Women's Interest in Genetic Testing for Breast Cancer Risk: The Influence of Sociodemographics and Knowledge[1]

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Abstract

The objective of this study was to assess women's interest in genetic testing for breast cancer risk. Randomly selected samples of 761 women without breast cancer from the general population of British Columbia, Canada, and 260 women with breast cancer from the provincial cancer registry participated in a telephone survey that assessed interest in genetic testing for breast cancer risk, knowledge of hereditary breast cancer and genetic testing, and sociodemographics. Women with breast cancer did not possess superior knowledge of breast cancer genetics compared with women from the general population. Of the women with breast cancer, 30.8% reported interest in testing or had been tested, compared with 28.5% of women without breast cancer. Controlling for differences in age, education, personal history of breast cancer, and knowledge of genetics, women with at least one relative with breast cancer were 2.3 times more likely to express interest in genetic testing for breast cancer risk than those with no family history. There were significant interactions between breast cancer status and education and between age and knowledge of breast cancer genetics. Women without breast cancer and with a positive family history, who were between 20 and 40 years of age, were most likely to be interested in testing. The women with breast cancer who were interested in testing tended to be ~50 years of age, had a positive family history, and had more years of education. Women with a family history of breast cancer, well-educated women with breast cancer, and younger women, particularly those with knowledge of genetic testing, are important target audiences for community-based education on genetic testing for breast cancer risk.

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Introduction

Breast cancer is the most common cancer affecting Canadian women today, and the incidence has been rising steadily, albeit gradually, over the past decade. It was estimated recently that there would be 19,200 new cases of breast cancer in Canada in 2000 (1). Promotion of mammography screening and other breast health practices and public awareness campaigns have heightened women's concern about breast cancer (2). Consequently, women often seek information about their individual risk for breast cancer (3, 4). Genetic testing presents a new avenue for obtaining individualized risk information and has attracted the attention of increasing numbers of women, regardless of their risk profile. For example, women with a family history of breast cancer and those at relatively low risk alike often seek genetic testing information (5). The substantial personal (5) and economic costs associated with inappropriate test seeking (*i.e.*, by those with relatively low risk; Refs. 6, 7) highlight the urgent need for better understanding of the demographic factors that influence women's interest in genetic testing as a basis for developing targeted community educational strategies.

An emerging body of literature describes demographic factors that influence women's interest in genetic testing for breast cancer risk. The percentage of women interested in genetic testing is estimated to range from 43 to 89%, with interest being higher in younger women (2, 8, 9) and in those with a diagnosis of breast cancer (10). Studies of the association between family history of breast cancer and interest in genetic testing are equivocal. Some researchers have reported that interest in genetic testing is higher among those with a family history of breast cancer (11), others have reported lower levels of interest in individuals with a family history (12), and yet others have found no association between interest in genetic testing and a family history of breast or ovarian cancer (13).

There is also a lack of consensus on the relationship between educational attainment and interest in genetic testing, with some researchers reporting greater interest among those with more than high school education (12, 14) and others describing higher levels of interest among those whose years of education were less than or equal to high school completion (11, 13). In one study, no demographic variables, including age, educational level, marital status, presence of children, religion, or family income, were associated with interest in genetic testing (10).

Women with and without a diagnosis of breast cancer are reported to have poor or limited knowledge of the availability of genetic testing for breast cancer risk (15), the information provided by testing, and the implications of testing (16). Although in clinical settings it has been observed that knowledge

of genetic testing for breast cancer risk and its limitations may reduce interest in testing in high-risk individuals, a similar association has not been observed among women in the general public (8, 10, 13).

Although previous research provides important insights, the predominant use of relatively small, nonprobability samples and the variety of approaches used to assess interest in and knowledge of genetic testing make it difficult to draw conclusions. Researchers have tended to survey women with breast cancer or those with family histories of breast cancer. Few have studied probability samples of women from the general population, including those without breast cancer or positive family histories. Furthermore, limited research has been conducted to examine the combined effects of sociodemographic factors, family history of breast cancer, and women's knowledge of genetic testing for breast cancer risk on their interest in testing using multivariate techniques. These limitations have restricted the development of targeted community educational strategies related to genetic testing for breast cancer risk.

The purpose of the present study was to examine women's interest in genetic testing for breast cancer risk to provide a basis for the development of community educational programs. Specifically, we explored the following questions: (*a*) What proportion of women are interested in genetic testing for breast cancer risk? (*b*) Are there significant differences between women who have been diagnosed with breast cancer and those who have not with regard to interest in genetic testing for breast cancer risk? (*c*) Are knowledge of genetic testing and sociodemographic factors associated with women's interest in genetic testing for breast cancer risk? (*d*) What are the important gaps in women's knowledge of hereditary breast cancer risk and genetic testing?

Materials and Methods

Study Samples. Two random samples were included in this study, a sample of women from the general public who had not been diagnosed with breast cancer and a sample of women from a cancer registry who had been diagnosed with breast cancer. The 761 subjects in the former sample, selected via the Canada Survey Sampler (a software program that draws geographically stratified phone samples from the general population for random-digit dialing), participated in a telephone survey. The target population for the survey was all women 20–79 years of age, residing in the province of British Columbia, Canada, who had not received a diagnosis of breast cancer and who could be contacted by telephone. To obtain a sample of 750 women with 250 women in each of three age groups (20–39 years; 40–59 years; 60–79 years) that would provide a maximum margin of error of ± 3.8% for estimated proportions, 6918 household telephone numbers were generated. Recruitment continued for each of the age groups until the quotas were filled. Of the initial sampling frame of telephone numbers, 2006 eligible individuals were identified, and 761 participated, resulting in a 37.9% response rate. Women participating in this study tended to be better educated when compared with education levels reported in the 1996 census data for the province of British Columbia (75% *versus* 48% reporting at least some postsecondary education).

The target population of the other sample was all living women who had been diagnosed with invasive breast cancer between September 1, 1994 and September 1, 1998, treated for breast cancer by the provincial cancer agency, who were 20 years of age or older at the time of diagnosis, and remain residents of the province. Of the total population ($n = 5888$) meeting these criteria, a probability sample stratified on the basis of four age groups (20–39 years; 40–59 years; 60–79 years; and 80+ years) was selected from the provincial breast cancer registry. To obtain a sample of each age group using predicted response rates of 70% for the three youngest age groups and of 40% for women 80+ years and a maximum margin of error of ± 4.8% for estimated proportions, a sample of 653 women was randomly selected. Of these, 128 were excluded because physicians advised against contacting the women for the study or because these women were too ill to participate, were not English speaking, or had moved. A total of 260 of the remaining eligible women participated, resulting in a response rate of 49.5%. Respondents were significantly younger [mean, 57.8 years ± 1.9% (95% CI)[3]] at age of first breast cancer diagnosis than nonrespondents [mean, 65.3 years ± 2.2% (95% CI)]. A significant relationship between participation status and breast cancer stage ($\chi^2 = 8.4$; $P = 0.038$) was found with women in stages 1, 2, and 3 having similar participation rates and women with stage 4 breast cancer tending not to participate. It should be noted that women with stages 3 and 4 breast cancer represented <5% of the eligible sample.

Procedures. The survey instrument was developed using items from well-established questionnaires and standardized measures. The survey was pretested with 20 women (15 from the general public and 5 from the breast cancer registry) to ensure ease of question flow and overall comprehensibility. All respondents were interviewed over the telephone by trained female interviewers using computer-assisted telephone interviewing.

Awareness of breast cancer genes was assessed in the first question of the survey by asking respondents, "How much have you heard or read about breast cancer genes, that is, genes that put some women at a higher risk for breast cancer?" Response categories included "almost nothing, a little bit, a fair amount, and a lot."

Interest in genetic testing for breast cancer risk was measured near the beginning of the interview by asking respondents which statement described them best: "You are . . . not considering or haven't thought about genetic testing; are considering genetic testing; probably will have genetic testing; definitely will have genetic testing; or already have had genetic testing." (14, 17, 18). Responses were dichotomized into expressions of no interest *versus* expressions of all other levels of interest. An open-ended question was also included to determine women's reasons for being interested in genetic testing, and responses were subjected to content analysis.

To assess women's knowledge about hereditary breast cancer and genetic testing for breast cancer risk, a seven-item true-false scale was used. The scale included six breast cancer-related items based on the knowledge scale develop by the United States NIH Cancer Genetic Studies Consortium (19) and one item to assess women's knowledge of the availability of tests to detect breast cancer genes. Modifications were made to the phrasing of questions to minimize confusion associated with scientific terms (*e.g.*, mutations or alterations in genes) and to enhance comprehension of the questions by a lay audience. Although we acknowledge the phrasing may not reflect current scientific understanding in all instances, the wording reflects the way women in the general population commonly talk about *BCRA1* and *BRCA2* gene mutations or alterations (5).

[3] The abbreviation used is: CI, confidence interval.

Table 1 Demographic characteristics of the study samples

Characteristics	Study samples					
	General public without breast cancer (n = 756)			Women diagnosed with breast cancer (n = 260)		
	n	%[a]	95% CI	n	%[a]	95% CI
Age (yr)						
20–29	124	16.4	13.8–19.0	0		
30–39	185	24.4	21.3–27.5	4	1.5	0.6–2.4
40–49	167	22.0	19.0–25.0	45	17.4	14.7–20.1
50–59	115	15.2	12.6–17.8	66	25.5	22.4–28.6
60–69	89	11.7	9.4–14.0	65	25.1	22.0–28.6
70+	78	10.3	8.1–12.5	79	30.5	27.2–33.8
Total household income						
<$30,000	200	31.9	28.6–35.2	81	39.1	35.6–42.6
$30,000–$49,999	173	27.6	24.4–30.8	57	27.5	24.3–30.7
$50,000+	254	40.6	37.1–44.1	69	33.3	29.9–36.7
Occupation[b]						
Paid work	465	61.5	58.0–65.0	86	33.0	29.6–36.4
Unemployed	21	2.8	1.6–4.0	11	4.2	2.8–5.6
Retired	129	17.0	14.3–19.7	129	49.5	45.9–53.1
No paid work	214	28.4	25.2–31.6	40	15.5	12.9–18.1
Geographic location						
Rural	87	12.4	10.0–14.8	39	15.3	10.9–19.7
Urban	615	87.6	85.2–90.0	219	84.7	80.3–89.1
Family history of breast cancer						
None	557	76.0	73.0–79.0	154	60.2	56.7–63.7
At least 1 first- or second-degree relative	176	24.0	21.0–27.0	102	39.8	36.3–43.3
Mean	SD	Mean	95% CI	Mean	SD	95% CI
Mean age	45.6	15.6	44.5–46.7	62.1	12.5	60.6–63.6
Mean number of years of education	14.6	3.0	14.4–14.8	13.8	3.2	13.4–14.2

[a] Percentages are based on responses and do not incorporate missing data.
[b] Multiple responses for occupation causes the sum for the "percentage of cases" to be >100. "Unemployed" refers to those without paid work who are currently seeking employment. No paid work includes those who are homemakers, caring for family, volunteering, attending school, disabled, or on maternity leave.

One point was given for each correct answer. The survey also included questions concerning demographics and family history of breast cancer.

Statistical Analysis. Descriptive statistics were used to characterize the study samples and to describe the study variables. Weighting factors for women from the general public were calculated based on 1996 age-stratified population distributions of women living in the study region (1996 Canadian Census Profile Tables) to accommodate over- and undersampling. For the sample of women with breast cancer, the study region's 1996 cancer registry statistics for age at breast cancer diagnosis were used to determine the weighting factors. The weighting factors were standardized such that the weighted number of cases equaled the sample size; consequently, the tests of statistical significance were neither inflated nor deflated. Ninety-five % confidence intervals were calculated for each sample's point estimates. We highlight instances where the confidence intervals do not overlap.

The two samples were combined to evaluate the influence of knowledge, family history, and sociodemographic factors on interest in genetic testing for breast cancer risk using multiple logistic regression analysis. Personal history of breast cancer (only those from the cancer registry had a diagnosis of breast cancer), age (deciles), years of education, family history of breast cancer (at least one primary or secondary relative with breast cancer), knowledge of genetic testing (continuous variable), and all theoretically plausible two-way interactions were entered as predictor variables in one block. Using backwards deletion, interaction variables that did not contribute significantly to the regression model were removed one at a time. Model fit was assessed with the Hosmer-Lemeshow goodness-of-fit statistic (20). Adjusted odds ratios and 95% CIs were estimated for each predictor.

Results

Demographic and Personal Characteristics. Women in the general public averaged 45.6 years of age [±1.1 years (95% CI)] and had 14.6 years of education [± 0.2 years (95% CI); Table 1]. The majority of these women were involved in paid work [61.5% ± 3.5% (95% CI)]. Twenty-four % [±3.0% (95% CI)] reported at least one first- or second-degree relative with breast cancer. The women with breast cancer were significantly older than the women in the general public [mean, 62.1 years ± 1.5 years (95% CI)], and the majority was retired [49.5% ± 3.6% (95% CI)]. They had, on average, 13.8 years of education [±0.4 years (95% CI)], and 39.8% [±3.5% (95% CI)] reported at least one first- or second-degree relative with breast cancer. The majority of both samples resided in urban settings.

Awareness of Breast Cancer Genes. There were no statistically significant differences in awareness of breast cancer genes between the two samples. About one in five [18.1% ± 2.7% (95% CI)] women without breast cancer and 16.9% [±4.6% (95% CI)] of women with breast cancer reported having heard or read almost nothing about breast cancer genes. The largest proportion of women without breast cancer had read or heard "a little bit" [47.2% ± 3.6% (95% CI)], as had 47.3% [±6.1% (95% CI)] of the women with breast cancer. The remaining women in both samples had either read or heard a "fair amount" or "a lot" about the "breast cancer genes."

Knowledge Related to Genetic Testing. The percentage of participants responding correctly to each knowledge question

Table 2 Descriptive statistics for knowledge measure

True or false questions	% of participants responding correctly (95% CI)	
	Women in general public	Women with breast cancer
1. A father can pass down a breast cancer gene to his daughters (T).	37.7 (34.3–41.2)	36.9 (31.0–42.8)
2. Breast cancer genes cause about one-half of all breast cancers (F).	22.4 (19.4–25.4)	33.8 (28.1–39.6)
3. A woman who does not have a breast cancer gene can still get breast cancer (T).	89.8 (87.6–92.0)	86.9 (82.8–91.0)
4. About 1 in 10 women has a breast cancer gene (F).	13.5 (11.1–15.9)	18.5 (13.8–23.2)
5. All women who have a breast cancer gene will get breast cancer (F).	87.8 (85.5–90.1)	85.4 (81.1–90.0)
6. A woman who has a sister with a breast cancer gene has a 50% chance of having the gene herself (T).	82.0 (79.3–84.7)	83.5 (79.0–88.0)
7. There are tests currently available to detect breast cancer genes (T).	75.3 (72.2–78.4)	78.5 (73.5–83.5)

	Mean	SD	95% CI	Mean	SD	95% CI
Mean summated knowledge score (range, 0–7)	4.1	1.1	4.0–4.2	4.2	1.3	4.1–4.4

Table 3 Interest in genetic testing by age of diagnosis/age

Breast cancer and age (yr)[a]	Percentage of women interested in genetic testing (95% CI)
No (n = 752)	
<50	31.4 (27.2–35.6)
50+	23.0 (18.1–27.9)
Yes (n = 248)	
<50	60.4 (46.6–74.2)
50+	23.5 (17.6–29.4)

[a] No breast cancer, age classified using age at time of survey; breast cancer, age classified using age at first diagnosis of breast cancer.

Table 4 Multiple logistic regression model predicting interest in genetic testing[a]

	Odds ratio	95% CI
Age (in deciles)	1.03	0.74–1.43
Years of education	0.90	0.85–0.96
Family history of BC[b]		
At least one first- or second-degree relative with BC	2.34	1.71–3.21
No family history	1.0	(Referent)
Personal history of BC		
Yes	0.11	0.02–0.52
No	1.0	(Referent)
Knowledge of GT	1.63	1.07–2.48
Age by knowledge interaction	0.92	0.84–0.99
Personal history of BC by education interaction	1.21	1.09–1.35

[a] Final model: −2 log likelihood: 1083.34; χ^2 (7 df) = 80.00, $P < 0.01$. Hosmer-Lemeshow goodness-of-fit test, 6.37, $P = 0.61$.
[b] BC, breast cancer.

ranged from 13.5% [±2.4% (95% CI)] to 89.8% [±2.2% (95% CI); Table 2]. No significant differences were found in summated knowledge scores between women with and without breast cancer. The average summated knowledge scores were 4.2 [±0.2 (95% CI)] and 4.1 [± 0.1 (95% CI)] for women with and without breast cancer, respectively. Regardless of their breast cancer status, almost two-thirds of the women did not know that one's paternal family history of breast cancer is important. More than two-thirds lacked knowledge about the prevalence of inherited genetic mutations and their role in breast cancer. For the most part, women with breast cancer did not express superior knowledge of breast cancer genetic testing.

Interest in Genetic Testing. When asked about their interest in genetic testing for breast cancer risk, 30.8% [± 5.7% (95% CI)] of the women with breast cancer and 28.5% [± 3.2% (95% CI)] of the women without breast cancer reported that they had considered testing, would probably/definitely have testing, or had already obtained testing. When age (<50 years *versus* 50+ years) was considered in addition to breast cancer status, the highest proportion of reported interest in genetic testing was by women with breast cancer <50 years when compared with all other groups (Table 3).

The results of the multiple logistic regression analysis to identify the association between knowledge and sociodemographic variables and interest in genetic testing are shown in Table 4. Personal history of breast cancer, family history of breast cancer, years of education, and knowledge of genetic testing were associated with women's interest. Controlling for other variables, women with breast cancer were 89% less likely to be interested in genetic testing than women without breast cancer. Women with at least one first- or second-degree relative with breast cancer were 2.4 times more likely to express interest in genetic testing than those with no reported family history.

Significant interactions in the model included breast cancer status by education and knowledge of genetic testing by age. The first interaction indicates that the influence of education on interest in genetic testing varies with personal history of breast cancer (Fig. 1). Among women who have 1–11 years of education (*i.e.*, less than high school), the probability of expressing interest in genetic testing is lower for women with breast cancer than for women without breast cancer. Among higher educated (14+ years) women, the effect is reversed, with the probability of interest in genetic testing being higher among women with breast cancer compared with those without.

The second interaction indicates that the influence of age on interest in genetic testing varies with knowledge of genetic testing (Fig. 2). Among women with low knowledge scores (0–3), the probability of expressing interest in genetic testing is highest among those 20–29 years of age and remained fairly stable in women >30 years of age. Among women who were more knowledgeable about genetic testing (scores 4–7), interest in genetic testing declined steadily with increasing age. The greatest differences between more knowledgeable and less knowledgeable women appeared at either end of the age continuum, with knowledgeable women <59 years expressing the greatest interest in genetic testing and knowledgeable women >60 years expressing the least interest in genetic testing.

Reasons for Interest in Genetic Testing. The two most frequently cited reasons for being interested in genetic testing, provided by women with breast cancer, were "curiosity" and

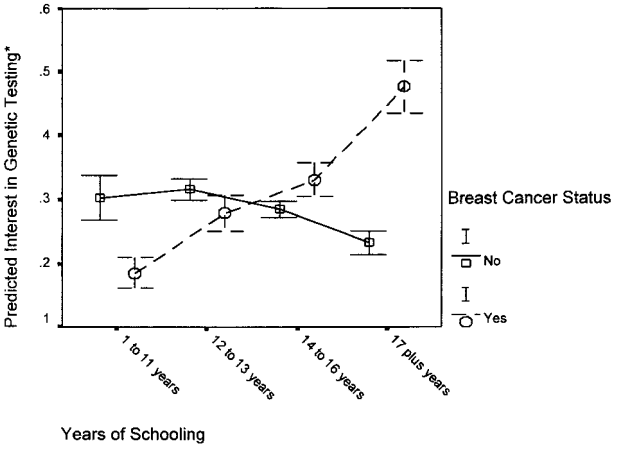

Fig. 1. Interaction between personal history of breast cancer and education and their association with interest in genetic testing.

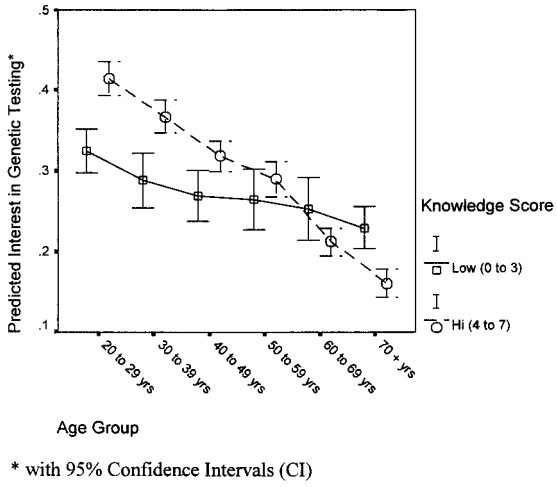

Fig. 2. Interaction between knowledge of genetic testing and age and their association with interest in genetic testing.

"to warn the family," accounting for >60% of their responses. "To take preventive action" and "to achieve peace of mind" or "to reduce worry" were the next most frequently reported reasons for being interested in genetic testing. Women without breast cancer reported similar reasons. The most frequently given reasons for testing in this group were "curiosity" and "to take preventive action" (>60%). "Peace of mind" or "reduced worry" and "to warn the family" were the next most frequent reasons given.

Discussion

Because the study was conducted in a Canadian context, the findings may not be generalizable to other jurisdictions, particularly those with different systems of health care provision. The results also need to be considered in light of the following limitations. It is well recognized that expressions of interest in genetic testing do not reflect actual participation rates. This is attributable to a number of factors, including the availability of testing, cost, and other real or perceived barriers to accessing testing (8). Levels of interest in genetic testing for breast cancer risk, however, provide some useful indicators of public awareness of testing and the potential demand for information about testing. Our measure of knowledge of genetic testing was based on seven items that have been used in other surveys (19, 21). Each item represents an important aspect of genetic testing for breast cancer risk; however, there are other areas of knowledge that were not assessed. Although it should be recognized that some responses to true/false items might reflect guesses rather than actual knowledge, our results are similar to others (19, 21). Finally, although our response rates were <50%, this is not unexpected in telephone surveys. The participation rates in the two study groups were considerably higher than another Canadian telephone survey on cancer genetics using similar methods (22). Nevertheless nonresponse biases cannot be entirely ruled out. Comparisons between nonresponders and responders suggest that the findings may have limited generalizability to less educated women and those with advanced breast cancer.

Despite media attention and increasing availability of information about genetic testing, the level of awareness about breast cancer genes observed in the study samples was relatively low. The proportion of women who reported some awareness of breast cancer genes is similar to that found by others (12, 21). Consistent with moderately low levels of awareness, women demonstrated limited knowledge of genetic testing, regardless of their breast cancer status. Although most women appeared to understand that not all breast cancer is caused by inherited gene mutations, that breast cancer gene mutations are not 100% penetrant, and that a woman's chance of carrying the breast cancer gene is 50% if her sister is a carrier, their lack of knowledge of the prevalence of breast cancer genes and the incidence of hereditary breast cancer is striking. Researchers have reported similar results from surveys of women seeking medical services (13) and women at high risk for breast or ovarian cancer (19, 21). Knowledge of the importance of paternal family history of breast cancer was particularly low in our study samples. In comparison, 48–75% correct response rates to this item have been reported in United States studies (13, 19, 21).

The reasons women gave for being interested in genetic testing for breast cancer risk indicate a lack of understanding about the limitations and implications of genetic testing. The primary reasons given for wanting genetic testing by women in this study are similar to those reported in other studies (2, 11, 17), with one exception. Unlike other studies, wanting to know their status or simple curiosity was the most frequently cited reason for being interested in genetic testing for both women with and without breast cancer. This finding reflects women's interest in obtaining categorical (will get the disease or not) rather than probabilistic information about their risk for breast cancer and their unrealistic expectations of what genetic testing for breast cancer risk can provide (5). Women's desire for categorical information may also be a function of the difficulty the general public has in understanding probabilistic risk information.

Critical gaps in knowledge essential to understanding hereditary breast cancer and genetic testing appear to persist and point to the need for better educational strategies. Understanding the role of hereditary breast cancer in relation to other risk factors and the limitations of genetic testing (*e.g.*, the potential for inconclusive results) are important not only to those most likely to be eligible for genetic testing but also for those at low or moderate risk for hereditary breast cancer who express an

interest in testing. This information may help women of low or moderate risk understand why they do not need genetic testing.

Levels of interest in genetic testing for breast cancer risk observed in this study are considerably lower than those reported in the United States and in other regions in Canada. Only one United States study conducted in 1998 reported rates of interest in genetic testing for breast cancer <50%, and this was limited to women who were >60 years of age (2). The only published Canadian study examining interest in genetic testing for breast cancer risk reported that 72% of women diagnosed with breast cancer before the age of 50 years were interested in genetic testing as were 46% of women without breast cancer (18–50 years of age; Ref. 10). Compared with these studies, the rates of interest in genetic testing in this study come closer to reflecting the actual demand for genetic testing (23). These comparably low rates of interest in genetic testing for breast cancer risk may be a reflection of the relatively low levels of awareness of this testing, demonstrated in our samples, that could be linked with the minimal use of direct advertising of genetic services in Canada and the limited availability of testing in the study region.

An important but not surprising finding is that after controlling for the effects of age, education, breast cancer status, and knowledge of genetic testing, women with at least one first- or second-degree relative with breast cancer are more likely to express an interest in genetic testing than women without a positive history. This may in part be a reflection of the profound influence of family experiences with breast cancer on risk perceptions and the level of anxiety this generates (24, 25). That interest in genetic testing among women who have breast cancer steadily increases with educational attainment has not been reported previously. Given that increasing levels of educational attainment are likely to positively influence women's ability to comprehend factors associated with hereditary breast cancer and assess the relevance of genetic testing for themselves or their families, it is possible that interest levels in this group may translate into higher levels of actual requests for genetic counseling and testing. Although this study did not consider psychosocial factors that may influence interest in genetic testing (*e.g.,* psychological distress, perceptions of risk), our examination of demographic variables demonstrates the usefulness of this readily available information to direct the development of community education strategies related to genetic testing for breast cancer risk.

The findings revealed that interest in genetic testing among those with more knowledge of genetic testing declines steadily with advancing age, whereas more modest declines are demonstrated among those with low levels of knowledge. Younger women's interest in testing may reflect the perceived implications of a breast cancer diagnosis during mid-life as well as better understanding of genetics because of exposure to developments in science and genetics during their formal education. The combined effect of knowledge of genetic testing and age, however, suggests that women with more knowledge of genetic testing have a better understanding of hereditary breast cancer and its association with premenopausal cancer.

The results of this study provide important directions for the development of educational strategies that should accompany increases in public awareness and the availability of genetic testing. Broad-based community education strategies are required to address interest in genetic testing for breast cancer risk among women in the general public as well as among those with breast cancer to facilitate informed decision-making. Critical gaps in knowledge of genetic testing and hereditary breast cancer risk identified in this study can provide a focus for these educational strategies. The broader implications of genetic testing (*e.g.,* potential for discrimination and barriers to reasonable life insurance) should also be addressed. Educational strategies should be targeted toward those who appear to be most interested in genetic testing for breast cancer risk, including women with a family history of breast cancer, well-educated women with breast cancer, and younger women, particularly those with some knowledge of genetic testing. Developing understandable and practical educational materials will ensure their accessibility to a broad range of audiences, including those women who may be candidates for genetic testing for hereditary breast cancer risk but who are not yet aware of its availability.

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