Breast Cancer Screening

What is breast cancer screening?

Screening exams find disease before symptoms begin. The goal of screening is to detect disease at its earliest and most treatable stage. In order to be widely accepted and recommended by medical practitioners, a screening program must meet *a number of criteria (https://www.radiologyinfo.org/en/info/safety-hiw_05)* , including reducing the number of deaths from the given disease.

Screening tests may include lab tests that check blood and other fluids, genetic tests that look for inherited genetic markers linked to disease, and imaging exams that produce pictures of the inside of the body. These tests are typically available to the general population. However, an individual's needs for a specific screening test are based on factors such as age, gender, and family history.

In breast cancer screening, a woman who has no signs or symptoms of breast cancer undergoes a breast examination such as:

- *Clinical breast exam:* A physical examination of the breast by a doctor or other health professional.
- Mammography (https://www.radiologyinfo.org/en/info/mammo) : A low-dose x-ray exam that produces images of the breast called a mammogram. Mammography plays a central part in early detection of breast cancers because it can often show changes in the breast before a patient or physician can feel them. Research has shown that annual mammograms can lead to early detection of breast cancers when they are most curable and breast-conservation therapies are available. A mammogram may also find ductal carcinoma in situ (DCIS), abnormal cells in the lining of a breast duct that may develop into invasive cancer. Mammography is the only breast cancer screening tool known to reduce deaths from the disease.

Supplemental Breast Cancer Screening

Many studies have shown that ultrasound and magnetic resonance imaging (MRI) can help supplement mammography by detecting breast cancers that may not be visible with mammography. Neither MRI nor ultrasound is meant to replace mammography. Rather, they are used in conjunction with mammography in selected women. Women should consult with their referring doctor or radiologist to determine if MRI or ultrasound screening is appropriate for them.

- MRI of the breast (https://www.radiologyinfo.org/en/info/breastmr) may be used for women at high risk for breast cancer, typically because of a strong family history of the disease.
- Ultrasound of the breast (https://www.radiologyinfo.org/en/info/breastus) may be used for women who are at high risk for breast cancer and unable to undergo an MRI examination or women who are pregnant and should not be exposed to x-rays used in mammography. Ultrasound of the breast can also be used to screen women who have dense breast (https://www.radiologyinfo.org/en/info/dense-breasts) tissue, meaning there are a lot of ducts, glands, fibrous tissue and less fat making it harder to find cancers with traditional mammography.

Who should consider breast cancer screening – and why?

About Breast Cancer

Breast Cancer (https://www.radiologyinfo.org/en/info/breast-cancer) is cancer that forms in tissues of the breast, usually in the ducts (tubes that carry milk to the nipple) and lobules (glands that make milk). It occurs in both men and women, although male breast cancer is rare.

Breast cancer is the second leading cause of death from cancer in American women. About one woman in eight will be diagnosed with the disease over the course of her lifetime. A woman's risk of developing breast cancer increases with:

- age
- a family history of the disease
- a known BRCA1 or BRCA2 gene mutation
- beginning menstruation at an early age
- older age at birth of first child or never having given birth
- breast tissue that is dense
- use of hormones such as estrogen and progesterone
- obesity
- consumption of alcoholic beverages

Women at high risk for breast cancer include those who have:

- a known *BRCA1* or *BRCA2* gene mutation
- a first-degree relative (mother, father, brother, sister or child) with a *BRCA1* or *BRCA2* gene mutation, though she herself has not had genetic testing
- a lifetime risk of breast cancer of about 20 to 25 percent or greater, according to risk assessment tools that are based mainly on a family history that includes both their mother's and father's side
- had radiation therapy to the chest when they were between the ages of 10 and 30 years
- a genetic disease such as Li-Fraumeni syndrome, Cowden syndrome, or hereditary diffuse gastric cancer, or have a first-degree relative with one of these diseases
- a personal history of breast cancer

Screening Recommendations

Although guidelines differ, major regulatory bodies agree that annual screening mammography starting at age 40 saves lives. According to the U.S. Department of Health and Human Services (HHS) (https://www.cancer.gov/types/breast/patient/breast-screening-pdq) , women between the ages of 40 and 74 who have screening mammograms have a lower chance of dying from breast cancer than women who do not. Screening mammography is recommended every year for women who are at average risk for breast cancer beginning at age 40 by the American College of Radiology (ACR) (https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Breast-Cancer-Screening-for-Average-Risk-Women) and the Radiological Society of North America (RSNA) (https://www.rsna.org/uploadedFiles/RSNA/Content/Role_based_pages/Media/RSNA-Mammography-Screening-Statement.pdf) . The American Cancer Society (https://www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/american-cancer-society-recommendations-for-the-early-detection-of-breast-cancer.html) (ACS) recommends that women aged 40-44 talk to their doctor and consider screening, which saves lives. Per ACS, screening mammography should begin at age 45 and be done every year until age 55 after which women can transition to every other year. The United States Preventive Services Task Force (USPSTF) recommends that regular screening mammography for average risk women should begin at age 50 and be done every other year. The National Cancer Institute (NCI) advises women who have had breast cancer and those who are at increased risk due to a family history of breast cancer to seek expert medical advice about the frequency of screening and whether they should begin screening before age 40. The age at which screening mammography should stop has not been firmly established but in general, it is thought that screening should continue as long as a woman is in good health regardless of age.

Women at high risk for breast cancer should follow different guidelines. According to American Cancer Society guidelines (https://www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/american-cancer-society-recommendations-for-the-early-detection-of-breast-cancer.html) , most women at high risk should begin screening with MRI and mammography at age 30 and continue for as long they are in good health. Some women at high risk may begin MRI screening at age 25. It is important to remember that most breast cancer occurs in women with no risk factors.

Women should see their radiologist or primary care doctor to determine when to begin and how often to undergo breast cancer screening.

How is breast cancer screening performed?

Clinical Breast Exam

In a clinical breast exam, the doctor carefully feels the breasts and underarm area for lumps or anything else unusual. Women may also perform a breast self-exam by checking their own breasts for lumps or changes in size or shape. The clinical breast exam and breast self-exam can help women become more familiar with the regular look and feel of their breasts and more readily identify changes.

Screening Mammography

Mammography is a type of x-ray examination used to examine the breasts. This type of imaging involves exposing the breasts to a small amount of radiation to obtain pictures of the inside of the breasts. *See the Safety page (https://www.radiologyinfo.org/en/info/safety-radiation) for more information about x-rays.*

During mammography, a specially qualified radiologic technologist will position your breast in the mammography unit. Your breast is placed on a special platform and compressed with a paddle (often made of clear Plexiglas or other plastic). The technologist will gradually compress your breast and while you hold still. Usually two images of each breast will be obtained an image producing a top-to-bottom view of the breast and an image producing an angled side-to-side view.

Breast Tomosynthesis

Breast tomosynthesis (https://www.radiologyinfo.org/en/info/tomosynthesis) , also called three-dimensional (3-D) mammography, is an advanced type of breast imaging that uses low-dose x-rays and computer reconstruction to create images of the breast. It aids in the early detection and diagnosis of breast cancer before women experience symptoms. Breast tomosynthesis is not yet available in all imaging facilities.

Breast Ultrasound

Breast ultrasound is a type of imaging that uses sound waves to create pictures of the inside of the breast. Breast ultrasound can capture images of areas of the breast that may be difficult to see with mammography. It can also help to determine whether a breast lump is a solid mass or a fluid-filled cyst.

For breast ultrasound, you will lie on your back on the examining table. A clear water-based gel is applied to your breast and the sonographer (ultrasound technologist) or radiologist will then press the transducer firmly against your skin, sweeping over the breast.

Breast MRI

During breast MRI, a powerful magnetic field, radio frequency pulses and a computer are used to produce detailed pictures of the inside of the breasts. MRI is helpful in finding abnormalities that are not visible with mammography or ultrasound. In general, MRI is used only in women at high risk for breast cancer.

For an MRI of the breast, you will lie face down on a platform with openings to accommodate your breasts and allow them to be imaged without compression. A nurse or technologist will insert an intravenous (IV) catheter, also known as an IV line, into a vein in your hand or arm. You will be moved into the magnet of the MRI unit, which is a large tunnel, and an initial set of images will be taken while you remain very still. The contrast material is injected into the intravenous line (IV) and additional images are taken.

What are the benefits and risks of breast cancer screening?

Mammography

Benefits

- Imaging the breast improves a physician's ability to detect small tumors. When cancers are small, the woman has more treatment options.
- The use of screening mammography increases the detection of small abnormal tissue growths confined to the milk ducts in the breast, called ductal carcinoma in situ (DCIS). These early tumors rarely harm patients if they are removed at this stage, and mammography is the only proven method to reliably detect these tumors. It is also useful for detecting all types of breast cancer, including invasive ductal and invasive lobular cancer.
- Mammography has been shown to decrease the number of deaths from breast cancer when it is used for screening.
- No radiation remains in a patient's body after an x-ray examination.

Risks

- There is always a slight chance of cancer from excessive lifetime exposure to radiation. However, the amount of radiation from a mammogram is very small and the benefit of an accurate diagnosis far outweighs the risk.
- The effective radiation dose for this procedure varies. *See the Safety page (https://www.radiologyinfo.org/en/info/safety-xray) for more information about radiation dose.*
- False positive mammograms may occur. Five to 15 percent of screening mammograms require more testing such as additional mammograms or ultrasound. Most of these tests turn out to be normal. If there is an abnormal finding, a follow-up or rarely a biopsy may have to be performed. Most biopsies are done with a needle and confirm that no cancer was present.
- Based on statistical studies on the incidence of cancer over time, some researchers have suggested that cancer screening identifies both life-threatening diseases and diseases that would never have caused symptoms during the patient's lifetime, a phenomenon called over-diagnosis. Overdiagnosis of breast cancer is likely very small. Scientists are working on methods to classify abnormal cells according to their potential to cause harm; however, at this time, physicians have no way of distinguishing non-life threatening cancer cells from those that will cause advanced disease.
- Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant. *See the Safety page (https://www.radiologyinfo.org/en/info/safety-radiation) for more information about pregnancy and x-rays.*

Breast Ultrasound

Benefits

- Ultrasound scanning is noninvasive (no needles or injections).
- Occasionally, an ultrasound exam may be temporarily uncomfortable, but it is almost never painful.
- Ultrasound is widely available, easy-to-use and less expensive than other imaging methods.
- Ultrasound imaging is extremely safe and does not use any ionizing radiation.
- Ultrasound scanning may give a clear picture of soft tissues that do not show up well on x-ray images.
- Ultrasound imaging can help detect lesions in women with dense breasts that may not be visible on mammography.

Risks

- For standard diagnostic ultrasound, there are no known harmful effects on humans. Interpretation of a breast ultrasound examination may lead to additional procedures such as follow-up ultrasound and/or aspiration or biopsy. Many of the areas thought to be of concern only on ultrasound turn out to be non-cancerous (benign).

Breast MRI

Benefits

- MRI is a noninvasive imaging technique that does not involve exposure to ionizing radiation.
- MRI has proven valuable in detecting breast cancer and finding cancers that are not seen on mammography or ultrasound.
- The ability of MRI to detect breast cancer does not appear to be compromised by breast density.
- MRI as an addition to mammography has been shown to be useful in evaluating women at high risk for breast cancer.
- If a suspicious lesion is seen with MRI only, MRI can provide guidance for biopsy.

Risks

- Many potential abnormalities seen on MRI prove to be benign (false positives).
- MRI poses almost no risk to the average patient when appropriate safety guidelines are followed.
- Although the strong magnetic field is not harmful in itself, implanted medical devices that contain metal may malfunction or cause problems during an MRI exam. Inform your doctor or the technologist prior to the exam if you have such a device.
- There is a very slight risk of an allergic reaction if contrast material is injected. Such reactions usually are mild and easily controlled by medication. If you experience allergic symptoms, a radiologist or other physician will be available for immediate assistance.
- Nephrogenic systemic fibrosis is currently a recognized, but rare, complication of MRI believed to be caused by the injection of high doses of gadolinium contrast material in patients with very poor kidney function.
- Manufacturers of intravenous contrast indicate mothers should not breastfeed their babies for 24-48 hours after contrast medium is given. However, both the ACR and the European Society of Urogenital Radiology (http://www.esur.org/) note that the available data suggest that it is safe to continue breastfeeding after receiving intravenous contrast. *For further information please consult the ACR Manual on Contrast Media (http://www.acr.org/Quality-Safety/Resources/Contrast-Manual) and its references*.

What happens if something is detected on my screening exam?

Lumps, other abnormalities or questionable findings in the breast are often detected by screening tests. However, it is not always possible to tell from these imaging tests whether a finding is benign or cancerous. To determine whether there is a cancer present, your doctor may recommend that one or more of the following imaging tests may be performed:

- diagnostic mammography
- breast ultrasound
- breast MRI

If a finding is proven to be benign by its appearance on these exams, no further steps may need to be taken. If these tests do not clearly show that the finding is benign, a biopsy may be necessary. In a biopsy, a small amount of tissue is removed under local anesthesia so that it can be examined in a laboratory. One of the following image-guided procedures is used during a breast biopsy:

- Ultrasound-guided breast biopsy (https://www.radiologyinfo.org/en/info/breastbius) uses ultrasound imaging to visualize a breast lump. Using real-time ultrasound images, a radiologist will advance a needle to the site of the abnormality and remove some tissue for evaluation under a microscope. The biopsy procedure is usually quick, but it may take a few days before the

final tissue analysis (pathology report) is ready.

- Stereotactic (x-ray guided) biopsy (https://www.radiologyinfo.org/en/info/breastbixr) produces images of the breast at different angles with a digital mammography x-ray machine. Using these pictures, a computer then calculates the exact location of the abnormality in the breast. A radiologist will advance a needle to the site of the abnormality and remove tissue samples for further evaluation.
- MRI-guided breast biopsy (https://www.radiologyinfo.org/en/info/breastbimr) produces pictures of the breast with an MRI machine that also helps the radiologist guide a needle to the site of the abnormality to remove a tissue sample.

A pathologist examines the removed tissue specimen and makes a final diagnosis. Depending on the facility, the radiologist or your referring physician will share the results with you.

With early detection and improved treatments, more women are surviving breast cancer. If cancer is diagnosed, your doctor will discuss your treatment options and together you will determine your course of treatment. Today, women have more treatment options than ever before. *For more information on treatment, see the Breast Cancer Treatment page (https://www.radiologyinfo.org/en/info/breast-cancer-therapy)* .

Which test, procedure or treatment is best for me?

- *Breast Cancer Screening (https://www.radiologyinfo.org/en/info/acs-breast-cancer-screening)*
- *Breast Imaging of Pregnant and Lactating Women (https://www.radiologyinfo.org/en/info/acs-breast-imaging-pregnant-lactating)*
- *Transgender Breast Cancer Screening (https://www.radiologyinfo.org/en/info/acs-bc-screening-transgender)*

Where can I find more information about breast cancer screening?

You can find more information on breast cancer screening at:

- American College of Radiology (https://www.acraccreditation.org/Mammography-Saves-Lives/Guidelines)
- Mammography Myths and Misconceptions Videos (https://www.youtube.com/playlist?list=PLspI965fN2sevwJ7D8o0HKBeiITgK-V7P)
- The American Cancer Society (http://www.cancer.org/cancer/breastcancer/moreinformation/breastcancerearlydetection/index)
- The National Cancer Institute (http://www.cancer.gov/cancertopics/pdq/screening/breast/Patient)

Screening Trials

Before a screening program is widely accepted and recommended by medical practitioners, it must do more than detect disease at an early stage. The accepted measure of screening effectiveness is that it helps reduce the number of deaths from the given disease.

Clinical *screening trials (https://www.radiologyinfo.org/en/info/screening-clinical-trials)* are research studies that help determine to what extent screening methods actually reduce mortality (death rate) and at what cost.

If you would like more information on screening trials using imaging tests to screen for the presence of disease, visit the *Eastern Cooperative Oncology Group and the American College of Radiology Imaging Network (ECOG-ACRIN) (https://ecog-acrin.org/)* . Information on clinical trials studying both cancer screening and treatment methods is also available at the *National Cancer Institute (http://cancer.gov/clinicaltrials/search)* .

Disclaimer

Web site is further reviewed by an ACR (American College of Radiology) - RSNA (Radiological Society of North America) committee, comprising physicians with expertise in several radiologic areas.

However, it is not possible to assure that this Web site contains complete, up-to-date information on any particular subject. Therefore, ACR and RSNA make no representations or warranties about the suitability of this information for use for any particular purpose. All information is provided "as is" without express or implied warranty.

Please visit the RadiologyInfo Web site at **http://www.radiologyinfo.org** to view or download the latest information.

Note: Images may be shown for illustrative purposes. Do not attempt to draw conclusions or make diagnoses by comparing these images to other medical images, particularly your own. Only qualified physicians should interpret images; the radiologist is the physician expert trained in medical imaging.

Copyright