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Adherence to breast and ovarian cancer screening recommendations for female relatives from the Ontario Site of the Breast Cancer Family Registry

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Abstract

Objective—This study compares adherence to breast and ovarian cancer screening recommendations among a population cohort of women at familial risk to breast and/or ovarian cancer.

Methods—This cross-sectional study included 1039 first-degree female relatives without breast cancer identified from the Ontario site of the Breast Cancer Family Registry. We compared breast and ovarian cancer screening behaviours, using a telephone-administered questionnaire, among three groups of women defined by their familial risk (high; moderate; low) to breast and/or ovarian cancer. Associations between screening behaviours and familial risk were assessed using multinomial regression models adjusted by familial clustering.

Results—Women 40 to 49 years of age at moderate or high familial risk were significantly more likely to have had a screening mammogram within the past 12 months (OR: 2.80; 95% CI: 1.40–5.58), and women less than 50 years of age were more likely to have a clinical breast examination (OR: 1.84; 95% CI: 1.02–3.31) compared to women at low familial risk. Compared to women at low or moderate familial risk, women at high familial risk were significantly more likely to have ever had a genetic test for the BRCA 1/2 genes (OR: 2.67; 95% CI: 1.76–4.05).

Conclusions—Although the overall level of adherence among higher risk women is sub-optimal in the community, women at a higher familial risk are adhering more often to cancer screening recommendations than women at a lower familial risk.

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Keywords

breast cancer; ovarian cancer; cancer screening; family history

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Introduction

Breast cancer is the most common malignancy amongst Ontario women with an estimated 8700 new diagnoses and 2100 deaths in 2009 [1]. Women with at least one affected first-degree relative are about twice as likely to develop breast cancer compared with women who have no affected relatives and risks are higher when more than one first-degree relative is affected or when the relative is younger at diagnosis [2, 3]. Furthermore, a woman with a first-degree relative diagnosed with ovarian cancer is twice as likely to develop breast cancer and women with a first-degree relative affected with breast cancer have over two times the risk of developing ovarian cancer compared to women with no affected relatives [4].

There is evidence that a significant reduction in breast cancer mortality can be achieved through mammography screening [5-7]. The Canadian Task Force on the Periodic Health Examination recommends screening for breast cancer by mammography and clinical breast examination (CBE) every 1 to 2 years for all women aged 50 to 69 [8]. Women with a moderate or high risk of familial breast cancer, determined by the number of first- or second-degree relatives with breast cancer and the age of those diagnoses, are recommended to undergo annual mammographic screening examinations starting at the age of 40 [9]. Additionally, these moderate and high familial risk women should receive annual CBE starting at age 40 and those younger than 40 should receive a CBE with each routine health examination. Only women at high familial risk are recommended for referral to familial cancer clinics for genetic testing. In Ontario, these examinations are freely available within the universal, publicly funded health care system.

In women under the age of 50, higher breast density and biologically more aggressive cancers may reduce the benefit of mammographic screening [10]. Ultrasound is more sensitive than mammography for screening women with dense breasts, and ultrasound may be particularly useful for the surveillance of young women at high risk [11, 12]. Women with a BRCA1 or BRCA2 mutation and women who have not undergone testing but are part of families suggestive of hereditary breast and/or ovarian cancer are recommended to have transvaginal ultrasounds and evaluation of Cancer Antigen-125 blood levels every 6 to 12 months beginning at the age of 25 to 35 for ovarian cancer screening [13].

Although the impact of breast screening on breast cancer mortality for women with a family history currently remains unknown, cancer detection rates an interim indicator of screening effectiveness have been shown to be greater in women with a family history compared to women without a family history [14-16]. Therefore, current breast screening recommendations for high risk women are based on these findings and on expert opinion [9]. Similarly, there is no clear evidence showing the effectiveness of ovarian cancer screening in women at high familial risk and recommendations are based on expert opinion [17].

Previous research has demonstrated that women with a first degree relative who has been diagnosed with breast cancer are more likely to start screening at an earlier age when compared to women without a family history [18]. However, few studies have evaluated adherence to breast and ovarian cancer screening guidelines and recommendations among women at familial risk. The majority of these studies examined women visiting genetic counseling clinics or women from BRCA1/2 mutation families and show relatively high

adherence (67-90%) to CBE and mammography screening recommendations [19-23] and low (10-20%) to high (> 70%) adherence for ovarian cancer screening recommendations [19-21]. The high-risk women in these studies may not be representative of women at familial risk in the general population with respect to their cancer screening behaviours. One study that has examined mammography in a population-based group of women found lower adherence with approximately 40% of women at familial risk receiving a mammogram in the last 11 months [24]. Another recent population study of women from multiple-case breast cancer families showed high adherence to mammography guidelines (74%) but relatively lower adherence to CBE guidelines (45%) [25]. The purpose of this study was to compare adherence to breast and ovarian cancer screening recommendations by level of familial risk among a population-cohort of Ontario women 20 to 71 years of age, who had at least one first-degree relative diagnosed with breast or ovarian cancer.

Methods

Study Population

This study identified a cohort of female relatives of incident cases of invasive breast cancer from the Ontario site of the Breast Cancer Family Registry (BCFR) funded by the United States National Cancer Institute. The details of the BCFR and the Ontario site of the BCFR have been previously described [26, 27]. Briefly, cases of invasive breast cancer (probands), pathologically confirmed, and diagnosed between 1996 and 1998 were identified from the Ontario Cancer Registry. Physicians were contacted to obtain permission to mail their patients a cancer *Family History Questionnaire (FHQ)*. Respondents meeting a defined set of family history criteria, and a random sample (25%) of those not meeting the criteria were asked to participate in the Ontario site of the BCFR. Of those eligible at this stage (N=2587), 1851 (72%) probands participated.

These probands were asked for address information and permission to contact specific living relatives (first-degree, those affected with breast, ovarian, or certain other cancers, and their first-degree relatives). An invitation letter to participate in the Ontario site of the BCFR was sent to relatives, and those who agreed to participate were mailed an *Epidemiology Questionnaire (EQ)* between 1998 and 2004. Our study was conducted a few years after the initial recruitment of relatives. In this study, we identified all female relatives enrolled in the Ontario site of the BCFR who had completed the EQ, were still alive and unaffected by breast cancer at the time of the proband's diagnosis, and were residents of Ontario. From the 3374 participating female relatives, we identified 2066 (61%) who were residents of Ontario and of these 1885 (91%) met the other study criteria.

Of the 1885 female relatives identified, 1514 women were between 20 to 69 years of age as of January 1st, 2006 and sent a *Personal History and Screening Questionnaire (PHSQ)* between November 2005 and March 2007. Of the women sent a questionnaire, 37 were ineligible (deceased, moved out of Ontario, or acquired dementia) and 177 could not be contacted. Of the 1300 eligible women contacted, 1108 (85.2%) consented to be interviewed. Further exclusions included 37 women who had a breast cancer diagnosis and 32 women who did not have a first-degree relative with breast and/or ovarian cancer. Thus, the final study cohort consisted of 1039 women. This study was approved by Mount Sinai Hospital and University Health Network Research Ethics Boards.

Data Collection

The women in this study were initially contacted by a mailed questionnaire during the recruitment of female relatives from the Ontario site of the BCFR between 1998 and 2004. Since several years had elapsed since initial recruitment a follow-up telephone-questionnaire

(*PHSQ*) was administered to update changes in health behaviours and key demographic characteristics and to collect detailed information on breast and ovarian cancer screening examinations that were not collected on the *EQ*.

Age at interview was calculated as the difference in years between the date of birth and the date of the *PHSQ* interview. Descriptive analyses employed age categories < 40, 40 – 49, 50 – 59, and ≥ 60, but regression models were adjusted using age as a continuous variable. Marital status (currently married/common law, not currently married/common law), the highest level of education attained (high school or less, some college, university, technical or vocational school, and Bachelor's degree or higher), the average annual frequency of visiting a health care professional in the past two years (once a year or less, 2 to 3 times a year, and 4 or more times a year), hormone therapy use in women over 50 years of age (current, former, never), and oral contraceptive use for women aged under 50 (former, current, never) was determined using responses to the *PHSQ*. Finally, body mass index (< 25, 25 to < 30, and ≥ 30) of the participants in kg/m² was derived from information on height (*EQ*) and weight (*PHSQ*).

The *PHSQ* asked women to give either the dates (month and year) of their last mammogram and clinical breast examination or their age at the time of last examination. Additionally, women were asked whether their breast examinations were for screening purposes (part of a regular check-up or due to a family history of breast cancer) or for non-screening purposes (examination due to a breast problem/symptom, follow-up of a previous breast problem or participation in a research study). The time since last breast examination and the reason for examination were combined into a single variable to characterize a participant's breast screening behaviour. Similar methods were used to characterize ovarian cancer screening behaviours (Trans-vaginal ultrasound (TVUS) or Cancer Antigen 125 (CA-125) blood test). The study participants were also asked how frequently they conducted breast self-examinations (BSE), whether they had ever had a breast ultrasound for either screening or non-screening purposes and whether they ever had a genetic test for the breast and ovarian cancer (BRCA1/2) susceptible genes. Classification of family history of breast and/or ovarian cancer was based on information collected from the *FHQ* completed by the relative's proband using a modified definition of previously referenced groups for familial breast cancer risk [28, 29]. Table 1 shows the criteria for classifying women to low, moderate or high familial risk to breast and/or ovarian cancer.

Statistical Analyses

Pearson chi-square tests assessed the association between familial risk (high vs low, moderate vs low, and high vs moderate) and each characteristic. Primary outcomes included screening for breast or ovarian cancer according to time since last screen. For breast cancer screening examinations (mammography, CBE, BSE, breast ultrasound), women with moderate and high familial risk were compared to women at low familial risk (referent). For mammographic screening, we stratified women by age (< 40 years; 40 to 49 years; ≥ 50 years) according to current recommendations. Additionally, stratified analyses by age (< 50 years; ≥ 50 years) were conducted for the other breast screening examinations. For ovarian cancer screening examinations (TVUS and CA-125 blood test) and genetic testing for the BRCA1/2 genes, women at high familial risk were compared to women at moderate and low familial risk (referent).

Screening outcomes were analyzed using multinomial regression models [30]. The comparison group was either never had a screening test or had a non-screening examination except for the analysis of BSE where the comparison group was 'once a year or less'. Since many study participants were related and might share common cancer screening behaviors, a robust variance estimate was used to adjust for potential correlation due to family clustering

[31, 32]. All statistical analyses were conducted using SAS version 9.1 [33], and significance was evaluated using two-sided *P*-values at the 5% level.

Results

The study participants included 1039 women from 647 unique families of which 398 (61.5%) had one family member, 160 (24.7%) had two family members, and 89 (13.8%) had three to 8 family members. Using our familial risk definition, 521 (50.1%) women had a low familial risk, 244 (23.5%) had a moderate familial-risk and 274 (26.4%) had a high familial risk. Women at moderate and high familial risk were more likely to be older than women at low familial risk and more likely to have less education (table 2). Also, women at high familial risk were more likely to visit health professionals yearly compared to women at moderate risk.

For women aged 40 to 49 years at moderate or high familial risk, 56.8% had a mammogram within the last 12 months (table 3). Compared to women at low familial risk, these women were statistically significantly more likely to have had a screening mammogram (OR: 2.80; 95% CI: 1.40-5.58). No significant difference in annual mammography was observed in women younger than 40 years of age or 50 years of age or older.

For women under the age of 50 at moderate or high familial risk, 58.5% had a CBE within the last 12 months (table 4). Additionally, 39.3% of these women practiced BSE once a month or more and 13.4% had a screening breast ultrasound. Compared to women at low familial risk, women less than 50 years of age who were at moderate or high familial risk were statistically significantly more likely to have had a screening clinical breast exam (OR: 1.84; 95% CI: 1.02-3.31) within the last 12 months or had a screening breast ultrasound (OR: 1.89; 95% CI: 1.03-3.48). There were no significant differences in these breast screening examinations for women 50 years of age or older. Frequency of breast self-examination was also not associated with familial breast cancer risk.

Of the women at high familial risk, 2.8% had received a trans-vaginal ultrasound and 3.3% had a CA-125 blood test in the last 12 months (table 5). Compared to women at low or moderate familial risk, women at high familial risk were statistically significantly more likely to have a screening trans-vaginal ultrasound (OR: 3.30; 95% CI: 1.60-6.82) or a CA-125 blood test (OR: 4.01; 95% CI: 1.29-12.43) more than 12 months ago. Women at high familial risk were also more likely to have a screening trans-vaginal ultrasound or a CA-125 blood test within 12 months, although associations were not significant. Women at high familial risk were statistically significantly more likely to have ever had a genetic test for the BRCA 1/2 genes (OR: 2.67; 95% CI: 1.76-4.05) compared to women at low or moderate familial risk.

Discussion

Overall, this study revealed that adherence to breast and ovarian cancer screening was low among a population cohort of first-degree female relatives. However, screening adherence was significantly higher among Ontario women who were recommended for early and more frequent screening based on their age and level of familial risk. Women under 50 years of age at moderate and high familial risk for breast cancer reported greater utilization of breast cancer screening compared to women at low familial risk and women of all ages at high familial risk reported greater utilization of ovarian cancer screening and genetic testing for the BRCA genes when compared to women at low or moderate familial risk.

Previous studies have typically found mammography utilization to be one and a half to three times greater among women with a first-degree relative diagnosed with breast cancer

compared to women without a family history of breast cancer [34-37]. Our study showed a near threefold increase for annual mammography among women 40 to 49 years of age at moderate or high familial risk compared to women at low familial risk. Adherence to breast screening examinations may have been greater in women with higher familial risk given they would have been more likely to receive physician recommendations to undergo screening. Two recent studies have found that a physician or health professional's recommendations were significantly associated with breast cancer screening adherence among women from BRCA1/2 families or multiple-case breast cancer families [23, 25]. Additionally, a recent meta-analysis reported that women with a family history of breast cancer were significantly more likely to perceive their risk of developing breast cancer as higher than other women and found a positive association between higher perceived risk and mammography screening [38]. A recent study of this cohort also found a positive association between higher perceived risk and mammography screening [39].

The overall level of mammography adherence was lower in our study for women at moderate or high familial risk when compared to previous studies. About 57% of women 40 to 49 years of age at moderate or high familial risk adhered to mammography recommendations. Other studies reported higher levels of mammography adherence (>70%) among women at high-risk under the age of 50 [20, 22]. However, these previous studies included women visiting clinics for genetic counseling and may have differed from ours that included women in the general population at familial risk. Mammography adherence in our study for all women at moderate or high familial risk (56%) was higher than the 40% reported by one population based study but lower than the 74% reported by another population based study for women at similar familial risk [24, 25].

Similar to mammography, annual CBE was significantly higher in women under 50 years of age at moderate or high familial risk compared to women at low familial risk, although there was only a near twofold increase. Additionally, the overall level of adherence to CBE recommendations among women under the age of 50 years (59%) was lower than that seen in previous studies among high risk women under the age of 50 (>85%) [20, 22]. As with mammography adherence, this difference in CBE adherence may be the result of previous studies including women from genetic counseling clinics and not the general population.

In our study, adherence to mammography (65%) and CBE (65%) recommendations was found to be higher in women at moderate or high familial risk over the age of 50. However, these breast screening examinations did not differ by familial risk. Although all women over 50 are recommended to have regular mammograms and CBE regardless of their level of familial risk [8], it was expected that older women at moderate or high familial risk would have been screened more often within the last 12 months. One explanation may be that physicians are recommending yearly breast screening for all women over the age of 50 with a first-degree relative with breast and/or ovarian cancer, even if their level of familial risk is low. Additionally, the frequency of performing breast self-examinations did not vary by familial risk or by age group in our study. This finding may be due to the release of BSE recommendations by the Canadian Task Force on Preventive Health Care in 2001 which reported that regular BSE conferred no benefit in terms of survival from breast cancer [40].

In our study women under the age of 50 at moderate and high familial risk were more likely to have had a screening breast ultrasound compared to women at low risk (13% vs. 7%), but this association was not found for women over the age of 50. Our observed association between breast ultrasound and familial risk only in women younger than 50 was expected as breast ultrasounds are generally recommended for younger women with denser breast tissue [11]. To our knowledge, there have been no population studies that have evaluated uptake of breast ultrasounds in women at familial risk to breast cancer.

A population-based study of women with at least one first-degree relative with ovarian cancer found that the likelihood of receiving a CA-125 test increased 2.6 times for each affected first-degree relative [41]. A similar increase in ovarian cancer screening was observed in our study for women at high familial risk compared to low or moderate familial risk. Similar to breast cancer screening examinations, women at high familial risk may be more likely to have ovarian screening examinations compared to women at low or moderate familial risk due to their increased perceived risk or an increased likelihood to receive recommendations by their physicians to undergo these screening tests. However, there is much less literature studying these factors for ovarian cancer screening adherence compared to mammography adherence. In our study only 2.8% and 3.3% of high familial risk women received a TVUS or CA-125 blood test within the past 12 months respectively, although 8-10% of these women had ever received one of these examinations. This level of adherence is lower than previous studies where adherence to ovarian screening examinations was around 10-20% in the past year [20, 21] and much lower than the 70% adherence level observed in a recent study [19]. Adherence to these examinations may be low due to our study analyzing a population-cohort of women instead of women referred to genetic counseling clinics or women from BRCA families.

Women at high familial risk were also much more likely to have ever had a genetic test for the BRCA genes. Our results concur with a previous study on women from BRCA mutation families that found that the odds of receiving a genetic test for the BRCA1/2 genes significantly increases by 1.6 for every first-degree relative affected with breast cancer [42]. Two studies reported the uptake of BRCA mutation testing to be approximately 50% for unaffected women with a first-degree relative with a BRCA mutation [43, 44]. In our study, 25.7% of women at high familial risk had ever received a genetic test for the BRCA genes. The difference in uptake rates found in our study compared to other studies in the literature is most likely due to the differences in the study populations.

This study is unique in that it compares cancer screening behaviours in women with at least one first-degree relative diagnosed with breast cancer at differing risks of familial breast cancer. Also, our study had a much larger sample than similar studies and participants were identified from a population-based cohort instead of from BRCA mutation families or women attending genetic counseling clinics [19-23].

Despite the strengths of our study, there were a few limitations. First, the study was cross-sectional in design and therefore could not establish a temporal relationship between familial breast cancer risk and cancer screening behaviours. Second, the data on family history of breast cancer was self-reported by the probands. However, studies have shown that patient-reported family cancer histories for first-degree relatives are accurate for breast cancer risk assessments, although accuracy is somewhat lower for second-degree relatives [45]. Third, misclassification may have also occurred through the use of self-reported data to measure cancer screening behaviours. Although self-reported mammography data has been found to be accurate for determining whether a woman has had a mammogram, self-reported data is less accurate in determining the time since last mammogram [46] and women tend to underestimate the time since their last mammogram resulting in an overestimation of recent mammography use [47, 48]. To estimate the magnitude of recall bias, self reported date of the last mammogram was validated against the woman's mammography report. Approximately, 92% of women self-reported the date of their last mammogram to within 12 months of the actual date abstracted from the report. Fourth, we did not compare utilization of breast Magnetic Resonance Imaging (MRI) examinations among familial risk groups due to the small number of women in the cohort (about 1%) who had these tests for screening purposes. Finally, the generalizability of our results to other populations may be limited by

differences in cancer screening recommendations and health care systems between jurisdictions.

The results of this study demonstrate that adherence to screening recommendations among a population cohort of Ontario women with at least one first-degree relative with breast and/or ovarian cancer is sub-optimal. We speculate that high risk women in the general population are less likely to be referred appropriately for screening surveillance as compared to those who have visited familial genetic counseling clinics. Although overall adherence was observed to be lower, women at a higher familial risk are adhering more often to breast and ovarian cancer screening recommendations than women at a lower familial risk.

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Table 1

Classification of familial risk to breast and/or ovarian cancer

Familial Risk Group	Family History of Breast and/or Ovarian Cancer
High	Two or more first-degree relatives with breast and/or ovarian cancer diagnosed at any age One or more first-degree relative(s) with both breast and ovarian cancer diagnosed at any age One or more first-degree relative(s) diagnosed with bilateral breast cancer at any age A personal history of ovarian cancer
Moderate	A self-reported Ashkenazi Jewish background One first-degree relative with breast cancer diagnosed before age of 40 One first-degree relative with ovarian cancer One first-degree relative with breast cancer diagnosed after the age of 40 and two or more second-degree relatives with breast cancer
Low	One first-degree relative diagnosed with breast cancer after the age of 40

Table 2

Demographic characteristics and health practices by familial risk for female relatives from the Ontario site of the Breast Cancer Family Registry

Characteristics and Health Practices	Familial Risk [n (%)]		
	Low (N = 521)	Moderate (N = 244)	High (N = 274)
Age at Interview ^{a b}			
< 40	175 (33.6)	43 (17.6)	27 (9.9)
40-49	154 (29.6)	90 (36.9)	58 (21.2)
50-59	114 (21.9)	59 (24.2)	121 (44.2)
≥ 60	78 (15.0)	52 (21.3)	68 (24.8)
Currently Married / Common Law			
No	111 (21.3)	43 (17.7)	51 (18.6)
Yes	410 (78.7)	200 (82.3)	223 (81.4)
Education Level ^{c d}			
High school or less	130 (25.0)	72 (29.6)	99 (36.1)
Some college, university or vocational/technical school	196 (37.6)	102 (42.0)	116 (42.3)
Bachelor's Degree or higher	195 (37.4)	69 (28.4)	59 (21.5)
Visits to Health Professionals ^e			
Once a year or less	188 (36.1)	97 (39.8)	77 (28.2)
2-3 times per year	200 (38.4)	100 (41.0)	118 (43.2)
4 or more times per year	133 (25.5)	47 (19.3)	78 (28.6)
Hormone Therapy Use, women ≥ 50			
Never	111 (57.8)	59 (53.2)	118 (62.4)
Former	58 (30.2)	35 (31.5)	53 (28.0)
Current	23 (12.0)	17 (15.3)	18 (9.5)
Hormone Contraceptive Use, women < 50			
Never	37 (11.3)	9 (6.8)	12 (14.1)
Former	239 (72.6)	109 (82.0)	66 (77.7)
Current	53 (16.1)	15 (11.3)	7 (8.2)
Body Mass Index			
< 25	252 (50.4)	123 (50.8)	130 (48.0)
25 - < 30	149 (29.8)	58 (24.0)	69 (25.5)
≥ 30	99 (19.8)	61 (25.2)	72 (26.6)

^a p < 0.001 for high vs. low familial risk

^b p < 0.001 for moderate vs. low familial risk

^c p < 0.001 for high vs. low familial risk

^d p < 0.05 for moderate vs. low familial risk

^e p < 0.01 for high vs. moderate familial risk

Table 3

Adjusted odds ratios (ORs) and 95% confidence intervals (95% CI) for the association between mammographic screening examinations and familial risk for female relatives from the Ontario Site of the Breast Cancer Family Registry

	Familial Risk [n (%)]		
Screening Examinations	Low (N = 521)	Moderate or High (N = 518)	OR ^a (95% CI)
Time since last mammogram ^{b c}			
All women			
Never had or non-screening mammogram	195 (39.2)	93 (19.0)	1.00
Screening mammogram, ≤ 12 months ago	180 (36.1)	272 (55.5)	1.90 (1.26-2.85) ^d
Screening mammogram, > 12 – 24 months ago	65 (13.1)	76 (15.5)	1.52 (0.93-2.47)
Screening mammogram, > 24 months ago	58 (11.7)	49 (10.0)	1.11 (0.67-1.83)
Women < 40 years			
Never had or non-screening mammogram	136 (82.4)	48 (73.9)	1.00
Screening mammogram, ≤ 12 months ago	11 (6.7)	8 (12.3)	1.95 (0.54-7.00)
Screening mammogram, > 12 – 24 months ago	10 (6.1)	5 (7.7)	1.21 (0.36-4.11)
Screening mammogram, > 24 months ago	8 (4.9)	4 (6.2)	1.23 (0.30-5.05)
Women 40-49 years			
Never had or non-screening mammogram	47 (31.8)	27 (19.4)	1.00
Screening mammogram, ≤ 12 months ago	54 (36.5)	79 (56.8)	2.80 (1.40-5.58) ^d
Screening mammogram, > 12 – 24 months ago	18 (12.2)	18 (13.0)	1.83 (0.75-4.49)
Screening mammogram, > 24 months ago	29 (19.6)	15 (10.8)	0.94 (0.38-2.31)
Women ≥ 50 years			
Never had or non-screening mammogram	12 (6.5)	18 (6.3)	1.00
Screening mammogram, ≤ 12 months ago	115 (62.2)	185 (64.7)	1.10 (0.49-2.49)
Screening mammogram, > 12 – 24 months ago	37 (20.0)	53 (18.5)	0.98 (0.40-2.40)
Screening mammogram, > 24 months ago	21 (11.4)	30 (10.5)	0.95 (0.37- 2.45)

^a Odds ratio compare women at moderate or high familial risk to women at low familial risk. Models adjusted for age at interview, education and number of health profession visits

^b Excludes women who stated they had a bilateral mastectomy (N = 6)

^c Excludes women for whom the reason for mammogram could not be ascertained (N = 24)

^d p < 0.01

Table 4

Adjusted odds ratios (ORs) and 95% confidence intervals (95% CI) for the association between other breast cancer screening examinations and familial risk for female relatives from the Ontario Site of the Breast Cancer Family Registry

Screening Examinations	Familial Risk [n (%)]		OR ^a (95% CI)
	Low (N = 521)	Moderate or High (N = 518)	
Time since last Clinical Breast Exam ^b			
All women			
Never had or Non-screening CBE	57 (11.3)	42 (8.4)	1.00
Screening CBE, ≤ 12 months ago	264 (52.2)	312 (62.3)	1.40 (0.90-2.16)
Screening CBE, > 12 – 24 months ago	115 (22.7)	87 (17.4)	0.95 (0.57-1.57)
Screening CBE, > 24 months ago	70 (13.8)	60 (12.0)	1.11 (0.64-1.92)
Women < 50 years			
Never had or Non-screening CBE	48 (15.1)	22 (10.6)	1.00
Screening CBE, ≤ 12 months ago	153 (48.3)	121 (58.5)	1.84 (1.02-3.31) ^c
Screening CBE, > 12 – 24 months ago	69 (21.8)	40 (19.3)	1.37 (0.69-2.72)
Screening CBE, > 24 months ago	47 (14.8)	24 (11.6)	1.18 (0.53-2.62)
Women ≥ 50 years			
Never had or Non-screening CBE	9 (4.8)	20 (6.8)	1.00
Screening CBE, ≤ 12 months ago	111 (58.7)	191 (65.0)	0.87 (0.38-2.02)
Screening CBE, > 12 – 24 months ago	46 (24.3)	47 (16.0)	0.53 (0.22-1.32)
Screening CBE, > 24 months ago	23 (12.2)	36 (12.2)	0.83 (0.31-2.21)
Frequency of Breast Self-Examination ^b			
All women			
Once a year or less	88 (17.1)	68 (13.4)	1.00
Every 2-6 months	228 (44.2)	227 (44.6)	1.22 (0.81-1.85)
Once a month or more	200 (38.8)	214 (42.0)	1.19 (0.78-1.83)
Women < 50 years			
Once a year or less	58 (17.8)	31 (14.5)	1.00
Every 2-6 months	149 (45.7)	99 (46.3)	1.12 (0.64-1.97)
Once a month or more	119 (36.5)	84 (39.3)	1.07 (0.60-1.93)
Women ≥ 50 years			
Once a year or less	30 (15.8)	37 (12.5)	1.00
Every 2-6 months	79 (41.6)	128 (43.4)	1.31 (0.71-2.39)
Once a month or more	81 (42.6)	130 (44.1)	1.26 (0.68-2.33)
Ever had a Breast Ultrasound ^b			
All Women			
No or Non-Screening breast ultrasound	478 (92.6)	451 (88.4)	1.00
Screening breast ultrasound	38 (7.4)	59 (11.6)	1.76 (1.09-2.84) ^c
Women < 50 years			
No or Non-Screening breast ultrasound	304 (93.0)	187 (86.6)	1.00

Screening Examinations	Familial Risk [n (%)]		OR ^a (95% CI)
	Low (N = 521)	Moderate or High (N = 518)	
<i>Screening breast ultrasound</i>	23 (7.0)	29 (13.4)	1.89 (1.03-3.48) ^c
<i>Women ≥ 50 years</i>			
<i>No or Non-Screening breast ultrasound</i>	174 (92.1)	264 (89.8)	1.00
<i>Screening breast ultrasound</i>	15 (7.9)	30 (10.2)	1.33 (0.66-2.70)

^a Odds ratio compare women at moderate or high familial risk to women at low familial risk. Models adjusted for age at interview, education and number of health profession visits

^b Excludes women who stated they had a bilateral mastectomy (N = 6)

^c $p < 0.05$

Table 5

Adjusted odds ratios (ORs) and 95% confidence intervals (95% CI) for the association between ovarian and genetic cancer screening and familial risk for female relatives from the Ontario Site from the Breast Cancer Family Registry

Screening Examinations	Familial Risk [n (%)]		
	Low or Moderate (N= 757)	High ^a (N = 282)	OR ^b (95% CI)
Last Trans-Vaginal Ultrasound ^c			
<i>Never</i>	528 (77.7)	187 (74.9)	1.00
<i>Non-screening test</i>	130 (19.1)	35 (14.2)	0.80 (0.49-1.28)
<i>Screening test, ≤ 12 months ago</i>	7 (1.0)	7 (2.8)	2.35 (0.74-7.45)
<i>Screening test, > 12 months ago</i>	15 (2.2)	20 (8.1)	3.30 (1.60-6.82) ^d
Last Cancer Antigen 125 Blood Test ^c			
<i>Never</i>	585 (94.5)	187 (87.8)	1.00
<i>Non-screening test</i>	21 (3.4)	9 (4.2)	1.07 (0.44-2.60)
<i>Screening test, ≤ 12 months ago</i>	7 (1.1)	7 (3.3)	2.57 (0.92-7.14)
<i>Screening test, > 12 months ago</i>	6 (1.0)	10 (4.7)	4.01 (1.29-12.43) ^e
Ever had a Genetic Test for BRCA Genes			
<i>No</i>	637 (89.5)	191 (74.3)	1.00
<i>Yes</i>	75 (10.5)	66 (25.7)	2.67 (1.76-4.05) ^d

^aFor the ovarian screening examinations, the high familial risk group included women who had a first-degree relative with ovarian cancer but no first-degree relatives with breast cancer (N=8)

^bOdds ratio compares women at high familial risk to women at moderate or low familial risk. Models adjusted for age at interview, education and number of health professional visits.

^cExcludes women who stated they had a bilateral oophorectomy (N = 82)

^dp < 0.001

^ep < 0.05