Family History of Cancer and Its Association With Breast Cancer Risk Perception and Repeat Mammography

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Objectives. We examined the strength of association between family history of breast cancer and family history of other cancers with breast cancer risk perception and repeat mammography.

Methods. The sample included 6706 women, aged 46 to 74 years, with no breast cancer history. Multinomial logistic regression assessed the association between family history of cancer and breast cancer risk perception. Structural equation modeling estimated the relationship between family history of cancer and repeat mammography.

Results. Breast cancer risk perception was strongly associated with family history of breast cancer in the mother or mother and sister (odds ratio [OR] = 32.15; $P < .001$); family history of breast cancer in the sister, daughter, or male first-degree relative (OR = 6.6–8.4; $P < .001$); and maternal history of other cancers (OR = 1.38–2.73; $P < .001$). For repeat mammography, women with maternal history of breast cancer had a mean increase of 0.50 more mammograms in the past 6 years compared with women without maternal history of breast cancer ($P < .001$).

Conclusions. Breast cancer risk perception was associated with the type of cancer found in first-degree relatives and with the person's relationship to the family member with cancer. Family history of breast cancer affected repeat mammography behavior. (*Am J Public Health.* 2012;102:2322–2329. doi:10.2105/AJPH.2012.300786)

Estimated to be diagnosed in 1 of every 8 women in their lifetime, breast cancer continues to present a public health concern.[1] Secondary prevention in the form of screening mammography has been shown to be the most effective population-wide approach to reducing the morbidity and mortality associated with breast cancer,[2–7] and studies indicate that each year of delay between screening mammograms decreases the life-sparing potential of screening by approximately 33%.[2,4–7]

Lower breast cancer morbidity and mortality are associated with repeat mammography. Because delays between screenings can affect the efficacy of mammography screening programs, it becomes important to understand the overall pattern of women's mammography use—the question is not only whether a woman had a mammogram, nor when was her last mammogram, but rather, has she been having mammograms at regular intervals since she was eligible for routine screening? Has she established a behavioral pattern of repeat mammography?

Studies on repeat mammography, using medical records, have shown that the majority of eligible women are not screened annually. In one of the largest studies of its kind, Blanchard et al.[2] found that over a 10-year period only 6% of women received all annual mammograms. The mean number of mammograms was 5.06, consistent with the new United States Preventive Service Task Force recommendations, but half that of most screening guidelines at the time of the study.[2,8] When these results were stratified by age, race/ethnicity, zip code, income, language, insurance status, previous screening use, and medical history, no grouping of women showed a propensity toward repeat annual screening.[2] These results were echoed in 2 other studies using medical records to ascertain levels of repeat mammography over a minimum of 5 years: 16% in women aged 50 to 74 years enrolled in a health maintenance organization in Michigan[9] and 30% in women aged 65 years and older enrolled in the California Fee-for-Service Medicare plan[10] received 5 mammograms in a 5-year period.

In attempting to increase participation in a health behavior (in this case, mammography), health behavior theorists often include the concept of risk perception or constructs related to risk perception in their frameworks. Because risk perception is a subjective judgment made at an individual level regarding the characteristics and severity of a risk, the framework of this research relies on both a psychological and public health approach. The psychological (individual) approach is based on early psychometric research by Tversky and Kahneman,[11] who identified heuristics that individuals rely on when making judgments of the comparative risk of an event, including availability (events that are easily brought to mind), anchoring (anchoring the known information to the unknown), and threshold effect (determining how much of a risk reduction is worthwhile). The public health approach relies on the concept of risk perception or susceptibility found in multiple health behavior models, including, but not limited to, the health belief model,[12] protection motivation theory,[13] the self-regulation model,[14] the theory of reasoned action,[15] the theory of planned behavior,[16] and expected utility theory.[17]

Multiple studies indicate that family history of breast cancer is the risk factor that women base their own risk perception on.[18–20] However, breast cancers resulting from familial or genetic predisposition are thought to account for only 15% to 20% of all diagnosed cases; this means that 80% to 85% of breast cancers are occurring in women with no family history of the disease. Overreliance on family history of breast cancer to determine one's own breast cancer risk may skew not only breast cancer risk perception, but may also affect rates of repeat mammography screening.

Given the importance that women place on family history of breast cancer, the aim of this research was to determine the strength of the relationship between family history of breast cancer and family history of cancer other than breast cancer to perceived risk of developing cancer and to repeat mammography. It was hypothesized that differences in risk perception were associated with a family history of breast cancer, and that a family history of breast cancer predicted increased repeat mammography. The results might serve to elucidate the role family history of cancer plays in secondary prevention of breast cancer.

METHODS

The data source was the 2005 National Health Interview Survey (NHIS), a cross-sectional, self-report, nationally representative survey of the non-institutionalized US population. The data are weighted to census population estimates, and include oversampling of Black and Hispanic persons to improve the reliability of estimates. In 2005, the response rate for the Sample Adult component of the survey, from which the data for this research were drawn, was 69.0%.[21]

The study sample (n = 6706) were women between the ages of 46 and 74 years, with no personal history of breast cancer, who self-identified as non-Hispanic White, non-Hispanic Black, and Hispanic. The lower limit of the age range of selected individuals was 46 years, allowing for the possibility of an established pattern of 6 annual mammograms from the earliest recommended age for beginning routine mammograms (40 years) as per the United States Preventive Service Task Force recommendations at the time of the survey. The upper limit of 74 years was selected because of the possibility of competing comorbidities for women aged 75 years and older.

Measures

Family history of cancer. Family history of cancer was divided into 2 mutually exclusive categories: family history of breast cancer and family history of any cancer other than breast cancer. Family history of other cancer was divided into 6 categories: no cancer history, and cancer diagnosed in son or brother, father, daughter, sister, and mother. Because of small sample sizes of participants with a family history of breast cancer, family history of breast cancer was coded to 3 categories: no family history of breast cancer; sister, daughter, or any first-degree male relative (father, brother, son); and mother or mother and sister. The response categories of "mother and sister," "mother," and "sister" are mutually exclusive.

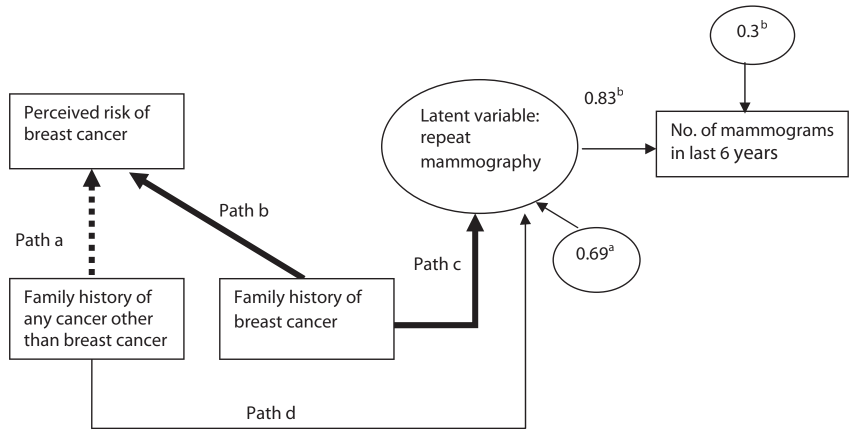
Breast cancer risk perception. Perceived risk of breast cancer was measured by the following question: "Compared to the average women your age, would you say that you are more likely to get breast cancer, less likely, or about as likely?" Response categories were categorized as less likely, about as likely, and more likely.

Repeat mammography. Repeat mammography was measured by the question: "How many mammograms have you had in the last 6 years?" Responses were coded as a count variable, ranging from 0 to 13+.

Covariates. The following covariates, commonly associated with mammography use, were included in the models. Race/ethnicity, self-reported by the participants and recoded by the NHIS into commonly used racial/ethnic categories, was categorized as non-Hispanic White, non-Hispanic Black, and Hispanic. Country of birth or nativity was categorized as US-born and not US-born. Age was treated in the analyses as a continuous variable, although reported in the demographic tables as 46 to 49, 50 to 54, 55 to 59, 60 to 64, 65 to 69, and 70 to 74 years. As with age, education was treated in the analyses as a continuous variable, although reported in the demographic tables as less than high school, high school graduate, some college, bachelor's degree, and postgraduate. Geographic region was categorized as Northeast, Midwest, South, and West.

Income was defined as total combined family income from all sources and was imputed by the NHIS because of the large amount of missing data generally associated with the variable. The imputation was run as a sequential regression multivariate imputation algorithm, using 60 predictors.[22] Five NHIS imputed income files were used in the analysis and categorized as $0 to $4999, $5000 to $9999, $10 000 to $14 999, $15 000 to $19 999, $20 000 to $24 999, $25 000 to $34 999, $35 000 to $44 999, $45 000 to $54 999, $55 00 to –$64 999, $65 000 to $74 999, and $75 000 or greater.

Insurance type was created by combining participant responses to a series of questions regarding insurance coverage (yes or no) and categorized as private insurance, Medicare, other government insurance, and no insurance.



Note. Emphasized lines indicate statistical significance found; dotted line indicates statistical significance found for selected family members. Paths a and b covariates not shown but included in the model were age, income, race/ethnicity, education, nativity, and geographic region. Paths c and d covariates not shown but included in the model were age, income, race/ethnicity, education, nativity, geographic region, insurance status, physician recommendation, no care because of cost, delayed care because of cost, and system barriers.
[a]The model is just identified and accounts for 31% of the variance in repeat mammography.
[b]For every 1 standard score that the latent variable of frequency of mammograms changes, the observed score of frequency of mammograms is predicted to change 0.83 standard units, given a measurement error of 0.3 units.

FIGURE 1—Structural equation model: family history of cancer predicting risk perception and repeat mammography.

Additional potential confounders, originally considered for inclusion in the model, but not used after preliminary analysis indicated no effect on the relationship of interest, included primary language (for all participants) and country of birth, years in the United States, and citizenship status (for those not born in the United States).

Statistical Analysis

Analyses were conducted using a structural equation modeling (SEM) framework (Figure 1) and MPlus version 5.1 software (Muthén & Muthén, Los Angeles, CA) to account for the complex survey sample design effect. Multinomial logistic regression was conducted to examine the relationship of family cancer to risk perception. Because risk perception is ordinal in nature with 3 levels, the Holm-modified Bonferroni method was used to control for the possibility of committing a type I error.[23] SEM was used to examine the relationship between the predictors of family history of cancer and the number of mammograms in the last 6 years (repeat mammography). The model accounts for 31% of the variance in repeat mammography (Figure 1).

Normality and missing data. Repeat mammography, as a count variable, was not expected to be normally distributed, and despite skewness and kurtosis values of −0.034 and −0.760, respectively, an examination of the frequency distribution histogram showed that the data were clearly non-normally distributed. After determining the data did not meet Poisson, negative binomial, zero-inflated Poisson, and zero-inflated negative binomial distributions, the robust maximum likelihood framework was invoked in MPlus to accommodate the non-normality and distributional issues of the data.

Percentage of missing data on the focal independent and dependent variables ranged from 6.9% (family histories of cancer) to 13.0% (risk perception). Missing data were negligible on covariates (0%–1%). Missing data biases were assessed, and results were consistent with data missing at random. With no systematic patterns observed in the missing data, the full information maximum likelihood method, built into Mplus, was used.

TABLE 1—Sociodemographic Characteristics, Insurance Status, Family History of Cancer, Risk Perception, and Repeat Mammography in Women Aged 46–74 Years With No Personal History of Breast Cancer: National Health Interview Survey, United States, 2005

Characteristics	No. (%)	Population Estimate (Million)
Total	6706 (100)	41.9
Race/ethnicity		
White	4806 (71.7)	33.2
Black	1016 (15.1)	4.9
Hispanic	884 (13.2)	3.8
Nativity		
US-born	5845 (87.2)	37.5
Foreign-born	856 (12.8)	4.4
Age, y		
46–49	1260 (18.8)	8.5
50–54	1475 (22.0)	9.7
55–59	1303 (19.4)	8.1
60–64	1054 (15.7)	6.5
65–69	852 (12.7)	4.9
70–74	762 (11.4)	4.2
Household income, $		
0–4999	200 (2.0)	0.8
5000–9999	552 (4.9)	2.1
10 000–14 999	523 (5.6)	2.3
15 000–19 999	503 (6.2)	2.6
20 000–24 999	613 (8.0)	3.3
25 000–34 999	834 (12.1)	5.1
35 000–44 999	697 (10.4)	4.4
45 000–54 999	600 (9.4)	4.0
55 000–64 999	403 (6.9)	2.9
65 000–74 999	354 (6.2)	2.6
≥ 75 000	1427 (28.3)	11.9
Education		
< high school	1200 (17.9)	6.4
High school graduate	2101 (31.3)	13.8
Some college	1817 (27.1)	11.4
Bachelors degree	903 (13.5)	6.0
Postgraduate	620 (9.2)	4.0
Insurance		
Private	4256 (63.5)	28.4
Medicare	765 (11.4)	4.0
Other government	875 (13.1)	5.1
No insurance	759 (11.3)	4.3
Family history of breast cancer		
Mother/mother and sister	444 (6.6)	2.9
Sister/daughter/father/brother/son	317 (4.7)	2.0
No breast cancer history	5482 (81.8)	34.3

Continued

TABLE 1—*Continued*

Family history of any cancer other than breast cancer		
Mother	1180 (17.6)	7.6
Sister	389 (5.8)	2.4
Daughter	84 (1.2)	0.5
Father	1087 (16.2)	7.2
Brother/son	335 (5.0)	2.0
No other cancer	3169 (47.3)	19.3
Perception of developing breast cancer, compared with average woman same age		
Less likely	2202 (32.8)	13.9
As likely	2912 (43.4)	18.3
More likely	723 (10.8)	4.6
No. mammograms, past 6 y		
0	956 (14.3)	5.6
1	659 (9.8)	4.1
2	569 (8.5)	3.4
3	628 (9.4)	3. 9
4	389 (5.8)	2.6
5	395 (5.9)	2.6
6	2321 (34.6)	14.8
≥ 7	177 (2.6)	1.2

Note. Population estimates calculated using weighted data in SPSS Complex Survey Samples version 17.0. Percentages may not add up to 100% because of rounding.

Population estimates. To make inferences from the survey sample to the US population with the intent of showing the magnitude of US women affected, population estimates were assessed. The NHIS inflates participant responses by a national weight factor, which allows for (as close as possible) unbiased population estimation. The weight is based on the inverse of the probability of selection, and includes a nonresponse adjustment and a poststratification adjustment of 88 age, gender, and race/ethnicity classes, which include oversampling for Black and Hispanic persons.[24] SPSS Complex Survey Samples version 17.0 (SPSS Inc, Chicago, Illinois) was used to calculate these population estimates using the weighted data.

RESULTS

Demographic characteristics and population estimates of the sample, which represents approximately 42 million White, Black, and Hispanic women in the United States, are outlined in Table 1. Approximately 11.3% of women had a family history of breast cancer, and 46% of women had a family history of other cancer. The majority of women perceived breast cancer risk as “as likely” compared with their counterparts of the same age (43%), followed by “less likely” (33%) and “more likely” (11%). The mean number of mammograms in the past 6 years (data not shown) was 3.8 (SE = 0.039; 95% confidence interval [CI] = 3.7, 3.9).

The relationships between family history of cancer and risk perception and repeat mammography are shown in Table 2. Participants with a family history of breast cancer held higher risk perception levels (36%–51%, more likely) than those with a family history of other cancer (12%–22%, more likely), and those with no family cancer history (8%–11%, more likely). As with risk perception, those women with a family history of breast cancer demonstrated higher levels of repeat mammography (47%–48%, 6 mammograms in 6 years) than those with a family history of other cancer (40%–41%, 6 mammograms in 6 years) and those with no cancer history (37%–38%, 6 mammograms in 6 years).

Results of the multinomial logistic regression indicated a statistically significant association between family history of breast cancer and increased risk perception (Table 3). Women with a family history of breast cancer in their mothers or mothers and sisters were significantly more likely to report a higher level of risk perception compared with those women with no family history of breast cancer; odds ratios (ORs) ranged from 32.2 (more likely vs less likely; $P < .001$), to 10.3 (more likely vs as likely; $P < .001$), to 3.1 (as likely vs less likely; $P < .001$). These results held when the comparison was made between women with a family history of breast cancer in their mothers or mothers and sisters compared with those with a family history of breast cancer in sisters, daughters, or first-degree male relative; ORs ranged from 3.9 (more likely vs less likely; $P < .001$), to 2.5 (as likely vs less likely; $P < .001$), to 1.6 (more likely vs as likely; $P = .024$).

In terms of the relationship between risk perception and family history of other cancer, women with a family history of other cancer in their mothers were significantly more likely to report a higher level of risk perception compared with those women with no family history; ORs ranged from 2.7 (more likely vs less likely; $P < .001$), to 1.7 (as likely vs less likely, $P < .001$), to 1.4 (more likely vs as likely; $P < .001$). Although other significant relationships were shown between risk perception and family history of other cancer, the only contrast that held consistently between all levels of risk perception was that of a history of other cancer in the mother compared with no family history of other cancer.

Table 3 also presents the results of the SEM analysis of the difference in mean number of mammograms in the past 6 years, given varying levels of cancer history. Results of the SEM analysis indicated that, on average, for every 1 standard score that the latent variable of frequency of mammograms changed, the observed score of frequency of mammograms was predicted to change 0.83 standard units, given a measurement error of 0.3 units (Figure 1). Women with a family history of breast cancer in their mothers or mothers and sisters had, on average, 0.5 more mammograms in the past 6 years ($P < .001$) compared with women with no breast cancer history, and 0.45 more mammograms in the past 6 years ($P = .01$) compared with women with breast cancer

TABLE 2—Family History of Cancer, Breast Cancer Risk Perception, and Number of Mammograms in Past 6 Years in Women Aged 46–74 Years With No Personal History of Breast Cancer: National Health Interview Survey, United States, 2005

Characteristics	Family History of Breast Cancer			Family History of Cancer Other Than Breast Cancer					
	Mother/Mother and Sister,[a] % (95% CI)	Sister/Daughter/Male,[b] % (95% CI)	No Breast Cancer History, % (95% CI)	Mother, % (95% CI)	Sister, % (95% CI)	Daughter, % (95% CI)	Father, % (95% CI)	Brother/Son, % (95% CI)	No Other Cancer, % (95% CI)
Breast cancer Risk perception[c]									
Less likely to get breast cancer	11.0 (8.2, 14.6)	25.0 (20.1, 31.4)	40.9 (39.9, 42.5)	31.5 (28.6, 34.6)	44.5 (38.7, 50.5)	26.8 (16.6, 40.3)	32.9 (29.7, 36.2)	39.5 (33.3, 46.0)	41.4 (39.3, 43.5)
As likely to get breast cancer	37.5 (32.6, 42.8)	39.0 (33.0, 45.3)	51.3 (49.7, 53.0)	55.3 (52.1, 58.6)	43.2 (37.5, 49.2)	50.8 (37.8, 63.6)	50.7 (47.2, 54.3)	49.0 (42.5, 55.6)	47.9 (45.8, 50.0)
More likely to get breast cancer	51.4 (45.9, 56.9)	35.7 (29.8, 42.0)	7.8 (7.0, 8.6)	13.1 (11.0, 15.5)	12.2 (8.9, 16.6)	22.4 (13.8, 34.2)	16.4 (14.2, 18.8)	11.5 (8.3, 15.9)	10.7 (9.4, 12.1)
No. of mammograms in past 6 y									
0	9.3 (6.3, 13.3)	9.9 (7.0, 13.7)	15.3 (14.2, 16.4)	11.7 (9.7, 13.9)	13.6 (10.2, 17.8)	12.8 (6.3, 24.1)	14.9 (12.6, 17.7)	12.6 (9.1, 17.2)	16.0 (14.6, 17.5)
1	6.6 (4.4, 9.7)	10.6 (7.2, 15.2)	11.2 (10.2, 12.3)	11.1 (9.0, 13.7)	7.9 (5.5, 11.3)	9.6 (5.0, 17.7)	9.9 (7.8, 12.5)	13.2 (9.3, 18.4)	11.2 (9.9, 12.6)
2	6.1 (4.2, 8.7)	7.9 (5.0, 12.3)	9.1 (8.3, 10.1)	8.8 (7.0, 10.9)	11.1 (8.2, 14.8)	9.7 (4.6, 19.5)	7.5 (5.8, 9.5)	8.3 (5.9, 11.5)	9.2 (8.1, 10.4)
3	10.0 (7.3, 13.6)	10.7 (7.6, 14.7)	10.2 (9.3, 11.2)	9.0 (7.4, 10.9)	8.8 (6.2, 12.4)	14.4 (7.8, 24.9)	11.8 (9.8, 14.2)	10.0 (6.6, 14.7)	10.2 (9.0, 11.5)
4	7.1 (4.8, 10.3)	5.1 (3.1, 8.4)	6.9 (6.1, 7.7)	8.7 (6.9, 10.9)	5.9 (3.6, 9.5)	11.4 (4.5, 26.2)	5.5 (4.1, 7.4)	6.9 (4.4, 10.6)	6.5 (5.5, 7.6)
5	8.1 (5.3, 12.0)	6.4 (4.0, 10.0)	6.8 (6.0, 7.7)	7.5 (5.8, 9.7)	7.3 (4.8, 10.9)	4.3 (1.6, 10.9)	5.8 (4.5, 7.5)	5.6 (3.4, 9.0)	7.2 (6.1, 8.5)
6	48.1 (42.6, 53.6)	47.3 (41.8, 52.8)	37.6 (36.1, 39.2)	40.3 (37.1, 43.6)	41.3 (35.5, 47.3)	36.2 (25.3, 48.7)	41.0 (37.8, 44.3)	40.0 (33.7, 46.6)	37.2 (35.2, 39.3)
≥ 7	5.6 (3.6, 8.4)	2.2 (1.0, 4.8)	3.0 (2.5, 3.5)	3.3 (2.4, 4.8)	4.2 (2.5, 6.8)	1.6 (0.2, 10.6)	3.7 (2.6, 5.1)	3.6 (1.8, 7.0)	2.7 (2.1, 3.5)

Note. CI = confidence interval. Percentages and confidence intervals calculated using weighted data in SPSS Complex Survey Samples version 17.0.
[a]"Mother" and "Mother and sister" are mutually exclusive categories.
[b]Male is a first-degree male relative: father, brother, or son.
[c]Breast cancer risk perception defined by the question: "Compared to the average woman your age. . ."

history in their sister, daughter, or first-degree male relative. The examination of the difference in mean number of mammograms in the past 6 years among women with a family history of other cancer showed no statistically significant contrasts.

DISCUSSION

The present investigation focused on the strength of the association between family history of cancer on breast cancer risk perception and on repeat mammography in an effort to understand the role family cancer history plays in secondary prevention of breast cancer. In contrast to other studies on this issue, this research separated family history into 2 mutually exclusive categories—family history of breast cancer and family history of any cancer other than breast cancer—to ascertain if the association was related to the type of cancer, to the relative involved, or to a combination of both factors. Furthermore, we looked at the strength of association of family history of cancer with all levels of breast cancer risk perception (measured as "compared with the average woman your age. . . more likely, as likely, less likely") to understand the potential for overreliance on family history of breast cancer and its possible implications to over- and under-screening.

As expected, the overall results indicated that breast cancer risk perception was very strongly associated with family history of breast cancer in any first-degree relative, with the most compelling results seen in those whose mother or mother and sister had breast cancer. These results are consistent with the work of Buxton et al.,[18] Caruso et al.,[19] Silk et al.,[20] and a meta-analytic review by Katapodi et al.,[25] all of whom found an association between risk perception and family history of breast cancer. The important distinction in this research was that we included all levels of risk perception using a representative sample of US women, as opposed to samples of only women who perceived themselves to be at high risk. Additionally, this association held for all levels of risk perception, such that those who believed they were less likely to be diagnosed with breast cancer might be basing that judgment, in part, on the absence of a family history of breast cancer.

TABLE 3—Family History of Cancer Predicting Risk Perception and Predicting Difference in Mean Number of Mammograms in the Past 6 Years in Women Aged 46–74 Years With No Personal History of Breast Cancer: National Health Interview Survey, United States, 2005

	OR[a] (95% CI) or Mean Difference (95% CI)	P
Family history of breast cancer		
Risk perception (more likely vs less likely)		
Mother or mother and sister vs no cancer	32.15 (21.92, 47.15)	< .001
Sister, daughter, or male vs no cancer	8.35 (5.70, 12.24)	< .001
Mother or mother and sister vs sister, daughter, or male	3.85 (2.30, 6.45)	< .001
Risk perception (more likely vs as likely)		
Mother or mother and sister vs no cancer	10.29 (7.82, 13.54)	< .001
Sister, daughter, or male vs no cancer	6.60 (4.77, 9.14)	< .001
Mother or mother and sister vs sister, daughter, or male	1.56 (1.06, 2.29)	.02
Risk perception (as likely vs less likely)		
Mother or mother and sister vs no cancer	3.12 (2.21, 4.42)	< .001
Sister, daughter, or male vs no cancer	1.27 (0.89, 1.80)	.19
Mother or mother and sister vs sister, daughter, or male	2.47 (1.52, 4.01)	< .001
Family history of any cancer other than breast cancer		
Risk perception (more likely vs less likely)		
Mother cancer vs no cancer	2.73 (2.06, 3.62)	< .001
Daughter cancer vs no cancer	3.64 (1.61, 8.24)	.002
Father cancer vs no cancer	1.76 (1.32, 2.36)	< .001
Mother cancer vs sister cancer	1.66 (1.02, 2.71)	.04
Mother cancer vs father cancer	1.55 (1.15, 2.09)	.004
Mother cancer vs brother/son cancer	2.05 (1.26, 3.33)	.004
Risk perception (more likely vs as likely)		
Mother cancer vs no cancer	1.38 (1.23, 1.57)	< .001
Daughter cancer vs no cancer	1.96 (0.99, 3.85)	.05
Father cancer vs no cancer	1.30 (0.99, 1.69)	.05
Mother cancer vs sister cancer	0.93 (0.59, 1.55)	.78
Mother cancer vs father cancer	1.25 (0.93, 1.67)	.14
Mother cancer vs brother or son cancer	1.42 (0.87, 2.32)	.15
Risk perception (as likely vs less likely)		
Mother cancer vs no cancer	1.69 (1.42, 2.00)	< .001
Daughter cancer vs no cancer	1.86 (0.95, 3.62)	.07
Father cancer vs no cancer	1.36 (1.13, 1.64)	< .001
Mother cancer vs sister cancer	1.79 (1.02, 2.71)	< .001
Mother cancer vs father cancer	1.24 (1.15, 2.09)	.05
Mother cancer vs brother or son cancer	1.44 (1.26, 3.33)	.02
Mean difference in no. of mammograms in the past 6 y[c]		
Family history of breast cancer		
Mother or mother and sister vs no cancer	0.50 (0.25, 0.77)	< .001
Sister, daughter, or male vs no cancer	0.06 (–0.20, 0.32)	.68
Mothers or mothers and sisters vs sister, daughter, or male	0.45 (0.10, 0.80)	.01

Continued

Breast cancer risk perception was also associated with family history of any cancer in either the mother or the father, although the association was strongest for maternal cancer history. Previous studies on the relationship between family cancer history and breast cancer risk perception were limited to family history of breast cancer or family history of breast and ovarian cancer, and did not include family history of all other cancers.[18–20,26]

The findings on family history of cancer and breast cancer risk perception were consistent with the Tversky and Kahneman[11] heuristics of availability (the family experience with a parent's cancer diagnosis, particularly the mother), anchoring (anchoring a potential breast cancer diagnosis to the known family experience), and threshold effect (determining, based on experience with one's parent, what level of risk was acceptable).

The implications of these results were twofold. First, the results suggested that increased risk perception compared with the average woman of the same age (more likely, less likely to develop breast cancer) was associated with family history of breast cancer, regardless of age, ethnicity, income, or educational level. Although family history of breast cancer would be expected to heighten perceived risk and repeat mammography, little emphasis was placed on the effects of an absence of family history of breast cancer. Thus, women who reported their risk as less likely might be basing that judgment, in part, on their family history of the disease, and not taking into consideration the multiple other risk factors associated with the development of breast cancer. Because familial or genetic breast cancers only account for approximately 15% to 20% of all breast cancers, the concern was that women with no maternal history of breast cancer used the absence of breast cancer history to determine their own risk level, thus placing excessive significance on this risk factor in determining their actual risk and negatively impacting their screening mammography patterns. The population estimate of women aged 46 to 74 years with no history of breast cancer is more than 34 million; placing excessive significance on absence of breast cancer family history when assessing one's own breast cancer risk was of concern given the number of women at potential risk of developing the disease.

TABLE 3—*Continued*

Family history of cancer other than breast cancer		
Mother cancer vs no cancer	0.14 (–0.03, 0.32)	.11
Sister cancer vs no cancer	0.13 (–0.11, 0.38)	.28
Daughter cancer vs no cancer	–0.20 (–0.70, 0.30)	.44
Father cancer vs no cancer	0.05 (–0.13, 0.23)	.6
Brother/son cancer vs no cancer	0.05 (–0.24, 0.35)	.36
Mother cancer vs sister cancer	0.09 (–0.23, 0.41)	.58
Mother cancer vs daughter cancer	0.34 (–0.16, 0.84)	.18
Mother cancer vs father cancer	0.09 (–0.13, 0.32)	.41
Mother cancer vs brother/son cancer	0.09 (–0.23, 0.41)	.58

Note. CI = confidence interval; male = first-degree male relative (father, brother, or son); OR = odds ratio. Selected results reported.
[a]Covariates included in the model were age, income, race/ethnicity, education, nativity, and geographic region.
[b]Values represent differences in mean number of mammograms (first group mean–second group mean) and analysis includes the following covariates: age, income, race/ethnicity, education, nativity, geographic region, insurance status, physician recommendation, no care because of cost, delayed care because of cost, and system barriers.

Second, the results implied that the risk perception was associated not only with the type of cancer (breast), but also with the person's relationship to the family member with cancer (maternal and paternal history of any other cancer).

In terms of family history of cancer predicting repeat mammography, results once again showed the influence of maternal history of breast cancer. The unadjusted mean number of mammograms for women with a maternal history of breast cancer was 4.53 compared with 4.13 for those with a history of breast cancer in other first-degree relatives, and 3.73 for those with no breast cancer history (data not shown). Once adjusted for all covariates, the difference in mean number of mammograms amounted to approximately 0.50 mammograms over the course of 6 years, suggesting that family history of breast cancer translated to a moderate increase in mammography use.

Previous studies on the relationship between risk perception and mammography use also found an association between mammography screening and family history of breast cancer[26-28]; however, those studies did not look at a pattern of repeat mammography and presented their results as ORs, whereas the results of the present study were presented as a net change in the mean number of mammograms.

The model estimating the difference in the mean number of mammograms by family cancer history took into account insurance status, economic barriers, system barriers, and physician recommendation. These additional covariates could potentially explain the smaller than expected difference in mammograms, particularly given the moderating influence of physician recommendation, which was shown to be the strongest predictor of screening mammography use among all women.[29-32] Previous studies also found that for a small percentage of women who either were at increased risk or perceived themselves to be at increased risk, increased distress or anxiety could lead to an avoidance of screening.[26] The expectation was that with the large sample size in this study, the number of women who delayed screening because of anxiety would not significantly alter results.

Strengths and Limitations

Use of the NHIS allowed for a well-powered study with results generalizable to non-Hispanic Black, non-Hispanic White, and Hispanic women. However, there were inherent limitations in using the NHIS data. The cross-sectional design of the survey precluded determining causality; as a self-report survey, both recall and self-report bias were expected, particularly in the measurement of repeat mammography.[33-35] These limitations were addressed through SEM methodology by modeling the outcome variable as a latent variable with a single indicator and by setting measurement error at 0.3 to accommodate for possible random error in measurement. On average, for every 1 standard score that the latent variable of frequency of mammograms changed, the observed score of frequency of mammograms was predicted to change 0.83 standard units, given a measurement error of 0.3 units.

Conclusions

Breast cancer risk perception was associated with the presence of a family history of breast cancer, as well as with the type of cancer and the individual's relationship to the family member with cancer. Maternal history of breast cancer was associated with a modest increase in the net number of repeat mammograms. ■

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Contributors

G. Haber conceptualized the research and design methods, and was the primary author. N. U. Ahmed supervised analysis, interpretation of results, and writing of the Discussion section. V. Pekovic supervised design and presentation of results, and assisted in writing of the Discussion section.

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Human Participant Protection

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