Do Women in the Community Recognize Hereditary and Sporadic Breast Cancer Risk Factors?

Maria C. Katapodi, RN, MSc, PhD, and Bradley E. Aouizerat, PhD

Purpose/Objectives: To describe knowledge of hereditary, familial, and sporadic breast cancer risk factors among women in the community and to identify characteristics associated with this knowledge.

Design: Descriptive, cross-sectional.

Setting: Community settings in the San Francisco Bay Area.

Sample: 184 women who had never been diagnosed with cancer, were 30–85 years old ($\bar{X} = 47 \pm 12$), and agreed to complete a questionnaire in English. Participants were from diverse racial and cultural backgrounds (i.e., 43% European descent, 27% African descent, 16% Asian descent, and 14% Hispanic descent). Many (49%) were college graduates, and 24% had a median annual family income of $30,000–$50,000.

Methods: Survey.

Main Research Variables: Knowledge of hereditary, familial, and sporadic breast cancer risk factors and characteristics associated with this knowledge.

Findings: Although most women recognized heredity as a risk factor, some did not understand the impact of paternal family history on risk. Some women did not recognize the relationship between breast and ovarian cancer, risk factors associated with the Gail model, and that aging increases risk. Education level was the most important characteristic associated with knowledge of risk factors.

Conclusions: Although age and family history are independent predictors of sporadic, hereditary, and familial breast cancer risk, women in the community could not distinguish between the three forms of the disease. Although the sample included a large number of educated women, their knowledge of breast cancer risk factors appeared incomplete.

Implications for Nursing: Advanced practice nurses should provide individualized risk assessment and education regarding breast cancer risk factors.

Key Points . . .

- ➤ Women's knowledge of breast cancer risk factors is incomplete, and some risk factors are overlooked.
- ➤ Women in the community do not seem to recognize the difference among hereditary, familial, and sporadic breast cancer.
- ➤ Advanced practice nurses should provide individualized counseling and education regarding hereditary, familial, and sporadic breast cancer.
- ➤ Reevaluation of the accuracy of breast cancer risk factor literature is necessary.

Breast cancer is the leading cancer diagnosed among women in the United States, and the American Cancer Society (2005) estimated that more than 210,000 women will be diagnosed with the disease in 2005. The disease currently is divided into three categories based on its underlying etiology. Hereditary breast cancer comprises 5%–10% of cases and is attributed to known genetic mutations (e.g., genetic lesion in breast cancer genes, *BRCA1*, *BRCA2*). Familial breast cancer comprises 20%–25% of cases and is associated with a positive family history, but no known genetic mutation can be identified. Sporadic breast cancer, for which no discernible heritability can be established, comprises approximately 70% of cases (American Cancer Society).

Research has identified factors that put women at risk for developing the disease. The most important overall risk factor for sporadic cases is age, and a majority of cases develops in women 50 years and older. Women of European descent appear to be at higher risk compared with other racial groups. Other identified risk factors include a previous breast cancer diagnosis, family history of breast or ovarian cancer, atypical hyperplasia or lobular carcinoma in situ, and genetic factors, which are more prevalent in women of Ashkenazi Jewish descent. Suggested risk factors include exposure to hormones (e.g., estrogen replacement, early menarche), late parity (i.e., after age 30), dense breast tissue, alcohol use, and postmenopausal obesity (American Cancer Society, 2005).

Some discrepancy exists about whether information aimed at raising awareness about breast cancer risk factors has been integrated successfully into women's perceptions. A lack of balance in the mass media's presentation of certain aspects of breast cancer may affect community perceptions (Gottlieb, 2001). In light of the rapid evolution in cancer genetics, tracking changes in the knowledge regarding breast cancer risk factors is important. As the area of breast cancer research continues to expand and educational materials are developed and made available to the lay public and the professional community, healthcare educators should examine how specific knowledge about breast cancer has been understood and incorporate their findings into future planning.

Given this information, the current study explored community knowledge about breast cancer risk factors. The specific objectives were to describe women's knowledge of hereditary,

Maria C. Katapodi, RN, MSc, PhD, is a nurse researcher and Bradley E. Aouizerat, PhD, is an assistant professor, both in the Department of Physiological Nursing at the University of California, San Francisco. *Funding for this study was provided by the Department of Defense Medical Research, Breast Cancer Research Program, Clinical Nurse Research Grant (Award No. DAMD17-03-1-0356). (Submitted June 2004. Accepted for publication August 24, 2004.)*

Digital Object Identifier: 10.1188/05.ONF.617-623

familial, and sporadic breast cancer risk factors and to identify characteristics associated with this knowledge.

Literature Review

Efforts to promote breast cancer screening and early detection rely on dissemination of information about the disease, its risk factors, and the importance of screening. Much of this effort is made through press releases, television and radio broadcasts, and articles and advertisements in women's magazines (Curry, Byers, & Hewitt, 2003). Research has shown that, independent of physicians' advice, the media influences women's decisions to have mammograms (Yanovitzky & Blitz, 2000) and that a correlation exists between community newspaper advertisements and mammography use (Urban et al., 1995). However, others have concluded that although messages in the media can heighten awareness and increase behavioral intention, they are unlikely to assert any influence beyond awareness of breast cancer screening (Rimer, 1997). A meta-analysis summarizing the results of interventions that aimed to raise screening rates and knowledge of risk factors concluded that behavioral interventions increase the rate of breast cancer screening by 13%. Cognitive interventions that used generic education strategies had little impact, but those that used theory-based education increased screening rates by 24% (Yabroff & Mandelblatt, 1999).

Low-income and minority women are more likely to benefit significantly from educational programs (Hiatt & Pasick, 1996). For instance, among high-risk women of African descent, those who declined genetic counseling had considerably less knowledge of breast cancer genetics and associated risk factors than those who accepted genetic counseling and genetic testing (Thompson et al., 2002). Several studies provided evidence that differences in knowledge regarding risk factors exist among sociodemographically diverse samples of women (Campbell, 2002; Donovan & Tucker, 2000; Magai, Consedine, Conway, Negut, & Culver, 2004).

Therefore, an increasing need exists for refinement of outreach and intervention efforts and for continuous monitoring of the knowledge levels among community women, especially those from racially or culturally diverse communities. This study examined knowledge of risk factors for hereditary, familial, and sporadic breast cancer among community women from diverse racial or cultural backgrounds.

Theoretical Framework

Weinstein (1988) suggested that a person who knows little about a health problem and its associated risk factors will be open-minded to learning about it. In contrast, a person who is aware of the health problem but does not consider specific situations to be risk factors will not be open-minded. This person's commitment to a particular point of view tends to produce a biased response; he or she will selectively attend to messages that support his or her own position and will show belief perseverance when faced with disconfirming evidence.

These suggestions should be taken into account when conducting interventions that aim to increase knowledge about breast cancer risk factors and change women's perceptions of their risk of developing the disease. These suggestions also help to explain why educational interventions may not be successful in increasing some women's knowledge regarding breast cancer risk factors and changing preexisting belief systems. Health educators should assess for possible preexisting biases that may affect women's open-mindedness to health messages.

Methods

Recruitment and Procedures

Assessing knowledge of breast cancer risk factors was a secondary aim of a community-based survey that examined perceived breast cancer risk and the relationship between subjective and objective risk estimates. Details about recruitment methods and study procedures have been reported elsewhere (Katapodi, Dodd, Lee, Facione, & Cooper, 2004). This study recruited a convenience sample of women, aged 30–85, who never had been diagnosed with cancer and agreed to complete a questionnaire in English. Women with a prior diagnosis of any type of cancer were excluded from the survey. Recruitment was conducted by posting flyers on bulletin boards in community settings in the San Francisco Bay Area, such as churches, senior centers, coffee shops, public libraries, and workplaces, and through a newspaper advertisement. Women responded by calling a dedicated telephone number and expressing their interest in participating in the study. Participants completed an anonymous questionnaire and were paid $15. According to the study protocol, which was approved by the University of California, San Francisco, Committee of Human Rights, participants signed an informed consent before completing the questionnaire. Data collection occurred over a period of 13 months, from February 2003–March 2004.

Measurements

Age, race or culture, education, income, employment status, health insurance status, and marital status were assessed with single-item questions from the Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2002). Women's family history of breast cancer was assessed by asking them to indicate the number of their first- and second-degree relatives who had been affected by the disease. Women were categorized into one of four groups: no family history, one or more affected second-degree relatives, one affected first-degree relative, and multiple affected family members (i.e., more than one first-degree relative or one first-degree and one second-degree relative) ("Statement of the American Society of Clinical Oncology," 1996). Breast cancer risk factors used by the Gail model (Gail et al., 1989), such as age at first menstrual period, age at first live birth, and the number of breast biopsies, also were assessed.

Participants indicated whether 13 situations might be risk factors for breast cancer. The researchers defined women's knowledge of breast cancer risk factors as the total number of situations recognized that increased the probability of developing the disease. Five of these items described risk factors identified by the Gail model (Royak-Schaler et al., 2002). The remaining eight items were based on current literature and examined knowledge of hereditary and familial risk factors for breast cancer. Women could respond "yes," "no," or "don't know" to each item. According to the theoretical framework of the study, women who responded "don't know" to a particular item would be more open-minded to acknowledging that item as a risk factor, compared to women who responded "no" to the same item. Items that

were answered affirmatively were summed to calculate each woman's score for knowledge of breast cancer risk factors and to create the **Breast Cancer Risk Factor Knowledge Index (BCRFKI),** with scores ranging from 0–13. These 13 items were highly intercorrelated (Cronbach's $\alpha = 0.80$). Psychometric theory suggests that lists of items, such as a list that examines knowledge of risk factors, should be treated as indexes and have reliability assessed by test-retest (Streiner, 2003). However, the cross-sectional study design did not allow for examination of the test-retest reliability of the BCRFKI.

Statistical Analysis

Data were analyzed using the SPSS® 11.5 (SPSS Inc., Chicago, IL) statistical program. For all statistical analyses, significance was set at the 0.05 level with 95% confidence intervals. Bivariate analysis, such as Pearson correlations (r), and F tests with Bonferoni post-hoc contrasts were used to examine significant demographic differences among women in the sample. Simultaneous multiple regression analysis and binary logistic regression analysis were used to identify factors associated with knowledge of breast cancer risk factors (Cohen & Cohen, 1983).

Results

In total, 184 women were recruited ($\bar{X}$ age = 47 ± 12 years; range = 30–85). Forty-three percent identified themselves as non-Hispanic and of European descent, 27% as non-Hispanic and of African descent, 16% as Asian descent, and 14% as Hispanic descent. Ten participants (6%) were of Ashkenazi Jewish descent. Many women (49%) had attended four or more years of college, but 8% had not completed high school. The median annual income was less than $40,000, with 21% of the sample reporting an annual income of less than $10,000 and 12% reporting an annual income of more than $70,000. More than half of the women (55%) were employed outside of the home, and 77% had health insurance. Only 33% were married or a member of an unmarried couple (see Table 1). Although the sample was comparable to the San Francisco Bay Area population, it included an overrepresentation of non-Hispanic women of African descent and women with a college education ("San Francisco Bay Area Census," 2000).

Approximately two-thirds (64%) of the participants did not have a family history of breast cancer. Twenty-four women (14%) had one or more affected second-degree relatives, 18 women (10%) had one affected first-degree relative, and 16 women (9%) had multiple affected relatives. Approximately one in five women had her first menstrual period before age 12 (21%) or had undergone one or more breast biopsies (18%), and 18 women (10%) had their first baby after age 30 (see Table 2).

No significant differences were found among women of different races or cultures in regard to mean age and family history of breast cancer. Women of European descent were more likely to have more education than women of African descent and Hispanic women, and women of Asian descent were more likely to be more educated than women of African descent but not Hispanic women ($F[3, 180] = 15.86$, $p < 0.001$). Women of Asian descent were more likely to report higher incomes than women of other racial or cultural backgrounds ($F[3, 172] = 6.90$, $p < 0.001$). Education was significantly correlated with income for women of African descent only ($r = 0.50$, $p = 0.001$).

Table 1. Demographic Characteristics of the Sample

Variable	n	%
Age (years)		
$\bar{X} = 47 \pm 12$	–	–
Range = 30–85	–	–
30–39	63	34
40–49	51	28
50–69	54	29
70–85	10	5
Not available	6	3
Race or culture		
Non-Hispanic European descent	69	37
• Ashkenazi Jewish descent	10	6
Non-Hispanic African descent	50	27
Hispanic	25	14
Asian descent	30	16
Education		
Elementary school (grades 1–8)	7	4
Some high school (grades 9–11)	8	4
High school graduate (grade 12, GED)	31	17
Some college or technical school (1–3 years)	48	26
College graduate (more than 4 years)	90	49
Annual family income ($)		
Less than 10,000	39	21
10,000–30,000	49	27
30,000–50,000	45	24
50,000–70,000	22	12
More than 70,000	21	12
Not available	8	4
Employment status		
Full-time	102	55
Unemployed, employed part-time, retired, student	80	44
Not available	2	1
Health insurance		
Yes	142	77
No	38	21
Not available	4	2
Marital status		
Married	45	25
Divorced	30	16
Widowed	17	9
Separated	7	4
Never married	69	38
Member of an unmarried couple	15	8
Not available	1	1

N = 184

Knowledge of Breast Cancer Risk Factors

Table 3 presents participants' responses on the BCRFKI. Approximately 75% recognized that multiple affected family members, a maternal family history of breast cancer, and a previous breast cancer diagnosis are risk factors. Surprisingly, only 45% recognized that a positive paternal family history is a risk factor, whereas 28% responded "don't know" to this item. Similarly, 42% responded affirmatively that having a genetic mutation is a risk factor, whereas 30% responded "don't know." Approximately 70% recognized that a family member with both breast and ovarian cancer is a risk factor, but only 41% recognized that a family history of ovarian cancer could

Table 2. Breast Cancer Risk Factors Within the Sample

Variable	n	%
Family history of breast cancer		
No family history	117	64
One or more affected second-degree relatives	24	14
One affected first-degree relative	18	10
Multiple affected relatives[a]	16	9
Not available	9	4
Age at first menstrual period		
Younger than 12	38	21
12–13	84	46
14 or older	56	30
Not available	6	3
Age at first live birth		
Nulliparous	87	47
Younger than 20	30	16
20–24	30	16
25–29	19	11
30 or older	18	10
History of breast biopsy		
None	150	82
One	25	14
More than one	9	4

N = 184

[a] More than one first-degree relative or one first-degree relative and one or more second-degree relatives

Note. Because of rounding, not all percentages total 100.

be a risk factor. Fewer women, 10% and 34%, respectively, responded "don't know" to these items.

Aging was recognized as a risk factor by 57% of the women in the study, whereas 23% and 15% responded "no" and "don't know" respectively. Half of the women (50%) thought that a previous breast biopsy was not a risk factor, and 17% responded "don't know." Similarly, 41% recognized that older age at first live birth is a risk factor, and 28% responded "don't know." Forty-nine and fifty-seven percent of women responded that they did not know whether delayed onset of menopause or being of Ashkenazi Jewish descent were breast cancer risk factors, respectively.

Characteristics Associated With Knowledge of Breast Cancer Risk Factors

Most participants correctly identified between six and eight risk factors ($\overline{X} = 6 \pm 3$; range = 0–13). A simultaneous multiple regression was performed. The dependent variable was the total score on the BCRFKI, which represented knowledge of hereditary, familial, and sporadic breast cancer risk factors. The independent variables were age, education, income, race or culture, Ashkenazi Jewish descent, family history of breast cancer, age at first live birth, age at first menstrual period, and number of breast biopsies. Race or culture, family history of breast cancer, and age at first period were entered in the regression model as dummy-coded variables. Most women (n = 172) had complete responses and were included in the analysis. The overall model predicted the variance of the BCRFKI to be approximately 22% ($R^2 = 0.224$, $\Delta F = 3.51$, $p < 0.001$). Characteristics significantly associated with a higher score on the BCRFKI were education, one or more affected second-degree relatives, and being of Ashkenazi Jewish descent (see Table 4). A logistic regression analysis was performed using the item "getting older" as a dichotomous (i.e., yes or no) criterion variable and the age of the participants as the predictor variable. Interestingly, as the age of participants increased, the probability of recognizing "getting older" as a risk factor for breast cancer decreased (n = 168, B = –0.037, SE = 0.014, Wald $\chi^2 = 7.408$, df = 1, p = 0.006, Exp(B) = 0.963, 95% confidence interval for Exp(B) = 0.938–0.990).

Discussion

This study examined knowledge of sporadic, hereditary, and familial breast cancer risk factors and characteristics associated with that knowledge in a multicultural sample. Participants were recruited from community settings they

Table 3. Knowledge of Breast Cancer Risk Factors

		Yes		No		Don't Know		Not Available	
Type of Breast Cancer	**Risk Factor**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Hereditary or familial	Multiple family members with breast cancer	140	76	24	13	10	5	10	5
	Family history of breast cancer from the mother's side of the family	138	75	23	13 21	10	5	10	5
	Having had breast cancer before	131	71	39		4	2	10	5
	Family member with both breast and ovarian cancer	127	69	27	15	18	10	12	7
	Family history of breast cancer from the father's side of the family	82	45	40	22	51	28	11	6
	Having a genetic mutation	78	42	37	20	56	30	13	7
	Family history of ovarian cancer	75	41	35	19	63	34	11	6
	Being of Ashkenazi Jewish descent	14	8	53	29	104	57	13	7
Sporadic	Getting older	104	57	42	23	28	15	10	5
	Late age at first pregnancy	75	41	47	26	52	28	10	5
	Early start of menstruation	52	28	60	33	59	32	13	7
	Having had a breast biopsy	50	27	92	50	31	17	11	6
	Late start of menopause	22	12	58	32	90	49	14	8

N = 184

Table 4. Predictors of Knowledge of Breast Cancer Risk Factors

Variable	B	SEB	β
Age	0.005	0.021	0.018
Education	0.873	0.274	0.279*
Asian descent versus European descent (dummy variable)	−0.953	0.752	−0.108
African descent versus European descent (dummy variable)	−0.520	0.653	−0.072
Hispanic versus European descent (dummy variable)	0.205	0.783	0.022
First menstrual period before age 12 versus age 12–13	−0.310	0.300	−0.081
First menstrual period after age 14 versus age 12–13	−0.207	0.262	−0.062
Age at first live birth	−0.052	0.020	−0.211
Number of breast biopsies	0.563	0.328	0.129
Ashkenazi Jewish descent	−2.119	1.062	−0.151*
Second-degree relatives versus no family history (dummy variable)	0.858	0.630	0.106*
First-degree relatives versus no family history (dummy variable)	1.522	1.086	0.105
Multiple family members versus no family history (dummy variable)	0.155	0.809	0.014

*$p < 0.05$

were likely to visit within the context of their everyday lives, such as coffee shops, senior centers, and workplaces.

Despite the general awareness of the role of family history in breast cancer susceptibility, 20% of participants lacked important understanding regarding the impact of family history on the risk of developing the disease. Consistent with other studies (Grande, Hyland, Walter, & Kinmonth, 2002; Mouchawar, Byers, Cutter, Dignan, & Michael, 1999), most participants (76%) recognized that having multiple affected family members is an important risk factor. However, women were more likely to recognize maternal family history as a risk factor (75%), whereas significantly fewer (45%) recognized paternal family history as an independent risk factor. A community-based study (Vuckovic, Harris, Valanis, & Stewart, 2003) and a study that recruited patients with early-onset breast cancer (Miesfeldt, Cohn, Ropka, & Jones, 2001) suggested that many women are unsure of how and from whom breast cancer risk can be inherited. Those women are significantly more likely to underestimate their breast cancer risk if affected family members are on the father's side.

Women at risk for hereditary breast cancer also are at risk for ovarian cancer and vice versa. Although most women (69%) recognized that a family history of breast and ovarian cancer is a risk factor, only 41% recognized that a family history of ovarian cancer might increase one's risk for hereditary breast cancer. Some participants possibly did not recognize that the etiology of hereditary breast cancer could be related closely to that of ovarian cancer. Andersen, Bowen, Yasui, and McTiernan (2003) reported that 75% of women at high risk for hereditary breast and ovarian cancer did not know that they were at increased risk for ovarian cancer and did not use existing screening methods for early detection of the disease. Women in this risk group are more likely to underestimate their breast cancer risk if they are not aware of the connection between breast and ovarian cancer.

A significant number of women (38%) did not recognize aging as a risk factor for breast cancer. The older the participant, the less likely she was to recognize age as a risk factor for breast cancer. This finding was surprising because age is a well-established risk factor for sporadic breast cancer. Apparently, however, women do not always understand and integrate this information. Strecker, Williams, Bondy, Johnston, and Northrup (2002) reported that 35% of healthcare providers and 45% of laywomen did not recognize age as a breast cancer risk factor after receiving extensive education on the subject. Other studies have suggested that some women lack basic knowledge about breast cancer risk factors (Absetz, Aro, Rehnberg, & Sutton, 2000) and create mental images of a stereotypical person who is likely to be affected by the disease (Katapodi, Facione, Humphreys, & Dodd, 2005). These findings suggest that when women lack the specific knowledge that getting older increases the risk for developing breast cancer, they are more likely to believe that the disease affects mostly younger women.

Age and family history are independent predictors of sporadic, hereditary, and familial forms of breast cancer. Interactions between these two risk factors are complicated and difficult to interpret in clinical practice. Strecker et al. (2002) reported that the differences between sporadic and inherited predisposition to breast cancer were the most difficult to understand both by laywomen and healthcare providers. Women carrying genetic mutations associated with hereditary breast cancer have an increased risk of early onset of the disease that is reduced to an average level as they age. Similarly, the diagnosis of a second-degree relative with breast cancer does not significantly increase a woman's risk for the disease unless it occurs at an early onset, which might signify hereditary or familial breast cancer. These cases differ strikingly from sporadic breast cancer, which poses a greater risk as women age.

Situations that increase women's risk for sporadic breast cancer, such as early age at menarche, late age at menopause, late age at first live birth, and having one or more breast biopsies, were less acknowledged as breast cancer risk factors by participants in the study. These risk factors are related to breast cancer etiology, possibly because women's breast tissue before pregnancy is more sensitive to carcinogens than breast tissue that has gone through its complete hormonal development (American Cancer Society, 2005). An average of only one in three women responded affirmatively that these items were risk factors, whereas approximately 65% were unsure of their implications. In contrast, studies have reported that women most often estimate their breast cancer risk based on factors whose role in breast cancer etiology remain to be established, such as smoking (Aiken, Fenaughty, West, Johnson, & Luckett, 1995; Silverman et al., 2001). These findings suggest a gap in knowledge of breast cancer risk factors.

Education levels were significantly associated with knowledge of breast cancer risk factors. Despite the fact that 49% of the study participants had completed four or more years of college and an additional 26% had completed some college or a technical school, their knowledge of breast cancer risk factors was incomplete. Women also displayed an incomplete knowledge of risk factors regardless of their race or culture. Studies suggested that racial or cultural differences affect decision making regarding genetic testing among women of African descent (Hughes, Fasaye, LaSalle, & Finch, 2003). The data from this study showed that education was the strongest recorded predictor of a high score on the BCRFKI and suggested the possibility that education and race or culture should be examined together as predictors of knowledge of breast cancer risk factors. The finding that only 42% of women recognized a genetic mutation as a breast cancer risk factor most likely reflects that women do not understand the meaning of "genetic mutation." Roche et al. (1998) suggested that women often do not understand the meaning of terms and phrases commonly used by healthcare professionals.

Having one or more affected second-degree relatives was significantly associated with a high score on the BCRFKI, whereas the associations between BCRFKI scores and having one affected first-degree relative or multiple affected family members were not significant. Several explanations are possible for these findings. Family history with one affected first-degree relative or multiple affected relatives may not have reached statistical significance because of the small number of women in the sample with those conditions. Alternatively, some women underestimate the importance of having one affected first-degree relative as a risk factor (Absetz et al., 2000; Aiken et al., 1995), whereas women with multiple affected family members concentrate on the importance of genetic risk factors. Of concern in such scenarios is the underestimation of the importance of other factors that increase the probability of sporadic breast cancer. Future studies in which larger samples are stratified according to family history of breast cancer may address this issue.

Limitations

The limitations of this study should be considered to properly temper any conclusions drawn. The results were based on a convenience sample of self-selected women, and the assessment of risk factors was based on self-report. Although knowledge of important breast cancer risk factors was examined, the list was not exhaustive. Breast cancer risk factors that were not examined include alcohol consumption, obesity, Caucasian ethnicity, and postmenopausal use of hormone therapy. In addition, whether women knew that early onset is indicative of hereditary disease or about the possibility of an association between breast cancer and other forms of cancer were not examined. However, the latter seem unlikely to be of further use because of the strong likelihood that knowledge of risk related to technical genetic terminology is lacking in the general population. The cross-sectional nature of the study did not allow examination of the test-retest reliability of the BCRFKI, which may have implications for the validity of the measure. Despite these limitations, the strengths of the study include its recruitment of women from diverse socioeconomic and racial and cultural backgrounds and from community settings, which ensured that participation was not limited only to women who have greater access to healthcare services and therefore to greater access to educational material related to breast cancer risk factors.

Implications for Nursing

Nursing has offered compelling examples of educational and counseling interventions targeting high risk (Snyder et al., 2003) and medically underserved women (Lane, Martin, Uhler, & Workman, 2003) recruited from the community. Until similar programs become widely available and accessible, women in the community must depend on primary care providers for risk assessment, counseling, and education about breast cancer risk factors. Advanced practice nurses (APNs) can incorporate the calculation of a woman's risk for breast cancer and the probability that she is a carrier of a genetic mutation into routine care by using an appropriate risk assessment model (Rubinstein, O'Neill, Peters, Rittmeyer, & Stadler, 2002). Obtaining a family history and calculating an individual's risk for the disease are time consuming and not commonly practiced; however, an increasing need does exist for redirecting efforts toward personalized breast cancer risk analysis and individually tailored breast cancer screening recommendations (Strecker et al., 2002). Unless APNs obtain an adequate family history and information about breast cancer risk factors, they may not recognize clients at increased risk for the disease or for hereditary cancer syndromes. APNs can apply recent advances in cancer genetics to improve the care and education of their clients by informing women about the mechanisms of sporadic, hereditary, and familial cancer in terms of clients' level of risk. A helpful first step in defining family history might be clarifying which types of cancer, the age at onset of cancer, and the degree of relatedness of family members of both genders with the disease (McKelvey & Evans, 2003).

Finding the most effective ways to educate individuals regarding their risk for sporadic, hereditary, and familial disease is not an easy task. As suggested by the theoretical framework of the study, educational interventions should assess preexisting knowledge and personal experiences that predispose individuals to biased information processing. Women who respond "no" to a particular item may be less open-minded to accepting that situation as a risk factor compared to women who respond "don't know." For instance, more women in this study believed that having breast cancer once before and having one or more breast biopsies were not breast cancer risk factors, compared to women who responded "don't know" to these items. More effort and a different approach may be needed to persuade the first group of women that these two situations increase a woman's risk for the disease. Future studies should investigate the best way to examine open-mindedness, biased information processing, and readiness to learn. In addition, future studies should examine other factors that influence the outcome of educational interventions, such as cultural factors that influence genetic counselors' attitudes toward preventive measures (Bouchard et al., 2004) and the optimum amount of information that should be given to clients seeking genetic consultation (Lobb et al., 2004). As the field of cancer risk assessment continues to grow, educational materials should evolve to meet the knowledge needs of healthcare providers and women in the community.

Author Contact: Maria C. Katapodi, RN, MSc, PhD, can be reached at maria.katapodi@nursing.ucsf.edu, with copy to editor at rose_mary@earthlink.net.

References

Absetz, P., Aro, A.R., Rehnberg, G., & Sutton, S.R. (2000). Comparative optimism in breast cancer risk perception: Effects of experience and risk factor knowledge. *Psychology, Health, and Medicine, 5,* 376–386.

Aiken, L.S., Fenaughty, A.M., West, S.G., Johnson, J.J., & Luckett, T.L. (1995). Perceived determinants of risk for breast cancer and the relations among objective risk, perceived risk, and screening behavior over time. *Women's Health, 1*(1), 27–50.

American Cancer Society. (2005). Cancer facts and figures 2005. Retrieved February 25, 2005, from http://www.cancer.org/downloads/STT/CAFF2005f4PWSecured.pdf

Andersen, M.R., Bowen, D., Yasui, Y., & McTiernan, A. (2003). Awareness and concern about ovarian cancer among women at risk because of a family history of breast or ovarian cancer. *American Journal of Obstetrics and Gynecology, 189*(4, Suppl.), S42–S47.

Bouchard, L., Blancquaert, I., Eisinger, F., Foulkes, W., Evans, G., Sobol, H., et al. (2004). Prevention and genetic testing for breast cancer: Variations in medical decisions. *Social Science and Medicine, 58,* 1085–1096.

Campbell, J.B. (2002). Breast cancer-race, ethnicity, and survival: A literature review. *Breast Cancer Research and Treatment, 74,* 187–192.

Centers for Disease Control and Prevention. (2002). Behavioral risk factor surveillance system: 2001 survey data. Retrieved December 1, 2002, from http://www.cdc.gov/brfss/technical_infodata/surveydata/2001.htm

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/ correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Curry, S.J., Byers, T., & Hewitt, M. (2003). Improving participation in cancer screening programs: Breast cancer screening. In S.J. Curry, T. Byers, & M. Hewitt (Eds.), *Fulfilling the potential of cancer prevention and early detection* (pp. 224–259). Washington, DC: Institute of Medicine National Research Council.

Donovan, K.A., & Tucker, D.C. (2000). Knowledge about genetic risk for breast cancer and perceptions of genetic testing in a sociodemographically diverse sample. *Journal of Behavioral Medicine, 23,* 15–36.

Gail, M.H., Brinton, L.A., Byar, D.P., Corle, D.K., Green, S.B., Schairer, C., et al. (1989). Projecting individualized probabilities of developing breast cancer for white females who are being examined annually. *Journal of the National Cancer Institute Monographs, 81,* 1879–1886.

Gottlieb, N. (2001). The age of breast cancer awareness: What is the effect of media coverage? *Journal of the National Cancer Institute, 93,* 1520–1522.

Grande, G.E., Hyland, F., Walter, F.M., & Kinmonth, A.L. (2002). Women's views of consultations about familial risk of breast cancer in primary care. *Patient Education and Counseling, 48,* 275–282.

Hiatt, R.A., & Pasick, R.J. (1996). Unsolved problems in early breast cancer detection: Focus on the underserved. *Breast Cancer Research and Treatment, 40,* 37–51.

Hughes, C., Fasaye, G.A., LaSalle, V.H., & Finch, C. (2003). Sociocultural influences on participation in genetic risk assessment and testing among African American women. *Patient Education and Counseling, 51,* 107–114.

Katapodi, M.C., Dodd, M.J., Lee, K.A., Facione, N.C., & Cooper, B.A. (2004, March). *Optimistic bias regarding the risk of developing breast cancer in a multicultural community sample.* Paper presented at the 9th Biennial Symposium on Minorities, the Medically Underserved and Cancer, Washington, DC.

Katapodi, M.C., Facione, N.C., Humphreys, J.C., & Dodd, M.J. (2005). Perceived breast cancer risk: Heuristic reasoning and search for a dominance structure. *Social Science and Medicine, 60,* 421–432.

Lane, A., Martin, M., Uhler, J., & Workman, L. (2003). Enhancing breast health in rural populations: Clinical nurse specialist as the key. *Clinical Nurse Specialist, 17,* 292–297.

Lobb, E.A., Butow, P.N., Barratt, A., Meiser, B., Gaff, C., Young, M.A., et al. (2004). Communication and information-giving in high-risk breast cancer consultations: Influence on patient outcomes. *British Journal of Cancer, 90,* 321–327.

Magai, C., Consedine, N., Conway, F., Negut, A., & Culver, C. (2004). Diversity matters: Unique populations of women and breast cancer screening. *Cancer, 100,* 2300–2307.

McKelvey, K.D., Jr., & Evans, J.P. (2003). Cancer genetics in primary care. *Journal of Nutrition, 133*(11, Suppl. 1), 3767S–3772S.

Miesfeldt, S., Cohn, W., Ropka, M., & Jones, S. (2001). Knowledge about breast cancer risk factors and hereditary breast cancer among early-onset breast cancer survivors. *Familial Cancer, 1,* 135–141.

Mouchawar, J., Byers, T., Cutter, G., Dignan, M., & Michael, S. (1999). A study of the relationships between family history of breast cancer and knowledge of breast cancer genetic testing prerequisites. *Cancer Detection and Prevention, 23,* 22–30.

Rimer, B.K. (1997). Current use and how to increase mammography screening in women. *Surgical Oncology Clinics of North America, 6,* 203–211.

Roche, R.A., Stovall, C.E., Suarez, L., Goldman, D.A., Wright, S.A., & Mendez, M.C. (1998). Language differences in interpretation of breast cancer health messages. *Journal of Cancer Education, 13,* 226–230.

Royak-Schaler, R., Klabunde, C.N., Greene, W.F., Lannin, D.R., DeVellis, B., Wilson, K.R., et al. (2002). Communicating breast cancer risk: Patient perceptions of provider discussions. *Medscape Women's Health, 7*(2), 2.

Rubinstein, W.S., O'Neill, S.M., Peters, J.A., Rittmeyer, L.J., & Stadler, M.P. (2002). Mathematical modeling for breast cancer risk assessment: State of the art and role in medicine. *Oncology, 16,* 1082–1094.

San Francisco Bay Area census. (2000). Retrieved July 25, 2004, from http://www.bayareacensus.ca.gov/bayarea.htm

Silverman, E., Woloshin, S., Schwartz, L.M., Byram, S.J., Welch, H.G., & Fischhoff, B. (2001). Women's views on breast cancer risk and screening mammography: A qualitative interview study. *Medical Decision Making, 21,* 231–240.

Snyder, L.A., Wallerstedt, D.B., Lahl, L.L., Nehrebecky, M.E., Soballe, P.W., & Klein, P.M. (2003). Development of the breast cancer education and risk assessment program. *Oncology Nursing Forum, 30,* 803–808.

Statement of the American Society of Clinical Oncology: Genetic testing for cancer susceptibility, adopted on February 20, 1996. (1996). *Journal of Clinical Oncology, 14,* 1730–1736.

Strecker, M.N., Williams, A.J., Bondy, M., Johnston, D.A., & Northrup, H. (2002). Knowledge and attitudes of Hispanic women and their health care providers about breast cancer risk factors and screening. *Community Genetics, 5,* 222–231.

Streiner, D.L. (2003). Being inconsistent about consistency: When coefficient alpha does and doesn't matter. *Journal of Personality Assessment, 80,* 217–222.

Thompson, H.S., Valdimarsdottir, H.B., Duteau-Buck, C., Guevarra, J., Bovbjerg, D.H., Richmond-Avallaneda, C., et al. (2002). Psychosocial predictors of BRCA counseling and testing decisions among urban African-American women. *Cancer Epidemiology, Biomarkers and Prevention, 11,* 1579–1585.

Urban, N., Taplin, S.H., Taylor, V.M., Peacock, S., Anderson, G., Conrad, D., et al. (1995). Community organization to promote breast cancer screening among women ages 50–75. *Preventive Medicine, 24,* 477–484.

Vuckovic, N., Harris, E.L., Valanis, B., & Stewart, B. (2003). Consumer knowledge and opinions of genetic testing for breast cancer risk. *American Journal of Obstetrics and Gynecology, 189*(4, Suppl.), S48–S53.

Weinstein, N.D. (1988). The precaution adoption process. *Health Psychology, 7,* 355–386.

Yabroff, K.R., & Mandelblatt, J.S. (1999). Interventions targeted toward patients to increase mammography use. *Cancer Epidemiology, Biomarkers and Prevention, 8,* 749–757.

Yanovitzky, I., & Blitz, C.L. (2000). Effect of media coverage and physician advice on utilization of breast cancer screening by women 40 years and older. *Journal of Health Communication, 5,* 117–134.