

Predisposing Factors Associated with Compliance to Biennial Breast Screening among Centers with and without Nurses

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Abstract

Background: Previous research suggests that predisposing factors such as previous screening experience, participation in preventive health behaviors, and knowledge/beliefs about breast cancer and screening influence a woman's decision to make a timely return for a second screen.

Methods: A stratified random sample of compliers and noncompliers to biennial screening were selected from a cohort of 51,242 women ages 50 to 65 years who had their initial screen at the Ontario Breast Screening Program. In total, 1,901 women were telephone-interviewed. The associations between predisposing factors and compliance were estimated separately for centers with and without nurses using logistic regression analyses adjusted for demographics and smoking status.

Results: Women screened at nurse centers were less likely to comply if they thought women should stop

having mammograms before age 70 years [odds ratio (OR), 0.39; 95% confidence interval (95% CI), 0.19-0.79], did not consider mammograms very likely to find cancer (OR, 0.73; 95% CI, 0.56-0.95), felt their likelihood of getting breast cancer was below average (OR, 0.69; 95% CI, 0.54-0.89), or believed a high-fat diet was not an important risk factor for breast cancer (OR, 0.59; 95% CI, 0.36-0.97). Women attending nurse centers were significantly more likely to comply if they sometimes had thoughts or worries about developing breast cancer (OR, 1.40; 95% CI, 1.10-1.80).

Conclusions: Nurses at screening centers may reinforce a woman's knowledge or beliefs about breast cancer or screening and as a result increase their compliance to biennial breast screening. (Cancer Epidemiol Biomarkers Prev 2009;18(3):739-47)

Introduction

In Canada, breast cancer is the most common cancer in women, with an estimated 22,400 new diagnoses and 5,300 deaths to occur in 2008 (1). A significant reduction in breast cancer mortality can be achieved through screening but only if regular attendance is maintained for 7 to 10 years by 70% of the target age group (2, 3). As a result, high levels of participation are essential to the effectiveness of population-based screening programs. An understanding of how various factors are associated with rescreening is important for targeting appropriate strategies to reinforce regular participation.

Many studies have contributed to the understanding of factors that influence the return of women for a second screen. Demographic factors such as younger age, higher education, higher income, and being married have been shown to be associated with returning for a second screen (4-19). Whether women live in a rural or urban setting has also been shown to have an influence on screening (20-22). Although living in an urban area has been found to be positively associated with rescreening

in mammography facilities in the United States, living in a rural area has been found to be positively associated with rescreening in the Ontario Breast Screening Program (OBSP) as well as in the BreastScreen Victoria Programme in Australia (20-22). Studies from both the United States and Switzerland have shown that foreign birth is associated with not returning for a second screen (5, 23). A family history of breast cancer has also been shown to be positively associated with a woman returning for a screening (5, 9, 16, 19, 24-27).

The practice of preventive health behaviors also appears to have an effect on rescreening. Women with regular physicians are more likely to return for screening (13, 18, 19, 28). The type of practitioner a woman uses also affects her screening behavior, as women who use a gynecologist for regular care were significantly more likely to attend rescreening (9, 16, 19, 29). Healthy practices such as having a recent Papanicolaou (Pap) test within 3 years or regular dental checkups were found to be positively associated with repeat mammography screenings (14, 24, 28, 30). High-risk behaviors such as current or past smoking were associated with a decreased likelihood of rescreening (12, 23, 28, 31).

Additional studies have suggested the importance of a woman's previous screening experience and knowledge and beliefs about breast screening and cancer on reattendance. Women who have had a prior or recent mammogram are more likely to attend rescreening (5, 10, 23).

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Regular performance of a clinical breast examination also has a positive association with mammography rescreening adherence (7, 19, 24, 28). Knowledge about and belief in the benefits of screening and beliefs that a mammogram is needed even if there is not a problem and that mammograms are effective at reducing breast cancer has been found to be positively associated with rescreening (11, 24, 28). Interviews conducted with women who regularly participate in breast cancer screening indicated they had adequate knowledge of the risk factors for breast cancer, knew the benefits of early detection, and had trust in the treatment and screening process (25). Knowledge that women ages ≥ 50 years were at an increased risk of breast cancer has also been found to be associated with rescreening (6, 15, 26).

The OBSP, under the auspices of Cancer Care Ontario, is an organized screening program that has been offering two-view mammography and clinical breast examination by a nurse to women between 50 and 69 years old since 1990 through regional cancer centers and affiliate centers. In addition to providing a clinical breast examination, nurses communicate important breast health information and educate women about screening. However, as of 1998, due to program restructuring, not all affiliated centers had a nurse.

The OBSP thus provides a unique opportunity to evaluate the influence of the nurse on women's rescreening behavior and knowledge of breast cancer and screening, as these may be important determinants in returning for screening. The purpose of this study was to determine the association between predisposing factors and compliance to biennial screening. A stratified random sample of compliers and noncompliers in centers with and without nurses were selected from a cohort of women ages 50 to 65 years who had their initial screen at OBSP.

Materials and Methods

Study Population. A cohort of 51,242 women ages 50 to 65 years on a first screen undertaken between January 1 and December 31, 2002 was identified from data routinely collected by the OBSP. The OBSP offers eligible women biennial screening consisting of two-view mammography at all centers and at some centers, a clinical breast examination by a nurse. Women are not eligible if they have had a prior history of breast cancer or augmentation mammoplasty or if they currently have symptoms of breast disease. Although most women are screened every 2 years at OBSP, women considered at high risk of breast cancer are recalled annually. A complete description of the details of the operation of OBSP has been recently published (32).

Since the program started in 1990, mammography screening and clinical breast examination by a nurse have been provided through nine dedicated regional cancer centers. As of 1995, screening has also been offered at affiliated centers within established mammography facilities in hospitals or independent health facilities alongside other imaging services. Although all of the affiliated centers offer screening mammography, as of 1998, not all provided clinical breast examinations. Therefore, during the study period, 60 (71%) of the 85 OBSP affiliates had a nurse and 25 (29%) did not. The

regional cancer centers also provide administration, coordination, education, and training to affiliate centers within their respective regions and all have nurses. As a result of differences in practice setting and number of years of operation between regional and affiliate centers, this study compared only affiliate centers with and without nurses and women screened at regional cancer centers (8,536) were excluded.

Nurses are awarded certification following instructional training and a written examination; in addition, their competence is regularly assessed through the OBSP Quality Assurance Program. At centers with a nurse, their primary role is the performance of the clinical breast examination at both initial and subsequent screens. In addition, the nurse educates the woman about the screening process and breast health and brings normal breast findings to her attention. The nurse also informs the woman of any clinical abnormality at the time of the visit and makes an independent decision to refer her to her family physician for assessment.

At centers without a nurse, each woman is encouraged to visit her family physician for a clinical breast examination. At these centers, in addition to performing the mammogram, a medical radiation technologist will also perform a visual inspection of both breasts and document any visual findings as well as physical findings identified by the woman. The technologist provides information about the screening process but does not provide breast health teaching to the woman. The technologist has undertaken training in mammography and receives accreditation with the Canadian Association of Radiologists Mammography Accreditation Program.

To control for potential factors that may affect compliance to a second screen, women were excluded if they had a 1 year screening recommendation (13,650), returned for a second screen at or earlier than 18 months (900), had an abnormal first screen (2,233), had acute breast symptoms (261), had not consented to be sent information on breast health studies (5,571), had any breast biopsies or surgeries (1,142), or returned more than once to OBSP during the study period (481). The study was approved by the Health Sciences Research Ethics Board at the University of Toronto.

Data Collection. Data on factors associated with biennial screening compliance were collected from a stratified random sample selected from the 18,468 eligible women ages 50 to 65 years screened in 2002. There were 6 centers that had <35 eligible women screened for this study and these centers were excluded from the sampling along with the 396 women screened at those centers. As well, 65 women who had a clinical breast examination in a center that no longer had nurses and 1,069 women who did not have a clinical breast examination (for various reasons) at a center that had nurses were excluded. Therefore, there were 16,858 eligible women that attended 79 affiliate centers. From the 56 centers with a nurse, there were 12,199 eligible women, of whom 10,446 were compliers and 1,753 were noncompliers. From the 23 centers without a nurse, there were 3,509 compliers and 1,150 noncompliers. Women were considered compliers if they returned for their second screen after 18 months and within 30 months of their first screen and noncompliers if they returned after 30 months or did not return at all.

From each of the 79 eligible centers, up to 55 women were selected randomly. To ensure an adequate sample size for this study, it was proposed that up to 20 eligible women who had complied and 20 who did not comply would be selected from each center. However, as it was anticipated that fewer noncompliers may respond to the questionnaire, these women were oversampled with up to 35 noncompliers randomly selected from each center. In total, 2,321 questionnaires were sent to eligible women attending a nurse center; 1,282 were sent to compliers and 1,039 were sent to noncompliers. Additionally, 1,066 questionnaires were sent to eligible women attending non-nurse centers; 551 were sent to compliers and 515 were sent to noncompliers (Fig. 1).

The eligible women were sent a copy of the study questionnaire about 2 weeks before being contacted by phone. Questionnaires were administered by phone by trained interviewers and interviews typically lasted 20 to 30 min. The telephone-administered questionnaire focused on factors associated with compliance. The questions on knowledge and the beliefs toward breast cancer risk and screening were developed using the PRECEDE model as a framework for eliciting information on factors influencing behavior change (33). The model framework identifies three determining factors for behavior change including predisposing, enabling, and reinforcing factors.

This study focused on predisposing factors that comprise knowledge and beliefs that are influenced by emotional factors and demographics. The questions on

predisposing factors focused on breast screening behaviors as well as knowledge and beliefs about breast cancer and screening. For breast screening behaviors, women were asked whether they had a clinical breast examination and/or mammogram before attending the OBSP, whether they performed a breast self-examination after attending OBSP, and how certain they were to have another mammogram in the next 2 years. Knowledge and belief questions on breast cancer included whether women had found out anything about breast cancer or screening since attending their OBSP screening appointment, the importance of various risk factors for breast cancer, the proportion of women who will get breast cancer, their perceived likeliness of getting breast cancer in their lifetime, and their thoughts and worries about breast cancer. Knowledge and belief questions on breast screening included how often women should have mammograms, the age they should start and stop regular mammograms, and the likeliness of a mammogram and clinical breast examination finding breast cancer.

Demographic questions included date of birth from which their age at interview was calculated (50-59; 60-69 years), highest level of education achieved, current marital status (married; other, which included single, widowed, divorced, or separated), country of birth (North America; Europe; Asia; other), and height and weight that were used to calculate body mass index [kg/m^2 ; below average (<20); average (20-25); overweight (26-30); obese (>30)]. Additional questions on risk factors and health practices included family history

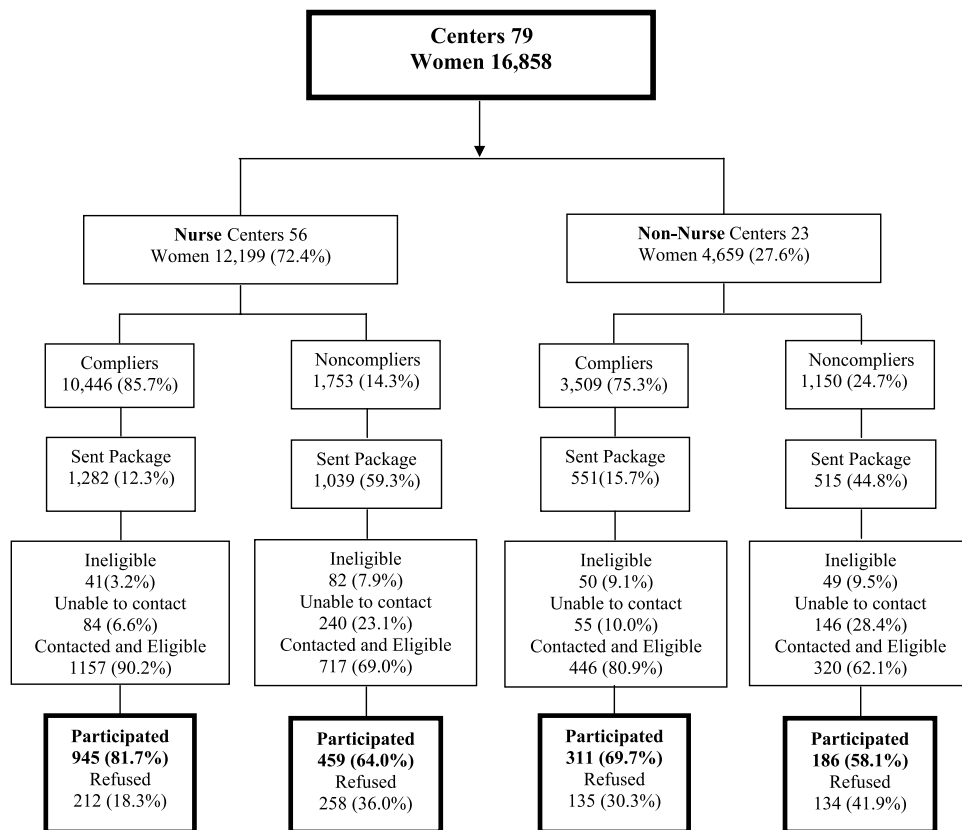


Figure 1. Cohort of eligible women responding to the questionnaire.

Table 1. OR (95% CI) for compliance to biennial breast screening by demographic characteristics

Demographic characteristics	Nurse centers			Non-nurse centers		
	Compliers (n = 945)	Noncompliers (n = 459)	OR (95% CI)	Compliers (n = 311)	Noncompliers (n = 186)	OR (95% CI)
Age at interview						
50-59	493 (52.2)	280 (61.0)	1.00	156 (50.3)	110 (59.1)	1.00
60-69	452 (47.8)	179 (39.0)	1.43 (1.14-1.80)*	154 (49.7)	76 (40.9)	1.43 (0.99-2.06)
Body mass index						
20-25	306 (33.0)	144 (31.9)	1.00	103 (34.3)	60 (33.5)	1.00
<20	14 (1.5)	14 (3.1)	0.47 (0.22-1.01)	11 (3.7)	8 (4.5)	0.80 (0.31-2.10)
26-30	321 (34.6)	161 (35.7)	0.94 (0.71-1.23)	108 (36.0)	62 (34.6)	1.01 (0.65-1.59)
>30	286 (30.9)	132 (29.3)	1.02 (0.77-1.36)	78 (26.0)	49 (27.4)	0.93 (0.58-1.50)
Currently married						
Yes	754 (79.8)	338 (73.8)	1.00	247 (79.4)	136 (73.1)	1.00
No	191 (20.2)	120 (26.2)	0.71 (0.55-0.93)†	64 (20.6)	50 (26.9)	0.70 (0.46-1.08)
Current education						
Less than high school	53 (5.6)	26 (5.7)	1.00	16 (5.2)	16 (8.7)	1.00
High school, vocational, technical	730 (77.3)	353 (77.2)	1.01 (0.62-1.65)	225 (72.6)	129 (69.7)	1.74 (0.84-3.61)
Bachelor's degree or higher	161 (17.0)	78 (17.1)	1.01 (0.59-1.74)	69 (22.3)	40 (21.6)	1.73 (0.78-3.82)
Country of birth						
North America	774 (81.9)	374 (81.7)	1.00	177 (57.1)	112 (60.2)	1.00
Europe	143 (15.1)	63 (13.8)	1.10 (0.80-1.51)	66 (21.3)	34 (18.3)	1.23 (0.76-1.98)
Asia	11 (1.2)	13 (2.8)	0.41 (0.18-0.92)†	27 (8.7)	21 (11.3)	0.81 (0.44-1.51)
Other	17 (1.8)	8 (1.7)	1.03 (0.44-2.40)	40 (12.9)	19 (10.2)	1.33 (0.74-2.42)
Community type						
Urban	614 (65.0)	322 (70.1)	1.00	284 (91.3)	162 (87.1)	1.00
Rural	330 (35.0)	137 (29.9)	1.26 (0.99-1.61)	27 (8.7)	24 (12.9)	0.64 (0.36-1.15)
Income quintile						
1	164 (17.4)	104 (22.7)	1.00	33 (10.6)	19 (10.2)	1.00
2	194 (20.6)	91 (19.9)	1.35 (0.95-1.92)	44 (14.2)	30 (16.1)	0.84 (0.41-1.75)
3	197 (21.0)	89 (19.4)	1.40 (0.99-1.99)	61 (19.6)	36 (19.4)	0.98 (0.49-1.96)
4	182 (19.4)	88 (19.2)	1.31 (0.92-1.87)†	80 (25.7)	48 (25.8)	0.96 (0.49-1.87)
5	203 (21.6)	86 (18.8)	1.50 (1.05-2.13)†	93 (29.9)	53 (28.5)	1.01 (0.52-1.95)
Family history of breast cancer						
No	838 (90.9)	406 (90.8)	1.00	283 (92.2)	166 (91.2)	1.00
Yes	84 (9.1)	41 (9.2)	0.99 (0.67-1.47)	24 (7.8)	16 (8.8)	0.88 (0.45-1.70)
Smoking status						
Never	506 (53.6)	211 (46.2)	1.00	183 (58.8)	100 (53.8)	1.00
Former	332 (35.1)	156 (34.1)	0.89 (0.69-1.14)	97 (31.2)	52 (27.9)	1.02 (0.67-1.55)
Current	107 (11.3)	90 (19.7)	0.50 (0.36-0.69)‡	31 (10.0)	34 (18.3)	0.50 (0.29-0.86)*

*P < 0.01.

†P < 0.05.

‡P < 0.0001.

of breast cancer (one or more first-degree relatives with breast cancer; no first-degree relatives with breast cancer), their use of hormone therapy (ever; never), time since last Pap test (<2; ≥2 years), and smoking status (never; former; current). Income level and community type were based on the woman's postal code of residence at the time of interview. Income quintile [from 1 (lowest) to 5 (highest)] was calculated using the Statistics Canada Postal Code Conversion File (34), which uses the postal code to determine quintile of annual income per person equivalent based on 2001 census summary data. Community type (urban; rural) was based on community size determined from residence postal code. A community size of <10,000 residents was defined as rural.

Statistical Analysis. Univariate logistic regression was used to examine associations among demographic characteristics, screening and other health practices, and knowledge and beliefs about breast cancer and screening to compliance to biennial screening for women screened at centers with and without nurses. Odds ratios (OR) with 95% confidence intervals (95% CI) were estimated separately for women screened at centers with

and without nurses. Screening behaviors, health practices, and knowledge and beliefs about breast cancer and screening were then adjusted by known factors associated with rescreening including age, marital status, country of birth, education, community type, income, and smoking status. Adjusted OR and 95% CI were calculated using multivariate logistic regression analysis. All "don't know" responses and refusals were excluded from the analyses. As unadjusted and adjusted ORs are similar, the tables present the adjusted analysis only. Analyses were conducted using SAS (35) and all reported P values are for two-sided alternatives.

Results

Of the 3,387 women sent questionnaires, 2,640 (77.9%) women were contacted and 1,901 (72.0%) of the contacted women were interviewed (Fig. 1). The response rate was higher for women attending nurse centers (74.9%) compared with women attending non-nurse centers (64.9%). However, for both types of centers, compliers were more likely to participate in the study

than noncompliers. Of the 645 noncompliers, 126 returned for their second OBSP screen later than 30 months (22 returned before 36 months and 104 by 36 months or later).

For women attending nurse centers, older age (between 60 and 69 years; OR, 1.43; 95% CI, 1.14-1.80) and being in the highest income quintile (OR, 1.50; 95% CI, 1.05-2.13) were significantly associated with compliance to biennial breast screening (Table 1). Women who were unmarried (OR, 0.71; 95% CI, 0.55-0.93), born in Asia (OR, 0.41; 95% CI, 0.18-0.92), or current smokers (OR, 0.50; 95% CI, 0.36-0.69) were significantly less likely to comply with biennial breast screening. Similar trends were seen in women attending non-nurse centers; however, only women who were current smokers were significantly less likely to comply (OR, 0.50; 95% CI, 0.29-0.86).

For screening behaviors and other health practices, women attending either nurse or non-nurse centers were significantly less likely to comply if they did not have a physical breast examination before attending the OBSP (OR, 0.44; 95% CI, 0.30-0.66 and OR, 0.32; 95% CI, 0.17-0.60, respectively), were not certain they would have a mammogram in the next 2 years (OR, 0.12; 95% CI, 0.07-0.22 and OR, 0.21; 95% CI, 0.09-0.50, respectively), or had their last Pap test ≥ 2 years ago (OR, 0.71; 95% CI, 0.57-0.90 and OR, 0.52; 95% CI, 0.35-0.78, respectively; Table 2). Women attending nurse centers were also significantly less likely to comply if they did not have a mammogram before their first OBSP visit (OR, 0.68; 95% CI, 0.54-0.87) and significantly more likely to comply if they had ever taken hormone

therapy (OR, 1.26; 95% CI, 1.00-1.58); although similar trends were seen in non-nurse centers, the associations were not significant.

For knowledge and beliefs of screening, women attending nurse centers were less likely to comply with biennial breast screening if they thought women should have a mammogram less often than once every 2 years (OR, 0.25; 95% CI, 0.15-0.44), thought women should stop receiving mammograms between ages 50 and 69 years (OR, 0.39; 95% CI, 0.19-0.79), or did not consider mammograms very likely to find cancer (OR, 0.73; 95% CI, 0.56-0.95; Table 3). They were significantly more likely to comply if they thought women should start having regular mammograms at ages < 50 years. For women attending non-nurse centers, women were significantly less likely to comply if they thought they should have a mammogram once every 3 years (OR, 0.34; 95% CI, 0.14-0.84); however, no association was found for questions on appropriate age for a regular mammogram or likelihood of a mammogram or physical breast examination to find cancer.

Women attending nurse centers were significantly less likely to comply if they considered their likelihood of getting breast cancer to be below average risk (OR, 0.69; 95% CI, 0.54-0.89) and significantly more likely to comply if they sometimes had thoughts or worries about developing breast cancer (OR, 1.40; 95% CI, 1.10-1.80). Women who did not find out anything more about breast cancer or screening since their first visit to the OBSP were significantly less likely to return in nurse centers (OR, 0.71; 95% CI, 0.56-0.90) and a similar trend was seen in non-nurse centers.

Table 2. Adjusted OR (95% CI) for compliance to biennial breast screening by screening behavior and other health practices

Screening behavior and other health practices	Nurse centers			Non-nurse centers		
	Compliers (n = 945)	Noncompliers (n = 459)	Adjusted* OR (95% CI)	Compliers (n = 311)	Noncompliers (n = 186)	Adjusted* OR (95% CI)
Physical breast examination before OBSP						
Yes	886 (94.0)	398 (87.3)	1.00	289 (93.5)	157 (84.9)	1.00
No	57 (6.0)	58 (12.7)	0.44 (0.30-0.66) [†]	20 (6.5)	28 (15.1)	0.32 (0.17-0.60) [†]
Mammogram before OBSP						
Yes	625 (67.2)	251 (56.4)	1.00	194 (63.0)	101 (55.2)	1.00
No	305 (32.8)	194 (43.6)	0.68 (0.54-0.87) [‡]	114 (37.0)	82 (44.8)	0.78 (0.53-1.15)
Breast self-examination after OBSP						
Yes	796 (84.2)	395 (86.2)	1.00	258 (83.0)	146 (78.5)	1.00
No	149 (15.8)	63 (13.8)	1.23 (0.89-1.71)	53 (17.0)	40 (21.5)	0.74 (0.46-1.18)
Have mammogram in next 2 y						
Certain	927 (98.4)	399 (88.1)	1.00	301 (97.4)	160 (88.4)	1.00
Not certain	15 (1.6)	54 (11.9)	0.12 (0.07-0.22) [†]	8 (2.6)	21 (11.6)	0.21 (0.09-0.50) [†]
No. visits for health advice [§]						
Less than once per year	304 (32.8)	136 (30.7)	1.00	78 (25.2)	56 (31.6)	1.00
2-3 times per year	346 (37.4)	147 (33.2)	1.06 (0.80-1.41)	116 (37.4)	64 (36.2)	1.28 (0.80-2.05)
≥ 4 times per year	276 (29.8)	160 (36.1)	0.81 (0.61-1.08)	116 (37.4)	57 (32.2)	1.53 (0.95-2.48)
Hormone therapy use						
Never	457 (48.4)	252 (55.2)	1.00	160 (51.4)	111 (59.7)	1.00
Ever	487 (51.6)	205 (44.8)	1.26 (1.00-1.58)	151 (48.6)	75 (40.3)	1.42 (0.97-2.08)
Last Pap test [¶]						
< 2 y ago	534 (57.4)	223 (49.7)	1.00	220 (72.3)	106 (58.6)	1.00
≥ 2 y ago	396 (42.6)	226 (50.3)	0.71 (0.57-0.90) [‡]	84 (27.7)	75 (41.4)	0.52 (0.35-0.78) [‡]

*Adjusted by age, marital status, country of birth, education, community type, income, and smoking status.

[†] $P < 0.0001$.

[‡] $P < 0.01$.

[§]35 women excluded from analysis who did not go for a health advice visit.

^{||} $P < 0.05$.

[¶]21 women excluded from analysis who never had a Pap test.

Table 3. Adjusted OR (95% CI) for compliance to biennial breast screening by knowledge and beliefs about breast cancer and screening

Knowledge and beliefs about breast cancer and screening	Nurse centers			Non-nurse centers		
	Compliers (n = 945)	Noncompliers (n = 459)	Adjusted* OR (95% CI)	Compliers (n = 311)	Noncompliers (n = 186)	Adjusted* OR (95% CI)
How often should women have mammogram						
Once every 2 y or once per year	901 (96.0)	386 (90.0)	1.00	290 (95.4)	159 (89.8)	1.00
More often (once every 6 mo)	13 (1.4)	6 (1.4)	1.11 (0.42-2.99)	5 (1.6)	6 (3.4)	0.49 (0.13-1.90)
Less often (once every 3 y)	24 (2.6)	37 (8.6)	0.25 (0.15-0.44) [†]	9 (3.0)	12 (6.8)	0.34 (0.14-0.84) [‡]
Age start regular mammograms						
50-59	167 (18.7)	107 (25.8)	1.00	66 (21.9)	33 (18.9)	1.00
40-49	416 (46.7)	182 (43.8)	1.59 (1.17-2.16) [§]	125 (41.5)	86 (49.1)	0.71 (0.43-1.18)
≤39	298 (34.6)	126 (30.4)	1.64 (1.18-2.27) [§]	110 (36.6)	51 (32.0)	0.96 (0.56-1.64)
Age stop regular mammograms						
>70	187 (22.2)	82 (21.0)	1.00	56 (20.7)	40 (24.7)	1.00
Younger (50-69)	17 (2.0)	21 (5.4)	0.39 (0.19-0.79) [§]	11 (4.1)	8 (4.9)	1.06 (0.38-2.97)
Never	640 (75.8)	287 (73.6)	1.03 (0.76-1.39)	203 (75.2)	114 (70.4)	1.32 (0.82-2.14)
Likelihood of mammogram finding cancer						
Very likely	731 (77.7)	326 (71.8)	1.00	227 (73.2)	130 (71.8)	1.00
Not at all, not very or somewhat likely	210 (22.3)	128 (28.2)	0.73 (0.56-0.95) [‡]	83 (26.8)	31 (28.2)	0.94 (0.62-1.43)
Likelihood of physical breast examination finding cancer						
Very likely	461 (49.0)	210 (46.0)	1.00	141 (45.8)	81 (44.7)	1.00
Not at all, not very, or somewhat likely	480 (51.0)	246 (54.0)	0.93 (0.74-1.17)	167 (54.2)	100 (55.3)	0.95 (0.65-1.38)
No. women who will get breast cancer						
1 in 9 or 1 in 10	337 (42.9)	158 (43.5)	1.00	86 (35.3)	57 (38.5)	1.00
Lower (1 in 25 or 1 in 50)	176 (22.4)	99 (27.3)	0.87 (0.63-1.19)	83 (34.0)	47 (31.8)	1.07 (0.63-1.81)
Higher (1 in 5)	272 (34.7)	106 (29.2)	1.25 (0.93-1.69)	75 (30.7)	44 (29.7)	1.22 (0.74-2.01)
Likelihood of getting breast cancer						
Same average risk	540 (58.6)	223 (50.7)	1.00	166 (56.5)	95 (53.4)	1.00
Below average risk	288 (31.3)	163 (37.0)	0.69 (0.54-0.89) [§]	94 (32.0)	64 (36.0)	0.80 (0.53-1.21)
Above average risk	93 (10.1)	54 (12.3)	0.75 (0.51-1.09)	34 (11.5)	19 (10.6)	1.03 (0.55-1.94)
Thoughts/worries about developing breast cancer						
Not at all or rarely	401 (42.4)	225 (49.1)	1.00	134 (43.1)	86 (46.2)	1.00
Sometimes	426 (45.1)	170 (37.1)	1.40 (1.10-1.80) [§]	138 (44.4)	73 (39.3)	1.16 (0.77-1.73)
Often/almost all the time	118 (12.5)	63 (13.8)	1.06 (0.74-1.50)	39 (12.5)	27 (14.5)	0.94 (0.53-1.67)
Found out anything about breast cancer/screening						
Yes	501 (53.6)	203 (45.0)	1.00	150 (49.3)	77 (41.4)	1.00
No	433 (46.4)	248 (55.0)	0.71 (0.56-0.90) [†]	154 (50.7)	109 (58.6)	0.77 (0.53-1.13)

*Adjusted by age, marital status, country of birth, education, community type, income, and smoking status.

[†]P < 0.0001.

[‡]P < 0.05.

[§]P < 0.01.

Believing a high-fat diet was not an important cause of breast cancer was the only risk factor significantly associated with noncompliance (OR, 0.59; 95% CI, 0.36-0.97) for women attending nurse centers (Table 4). Although not significant, women attending non-nurse centers were more likely to comply if they believed a family history of breast cancer was a risk factor for breast cancer.

Discussion

Women who had attended either nurse or non-nurse centers were more likely to comply if they had participated in breast screening before attending the OBSP, including having a previous clinical breast examination and/or mammogram. This finding is not surprising, as previous research has shown women who have had a prior or recent mammogram are more likely to attend rescreening as are women who regularly obtain a clinical breast examination (5, 10, 23). In addition, planning to have a mammogram appears to play a role in

screening behavior as women who were certain they would have another mammogram in 2 years were found to be more likely to return for a second screen. A recent study found similar results in that intention to attend a future screen was positively associated with likelihood of rescreening (11).

In our study, as in previous studies, women with positive health practices in all centers were more likely to comply with breast screening (5, 12, 14, 23, 24, 28, 31). In our study, women who had ever been on hormone therapy were more likely to comply with biennial screening in both nurse and non-nurse centers. This finding supports previous research that found that women using hormone therapy or those being prescribed hormone therapy in the last 2 years were more likely to attend rescreening than those women not using hormone therapy (5, 24, 28). It has been suggested that use of hormone therapy is an important factor given its association with regular visits to a physician, which in turn have been shown to influence reattendance (5, 24, 28). Women in nurse and non-nurse centers who had their last Pap test ≥ 2 years ago were also found to be

significantly less likely to comply with biennial screening. Our finding agrees with previous research that indicated that having a Pap test within the last 2 years was positively associated with repeat screening (14, 24, 28). Women at nurse and non-nurse centers who were current smokers at the time of our study were about half as likely to comply with breast screening within 2 years as women who had never smoked. This result concurs with previous studies that found that current or past smoking was associated with a decreased likelihood of rescreening (12, 23, 28, 31). The nurse does not seem to influence the relationship between positive health practices and compliance to biennial breast screening, as women in both nurse and non-nurse centers showed very similar associations. This finding is not unexpected as the nurse does not provide additional teaching in terms of other positive health practices.

In our study, knowledge about breast screening guidelines such as frequency and age women should start and stop screening was found to have an effect on compliance with biennial breast screening. Women in both nurse and non-nurse centers who thought they should have a mammogram less often than once every 3 years were significantly less likely to comply. Recent studies have also found that respondents who reported that women ages >50 years should be screened less frequently than annually were significantly less likely to attend screening as were respondents who incorrectly identified the appropriate interval between mammograms (31, 36). Interestingly, given the apparent influence of women's beliefs around the appropriate age to start and stop breast screening, only a small proportion

of women attending both nurse and non-nurse centers in our study were able to correctly identify the appropriate age to begin or stop regular screening. The interaction with the nurse may increase the importance of regular screening to women although not improve their knowledge on age-appropriate screening guidelines.

Qualitative research has shown that women who regularly participate in breast screening know the benefits of early detection and had trust in the screening process (25). Although women in nurse centers are receiving information on the importance of having a mammogram, about a quarter of the participants believed that a mammogram was not likely to find breast cancer and as a result were significantly less likely to comply. This finding indicates a need to ensure that all women attending breast screening programs obtain suitable information on the effectiveness of mammograms in preventing deaths from breast cancer and that currently mammograms are the most effective method available for finding breast cancer.

Women who felt they were at below average risk for getting breast cancer were less likely to comply in centers both with and without nurses. Low perceived susceptibility to breast cancer has been shown previously to be associated with not returning for a second screen (15, 16, 26). In a previous study, women who recognized the relationship between being ages ≥ 50 years and breast cancer risk had 1.7 times the odds of having had two or more mammograms (15). Awareness of the risk association between increasing age and cancer may help to reinforce the importance of breast screening among women ages 50 to 69 years.

Table 4. Adjusted OR (95% CI) for compliance to biennial breast screening by knowledge of risk factors associated with breast cancer

Knowledge of risk factors associated with breast cancer	Nurse centers			Non-nurse centers		
	Compliers (n = 945)	Noncompliers (n = 459)	Adjusted* OR (95% CI)	Compliers (n = 311)	Noncompliers (n = 186)	Adjusted* OR (95% CI)
High-fat diet						
Very important	350 (38.6)	166 (38.5)	1.00	122 (42.1)	75 (42.8)	1.00
Somewhat or moderately important	513 (56.6)	230 (53.2)	1.10 (0.86-1.41)	143 (49.3)	82 (46.9)	1.03 (0.68-1.54)
Not important	44 (4.8)	36 (8.3)	0.59 (0.36-0.97) [†]	25 (8.6)	18 (10.3)	0.88 (0.44-1.75)
Alcohol use						
Very important	156 (17.9)	85 (20.7)	1.00	52 (18.4)	32 (19.2)	1.00
Somewhat or moderately important	561 (64.2)	234 (57.1)	1.34 (0.99-1.83)	175 (61.8)	94 (56.3)	1.16 (0.68-1.96)
Not important	156 (17.9)	91 (22.2)	0.96 (0.66-1.39)	56 (19.8)	41 (24.5)	0.78 (0.42-1.43)
Lack of exercise						
Very important	296 (32.5)	151 (35.1)	1.00	92 (31.5)	55 (30.4)	1.00
Somewhat or moderately important	538 (59.1)	235 (54.5)	1.15 (0.89-1.48)	167 (57.2)	102 (56.3)	0.98 (0.64-1.50)
Not important	76 (8.4)	45 (10.4)	0.91 (0.59-1.40)	33 (11.3)	24 (13.3)	0.79 (0.42-1.50)
Stress						
Very important	384 (42.3)	193 (44.7)	1.00	134 (46.2)	68 (37.8)	1.00
Somewhat or moderately important	471 (52.0)	204 (47.2)	1.14 (0.89-1.45)	136 (46.9)	97 (53.9)	0.70 (0.47-1.05)
Not important	52 (5.7)	35 (8.1)	0.78 (0.48-1.25)	20 (6.9)	15 (8.3)	0.65 (0.30-1.38)
Hormone therapy use						
Very important	305 (35.5)	60 (41.0)	1.00	259 (85.2)	161 (88.5)	1.00
Somewhat or moderately important	517 (60.3)	205 (52.4)	1.19 (0.93-1.51)	34 (11.2)	16 (8.7)	0.77 (0.51-1.15)
Not important	36 (4.2)	26 (6.6)	0.83 (0.48-1.45)	11 (3.6)	5 (2.8)	1.05 (0.45-2.46)
Family history of breast cancer						
Very important	797 (85.4)	381 (84.6)	1.00	109 (40.7)	55 (36.0)	1.00
Somewhat or moderately important	121 (13.0)	56 (12.4)	0.97 (0.69-1.38)	139 (51.8)	88 (57.5)	1.34 (0.70-2.55)
Not important	15 (1.6)	13 (2.9)	0.61 (0.28-1.34)	20 (7.5)	10 (6.5)	1.40 (0.46-4.31)

*Adjusted by age, marital status, country of birth, education, community type, income, and smoking status.

[†] $P < 0.05$.

Women in nurse centers who reported sometimes having thoughts or worries about breast cancer were significantly more likely to comply with biennial screening, and a similar nonsignificant trend was seen in non-nurse centers. These findings are similar to the results of a meta-analysis that showed breast cancer worry has a small, consistent association with breast cancer screening behavior and that high levels of breast cancer worry are uncommon (37). In this study, <15% of women in all centers reported thoughts or worries about breast cancer often or all the time, and no risk effect on compliance was found in this group of women.

Our results showed that women who did not find out anything more about breast cancer or screening since their first visit to the OBSP were less likely to comply with biennial screening for both centers with and without nurses. Similar findings were found in another study where women who paid no attention to a variety of media sources such as television, radio, newspapers, or the Internet were less likely to return for screening (31). In our study, women were also more likely to comply with biennial breast screening if they felt a risk factor was somewhat or moderately important and less likely to comply if they felt the risk factor was not at all important. Interviews conducted with women who regularly participate in breast cancer screening indicated they had adequate knowledge of the risk factors for breast cancer (25).

The main limitation in this study is the smaller sample size for women attending non-nurse centers, which may have led to several of the factors not being significant, although the same trends in associations were seen as with the larger nurse center population. Another limitation is that we examined factors associated with compliance to biennial breast screening only within the OBSP and from the questionnaire data we know that 35 (5.4%) of the noncompliers indicated they returned for a second screen outside of the OBSP. Although this is an important consideration, the purpose of this study was to examine compliance within an organized screening program, which offers the essential components of recruitment and automatic recall. In addition, the percentage did not differ by type of screening center.

The results of this study suggest that previous participation in breast screening and positive health practices influence compliance to biennial screening regardless of whether a woman attended a nurse or non-nurse center. However, knowledge of breast screening recommendations and effectiveness of screening tests and beliefs about breast cancer risk were more likely to influence compliance to screening among women who attended centers with nurses compared with women who attended centers without nurses. Although women screened at nurse centers did not show a greater knowledge of breast screening or breast cancer, those that were informed were more likely to comply with biennial breast screening. Nurses may reinforce a woman's knowledge or beliefs about breast cancer and screening and consequently increase the effect of this information on their compliance to biennial screening.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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