



About Acute Lymphocytic Leukemia (ALL)

Overview of ALL

If you have been diagnosed with acute lymphocytic leukemia or are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- [What Is Acute Lymphocytic Leukemia?](#)

Research and Statistics

See the latest estimates for new cases of acute lymphocytic leukemia and deaths in the US and what research is currently being done.

- [Key Statistics for Acute Lymphocytic Leukemia](#)
- [What's New in Acute Lymphocytic Leukemia Research and Treatment?](#)

What Is Acute Lymphocytic Leukemia?

Cancer starts when cells in the body begin to grow out of control. Cells in nearly any part of the body can become cancer, and can spread to other areas of the body. To learn more about how cancers start and spread, see [What Is Cancer?](#)

Acute lymphocytic leukemia (ALL), also called *acute lymphoblastic leukemia*, is a cancer that starts from the early version of white blood cells called *lymphocytes* in the bone marrow (the soft inner part of the bones, where new blood cells are made).

Leukemia cells usually invade the blood fairly quickly. They can then spread to other parts of the body, including the lymph nodes, liver, spleen, central nervous system (brain and spinal cord), and testicles (in males). Other types of cancer also can start in

these organs and then spread to the bone marrow, but these cancers are not leukemia.

The term “acute” means that the leukemia can progress quickly, and if not treated, would probably be fatal within a few months. *Lymphocytic* means it develops from early (immature) forms of lymphocytes, a type of white blood cell. This is different from acute myeloid leukemia (AML), which develops in other blood cell types found in the bone marrow. For more information on AML, see [Acute Myeloid Leukemia](#).

Other types of cancer that start in lymphocytes are known as *lymphomas* (non-Hodgkin lymphoma or Hodgkin disease). The main difference between these types of cancers is that leukemias like ALL mainly affects the bone marrow and the blood, and may spread to other places, while lymphomas mainly affect the lymph nodes or other organs but may involve the bone marrow. Sometimes cancerous lymphocytes are found in both the bone marrow and lymph nodes when the cancer is first diagnosed, which can make it hard to tell if the cancer is leukemia or lymphoma. If more than 25% of the bone marrow is replaced by cancerous lymphocytes, the disease is usually considered leukemia. The size of lymph nodes is also important. The bigger they are, the more likely the disease will be considered a lymphoma. For more information on lymphomas, see [Non-Hodgkin Lymphoma](#) and [Hodgkin Disease](#).

There are actually many types of leukemia. They differ based on what types of cells they start in, how quickly they grow, which people they affect, and how they are treated. To understand leukemia, it helps to know about the blood and lymph systems.

Normal bone marrow, blood, and lymphoid tissue

Bone marrow

Bone marrow is the soft inner part of some bones, such as the skull, shoulder blades, ribs, pelvis, and bones in the spine. The bone marrow is made up of a small number of blood stem cells, more mature blood-forming cells, fat cells, and supporting tissues that help cells grow.

Blood stem cells go through a series of changes to make new blood cells. During this process, the cells develop into 1 of the 3 main types of blood cell components:

- Red blood cells
- Platelets
- White blood cells (which include lymphocytes, granulocytes, and monocytes)

Red blood cells

Red blood cells carry oxygen from the lungs to all other tissues in the body, and take carbon dioxide back to the lungs to be removed.

Platelets

Platelets are actually cell fragments made by a type of bone marrow cell called a *megakaryocyte*. Platelets are important in plugging up holes in blood vessels caused by cuts or bruises.

White blood cells

White blood cells help the body fight infections.

Lymphocytes

These are the main cells that make up lymphoid tissue, a major part of the immune system. Lymphoid tissue is found in lymph nodes, the thymus, the spleen, the tonsils and adenoids, and is scattered throughout the digestive and respiratory systems and the bone marrow.

Lymphocytes develop from cells called *lymphoblasts* to become mature, infection-fighting cells. The 2 main types of lymphocytes are B lymphocytes (B cells) and T lymphocytes (T cells).

- **B lymphocytes:** B lymphocytes protect the body from invading germs by maturing into plasma cells, which make proteins called antibodies. The antibodies attach to the germs (bacteria, viruses, and fungi), which helps the immune system destroy them.
- **T lymphocytes:** There are several types of T cells, each with a special job. Some T cells can destroy germs directly, while others play a role in either boosting or slowing the activity of other immune system cells.

Acute lymphocytic leukemia develops from early forms of lymphocytes. It can start in either early B cells or T cells at different stages of maturity. This is discussed in [How is acute lymphocytic leukemia classified?](#)

Granulocytes

These are white blood cells that have granules in them, which are spots that can be

seen under the microscope. These granules contain enzymes and other substances that can destroy germs, such as bacteria. The 3 types of granulocytes – *neutrophils*, *basophils*, and *eosinophils* – are distinguished by the size and color of their granules.

Monocytes

These white blood cells, which are related to granulocytes, also help protect the body against bacteria. After circulating in the bloodstream for about a day, monocytes enter body tissues to become *macrophages*, which can destroy some germs by surrounding and digesting them.

Development of leukemia

Any type of early blood-forming cell of the bone marrow can turn into a leukemia cell. Once this change happens, the leukemia cells will not mature normally. The leukemia cells could reproduce quickly, and might not die when they should. Instead they survive and build up in the bone marrow. Over time, these cells spill into the bloodstream and spread to other organs, where they can keep other cells from functioning normally.

Types of leukemia

There are 4 main types of leukemia:

- [Acute myeloid \(or myelogenous\) leukemia \(AML\)](#)
- [Chronic myeloid \(or myelogenous\) leukemia \(CML\)](#)
- Acute lymphocytic (or lymphoblastic) leukemia (ALL)
- [Chronic lymphocytic leukemia \(CLL\)](#)

Acute leukemia versus chronic leukemia

The first factor in classifying leukemia is whether most of the abnormal cells are mature (look like normal white blood cells) or immature (look more like stem cells).

Acute leukemia: In acute leukemia, the bone marrow cells cannot mature properly. Immature leukemia cells continue to reproduce and build up. Without treatment, most people with acute leukemia would live only a few months. Some types of acute leukemia respond well to treatment, and many patients can be cured. Other types of acute leukemia have a less favorable outlook.

Chronic leukemia: In chronic leukemia, the cells can mature partly but not completely. These cells may look fairly normal, but they generally do not fight infection as well as normal white blood cells do. They also live longer, build up, and crowd out normal cells. Chronic leukemias tend to progress over a longer period of time, and most people can live for many years. But chronic leukemias are generally harder to cure than acute leukemias.

Myeloid leukemia versus lymphocytic leukemia

The second factor in classifying leukemia is the type of bone marrow cells that are affected.

Myeloid leukemia: Leukemias that start in early forms of myeloid cells – the cells that make white blood cells (other than lymphocytes), red blood cells, or platelet-making cells (megakaryocytes) – are *myeloid* leukemias (also known as *myelocytic*, *myelogenous*, or *non-lymphocytic* leukemias).

Lymphocytic leukemia: Leukemias that start in immature forms of lymphocytes are called *lymphocytic* leukemias (also known as *lymphoid* or *lymphoblastic* leukemias).

The rest of this document focuses on acute lymphocytic leukemia (ALL) in adults. For information on ALL in children, see [Childhood Leukemia](#). Chronic leukemias and acute myeloid leukemia of adults are discussed in other American Cancer Society documents.

- [References](#)

[See all references for Acute Lymphocytic Leukemia](#)

Last Medical Review: December 2, 2014 Last Revised: February 18, 2016

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Key Statistics for Acute Lymphocytic Leukemia

The American Cancer Society's estimates for acute lymphocytic leukemia (ALL) in the

United States for 2018 (including both children and adults) are:

- About 5,960 new cases of ALL (3,290 in males and 2,670 in females)
- About 1,470 deaths from ALL (830 in males and 640 in females)

The risk for developing ALL is highest in children younger than 5 years of age. The risk then declines slowly until the mid-20s, and begins to rise again slowly after age 50. Overall, about 4 of every 10 cases of ALL are in adults.

The average person's lifetime risk of getting ALL is less than 1 in 750. The risk is slightly higher in males than in females, and higher in whites than in African Americans.

Most cases of ALL occur in children, but most deaths from ALL (about 4 out of 5) occur in adults. Children may do better because of differences in childhood and adult ALL in the disease itself, differences in treatment (children's bodies can often handle aggressive treatment better than adult's), or some combination of these.

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

- [References](#)

[See all references for Acute Lymphocytic Leukemia](#)

American Cancer Society. *Cancer Facts & Figures 2018*. Atlanta, Ga: American Cancer Society; 2018.

Last Medical Review: December 2, 2014 Last Revised: January 4, 2018

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What's New in Acute Lymphocytic Leukemia Research and Treatment?

Researchers are now studying the causes, diagnosis, supportive care, and treatment of acute lymphocytic leukemia (ALL) at many medical centers, university hospitals, and other institutions.

Genetics of leukemia

Scientists are making great progress in understanding how changes in a person's DNA can cause normal bone marrow cells to develop into leukemia cells. A greater understanding of the genes (regions of the DNA) involved in certain translocations that often occur in ALL is providing insight into why these cells become abnormal. Doctors are now looking to learn how to use these changes to help them determine a person's outlook and whether they should receive more or less intensive treatment.

As this information unfolds, it may also be used to develop newer targeted therapies against ALL. Drugs such as imatinib (Gleevec) and dasatinib (Sprycel) are examples of such treatments. They are now used in treating ALL patients whose leukemia cells have the Philadelphia chromosome.

Gene expression profiling

This new lab technique is being studied to help identify and classify different cancers. Instead of looking at single genes, this test uses a special technology to look at the patterns of many different genes in the cancer cells at the same time. This may add to the information that comes from the current lab tests.

This information may eventually allow more personalized treatment by predicting which chemo drugs are likely to be most effective for each patient. These tests are also being used to find previously unknown changes inside ALL cells to help guide researchers in developing new drugs.

Detecting minimal residual disease

Progress in understanding DNA changes in ALL has already provided a highly sensitive test for detecting minimal residual disease after treatment – when so few leukemia cells are present that they cannot be found by routine bone marrow tests.

The polymerase chain reaction (PCR) test can identify ALL cells based on their gene translocations or rearrangements. This test can find one leukemia cell among many thousands of normal cells. A PCR test can be used in determining how completely chemotherapy has destroyed the ALL cells.

Doctors are now trying to determine if patients with minimal residual disease will benefit from further or more intensive treatment.

Improving chemotherapy

Studies are in progress to find the most effective combination of [chemotherapy](#) (chemo) drugs while limiting unwanted side effects. This is especially important in older patients, who often have a harder time tolerating current treatments.

New chemo drugs are also being developed and tested. For example, clofarabine (Clolar[®]) is approved to treat childhood ALL and shows promise in early studies of adults with this disease. Many other new drugs are also being studied.

Studies are also under way to determine whether patients with certain unfavorable prognostic features benefit from more intensive chemo, and whether some ALL patients with favorable [prognostic factors](#) might not need as much treatment.

The effectiveness of chemotherapy may be limited in some cases because the leukemia cells become resistant to it. Researchers are now looking at ways to prevent or reverse this resistance by using other drugs along with chemotherapy.

Stem cell transplants

Researchers continue to refine [stem cell transplants](#) to try to increase their effectiveness, reduce complications and determine which patients are likely to be helped by this treatment. Many studies are being done to try to help determine exactly when allogeneic, autologous, and mini-transplants might best be used.

Doctors are also studying *donor leukocyte infusion* in people who have already received an allogeneic transplant and who relapse. In this technique, the patient gets an infusion of white blood cells (leukocytes) from the same donor who contributed stem cells for the original transplant. The hope is that the cells will boost the new immune system and add to the graft-versus-leukemia effect. Early study results have been promising, but more research on this approach is needed.

Monoclonal antibodies

These drugs are man-made versions of immune system proteins (antibodies). They can be targeted to attach only to certain molecules, such as proteins on the surface of certain lymphocytes.

Some monoclonal antibodies, such as rituximab (Rituxan) and alemtuzumab (Campath), are already used to treat other blood disorders and are now being studied for use against ALL. Early results have been favorable, but it is still too early to know for

sure.

Epratuzumab, a newer antibody, has also shown promise against ALL in early studies. Further studies are planned.

Another approach is to attach a chemo drug to a monoclonal antibody. The antibody serves as a homing device to bring the chemo drug to the cancer cell. One such drug, inotuzumab ozogamicin, has shown promise in treating ALL.

Studies of several other monoclonal antibodies to treat ALL are now under way as well.

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- [References](#)

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