Screening for Breast Cancer: Evidence and Recommendations

Suzanne M. Mahon, RN, DNSc, AOCN®, APNG

Guidelines for the early detection of breast cancer vary across agencies. This article compares available breast cancer screening guidelines for women of average or increased risk, as well as for older women. Nurses are challenged to explain risk factors, discuss variations in guidelines, and assist women in understanding the strengths and limitations of various screening modalities for the early detection of breast cancer.

The American Cancer Society (ACS, 2012) estimated that 226,870 new cases of invasive breast cancer and 63,500 new cases of in situ breast cancer will be diagnosed in the United States in 2012. Breast cancer is the second leading cause of cancer death among women, with an estimated 39,920 deaths expected in 2012 (ACS, 2012). The widespread use of screening mammography combined with treatment advances has been credited with significant reductions in breast cancer mortality. A cancer screening program should be implemented only when the magnitude of benefits exceeds the harms to a degree that justifies the costs and effort of the program (Harris, Yeatts, & Kinsinger, 2011). Because breast cancer is a significant problem, screening is an appropriate consideration. Screening modalities that have demonstrated some sensitivity and specificity used in the early detection of breast cancer in asymptomatic women include breast self-examination, clinical breast examination, mammography and, in some women, breast magnetic resonance imaging (MRI).

Breast cancer risk is an important consideration in the application of screening guidelines. Most guidelines provide recommendations for women at average risk; to date, the lifetime risk for developing breast cancer in the United States is 12.15%, which means one in eight women will develop breast cancer in her lifetime (to age 85) (ACS, 2011). The health benefits and cost utility of screening mammography are influenced by a woman’s risk factors for breast cancer, particularly her age, breast density on an initial mammogram, history of breast biopsy, and family history of the disease (Boyd et al., 2011; Schousboe, Kerlikowske, Loh, & Cummings, 2011). Breast density is best categorized with the Breast Imaging Reporting and Data System, which classifies breast density with a score ranging from 1 (almost entirely fatty breast tissue) to 4 (extremely dense breast tissue); a rating of 3 or 4 suggests increased density and risk (Schousboe et al., 2011). Family history of breast cancer, particularly those with a history suggestive of a hereditary cancer syndrome, and a previous breast biopsy showing atypia also indicate increased risk (Nelson et al., 2012).

Understanding relative risk for developing cancer is important to selecting the proper breast cancer screening modality. Relative risk is a comparison of a risk factor to someone who does not have it (see Table 1). Screening recommendations may be modified based on risk factor profile for some women. Common models for calculating the lifetime risk of developing breast cancer and the risk of having a mutation associated with hereditary breast cancer syndromes include the following.

- **Lifetime risk only:** Modified Gail model or Breast Cancer Risk Assessment Tool (www.cancer.gov/bcrisktool) and the Claus model (Claus, Risch, & Thompson, 1994)
- **Lifetime and mutation risk:** CancerGene (www4.utsouthwestern.edu/breasthealth/cagene) and the Tyrer-Cuzick model or International Breast Cancer Intervention Study Breast Cancer Risk Evaluation Tool (www.ems-trials.org/riskevaluator)
- **Mutation risk only:** BRCA Risk Calculator (www.myriadpro.com/brcarisk-calculator)

Each model considers different risk factors, and the clinician is responsible for selecting a model that will most accurately summarize risk. Those models help to identify women with significantly increased risk for developing breast cancer compared to women of the same age without risk factors.

Accuracy of Screening Tests

In screening, sensitivity measures the proportion of actual positive test results that are correctly identified as a positive screen, whereas specificity measures the proportion of correctly identified negative test results. A perfect breast cancer screening test would have 100% sensitivity (i.e., identifies all women with breast cancer—no false negatives) and 100% specificity (i.e., would not have false positives resulting in unnecessary workup). Any test usually has a trade-off between sensitivity
Sensitivity and specificity are affected by many factors, including age, time since last examination, breast tissue density, body mass index, age at menarche and menopause, use of hormone replacement therapy, quality of the mammography equipment, and the skill of the interpreting radiologist (Sinclair, Littenberg, Geller, & Muss, 2011; Warner et al., 2008). Standardization of practices enacted by the Mammography Quality Standards Act in 1992 has led to improved mammography quality (U.S. Food and Drug Administration, 2004) and increased sensitivity and specificity.

The harms resulting from screening for breast cancer most often are associated with false positives and include psychological harms, unnecessary imaging tests and biopsies in women without cancer, and inconvenience. Concern also exists that overdiagnosis of ductal carcinoma in situ that would not have become clinically significant and treatment of breast cancer that would not have shortened a woman’s life might occur (U.S. Preventive Services Task Force, 2009). Another minor concern is radiation and dye exposure during MRI. Genuine harm can occur from a false negative when a screening modality fails to detect breast cancer. The risks and benefits of different screening modalities are shown in Table 2.

### Recommendations Across Groups

Different agencies have issued recommendations for breast cancer screening. An excellent resource to compare recommendations is [www.guidelines.gov](http://www.guidelines.gov). Agencies differ in the use of screening modalities, when to begin, the interval of use, and when to stop using a particular modality. These recommendations consider sensitivity, specificity, harm-benefit ratio, and cost. The recommendations of some of the major groups are summarized in Table 3.

Some recommendations address the use of digital mammography versus film screen mammography (Kerlikowske, 2012). The U.S. Preventive Services Task Force (2009) does not have a recommendation to date. ACS (2011) and the National Comprehensive Cancer Network (2011, 2012) recommend digital mammography for younger women and those with dense breasts. The Digital Mammography Imaging Screening Trial (DMIST) study had a sample of more than 42,760 women and performed film screen and digital mammography in asymptomatic women in the United States at the same time. Overall accuracy of film screen and digital mammography for breast cancer detection was similar, but digital mammography was more accurate in premenopausal or perimenopausal women younger than 50 years with mammographically dense breasts (Pisano et al., 2005). The Breast Cancer Surveillance Consortium conducted a study based on mammography performed in community practice and found similar results to DMIST (Kerlikowske et al., 2011). A detailed analysis mostly based on the DMIST data found digital mammography to be cost effective compared with film screen mammography only for women younger than 50 years; film mammography was cost effective for all other women (Tosteson et al., 2008).

### Screening in Older Women

The consequences of screening older women for breast cancer are controversial and often emotionally charged. Early detection has the same potential benefits as for younger women, including lowering disease complications and mortality, but also may be harmful and costly because of overdiagnosis and overtreatment (Galit, Green, & Lital, 2007). Screening mammography is more accurate in older women than in younger women because of decreased breast density. Estimates suggest as many as 40% of women older than age 80 who are screened are very unlikely to benefit from it because of poor health (Sinclair...
et al., 2011). Another consideration is screening older women for breast cancer may be less cost effective than for younger women, and the life expectancy gains are likely to be smaller (U.S. Preventive Services Task Force, 2009). Therefore, more complete consideration of the potential benefits and harms might best be made by individual estimation of life expectancy (recommended if life expectancy is 5–7 years) and the severity of comorbidities rather than by focusing on chronologic age (Sinclair et al., 2011).

Screening Women at Increased Risk

For women at increased risk for developing breast cancer, including those with a known mutation in the BRCA1 or BRCA2 genes or a lifetime risk of breast cancer higher than 20% (based on a risk model such as the Gail, Claus, or Tyrer-Cuzick), management can be complicated. For women with a known or suspected genetic predisposition such as in the BRCA1 or BRCA2 genes, prophylactic mastectomy reduces the risk of breast cancer by more than 90%, but many women with known hereditary risk are unwilling or unable to undergo such surgery (ACS, 2011). For women who choose to engage in screening, recommendations usually are modified regarding interval, age to begin, and type of screening modalities. Screening is aimed at finding stage I tumors when the risk of metastasis is low and long-term survival is high.

For women with hereditary predisposition who undergo annual conventional mammography-based screening, the annual cancer detection rate is estimated to be 35%–50%. Of those cancers detected, 40%–78% are invasive tumors larger than 1 cm, and 20%–56% have lymph node involvement (Warner et al., 2008). Therefore, efforts have been made to identify other screening modalities that can be combined with mammography; breast MRI is the most studied and available adjunct screening modality to date (Morrow, Waters, & Morris, 2011). The specificity of MRI is significantly lower than that of mammography, resulting in more recalls and biopsies. Call-back rates for additional imaging ranged from 8%–17% in the MRI screening studies, and biopsy rates ranged from 3%–15%; the overall proportion of biopsies that are malignant (positive predictive value) is estimated to be 20%–40% (Saslow et al., 2007). Therefore, breast MRI is reserved for those women at increased risk (greater than 20% lifetime risk or known BRCA1 or BRCA2 mutation) and only after informed decision making occurs with their healthcare provider.

Implications for Nursing and Conclusions

Variation among screening recommendations is confusing to healthcare professionals and the public. When a particular agency’s recommendations are selected, the provider should be able to articulate why the recommendations are followed. In all cases, that involves careful patient education. Women should be informed of potential risks, benefits, and harms of each screening modality. Nurses should provide education in understandable

<p>| TABLE 2. Strengths and Weakness of Breast Cancer Screening Modalities |</p>
<table>
<thead>
<tr>
<th>Modality</th>
<th>Potential for Prevention</th>
<th>Potential Harms</th>
<th>Costs</th>
<th>Limitations</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
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<tr>
<td>Breast magnetic resonance imaging (MRI)</td>
<td>In studies of very high-risk populations, MRI detected more cases of cancer than mammography.</td>
<td>Contrast-enhanced MRI requires the injection of contrast dye that might be associated with an increased risk of anaphylaxis or kidney damage. MRI yields many more false-positive results than mammography.</td>
<td>Significantly more expensive than mammography ($1,000–$2,000)</td>
<td>Might not be readily available</td>
<td>71–100</td>
<td>81–97</td>
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<td>Breast self-examination (BSE)</td>
<td>May detect an interval cancer</td>
<td>May increase women’s likelihood of undergoing additional unnecessary imaging and biopsies</td>
<td>Negligible—BSE is done by women at home.</td>
<td>Approaches may not be standardized and women may not be comfortable with their ability to detect changes.</td>
<td>12–41</td>
<td>Not reported</td>
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<td>Clinical breast examination (CBE)</td>
<td>Indirect evidence suggests CBE may detect a substantial proportion of cases of cancer if it is the only screening test available.</td>
<td>False-positive test results might lead to anxiety, distress, worry, repeated visits to providers, and unnecessary imaging and biopsies.</td>
<td>Negligible—in most cases, the woman will already be seeing the provider for other services.</td>
<td>Lacks standard approach and reporting</td>
<td>40–69</td>
<td>88–99</td>
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<td>Mammography</td>
<td>Using screening mammography to detect early-stage invasive breast cancer reduces breast cancer mortality by 15%–25%.</td>
<td>False-positive results can cause anxiety and lead to additional imaging studies and biopsies.</td>
<td>$150–$200</td>
<td>May be less sensitive in younger women, particularly those with dense breasts</td>
<td>77–95</td>
<td>94–97</td>
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Note. Based on information from American Cancer Society, 2011, 2012; Chiarelli et al., 2009; Moore et al., 2009; Saslow et al., 2007; Schousboe et al., 2011; Trivedi et al., 2008; U.S. Preventive Services Task Force, 2009.
TABLE 3. Comparison of Breast Cancer Screening Guidelines

<table>
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<tr>
<th>Guideline</th>
<th>BSE</th>
<th>CBE</th>
<th>Mammography</th>
<th>MRI</th>
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<td>American Cancer Society, 2011, 2012; Saslow et al., 2007</td>
<td>Women may choose to perform BSE or not. Beginning at about age 20, women should be instructed regarding benefits and limitations of BSE and the importance of prompt reporting of new breast symptoms. Women who choose BSE should receive instructions and have their technique reviewed.</td>
<td>Every 1–3 years for women aged 20–39 years and annually for women aged 40 years and older, prior to mammography</td>
<td>Mammography should begin annually at age 40 with no specific age to stop. The decision to stop should be individualized based on the potential benefits and risks depending on overall health status and estimated longevity. As long as a woman is in good health and would be a candidate for breast cancer treatment, she should continue to be screened.</td>
<td>MRI is recommended for women with a 20%–25% or higher lifetime risk for developing breast cancer, including women with a strong family history of breast or ovarian cancer and those treated for Hodgkin disease. MRI should be performed annually beginning at age 30.</td>
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<td>Canadian Task Force on Preventive Health Care, 2011</td>
<td>Women should not routinely practice BSE.</td>
<td>Women should not routinely receive CBE alone or with mammography.</td>
<td>Routine screening mammography for women aged 40–49 years is not recommended. Women aged 50–69 years should undergo mammography every 2–3 years. Benefits are likely to be limited after age 70, and practitioners should discuss that with patients.</td>
<td>MRI should not be used for screening.</td>
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<td>National Comprehensive Cancer Network, 2011, 2012</td>
<td>Breast awareness is recommended, which includes education about signs and symptoms of breast cancer that should be reported immediately. Women should be familiar with their own breast anatomy, and BSE is an option.</td>
<td>CBE should be performed every 1–3 years for women aged 20–39 years and annually for those aged 40 or older. However, CBE is recommended every 6–12 months for women with a lifetime risk for developing breast cancer higher than 20%, beginning at age 20.</td>
<td>Begin annually at age 40. Mammography is recommended 5–10 years before the youngest age at diagnosis of a family member with breast cancer (not before age 25) for women with a risk for developing breast cancer higher than 20%. Clinicians should use their judgment for older adult women and consider life expectancy and other comorbid conditions.</td>
<td>Annually for women with a lifetime risk higher than 20%</td>
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<td>U.S. Preventive Services Task Force, 2009</td>
<td>Teaching or practicing BSE is not recommended.</td>
<td>Current evidence is insufficient to assess the additional benefits and harms of CBE beyond screening mammography for women aged 40 years or older.</td>
<td>Routine screening for women aged 40–49 years is not recommended. Begin biennial screening mammography for women at age 50 until 74. Current evidence is insufficient to assess the additional benefits and harms of screening mammography for women aged 75 years or older.</td>
<td>Current evidence is insufficient to assess the additional benefits and harms of MRI as a screening modality.</td>
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BSE—breast self-examination; CBE—clinical breast examination; MRI—magnetic resonance imaging

terms and give women an opportunity to ask questions. A woman’s lifetime risk of developing breast cancer should be considered, and screening guidelines may need to be modified based on risks. To provide effective patient education, nurses should be aware of the evidence and science on which a recommendation is based and remain current on screening recommendations, with the ultimate goal of appropriate implementation of guidelines to decrease morbidity and mortality associated with breast cancer.

References


