



Breast Cancer Screening: A Review of Current Guidelines

Recent updates have led to variations in national recommendations.

ABSTRACT: Breast cancer accounts for more than a quarter million diagnoses each year in the United States. Routine screening is the primary method used to detect cancer in its earliest stages, before symptoms develop. Recent changes to national screening guidelines have resulted in a lack of consensus and confusion among health care providers and the public. This article reviews the guidelines of the American Cancer Society, the U.S. Preventive Services Task Force, and the National Comprehensive Cancer Network and provides guidance to nurses as they support and educate patients.

Keywords: breast cancer, guidelines, mammography, screening

Breast cancer is the most commonly diagnosed cancer in the United States, affecting approximately 12% of women during their lifetimes (though fewer than 1% of men).^{1,2} In 2017, more than 250,000 women were expected to be diagnosed with invasive breast cancer, and it was estimated that approximately 40,000 would die from the disease.¹ Because being a woman and advancing age are the most significant risk factors for breast cancer, screening is considered an essential part of women's health care.³

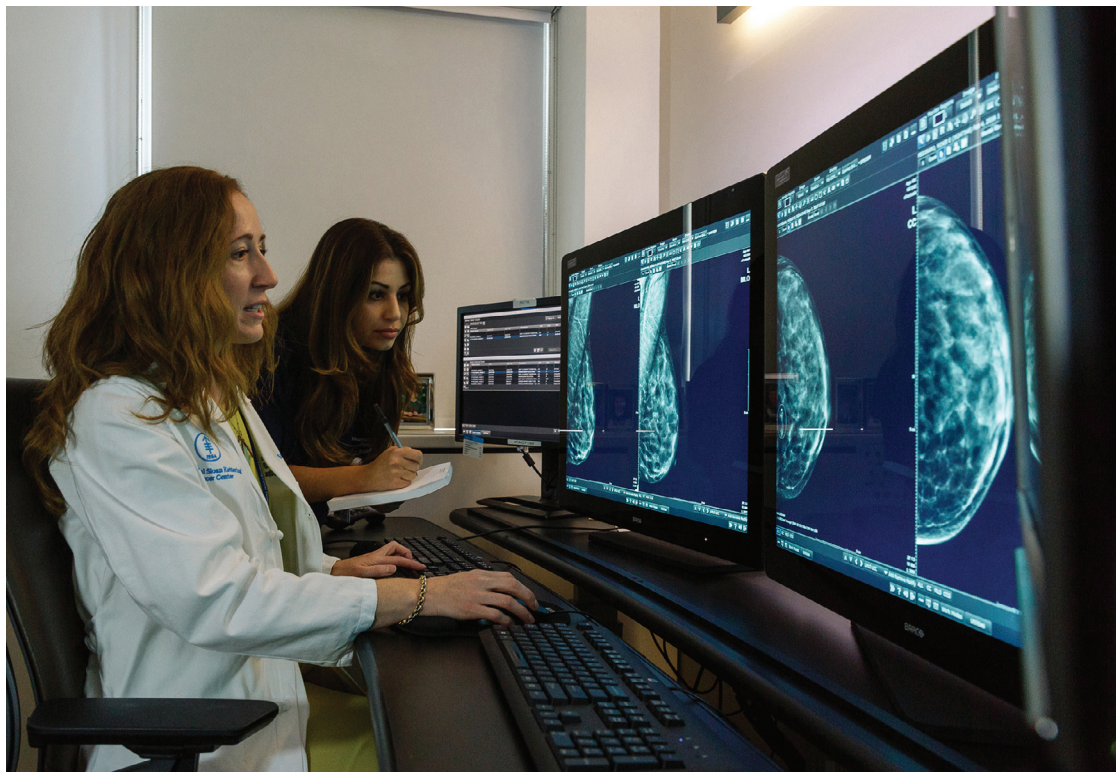
Screening is used to detect breast cancer and precancerous breast conditions at the earliest and most treatable stages, before the signs and symptoms of disease appear.⁴ Screening guidelines are developed using data collected from clinical research and cancer registry databases. The process involves the use of risk stratification, and the benefits of screening are weighed against its potential impact on quality of life and financial costs.⁵ Recent changes in the screening guidelines of the major organizations have led to variations in their recommendations. As a result, there is a need

to educate clinicians on the new guidelines, so they can appropriately guide patients in decision making.⁶

This article discusses the current screening recommendations of three highly regarded organizations: the American Cancer Society (ACS), the U.S. Preventive Services Task Force (USPSTF), and the National Comprehensive Cancer Network (NCCN). The rationale behind these guidelines, the benefits and risks of screening, and controversies surrounding the recommendations are examined. We also provide guidance for nurses when discussing guideline selection with patients.

SCREENING GUIDELINES

There are notable differences in the available screening guidelines, including the age at which women should start and stop screening, the frequency of screening, and the type of screening modalities recommended, although mammography continues to be the gold standard (see Table 1⁷⁻⁹). These variations are related to long-standing controversies about breast cancer screening and the data each organization used to



Sandra B. Brennan, director of radiology at Memorial Sloan Kettering Westchester in West Harrison, New York, reads mammogram results with a mammography technician. Photo courtesy of the Memorial Sloan Kettering Cancer Center Graphics Team.

develop its guidelines. The differences between these organizations' recommendations can cause confusion among both the public and health care providers about how to properly screen for breast cancer. Researchers continue to seek ways to eliminate the variations in these screening guidelines—and to hopefully reach consensus. In the meantime, nurses are at the forefront of supporting and educating patients and must use the most currently available information to advise them.

Screening modalities include imaging, a physical examination completed by a health care provider, and self-examination. Imaging modalities may include mammography, sonography, magnetic resonance imaging (MRI), and most recently, tomosynthesis and contrast-enhanced mammography.^{4,10} Tomosynthesis is three-dimensional mammography that can reveal hidden changes in the breast tissue. Contrast-enhanced mammography highlights abnormal blood flow, which can indicate a malignancy. These new technologies have not yet become standard but are beginning to emerge as screening options.¹⁰

A clinical breast examination is a standardized breast assessment performed by a trained clinician—a

midwife, NP, gynecologist, internist, or other clinician who routinely performs breast examinations. This person is proficient in the visual inspection and palpation of the breasts to detect any concerning abnormalities. Self-screening refers to either breast self-examination or breast self-awareness. A breast self-examination is a technique used by a person to examine her or his breasts on a regular and repetitive basis, inspecting for any physical or visual changes. Breast self-awareness, by contrast, refers to being familiar with how one's breasts normally look and feel and promptly reporting any observed changes to a health care provider.⁷ Which modality is used and when screening begins depends on a person's risk characteristics, the screening guidelines used, and the patient's preference.

Screening guidelines also vary depending on whether a patient has an average or elevated risk of breast cancer. Women at average risk have no personal or family history of breast cancer, no genetic susceptibility to breast cancer, and no history of chest radiation treatments.¹¹ Women are considered to be at high risk if they have a lifetime risk of breast cancer that is 20% or higher, and at moderate risk if their lifetime risk is 15% to 20%.¹¹ The risk percentage is

determined by using an assessment calculator that is mainly based on a woman's family history (one example is the National Cancer Institute's Breast Cancer Risk Assessment Tool, available at <https://www.cancer.gov/bcrisktool>). For more information, see *Breast Cancer Risk Criteria*.¹¹

MAMMOGRAPHY CONTROVERSIES

Modern mammography has been in use for many decades, yet controversies about its sensitivity and specificity persist. Sensitivity refers to the ability of a test to correctly identify those with the disease (the true positive rate), and specificity refers to the ability of a test to correctly identify those without the disease (the true negative rate).

The value of mammography versus other imaging techniques has been questioned over the years, particularly because of its lower sensitivity in detecting cancers in women with dense breasts.¹² This concern has led to legislation, known as breast density laws, that require notifying women if their mammogram results indicate they have dense breast tissue. The notification is meant to inform women that further testing (typically using ultrasound) might be indicated.¹²

False-positive results (identification of a suspicious abnormality that is found not to be cancerous) can be common, particularly in women in their 40s. This can lead to additional imaging and, possibly, biopsy. False-negative results (missed cancer) also occur, providing false reassurance. Overdiagnosis (sometimes referred to as overtreatment) can occur when a very low-risk cancer that would not have become symptomatic is detected by mammography, potentially leading to overtreatment.^{8,9,13} Currently, mammography cannot distinguish between harmful and harmless tumors.

Despite the potential drawbacks of mammography, it remains the gold standard and continues to be

the only method of breast cancer screening proven to reduce mortality.¹⁴

SCREENING RECOMMENDATIONS FOR THOSE AT AVERAGE RISK

Nurses provide essential patient education and psychosocial support at every level of practice. By emphasizing early diagnosis, nurses can influence patients' views about routine breast cancer screening. It's known, for instance, that providing patients with information about both the benefit and harm of screening helps them make informed decisions and influences screening participation.¹⁵ A randomized controlled trial of women ages 50 to 69 in Spain also found that the introduction of patient education and emotional support via a nursing intervention reduced patient anxiety by 60% prior to mammography.¹⁶

To help patients navigate the maze of confusion created by the recent changes to the breast cancer screening recommendations, nurses must first have a thorough understanding of the different screening guidelines and the evidence behind their recommendations. To follow is a description of the screening recommendations of the ACS, USPSTF, and NCCN, as well as a closer look at the rationale for each.

The American Cancer Society. In 2015, the ACS updated its 2003 breast cancer screening recommendations for women at average risk.⁸ The new recommendations were devised by an interdisciplinary guideline development group consisting of clinicians, biostatisticians, epidemiologists, patient representatives, and an economist.⁸ This group performed a systematic review of the current breast cancer screening literature for women at average risk. This review also included long-term follow-up of previously performed randomized controlled trials and observational studies used in the creation of the 2003 guidelines. Articles

Table 1. Recommendations for Mammography Screening in Women at Average Risk⁷⁻⁹

Age	American Cancer Society	U.S. Preventive Services Task Force	National Comprehensive Cancer Network
40–44	The decision to start screening is at the discretion of the individual.	The decision to start screening is at the discretion of the individual.	Annually
45–49	Annually	The decision to start screening is at the discretion of the individual.	Annually
50–54	Annually	Biennially	Annually
55–74	Biennially for as long as a woman is in good health and is expected to live ≥ 10 years	Biennially	Annually
75+	Biennially for as long as a woman is in good health and is expected to live ≥ 10 years	Insufficient evidence to assess the benefits vs. the harms of continued screening	Not yet established. Clinical judgment recommended.

Breast Cancer Risk Criteria¹¹

A woman is at high risk for breast cancer if she

- has a lifetime risk of 20% or higher (determined by a risk assessment tool based on family history).
- is known to have the *BRCA1* or *BRCA2* genetic mutation.
- has a first-degree relative (parent, sister, brother, or child) who has a *BRCA* mutation and hasn't been tested.
- received chest radiation between 10 and 30 years of age.
- has a syndrome, such as Li-Fraumeni syndrome or Cowden syndrome, or a first-degree relative who has one of these syndromes.

A woman is at moderately increased risk for breast cancer if she has

- a lifetime risk of 15% to 20%.
- a family history of breast cancer.
- a personal history of breast cancer or other high-risk diagnosis, including lobular carcinoma in situ, atypical ductal hyperplasia, or atypical lobular hyperplasia.
- extremely or heterogeneously dense breasts, per her mammogram.

dating to January 2000 were reviewed.⁸ The ACS's breast cancer screening recommendations are categorized by age and risk.

For the 2015 recommendations, the guideline development group considered the quality of the evidence and sought clear evidence of benefit. It then came to a decision about the balance of benefits (such as cancer detection) and harms (such as false-positive findings, overdiagnosis, and the radiation exposure inherent in any imaging modality) associated with screening and ranked its recommendations as either *strong* or *qualified*.⁸ The former indicates that the group agreed the benefits of screening outweighed the risks, the latter that they were less certain about the balance of benefits versus risks but still found clear evidence of the benefit of screening.⁸

The ACS recommends that women at average risk for developing breast cancer begin regular screening mammography at age 45 (strong recommendation). Qualified recommendations include annual screening for women ages 45 to 54, biennial or annual screening for women ages 55 and older, and the opportunity to begin annual screening at age 40.⁸ The ACS concluded there is insufficient evidence to recommend for or against using MRI as an additional screening method in women who are not at high risk for breast cancer but in whom mammography may be less effective, such as women with dense breast tissue.⁸

The U.S. Preventive Services Task Force. The USPSTF includes a panel of experts convened by the Agency for Healthcare Research and Quality. Its members specialize in family medicine, internal medicine, obstetrics and gynecology, geriatrics, pediatrics, nursing, and behavioral health. They make evidence-based recommendations about clinical preventive services, such as cancer screening, counseling services, and medications.¹⁷

In 2016, the USPSTF commissioned a series of systematic reviews in preparation for an update to its 2009 recommendations on breast cancer screening. The task force determined that the net benefit of mammography screening in women ages 40 to 49 was positive but small.⁹ It concluded that the benefits of screening women in this age group do not outweigh the risks (the likelihood of false-positive results may be increased, for example), and thus doesn't recommend screening mammography in this population. However, recognizing that some women ages 40 to 49 may benefit from screening, the task force recommended that the ultimate decision about when to initiate screening should be an individual one.⁹

The USPSTF also examined clinical trial evidence on how frequently screening should occur among women ages 40 to 49.⁹ None of the trials specifically compared the benefit of annual mammography with screenings at longer intervals. The randomized trials that examined screening included intervals ranging from 12 to 33 months.⁹ These trials didn't show that a specific interval was associated with a greater benefit; however, differences between the trials make it difficult to know with certainty that a difference in benefit doesn't exist.⁹

The evidence also showed no difference in the number of breast cancer deaths when screening was performed biennially versus annually in women age 50 or older.⁹ Research has shown a small, incremental increase in the number of deaths averted when women switch from biennial to annual mammography, but it also revealed a large increase in the number of harms (defined as the number of false-positive test results, unnecessary breast biopsies, and overdiagnosed breast tumors).⁹ To provide the best overall balance of benefits versus harms, the USPSTF concluded that biennial mammography screening is appropriate for most women ages 50 to 74.⁹

Another consideration is the utility of adjunctive screening, such as ultrasound, MRI, or tomosynthesis, in women with dense breasts. The most commonly used classification system for breast density is the American College of Radiology's Breast Imaging Reporting and Data System, which categorizes breast composition as follows¹⁸:

- The breasts are almost entirely fatty
- There are scattered areas of fibroglandular density
- The breasts are heterogeneously dense, which may obscure small masses
- The breasts are extremely dense, which lowers the sensitivity of mammography

The sensitivity of screening mammography is lower in women with breasts categorized as extremely dense.¹⁹ Interestingly, although increased breast density is a risk factor for breast cancer, it is not associated with an increased risk of dying from the disease or from any other cause.¹⁹

Increased breast density is not associated with an increased risk of dying from breast cancer.

The USPSTF concluded there was insufficient evidence that screening with ultrasound, MRI, or other imaging modalities in addition to mammography provided any additional benefit in women at average risk who have dense breasts.⁹ In fact, adjunctive screening using ultrasound or MRI has been shown to lead to higher recall rates (the need for additional diagnostic testing, including biopsy).²⁰ Tomosynthesis is a new modality, and comparative data on its long-term benefits are not available.

The USPSTF also found that the evidence was insufficient to determine the most favorable time to stop screening. To address this clinical question, it commissioned a report from the National Cancer Institute–sponsored consortium of investigators known as the Cancer Intervention and Surveillance Modeling Network (CISNET).²¹ The models it produces are created and utilized to gain more knowledge about how interventions in cancer control, such as prevention and screening, may affect incidence and mortality trends.²¹ CISNET's Breast Working Group suggested that biennial mammography screening may continue to offer a net benefit after age 74 for those with no or low comorbidity; however, no randomized trials including patients in this age group have been

conducted.⁹ The working group found that mammography is unlikely to be beneficial in women who have a shorter life expectancy than the average woman because of moderate to severe comorbid conditions.⁹

The National Comprehensive Cancer Network.

The NCCN was created in 1995 to develop and institute standards of care to help health care professionals diagnose and treat people with cancer. Today it is a nonprofit alliance comprising 27 leading cancer centers around the world. Its mission is “to improve the quality, effectiveness, and efficiency of cancer care.”²²

The NCCN guidelines currently provide management information for about 97% of cancers.²³ There are 67 NCCN guidelines, which are reviewed and updated at least once a year. The guidelines are developed by 52 volunteer panels that include clinicians and researchers from many specialty areas.²³

Current NCCN guidelines recommend that women at average risk for developing breast cancer begin screening mammography at age 40.²⁴ These guidelines are based on a 1997 consensus statement from the ACS and National Cancer Institute and supported by the results of meta-analyses of randomized clinical trials and the 2003 ACS guidelines for breast cancer screening.²⁴⁻²⁷ Notably, the NCCN guidelines were not changed after the 2015 ACS guideline update. This is because the NCCN guidelines only include recommendations based on the highest levels of evidence, as well as on NCCN consensus that the intervention is appropriate. The screening recommendations in the 2015 ACS guideline update did not meet these criteria.¹³

In developing the NCCN breast cancer screening guidelines, the NCCN committee considered both randomized clinical data as well as data on modern screening (such as digital mammography) in observational studies.⁷ Malmgren and colleagues conducted a retrospective analysis when evaluating the benefits of mammographic screening in women 40 to 49 years of age.²⁸ They found an increased incidence of mammography-detected breast cancer over time and noted that it coincided with an increase in the number of lower-stage breast cancer diagnoses.²⁸ The researchers noted that this resulted in the need for less treatment (because the cancer was discovered at an earlier stage) and lower rates of recurrence.²⁸ According to Therese Bevers, MD, chair of the NCCN Breast Cancer Screening and Diagnosis Panel, “Women who are screened are less likely to be diagnosed at a more advanced stage and may not require aggressive therapy. Women aged 40 to 49 years had the highest number of years of life gained from screening, even though the reduction in mortality is greater in women in their 50s.”¹³

The NCCN also reviewed the time interval between screening mammograms. Performing screening mammography every year instead of every other year remains controversial.⁷ Because a lesion can be detected

by mammogram two years before a clinical breast examination, the NCCN elected to recommend yearly mammography, following the ACS guidelines.²⁴ The NCCN also looked at studies and models that suggested an incremental benefit with annual screening, especially among younger women and premenopausal women.⁷ For instance, in an evaluation of findings from CISNET, researchers found that adding annual digital mammography screening to biennial screening saved 30% more lives and 47% more life-years.²⁹

The NCCN emphasizes the often neglected yet important measurement of life-years gained. Collectively, women in their 40s show fewer deaths averted than women over 50; however, they have more years of life gained when cancer is found and managed earlier.¹³ It is also the NCCN's view that the harms of screening should be weighed against the harms of not screening, rather than comparing the harms of screening with no harm.¹³

RECOMMENDATIONS FOR THOSE AT HIGH RISK

Both the ACS and NCCN recommend yearly mammography and MRI for women at high risk, generally starting at 30 years of age, although this may vary depending on the woman's personal circumstances and preferences.^{7,11} The USPSTF doesn't include specific high-risk screening criteria, but it notes that women ages 40 to 49 who have a first-degree relative with a history of breast cancer may benefit more than average-risk women of the same age by beginning screening mammography before age 50.⁹

For women at moderately increased risk, the current ACS and NCCN screening recommendations are the same as for women at average risk. For these women, there is not enough information to make a recommendation for or against yearly MRI.^{7,8,11} Women should discuss with their health care providers the risks and benefits of annual MRI.^{7,11}

Different assessment tools are available to help clinicians estimate a woman's risk of developing

Breast Cancer Screening Key Points

What to discuss with patients.

Benefits

- Mammography is not a perfect breast cancer screening test, but it can significantly save lives, including approximately¹³
 - five out of 10,000 women 40 to 49 years old.
 - 10 out of 10,000 women 50 to 59 years old.
 - 42 out of 10,000 women 60 to 69 years old.
- Mammography reduces the risk of being diagnosed with advanced-stage disease, potentially averting the need for aggressive treatment.¹³

Harms (sometimes referred to as risks or limitations)

- False-positive results:
 - Mammography findings can include an abnormal-looking area that is suspected of being cancerous but is found to be normal.
 - This can lead to additional imaging and, possibly, a biopsy.
 - Most findings turn out to be benign but can cause anxiety.³⁴⁻³⁶
- Overdiagnosis:
 - Mammography may detect a very low-risk cancer that would not have become symptomatic.^{9,13}
 - This can lead to unnecessary treatment.
- False-negative results:
 - Mammogram results can look normal, even if cancerous tissue is present.
 - These findings can provide false reassurance and delay treatment.

Decision making

- Decisions must be made about the
 - age at which screening should begin (40, 45, or 50 years).
 - frequency at which it should occur (annually or biennially).
 - type of screening modalities used (including different imaging options).
- Nurses can help women make informed choices based on risk factors, the benefits and harms of screening, and their personal values and preferences.

breast cancer. The tools provide approximate estimates based on different combinations of risk factors. Common tools include the Tyrer–Cuzick model and the Gail model.^{30,31} The Tyrer–Cuzick model is comprehensive and incorporates extensive family history, the presence of *BRCA* gene mutations, and personal risk factors, such as the use of hormone replacement therapy.³⁰ The Gail model estimates risk based on personal risk factors, such as current age, onset of menarche, history of breast biopsies, and first-degree relatives with a history of breast cancer.³¹ Risk assessment tools that include family history in first-degree (parents, siblings, and children) and second-degree (aunts and cousins, for example) relatives on both sides of the family should be used, along with the ACS and NCCN guidelines, to decide if a woman should have MRI screening.^{7,11}

Men who are at high risk, such as those with a mutation in one of the *BRCA* genes, should have a yearly clinical breast examination and be taught to perform breast self-examinations starting at age 35.³² These men should also follow prostate screening guidelines because of an associated increased risk of prostate cancer.³² There are limited data to support breast imaging in this population.³²

BREAST SELF-EXAM AND CLINICAL BREAST EXAM

Recommendations for breast self-examinations have significantly changed in recent years. Data from a large randomized trial showed that instruction in breast self-examination and supervised practice had no effect on breast cancer mortality and led to an increased number of benign breast biopsies.³³ Although the three organizations do not recommend the formal practice of breast self-examination, the ACS and NCCN concur that all women should engage in breast self-awareness, and the NCCN recommends that some men perform breast self-examinations.^{7,11} The USPSTF supports patients being aware of any changes in their bodies and discussing these with their health care providers.⁹

A clinical breast examination is not recommended by the ACS for women at average risk at any age. This is because there is a lack of evidence of a benefit to clinical breast examinations alone or in conjunction with a screening mammogram.⁸ There is also moderate evidence that adding a clinical breast examination to mammography screening increases the false-positive rate.⁸ The USPSTF's 2009 conclusion that there is a lack of evidence to assess the benefits and harms of clinical breast examinations in addition to screening mammography in women age 40 or older remains unchanged in the 2016 update.⁹ The NCCN, however, continues to recommend clinical breast examinations based on the rationale that they help to maximize the earliest detection of breast cancers.⁷ In addition, there is a lack of randomized trials comparing clinical breast examinations with no

screening.⁷ As a result, the NCCN recommends clinical breast examinations every one to three years in women 25 to 39 years of age and annually thereafter.⁷

NURSING IMPLICATIONS

The current lack of consensus among the ACS, USPSTF, and NCCN breast cancer screening guidelines has led to confusion and uncertainty among health care providers and the public. When deciding which screening guidelines to follow, many factors should be considered, including the patient's age, risk factors, and preference. *Breast Cancer Screening Key Points*^{9,13,34-36} summarizes important breast cancer screening issues to discuss with patients.

It's important to note that two leading cancer institutions, the MD Anderson Cancer Center and the Memorial Sloan Kettering Cancer Center, continue to follow NCCN recommendations for breast cancer screening, whereas a third institution, the Dana-Farber Cancer Center, has chosen to follow the ACS screening guidelines.³⁷⁻³⁹ According to Elizabeth Morris, chief of the Breast Imaging Service at Memorial Sloan Kettering (e-mail communication, July 7, 2017): "If a woman wants to reduce her risk of dying of breast cancer, she should choose yearly mammography starting at age 40. All major stakeholders agree that this saves the most lives. It is important to protect women's access to screening, so they can have a choice in the timing and frequency of screening."

Another major organization, the American College of Obstetricians and Gynecologists (ACOG), agrees and continues to recommend that clinicians offer mammography to women starting at age 40, after first discussing the potential benefits and harms.⁴⁰ If the patient wants to delay screening, ACOG recommends that screening begin no later than age 50 and strongly supports shared decision making between providers and patients.⁴⁰

Health care providers and the public need to be aware that mammography or any other imaging modality is not a stand-alone procedure. Clinical judgment is needed to ensure appropriate management, and the patient's concerns and any physical findings must be considered along with the imaging results and histologic assessment.

In a time of uncertainty about breast cancer screening, the role of the nurse in communicating information to patients about screening's health risks and benefits is more important than ever. Until consensus is reached, nurses should become familiar with the different screening guidelines, the rationale behind them, and the risks and benefits of each screening modality. Discussing priorities regarding health and prevention efforts can help clinicians to better understand patients' needs and thus the most appropriate guidelines to follow. In addition, describing how the guidelines differ and how they were derived can help to clarify any confusion, and also help patients decide

which recommendations are most aligned with their health goals. Nurses are essential to ensuring that patients are informed and confident in their decisions. ▼

For 21 additional continuing nursing education activities on the topic of breast cancer, go to www.nursingcenter.com/ce.

Roberta Baron is a clinical nurse specialist, and Karen Drucker, Liza Lagdamen, Maureen Cannon, and Carrie Mancini are all NPs at Memorial Sloan Kettering Cancer Center in New York City, where Erica Fischer-Carlidge is the clinical nurse specialist coordinator. Contact author: Erica Fischer-Carlidge, fischere@mskcc.org. The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

REFERENCES

1. National Cancer Institute, Surveillance, Epidemiology, and End Results Program (SEER). *Cancer stat facts: female breast cancer*. National Institutes of Health. 2014. <https://seer.cancer.gov/statfacts/html/breast.html>.
2. American Cancer Society. *Cancer basics: lifetime risk of developing or dying from cancer*. 2018. <https://www.cancer.org/cancer/cancer-basics/lifetime-probability-of-developing-or-dying-from-cancer.html>.
3. Centers for Disease Control and Prevention. *Breast cancer. What are the risk factors for breast cancer?* 2017. https://www.cdc.gov/cancer/breast/basic_info/risk_factors.htm.
4. American Cancer Society. *Cancer facts and figures 2017*. Atlanta; 2017. <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2017/cancer-facts-and-figures-2017.pdf>.
5. Warner E. Clinical practice. Breast-cancer screening. *N Engl J Med* 2011;365(11):1025-32.
6. Loh KP, et al. Healthcare professionals' perceptions and knowledge of the USPSTF guidelines on breast self-examination. *South Med J* 2015;108(8):459-62.
7. National Comprehensive Cancer Network. *Breast cancer screening and diagnosis*. Fort Washington, PA; 2017 Jun 2. Version 1.2017. NCCN clinical practice guidelines in oncology (NCCN guidelines); https://www.nccn.org/professionals/physician_gls/pdf/breast-screening.pdf.
8. Oeffinger KC, et al. Breast cancer screening for women at average risk: 2015 guideline update from the American Cancer Society. *JAMA* 2015;314(15):1599-614.
9. Siu AL, U.S. Preventive Services Task Force. Screening for breast cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med* 2016;164(4):279-96.
10. Drukteinis JS, et al. Beyond mammography: new frontiers in breast cancer screening. *Am J Med* 2013;126(6):472-9.
11. American Cancer Society. *American Cancer Society screening recommendations for the early detection of breast cancer*. 2017. <https://www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/american-cancer-society-recommendations-for-the-early-detection-of-breast-cancer.html>.
12. Ho JM, et al. Dense breasts: a review of reporting legislation and available supplemental screening options. *AJR Am J Roentgenol* 2014;203(2):449-56.
13. Bevers T, et al. Controversies in breast cancer screening strategies. *J Natl Compr Canc Netw* 2016;14(5 Suppl):651-3.
14. Mainiero MB, et al. ACR appropriateness criteria breast cancer screening. *J Am Coll Radiol* 2016;13(11S):R45-R49.
15. Edgar L, et al. Factors influencing participation in breast cancer screening. *Br J Nurs* 2013;22(17):1021-6.
16. Fernandez-Feito A, et al. A brief nursing intervention reduces anxiety before breast cancer screening mammography. *Psicothema* 2015;27(2):128-33.
17. U.S. Preventive Services Task Force. *About the USPSTF*. 2017. <https://www.uspreventiveservicestaskforce.org/Page/Name/about-the-uspstf>.
18. American College of Radiology. *ACR BI-RADS Atlas fifth edition: quick reference*. Reston, VA 2015.
19. Gierach GL, et al. Relationship between mammographic density and breast cancer death in the Breast Cancer Surveillance Consortium. *J Natl Cancer Inst* 2012;104(16):1218-27.
20. Melnikow J, et al. Supplemental screening for breast cancer in women with dense breasts: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med* 2016;164(4):268-78.
21. Mandelblatt JS, et al. Collaborative modeling of the benefits and harms associated with different U.S. breast cancer screening strategies. *Ann Intern Med* 2016;164(4):215-25.
22. National Comprehensive Cancer Network. *About NCCN*. n.d. <https://www.nccn.org/about>.
23. National Comprehensive Cancer Network. *At our core. NCCN annual report 2016*. Fort Washington, PA; 2016 Dec 31.
24. Bevers TB, et al. NCCN clinical practice guidelines in oncology: breast cancer screening and diagnosis. *J Natl Compr Canc Netw* 2009;7(10):1060-96.
25. Berry DA. Benefits and risks of screening mammography for women in their forties: a statistical appraisal. *J Natl Cancer Inst* 1998;90(19):1431-9.
26. Humphrey LL, et al. Breast cancer screening: a summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med* 2002;137(5 Part 1):347-60.
27. Smith RA, et al. American Cancer Society guidelines for breast cancer screening: update 2003. *CA Cancer J Clin* 2003;53(3):141-69.
28. Malmgren JA, et al. Impact of mammography detection on the course of breast cancer in women aged 40-49 years. *Radiology* 2012;262(3):797-806.
29. Hendrick RE, et al. Implications of CISNET modeling on number needed to screen and mortality reduction with digital mammography in women 40-49 years old. *AJR Am J Roentgenol* 2014;203(6):1379-81.
30. Tyrer J, et al. A breast cancer prediction model incorporating familial and personal risk factors. *Stat Med* 2004;23(7):1111-30.
31. Gail MH, et al. Projecting individualized probabilities of developing breast cancer for white females who are being examined annually. *J Natl Cancer Inst* 1989;81(24):1879-86.
32. Daly MB, et al. NCCN guidelines insights: genetic/familial high-risk assessment: breast and ovarian, version 2.2017. *J Natl Compr Canc Netw* 2017;15(1):9-20.
33. Thomas DB, et al. Randomized trial of breast self-examination in Shanghai: final results. *J Natl Cancer Inst* 2002;94(19):1445-57.
34. Myers ER, et al. Benefits and harms of breast cancer screening: a systematic review. *JAMA* 2015;314(15):1615-34.
35. Pace LE, Keating NL. A systematic assessment of benefits and risks to guide breast cancer screening decisions. *JAMA* 2014;311(13):1327-35.
36. Yaffe MJ, Pritchard KI. Overdiagnosing overdiagnosis. *Oncologist* 2014;19(2):103-6.
37. Dana-Farber Cancer Institute. *Breast cancer screening recommendations*. n.d. <http://www.dana-farber.org/health-library/articles/breast-cancer-screening-recommendations>.
38. Memorial Sloan Kettering Cancer Center. *Breast cancer screening guidelines*. 2017. <https://www.mskcc.org/cancer-care/types/breast/mammograms-breast-exams/screening-guidelines-breast>.
39. University of Texas MD Anderson Cancer Center. *Breast cancer screening*. 2017. <https://www.mdanderson.org/documents/for-physicians/algorithms/screening/screening-breast-web-algorithm.pdf>.
40. American College of Obstetricians and Gynecologists. *Practice bulletin No. 179 summary: breast cancer risk assessment and screening in average-risk women*. *Obstet Gynecol* 2017;130(1):241-3.