



About Breast Cancer

Breast Cancer Basics

Get an overview of what breast cancer is, how it forms, and how common it is.

- [What Is Breast Cancer?](#)
- [How Does Breast Cancer Form?](#)
- [How Common Is Breast Cancer?](#)

Signs and Symptoms of Breast Cancer

The most common symptom of breast cancer is a new lump or mass, but other symptoms are also possible. It's important to have any breast change checked by a health care provider.

- [Breast Cancer Signs and Symptoms](#)

What Is Breast Cancer?

Breast cancer starts when cells in the breast begin to grow out of control. These cells usually form a tumor that can often be seen on an x-ray or felt as a lump. The tumor is malignant (cancer) if the cells can grow into (invade) surrounding tissues or spread (metastasize) to distant areas of the body. Breast cancer occurs almost entirely in women, but [men can get breast cancer](#), too.

Cells in nearly any part of the body can become cancer and can spread to other areas of the body. To learn more about what is cancer and how all cancers start and spread, see our section on [Cancer Basics](#).

Where breast cancer starts

Breast cancers can start from different parts of the breast. Most breast cancers begin in the ducts that carry milk to the nipple (ductal cancers). Some start in the glands that make breast milk (lobular cancers). There are also other types of breast cancer that are less common.

A small number of cancers start in other tissues in the breast. These cancers are called [sarcomas](#) and [lymphomas](#) and are not really thought of as breast cancers.

Although many types of breast cancer can cause a lump in the breast, not all do. There are other symptoms of breast cancer you should watch for and report to a health care provider.

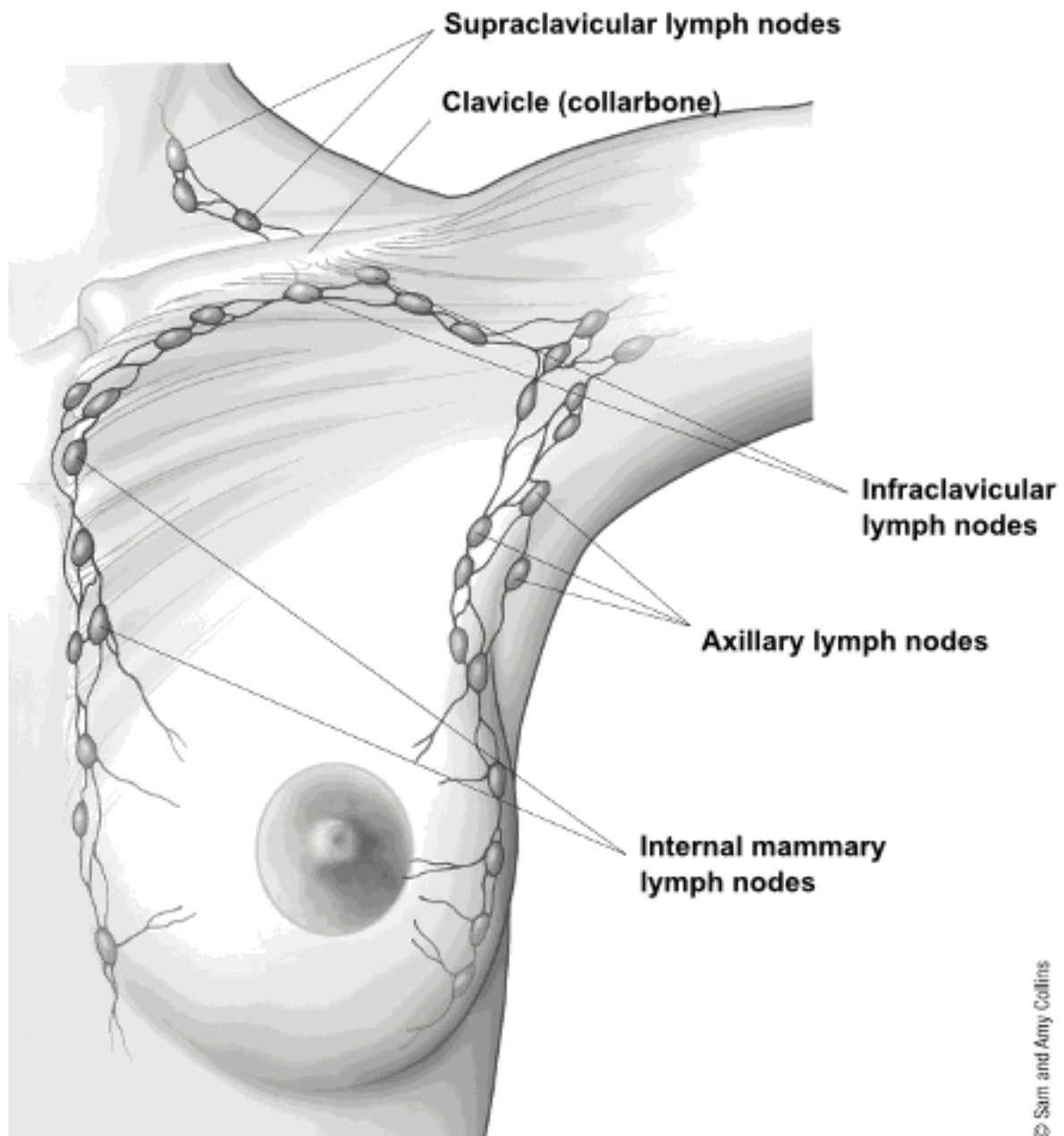
It's also important to understand that most breast lumps are not cancer, they are benign. Benign breast tumors are abnormal growths, but they do not spread outside of the breast and they are not life threatening. But some benign breast lumps can increase a woman's risk of getting breast cancer. Any breast lump or change needs to be checked by a health care provider to determine whether it is benign or cancer and whether it might impact your future cancer risk.

How breast cancer spreads

Breast cancer can spread when the cancer cells get into the blood or lymph system and are carried to other parts of the body.

The lymph system is a network of lymph (or lymphatic) vessels found throughout the body. The lymph vessels carry lymph fluid and connect lymph nodes. Lymph nodes are small, bean-shaped collections of immune system cells. Lymph vessels are like small veins, except that they carry a clear fluid called lymph (instead of blood) away from the breast. Lymph contains tissue fluid and waste products, as well as immune system cells. Breast cancer cells can enter lymph vessels and start to grow in lymph nodes. Most of the lymph vessels of the breast drain into:

- Lymph nodes under the arm (axillary nodes).
- Lymph nodes around the collar bone (supraclavicular and infraclavicular lymph nodes)
- Lymph nodes inside the chest near the breast bone (internal mammary lymph nodes)



Lymph nodes in relation to the breast

If cancer cells have spread to your lymph nodes, there is a higher chance that the cells could have traveled through the lymph system and spread (metastasized) to other parts of your body. The more lymph nodes with breast cancer cells, the more likely it is that the cancer may be found in other organs as well. Because of this, finding cancer in one

or more lymph nodes often affects your treatment plan. Usually, surgery to remove one or more lymph nodes will be needed to know whether the cancer has spread.

Still, not all women with cancer cells in their lymph nodes develop metastases, and some women have no cancer cells in their lymph nodes and later develop metastases.

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How Does Breast Cancer Form?

Changes or mutations in DNA can cause normal breast cells to become cancer. Certain DNA changes are passed on from parents (inherited) and can greatly increase the risk for breast cancer. Other lifestyle-related risk factors, such as what you eat and how much you exercise, can increase your chance of developing breast cancer, but it's not yet known exactly how some of these risk factors cause normal cells to become cancer. Hormones seem to play a role in many cases of breast cancer, but just how this happens is not fully understood.

Inherited versus acquired DNA mutations

Normal breast cells become cancer because of changes (mutations) in DNA. DNA is the chemical in each of our cells that makes up our genes. Genes have the instructions for how our cells function. Some DNA mutations are inherited or passed to you from your parents. This means the mutations are in every cell in your body and certain mutations can greatly increase the risk of certain cancers. They cause many of the cancers that run in some families.

But most DNA changes linked to breast cancer are acquired. This means the change takes place in breast cells during a woman's life rather than having been inherited. Acquired DNA changes take place over time and are only in the breast cancer cells, not in every cell in the body.

Mutated DNA can lead to mutated genes. Some genes control when our cells grow, divide into new cells, and die. Changes in these genes are linked to cancer.

Oncogenes

Genes that speed up cell division are called oncogenes.

Proto-oncogenes are genes that normally help cells grow. When a proto-oncogene mutates (changes) or there are too many copies of it, it becomes a "bad" gene that can stay turned on or activated when it's not supposed to be. When this happens, the cell grows out of control and makes more cells that grow out of control. This can lead to cancer. This bad gene is called an oncogene.

Think of a cell as a car. For the car to work properly, there need to be ways to control how fast it goes. A proto-oncogene normally functions in a way that's much like a gas pedal. It helps control how and when the cell grows and divides. An oncogene is like a gas pedal that's stuck down, which causes the cell to divide out of control.

Tumor suppression genes

Tumor suppressor genes are normal genes that slow down cell division, repair DNA mistakes, or tell cells when to die (a process known as apoptosis or programmed cell death). When tumor suppressor genes don't work properly, cells can grow out of control and make more cells that grow out of control, which can lead to cancer.

A tumor suppressor gene is like the brake pedal on a car. It normally keeps the cell from dividing too quickly, just as a brake keeps a car from going too fast. When something goes wrong with the gene, such as a mutation, the "brakes" don't work and cell division can get out of control.

Inherited gene changes

Certain inherited DNA mutations (changes) can dramatically increase the risk for developing certain cancers and are linked to many of the cancers that run in some families. For instance, the BRCA genes (BRCA1 and BRCA2) are tumor suppressor genes. When one of these genes changes, it no longer suppresses abnormal cell growth, and cancer is more likely to develop. A change in one of these genes can be passed on from a parent.

Women have already begun to benefit from advances in understanding the genetic basis of breast cancer. Genetic testing can identify some women who have inherited mutations in the BRCA1 or BRCA2 tumor suppressor genes (or less commonly in other genes such as PTEN or TP53). These women can then take steps to reduce their risk of breast cancers and make plans to look for changes in their breasts to help find cancer at an earlier, more treatable stage.

[Learn more in our breast cancer risk and prevention section.](#)

Mutations in tumor suppressor genes like the BRCA genes are considered “high-penetrance” because they often lead to cancer. Although many women with high-penetrance mutations develop cancer, most cases of cancer (including breast cancer) are not caused by this kind of mutation.

More often, low-penetrance mutations or gene variations are a factor in cancer development. Each of these may have a small effect on cancer occurring in any one person, but the overall effect on the population can be large because the mutations are common, and people often have more than one at the same time. The genes involved may affect things like hormone levels, metabolism, or other things that impact risk factors for breast cancer. These genes may cause much of the risk of breast cancer that runs in families.

Acquired gene changes

Most DNA mutations related to breast cancer take place in breast cells during a woman's life rather than having been inherited. These acquired mutations of oncogenes and/or tumor suppressor genes may result from other factors, like radiation or cancer-causing chemicals. But so far, the causes of most acquired mutations that could lead to breast cancer are still unknown. Most breast cancers have several acquired gene mutations.

Tests to spot acquired gene changes may help doctors more accurately predict the outlook (prognosis) for some women with breast cancer. For example, tests can identify women whose breast cancer cells have too many copies of the HER2 oncogene. These cancers tend to grow and spread faster. There are drugs that target these cancer cell changes and improve outcomes for patients.

Learn more about genes changes and how they can affect cancer risk and treatment in our section on breast cancer risk and prevention.

- [References](#)

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How Common Is Breast Cancer?

Breast cancer is the most common cancer in American women, except for skin cancers.

Current year estimates for breast cancer

The American Cancer Society's estimates for breast cancer in the United States for 2017 are:

- About 252,710 new cases of invasive breast cancer will be diagnosed in women.
- About 63,410 new cases of carcinoma in situ (CIS) will be diagnosed (CIS is non-invasive and is the earliest form of breast cancer).
- About 40,610 women will die from breast cancer.

Trends in breast cancer incidence

In recent years, incidence rates have been the same in white and African American women. Breast cancer is more common in these women, compared to women of other races/ethnicities.

Trends in breast cancer deaths

Breast cancer is the second leading cause of cancer death in women. (Only lung cancer kills more women each year.) The chance that a woman will die from breast cancer is about 1 in 37 (about 2.7%).

Death rates from breast cancer dropped from 1989 to 2007. Since 2007, breast cancer death rates have been steady in women younger than 50, but have continued to decrease in older women.

These decreases are believed to be the result of finding breast cancer earlier through screening and increased awareness, as well as better treatments.

Breast cancer survivors

At this time there are more than 3.1 million breast cancer survivors in the United States. (This includes women still being treated and those who have completed treatment.)

Survival rates are discussed in the section on breast cancer survival rates by stage.

Visit the [American Cancer Society's Cancer Statistics Center](#) for more key statistics.

- [References](#)

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Breast Cancer Signs and Symptoms

Knowing how your breasts normally look and feel is an important part of breast health. Finding breast cancer as early as possible gives you a better chance of successful treatment. But knowing what to look for does not take the place of having regular mammograms and other screening tests. Screening tests can help find breast cancer in its early stages, even before any symptoms appear.

The most common symptom of breast cancer is a new lump or mass. A painless, hard mass that has irregular edges is more likely to be cancer, but breast cancers can be tender, soft, or rounded. They can even be painful. For this reason, it is important to have any new breast mass or lump or breast change checked by a health care provider experienced in diagnosing breast diseases.

Other possible symptoms of breast cancer include:

- Swelling of all or part of a breast (even if no distinct lump is felt)
- Skin irritation or dimpling
- Breast or nipple pain
- Nipple retraction (turning inward)
- Redness, scaliness, or thickening of the nipple or breast skin
- Nipple discharge (other than breast milk)

Sometimes a breast cancer can spread to lymph nodes under the arm or around the collar bone and cause a lump or swelling there, even before the original tumor in the breast tissue is large enough to be felt. Swollen lymph nodes should also be checked by a health care provider.

Although any of these symptoms can be caused by things other than breast cancer, if you have them, they should be reported to a health care provider so that he or she can find the cause.

Because mammograms do not find every breast cancer, it is important for you to be aware of changes in your breasts and to know the signs and symptoms of breast cancer.

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What's New in Breast Cancer Research?

Researchers around the world are working to find better ways to prevent, detect, and treat breast cancer, and to improve the quality of life of patients and survivors.

Breast cancer is being studied in many medical centers throughout the world. Some of the many active areas of research include:

- Breast cancer causes
- Reducing breast cancer risk
- Managing DCIS
- New lab tests for breast cancer
- New imaging tests for breast cancer
- Breast cancer treatment

Causes of breast cancer

Studies continue to uncover lifestyle factors and habits, as well as inherited genes, that affect breast cancer risk. Here are a few examples:

- Several studies are looking at the effect of exercise, weight gain or loss, and diet on risk.
- Studies on the best use of genetic testing for *BRCA1* and *BRCA2* mutations continue at a rapid pace.
- Scientists are exploring how common gene variations (small changes in genes that are not as significant as mutations) may affect breast cancer risk. Gene variants typically have only a modest effect on risk, but when taken together they may potentially have a large impact.
- Potential causes of breast cancer in the environment have also received more attention in recent years. While much of the science on this topic is still in its earliest stages, this is an area of active research.
- A large, long-term study funded by the National Institute of Environmental Health Sciences (NIEHS) is now being done to help find the causes of breast cancer. Known as the Sister Study, it has enrolled 50,000 women who have sisters with breast cancer. This study will follow these women for at least 10 years and collect information about genes, lifestyle, and environmental factors that may cause breast cancer. An offshoot of the Sister Study, the Two Sister Study, is designed to look at possible causes of early onset breast cancer. To find out more about these studies, call 1-877-4-SISTER (1-877-474-7837) or visit the Sister Study website (www.sisterstudy.org).

Reducing breast cancer risk

Researchers continue to look for medicines that might help lower breast cancer risk, especially in women who are at high risk.

- Hormone therapy drugs are typically used to help treat breast cancer, but some might also help prevent it. Two drugs, tamoxifen and raloxifene, are already approved for this purpose, although concerns about side effects have limited their use. Aromatase inhibitors such as exemestane, anastrozole, and letrozole are also being studied to reduce the risk of breast cancer.
- Many other drugs are also being studied as ways to help reduce the risk of breast

cancer.

- Other clinical trials are looking at breast cancer reduction as an unintended effect of drugs used for other reasons. Drugs of interest include bisphosphonates (drugs for osteoporosis), COX-2 inhibitors, non-steroidal anti-inflammatory drugs, and statins (used to lower cholesterol).
- Dietary supplements are also being studied to see if they can reduce breast cancer risk. These have included linoleic acid, folate, omega-3 fatty acids, and vitamins B6 and D. Although some human studies of these supplements have been completed, very little has been published in the available medical literature to date.

This type of research takes many years. It might be some time before meaningful results on any of these compounds are available.

Managing DCIS

In ductal carcinoma in situ (DCIS), the abnormal cells are just in the top layers of cells in the ducts within the breast and haven't invaded any deeper. In some women, DCIS turns into invasive breast cancer, or sometimes an area of DCIS contains invasive cancer. In some women, though, the cells just stay within the ducts and never invade deeper or spread to lymph nodes or other organs. The uncertainty about how DCIS will behave can make it hard to choose the best treatments. Researchers are looking for ways to help with these challenges.

Researchers are studying the use of computers and statistical methods to estimate the odds that a woman's DCIS will become invasive. Decision aids are another approach. They ask a woman with DCIS questions that help her decide which factors (such as survival, preventing recurrence, and side effects) she considers most important in choosing a treatment.

Another recent area of research and debate among breast cancer specialists is whether changing the name of DCIS to one that emphasizes that this is not an invasive cancer could help some women avoid overly aggressive treatment.

Newer lab tests

Tests for circulating tumor cells (CTCs)

Researchers have found that in many women with breast cancer, cells may break away from the tumor and enter the blood. These circulating tumor cells can be detected with

sensitive lab tests. Although these tests can help predict which patients may have breast cancer that has spread beyond the breast (metastatic disease), it isn't clear that the use of these tests can tell whether the cancer will come back after treatment (recur) or help patients live longer.

Newer imaging tests

Newer imaging methods are now being studied for evaluating breast changes that may be cancer.

Scintimammography (molecular breast imaging)

In this test, a slightly radioactive drug called a *tracer* is injected into a vein. The tracer attaches to breast cancer cells and is detected by a special camera.

This technique is still being studied to see if it will be useful in finding breast cancers. Some doctors believe it may be helpful in looking at suspicious areas found by regular mammograms, but its exact role is still unclear. Current research is aimed at improving the technology and evaluating its use in specific situations such as in the dense breasts of younger women.

Treatment

Oncoplastic surgery

Breast-conserving surgery (lumpectomy or partial mastectomy) can often be used for early-stage breast cancers. But for some women, it can result in breasts of different sizes and/or shapes. For larger tumors, it might not even be possible, and a mastectomy might be needed instead. Some doctors are addressing this problem by combining cancer surgery and plastic surgery techniques, known as *oncoplastic surgery*. This typically involves reshaping the breast at the time of the initial surgery, such as doing a partial breast reconstruction after breast-conserving surgery or a full reconstruction after mastectomy. Oncoplastic surgery may mean operating on the other breast as well to make the breasts more alike.

Targeted therapy drugs

Targeted therapies are a group of drugs that specifically target gene changes in cancer cells that help the cells grow or spread. New targeted therapies are being studied for

use against breast cancer, including:

PARP inhibitors: These drugs are most likely to be helpful against cancers caused by *BRCA* mutations, and have shown some promise in treating some types of breast cancers. Further studies are being done to determine when these drugs might be most helpful.

Anti-angiogenesis drugs: For cancers to grow, blood vessels must develop to nourish the cancer cells. This process is called angiogenesis. Blocking angiogenesis may prove useful in breast cancer treatment. Several anti-angiogenesis drugs are being tested in clinical trials.

Other targeted drugs: Other potential targets for new breast cancer drugs have been identified in recent years. Drugs based on these targets are now being studied, but most are still in the early stages of clinical trials. There's a special research interest in targeted drugs to treat triple negative breast cancers.

Bone-directed treatments

When breast cancer spreads, it often goes to the bones. Some drugs can help treat the spread of cancer to the bones, and might even help prevent it. Studies are looking at whether any of these drugs might help other cancer treatments work better.

Researchers are looking for new drugs to treat breast cancer that has spread to the bones. They're also looking for ways to identify and target the markers that affect bone turnover.

Treatment side effects

Late and long-term side effects of different types of breast cancer treatment are another active area of research. Studies are looking at what the side effects are, as well as how to manage them.

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