Patient Barriers to Mammography Identified During a Reminder Program

Adrienne C. Feldstein, M.D., M.S.,^{1,2} Nancy Perrin, Ph.D.,² A. Gabriela Rosales, M.S.,²
Jennifer Schneider, M.P.H.,² Mary M. Rix, R.N.,² and Russell E. Glasgow, Ph.D.³

Abstract

Background: Patient mammogram reminders are effective at increasing screening, but patient barriers remain. We evaluated patient characteristics and reported barriers for their association with mammogram completion after a reminder program.

Methods: This retrospective cohort study used data from electronic records and a subgroup survey. Participants were female Kaiser Permanente Northwest health maintenance organization (HMO) members aged 50–69 who were 20 months past their last mammogram (index date) and had received a reminder intervention ($n = 4708$). A mailed survey was completed by 340 of 667 (50.2%) women who received it. The intervention was a “mammogram due soon” postcard 20 months after the last mammogram, followed by up to two automated phone calls and one live call for nonresponders. The outcome was mammogram completion at 10 months after index date.

Results: Characteristics associated with lower mammogram completion rates were aged <60 (odds ratio [OR] 0.69, $p < 0.0001$), health plan membership <5 years (OR 0.81, $p = 0.019$), family income $<\$40,000/\text{year}$ (OR 0.77, $p = 0.018$), and obesity (OR 0.67, $p < 0.0001$). Obese women were more likely than nonobese women to report “too much pain” from mammograms (31.3% vs. 18.8%, $p < 0.01$). Younger women were more likely to endorse that they were “too busy” (19.1% vs. 6.4%, $p < 0.001$) and had more worries about mammogram accuracy (2.5 vs. 2.3 on a 5-point scale, $p < 0.05$). Pain mediated the relationship between obesity and mammogram completion rates (indirect effect = -0.111 , $p = 0.008$).

Conclusions: Important barriers to mammogram completion remain even after an effective mammogram reminder system among insured patients. Tailored interventions are necessary to overcome these barriers.

Introduction

THE SOCIETAL IMPACT OF BREAST CANCER is high. A woman's lifetime risk of developing breast cancer is nearly 1 in 8,¹ making it the most common cancer among women² and accounting for 15% of female cancer deaths.³ Early detection through mammography screening can reduce mortality from breast cancer; the United States Preventive Services Task Force (USPSTF) recommends screening women every 1–2 years beginning at age 50.⁴ Breast cancer death rates have been declining since about 1990, likely due to increased use of screening mammography and improved treatment.¹

Despite the USPSTF recommendations, $>30\%$ of eligible women do not get regular breast screening examinations.⁵ Mammography use as recommended declined during the

period 2000–2005 from 70% to 66%.⁶ In order for mammography to achieve its potential to reduce morbidity and mortality, high rates of community screening are necessary,^{7–9} and patient reminders by mail and telephone reminders using live callers or automated calls may be an excellent way to raise screening rates, as they have already been proven effective and are relatively inexpensive to implement.^{9–12}

We previously evaluated the effectiveness of a multimodal reminder program that incorporated automated calls to reach large numbers of community-based insured women to improve repeat mammography screening. The evaluation of the reminder system and methodological details have been published previously.¹¹ The intervention targeted women aged 50–69 years, and intervention women were 1.81 times more likely to complete a mammogram in the second year of the program

¹Kaiser Permanente Northwest, Portland, Oregon.

²Center for Health Research, Kaiser Permanente Northwest, Portland, Oregon.

³Institute for Health Research, Kaiser Permanente, Denver, Colorado.

(2007) than a comparison group of younger women for whom a mammogram was also indicated at the time of the study.⁷

Multiple patient barriers to completing mammography screening have been described, in both uninsured and insured populations. Uninsured populations often face obvious barriers, such as reduced access to healthcare, not having a primary care physician (PCP), having to pay for screening, and numerous other barriers, in addition to less obvious barriers that insured populations may face. Previous research, some conducted in uninsured and some in insured populations, described such factors as fear and pain surrounding the procedure,¹³ low levels of income and education, older age,¹⁴ rural residency,¹² African American or Hispanic race/ethnicity,¹⁵ recent immigration,¹³ obesity,¹⁶ and knowledge gaps¹⁷ as barriers to mammogram completion. Not surprisingly, not having a PCP and not receiving recommendations to get a mammogram also have consistently been reported as important barriers to completing a mammogram.¹⁸ Lack of time and inconvenience have been described as weaker barriers.¹⁹

This article focuses on potential barriers to mammogram completion in an insured population. Although there are many factors involved, electronic medical records (EMR) allow the exploration of several factors that contribute to lack of clear understanding of barriers to mammography completion in this group of women. First, the majority of prior work relied largely on patient self-report of mammography history and weight.¹⁶ Women tend to underestimate the time since their last mammogram.²⁰ All women,²¹ and obese women in particular,²² tend to underestimate their weight. Second, insufficient work has been done to clarify barriers among insured patients specifically in the context of effective reminder systems.¹⁸ The women in our study have high mammogram completion rates compared to uninsured, partially insured, or rarely screened women because of having excellent access to mammograms through their health insurance, consistently having PCPs (95% of women members of Kaiser Permanente Northwest [KPNW] have a PCP), and consistently receiving advice to get mammograms through reminder systems, yet a significant portion of the population is not getting screened. Thus, there are important barriers to completion that either have not been identified, have not been addressed, or both.

Our objectives in this study were to evaluate patient characteristics potentially associated with mammogram non-completion among women who had received the reminder intervention and to identify patient-reported barriers that might explain differential mammography completion rates. EMR data provided access to clinically measured body mass index (BMI) and to mammogram completion data of patients who have health insurance. By studying an insured population who received the benefit of a reminder intervention, our research sought to identify some of the less obvious barriers that may be preventing women from completing mammograms. Very likely, these factors also affect uninsured women, but little research to date has studied less obviously associated factors that may affect mammogram completion rates in either insured or uninsured populations.

Materials and Methods

The protocol for this study was approved by the Institutional Review Board within the study health maintenance organization (HMO).

Study setting and data sources

The study was conducted in 2008–2009 at KPNW, a non-profit group model HMO with about 485,000 members in southern Washington and northern Oregon. The demographic characteristics of the members are similar to those of the area population. Electronic databases provide data on patient membership, healthcare coverage, demographics, height, weight, vital signs, personal and family medical history, and healthcare use, including pharmacy and mammogram completion (internally, as well as from outside claims and referrals). These data capture >95% of all medical care members receive,²³ and data are linked through each member's health record number. Screening mammography is a covered benefit, and the internal data are likely to be a nearly complete assessment of screening patterns.²⁴ Fewer than half of women have a copayment, and when they do, it ranges from \$10 to \$20. Approximately 84% (84.1%) of women aged 52–69 were up to date for mammography at the time of the study.

Study design and population

This retrospective cohort study was conducted in two phases. Phase 1 evaluated patient characteristics available through the EMR for their association with mammography screening completion among a population-based patient group targeted by a multimodal reminder program. Phase 2 analyzed a patient survey sent to a subgroup of those targeted by the reminders. We examined the association of patient-reported facilitators of and barriers to mammogram completion. Finally, we tested whether the survey-reported barriers or facilitators were mediators of the relationship between key patient characteristics found in the EMR and mammogram screening rates.

Figure 1 outlines the study population flow. Phase 1 participants were women aged 50–69 who were 20 months after a prior mammogram (index date) from January 1 to July 1, 2007 ($n = 6934$). We required each woman to have a minimum continuous membership from 24 months before the index date to 10 months after (the follow-up period) ($n = 4834$) and to have no history of breast cancer (i.e., be eligible for a screening

FIG. 1. Study population flow cohort targeted by reminder program and survey subsample.

vs. a monitoring mammogram) (final $n = 4708$). The 10-month follow-up period was used to identify outcomes and clinic visits, and the 24-month pre-index period was used to ascertain prior mammograms and other explanatory variables.

Phase 2 participants were from a subgroup of 677 women from the 2007 cohort who were still active HMO members, had a PCP, did not report prior breast cancer, and completed a mailed survey to elicit their perspectives about and experiences relevant to breast cancer screening. In this study phase, we did not aim to obtain a representative sample of the phase 1 population. We sought to oversample women who had important barriers identified in phase 1 in order to further elucidate factors associated with the barriers. To this end, we aimed to collect information from a diverse sample of members who were more likely to have had barriers to mammography and to have experienced varying levels of support from their PCP team to overcome those barriers. To achieve this, the target group cohort included all available racial and ethnic minorities and Medicaid enrollees in the survey sample, oversampled those who had not completed a mammogram, and sampled from PCP practices with higher (those with $\geq 85\%$ mammogram completion) and lower (those with $< 80\%$ mammogram completion) rates of mammography.

The 677 patients were mailed a written questionnaire with a cover letter signed by the principal investigator. A single follow-up mailing of the questionnaire was sent to nonresponders. We then reminded continued nonresponders by phone. Of those, 340 (50.2%) completed the survey and were used in mammogram completion and age analyses; 336 (49.6%) had height and weight data available in the medical record, which we used to compute BMI, and were included in the survey-related BMI analyses.

Study variables from EMR data

The primary outcome was screening mammography completion by 10 months. Patients' ages were determined at the index date. Individual racial categories were obtained from electronic databases for 3192 (67.8%) participants, and the missing data were geocoded using the census tract block corresponding to each subject's mailing address. Patients' race was categorized into white and other (black, Pacific Islander, Asian, and Native American). We also used geocoded data to estimate family income and then coded income as $< \$40,000$ or $\geq \$40,000$ /year. We ascertained Medicaid enrollment and length of membership through membership records. We included baseline BMI using the weight in the preperiod closest to the index date and any height. Using BMI, we determined the presence or absence of obesity ($\text{BMI} \geq 30$). In addition, as a measure intended to reflect disease burden,^{25,26} we determined the mean number of unique generic drugs dispensed to each participant. We also determined whether or not the patient had visited a PCP or an obstetrician/gynecologist during follow-up period.

Survey variables

Single-item survey questions were from prior studies.²⁷ The survey presented patients with a list of reasons and concerns that had or might have prevented them from getting a mammogram (barriers), as well as a list of reasons describing why they had or might have completed a mammogram (facilitators). Barrier items to be checked included (1) I'm afraid of finding

breast cancer, (2) I'm busy and don't have time, (3) I'm embarrassed about having a mammogram, and (4) The procedure causes too much pain. Facilitator items to be checked included (1) I believe in getting preventive screening and (2) my PCP recommended I get a mammogram done. Three survey yes/no questions addressed several aspects of the PCP communication about mammograms: Your PCP (1) explained why breast cancer screening was important, (2) described how the procedure was done, and (3) asked if you had questions. We drew on items from various previously validated measures of benefits and worries associated with cancer screening to create measures rated from strongly agree (1) to strongly disagree (5).^{28–30}

The worries scale had a Cronbach's alpha reliability of 0.73 and included a series of statements related to mammogram accuracy: I am worried that a mammogram would show that I do not have cancer when in fact I do; I am worried that a mammogram would show that I do have cancer when in fact I do not; mammograms often lead to breast surgery that is not needed. The benefits scale had a Cronbach's alpha reliability of 0.78 and included: having a mammogram every year or 2 gives me a feeling of control over my health; women my age need mammograms even when they have no family history of breast cancer; I understand the benefit of mammography for women my age.

Mammography patient reminder program

The reminder program has been described in detail previously.¹¹ At 20 months after a prior mammogram, eligible women were sent an informational postcard reminding them that they would be soon due for a mammogram and encouraging them to make an appointment. Women who did not make an appointment for a mammogram by 21 months received an automated telephone reminder through Kaiser Voice Messaging (AVM). The automated telephone reminder informed the patient that her mammogram was due soon, encouraged her to make an appointment, and provided instructions on how to do so. At 22 months, those who had not made an appointment received a second AVM reminder call. At 23–24 months, the names and demographic information of women who had not yet made an appointment were given to local healthcare teams so that follow-up live calls could be made.

Statistical methods

We used logistic regression to predict mammogram completion during the 10-month follow-up period in the phase 1 cohort and included the following variables: age (< 60 vs. ≥ 60 years), having any obstetrician/gynecologist visit during the follow-up period, having any PCP visit during the follow-up period, race (white vs. other race), family income ($< \$40,000$ vs. $\geq \$40,000$ /year), length of membership (< 5 vs. ≥ 5 years), BMI (≥ 30 vs. < 30), and number of medications (≥ 7 medications vs. < 7 medications). All variables with significant bivariate associations with mammogram completion were included in the final multivariable model. A subanalysis to determine univariate and multivariate predictors of mammogram completion among low-income women was also conducted. In the phase 2 sample we used logistic regressions to determine the association between survey-reported barriers and facilitators and mammogram completion. *T*-tests were used to test differences on the barriers and facilitators by age and obesity and to identify

possible mediators of the relationship between age and obesity and mammogram completion. A variable is considered a mediator "to the extent that it accounts for the relationship between the predictor and the criterion."³¹ The mediation effect can be estimated by the indirect effect of the predictor on the criterion through the mediator by calculating the product of the coefficients from the predictor to mediator and mediator to criterion. Sobel's test with bootstrapped estimates³² was used to estimate and test indirect effects.

Results

Table 1 presents the baseline characteristics of patients in the reminder cohort (phase 1) and in the survey responders (phase 2). Mean age was about 59 in both samples. About three quarters of both groups visited their PCP, and about one eighth visited their obstetrician/gynecologist their during follow-up. As expected in the survey subsample, because of deliberate oversampling of racial minorities and those who did not complete a mammogram, the cohort has a higher percentage of whites compared to the survey sample (92.1 vs. 76.9) and those who completed a mammogram (80.9 vs. 62.1). Other characteristics, including the percent who were obese (46.8 in the cohort vs. 47.6 in the survey), were similar in the two groups. Survey sample responders compared to nonresponders were slightly older (age 59.0 vs. 58.0, $p = 0.022$) and had more obstetrician/gynecologist visits (13.4% vs. 7.4%, $p = 0.007$), and fewer people had an annual family income <\$40,000 (13.4 vs. 20.1, $p = 0.022$) and a higher rate of mammogram completion (62.1% vs. 39.8%, $p < 0.001$). Other characteristics of responders and nonresponders to the survey were not significantly different (data not shown).

TABLE 1. DEMOGRAPHICS FOR REMINDER COHORT AND SURVEY SUBSAMPLE

Variable	Reminder cohort Phase 1 n = 4708	Survey sample Phase 2 n = 340
Age, years	58.7 ± 5.4	59.0 ± 5.7
Age < 60 years	2891 (61.4)	199 (58.5)
Obstetrician/gynecologist visits (any)	602 (12.8)	47 (13.8)
PCP visits (any)	3578 (76.0)	249 (73.2)
Race: white ^b	4309 (92.1)	260 (76.9)
Family income (<\$40,000 per year) ^c	614 (13.3)	45 (13.4)
Length of membership < 5 years	1048 (22.3)	68 (20.0)
BMI ≥ 30 ^a	2157 (46.8)	160 (47.6)
No. of medications	9.1 ± 7.4	8.8 ± 6.6
No. of medications ≥ 7	2593 (55.1)	190 (55.9)
Mammogram completed ^d	3809 (80.9)	211 (62.1)

^a98 (2.1) patients from the phase 1 group are missing body mass index (BMI) data, and 4 (1.2) from the phase 2 group are missing BMI data.

^b30 (0.6) patients from the phase 1 group and 2 (0.6) patients from the phase 2 group are missing race data.

^c92 (2.0) patients from the phase 1 group and 5 (1.5) patients from the phase 2 group are missing income data.

^dMammogram completed during 10 months of follow-up. PCP, primary care physician.

Table 2 presents the multivariable model predicting mammogram completion at 10 months of follow-up for the reminder cohort. Those aged <60 (odds ratio [OR] 0.69, 95% confidence interval [CI] 0.59-0.81), with health plan membership of <5 years (OR 0.81, 95% CI 0.68-0.97), family income <\$40,000/year (OR 0.77, 95% CI 0.62-0.96), and who were obese (OR 0.67, 95% CI 0.57-0.78) had reduced odds of completing a mammogram. Visiting a PCP (OR 2.40, 95% CI 2.04-2.83) or obstetrician/gynecologist (OR 2.15, 95% CI 1.63-2.85) during follow-up increased the odds of completing a mammogram. A multivariable model predicting mammogram completion among the 614 women who had family income <\$40,000/year revealed that only visiting a PCP (OR 2.66, 95% CI 1.77-4.00) or obstetrician/gynecologist (OR 2.62, 95% CI 1.27-5.42) during follow-up increased the odds of completing a mammogram. In this subgroup, those of white race tended to complete mammograms more frequently (OR 1.66, 95% CI 0.98-2.83, $p = 0.059$).

Table 3 presents the ORs for mammogram completion associated with patient-reported potential barriers and facilitators. Table 3 also shows the percent of women endorsing each barrier and facilitator by those aged <60 and ≥60 and those with and without obesity for the survey sample. Being "too busy" (OR 0.54, $p = 0.048$), feeling embarrassed about having a mammogram (OR 0.09, $p = 0.001$), and selecting the option that the mammogram caused "too much pain" (OR 0.41, $p = 0.001$) were associated with lower likelihood of screening completion. Belief in preventive screening (OR 3.01, $p < 0.001$) and higher scores on the benefits scale (OR 2.32, $p < 0.001$) were associated with greater likelihood of mammogram completion. Fear of finding breast cancer, worries about breast cancer screening, PCP recommendation to get a mammogram, and elements of this counseling (explaining why screening was important, how the procedure was done, and asking if the patient had questions) were not significantly related to mammogram screening rates in the overall group.

Younger women were significantly more likely to be "too busy" to get mammograms (19.1% vs. 6.4%, $p < 0.001$) and to have more worries about mammogram accuracy and unnecessary surgery (2.5 vs. 2.3 on worries scale, $p < 0.05$) than older women, making these two variables possible mediators of the relationship between age and mammogram completion. By contrast, even though younger women were

TABLE 2. MULTIVARIATE MODEL PREDICTING MAMMOGRAM SCREENING COMPLETION

Variable	Odds Ratio	95% CI	p value
Age < 60 years	0.69	0.59 0.81	<0.0001
Obstetrician/gynecologist visits (any)	2.15	1.63 2.85	<0.0001
PCP visits (any)	2.40	2.04 2.83	<0.0001
Family income < 40,000/year	0.77	0.62 0.96	0.018
Length of membership < 5 years	0.81	0.68 0.97	0.019
Obesity (BMI ≥ 30)	0.67	0.57 0.78	<0.0001

Mammogram screening during 10 months of follow-up. Model includes the 4521 (96%) of patients with complete data.

CI, confidence interval.

TABLE 3. PATIENT-REPORTED POTENTIAL MAMMOGRAM BARRIERS AND FACILITATORS BY AGE AND OBESITY STATUS

	<i>Mammogram completion</i>		<i>Age</i>		<i>Obesity^a</i>	
	<i>No n = 129 (37.9%)</i>	<i>Yes n = 211 (62.1%)</i>	<i><60 n = 199 (58.5%)</i>	<i>>60 n = 141 (41.5%)</i>	<i>No n = 176 (52.3%)</i>	<i>Yes n = 160 (47.7%)</i>
	<i>OR</i>	<i>p value</i>	<i>% Responding Yes</i>			
Barriers						
I'm afraid of finding breast cancer	0.58	0.158	10.1	7.1	9.1	8.1
I'm busy and don't have time for mammogram	0.54	0.048	19.1	6.4*	13.6	13.8
I'm embarrassed about having a mammogram	0.09	0.001	5.5	2.8	4.0	5.0
The procedure causes too much pain	0.41	<0.001	27.6	21.3	18.8	31.3**
Worries scale	1.03	0.82	2.51 (0.81)	2.32*** (0.84)	2.50 (0.81)	2.36 (0.85)
Mean (SD)						
Facilitators						
I believe in getting preventive screening	3.01	<0.001	82.4	71.6***	79.0	77.5
PCP recommended I get mammogram done	0.75	0.203	53.8	63.1	56.8	58.8
PCP explained why breast cancer screening was important	0.88	0.610	26.1	24.8	27.8	23.8
PCP explained how the procedure was done	1.04	0.918	11.6	8.5	11.4	9.4
PCP asked if I had questions about breast cancer screening	0.71	0.300	12.6	12.1	12.5	12.5
Benefit scale	2.32	<0.001	4.43 (0.63)	4.35 (0.73)	4.41 (0.69)	4.38 (0.66)
Mean (SD)						

^aThe 4 patients (1.2%) missing BMI data were excluded from BMI analyses.

* $p \leq 0.001$; ** $p \leq 0.01$; *** $p \leq 0.05$.

OR, odds ratio; SD, standard deviation.

less likely to complete their mammograms, they were more likely than the older group to say they believed in getting preventive screening in general (82.4% vs. 71.6%, $p \leq 0.05$, respectively).

Overall, 24.7% of respondents reported "too much pain" from mammograms. Obese women were more likely to report "too much pain" compared to the nonobese (31.3% vs. 18.8%, $p < 0.01$), making pain a possible mediator of the relationship between obesity and mammogram completion (indirect effect = -0.111 , 95% CI -0.229 – -0.025 , $p = 0.008$). Interestingly, although being obese was associated with increased likelihood that pain was a barrier to mammogram completion, which was in turn associated with decreased likelihood of completing a mammogram, obese women did not report embarrassment about having a mammogram more frequently and did not report less frequent recommendations to get a mammogram from PCPs or differences in the elements included in the PCP counseling they received (explaining why screening was important, how the procedure was done, and asking if the patient had questions) compared to the nonobese. Being busy and the worries scale did not mediate the relationship between age and mammogram screening rates ($p = 0.128$ and $p = 0.734$, respectively). All other variables did not differ significantly between younger and older women or between those with and without obesity.

Discussion

We found that in the context of a reminder program to encourage repeat mammograms among insured patients, important barriers to examination completion remain. In particular, younger age, more recent health plan membership, lower family income, and obesity significantly reduced the odds of completing a mammogram. Our findings are consistent with findings from other studies,^{10,13,15,33} including the finding that family income (and associated factors) appears to be a stronger predictor than race. However, this study serves to highlight that access to mammograms through health insurance and reminding patients that mammograms are due does not completely alleviate patient barriers. Disparities cannot be addressed solely by providing access to clinician advice about the procedure. Thus, to improve mammogram screening rates among the insured, it will be important for health plans to expand beyond reminding women to obtain mammograms.

In another study at this site that used an alternative method of assessing compliance with mammography guidelines, the Prevention Index (PI), or the proportion of time a patient is observed during which the patient has had the prevention services needed or is appropriately "covered according to guidelines," those aged 50–59 (compared to those 60–69) and those with shorter periods of health plan membership had lower mammography PIs.³³ The current study expands on

these findings by exploring patient-reported factors that could explain the lower likelihood of mammography completion among younger women. Younger targeted women were significantly more likely to report being "too busy" to have mammograms. Although we did not explore patient perceptions of how this barrier could be alleviated, it may be useful to evaluate such interventions as worksite and mobile mammography facilities or the availability of after-work appointments for younger women. Younger targeted women also had more worries about mammograms than older women. The worries largely related to concerns about the accuracy of mammograms that could cause either missed cancers or unnecessary surgery. Younger women's perceptions in this regard have some basis in fact because although the USPSTF recommends mammograms every 1–2 years among women aged 50–69, the balance of benefits and harms grows more favorable as women age.⁴ This highlights the need for assistance with informed decision making in younger women and the continued need for improved technologies for breast cancer screening.

Obesity has been described previously as a barrier to mammogram completion.^{16,34} This study helps confirm the strength of this association by using objective measures, such as height and weight and mammography examination data. We also elucidated several issues related to the obesity barrier. Most importantly, we found that the prevalence of this barrier was very high; nearly half (47%) of this community-based sample of insured women who had already had a prior mammogram and had been weighed were obese. The findings in our sample are not dissimilar to those of the National Health and Nutrition Examination Survey (NHANES) for 2005–2006. There, 42% of women aged 40–59 in the United States were found to be obese.³⁵ The somewhat higher prevalence of obesity found here may be explained by the fact that the state of Oregon has a higher prevalence of obesity among adults than the national average.³⁶ Given the obesity epidemic,³⁷ the higher incidence and mortality from breast cancer among the obese,³⁴ and the need for patients to participate in regular screening to achieve desired reductions in mortality,⁸ obesity is an exceedingly common and important barrier to mammography. Therefore, it is crucial to understand what, specifically, about obesity is causally linked to lower rates of mammography screening completion among these women.

Obese women were significantly more likely to report "too much pain" from mammograms when compared to the nonobese. Other studies have shown that up to 35% of all women receiving mammograms complain of pain (24.7% did so in this study), and that pain serves as a deterrent to repeating mammograms among all women.³⁸ We could only identify one small study that evaluated the relationship of obesity to pain from mammograms, and this study did not find that obese women reported more pain with mammograms.³⁹ The reason obese women may more frequently report pain remains uncertain. Mammogram-related pain in the Sharp et al. study³⁹ was unrelated to breast size or reported sensitivity to pain in general. At least one study suggests that obesity may be associated with a lowered pain threshold.⁴⁰

The null findings in our study about obesity and mammography may be as important as the positive ones. Other studies have hypothesized that the adverse effect of obesity on mammogram screening relates to a reduced focus on preventive healthcare among obese women, discriminatory attitudes

or counseling by healthcare providers, and embarrassment.¹⁶ Consistent with the findings of Ferrante et al.,³⁴ we did not find differences among the obese and nonobese in the reporting of these factors. In our survey, obese respondents were as likely as nonobese respondents to report that their PCPs had recommended a mammogram, and they were as likely to have received various counseling components. Thus, clinician-oriented interventions likely cannot, by themselves, fully address the complexity of patient barriers to mammography completion among the obese. Patients in general and obese patients in particular may benefit from interventions to reduce pain, such as patient-controlled compression³⁸ or, ultimately, the use of alternative technologies for breast cancer screening.

This study has several limitations. It was conducted at a single HMO, so the findings may not be generalizable to other populations. Because members of the HMO where the study was conducted closely resemble the general community, however, our findings are likely to be relevant to larger populations. In the cohort analyses, individual race data were not complete, and missing race data and all family income data were from neighborhood estimates (geocoded). These data may not be as accurate as those derived from self-report. The phase 2 (survey group) results need to be interpreted with caution. This group was not selected to be a representative sample of the population; rather, they were selected in a manner to oversample those with barriers in order to further elucidate them. Thus, the specific frequency of barriers found in this subgroup would not likely be the same as that found in the general population. Conclusions comparing those with and without barriers (e.g., pain in the obese vs. nonobese) should be generalizable, however. We did not have the power in phase 2 to examine patient-reported barriers among income and membership subgroups. Also, we could not assess obesity subgroups by race in either phase of the study because of limited sample size. Finally, only 50% of patients responded to the survey, which could lead to response bias.

Conclusions

Even in the context of an effective mammogram reminder system, important patient barriers to mammography remain. Our findings indicate that remaining patient barriers are not likely to be overcome through more reminders and interventions with clinicians; therefore, resources spent addressing the problem from this angle are likely to be wasted. Instead, our study suggests that patient interventions to address barriers identified by the respondents may be beneficial. Specifically, given the large percentage of obese women in the target age groups for mammograms, understanding and addressing why obesity appears to be a significant hurdle to mammogram completion should be a research priority.

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Disclosure Statement

None of the authors report potential conflicts of interest.

References

- Berry DA, Cronin KA, Plevritis SK, et al. Effect of screening and adjuvant therapy on mortality from breast cancer. *N Engl J Med* 2005;353:1784–1792.
- Overmoyer B. Breast cancer screening. *Med Clin North Am* 1999;83:1443–1557.
- National Cancer Institute. Surveillance Epidemiology and End Results. Available at seer.cancer.gov/statfacts/html/breast.html
- U.S. Preventive Services Task Force. Screening for breast cancer, Topic page. AHRQ, 2009. www.uspreventiveservices.org/uspstf/uspstf.htm
- Valanis BG, Glasgow RE, Mullooly J, et al. Screening HMO women overdue for both mammograms and Pap tests. *Prev Med* 2002;34:40–50.
- Breen N, Cronin A, Meissner HI, et al. Reported drop in mammography: Is this cause for concern? *Cancer* 2007;109:2405–2409.
- U.S. Preventive Services Task Force. Screening for breast cancer. Available at www.ahrq.gov/clinic/uspstf/uspstf.htm
- American College of Obstetricians and Gynecologists. ACOG practice bulletin. Clinical management guidelines for obstetrician-gynecologists. Number 42, April 2003. Breast cancer screening. *Obstet Gynecol* 2003;101:821–831.
- Baron RC, Rimer BK, Coates RJ, et al. Client-directed interventions to increase community access to breast, cervical, and colorectal cancer screening: A systematic review. *Am J Prev Med* 2008;35:S56–S66.
- Bonfill X, Marzo M, Pladevall M, Marti J, Emparanza JI. Strategies for increasing women participation in community breast cancer screening. *Cochrane Database Syst Rev* 2004;3.
- Feldstein AC, Perrin N, Rosales AG, et al. Effect of a multimodal reminder program on repeat mammogram screening. *Am J Prev Med* 2009;37:94–101.
- Jean S, Major D, Rochette L, Brisson J. Screening mammography participation and invitational strategy: The Quebec Breast Cancer Screening Program, 1998–2000. *Chronic Dis Can* 2005;26:52–58.
- Bailey TM, Delva J, Gretebeck K, Siefert K, Ismail A. A systematic review of mammography educational interventions for low-income women. *Am J Health Promot* 2005;20:96–107.
- Rimer BK, Meissner H, Breen N, Legler J, Coyne CA. Social and behavioral interventions to increase breast cancer screening. In: Schneiderman N, Speers M, Silva J, et al, eds. Integrating behavioral and social sciences with public health. Washington, DC: American Psychological Association, 2001:177.
- Vernon SW, Briss PA, Tiro JA, Warnecke RB. Some methodologic lessons learned from cancer screening research. *Cancer* 2004;101:1131–1145.
- Maruthur NM, Bolen S, Brancati FL, Clark JM. Obesity and mammography: A systematic review and meta-analysis. *J Gen Intern Med* 2009;24:665–677.
- Screening mammography: A missed clinical opportunity? Results of the NCI Breast Cancer Screening Consortium and National Health Interview Survey Studies. *JAMA* 1990;264:54–58.
- Schueler KM, Chu PW, Smith-Bindman R. Factors associated with mammography utilization: A systematic quantitative review of the literature. *J Womens Health* 2008;17:1477–1498.
- George SA. Barriers to breast cancer screening: An integrative review. *Health Care Women Int* 2000;21:53–65.
- Cronin KA, Miglioretti DL, Krapcho M, et al. Bias associated with self-report of prior screening mammography. *Cancer Epidemiol Biomarkers Prev* 2009;18:1699–1705.
- Burkhauser RV, Cawley J. Beyond BMI: The value of more accurate measures of fatness and obesity in social science research. *J Health Econ* 2008;27:519–529.
- Palta M, Prineas RJ, Berman R, Hannan P. Comparison of self-reported and measured height and weight. *Am J Epidemiol* 1982;115:223–230.
- Freeborn DK, Pope C. Promise and performance in managed care: The prepaid group practice model. Baltimore, MD: Johns Hopkins University Press, 1994.
- Valanis B, Whitlock EE, Mullooly J, et al. Screening rarely screened women: Time-to-service and 24-month outcomes of tailored interventions. *Prev Med* 2003;37:442–450.
- Schneeweiss S, Wang PS, Avorn J, Maclure M, Levin R, Glynn RJ. Consistency of performance ranking of comorbidity adjustment scores in Canadian and U.S. utilization data. *J Gen Intern Med* 2004;19:444–450.
- Schneeweiss S, Walker AM, Glynn RJ, Maclure M, Dormuth C, Soumerai SB. Outcomes of reference pricing for angiotensin-converting-enzyme inhibitors. *N Engl J Med* 2002;346:822–829.
- Glasgow RE, Whitlock EP, Valanis BG, Vogt TM. Barriers to mammography and Pap smear screening among women who recently had neither, one or both types of screening. *Ann Behav Med* 2000;22:223–228.
- McCaul KD, Goetz PW. Worry—The Penn State Worry Questionnaire (PSWQ). Health behavior constructs: Theory, measurement and research. Bethesda, MD: National Cancer Institute, 2009.
- Champion V. Perceived benefits. Health behavior constructs: Theory, measurement and research. Bethesda, MD: National Cancer Institute, 2009.
- Breast cancer. HINTS Health Information National Trends Survey. Bethesda, MD: National Cancer Institute, 2009.
- Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J Pers Soc Psycho* 1986;51:1173–1182.
- Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav Res Methods Instruments Comput* 2004;36:717–731.
- Feldstein AC, Vogt TM, Aickin M, Hu WR. Mammography screening rates decline: A person-time approach to evaluation. *Prev Med* 2006;43:178–182.
- Ferrante JM, Chen PH, Crabtree BF, Wartenberg D. Cancer screening in women: Body mass index and adherence to physician recommendations. *Am J Prev Med* 2007;32:525–531.
- Ogden CL, Carroll MD, McDowell MA, Flegal KM. Obesity among adults in the United States—No statistically significant change since 2003–2004. *NCHS Data Brief* 2007;1–8.

36. State-specific prevalence of obesity among adults—United States, 2007. *MMWR* 2008;57:765–768.
37. Centers for Disease Control and Prevention. Obesity trends: Obesity trends among adults (1985–2003). Available at www.cdc.gov/nccdphp/dnpa/obesity/trend/index.htm
38. Miller D, Livingstone V, Herbison P. Interventions for relieving the pain and discomfort of screening mammography. *Cochrane Database Syst Rev* 2008;CD002942.
39. Sharp PC, Michielutte R, Freimanis R, Cunningham L, Spangler J, Burnette V. Reported pain following mammography screening. *Arch Intern Med* 2003;163:833–836.
40. Emery C. Are those suffering from obesity more sensitive to pain? *Pain News* 2009.

Address correspondence to:
Adrianne C. Feldstein, M.D., M.S.
Center for Health Research
3800 N. Interstate Avenue
Portland, OR 97227-1110
E-mail: adrianne.c.feldstein@kpchr.org