

# Breast Cancer Screening

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**Mammography remains the primary technique for breast cancer screening. Women with dense breast tissue may benefit from digital mammography and tomosynthesis, and women at high risk may benefit from magnetic resonance imaging. However, false-positive results are problematic. The North Carolina breast density law necessitates education about screening options for women with dense breasts.**

*At the end of a long day, as she gets into her SUV after picking up her puppy at doggie daycare, Mary notices the message light blinking on her smartphone. The message directs her to the patient portal of the new electronic medical record system of the clinic where she had her mammogram last week. There she finds this report:*

Your mammogram shows no signs of cancer. However, North Carolina law now requires that we give you the following information: "Your mammogram indicates that you may have dense breast tissue. Dense breast tissue is relatively common and is found in more than forty percent (40%) of women. The presence of dense tissue may make it more difficult to detect abnormalities in the breast and may be associated with an increased risk of breast cancer. We are providing this information to raise your awareness of this important factor and to encourage you to talk with your physician about this and other breast cancer risk factors. Together, you can decide which screening options are right for you. A report of your results was sent to your physician."

*Her puppy is barking at a stray cat crossing the parking lot, and Mary's daughter is waiting at school, so she puts her gearshift into reverse—and backs directly into another car that is pulling out. She drops her face into her hands as she imagines a cascade of medical events that she fears will land her right where her Aunt Sarah ended up—swollen, bald, breastless, and breathless.*

**W**hile dramatized, this vignette illustrates one potential effect of the new North Carolina breast density law [1]. It also serves as a reminder that cancer screening has emotional and psychological costs, in addition to financial costs and possible medical complications. False-positive results of breast cancer screening are particularly likely to induce anxiety because of the special place that the breast holds in our society—as a powerful symbol of motherhood, nurturing, stability, family, femininity, sexuality, and vitality.

In addition to the psychological effects of false-positive results, breast cancer screening carries other risks: expo-

sure to radiation, overdiagnosis resulting in unnecessary interventions, complications from additional procedures, and financial costs. Also, overscreening may strain available health care resources and ultimately limit access to screening. Making recommendations for breast cancer screening is no simple matter. This commentary will review the benefits of screening by imaging, discuss the available modalities, and summarize current recommendations for screening.

## Benefits of Breast Cancer Screening

Screening mammography is based on the principle that it is best to detect tumors early, when they are too small to be palpated. One benefit of earlier detection is that treatment options are better when cancers are detected early. Tumors that are smaller and less aggressive may be treated with lumpectomy rather than mastectomy.

Numerous studies have shown a clear survival benefit if cancers are identified when they are small and at an early stage. However, other studies evaluating the effect of mammography on mortality have reached different conclusions because of the interaction of various factors and biases. Consequently, there is an array of ever-changing recommendations. Physicians, patients, health insurance organizations, and governments each have different viewpoints, further adding to this confusion. As physicians, we must balance medical knowledge with our patients' best interests and make reasonable recommendations, even if the right answer for every patient is not always clear.

One of the main enticements used to encourage women to undergo mammography screening is that it can offer peace of mind. That is true if the report is normal—and if the woman does not have dense breasts. On January 1, 2014, North Carolina joined 12 other states in requiring that patients be informed about breast density. All North Carolina mammography providers must now inform each patient by letter of her breast density classification, and women classified as having heterogeneously dense or extremely dense breast tissue must be given the information quoted in the vignette above.

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The wording and implications of such a letter will certainly cause concern for many women. Assessment of a patient's breast density has become pivotal, but this assessment is actually one of the most subjective determinations a radiologist must make. Unfortunately, determination of breast density will continue to be subjective until we have widely available tools that can measure breast density objectively.

## Imaging Modalities

**Mammography.** Compared with computed tomography (CT), mammography uses a relatively small amount of radiation; nevertheless, this radiation exposure still carries theoretical risks. The risk of having a mammogram is approximately the same as the difference in risk from background radiation received while living for 1 year in Colorado (where background radiation levels are higher) versus North Carolina. Mammography is highly sensitive for detection of calcifications, which may indicate the presence of ductal carcinoma in situ (DCIS). However, the detection of invasive cancers presenting as small masses is compromised by the presence of dense breast tissue. Because some cancers are difficult to see, subtle findings seen on screening may result in patients being recalled for diagnostic imaging, which most often reveals the findings to be benign.

Digital mammography has replaced film mammography in many North Carolina clinics. A multi-institutional trial conducted by Pisano and colleagues—the Digital Mammographic Imaging Screening Trial (DMIST)—showed that the overall diagnostic accuracy of digital mammography is similar to that of film mammography, and digital mammography is more accurate in some subgroups: women younger than 50 years, those with dense breasts, and those who are premenopausal or perimenopausal [2, 3]. Interestingly, mammographic technique may affect classification of a particular patient's breast density. Specifically, the breasts of a particular patient may appear less dense on digital mammography than on film mammography.

**Tomosynthesis.** Tomosynthesis is the newest improvement in mammography to gain acceptance in practice. This technique uses multiple low-dose radiographic exposures taken at different angles to generate a data set from which 3-dimensional images are reconstructed. Currently, the 3-dimensional images are taken in addition to the standard images, roughly doubling the radiation exposure compared with that of a standard mammogram, but the total radiation dose is still within the limits set by the US Food and Drug Administration. The main benefits of tomosynthesis are lower recall rates and a slight increase in cancer detection [4]. By having fewer recalls, tomosynthesis may reduce the number of women who experience anxiety associated with screening. Tomosynthesis is particularly helpful in women with dense breasts [4], but until a current procedural terminology (CPT) code is established for this procedure, clinicians will face challenges in ordering this study and obtaining reimbursement for it.

**Ultrasound.** Because a sonogram uses sound waves to visualize the body, it does not expose the patient to radiation or require the use of an intravenous (IV) contrast agent. However, ultrasound is highly operator-dependent, and the quality of the images is variable. Normal breast tissue can mimic cancer on ultrasound, so the false-positive rate is high; thus many ultrasound findings lead to biopsies that ultimately reveal benign results [5]. Therefore, although ultrasound can be extremely helpful in diagnostic mammography, it is not generally used for screening. Some physicians recommend ultrasound for screening of dense breasts if a patient cannot undergo magnetic resonance imaging (MRI). The cost of ultrasound is less than that of MRI and similar to that of mammography.

**MRI.** Because MRI is less affected by breast density, it has high sensitivity for invasive cancer and can detect additional invasive breast tumors beyond those found on mammography or ultrasound [6]. However, we do not yet know whether finding this additional disease affects mortality. The false-positive rate for MRI is lower than that of ultrasound, but this rate is only acceptably low if screening is limited to high-risk women. MRI is also considerably more expensive than mammography or ultrasound.

Although MRI does not involve the use of radiation, effective cancer screening does require the use of a nonradioactive gadolinium-based IV contrast agent. An allergy to the contrast agent, poor renal function, or pregnancy can thus preclude the use of MRI for breast cancer screening. Also, patients with certain devices—such as pacemakers or aneurysm clips—cannot undergo MRI, and highly claustrophobic patients may not tolerate MRI, even with premedication. Finally, MRI does not replace mammography, because the calcifications that may indicate DCIS are not visible on MRI.

## Current Breast Cancer Screening Recommendations

In the profusion (and confusion) of changing recommendations for breast cancer screening, patients and providers can look to larger specialty organizations for stable, evidence-based recommendations. The breast imaging section at Wake Forest Baptist Medical Center has generally followed the guidelines of the American Cancer Society (ACS) and the American College of Radiology (ACR).

The ACS guidelines are the simplest set of guidelines, but they do not take into account breast density or special risk categories. They recommend that women aged 40 years or older have yearly mammography for as long as they are in good health, and that high-risk women undergo both MRI and mammography every year [7].

The more detailed ACR guidelines use appropriateness criteria that weigh the value of imaging tests according to patient factors, and these guidelines include definitions of risk factors. On the ACR scale, ratings of 7, 8, or 9 mean that the procedure is "usually appropriate"; ratings of 4, 5, or 6 mean that it "may be appropriate"; and ratings of

1, 2, or 3 mean that it is “usually not appropriate.” Table 1 summarizes the ACR recommendations [8], which can be read in their entirety on the ACR Web site (<http://www.acr.org/-/media/ACR/Documents/AppCriteria/Diagnostic/BreastCancerScreening.pdf>).

Given the complexity of these recommendations, determining optimal screening strategies for an individual woman may necessitate an in-depth analysis of risks and benefits. If half of all women undergoing mammography receive “dense breast” letters, there will be a tremendous need for education of both providers and patients. Fortunately, helpful information is available online. The California Breast Density Information Group has developed an excellent Web site, [www.breastdensity.info](http://www.breastdensity.info). After consulting with the California group, Cherie Kuzmiak, MD, of the University of North Carolina at Chapel Hill began adapting this Web site for use in North Carolina, and the North Carolina Web site is now available at [www.ncacr.org/breast-health.php](http://www.ncacr.org/breast-health.php). The value of this Web site lies in 2 aspects: its design, which is very clear and user-friendly, targeting patients as well as referring physicians and radiologists; and its comprehensiveness, with detailed sections devoted to the new law, breast density, screening techniques, and references. Other informative resources include the ACR appropriateness criteria for breast screening mentioned above, as well as an ACS article discussing early detection of breast cancer [9]. While online resources are helpful, clinic consultations will still be necessary for anxious patients and those with a complicated risk profile, and genetic counseling is appropriate for some women with a strong family history of breast cancer.

## Conclusion

Breast cancer screening has been proven to save lives and to permit better treatment options. Mammography remains the mainstay of screening and has recently been improved by the development of a digital technique and tomosynthesis. MRI is also firmly established as part of the breast cancer screening process for high-risk women. Ultrasound may be useful in some situations, but it carries the highest false-positive rate of the available screening technologies.

The North Carolina breast density law, which took effect on January 1, 2014, will have positive and negative consequences. There is debate regarding the exact percentage of women who have dense breast tissue and the degree of increased risk they face, but detecting cancer in these women is more difficult, and a normal report without the type of caveat the law requires could be falsely reassuring. Therefore, it is good to share this potentially significant medical information with patients, even though it makes peace of mind more elusive as women undergo additional screening and receive further test results, which may or may not be normal. Our challenge as physicians is to be prepared to respond to the increased concern and questions of women with dense breast tissue.

Although the complexity of breast cancer screening prevents me from giving a simple set of recommendations that would be applicable to all asymptomatic women, I would like to suggest this summary as a reasonable approach:

- (1) All women should receive yearly mammograms, preferably digital, beginning at age 40 years, or pos-

**TABLE 1.**  
**American College of Radiology Criteria for Appropriateness of Various Breast Cancer Screening Methods**

Screening method	Appropriateness rating <sup>a</sup>	Special considerations
For women at average risk <sup>b</sup>		
Yearly mammography	9	
MRI with a contrast agent	3	
Ultrasound	2	
For women at intermediate risk <sup>c</sup>		
Yearly mammography	9	
MRI with a contrast agent	7	
Ultrasound	5	
For women at high risk <sup>d</sup>		
Yearly mammography	9	Recommended to begin between age 25 years and age 30 years, or 10 years before the age at which a first-degree relative was diagnosed, or 8 years after radiation therapy, but not before age 25 years
MRI with a contrast agent	9	
Ultrasound	6	If the patient cannot have an MRI

Note. MRI, magnetic resonance imaging.

<sup>a</sup>Ratings of 7, 8, or 9 mean that the procedure is “usually appropriate”; ratings of 4, 5, or 6 mean that it “may be appropriate”; and ratings of 1, 2, or 3 mean that it is “usually not appropriate.”

<sup>b</sup>Average-risk women are those whose breasts are not dense and whose lifetime risk of breast cancer is less than 15%.

<sup>c</sup>Intermediate-risk women are those with a personal history of breast cancer, lobular neoplasia, atypical ductal hyperplasia, or a 15%–20% lifetime risk of breast cancer.

<sup>d</sup>High-risk women are those who have a *BRCA* gene mutation or who are untested but have a first-degree relative with such a mutation, those who received chest irradiation between the ages of 10 and 30 years, and those with a 20% or greater lifetime risk of breast cancer.

sibly earlier if they have certain risk factors.

- (2) Women with dense breast tissue should receive yearly digital mammograms, preferably including tomosynthesis.
- (3) In addition to yearly mammograms, women at high risk for breast cancer should also receive yearly MRI screening.
- (4) For patient and physician education, refer to the North Carolina breast density website.

Both referring providers and radiologists should consider the fact that an excessive number of false-positive findings may drive patients away from screening, cause insurance providers to limit coverage, and ultimately limit access to these lifesaving procedures. Finally, clinicians should always keep in mind that any concerning clinical finding should be further evaluated, because some breast cancers cannot be detected with imaging. **NCMJ**

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