
EARLY DETECTION AND SCREENING FOR BREAST CANCER

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OBJECTIVE: *To review the history, current status, and future trends related to breast cancer screening.*

DATA SOURCES: *Peer-reviewed articles, web sites, and textbooks.*

CONCLUSION: *Breast cancer remains a complex, heterogeneous disease. Serial screening with mammography is the most effective method to detect early stage disease and decrease mortality. Although politics and economics may inhibit organized mammography screening programs in many countries, the judicious use of proficient clinical and self-breast examination can also identify small tumors leading to reduced morbidity.*

IMPLICATIONS FOR NURSING PRACTICE: *Oncology nurses have exciting opportunities to lead, facilitate, and advocate for delivery of high-quality screening services targeting individuals and communities. A practical approach is needed to translate the complexities and controversies surrounding breast cancer screening into improved care outcomes.*

KEY WORDS: *breast cancer, screening, early stage, quality, breast centers, advocacy.*

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The future is hopeful for the public, professionals, and interdisciplinary teams as multifaceted progress continues to reveal new insights in carcinogenesis, genomics, tumor biology, translational research, and quality improvement from prevention to palliation and survivorship for cancer care.¹⁻⁸ Oncology nurses are on the front line of care delivery across settings; they also assert a strong leadership voice to advocate for improvements in academic education, patient care, and health care policy.⁹⁻¹⁵ Breast cancer and, in particular, screening for this disease, has been a topic fraught with controversy and confusion based on conflicting national guidelines.¹⁶⁻²⁹

The bottom line in screening for breast cancer today is tumor size – a critical determinant of outcome.³⁰⁻⁴¹ This article describes the burden of breast cancer worldwide, the rationale for screening, relevant historical context, and core methods of secondary prevention. An array of educational and organizational resources is also provided to support early disease detection through local, national, and international organizations.

THE WORLDWIDE BURDEN OF BREAST CANCER

Breast cancer remains a universally challenging public health problem. In the United States (US), 255,180 new cases of invasive cancer are estimated to occur (252,710 in women and 2,470 in men) during 2017.⁴² In addition, an estimated 63,410 cases of non-invasive, in situ breast cancer will be newly diagnosed.⁴² Estimated deaths include 40,610 for women and 460 in men.⁴² From 1989 to 2012, death rates from breast cancer fell 36% in the US, resulting in 249,000 fewer deaths.⁴³ Black women are more likely to die from breast cancer (31 deaths per 100,000 people) followed by white women (21.9), American Indian/Alaska Native (15), Hispanic (14.5) or Asian/Pacific Islanders (11.4).^{43,44} The probability of developing invasive breast cancer in US females based on age groups from birth to 49 years is one in 52; 50 to 59 (one in 44); 60 to 69 (one in 29); and greater than or 70 (one in 15).⁴³ The overall lifetime risk is 12% or one in eight.⁴³ Finally, there are more than 3.1 million women surviving breast cancer in the US.⁴⁴

INTERNATIONAL TRENDS

In 2012, breast cancer was the most frequently diagnosed female cancer worldwide and accounted for 25% or 1.7 million new cases, with 53% occurring in economically developing countries.^{45,46} Those countries represent 82% of the world population.⁴⁶ Breast cancer incidence rates continue to increase in all countries except a few high-income countries, with mortality decreasing in many high-income countries and increasing in low- and middle-income countries. Currently, more than half of new breast cancer diagnoses and 62% of cancer deaths occur because of presentation of advanced cancer in low- to middle-income countries.⁴⁷

Incidence rates vary nearly 4-fold across different regions,⁴⁵ with a rate of 27 per 100,000 in Middle

Africa and Eastern Asia to 92 per 100,000 in North America. Worldwide, there are more than 5,200,000 breast cancer 5-year survivors.⁴⁶ In 2012, Asian countries represented 59% of the global population and had the largest burden of breast cancer, with 39% new cases, 44% of deaths, and 37% of the world's 5-year survivors.⁴⁶ Northern America, representing 5% of the world population (US and Canada) had 15% of all new cases, 9% of deaths, and 17% of 5-year survivors.⁴⁶ Because of more advanced disease, African countries (15% of world population) had 8% of new cases, 12% of breast cancer deaths, and only 7% 5-year survivors.⁴⁶ Survival rates at 5 years are more than 85% in the US, Canada, Australia, Israel, Brazil, and northern/western European countries. Early stage I and II disease detection is more common in China, the UK, USA, Canada, and Denmark. Survival rates of 60% or lower occur in developing countries such as India, Algeria, South Africa, and Mongolia. Stage III or IV disease occurs commonly in Nigeria (77%), Libya (66%), and Malaysia (56%). Many factors account for delayed detection and diagnosis. These may include inadequate local or national health care systems or infrastructure; poor access to adequate screening, diagnosis, or treatment facilities or cancer specialists; social or cultural barriers such as stigma, embarrassment, fear, or cancer fatalism.⁴⁶

By 2030, the total number of breast cancer cases per year worldwide is expected to reach 2.4 million, with anticipated increases in economically disadvantaged countries.⁴⁷ Clearly, the global priorities and disparities surrounding the public health burden of cancer and breast cancer persist today.^{46,48-52} However, progress is evident after decades of investment in time, money, leadership, advocacy, hard work, and volunteer power.⁵³ Fortunately, many governmental, industrial, and non-profit organizations have begun partnering to advance progress in technology transfer, capacity building, professional training, public education, social services, and culturally appropriate outreach, and to facilitate access to research trials.⁴⁶⁻⁵⁴ Because of the collaborative efforts of the Institute of Medicine, Center for Disease Control and Prevention,^{54,55} and other organizations in the US and worldwide, action-oriented planning and implementation of specialized cancer control programs, navigation services, and research studies have led to increasing quality of comprehensive breast cancer care⁵⁶⁻⁶⁷ (see conceptual framework in [Figure 1](#)). Professional nurses have been involved at all levels of leadership and care delivery in many of these organizations.

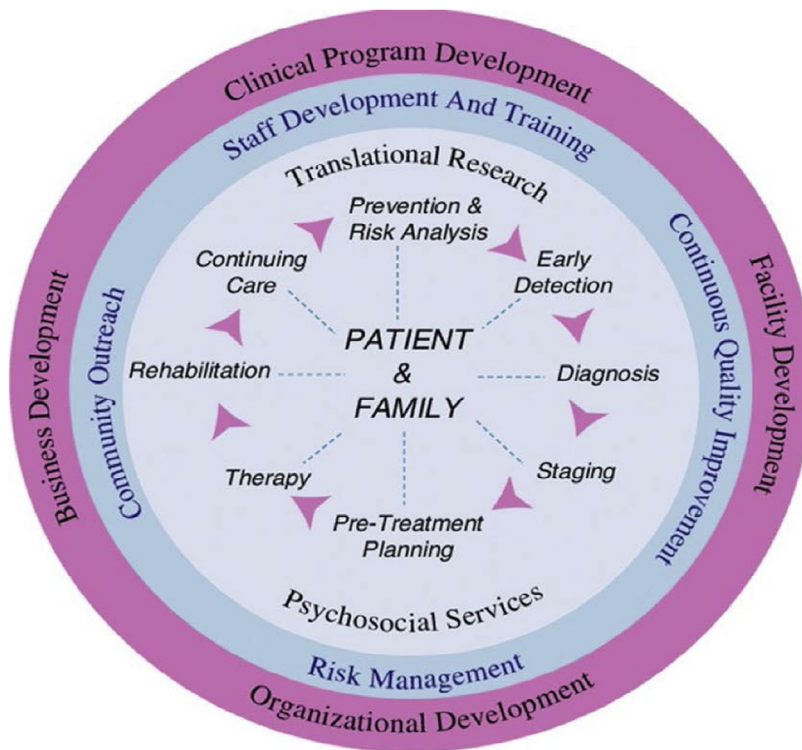


FIGURE 1. Conceptual framework for comprehensive breast care.⁶¹ (With permission from Coleman CM, Lebovic G. Organizing a comprehensive breast center. In: Harris JR, Lippman M, Morrow M, Hellman S, eds. *Diseases of the breast*. Philadelphia PA: Raven Publishers; 1996: pp 963-970.).

EARLY DETECTION AND SCREENING

Background

Since the 1930s, cancer care pioneers such as the American Cancer Society (ACS) promoted campaigns with motivational messages that “early” is the watchword for cancer. One of the first “breast services” to establish a “modern” center specializing in cancer care that fostered cooperation between physician subspecialists based on guidance by the pathologist, data collection, and patient follow-up was at New York Presbyterian/Columbia University.⁶¹ This preceded the development of specialized cardiac care centers in the 1960s. Clinical breast exam (CBE) and breast self-examination (BSE) were encouraged to find earlier tumors because screening mammography was not yet available.⁶⁸ In 1959, staging classification systems were established by the American Joint Committee on Cancer that emphasized smaller tumor size as one predictor of lower disease stage and better outcomes.^{1,31} Women with larger tumors are associated with decreased survival; patients with tumors ≤ 2.0 cm have a 5-year survival of 95% compared with 70% for those with tumors > 5 cm.^{38,44,46} During the 1980s, registered nurses were just beginning

to practice “standardized procedures” such as CBE that belonged to the “gray area” between medicine and nursing practice.

Since the 1980s, evidence from randomized controlled trials have demonstrated that screening with mammography results in detection of small (< 15 mm) tumors with favorable outcomes, especially at pre-palpable and pre-clinical presentation.^{22,33,35-41,69} Regardless of how “early” an invasive or microinvasive tumor is detected, the inherent capacity for distant spread, sooner or later, may still be present in subsets of tumors in patients.^{38,70-72} The variable course of invasive breast cancer can range from a “personal cure” in some, to recurrences up to 30 years post diagnosis in others, and rapid disease and death within 3 years of diagnosis for those with aggressive, unfavorable cancer diagnoses.^{56,73-75} Thus, for oncology nurses who care for patients throughout the care continuum, the importance of realistic hope,⁷⁶ informed, balanced educational perspectives, and shared decision making⁷⁷⁻⁷⁹ regarding options remains paramount. The necessity to continue to promote and participate in clinical research³ and interdisciplinary education^{80,81} also frames the future for oncology nurses.¹²

DATA FROM SCREENING TRIALS

Researchers have studied the characteristics of tumors discovered during screening trials of asymptomatic women. After analyzing the interval from mammographic and clinical detectability, some models indicate a mean interval of 1.3 to 2.4 years.⁷⁵ Tabar and colleagues⁸² define “sojourn time” as the duration of the preclinical screen-detectable phase. They evaluated histology, prognosis, and progression to estimate sojourn time from 1973 breast tumors in women aged 40 to 69 years of age from a randomized, controlled Swedish two-county mammography screening trial.⁸² The subgroup analysis revealed a different, age-specific sojourn time for nine histologies. The shortest mean sojourn time was calculated for medullary carcinoma (1.2 years) for women aged 40 to 69 years of age, and the longest for ductal carcinoma grade 1 (7.7 years) in women 50 to 69 years.⁸² A hypothesis of dedifferentiation (cancer grade becomes more high grade over time) was also studied and women aged 40 to 54 had 91% of ductal tumors with the potential to dedifferentiate over time compared with 38% for women with ductal tumors aged 55 to 69 years of age. Thus, tumors in younger women progressed faster from the preclinical to the clinically detectable phase. The Swedish National Board of Health and Welfare and the ACS suggested a 12- to 18-month and the ACS recommended a 1-year interval between screening exams for women 40 to 49 years of age.^{40,83} Because there is no current capacity to predict an individual tumor’s sojourn time, the frequency of rescreening and radiologic interpretation with comparison to prior films is critical to assess interval mammographic changes and find small, curable breast cancer <15 mm in size.³⁸ In summary, a longer interval between screens may lead to larger, palpable, and less curable breast cancer.

Today, it is widely accepted that results from randomized, controlled trials support a reduction in breast cancer mortality resulting from screening with mammography and treatment advances from adjuvant systemic chemotherapy.^{33,35-37} In addition, ongoing efforts to promote primary and secondary prevention of breast cancer through education and early detection must target all adult women. Standards of nursing practice for oncology nurses reinforce their pivotal and ethical roles in education, health promotion, primary prevention and risk factor assessment, disease detection, and psychosocial care that is culturally responsive.^{12,84-93}

METHODS FOR EARLY DETECTION AND SCREENING

Currently there is no cure for breast cancer; although primary prevention through risk reduction utilizing chemoprevention or prophylactic surgery remain options for selected women at significantly high risk.⁴⁴ Therefore, secondary prevention through earlier detection and screening offers the most viable, effective, and practical interventions for women worldwide. The goals of early detection and screening have not changed in over 100 years, as reflected in a detailed history of mammography in the US (see Table 1).

Screening trials have conclusively proven that screen-detected, nonpalpable, preclinical tumors of ≤15 mm have the best prognosis.^{33-37,39,54,69} Currently there are three cost-effective, practical, and reliable methods/procedures for early detection and screening of breast cancer: 1) Full-field digital mammography;^{38,63} 2) CBE;^{54,55,93-95} and 3) breast awareness and BSE.^{34,55,68,96-98} However, the most sensitive methods for breast cancer screening are mammography and CBE. A brief overview of each method is provided below.

After a thorough personal/family history and determination of risk status are completed,⁹³⁻¹⁰¹ an individual plan for breast health care including patient education can be provided. This should include age-appropriate mammography screening with or without CBE and breast health awareness education, with or without BSE instruction as indicated.^{48,49,63,64,66,74,96-102} Recommended breast cancer screening guidelines from the ACS, American College of Radiology (ACR), National Comprehensive Cancer Network, and American Congress of Obstetrics and Gynecology can be found in the National Guidelines Clearinghouse.¹⁰³

Mammography

The most reliable, valid, and reproducible secondary prevention method aimed at earlier detection of breast cancer is serial, quality digital mammography for age-eligible, asymptomatic women and those at higher than average risk for developing the disease.^{33,37,38,63,83,101-103} When mammography with certified, safe equipment is used for screening and performed by skilled technologists with interpretation by experienced radiologists, an accuracy rate of 85% to 90% can be achieved to identify pre-clinical, non-palpable tumors <15 mm in size.³⁸ This leads to a mortality reduction from

TABLE 1.
Timeline – history of screening mammography

1895	Invention of x-ray by Wilhelm Conrad Röntgen in Germany. Wins Nobel Prize in 1901.
1913	First roentgen ray picture of the breasts taken by Dr. Albert Salomon on excised breast tissue to characterize tumors and the radiographic differences of mammary cancer.
1930	Stafford Warren, MD, Radiologist, Rochester, NY published first results in America of breast x-rays in pre-op patients; correlated tissue specimens with 85%-95% accuracy.
1937	Dr. Gershon-Cohen published studies of pre-operative x-ray tumors, breast pathology, and refinements in technique. First physician advocate for screening asymptomatic women.
1937	Cancer Act authorized by Surgeon General to cooperate with state agencies.
1956-1965	Gershon-Cohen and colleagues at Albert Einstein Medical Center in Philadelphia performed first “extensive mammographic survey” of 1312 asymptomatic women.
1955-1960	Robert Egan, MD, Radiologist at MD Anderson in Houston, TX studied mammography and published results of 1000 consecutive breast x-rays. He promoted a team approach with pathologist (H. Stephen Gallagher) and surgeon (Edgar White).
1963	Health Insurance Plan (HIP) of Greater NY began first screening study in US to examine 62,000 women aged 40-64 paired and randomly divided between study and control group with annual mammography and clinical breast exam for 5 years. Led by radiologist (Philip Strax), surgeon (Venet) and biostatistician (Shapiro).
1964	American College of Radiology (ACR) formally endorses mammography.
1965	First interdisciplinary conference at the national Cancer Control Program meeting in Philadelphia; established first standards, techniques, basic training in mammography.
1971	National Cancer Act includes establishment of cancer control programs.
1973-1980	Breast Cancer Detection Demonstration Project (BCDDP) enrolled 283,222 women 35 to 74 years of age in 29 US centers. Five annual screenings using both CBE and two-view mammography; 4,275 women diagnosed with breast cancer.
1976-1980	Nine randomized clinical trials for screening mammography from US, Sweden, Canada, Scotland.
1990	The National Breast and Cervical Cancer Program established (NBCCEDP) to increase breast and cervical cancer screening among low-income, uninsured, and underinsured women. First national cancer screening program in USA (https://www.cdc.gov/cancer/nbccedp).
1992	ACR creates first BIRADS atlas to classify and standardize level of suspicion for radiographic findings on screening to better communicate results to referring clinicians (https://www.acr.org/Quality-Safety/Resources/BIRADS).
1992	Mammography Quality Assurance Act (MQSA) became law on Oct. 27, 1992.
1994	Agency for Health Care Policy and Research publishes first Clinical Practice Guideline for Mammography – Quality Determinants of Mammography.
1997	HIP study results reveal the study group had 25% lower breast cancer mortality among women aged 40-49 and 50-59 than the control group.
2008	National Mammography Database (NMD) established (https://www.acr.org/Quality-Safety/National-Radiology-Data-Registry/National-Mammography-DB); a quality improvement tool to enable mammography facilities and radiologists to compare performance with peers across the country.
2011	Breast Cancer Surveillance Consortium (BCSC) reports that subgroups of radiologists who read more mammograms have less false-positive rates and better sensitivity.
2017	Breast cancer screening guidelines available through National Guideline Clearinghouse of the Agency for Healthcare Research and Quality (https://www.guideline.gov/search?q=breast+cancer+screening). Updates from BCSC and NMD indicate majority of radiologists in US community practice surpass most performance recommendations of the American College of Radiology (http://pubs.rsna.org/doi/pdf/10.1148/radiol.2017170181).

Data from references 7, 32, 38, 40, 41, 54, 56, 63, and 74.

30% to 50%.^{33,36-41} In one analysis of breast cancer screening in the United Kingdom for women aged 50 to 69 years of age at average risk, the reduction in mortality equated to a range of one life saved per 64 to 257 women screened.⁹⁴ For women who are recalled after a screening mammography exam, adjunctive diagnostic mammography views and ul-

trasound are often used to determine resolution of a screen-detected abnormality.^{44,101,103}

Additional Screening Methods

In addition to routine screening with mammography, high-risk women benefit from refinements in patient positioning,¹⁰⁴⁻¹⁰⁶ adjunctive imaging pro-

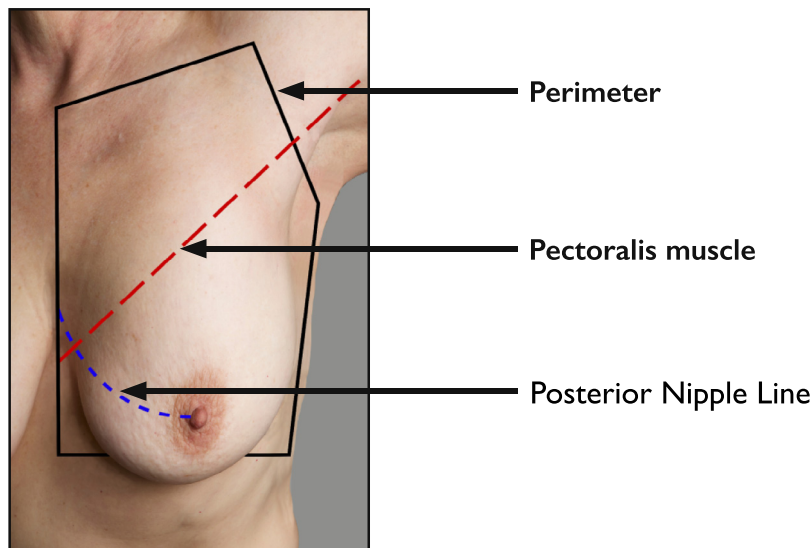


FIGURE 2. Area of breast tissue coverage in a screening mammogram includes breast perimeter, pectoralis muscle, and posterior nipple line (With permission from Mammography Educators, San Diego, CA.¹⁰⁵).

cedures such as ultrasound or breast magnetic resonance imaging (MRI), and clinical trials.¹⁰⁷⁻¹⁰⁹ One promising modality is digital breast tomosynthesis (so called DBT or “3D mammography”). DBT enables visualization of multiple tissue projections instead of just two standard screening views, including the craniocaudal (CC) and mediolateral oblique (MLO) views. The device moves in an arc around the breast while approximately 11 images are taken and transmitted to a computer where the interpreting radiologist can assemble and reassemble tomographic sections of breast tissue to sharply characterize and identify early signs of malignancy. DBT enhances imaging interpretation and results in less patient recalls for additional imaging.^{107,108} A depiction of the area to be included in the mammography exam is seen in Figure 2; correct positioning for the MLO view (which includes the upper outer quadrant) is shown in Figure 3. The difference in images between a properly positioned MLO view (Fig. 4) and an improperly positioned view (Fig. 5) illustrates the importance of tissue capture in screening mammography. This reinforces the important role of mammography technologists in screening exams.^{104,105}

Future studies will determine DBT effectiveness as compared with conventional mammography. The Tomosynthesis Mammography Imaging Screening Trial is sponsored by the American College of Radiology Imaging Network and the Eastern Cooperative Oncology Group of the National Institutes of Health. Three lead-in study sites are enrolling 6354 participants; estimated completion date is

November 2019.¹⁰⁸ The purpose of the lead-in randomized study is to compare technical factors that impact diagnostic accuracy of 3-dimensional DBT plus 2-dimensional full-field digital mammography versus full-field digital mammography alone over a 3-year period.¹⁰⁸ Eligibility includes asymptomatic women 40 years of age and older who are

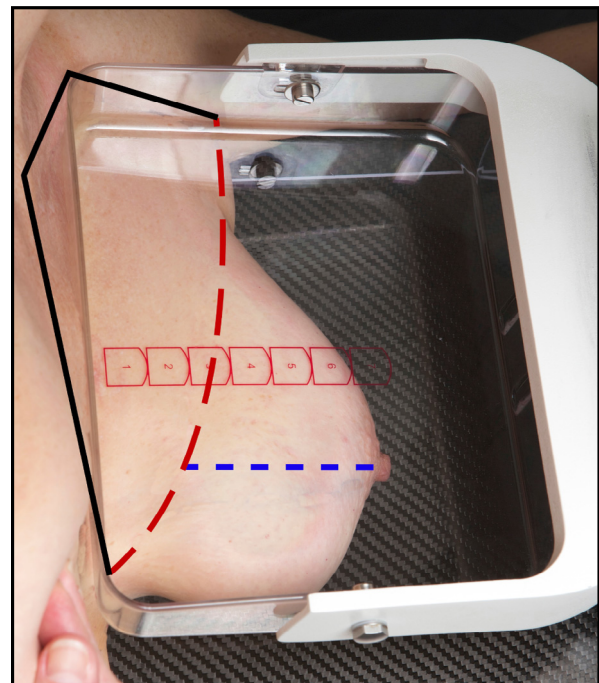


FIGURE 3. Proper positioning mediolateral oblique (MLO) screening view. (With Permission from Mammography Educators, San Diego, CA.¹⁰⁵).

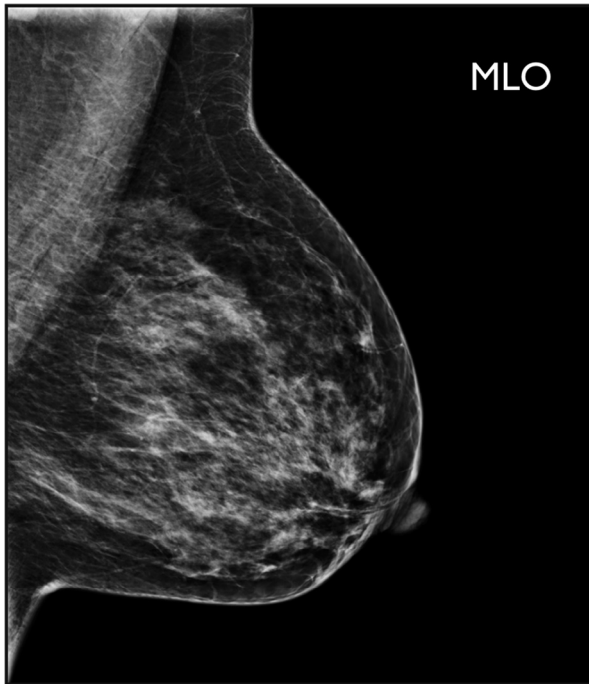


FIGURE 4. Properly positioned mediolateral oblique (MLO) screening view x-ray. (With permission from Mammography Educators, San Diego, CA.¹⁰⁵).

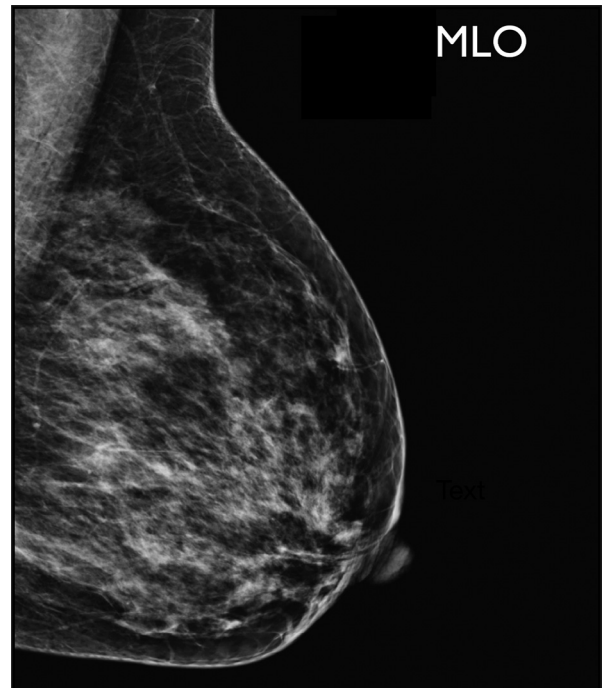


FIGURE 5. Improperly positioned mediolateral oblique (MLO) screening view. The pectoralis muscle is not well visualized because the angle is too steep or the patient is not properly facing machine. (With permission from Mammography Educators, San Diego, CA.¹⁰⁵).

scheduled for a screening mammogram. Women undergo three consecutive screening rounds in the assigned arm followed by 1 year of imaging follow-up. DBT may also be extremely useful in the mobile mammography setting to mitigate the barriers associated with follow-up in many underserved or rural populations.

Screening in high-risk women may also include ultrasound and breast MRI as a complement to routine mammography screening.¹⁰⁷ The ACR has defined “appropriateness criteria” for breast cancer screening of high-, intermediate-, and average-risk women.¹⁰⁷ This reference document summarizes not only the most current and emerging breast imaging technologies, but also the usefulness by category of risk to the patient.¹⁰⁷ The ACR also provides a quick reference guide describing the Breast Imaging Reporting and Data System¹¹⁰ for radiologist interpretation of mammography, ultrasound, and breast MRI findings (https://www.acr.org/~media/ACR/Documents/PDF/QualitySafety/Resources/BIRADS/Posters/BIRADS-Reference-Card_web_F.pdf?la=en).

New studies that address shared decision making for women and families facing screening and risk counseling challenges are ongoing.^{78-80,93,107-110} Adjunctive technologies that extend the effectiveness

of digital mammography are emerging. In August 2016, a new breast cancer screening trial was launched in California and South Dakota, funded by public and private partners. The “Enabling a Paradigm Shift: A Preference-Tolerant RCT of Personalized vs. Annual Screening for Breast Cancer” (also known as The Women Informed to Screen Depending on Measures of Risk) is a 5-year trial aiming to enroll 100,000 women aged 40 to 74 years.¹⁰⁹ This randomized study will compare annual screening with a risk-based breast cancer screening schedule, based on an individualized breast cancer risk assessment. This trial may answer questions about interval cancer rates, morbidity, stage-specific outcomes, and psychosocial sequelae of screening. See Table 2 for more information on mammography.

CBE

Proficiency techniques have been defined by many authors and organizations.^{48,96} CBE remains an important tool for early detection, diagnosis, and surveillance, especially in subgroups of women at higher risk for breast cancer, regardless of age. These subgroups include patients with radiographically

TABLE 2.
Mammography

Purpose	Signs and/or symptoms	Technique	Advantages	Disadvantages	Controversies
To identify occult signs of cancer in preclinical phase before clinical symptoms or progression and viable micro/macro metastasis occur.	Mammographic signs of screen-detected findings include lesions that are circular or oval, stellate or spiculated; microcalcifications that may or may not relate to a tumor; abnormal skin thickening, asymmetries and combinations of these.	Positioning of patients requires screening (2 views - cranio-caudal (CC) and mediolateral oblique (MLO) - see Figure 4) and diagnostic views (2 or more) depending on location and character of the finding. Special adaptations are important for women with implants, handicapped patients, those in wheelchairs or with other anatomical variations.	Reduction in mortality for women over 40; reductions between 30% and 50%. Cost effectiveness estimated at \$35,000 per year of life saved Data registries such as the National Mammography Database (https://www.acr.org/Quality-Safety/National-Radiology-Data-Registry/National-Mammography-DB) have helped to evaluate benefits/risks, quality issues and outcomes.	Compression can be uncomfortable. False-positive results can lead to overdiagnosis, unnecessary testing, consults and costs. Low-dose radiation exposure. Sensitivity to radiation in patients with familial or rare hereditary cancer syndromes. Women with implants, post radiation therapy, or alterations in body habitus are difficult to position. Technologists and radiologists may not have the requisite training, especially in rural and underserved areas. Disparities may exist in terms of who gets screened. Radiologists may not have access to other specialists such as pathologists to confirm the diagnosis.	Continuing debate exists about conflicting recommendations for frequency of screening; The age at beginning screening (40) and the age to stop performing it (75?) continue to be debated. Issues related to risks, harms, and potential psychological anxiety from overdiagnosis are not adequately communicated to women and decision makers. The benefit of increased cancer detection rates may not be a fair trade off for anxiety and the cost of additional testing for some women. No screening test is perfect and careful oversight, training, data registries, and new innovations in early detection can keep overdiagnosis to a minimum. Debate surrounds who should finance the cost of organized screening programs (government, health insurance companies, or cancer control organizations).
If questionable, schedule diagnostic mammography and/or other imaging tests as indicated until the concern is resolved.	Presence of proportionately high volume of radiographic breast density is a risk factor (https://www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/mammograms/breast-density-and-your-mammogram-report.html).	Adequate compression is necessary to keep radiation dosage low and image resolution high. When discomfort is an issue, interventions include use of a radiolucent MammoPad breast cushion; relaxation and mindfulness techniques. Clinical trial underway testing local anesthetics such as lidocaine on the skin during the exam with music therapy (https://www.cancer.gov/about-cancer/treatment/clinical-trials/search/view?cdrid=784503)	Digital breast tomosynthesis, breast MRI and ultrasound add diagnostic accuracy and specificity to complement screening mammography especially in high risk women.		

Data from references 35-38, 41, 44, 49, 63, 67, 103, 105, and 108-110.

dense breasts, breast implants, women who are post radiotherapy, those who refuse mammography, or patients without access to optimal breast health care. In economically disadvantaged countries or those that choose not to develop organized mammography screening programs, CBE training is being implemented.^{47,48} Lawsuits and medical liability claims may also increase if early detection practices remain variable with conflicting guidelines.²³ Fortunately, more radiologic technologists are interested in learning CBE to aid in the radiologic diagnosis of breast abnormalities. This may become more commonplace in some remote or medically underserved communities, where nonlicensed workers can be carefully trained to perform CBE.⁴⁸ Partnerships formed by groups such as the Union for International Cancer Control and the Breast Health Global Initiative are emerging to change the current pattern of late stage presentation of breast cancer, especially in low- and middle-income countries.⁴⁶⁻⁴⁹ Table 3 highlights information about CBE.

Breast Awareness and BSE

A growing number of countries lack access to safe mammography screening facilities or medical professionals who perform CBE, which prohibits organized, mass screening programs.⁴⁶⁻⁴⁹ Breast health and BSE instruction have been incorporated into international cancer control programs targeting economically disadvantaged, low- and middle-income resource countries.^{46,47,54,55} With partial federal funding from the National Science Foundation, MammaCare Foundation (https://www.nsf.gov/news/news_summ.jsp?cntn_id=122294) has developed a computerized training system that provides immediate feedback to learners. In medically underserved areas, this may offer a practical solution for education and patient care. Table 4 highlights information about breast awareness and BSE.

FUTURE DIRECTIONS AND IMPLICATIONS FOR NURSING

Perhaps someday, the tremendous costs and efforts needed to provide high-quality screening will be replaced with a biomarker.⁷² Until then, efforts must focus on education, competent care, and outreach to apply and optimize all three core methods

of early breast cancer detection available today in addition to adjunctive imaging and/or genetic testing for those at high risk. In this author's opinion, these activities can best be accomplished through comprehensive breast centers in the US and abroad,^{52,61,64-66,92,95} ACR-accredited breast imaging centers of excellence,⁶³ and accredited cancer centers designated by the American College of Surgeons Commission on Cancer or the National Cancer Institute.^{14,21,95} In addition, nurses will increasingly advocate for improved access for underserved or uninsured populations both in the US and abroad.⁴⁵⁻⁴⁸ Hopefully, the Centers for Disease Control and Prevention and state partnerships for the National Breast and Cervical Cancer Early Detection Program⁵⁴ (<https://www.cdc.gov/cancer/nbccedp/>) will continue to provide a safety net and referrals for care of underserved, low-income, uninsured women in the US. The Union for International Cancer Control and International Cancer Control Program (<http://www.iccp-portal.org>), through their network of organizational partners, will also sustain progress in reaching economically disadvantaged communities through interprofessional outreach, direct patient care, and local breast health campaigns.⁴⁶⁻⁵⁰

Oncology nurses experience countless patients and family members affected by breast cancer; they are front line care providers who promote interprofessional team work,⁵ navigation guidance,^{11,111} and systems change.^{4,13,91,112} Oncology nurses will continue to lead^{9,92} on all fronts by applying their specialized knowledge, skills, and compassionate demeanor to improve care. Practical approaches are needed to stimulate and sustain ongoing awareness, education, training, access to organized, high-quality screening programs/systems^{13,54,55,110,112,113} and centralized data registries^{1,21,32,66,67,114} for women worldwide. Through promotion of earlier detection and screening for breast cancer, self-care, competent professional practice,^{9,10,12,113} and interdisciplinary team work, oncology nurses will continue to advocate for high standards to advance excellence and quality cancer care.

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TABLE 3.
Clinical breast examination

Purpose	Signs and/or symptoms	Technique	Advantages	Disadvantages	Controversies
Identify familiarity with breast tissue throughout different phases of the lifespan. Physical exam by a health care provider to detect lumps, physical changes from the "normal" visual appearance, or palpable texture of breast tissue. Complements screening mammography, especially in high-risk women.	Palpable lump, mass, thickening tissue, irregularity that feels distinctly different from surrounding tissue, asymmetric as compared with the other breast, or regional axillary tail/nodes. Enlarged supraclavicular lymph nodes and cervical nodes. Visual change, eg, retraction, dimpling, puckering; or nipple changes such as inversion, retraction, ulceration. Nipple discharge (bloody or watery), unilateral. Redness, swelling, or tenderness may indicate inflammatory breast cancer. Bilateral expressible discharge, focal pain, or diffuse discomfort, engorgement, evaluate for benign breast conditions. CBE should continue during pregnancy or lactation.	ICCP (http://www.iccp-portal.org/early-detection-and-screening) for specific techniques. Examine all tissue (see Figure 2). CBE (asymptomatic) should take approx. 6 minutes and a diagnostic (symptomatic) CBE 6 to 10 minutes for both breasts. Document clinical findings and correlate with breast imaging findings.	Opportunity to detect small tumors ≤ 15 mm. Allows clinician time to review negative or positive findings from prior CBEs and/or breast imaging, biopsies. Allows time to discuss a follow-up plan of action and shared decision-making for either routine screening or appropriate referrals. Allows time to explore barriers and obstacles related to breast cancer screening and offer solutions (transportation, reminders, low-cost programs for medically uninsured etc.) No ionizing radiation.	Time to conduct a CBE may not be feasible in some settings. Missed or delayed diagnosis of breast cancer. Some clinicians do not feel confident or competent performing CBE. Lack of access to training. Licensing requirements and scope of practice for performing CBE may be a barrier for training clinicians, nurses, or radiologic technologists. Confusion about various guidelines regarding CBE. Patients may seek care elsewhere if CBE is not offered.	False-positive test results may prompt anxiety, unnecessary imaging, consults, biopsies. Scope of practice issues relative to licensed and non-licensed personnel conducting CBE. CBE exclusion from some recommended guidelines based on levels of evidence has caused conflicts among clinicians who believe CBE is part of routine care. Medical-legal implications of screening, diagnostic work-up, and follow-up. Benefits of population-based CBE screening in low- to middle-income communities. Ability to bill for reimbursement of time for CBE and associated care coordination.

Data from references 41, 48, 96, and 97.
CBE, clinical breast exam; ICCP, International Cancer Control Program.

TABLE 4.
Breast awareness and self-examination

Purpose	Signs and/or symptoms	Technique	Advantages	Disadvantages	Controversies
Become familiar with breast tissue throughout different phases of life cycle, including pregnancy and menopause. Detect new or interval change from "normal" visual appearance or palpable texture of breast tissue and promptly report it. Complement mammography and CBE, especially in high-risk women.	Palpable lump, mass, thickening, or other tissue irregularity that feels distinctly different or asymmetric as compared with opposite breast. Visual change in skin: discrete retraction, dimpling, puckering; or nipple changes such as inversion, retraction or scaly, ulceration. New, nipple discharge, especially if bloody or watery, unilateral. Diffuse and rapidly developing redness, swelling, and tenderness.	Steps of a BSE: https://www.maurerfoundation.org/about-breast-cancer-breast-health/how-to-do-a-bse-breast-self-exam/ http://mammacare.org/ See Figure 2 for perimeter of tissue to be covered.	Helpful for women who have no access to mammography, not age-eligible for mammography; during pregnancy; with cosmetic implants, post radiotherapy; dense breast tissue, and taking hormonal medications. Inexpensive Increases self-awareness Fingerpads sensitive to discern and differentiate tissue. Tumor simulations in breast models improve learning. Useful for surveillance in women who choose breast cancer chemoprevention regimens.	False-positive results can occur and necessitate further testing, time, money, and anxiety. Some women may become hypervigilant and anxious, instead of confident and reassured. Time-consuming: up to 15 minutes per month. Inconvenient to remember to wait 5 to 7 days after first day of menses. Women without access to clinicians for 1:1 training and feedback on normal tissue characteristics may become confused and find more false-positives. BSE may increase fear of finding breast cancer and become a hindrance vs help.	Training perceived as too costly for population-based programs. BSE not as effective in detecting preclinical, non-palpable changes as mammography. Small tumor size may not always be the sole determinant of outcomes.

Data from references 34, 44, 46-48, and 98-99.
CBE; clinical breast exam; BSE, breast self-exam.

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