randomization was stratified by the type of screening(s) for which the participants were past due (BC, CRC, or both). Patients who were eligible for mammography and CRC interventions were randomized once and received interventions targeting both mammography and CRC screening. The office clinicians and study staff were blinded to group assignment.

Statistical Analysis

We compared baseline characteristics of patients in each the 3 intervention groups using the χ^2 test for binary variables and t tests for continuous variables. We defined statistical significance as $P < .05$. All participants were analyzed in the originally assigned study group based on intention to treat. We compared postintervention screening rates between the 3 randomized groups using the Pearson χ^2 test. We calculated both unadjusted (crude) and adjusted rates. In the adjusted analyses we adjusted for

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small differences in age, sex, race/ethnicity, insurance status, and household income between groups. All statistical analyses were performed using SAS software version 9.3 (SAS Institute Inc., Cary, NC).

Results

Baseline Characteristics

The characteristics of the mammography screening participants are shown in Table 1, and characteristics of the CRC screening participants are shown in Table 2. All BC screening and 62% of CRC screening subjects were women. The mean age of all subjects was 58 years. Most participants were non-Hispanic white (78%); fewer were black (13%) or other (9%). Most patients had private insurance (63%), followed by Medicare (25%) and Medicaid (12%). Approximately 20% resided in ZIP codes with a median annual household income <$30,000. By definition, rates for both mammography and CRC screening were 0% before the intervention in each randomization group.

Primary Outcome Measures

Results are shown in Table 3. The crude screening rates for BC were 19%, 22%, and 37% and for CRC were 17%, 14%, and 24% for the letter, automated call, and combined (letter and automated call) groups, respectively. The adjusted screening rates for BC were 20%, 24%, and 39% and for CRC were 20%, 16%, and 28% for the letter, automated call, and combined (letter and automated call) groups, respectively. Overall, 7% of FIT kits mailed were completed and processed, contributing to one third of all CRC screenings. The combined intervention group had a statistically higher screening rate ($P < .05$) compared with either of the single intervention groups (automated call only or letter only) for both BC and CRC. Results remained significant for multiple comparisons using the Hochberg and false discovery rate methods. There was no statistical difference between the 2 single interventions. We observed no significant differences in effects across patient race and insurance, though our power was limited. Women past due for both screenings showed significantly lower rates ($P < .05$) of screening following any intervention than women past due for only 1 screening, possibly reflecting reluctance to undergo cancer screening.

Cost and Cost-Effectiveness

For group 1, the cost of mammography mailings was $2.36 per patient per mailing. The total cost of mailed CRC letters and FIT kits, including prepa-

Table 1. Baseline Characteristics of Patients Past Due for Mammography Screening By Intervention Group

Characteristics	Intervention: Group 1 (Letter) (n = 90)	Group 2 (Automated Phone Call) (n = 88)	Group 3 (Letter and Automated Phone Call) (n = 93)	*P* Value
Age (years)				.5095
50–59	57.8 (52)	59.1 (52)	65.6 (61)	
≥60	42.2 (38)	40.9 (36)	34.4 (32)	
Race/ethnicity				.9718
Non-Hispanic white	77.9 (67)	79.8 (67)	76.3 (71)	
Non-Hispanic black	11.6 (10)	9.5 (8)	12.9 (12)	
Other (eg, Hispanic)	10.5 (9)	10.7 (9)	10.8 (10)	
Household income				.8252
≥$40,000	48.9 (44)	52.3 (46)	52.7 (49)	
$30,000-$39,999	26.7 (24)	28.4 (25)	22.6 (21)	
<$30,000	24.4 (22)	19.3 (17)	24.7 (23)	
Insurance*				.0034
Private	48.9 (44)	51.1 (45)	69.9 (65)	
Medicare	38.9 (35)	26.1 (23)	19.4 (18)	
Medicaid	12.2 (11)	22.7 (20)	10.7 (10)	
Preintervention screening rates*	0 (0)	0 (0)	0 (0)	NA

Data are % (n). Small discrepancies between the total number of patients in a group and the summed numbers in the columns reflect data missing for that variable.

*By design, patients without insurance or who were up to date on breast cancer and colorectal cancer screening were excluded from the study.

NA, not applicable.

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Table 2. Baseline Characteristics of Patients Past Due for Colorectal Cancer Screening By Intervention Group

Characteristics	Intervention			*P* Value
	Group 1 (Letter) (n = 198)	Group 2 (Automated Phone Call) (n = 199)	Group 3 (Letter and Automated Phone Call) (n = 203)	
Sex				.7824
Female	62.63 (124)	63.3 (126)	60.1 (122)	
Male	37.4 (74)	36.7 (73)	39.9 (81)	
Age (years)				.2677
50–59	64.1 (127)	68.3 (136)	60.6 (123)	
≥60	35.9 (71)	31.7 (63)	39.4 (80)	
Race/ethnicity				.7464
Non-Hispanic black	14.6 (28)	13.0 (25)	12.4 (25)	
Other (eg, Hispanic)	7.3 (14)	10.4 (20)	7.5 (15)	
Non-Hispanic white	78.1 (150)	76.6 (147)	80.1 (161)	
Household income				.3797
≥$40,000	53.5 (106)	58.1 (115)	55.0 (111)	
$30,000-$39,000	28.8 (57)	21.7 (43)	22.3 (45)	
<$30,000	17.7 (35)	20.2 (40)	22.8 (46)	
Insurance				.4658
Private	61.1 (121)	62.8 (125)	68.5 (139)	
Medicaid	12.1 (24)	14.1 (28)	9.8 (20)	
Medicare	26.8 (53)	23.1 (46)	21.7 (44)	
Preintervention screening rates	0 (0)	0 (0)	0 (0)	NA

Data are % (n). Small discrepancies between the total number of patients in a group and the summed numbers in the columns reflect data missing for that variable.
*By design, patients without insurance or who were up to date on breast cancer and colorectal cancer screening were excluded from the study.
NA, not applicable.

ration time and postage, was $7.17 per patient/mailing.

For group 2, the cost of automated calls was $0.09 per completed call (either a pick-up or an answering machine response). Most patients received 3 waves of calls, and the completion rate (ie, phone picked up or voicemail connected) was 91%. Because each person required multiple automated calls, this intervention cost approximately $0.25 per patient, plus $0.67 per patient for preparing patient lists, for a total of $0.92 per patient.

For group 3, the combined group, the cost was the sum of mailing costs and automated phone calls ($2.36 + $0.92 = $3.28/patient for BC screening; $7.17 + $0.92 = $8.09/patient for CRC screening).

The cost of automated calls was much less than that of either of the mailings, yet the improvement in screening was similar, suggesting that automated calls were more cost-effective. The cost-effectiveness of the combined intervention compared with the letter only group (ie, the marginal costs divided by the marginal improvement in screening per additional person screened) was $5.11 ($0.92/0.37–0.19) per additional person screened for BC or $13.14 (0.25/0.24–0.17) for additional CRC screening.

Discussion

Our findings from this pragmatic randomized trial are notable in 2 respects. Among insured family medicine patients who were past due for mammography or CRC screening, we observed no differences in screening rates between those who received mailed letters and automated telephone reminders, although each led to absolute increases in screening rates from 13.6% to 21.6% among patients who previously were not up to date. Second, the combination of letters and automated telephone reminders yielded improved rates compared with either alone. This suggests that combined outreach to patients past due for cancer screening is superior to either alone.

Few studies have compared letters with automated telephone reminders. Lieu et al[25] reported no difference in childhood immunizations between

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Table 3. Unadjusted and Adjusted Postintervention Breast and Colorectal Cancer Screening Rates*

	Unadjusted		Adjusted†	
	Screened (%)	*P* Value‡	Screened (Adjusted %)	*P* Value‡
Breast cancer screen				
Letter	18.9	.0062	20.3	.0300
Automated call	21.6	.0209	24.3	.0053
Letter and automated call	36.6		39.1	
Colorectal cancer screen				
Letter	16.7	.0519	20.0	.0297
Automated call	13.6	.0060	16.5	.0022
Letter and automated call	24.1		28.5	

*By definition, preintervention screening rates for each randomization group were 0% for both mammography and colorectal cancer screening.
†Screening rate adjusted for age, race/ethnicity, income, and insurance.
‡*P* values are for the single vs combined intervention.

these strategies. One study of women soon due for mammography reported higher rates following an automated reminder telephone call compared with a mailed reminder letter.[26] Given the substantial difference in cost, our findings support the use of automated telephone reminders as an alternative to mailed letters if only a single intervention is planned. Practices that are currently mailing reminders to patients past due for screening might consider switching modalities and assess whether they improve screening rates.

The finding that combined modalities yielded improved results is also consistent with some previous studies.[25,27–29] The addition of automated phone calls to letters nearly doubled rates of mammography screening and increased rates of CRC screening by 8%. Yet in a previous study we found that the use of automated phone calls was of no additional benefit beyond that of a personalized letter alone in improving cancer screening rates (12.2% vs 15.3%; $P > 0.05$)[21] The difference in findings may have resulted from higher poverty rates in the previous study and correspondingly lower automated phone reminder completion rates (82% vs 91%). These differences also could reflect possible differences in patients' responses to automated calls within the 2 practices. Some patients may be more likely to connect the phone call to the letter they received and follow up accordingly, whereas others may ignore telephone messages even if they are received.

Practices that are currently mailing reminders but wish to improve their performance might consider adding automated phone calls. Our finding of a marginal cost for the combined intervention ($1.57 and $3.57 per additional patient screened for BC and CRC, respectively) compare favorably with previous economic assessments of interventions to promote cancer screening.[30–34]

In our combined intervention patients received letters following the automated calls based on the supposition that patients would be "primed" to receive the subsequent letter. We are not aware of empirical data regarding the optimal sequence of reminders for cancer screening. In a study of childhood immunization promotion, however, delivering the automated calls after the letter (rather than before) improved rates.[25]

For mammogram screening, 72.4% of women (50 to 74 years old) in the general population who completed the National Health Interview Survey in 2010 reported screening in the past 2 years. This is well below the Healthy People 2020 goal of 81.1%.[35] In the practice studied here, 67% of insured women had been screened in the past year. Thus, while for most women the usual education and referral efforts have been effective, new methods are needed to reach the third of women currently not getting screened. A combined approach targeted solely at those not up to date yields improved screening rates compared with either mail or calls alone. The additional cost per patient screened seems modest compared with previous mammography and CRC promotion interventions.[30,32,36] Nonetheless, the overall outreach response even within the combined group was lower than we had hoped. We previously found relatively greater improvements in cancer screening from combined outreach and point-of-care prompts, suggesting that both outreach and in-reach may be needed to optimize responses.[20,21] Organized team approaches may also help.[37]

With implementation of the Affordable Care Act, physician revenues are becoming more dependent on achieving certain quality metrics such as cancer screening rates. In the Rochester, New York, area, where the study was conducted, most insurers are tracking mammogram and CRC screening rates. A portion of the supplemental payments to clinicians depends on these quality mea-

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sures. From a practice or individual provider perspective, it is likely that the additional reimbursements expected from meeting these metrics would offset the additional staff time and materials needed for patient outreach.

Limitations of this study include the potential that findings would not be generalizable to other insured groups within primary care practices in the United States. For example, all communication for this study was provided in English. This would not be effective in some practices with substantial non-English-speaking populations, yet providing outreach in other languages also increases the cost of those services. In addition, the cost of identifying insured patients who were overdue for screening was not included in the analysis of cost; however, it is reasonable to assume that electronic tracking of screening by electronic health record systems and payers will increase in the future, making this step automatic for most practices.

Conclusion

This study shows a significant and additive effect of 2 low-cost interventions to increase cancer screening rates in a primary care practice. These findings are of direct relevance to practices seeking to increase screening rates among patients who remain unscreened with usual care.

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