

Mammograms

Key Points

- A mammogram is an x-ray of the breast. Screening mammograms are used to check for breast cancer in women who have no signs or symptoms of the disease. Diagnostic mammograms are used to check for breast cancer after a lump or other sign or symptom of the disease has been found (see Question 1).
- It has been recommended that women age 40 and older should have mammograms every 1 to 2 years (see Question 3).
- The older a woman is, the greater her chance of developing breast cancer (see Questions 4 and 5).
- Women can get high-quality mammograms in breast clinics, hospital radiology departments, mobile vans, private radiology offices, and doctors' offices (see Question 13).

1. What is a mammogram?

A mammogram is an x-ray of the breast.

Mammograms can be used to check for breast cancer in women who have no signs or symptoms of the disease. This type of mammogram is called a screening mammogram. Screening mammograms usually involve two x-rays of each breast. They make it possible to detect tumors that cannot be felt. Screening mammograms can also find microcalcifications (tiny deposits of calcium) that sometimes indicate the presence of breast cancer.

Mammograms can also be used to check for breast cancer after a lump or other sign or symptom of breast cancer has been found. This type of mammogram is called a diagnostic mammogram. Signs of breast cancer may include pain, skin thickening, nipple discharge, or a change in breast size or shape. A diagnostic mammogram also may be used to evaluate changes found during a screening mammogram, or to view



breast tissue when it is difficult to obtain a screening mammogram because of special circumstances, such as the presence of breast implants (see Question 14).

2. How are *screening* and *diagnostic* mammograms different?

Diagnostic mammograms take longer than screening mammograms because they involve more x-rays in order to obtain views of the breast from several angles. The technician may magnify a suspicious area to produce a detailed picture that can help the doctor make an accurate diagnosis.

3. When does the National Cancer Institute (NCI) recommend that women have screening mammograms?

- Women age 40 and older should have mammograms every 1 to 2 years.
- Women who are at higher than average risk of breast cancer should talk with their health care providers about whether to have mammograms before age 40 and how often to have them.

4. What are the factors that place a woman at increased risk of breast cancer?

The risk of breast cancer increases gradually as a woman gets older. However, the risk of developing breast cancer is not the same for all women. Research has shown that the following factors *increase* a woman's chance of developing this disease:

- **Personal history of breast cancer**—Women who have had breast cancer are more likely to develop a second breast cancer.
- **Family history**—A woman's chance of developing breast cancer increases if her mother, sister, and/or daughter have been diagnosed with the disease, especially if they were diagnosed before age 50. Having a close male blood relative with breast cancer also increases a woman's risk of developing the disease.
- **Certain breast changes found on biopsy**—Looking at breast tissue under a microscope allows doctors to determine whether cancer or another type of breast change is present. Most breast changes are not cancer, but some may increase the risk of developing breast cancer. Changes associated with an increased risk of breast cancer include atypical hyperplasia (a noncancerous condition in which cells have abnormal features and are increased in number), lobular carcinoma *in situ* (LCIS) (abnormal cells are found in the lobules of the breast), and ductal carcinoma *in situ* (DCIS) (abnormal cells are found in the lining of breast ducts). Because some cases of DCIS will eventually develop into invasive breast cancer, this type of change is actively treated (see Question 10). Women with atypical hyperplasia and LCIS are usually monitored carefully and not actively treated. In addition, women who have had two or more breast biopsies for other noncancerous conditions also have an

increased risk of developing breast cancer. This increased risk is due to the conditions that led to the biopsies and not to the biopsy procedure itself.

- **Genetic alterations (changes)**—Changes in certain genes (for example, *BRCA1*, *BRCA2*, and others) increase the risk of breast cancer. These changes are rare; they are estimated to account for no more than 10 percent of all breast cancers.
- **Reproductive and menstrual history**—Women who began having menstrual periods before age 12 or went through menopause after age 55 are at increased risk of developing breast cancer. Women who have their first child after age 30 or who never have a child are also at increased risk of developing breast cancer.
- **Long-term use of menopausal hormone therapy**—Women who use combination estrogen-progestin menopausal hormone therapy for more than 5 years have an increased chance of developing breast cancer.
- **Breast density**—Breast density refers to the relative amounts of different tissue in the breast as seen on a mammogram. Dense breasts have more glandular (milk-producing) and connective tissue than fatty tissue. Low-density breasts have a greater proportion of fatty tissue. Younger women usually have denser breasts than older women. As a woman ages, the amount of glandular tissue normally decreases and the amount of fatty tissue increases. Because breast cancers tend to develop in the dense tissue of the breast, older women whose mammograms show more dense tissue have a higher risk of developing breast cancer. Abnormalities in dense breasts can be more difficult to detect on a mammogram.
- **Radiation therapy**—Women who had radiation therapy to the chest (including the breasts) before age 30 have an increased risk of developing breast cancer throughout their lives. This includes women treated for Hodgkin lymphoma. Studies show that the younger a woman was when she received her treatment, the higher her risk of developing breast cancer later in life.
- **DES (diethylstilbestrol)**—The drug DES was given to some pregnant women in the United States between 1940 and 1971. (It is no longer given to pregnant women.) Women who took DES during pregnancy may have a slightly increased risk of breast cancer. The possible effects on their daughters and granddaughters are under study.
- **Body weight**—Studies have found that the chance of getting breast cancer after menopause is higher in women who are overweight or obese.
- **Physical activity level**—Women who are physically inactive throughout life may have an increased risk of breast cancer. Being active may help reduce risk by preventing weight gain and obesity.

- **Alcohol**—Studies indicate that the more alcohol a woman drinks, the greater her risk of breast cancer.

5. What are the chances that a woman in the United States might develop breast cancer?

Age is the most important risk factor for breast cancer. The older a woman is, the greater her chance of developing breast cancer. Most breast cancers occur in women over the age of 50. The number of cases is especially high for women over age 60. Breast cancer is relatively uncommon in women under age 40. The NCI fact sheet *Probability of Breast Cancer in American Women* provides more information about lifetime risk. This fact sheet is available at <http://www.cancer.gov/cancertopics/factsheet/Detection/probability-breast-cancer> on the Internet.

6. What is the best method of detecting breast cancer as early as possible?

Getting a high-quality screening mammogram and having a clinical breast exam (an exam done by a health care provider) on a regular basis are the most effective ways to detect breast cancer early. As with any screening test, screening mammograms have both benefits and limitations. For example, some cancers cannot be detected by a screening mammogram but may be found by a clinical breast exam.

Checking one's own breasts for lumps or other unusual changes is called a breast self-exam, or BSE. Breast self-exams cannot replace regular screening mammograms or clinical breast exams. In clinical trials (research studies), breast self-exams alone have not been found to help reduce the number of deaths from breast cancer.

If a woman chooses to do breast self-exams, it is important to remember that breast changes can occur because of pregnancy, aging, menopause, during menstrual cycles, or taking birth control pills or other hormones. It is normal for breasts to feel a little lumpy and uneven. Also, it is common for breasts to be swollen and tender right before or during a menstrual period. If a woman notices any unusual changes in her breasts, she should contact her health care provider.

7. What are the benefits of screening mammograms?

Several large studies conducted around the world show that breast cancer screening with mammograms reduces the number of deaths from breast cancer for women ages 40 to 69, especially for those over age 50. Studies conducted to date have not shown a benefit from regular screening mammograms, or from a baseline screening mammogram (a mammogram used for comparison), in women under age 40.

8. What are some of the limitations or harms of screening mammograms?

- **Finding cancer does not always mean saving lives**—Even though mammograms can detect tumors that cannot be felt, finding a small tumor does not always mean that a woman’s life will be saved. Screening mammograms may not help a woman with a fast-growing or aggressive cancer that has already spread to other parts of her body before being detected.
- **False negatives**—False negatives occur when mammograms appear normal even though breast cancer is present. Overall, screening mammograms miss up to 20 percent of the breast cancers that are present at the time of screening. False negatives occur more often in younger women than in older women because the dense breasts of younger women make breast cancers more difficult to detect in mammograms. As women age, their breasts usually become more fatty (therefore, less dense), and breast cancers become easier to detect with screening mammograms.
- **False positives**—False positives occur when radiologists decide mammograms are abnormal, but no cancer is actually present. All abnormal mammograms should be followed up with additional testing (a diagnostic mammogram, ultrasound, and/or biopsy) to determine if cancer is present. False positives are more common in younger women, women who have had previous breast biopsies, women with a family history of breast cancer, and women who are taking estrogen (for example, hormone replacement therapy).
- **Radiation exposure**—Mammograms (as well as dental x-rays and other routine x-rays) use very small doses of radiation. The risk of any harm is very slight, but repeated x-rays could cause problems. The benefits nearly always outweigh the risk. Women should talk with their health care provider about the need for each x-ray. They should also ask about shielding to protect parts of the body that are not in the picture. In addition, they should always let their health care provider and the technician know if there is any possibility that they are pregnant.

9. What is the Breast Imaging Reporting and Database System (BI-RADS®)?

The American College of Radiology (ACR) has established a uniform way for radiologists to describe mammogram findings. The system, called BI-RADS, includes seven standardized categories, or levels. Each BI-RADS category has a follow-up plan associated with it to help radiologists and other physicians appropriately manage a patient’s care.

Breast Imaging Reporting and Database System (BI-RADS)		
Category	Assessment	Follow-up
0	Need additional imaging evaluation	Additional imaging needed before a category can be assigned
1	Negative	Continue annual screening mammograms (for women over age 40)
2	Benign (noncancerous) finding	Continue annual screening mammograms (for women over age 40)
3	Probably benign	Receive a 6-month follow-up mammogram
4	Suspicious abnormality	May require biopsy
5	Highly suggestive of malignancy (cancer)	Requires biopsy
6	Known biopsy-proven malignancy (cancer)	Biopsy confirms presence of cancer before treatment begins

Additional information about BI-RADS is available on the ACR Web site at <http://www.acr.org> or by calling the ACR at 1-800-ACR-LINE (1-800-227-5463).

10. What happens if a mammogram leads to the detection of ductal carcinoma *in situ* (DCIS)?

Over the past 30 years, improvements in mammography have made it possible to detect a larger number of tissue abnormalities, including DCIS. DCIS is a condition in which abnormal cells are confined to the milk ducts of the breast. The cells have not invaded the surrounding breast tissue. DCIS usually does not cause a lump, so it cannot be detected during a clinical breast exam or BSE. However, mammography is able to detect 80 percent of DCIS cases. Some of these cases will eventually develop into invasive breast cancer.

It is not possible to predict which cases of DCIS will progress to invasive cancer. Therefore, DCIS usually is removed surgically. In the past, DCIS was often treated with a mastectomy, but breast-conserving therapy (breast-sparing surgery plus radiation therapy) is now standard practice for many women with DCIS. Tamoxifen may also be used. Women who have been diagnosed with DCIS should talk with their doctor to make an informed decision about treatment.

11. How much does a mammogram cost?

The cost of screening mammograms varies by state and by facility, and can depend on insurance coverage. However, most states have laws requiring health insurance companies to reimburse all or part of the cost of screening mammograms. Women are

encouraged to contact their mammogram facility or their health insurance company for information about cost and coverage.

All women age 40 and older with Medicare can get a screening mammogram each year. Medicare will also pay for one baseline mammogram for a woman between the ages of 35 and 39. There is no deductible requirement for this benefit, but Medicare beneficiaries have to pay 20 percent of the Medicare-approved amount. Information about Medicare coverage is available at <http://www.medicare.gov> on the Internet, or through the Medicare Hotline at 1-800-MEDICARE (1-800-633-4227). For the hearing impaired, the telephone number is 1-877-486-2048.

12. How can women who are low-income or uninsured obtain a screening mammogram?

Some state and local health programs and employers provide mammograms free or at low cost. For example, the Centers for Disease Control and Prevention (CDC) coordinates the National Breast and Cervical Cancer Early Detection Program. This program provides screening services, including clinical breast exams and mammograms, to low-income, uninsured women throughout the United States and in several U.S. territories. Contact information for local programs is available on the CDC's Web site at <http://apps.nccd.cdc.gov/cancercontacts/nbccedp/contacts.asp> or by calling the CDC at 1-800-CDC-INFO (1-800-232-4636).

Information about low-cost or free mammography screening programs is also available through NCI's Cancer Information Service (CIS) at 1-800-4-CANCER (1-800-422-6237). Women can also check with their local hospital, health department, women's center, or other community groups to find out how to access low-cost or free mammograms.

13. Where can women get high-quality mammograms?

Women can get high-quality mammograms in breast clinics, hospital radiology departments, mobile vans, private radiology offices, and doctors' offices.

The Mammography Quality Standards Act (MQSA) is a Federal law designed to ensure that mammograms are safe and reliable. Through the MQSA, all mammography facilities in the United States must meet stringent quality standards, be accredited by the Food and Drug Administration (FDA), and be inspected annually. The FDA ensures that mammography facilities across the country meet MQSA standards. These standards apply to the following people at the mammography facility:

- The technician who takes the mammogram.
- The radiologist who interprets the mammogram.
- The medical physicist who tests the mammography equipment.

Women can ask their doctors or staff at the mammography facility about FDA certification before making an appointment. All mammography facilities are required to display their FDA certificate. Women should look for the MQSA certificate at the mammography facility and check its expiration date. MQSA regulations also require mammography facilities to give patients an easy-to-read report on the results of their mammogram.

Information about local FDA-certified mammography facilities is available through the CIS at 1-800-4-CANCER (1-800-422-6237). Also, a list of these facilities is on the FDA's Web site at <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfMQSA/mqsa.cfm> on the Internet.

14. What should women with breast implants do about screening mammograms?

Women with breast implants should continue to have mammograms. (A woman who had an implant following breast cancer surgery should ask her doctor whether a mammogram of the reconstructed breast is necessary.) It is important to inform the mammography facility about breast implants when scheduling a mammogram. The technician and radiologist must be experienced in x-raying patients with breast implants. Implants can hide some breast tissue, making it more difficult for the radiologist to detect an abnormality on the mammogram. If the technician performing the procedure is aware a woman has breast implants, steps can be taken to make sure that as much breast tissue as possible can be seen on the mammogram.

15. What is digital mammography? How is it different from conventional (film) mammography?

Both digital and conventional mammography use x-rays to produce an image of the breast; however, conventional mammography stores the image directly on film, whereas digital mammography takes an electronic image of the breast and stores it directly in a computer. This allows the recorded information to be enhanced, magnified, or manipulated for further evaluation. The difference between conventional mammography and digital mammography is like the difference between a traditional film camera and a digital camera. Aside from the difference in how the image is recorded and stored, there is no other difference between the two.

Because digital mammography allows a radiologist to electronically adjust, store, and retrieve digital images, digital mammography may offer the following advantages over conventional mammography:

- Health care providers can share image files electronically, making long-distance consultations with other mammography specialists easier.
- Subtle differences between normal and abnormal tissues may be more easily noted.

- The number of follow-up procedures needed may be fewer.
- Fewer repeat images may be needed, reducing the exposure to radiation.

In January 2000, the FDA approved the use of digital mammography in the United States. In September 2005, preliminary results from a large clinical trial that compared digital mammography to film mammography were published (1). These findings showed no difference between digital and film mammograms in detecting breast cancer in the general population of women in the trial. However, the researchers concluded that women with dense breasts who are premenopausal or perimenopausal (women who had their last menstrual period within 12 months of their mammograms) or who are younger than age 50 may benefit from having a digital rather than a film mammogram.

Some health care providers recommend that women who have a very high risk of breast cancer, such as those with *BRCA1* or *BRCA2* gene alterations, have digital mammograms instead of conventional mammograms; however, studies showing that digital mammograms are superior to conventional mammograms for these women are lacking.

Digital mammography can be done only in facilities that are certified to practice conventional mammography and have received FDA approval to offer digital mammography. The procedure for having a mammogram with a digital system is the same as with conventional mammography.

16. What other technologies are being developed for breast cancer screening?

NCI is supporting the development of several new technologies to detect breast tumors. This research ranges from methods being developed in research labs to those that have reached clinical trials. Efforts to improve conventional mammography include digital mammography (see Question 15), magnetic resonance imaging (MRI), and positron emission tomography (PET scanning).

In addition to imaging technologies, NCI-supported scientists are exploring methods to detect markers (genetic traits) of breast cancer in blood, urine, or nipple aspirates (fluid from the breast) that may serve as early warning signals for breast cancer. The NCI fact sheet *Improving Methods for Breast Cancer Detection and Diagnosis* provides more information about technologies that are under development for breast cancer screening and diagnosis. This fact sheet is available at <http://www.cancer.gov/cancertopics/factsheet/Detection/breast-cancer> on the Internet.

17. How is NCI supporting efforts to find better ways to prevent and treat breast cancer?

NCI conducts and supports ongoing breast cancer research that ranges from basic science through the full spectrum of clinical care.

- **Basic research**—Researchers are trying to identify the causes of breast cancer, including the role of gene changes or variations in addition to changes in *BRCA1* and

BRCA2. Scientists are also investigating how hormonal, dietary, and environmental factors might contribute to the development of breast cancer.

- **Prevention**—As a result of NCI-supported research, the drugs tamoxifen and raloxifene have been approved by the FDA to reduce the risk of developing breast cancer in women who are at high risk for the disease; tamoxifen can be used by both premenopausal and postmenopausal women, whereas raloxifene is appropriate for postmenopausal women only. Currently, researchers are looking for additional ways to prevent breast cancer in women who are at increased risk. They are studying other preventive agents and how changes in diet, physical activity, nutrition, and environmental factors may lead to a reduced risk of developing breast cancer.
- **Early detection and diagnosis**—Several studies are seeking better ways to detect and diagnose breast cancer, so women can receive treatment sooner.
- **Treatment**—Numerous studies are being conducted to find more effective and less toxic treatments for breast cancer, better ways to deal with the symptoms of this disease and the side effects of its treatment, and new approaches to improve the quality of life of breast cancer patients and survivors.

In the HTML version of this fact sheet on NCI's Web site (<http://www.cancer.gov/cancertopics/factsheet/Detection/mammograms>), the text below links to searches of clinical trials for female breast cancer prevention, screening, and treatment. The trials are included in the clinical trials database that can be searched at <http://www.cancer.gov/clinicaltrials/search> on the Internet.

[Current NCI-supported clinical trials for female breast cancer prevention](#)

[Current NCI-supported clinical trials for female breast cancer screening](#)

[Current NCI-supported clinical trials for female breast cancer treatment](#)

Additional information about clinical trials is available from NCI's Cancer Information Service (1-800-4-CANCER) or on the main clinical trials page of NCI's Web site at <http://www.cancer.gov/clinicaltrials> on the Internet.

Selected Reference

1. Pisano ED, Gatsonis C, Hendrick E, et al. Diagnostic performance of digital versus film mammography for breast cancer screening. *New England Journal of Medicine* 2005; 353(17):1773-1783.

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Related NCI materials and Web pages:

- National Cancer Institute Fact Sheet 5.6, *Probability of Breast Cancer in American Women* (<http://www.cancer.gov/cancertopics/factsheet/Detection/probability-breast-cancer>)
- National Cancer Institute Fact Sheet 5.14, *Improving Methods for Breast Cancer Detection and Diagnosis* (<http://www.cancer.gov/cancertopics/factsheet/Detection/breast-cancer>)
- Breast Cancer Home Page (<http://www.cancer.gov/cancertopics/types/breast>)
- *What You Need To Know About™ Breast Cancer* (<http://www.cancer.gov/cancertopics/wyntk/breast>)

How can we help?

We offer comprehensive research-based information for patients and their families, health professionals, cancer researchers, advocates, and the public.

- **Call** NCI's Cancer Information Service at 1-800-4-CANCER (1-800-422-6237)
- **Visit** us at <http://www.cancer.gov> or <http://www.cancer.gov/espanol>
- **Chat** using LiveHelp, NCI's instant messaging service, at <http://www.cancer.gov/livehelp>
- **E-mail** us at cancergovstaff@mail.nih.gov
- **Order** publications at <http://www.cancer.gov/publications> or by calling 1-800-4-CANCER
- **Get help** with quitting smoking at 1-877-44U-QUIT (1-877-448-7848)

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