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## Comparison of Breast Cancer Risk Estimations, Risk Perception, and Screening Behaviors in Obese Rural Korean Women

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**P**erceived risk of a health issue involves a risk judgment about the possibility of experiencing that issue; therefore, accurate information about cancer risk can influence health behaviors for prevention and screening (Katapodi, Dodd, Lee, & Facione, 2009). A meta-analysis found that interventions tailored to promote mammography screening produced the strongest effects on health behaviors (Sohl & Moyer, 2007), particularly in women with the *BRCA1* or *BRCA2* gene or otherwise at high risk for breast cancer (Lerman et al., 2000; Rothmund, Paepke, & Flor, 2001). Breast cancer rates are increasing rapidly in Korea, with an annual average incidence rate of about 6.5% from 1999–2008 (National Cancer Information Center [NCIC], 2011) compared to a 1.5% decrease rate per year in the United States (American Cancer Society [ACS], 2011). As breast cancer is the second most prevalent cancer in Korean women after thyroid cancer, involving 15% of female cancers (NCIC, 2011), strategies to assess women's risk are necessary for the adoption of proper health behaviors for prevention and early detection.

In Korea, the obesity rate was about 26% in adult women older than age 19 in 2007; the rate was higher in rural women (35%) compared to urban women (26%) (Ministry for Health, Welfare and Family Affairs, & Korea Centers for Disease Control and Prevention, 2008). Worldwide, obesity increases women's risk of breast cancer, as well as cardiovascular diseases and type 2 diabetes (Selvan, Wilkinson, Chamberlain, & Bondy, 2004; Stephenson & Rose, 2003; Yoo, Noh, & Choi, 1995). In a 14-year prospective cohort study in Korea, obese women (body mass index [BMI] = 30 or higher) aged 50 years or older were at increased risk for developing breast cancer (hazard ratio [HR] = 1.38, 95% confidence interval [CI] [1, 1.9]) (Jee et al., 2008). A cohort study with postmenopausal

**Purpose/Objectives:** To assess three breast cancer risk assessment tools in obese rural Korean women.

**Design:** Cross-sectional survey design.

**Setting:** Community settings in the rural region of north-eastern South Korea.

**Sample:** A nested cohort sample of 64 severely obese women aged 40–60 years from the Korean Genomic Regional Cohort registry.

**Methods:** The Breast Cancer Risk Assessment Tool of the National Cancer Institute (BCRAT-NCI), Breast Cancer Risk Appraisal for Korean Women (BCRA-K), and Estimation of Individualized Probabilities of Developing Breast Cancer for Korean Women (EIPDBC-K) were used for interview data. Mammography, women's perceptions, and screening behaviors also were analyzed.

**Main Research Variables:** Breast cancer risk assessment, mammography findings, women's perceptions of breast cancer risk, and breast cancer screening behaviors.

**Findings:** A total of 5 (BCRAT-NCI), 19 (BCRA-K), and 43 (EIPDBC-K) women were at higher (above average or high) risk for breast cancer. The BCRA-K ( $r = 0.28$ ,  $p < 0.05$ ) and EIPDBC-K ( $r = 0.43$ ,  $p < 0.001$ ) correlated with mammography findings. However, the BCRAT-NCI correlated only with the BCRA-K. Women's breast self-examination ( $\chi^2 = 4.77$ ,  $p < 0.05$ ) and mammography findings ( $\chi^2 = 5.22$ ,  $p < 0.05$ ) differed according to their risk perception.

**Conclusions:** Risk assessment by the BCRA-K and EIPDBC-K was related to mammography findings. Women's perception of breast cancer risk influenced their screening behaviors. When choosing a risk assessment tool, healthcare professionals should consider the ethnic and cultural backgrounds of the target population.

**Implications for Nursing:** Healthcare professionals should use appropriate risk assessment tools in breast cancer education and counseling to help women understand their risk factors and adopt proper health behaviors.

women aged 40–64 found a significant positive trend of breast cancer with an increase in BMI by 1 (HR = 1.38, 95% CI [1, 1.9]) (Song, Sung, & Ha, 2008). In the U.S. Nurses' Health Study, weight gain after menopause was strongly associated with breast cancer, showing a relative risk of 1.99 (95% CI [1.43, 2.76]) for weight gain over 20 lbs compared to no gain (Huang et al., 1997). In addition, mammography rates in obese women have been lower than in women of healthy weight (Fernante, Chen, Crabtree, & Wartenberg, 2007; Fontaine, Heo, & Allison, 2001). Research suggested that a woman's negative self-esteem and body image because of excessive weight may influence her adherence to early detection and examination recommendations, which may result in poorer health outcomes (Mitchell, Padwal, Chunk, & Klarenbach, 2008). A Korean study reported that overweight women (BMI = 23–25) (odds ratio [OR] = 1.28, 95% CI [1.09, 1.51]) and mildly obese women (BMI = 25–30) (OR = 1.21, 95% CI [1.05, 1.41]) were less likely to have had mammography than women of healthy weight (Kim, Koh, Hur, Park, & Park, 2009), which could result in delayed detection of cancer and higher breast cancer mortality.

As a strategy for promoting early detection, several mathematical breast cancer risk assessment tools have been developed in Western countries, based on the assumption that a mathematical model can represent women's probability of developing breast cancer (Eibner, Barth, Helmes, & Bengel, 2006). The Gail model is one of the most popular, based on risk factors such as age, age at menarche, age at first live birth, number of first-degree relatives with breast cancer, presence of atypical hyperplasia on biopsy, and number of breast biopsies (Gail et al., 1989). However, the model has been criticized for not addressing breast cancer history in second-degree relatives or personal history of lobular carcinoma in situ (Euhus, 2001). In addition, when Spiegelman, Colditz, Hunter, and Hertzmark (1994) compared the number of breast cancer cases predicted by the Gail model to the actual number of cases, the model overestimated breast cancer risk in premenopausal women, women with a strong family history of breast cancer, and women with a first birth before age 20. Tice et al. (2008) included breast density in the Gail model to estimate a woman's future risk for breast cancer, which resulted in better prediction that closely matched her actual medical history.

The Breast Cancer Risk Assessment Tool (BCRAT-NCI) was adopted by the National Cancer Institute (NCI, 2002). NCI modified the Gail model by excluding ductal and lobular carcinoma in situ because of concerns about the accuracy of the estimate. The BCRAT-NCI is the only tool available that accounts for breast cancer incidence by race and age, but the calculation for Asian women still is based entirely on data from Caucasian women. As breast cancer is influenced by multiple factors of inheritance, lifestyle, diet, and environment (McTiernan, 2000),

whether those models can accurately estimate the risk of breast cancer in Korean women is questionable. For example, breast cancer is most prevalent among women after menopause in the United States (ACS, 2011), whereas in Korea, women aged 40–49 years show the highest incidence rate of about 39% (National Cancer Center, 2011). In consideration of those differences, accounting for risk factors specific to populations that are ethnically and culturally diverse is essential.

The development of an assessment tool appropriate for Korean women and based on cohort data still is at an early stage. The Breast Cancer Risk Appraisal for Korean Women (BCRA-K) (Lee et al., 2004) was developed by identifying and validating risk factors through a case control study. Kim et al. (2008) developed the Estimation of Individualized Probabilities of Developing Breast Cancer for Korean Women (EIPDBC-K) tool based on the relative risk of breast cancer associated with selected risk factors in Korean women. To view the model, visit <http://user.dankook.ac.kr/~surgery/brca/brca-e.htm>. The EIPDBC-K is a useful tool for estimating absolute risks in the next five and 10 years up to ages 64–75 years; however, the model needs further refinement because the follow-up period in the Korean Genomic Regional Cohort (KGRC) database is not long enough to provide reliable information yet (Kim et al., 2008).

Giving women individualized estimations of breast cancer risk based on a mathematical model improves the accuracy of their risk perception, as opposed to a media message targeting unspecified women (Buxton et al., 2003; Lobb et al., 2004). However, some women tend to overestimate or underestimate their breast cancer risk, even when risk information is provided (Eibner et al., 2006). Women may be less likely to comply with screening recommendations if risk is underestimated, whereas women may be more likely to suffer unnecessary anxiety, psychological distress, and worry about cancer if risk is overestimated (Katapodi et al., 2009; Sabatino et al., 2004). Researchers also have indicated that women who have a high amount of worry about breast cancer and fear of finding cancerous lumps may not follow screening recommendations (Nahcivan & Secginli, 2007; Park, Hur, Kim, & Song, 2007). Therefore, reliable and accurate estimation of individual risk should be used in clinical practice as a key element to encourage a woman's realistic perception of her risk of breast cancer and, therefore, promote appropriate screening.

The current study assessed breast cancer risk estimates for obese Korean women and identified differences in breast cancer screening behaviors based on the level of risk defined by each tool. The specific objectives were to (a) compare the probability of developing breast cancer as identified by the selected estimation tools (BCRAT-NCI, BCRA-K, and EIPDBC-K), results of mammography, and the women's perception of breast cancer risk; (b) identify relationships among the estimates from each tool; and (c)

compare the differences in having mammography and performing breast self-examination between lower- and higher-risk groups, as classified by each tool.

## Methods

### Participants and Recruitment

The current study used a cross-sectional design. Participants consisted of 64 severely obese women who were selected from the KGRC registry using a nested cohort sampling method. The sample was composed of women older than age 40 from the rural region of northeastern South Korea who had registered with the Lifelong Health Care Center managed by Wonju College of Medicine at Yonsei University. Inclusion criteria for the current study were women who had a BMI of 30 or higher, were aged 40–60 years, had no history of invasive breast cancer or mastectomy, were able to provide voluntary informed consent, and were willing to undergo mammography offered by the research team. The World Health Organization's classification of BMI has been criticized for its lack of applicability to Asians; therefore, the current study used the criteria of the Korean Society for the Study of Obesity (Ou et al., 2002) as follows: low weight (BMI < 18.5), normal weight (BMI = 18.5–23), overweight (BMI = 23–25), mild obesity (BMI = 25–30), and severe obesity (BMI > 30).

The current study was reviewed by the research ethics committee of Wonju College of Medicine. The study participants were identified from the total sample of 5,912 KGRC registry enrollees from March 2007 to February 2008, based on demographic characteristics and medical histories in the database. The research team then attempted up to two telephone contacts with each of the 204 eligible women to invite them to participate. Women were screened for an initial contact if they had not had mammography within the past year (to ensure they were not exposed to a mammogram more than once in a year). After the research team contacted potential study participants, the study was explained and informed consent was obtained. Sixty-four women (31%) agreed to participate. The reasons for refusal included "too busy to participate" and "not being interested." Women were asked to be at the breast clinic an hour before the appointment time for mammography. After meeting the research team member at the site, participants were fully informed about the study again and gave voluntary written consent. All women completed the questionnaire by interview and underwent mammography. All data were collected from March through June 2009.

The mammography findings were obtained from a radiologist. Each woman was informed about her result via telephone call from the researcher, and participants were given an opportunity to ask additional questions when they received the follow-up guides.

**Table 1. Summary of Tools for Estimating the Probability of Developing Breast Cancer**

Variable	Breast Cancer Risk Assessment Tool of the National Cancer Institute	Breast Cancer Risk Appraisal for Korean Women	Estimation of Individualized Probabilities of Developing Breast Cancer for Korean Women
Items measured	Age, number of first-degree relatives with breast cancer, history of breast cancer, age of first live birth, age of menarche, and history of breast biopsy	Age (years): 35–39 (5) <sup>a</sup> , 40–59 (10), and 60 or older (7); family history of breast cancer (45); personal history of breast disease (20); less than two children (8); no breast feeding experience (10); and consumption of meat more than once a week (7)	Age, family history of first- and second-degree relatives with breast cancer, age at first delivery, history of breast feeding, body mass index, menopause, and history of breast biopsy
Interpretation of risk status	The tool estimates a woman's risk of developing invasive breast cancer during the next five-year period up to age 90 (lifetime risk) compared to women of the same age who are at average risk.	The risk score is calculated by the absolute size of the odds ratio for a total of 100 points: very high (70 or higher), moderately high (40–69), slightly high (20–39), or normal (19 or lower)	The tool estimates a woman's risk of developing invasive breast cancer during the next 5–10 years up to ages 64–74 (lifetime risk) compared to women of the same age at average risk for developing invasive breast cancer.
Criteria for higher risk	Having a higher calculated five-year breast cancer risk than women in the same age group (included women at above average and high risk)	Very high, moderately high, and slightly high scores	Having a calculated five-year breast cancer risk higher than women in the same age group
Criteria for lower risk	Having the same or lower risk than women in the same age group (included women at average and low risk)	Normal scores	Having the same or lower risk than women in the same age group

<sup>a</sup> Values in parentheses indicate the number of points added to the risk score in this model.

Note. Based on information from Kim et al., 2008; Lee et al., 2004; National Cancer Institute, 2002.

## Measurements

### Breast Cancer Risk Assessment

Breast cancer risk was estimated with the BCRAT-NCI, BCRA-K, and EIPDBC-K. Risk factor items, interpretation of results, and risk criteria used for the current study are identified in Table 1.

Mammography was used as a reference to compare the results of the risk assessment tools. A university hospital radiologist classified the findings based on the Breast Imaging Reporting and Database System (American College of Radiology, 2010). The mammography finding was rated 1 (negative), 2 (probably benign), or 3 (suspicious abnormality).

Women's perception of breast cancer risk was measured by the item, "There is a high likelihood that a cancerous lump may be developing in my breast." The answer was rated on a percentage scale from 0 (absolutely disagree) to 100 (absolutely agree).

Before having their study mammography, women were asked, "Have you performed breast self-examination in the past six months?" and "Have you had mammography within the past two years?" (yes or no). A previous Korean study revealed that only about 2% of women were regularly performing a monthly breast self-examination, although 49% reported that they had performed one in the past six months (Han & Chung, 2006). Because of the low rate, performing a breast self-examination, even if not regularly, was considered a reasonable indication of a woman's screening behavior.

### Statistical Analysis

SPSS®, version 18.0–Korean, was used for the following statistical analyses. Descriptive statistics of the demographic and study variables were identified, and relationships among the estimated risk score from each tool and mammography findings were analyzed with Pearson's correlation. Chi-square tests were used to examine differences in breast cancer screening behaviors between higher (coded as 1) and lower (coded as 0) risk groups. Mammography findings were coded 0 if negative and 1 if they showed a probably benign or suspicious abnormality for the chi-square tests. Women's perception of breast cancer risk was divided into less likely (< 50, coded as 0) or more likely (≥ 50, coded as 1). That categorization has been used in other studies (Evans, Blair, Greenhalgh, Hopwood, & Howell, 1994).

## Results

### Participant Characteristics

The women had a mean age of 52.3 years (range 42–60, SD = 5.57), and 39 had an annual family income lower than \$24,000 (U.S.). The KGRC comprised patients from

Table 2. Sample Characteristics

Characteristic	Range	$\bar{X}$	SD
Age (years)	42–60	52.3	5.57
Height (cm)	145–171.1	156.6	1.83
Weight (kg)	66.3–97.9	77.4	6.5
Body mass index	30–39.4	32	1.82

  

Characteristic	n
<b>Performed breast self-examination in past six months</b>	
Yes	39
No	25
<b>Education (years)</b>	
8 or less	38
9–11	10
12 or more	16
<b>Marital status</b>	
Unmarried	1
Married	63
<b>Annual family income (U.S. \$)</b>	
11,999 or less	16
12,000–23,999	23
24,000 or more	14
No answer	11
<b>Health insurance</b>	
National	58
Additional low income	6
<b>Family history of breast cancer</b>	
Yes	6
No	58
<b>Had mammography in past two years</b>	
Yes	34
No	30

N = 64

rural areas; therefore, the family income was below the average of \$48,000 (U.S.) in urban Korean populations (Korean Statistical Information Service, 2010). All participants were coverage by national health insurance, and six were receiving additional low-income insurance. Table 2 presents additional demographic data.

### Risk Assessment, Mammography, and Perception of Risk

Table 3 presents distributions of breast cancer risk according to each study instrument. The BCRAT-NCI and BCRA-K assessed most women as having lower risk of breast cancer, whereas the EIPDBC-K classified most as having higher risk. Regarding mammography reports, the radiologist recommended that women with probably benign (n = 14) or suspicious abnormality (n = 1) have follow-up sonograms. In addition, 54 women agreed to some extent (i.e., score higher than 50) that they had a high likelihood of developing a cancerous lump in their breast.

### Correlations of Risk Estimates

Table 4 presents correlations among the study findings. The BCRAT-NCI results were significantly related to the

**Table 3. Risk Assessment, Mammography Findings, and Perception of Breast Cancer Risk**

Characteristic	n
<b>Breast Cancer Risk Assessment Tool of the National Cancer Institute</b>	
Lower (average or low) risk	59
Higher (above average or high) risk	5
<b>Breast Cancer Risk Appraisal for Korean Women</b>	
Lower risk	45
Higher risk	19
• Slightly high	12
• Moderately high	6
• Very high	1
<b>Estimation of Individualized Probabilities of Developing Breast Cancer for Korean Women</b>	
Higher risk	43
Lower risk	21
<b>Mammography findings</b>	
Negative	49
• Fatty breast tissue	27
• Dense breast tissue	22
Probably benign	14
Suspicious abnormality	1
<b>Breast cancer risk perception<sup>a</sup></b>	
More likely	54
Less likely	10

N = 64

<sup>a</sup>  $\bar{X} = 71.9$  (SD = 16.78) on a scale from 0–100; higher scores indicated more risk perception.

BCRA-K, but not to the other tools or mammography findings. The EIPDBC-K showed significant positive correlations with the BCRA-K and mammography findings. In addition, the BCRA-K showed a significant correlation with mammography findings. Women who scored higher on the BCRA-K were more likely to perceive a higher risk of developing breast cancer. The BCRA-K was the only tool that showed a significant correlation with women's perception of breast cancer risk.

### Differences in Screening Behaviors

The three assessment tools, mammography findings, and women's perception of breast cancer risk were con-

sidered to identify differences in women's performance of breast self-examination or having mammography. Based on the women's perceived likelihood of developing breast cancer (more likely or less likely), their performance of breast self-examination and having mammography were significantly different (see Table 5). However, women's screening behaviors did not differ according to their perception of breast cancer risk or mammography findings.

## Discussion

Breast cancer risk assessment should accurately quantify a woman's chance of developing breast cancer. Therefore, the current study compared for the first time the breast cancer risk estimation tools developed for Korean and Western populations and examined their relationships to mammography findings and women's health behaviors in obese rural Korean women. The results suggest that a breast cancer risk assessment tool should be pertinent to its target population with ethnic, cultural, and personal factors.

The proportion of women in the higher risk groups varied by tools. The BCRAT-NCI indicated a lower proportion of women with higher risk of breast cancer than in a study of a national community-dwelling American sample in which 16% had a five-year Gail risk higher than 1.67% (Sabatino et al., 2004). The result is consistent with Bondy, Lustbader, Halabi, Ross, and Vogel's (1994) outcome, possibly because the BCRAT-NCI underestimated risk in most non-Caucasian women (e.g., Korean women) who had no family history. However, the EIPDBC-K defined 43 women with higher risk, which may be attributed to the sample of severely obese women and including BMI in the tool. Obesity and severe weight gain substantially increase the risk of postmenopausal breast cancer (Hu, 2003; Huang et al., 1997); therefore, assessment of those risk factors should be incorporated in breast cancer prevention strategies. In addition, only the BCRA-K included meat intake, which may explain its larger proportion of high-risk women versus the BCRAT-NCI. The findings are relevant to studies showing that Westernized diets

**Table 4. Correlations Among Tool Scores, Mammography Findings, and Perception of Breast Cancer Risk**

Variable	BCRAT-NCI	BCRA-K	EIPDBC-K	Mammography Findings
BCRA-K	0.38**			
EIPDBC-K	-0.06	0.42**		
Mammography findings, scored by an ordinal scale (1 = negative, 2 = probably benign, 3 = suspicious abnormality)	0.06	0.28*	0.43***	
Perception of breast cancer risk (raw score from 0–100)	0.05	0.42**	0.11	0.07

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

BCRA-K—Breast Cancer Risk Appraisal for Korean Women; BCRAT-NCI—Breast Cancer Risk Assessment Tool of the National Cancer Institute; EIPDBC-K—Estimation of Individualized Probabilities of Developing Breast Cancer for Korean Women

Note. Raw scores of each tool were used.

**Table 5. Differences in Breast Cancer Screening Behaviors by Risk Groups**

Variable	Breast Self-Examination			Mammography		
	Yes (N = 39)	No (N = 25)	$\chi^2$	Yes (N = 34)	No (N = 30)	$\chi^2$
<b>Breast Cancer Risk Assessment Tool of the National Cancer Institute</b>			0.99			0.36
Lower (average and low) risk	37	22		32	27	
Higher (above average and high) risk	2	3		2	3	
<b>Breast Cancer Risk Appraisal for Korean Women</b>			0.11			0.25
Lower risk	28	17		23	22	
Higher risk	11	8		11	8	
<b>Estimation of Individualized Probabilities of Developing Breast Cancer for Korean Women</b>			0.01			0.01
Lower risk	13	8		11	10	
Higher risk	26	17		23	20	
<b>Mammography findings</b>			1.27			3.21
Negative	28	21		23	26	
Probably benign or suspicious abnormality	11	4		11	4	
<b>Perception of breast cancer risk</b>			4.77*			5.22*
More likely	36	18		32	22	
Less likely	3	7		2	8	

\*  $p < 0.05$ 

increased the risk of breast cancer in Korean women (Ahn & Yoo, 2006) and that high intake of meat is associated with breast cancer risk (Gerber, Müller, Reimer, Krause, & Friese, 2003; McTiernan, 2003). To date, no single model integrates all those risk factors. Euhus (2001) recommended using a variety of models in the specialized risk assessment clinic. The current study provides additional information for understanding the strengths and weaknesses of each model, particularly for a specific target population. In addition, the findings suggest that factors such as a Westernized diet (e.g., animal meat, fried food) and obesity need to be incorporated to build strategies for preventing breast cancer in Korean women.

Although mammography has some specificity and sensitivity limitations, its findings offer an objective criterion for comparing the adequacy of estimations of the Korean tools and the BCRAT-NCI. In contrast to the BCRAT-NCI, the higher risk groups identified by the two Korean tools also had abnormal findings on mammography, thus supporting the clinical utility of the Korean tools. The National Comprehensive Cancer Network (2011) suggested that elements of breast cancer risk include BMI and breast density. Known breast cancer risk factors of age, menopause, use of hormone therapy, and obesity have been associated with mammographic breast density (Gapstur et al., 2003). Although the mammography finding was negative, obese women in the current study were found to have dense ( $n = 22$ ) and fatty ( $n = 27$ ) breast tissue, respectively; therefore, mammography findings of obese women may provide more reliable information for breast cancer education and counseling.

The current study's findings also provide insights about Korean women's self-awareness of breast health regarding screening behaviors. Although subjective risk perception could affect breast screening behaviors, whether women under- or overestimate their risk could affect their breast cancer-specific distress or worry (Hay, McCaul, & Magnan, 2006; Henderson et al., 2008). Of particular note, 84% of women indicated agreement (slightly to absolutely) that they had a high likelihood of developing a cancerous lump. Although the rate is higher in the current study than 57% reported by Asian women in Hong Kong (Chan et al., 2007), it may represent current regional perceptions about breast cancer in this target population, who is at higher risk because of obesity and age. However, the increased perceived risk also indicates an area for patient education to help women gain a more accurate awareness of their risk for breast cancer.

Because of public health advertisements through a television campaign, community health centers, and physician associations in South Korea (NCIC, 2011), women in the current study may have been aware of the affect of severe obesity on breast cancer risk. Unfortunately, awareness does not always correlate with actual behaviors, considering that women with a higher BMI had lower compliance to physician's guidelines for breast cancer screening (Fernante et al., 2007; Park, Song, Hur, & Kim, 2009). The low compliance may have been caused by the negative body image of the obese woman influencing her mammography behavior (Fletcher, Black, Harris, Rimer, & Shapiro, 1993). In addition, healthcare professionals also may hold negative perceptions about the need for

physical examinations or tests on obese women (Amy, Aalborg, Lyons, & Keranen, 2006). Obesity has become an important health issue globally; therefore, healthcare professionals need to enhance obese women's self-esteem and change their own attitudes toward obese patients to eliminate barriers to breast examinations.

### Limitations

The sample involved only 31% of 204 women from a cohort study; therefore, one should be cautious when interpreting the results. However, despite the small sample size and confined geographic area, the risk estimates were different across the three assessment tools, based on the risk factors they included. In the current study, the level of women's perception of breast cancer risk showed a difference in their performance of breast-screening behaviors. Screening was measured by only one item, so determining why women felt that way and what affected their level of perception was difficult. Therefore, subjective perception should be measured further with additional valid tools. In addition, having one radiologist rate the mammograms did not ensure that reports met a defined standard or establish inter-rater reliability; that limitation should be addressed in future studies.

## Conclusions and Implications for Nursing Practice

Assessment is important for providing primary and secondary preventive strategies that may reduce women's risk for developing breast cancer. About 51% of nurse practitioners provided breast cancer risk assessment to their patients in a study by Edwards, Maradiegue, Seibert, Saunders-Goldson, and Humphreys (2009); therefore, mathematically estimated breast cancer risk could be an excellent educational tool for healthcare providers as a first step to categorizing risk, particularly if the tool's

development is based on epidemiologic data of the appropriate country or population.

A clinical algorithm for recommending ongoing breast examinations based on degree of risk as estimated by those mathematical models should focus on the target population and incorporate appropriate major risk factors (e.g., family history, obesity, menopause). Those findings can help healthcare providers recommend appropriate screening to high-risk women, particularly if their screening behaviors are affected by their own risk perception. The BCRA-K is sensitive to Korean race and cultural background; therefore, the BCRA-K may be used for screening risk groups or providing education for immigrant Korean women in the United States.

Breast screening behaviors of obese women differed according to their perception of risk. The results indicate that women need to be aware of their actual breast cancer risk and the possible negative effect of not being screened appropriately. Therefore, future research should identify the characteristics that influence women's subjective perception through various measurement tools, as well as qualitative methods. In addition, women's perceived level of risk should be identified using tools that are based on data from their cultural and ethnic backgrounds.

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