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About Non-Hodgkin Lymphoma in Children

Overview and Types

If your child has just been diagnosed with non-Hodgkin lymphoma or you are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- [What Is Non-Hodgkin Lymphoma in Children?](#)
- [What Are the Differences Between Cancers in Adults and Children?](#)
- [Types of Non-Hodgkin Lymphoma in Children](#)

Research and Statistics

See the latest estimates for new cases of childhood non-Hodgkin lymphoma in the US and what research is currently being done.

- [Key Statistics for Non-Hodgkin Lymphoma in Children](#)
 - [What's New in Research and Treatment of Non-Hodgkin Lymphoma in Children?](#)
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What Are the Differences Between Cancers in Adults and Children?

The types of cancers that develop in children are often different from the types that develop in adults. Childhood cancers are often the result of DNA changes in cells that take place very early in life, sometimes even before birth. Unlike many cancers in adults, childhood cancers are not strongly linked to lifestyle or environmental risk factors.

There are exceptions, but childhood cancers tend to respond better to treatments such as chemotherapy. Children's bodies also tend to tolerate chemotherapy better than adults' bodies do. But cancer treatments such as chemotherapy and radiation therapy can have long-term side effects, so children who survive cancer need careful attention for the rest of their lives.

Since the 1960s, most children and teens with cancer have been treated at [specialized centers](#)¹ designed for them. Being treated in these centers offers the advantage of a team of specialists who know the differences between adult and childhood cancers, as well as the unique needs of children with cancer and their families. This team usually includes pediatric oncologists, surgeons, radiation oncologists, pathologists, pediatric oncology nurses, and nurse practitioners.

These centers also have psychologists, social workers, child life specialists, nutritionists, rehabilitation and physical therapists, and educators who can support and educate the entire family.

Most children with cancer in the United States are treated at a center that is a member of the Children's Oncology Group (COG). All of these centers are associated with a university or children's hospital. As we have learned more about treating childhood cancer, it has become even more important that treatment be given by experts in this area.

Any time a child or teen is diagnosed with cancer, it affects every family member and nearly every aspect of the family's life. You can read more about coping with these changes in [When Your Child Has Cancer](#)².

Hyperlinks

1. www.cancer.org/treatment/finding-and-paying-for-treatment/choosing-your-treatment-team/pediatric-cancer-centers.html
2. www.cancer.org/treatment/children-and-cancer/when-your-child-has-cancer.html

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What Is Non-Hodgkin Lymphoma in Children?

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?](#)¹

Lymphoma is a type of cancer that starts in cells called *lymphocytes*, which are part of the body's immune system.

Types of lymphoma

The 2 main kinds of lymphomas are:

- **Hodgkin lymphoma** (also known as **Hodgkin disease**), which is named after Dr. Thomas Hodgkin, who first described it
- **Non-Hodgkin lymphoma (NHL)**

These types of lymphomas differ in how they behave, spread, and respond to treatment, so knowing which type your child has is important.

Both of these types are more common in adults, but they can also occur in children and teens: NHL tends to occur in younger children, while Hodgkin lymphoma is more likely to affect older children and teens.

Hodgkin lymphoma is very similar in adults and children, and treatment is the same for both. For more information on this disease, see [Hodgkin Lymphoma](#)².

The lymph (lymphatic) system

The lymph system is part of the body's immune system, which helps fight infections and some other diseases. It also helps fluids move around in the body.

Lymphocytes

The lymph system is made up mainly of cells called *lymphocytes*, a type of white blood cell. The main types of lymphocytes are:

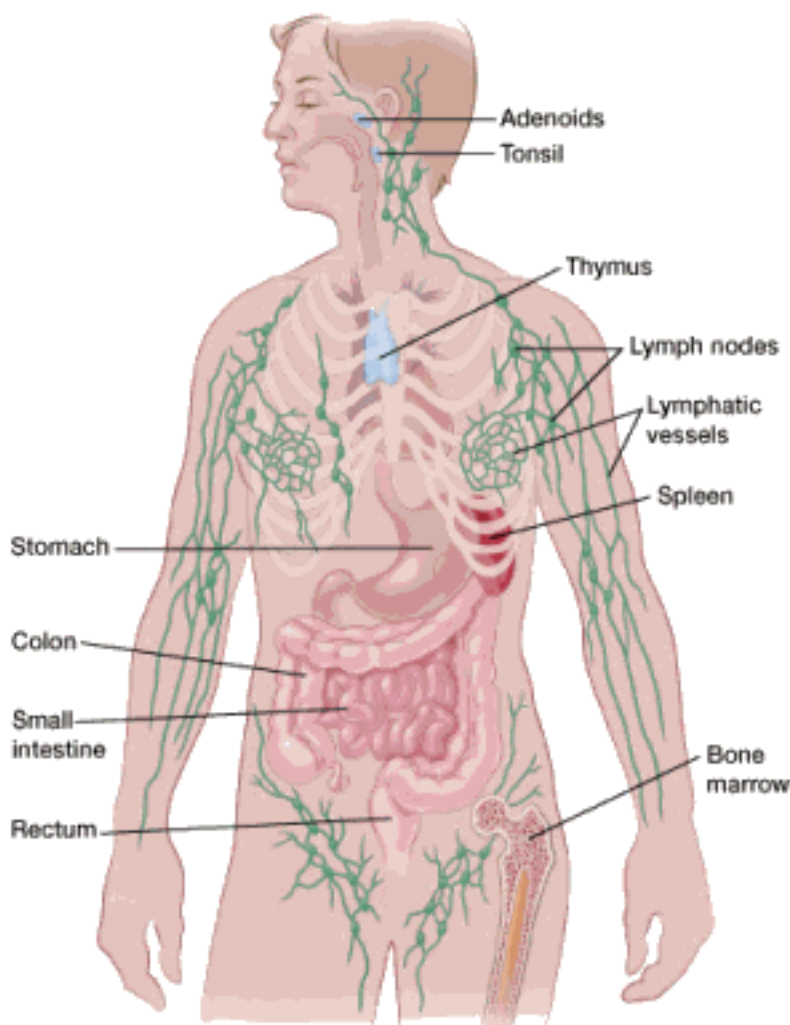
- **B lymphocytes (B cells):** B cells normally help protect the body against germs (bacteria or viruses) by making proteins called *antibodies*. The antibodies attach to the germs, marking them for destruction by other parts of the immune system.
- **T lymphocytes (T cells):** There are several types of T cells, each with a special job. Some T cells destroy germs or abnormal cells in the body. Other T cells help boost or slow the activity of other immune system cells.

Both types of lymphocytes can develop into lymphoma cells.

[Different types of NHL](#) can develop in children. Treatment depends on which type of NHL it is, so determining the exact type a child has is important.

Parts of the lymph system

The lymph system is in many parts of the body, so lymphomas can start almost anywhere. (This can affect what [symptoms](#)³ a child has.)



Lymph tissue is found in:

Lymph nodes: Lymph nodes are bean-sized collections of lymphocytes and other immune cells throughout the body. They can sometimes be felt under the skin in the neck, under the arms, and in the groin. Lymph nodes are connected to each other by a system of lymphatic vessels.

Lymph nodes get bigger when they fight infection. Lymph nodes that grow because of infection are called *reactive nodes* or *hyperplastic nodes* and are often painful when they are touched. An enlarged lymph node in a child is not usually a sign of a serious problem. Lymph nodes in the neck are often enlarged in children with sore throats or colds. But a large lymph node is also the most common sign of lymphoma. This is discussed more in [Signs and Symptoms of Non-Hodgkin Lymphoma in Children⁴](#).

Spleen: The spleen is an organ under the lower ribs on the left side of the body. The spleen makes lymphocytes and other immune system cells. It also stores healthy blood cells and filters out damaged blood cells, bacteria, and cell waste.

Bone marrow: The bone marrow is the spongy tissue inside certain bones, which is where new blood cells (including some lymphocytes) are made.

Thymus: The thymus is a small organ behind the upper part of the breast bone and in front of the heart. It's important in the development of T lymphocytes.

Adenoids and tonsils: These are collections of lymph tissue in the back of the throat. They help make antibodies against germs that are breathed in or swallowed. They are easy to see when they become enlarged during an infection, which occurs often in children, or if a lymphoma develops.

Digestive tract: Lymph tissue is also in the stomach and intestines, as well as many other organs.

Hyperlinks

1. www.cancer.org/cancer/cancer-basics/what-is-cancer.html
2. www.cancer.org/cancer/hodgkin-lymphoma.html
3. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/signs-symptoms.html
4. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/signs-symptoms.html

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Types of Non-Hodgkin Lymphoma in Children

Non-Hodgkin lymphomas (NHLs) are most often classified by how the cancer cells look under the microscope. Key features include the size and shape of the cells and how they are arranged (their pattern of growth).

- **Size** is described as large or small.
- **Shape** is described as cleaved (showing folds or indentations) or non-cleaved.
- The **growth pattern** may be either diffuse (cancer cells are scattered) or follicular (cells are arranged in clusters).

Not every lymphoma is described using all 3 features. Special lab tests are often needed to accurately classify lymphomas. These are discussed in [Tests for Non-Hodgkin Lymphoma in Children](#)¹.

The most common types of NHL in children are different from those in adults. Nearly all NHLs in children are 1 of 3 main types:

- Lymphoblastic lymphoma
- Burkitt lymphoma (small non-cleaved cell lymphoma)
- Large cell lymphoma

All 3 types are high grade (meaning they grow quickly) and diffuse, but it's important to find out which type a child has because they are treated differently.

There are many other types of NHL. These are much more common in adults and are rare in children, so they are not discussed further heret.

Lymphoblastic lymphoma

Lymphoblastic lymphoma (LBL) accounts for about 25% to 30% of NHL in children in the United States. Boys are about twice as likely to get LBL as girls.

The cancer cells of LBL are very young lymphocytes called *lymphoblasts*. They are the same cells as those seen in [acute lymphoblastic leukemia \(ALL\)](#)² in children. In fact, if more than 25% of the bone marrow is made up of lymphoblasts, the disease is classified and treated as ALL instead of lymphoma.

Most cases of LBL develop from **T cells** and are called **precursor T-lymphoblastic lymphomas**. These lymphomas often start in the thymus, forming a mass in the area behind the breast bone and in front of the trachea (windpipe). This can cause problems breathing, which may be the first symptom of LBL.

Less often, LBL develops in the tonsils, lymph nodes of the neck, or other lymph nodes. It can spread very quickly to the bone marrow, other lymph nodes, the surface of the brain, and/or the membranes that surround the lungs and heart.

A small fraction of LBLs develop from B cells, and are called **precursor B-lymphoblastic lymphomas**. These lymphomas more often begin in lymph nodes outside the chest, particularly in the neck. They can also involve the skin and bones.

LBL can grow very quickly and can often cause trouble breathing, so it needs to be diagnosed and treated quickly.

Burkitt lymphoma

Burkitt lymphoma, also known as *small non-cleaved cell lymphoma*, accounts for about 40% of childhood NHL in the United States. It is most often seen in boys, usually when they are around 5 to 10 years old.

A subtype of Burkitt lymphoma, sometimes called *Burkitt-like lymphoma* or *non-Burkitt lymphoma*, shares some features with diffuse large B-cell lymphoma (described below) when seen under the microscope, but it is still treated like Burkitt lymphoma.

Burkitt lymphoma is named after the doctor who first described it in African children. In certain parts of Africa, Burkitt lymphoma accounts for nearly all childhood NHL and over half of all childhood cancers. In African children this lymphoma usually develops in the jaw or other facial bones.

Burkitt lymphomas in other parts of the world, including the United States, most often start in the abdomen (belly). Typically, a child will develop a large tumor in his or her abdomen that can sometimes block the bowels (intestines). This can cause belly pain, nausea, and vomiting. Burkitt lymphoma can also sometimes start in the neck or tonsils, or rarely in other parts of the body.

This lymphoma develops from **B lymphocytes (B cells)**. It can spread to other organs, including the surface of the brain or inside the brain. It is one of the fastest growing cancers known, so it needs to be diagnosed and treated quickly.

Large cell lymphomas

These lymphomas start in more mature forms of T cells or B cells and can grow almost anywhere in the body. They are not as likely to spread to the bone marrow or brain, nor do they grow as quickly as other childhood lymphomas. These lymphomas tend to occur more often in older children and teens.

The 2 main subtypes of large cell lymphoma are:

Anaplastic large cell lymphoma (ALCL): This lymphoma makes up about 10% of all NHL in children. It usually develops from mature T cells. It may start in lymph nodes in the neck or other areas, and may be found in the skin, lungs, bone, digestive tract, or other organs.

Diffuse large B-cell lymphoma (DLBCL): This lymphoma accounts for about 15% of childhood lymphomas. It starts in B cells, as the name implies. These lymphomas sometimes grow as large masses in the mediastinum (the space between the lungs), in which case they are referred to as **primary mediastinal B-cell lymphomas**. But they are also sometimes found in other areas such as lymph tissue in the neck or abdomen, or in the bones.

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/how-diagnosed.html
2. www.cancer.org/cancer/leukemia-in-children.html

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Key Statistics for Non-Hodgkin Lymphoma in Children

About 5% of all childhood cancers are non-Hodgkin lymphomas (NHL); [Hodgkin lymphoma](#)¹ accounts for about another 3%.

In children up to age 14, most lymphomas are non-Hodgkin lymphomas, with about 500 of these cancers being diagnosed in the United States each year. If all children and teens up to age 19 are included, the numbers of Hodgkin and non-Hodgkin lymphomas are about equal, and there are about 800 cases of NHL diagnosed each year.

NHL is about 2 to 3 times more common in boys than in girls, and it is more common in white children than black children.

About 2% of all NHLs occur in children and teens.

Overall, the risk of NHL in children increases with age. It can occur at any age but is uncommon in children younger than 3.

Statistics on survival can be found in [Survival Rates for Childhood Non-Hodgkin Lymphoma](#)².

Hyperlinks

1. www.cancer.org/cancer/hodgkin-lymphoma.html
2. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/survival-rates.html

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What's New in Research and Treatment of Non-Hodgkin Lymphoma in Children?

Research on the causes, diagnosis, and treatment of childhood non-Hodgkin lymphoma (NHL) is being done at many medical centers, university hospitals, and other institutions around the world.

Genetics

As noted in [What Causes Non-Hodgkin Lymphoma in Children?](#)¹ scientists are making great progress in understanding how changes in the DNA inside normal lymphocytes can cause them to develop into lymphoma cells.

Understanding the gene changes that often occur in lymphoma cells can help explain why these cells grow too quickly, live too long, and don't develop into normal, mature cells. This information is being used to develop new treatments for lymphoma.

This progress has also led to very sensitive lab tests for detecting and monitoring this disease during treatment. Tests such as the polymerase chain reaction (PCR) can identify lymphoma cells based on some of these gene changes. This test is useful in determining how completely the lymphoma has been destroyed by treatment, and whether a relapse is likely if no further treatment is given.

Clinical trials of new treatments

Most children with NHL are treated at major medical centers, where treatment is often given as part of a [clinical trial](#)² to get the most up-to-date care. Several important questions are now being studied in clinical trials, such as:

- Can early-[stage](#)³ (stages I and II) lymphomas be treated with less intense [chemotherapy](#)⁴ regimens?
- What is the best length of treatment for each type of NHL?
- Can less intense treatments provide an outcome as good as highly intense treatments, while possibly helping children avoid some [long-term side effects](#)⁵?
- Can new chemotherapy drugs and new combinations of drugs improve cure rates?
- Can the safety and effectiveness of [stem cell transplants](#)⁶ be improved on?
- Can newer, targeted drugs such as monoclonal antibodies be helpful in treating NHL, either alone or added to current treatments to make them better? (See [Other Drugs for Non-Hodgkin Lymphoma in Children](#)⁷.)
- Can newer forms of [immunotherapy](#)⁸ (treatments that boost the immune system), such as CAR T-cell therapy, be helpful in treating childhood NHL, especially if other treatments are no longer working?

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/causes-risks-prevention/what-causes.html
2. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html
3. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/staging.html
4. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/treating/chemotherapy.html
5. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/after-treatment/long-term-effects.html
6. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/treating/bone-marrow-

- [stem-cell-transplant.html](#)
7. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/treating/monoclonal-antibodies.html
 8. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/immunotherapy.html

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Non-Hodgkin Lymphoma in Children Causes, Risk Factors, and Prevention

Risk Factors

A risk factor is anything that affects your chance of getting a disease such as cancer. Learn more about the risk factors for non-Hodgkin lymphoma in children.

- [Risk Factors for Non-Hodgkin Lymphoma in Children](#)
- [What Causes Non-Hodgkin Lymphoma in Children?](#)

Prevention

There is no known way to prevent all cases of childhood non-Hodgkin lymphoma. But there are some things that might lower risk. Learn more.

- [Can Non-Hodgkin Lymphoma in Children Be Prevented?](#)

Risk Factors for Non-Hodgkin Lymphoma in Children

A risk factor is anything that might affect a person's chance of getting cancer. Different cancers have different risk factors.

Lifestyle-related risk factors such as body weight, physical activity, diet, and tobacco use play a major role in many adult cancers. But these factors usually take many years to influence cancer risk, and they are not thought to have much of an effect on the risk of childhood cancers, including non-Hodgkin lymphoma (NHL).

Researchers have found some factors that can increase a child's risk of NHL. But most children with NHL do not have any known risk factors that can be changed.

Age, gender, and race

Non-Hodgkin lymphoma is rare in children in general, but it is more common in older children than in younger ones. It is also more common in boys than in girls and in white children than in black children. The reasons for these gender and racial differences are not known.

Having a weakened immune system

Some types of immune system problems have been linked with a higher risk of NHL in children.

Congenital (present at birth) immune deficiency syndromes

Some children are born with an abnormal immune system because of a genetic (inherited) syndrome. Along with an increased risk of serious infections, these children also have a higher risk of developing NHL (and sometimes other cancers as well). These syndromes include:

- Wiskott-Aldrich syndrome
- Severe combined immunodeficiency syndrome (SCID)
- Ataxia-telangiectasia
- Common variable immunodeficiency
- X-linked lymphoproliferative syndrome

Organ transplants

Children who have had organ transplants are treated with drugs that weaken their immune system to prevent it from attacking the new organs. These children have an increased risk of developing NHL that is almost always caused by Epstein-Barr virus infection (see below). The risk depends on which drugs and what doses are used.

HIV/AIDS

Infection with [human immunodeficiency virus](#)¹ (HIV), also known as the AIDS virus, can weaken the immune system. Children with HIV generally get the infection from contact with their mother's blood, usually before or during birth. HIV infection is a risk factor for developing NHL, so doctors may recommend that children with NHL be tested for HIV infection.

Radiation exposure

Radiation exposure may be a minor risk factor in childhood NHL.

Survivors of atomic bombs and nuclear reactor accidents have an increased risk of developing some types of cancer. Leukemia and thyroid cancers are the most common, but there is a slightly increased risk of NHL as well.

Patients treated with radiation therapy for other cancers have a slightly increased risk of NHL later in life. But it usually takes many years for this to develop, so these secondary cases of NHL are more common in adults than children.

The possible risks from fetal or childhood exposure to lower levels of radiation, such as from x-ray tests or CT scans, are not known for sure. If there is an increase in risk for NHL or other cancers it is likely to be small, but to be safe, most doctors recommend that pregnant women and children not get these tests unless they are absolutely needed.

Epstein-Barr virus infection

In areas of Africa where Burkitt lymphoma is common, chronic infection with both malaria and the Epstein-Barr virus (EBV) is an important risk factor. EBV has been linked with as much as 90% of Burkitt lymphomas in Africa. In the United States, EBV has been linked with about 15% of Burkitt lymphomas. It is also linked to lymphomas that occur after an organ transplant.

EBV infection is life-long, although it doesn't cause serious problems in most people. In Americans who are first infected with EBV as teens or young adults, it can cause infectious mononucleosis, sometimes known simply as *mono*. Most Americans have been infected with EBV by the time they are adults, but the infection seems to occur later in life in the United States than in Africa, which may help explain why it is less likely to cause childhood lymphoma here.

Exactly how EBV is linked to NHL is not completely understood, but it seems to have to do with the ability of the virus to infect and alter B lymphocytes. (For more information, see [What Causes Non-Hodgkin Lymphoma in Children?](#))

Other possible risk factors

Some research has suggested that a family history of NHL (in a brother, sister, or parent) might raise the risk of lymphoma. Lymphoma risk may also be higher in children of older mothers. More research is needed to confirm these findings, but if there is an increased risk tied to these factors, it is likely to be small.

Hyperlinks

1. www.cancer.org/cancer/cancer-causes/infectious-agents/hiv-infection-aids.html

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What Causes Non-Hodgkin Lymphoma in Children?

The exact cause of most cases of childhood non-Hodgkin lymphoma (NHL) is not known. However, scientists have found that the risk of this cancer is higher if the child has any of the conditions described in [Risk Factors for Non-Hodgkin Lymphoma in Children](#). Many of these conditions are related to problems with the immune system.

Lymphoma is a cancer that starts in cells called *lymphocytes*, which are a type of white blood cell. Scientists have found that certain changes in the DNA inside normal lymphocytes can make them become lymphoma cells. DNA is the chemical in our cells that makes up our genes, which control how our cells function. We look like our parents because they are the source of our DNA. But our genes affect more than the way we look.

Some genes control when our cells grow, divide into new cells, and die:

- Genes that help cells grow, divide, and stay alive are called **oncogenes**.
- Genes that slow down cell division or make cells die at the right time are called **tumor suppressor genes**.

Cancers can be caused by DNA mutations (changes) that turn on oncogenes or turn off tumor suppressor genes.

For example, *translocations* are a type of DNA change that can cause NHL to develop. A translocation means that part of one chromosome (a long strand of DNA) breaks off and attaches to a different chromosome. When this happens, oncogenes can be turned on or tumor suppressor genes can be turned off.

Some people inherit DNA changes from a parent that increase their risk for some types of cancer. But NHL is not one of the cancer types often caused by these inherited mutations.

Usually, DNA changes related to NHL occur during life rather than having been inherited before birth. In rare cases, these acquired changes result from exposure to radiation or other factors. But often they occur for no apparent reason.

The combination of immune deficiencies (from inherited conditions, medical treatment, or HIV infection) and Epstein-Barr virus (EBV) infection can cause some types of NHL.

EBV infects B lymphocytes. It can make the cells grow, divide, and live longer than they should. In young adults, EBV often causes infectious mononucleosis, also known as *mono*. Mono is usually not a serious disease because the person's immune system destroys the B cells that are infected with EBV. But when a child has an immune deficiency, EBV-infected B cells may grow and build up. These cells have an increased risk for DNA changes. If these changes affect certain oncogenes or tumor suppressor genes, lymphoma may develop.

Scientists have learned a lot about the gene changes commonly seen in lymphoma cells. This is being used to develop better tests to detect and classify certain types of NHL. Some of these discoveries are being used to create new treatments as well.

Most children who develop NHL in the United States do not have an immune deficiency or evidence of EBV infection. Even though researchers have found many of the key DNA changes in lymphoma cells, they still don't know what causes them in children without these risk factors.

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Can Non-Hodgkin Lymphoma in Children Be Prevented?

The risk of many adult cancers can be reduced by doing certain things such as staying at a healthy weight or quitting smoking, but there is no known way to prevent most childhood cancers.

Most children (and adults) with non-Hodgkin lymphoma (NHL) have no [risk factors](#) that can be changed, so at this time there is no way to prevent these lymphomas. For now, the best way to reduce the risk for NHL is to try to prevent known risk factors such as a weakened immune system.

The most common cause of acquired immune problems is [HIV infection](#)¹. HIV is spread among adults mostly through unprotected sex and sharing needles contaminated by injection drug users. Children generally get HIV infection from contact with their mother's blood, usually before or during birth. Treating the pregnant woman with anti-HIV drugs can greatly reduce the risk of infecting her infant. HIV can also be passed on in breast milk, so HIV-positive mothers are advised not to breastfeed.

Some cases of NHL are caused when other cancers are treated with radiation and chemotherapy or when immune-suppressing drugs are used to avoid rejection of transplanted organs. Doctors are trying to find better ways to treat these conditions without raising the risk of lymphoma. But for now, the small risk of developing NHL several years later because of treatment must be balanced against the risks of these life-threatening diseases themselves.

Because most children with NHL do not have known risk factors that can be changed, it's important to note that there is nothing these children or their parents could have done to prevent this cancer.

Hyperlinks

1. www.cancer.org/cancer/cancer-causes/infectious-agents/hiv-infection-aids.html

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Non-Hodgkin Lymphoma in Children

Early Detection, Diagnosis, and Staging

Detection and Diagnosis

Catching cancer early often allows for more treatment options. Some early cancers may have signs and symptoms that can be noticed, but that is not always the case.

- [Can Non-Hodgkin Lymphoma in Children Be Found Early?](#)
- [Signs and Symptoms of Non-Hodgkin Lymphoma in Children](#)
- [Tests for Non-Hodgkin Lymphoma in Children](#)

Stages for Non-Hodgkin Lymphoma in Children

After a cancer diagnosis, staging provides important information about the extent of cancer in the body and anticipated response to treatment.

- [Stages of Non-Hodgkin Lymphoma in Children](#)

Outlook (Prognosis)

Doctors often use survival rates as a standard way of discussing someone's outlook (prognosis). Some people want to know about survival statistics, while others might not find the numbers helpful, or might even not want to know them.

- [Survival Rates for Childhood Non-Hodgkin Lymphoma](#)

Questions to Ask About Non-Hodgkin Lymphoma in Children

Here are some questions you can ask the cancer care team to help you better understand your child's diagnosis and treatment options.

- [What Should You Ask Your Child's Doctor About Non-Hodgkin Lymphoma?](#)

Can Non-Hodgkin Lymphoma in Children Be Found Early?

Non-Hodgkin lymphoma (NHL) in children is uncommon, and there are no widely recommended screening tests for this cancer. (Screening is testing for cancer in people who don't have any symptoms.) Still, sometimes NHL can be found early.

The best way to find this cancer early is to be aware of its possible [signs and symptoms](#) and to take your child to the doctor if something concerns you.

Careful, regular medical checkups are important for children, especially those with known [risk factors](#)¹ for NHL, such as:

- Certain inherited immune deficiencies
- Prior cancer treatment or organ transplant
- HIV infection

These children do not usually develop NHL, but it's important for parents and doctors to know the possible symptoms and signs of lymphoma.

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/causes-risks-prevention/risk-factors.html

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Signs and Symptoms of Non-Hodgkin Lymphoma in Children

Childhood non-Hodgkin lymphoma (NHL) can cause many different signs and symptoms, depending on where it is in the body. Common symptoms include:

- Enlarged lymph nodes (seen or felt as lumps under the skin)
- Swollen abdomen (belly)
- Feeling full after only a small amount of food
- Shortness of breath or cough
- Fever
- Weight loss
- Night sweats
- Fatigue (feeling very tired)

Enlarged lymph nodes

Non-Hodgkin lymphoma may grow in lymph nodes under the skin (on the sides of the

neck, in the underarm area, above the collar bone, or in the groin area). The enlarged nodes are often seen or felt as lumps under the skin and are not usually painful. They are often first noticed by the child, parent, or a health care provider.

Enlarged lymph nodes in children are more often caused by infections than by NHL. Lymph nodes that grow in reaction to infection are called *reactive nodes* or *hyperplastic nodes* and are often tender to the touch.

Lymphoma in the abdomen (belly)

Lymphoma growing inside the abdomen can make it swollen and painful. There may also be a buildup of fluid that causes even more swelling.

Lymphoma can sometimes enlarge the spleen and make it press on the stomach. This can make a child feel full after eating only a small amount of food.

When lymphoma causes swelling near the intestines, bowel movements may be blocked, which may lead to belly pain, nausea, and vomiting.

Lymphoma can also block urine from leaving the kidneys. This can lead to low urine output, tiredness, loss of appetite, nausea, or swelling in the hands or feet.

Lymphoma in the chest

When lymphoma starts in the thymus (a small organ in the middle of the chest) or lymph nodes in the chest, it can press on the nearby trachea (windpipe). This can lead to coughing, shortness of breath, and trouble breathing.

The superior vena cava (SVC) is a large vein that carries blood from the head and arms back to the heart. It passes next to the thymus and lymph nodes inside the chest. Lymphomas in this area may press on the SVC, which can make the blood back up in the veins. This can lead to swelling in the face, neck, arms, and upper chest (sometimes with a bluish-red skin color). It can also cause trouble breathing, as well as headaches, dizziness, and a change in consciousness if it affects the brain. This condition, known as *SVC syndrome*, can be life-threatening, so it needs to be treated right away.

Lymphoma in the brain and spinal cord

Some types of lymphoma can spread to the area around the brain and spinal cord. This can cause problems such as headache, nausea, vision changes, facial numbness, and

trouble talking.

Lymphoma in the skin

Some lymphomas can affect the skin itself. They can cause itchy, red or purple lumps or nodules under the skin.

General lymphoma symptoms (B symptoms)

Along with causing symptoms in the part of the body where it starts, NHL can also cause general symptoms such as:

- Fever and chills
- Sweating (particularly at night)
- Unexplained weight loss

When talking about lymphoma, doctors sometimes call these B symptoms. B symptoms are often found in more rapidly growing lymphomas.

Other symptoms can be caused by low blood cell counts. Blood counts can become low if lymphoma spreads to the bone marrow and crowds out the normal, healthy cells that make new blood cells. This can lead to problems like:

- Severe or frequent infections (from low white blood cell counts)
- Easy bruising or bleeding (from low blood platelet counts)
- Fatigue and pale skin (from low red blood cell counts; anemia)

Many of the signs and symptoms above are more likely to be caused by something other than a lymphoma, such as an infection. Still, if your child has any of these symptoms, check with the doctor so that the cause can be found and treated, if needed.

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Tests for Non-Hodgkin Lymphoma in Children

Non-Hodgkin lymphoma (NHL) is usually found when a child is brought to a doctor because of [signs or symptoms](#) he or she is having. This might lead the doctor to suspect the child could have a lymphoma, but tests are needed to confirm this. The exams and tests below are used to diagnose lymphoma, to find out what type it is, and to learn how advanced it is.

Medical history and physical exam

If any signs and symptoms suggest a child might have lymphoma, the doctor will ask about the symptoms and how long they have been present. The doctor might also ask if there is any history of possible [risk factors](#)¹, such as immune system problems.

During the physical exam, the doctor will probably focus on any enlarged lymph nodes or other areas of concern. For example, the abdomen (belly) may be felt for signs of an enlarged spleen or liver.

The most common cause of enlarged lymph nodes in a child is an infection, so this is often what doctors think of first. Because of this, the diagnosis of NHL in a child can sometimes be delayed. There is usually little cause for concern in children with swollen lymph nodes unless they are very large (more than 1 inch across). Even in these instances, the child is usually watched closely for a time or given a course of antibiotics first to see if the nodes will shrink. If they don't, more tests are done, such as a biopsy to

remove part or all of a swollen node (see next section). But if the lymph nodes seem to be growing quickly or the child's health seems to be getting worse, a biopsy may be needed right away.

Biopsy

A doctor can't diagnose NHL in a child based only on symptoms or a physical exam. Most of the symptoms NHL can cause are more often caused by other problems, like infections. They may also be caused by other kinds of cancers. If a child does have NHL, it's important to know [which type it is](#)², because each type is treated slightly differently.

The only way to diagnose these things for sure is to remove some or all of an abnormal lymph node (or tumor) for viewing under a microscope and other lab tests. This is called a *biopsy*.

Types of biopsies used to diagnose non-Hodgkin lymphoma

There are several [types of biopsies](#)³. Doctors choose which one to use based on the situation. The goal is to get a sample large enough to make an accurate diagnosis as quickly as possible, with as few side effects as possible.

Surgical (excisional or incisional) biopsy: These are the most common types of biopsies done if lymphoma is suspected. An exception might be large chest tumors, for which a needle biopsy (described below) might be used instead.

In these procedures, a surgeon cuts through the skin to remove either an entire lymph node (excisional biopsy) or a small part of a large tumor (incisional biopsy).

If the node is near the skin surface, this is an operation that might be done with either local anesthesia (numbing medicine at the biopsy site) and sedation, or with general anesthesia (where the child is in a deep sleep). If the node is inside the chest or abdomen, then general anesthesia is typically needed.

This method almost always provides enough of a sample to diagnose the exact type of NHL.

Needle biopsy: These biopsies use hollow needles to remove small pieces of tissue. There are 2 main types:

- In an **fine needle aspiration (FNA) biopsy**, the doctor uses a very thin, hollow

needle attached to a syringe to withdraw (aspirate) a small amount of tissue from an enlarged lymph node or a tumor mass.

- For a **core needle biopsy**, the doctor uses a larger needle to remove a slightly larger piece of tissue.

If an enlarged lymph node is just below the skin, the doctor can aim the needle while feeling the node. If the enlarged node or tumor is deep in the body (such as in the chest or abdomen), the doctor can guide the needle while watching it on a CT scan or ultrasound (see discussion of imaging tests later in this section).

The main advantage of a needle biopsy is that it does not require surgery. This can be especially important for children with tumors in the chest, because general anesthesia (where the child is in a deep sleep) can sometimes be dangerous for these children. A needle biopsy is also useful when the lymphoma is in places other than the lymph nodes, such as the bones.

In children, needle biopsies can often be done using local anesthesia to numb the area, along with sedation to make the child sleepy. General anesthesia is needed less often.

The main drawback of needle biopsies (especially FNA) is that sometimes the needle might not remove enough of a sample to make a definite diagnosis. Most doctors don't use needle biopsies if they strongly suspect lymphoma (unless other types of biopsies can't be done for some reason). But if the doctor suspects that lymph node swelling is caused by an infection (even after antibiotics), a needle biopsy may be the first type of biopsy done. If a biopsy is needed, doctors typically prefer to do a core biopsy instead of FNA. An excisional biopsy might still be needed to diagnose and classify lymphoma, even after a needle biopsy has been done.

Once lymphoma has been diagnosed, needle biopsies are sometimes used to check areas in other parts of the body that might be lymphoma spreading or coming back after treatment.

Other types of biopsies

These other types of biopsies are not normally used to diagnose lymphoma, but they might be done if a lymphoma has already been diagnosed to help show how far it has spread.

Bone marrow aspiration and biopsy: These tests can show if a lymphoma has reached the bone marrow. The 2 tests are usually done at the same time. The biopsy samples are usually taken from the back of the pelvic (hip) bones, although sometimes

they may be taken from the front of the hip bones or from other bones.

For a **bone marrow aspiration**, the skin over the hip and the surface of the bone is numbed with local anesthetic. In most cases, children will be given other medicines to make them drowsy or asleep during the biopsy. A thin, hollow needle is then inserted into the bone, and a syringe is used to suck out a small amount of liquid bone marrow.

A **bone marrow biopsy** is usually done just after the aspiration. A small piece of bone and marrow is removed with a slightly larger needle that is put into the bone. Once the biopsy is done, pressure will be applied to the site to help stop any bleeding.

Lumbar puncture (spinal tap): This test is used to look for lymphoma cells in the cerebrospinal fluid (CSF), which is the fluid that surrounds the brain and spinal cord.

For this test, the doctor first numbs an area in the lower part of the back near the spine. The doctor usually also gives the child medicine to make him or her sleep during the procedure. A small, hollow needle is then placed between the bones of the spine to withdraw some of the fluid.

In children already diagnosed with lymphoma, a lumbar puncture can also be used to put [chemotherapy](#)⁴ drugs into the CSF to try to prevent or treat the spread of lymphoma to the spinal cord and brain.

Pleural or peritoneal fluid sampling: If lymphoma spreads to the thin membranes that line the inside of the chest and abdomen it can cause fluid to build up. Pleural fluid (inside the chest) or peritoneal fluid (inside the belly) can be removed by putting a hollow needle through the skin into the chest or abdomen.

- When this procedure is used to remove fluid from the chest, it's called a **thoracentesis**.
- When it's used to collect fluid from inside the belly, it's known as a **paracentesis**.

Before the procedure, the doctor uses a local anesthetic to numb the skin and may give the child other medicines so they are drowsy or asleep during the procedure. The fluid is then drawn out and looked at with a microscope to check for lymphoma cells

Lab tests on biopsy samples

All biopsy samples and fluids are looked at by a pathologist (a doctor with special training in using lab tests to identify cancer cells). The doctor uses a microscope to look at the size and shape of the cells and how they are arranged. This can show if a child

has lymphoma, and sometimes what type of lymphoma it is, as well. But usually other types of lab tests will be needed, too.

Flow cytometry and immunohistochemistry

For flow cytometry and immunohistochemistry, samples of cells are treated with antibodies, which are proteins that stick only to certain other proteins on cells. For immunohistochemistry, the cells are then looked at with a microscope to see if the antibodies stuck to them (meaning they have these proteins), while for flow cytometry a special machine is used.

These tests can help determine if a lymph node is swollen because of lymphoma, some other cancer, or a non-cancerous disease. The tests can also be used for *immunophenotyping* – determining which type of lymphoma a child has, based on certain proteins in or on the cells. Different types of lymphocytes have different proteins on their surface, which correspond to the type of lymphocyte and how mature it is.

Chromosome tests

Doctors use these tests to evaluate the chromosomes (long strands of DNA) in the lymphoma cells. In some types of lymphoma, the cells have changes in their chromosomes, such as having too many, too few, or abnormal chromosomes. These changes can often help identify the type of lymphoma.

Cytogenetics: In this type of lab test, the cells are looked at under a microscope to see if the chromosomes have any abnormalities. A drawback of this test is that it usually takes about 2 to 3 weeks because the lymphoma cells must grow in lab dishes for a couple of weeks before their chromosomes are ready to be seen with a microscope.

Fluorescent in situ hybridization (FISH): This test looks more closely at lymphoma cell DNA using fluorescent dyes that only attach to specific gene or chromosome changes. FISH can find most chromosome changes (such as translocations) that can be seen under a microscope on standard cytogenetic tests, as well as some changes too small to be seen with usual cytogenetic testing. FISH is very accurate and results are usually ready within a couple of days, which is why this test is now used in many medical centers.

Polymerase chain reaction (PCR): This is a very sensitive DNA test that can also find some chromosome changes too small to be seen with a microscope, even if there are very few lymphoma cells in a sample.

Blood tests

Blood tests measure the amounts of certain types of cells and chemicals in the blood. They are not used to diagnose lymphoma, but they might be one of the first types of tests done in children with symptoms to help the doctor determine what is going on. If a child has been diagnosed with lymphoma, these tests can also sometimes help tell how advanced the lymphoma is.

- The **complete blood count (CBC)** is a test that measures the levels of different cells in the blood, such as the red blood cells, the white blood cells, and the platelets. In children already known to have lymphoma, low blood cell counts might mean that the lymphoma is growing in the bone marrow and damaging new blood cell production.
- Blood levels of **lactate dehydrogenase (LDH)** may be checked. LDH will often be abnormally high in patients with fast-growing lymphomas.
- **Blood chemistry tests** can help detect liver or kidney problems caused by the spread of lymphoma cells or certain chemotherapy drugs. These tests can also help determine if treatment is needed to correct low or high blood levels of certain minerals.
- Tests may also be done to make sure the **blood is clotting properly**.
- For some types of lymphoma, the doctor might also want to order other blood tests to see if the child has been infected with certain viruses, such as the **Epstein-Barr virus (EBV)**, **hepatitis B virus (HBV)**, or **human immunodeficiency virus (HIV)**. Infections with some of these viruses can affect your child's treatment.

Imaging tests

Imaging tests use x-rays, sound waves, magnetic fields, or radioactive substances to create pictures of the inside of the body. These tests might be done for a number of reasons, including:

- To look for possible causes of certain symptoms (such as trouble breathing)
- To help determine the [stage](#) (extent) of the lymphoma
- To help show if treatment is working
- To look for possible signs of lymphoma coming back after treatment

A child with a known or suspected lymphoma might need one or more of these tests.

Chest x-ray

A chest x-ray may be done to look for enlarged lymph nodes inside the chest.

Computed tomography (CT or CAT) scan

The [CT scan](#)⁵ combines many x-rays to make detailed, cross-sectional images of the body. CT scans can be used to look for enlarged lymph nodes or other masses in the chest, abdomen, pelvis, head, and neck.

During the test, your child will need to lie still on a table that slides in and out of the ring-shaped scanner. Some younger children may be given medicine to help keep them calm or even asleep during the test to help make sure the pictures come out well.

CT-guided needle biopsy: A CT scan can also be used to guide a biopsy needle precisely into a suspected tumor or enlarged lymph node. For this procedure, the child remains asleep on the CT scanning table, while the doctor advances a biopsy needle through the skin and toward the area. CT scans are repeated until the needle is in the right place. A biopsy sample is then removed and looked at under a microscope.

Ultrasound (sonogram)

[Ultrasound](#)⁶ uses sound waves and their echoes⁶ to create pictures of internal organs or masses.

Ultrasound can be used to look at lymph nodes near the surface of the body or to look inside the abdomen (belly) for enlarged lymph nodes or organs such as the liver, spleen, and kidneys. (It can't be used to look inside the chest because the ribs block the sound waves.) It is also sometimes used to help guide a biopsy needle into an enlarged lymph node.

Magnetic resonance imaging (MRI) scan

An [MRI scan](#)⁷, like a CT scan, shows detailed images of soft tissues in the body. This test is not used as often as CT scans for lymphoma, but MRI is very useful for looking at the brain and spinal cord if a child has symptoms that might be caused by problems in the nervous system.

MRI scans take longer than CT scans, often up to an hour. Your child may have to lie inside a narrow tube, which can be distressing, so sedation is sometimes needed. Newer, more open MRI machines may be another option, although your child will still

have to lie still.

Positron emission tomography (PET) scan

For a [PET scan](#)⁸, a slightly radioactive sugar is injected into the blood. (The amount of radioactivity used is very low and will pass out of the body within a day or so.) Because lymphoma cells grow quickly, they absorb more of the sugar. After about an hour, your child will be moved onto a table in the PET scanner. He or she will lie on the table for about 30 minutes while a special camera creates a picture of areas of radioactivity in the body. Younger children may be given medicine to help keep them calm or even asleep during the test.

The picture from a PET scan is not detailed like a CT or MRI scan, but it provides helpful information about the whole body.

PET scans can be used for many reasons in a child with lymphoma:

- They can help tell if an enlarged lymph node contains lymphoma.
- They can help spot small areas in the body that might be lymphoma, even if the area looks normal on a CT scan.
- They can help tell if a lymphoma is responding to [treatment](#)⁹. Some doctors will repeat the PET scan after 1 or 2 courses of [chemotherapy](#)¹⁰. If the chemotherapy is working, the lymphoma will no longer show up as well on the scan.
- They can be used after treatment to help decide if an enlarged lymph node still contains lymphoma or is just scar tissue.

PET/CT or PET/MRI scan: Some newer machines can do both a PET as well as a CT or MRI scan at the same time. This lets the doctor compare areas of higher radioactivity on the PET scan with the more detailed appearance of that area on the CT or MRI scan.

Bone scan

A [bone scan](#)¹¹ is not usually needed unless a child is having bone pain or has lab test results that suggest the lymphoma might have reached the bones.

For this test, a radioactive substance called *technetium* is injected into the blood. (The amount of radioactivity used is very low and will pass out of the body within a day or so. Technetium travels to damaged areas of the bone over a couple of hours. Your child then lies on a table for about 30 minutes while a special camera detects the radioactivity and creates a picture of the skeleton. Younger children may be given medicine to help

keep them calm or even asleep during the test.

A bone scan can detect bone damage from lymphoma. But a bone scan may also show other things that are not cancer, so other tests might be needed to be sure.

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1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/causes-risks-prevention/risk-factors.html
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Stages of Non-Hodgkin Lymphoma in Children

What is the stage of a lymphoma?

A lymphoma's stage is the extent of the disease at the time of diagnosis. The treatment and prognosis (outlook) for a child with non-Hodgkin lymphoma (NHL) depend, to a large extent, on the lymphoma's stage.

The stage is based on the results of physical exams, biopsies, and imaging tests (CT scan, PET scan, etc.), which are described in [Tests for Non-Hodgkin Lymphoma in Children](#).

A staging system is a standard way for the cancer care team to describe how far a cancer has spread. The staging system most often used to describe the spread of NHL in children is called the **St. Jude staging system**. This is different from the staging system used for lymphomas in adults.

St. Jude staging system

The St. Jude system divides NHL in children into 4 stages:

- Stage I and II lymphomas are usually considered **limited-stage** disease and are treated the same way.
- Stage III and IV lymphomas are usually thought of as **advanced-stage** disease and are also treated alike.

Stage I

The lymphoma is in only one place, either as a single tumor *not* in lymph nodes, *or* in lymph nodes in one part of the body (the neck, groin, underarm, etc.). The lymphoma is not in the chest or abdomen (belly).

Stage II

Stage II lymphomas are not in the chest, and one of the following applies:

- The lymphoma is a single tumor and is also in nearby lymph nodes in only one part of the body (the neck, groin, underarm, etc.).
- The lymphoma is more than one tumor and/or in more than one set of lymph nodes, all of which are either above or below the diaphragm (the thin breathing muscle that separates the chest and abdomen). For example, this might mean nodes in the underarm and neck area are affected but not the combination of underarm and groin nodes.
- The lymphoma started in the digestive tract (usually at the end of the small intestine) and can be removed by surgery. It might or might not have reached nearby lymph nodes.

Stage III

For stage III lymphomas, one of the following applies:

- The lymphoma started in the chest (usually in the thymus or lymph nodes in the center of the chest or the lining of the lung).
- The lymphoma started in the abdomen and has spread too widely within the

abdomen to be removed completely by surgery.

- The lymphoma is located next to the spine (and may be elsewhere as well).
- The lymphoma is more than one tumor or in more than one set of lymph nodes that are both above and below the diaphragm. For example, the lymphoma is in both underarm and groin lymph nodes.

Stage IV

The lymphoma is in the central nervous system (brain or spinal cord) and/or the bone marrow when it is first found. (If more than 25% of the bone marrow is made up of cancer cells, called *blasts*, the cancer is classified as [acute lymphoblastic leukemia](#)¹ [ALL] instead of lymphoma.)

Hyperlinks

1. www.cancer.org/cancer/leukemia-in-children.html

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Survival Rates for Childhood Non-Hodgkin Lymphoma

Survival rates tell you what percentage of people with the same type and stage of

cancer are still alive a certain amount of time (usually 5 years) after they were diagnosed. They can't tell exactly what will happen with any person, but they may help give you a better understanding about how likely it is that treatment will be successful. Some parents might want to know the survival rates for their child's cancer, and some might not. If you don't want to know, you don't have to.

What is a survival rate?

Statistics on the outlook for a certain type of cancer are often given as survival rates. For example, the **5-year survival rate** is the percentage of people who live at least 5 years after being diagnosed with cancer. A 5-year survival rate of 80% means that an estimated 80 out of 100 people who have that cancer are still alive 5 years after being diagnosed. Keep in mind, however, that many of these people live much longer than 5 years.

Many cancer doctors prefer not to use the word "cure" when discussing cancer treatment and prognosis (outlook), because it can be hard to know for sure that all of the cancer is gone after treatment. But when it comes to children with non-Hodgkin lymphoma (NHL), those who are still alive and free of lymphoma after 5 years are very likely to have been cured, as it's rare for these cancers to return after this much time.

Cancer survival rates don't tell the whole story

Survival rates are often based on previous outcomes of large numbers of children who had the disease, but they can't predict for sure what will happen in any particular child's case. There are some limitations to keep in mind:

- The outlook for children with NHL varies by the [type](#)¹ and [stage](#) (extent) of the lymphoma. But other factors can also affect a child's outlook, such as the location and size of the tumor(s), and how well the lymphoma responds to [treatment](#)². The outlook for each child is specific to their circumstances.
- The numbers below are among the most current available. But to get these survival rates, doctors have to look at children were treated at least several years ago. As treatments are improving over time, children who are now being diagnosed with NHL may have a better outlook than these statistics show.

Your child's doctor can tell you how these numbers might apply to your child's particular situation.

Survival rates for non-Hodgkin lymphoma

Advances in treatment have increased the overall survival rates for children with NHL dramatically in recent decades.

The ranges of numbers given below are based on the results of several studies that have used different treatment regimens or included slightly different groups of patients.

Lymphoblastic lymphoma

With intensive treatment, the long-term survival rate for children with limited stage (stage I or II) lymphoblastic lymphoma is higher than 90%.

The long-term survival rate for more advanced (stage III or IV) lymphoblastic lymphomas is generally higher than 80%.

Burkitt and Burkitt-like lymphoma

Treatment of limited stage (stage I and II) Burkitt lymphomas is usually very successful, with a long-term survival rate of over 90%.

The long-term survival rate for children with more advanced (stage III or IV) Burkitt lymphoma ranges from about 80% to 90%.

Large cell lymphomas

The long-term survival rate is over 90% for limited stage (stage I and II) diffuse large B-cell lymphomas and is slightly lower for anaplastic large cell lymphomas.

The long-term survival rate for children with advanced (stage III or IV) diffuse large B-cell lymphoma ranges from about 80% to 90%.

For advanced anaplastic large cell lymphoma, the long-term survival rate is about 60% to 75%.

Remember, all of these survival rates are only estimates – they can't predict what will happen with any child. We understand that these statistics can be confusing and may lead you to have more questions. Talk to your child's doctor to better understand your child's specific situation.

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/about/types-non-hodgkin-children.html
2. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/treating.html

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What Should You Ask Your Child's Doctor About Non-Hodgkin Lymphoma?

It is important to have open, honest discussions with your child's cancer care team. You should ask any question, no matter how minor it might seem. For instance, consider asking these questions:

When you're told your child has non-Hodgkin lymphoma

- What [type of non-Hodgkin lymphoma](#)¹ does my child have?
- What is the [stage](#) (extent) of the lymphoma, and what does that mean?
- What [tests](#) need to be done before we can decide on treatment?
- Do we need to see any other types of doctors?

When deciding on a treatment plan

- How much experience do you have treating this type of lymphoma?
- What are our [treatment options](#)²?
- What treatment do you recommend and why?
- Should we get a second opinion before starting treatment? Can you suggest someone?
- How soon do we need to start treatment?
- What should we do to be ready for treatment?
- How long will treatment last? What will it be like? Where will it be done?
- How much of the treatment will need to be done in the hospital?
- How will treatment affect our daily activities?
- What are the risks and side effects of the treatments you suggest?
- Which side effects start shortly after treatment and [which ones might develop later on](#)³?
- Will treatment affect my child's ability to learn, grow, and develop?
- What are the chances of curing the lymphoma?
- What would our options be if the treatment doesn't work or if the lymphoma comes back?
- What type of follow-up will my child need after treatment?

You should also talk with your child's doctor before treatment to find out about the [possible long-term side effects](#)⁴. For example, you may want to ask about how it may affect your child's fertility later on. Here are some questions you might want to ask about the risk of infertility with treatment:

- Will this treatment affect my child's [ability to have children](#)⁵ someday?
- Is there anything that can be done to prevent or lower the risk of infertility? Would this interfere with my child's cancer treatment?
- If my child becomes infertile, what are their options for having a family?
- Should we talk to a fertility specialist?
- Once my child finishes treatment, how will we know if they might have fertility problems?

During treatment

Once treatment begins, you'll need to know what to expect and what to look for. Not all

of these questions may apply, but getting answers to the ones that do could be helpful.

- How will we know if the treatment is working?
- Is there anything we can do to help manage side effects?
- What symptoms or side effects should we tell you about right away?
- How can we reach you on nights, holidays, or weekends?
- Are there any limits on what my child can do?

After treatment

- What type of [follow-up](#)⁶ will my child need after treatment?
- Are there any limits on what they can do?
- What symptoms should we watch for?
- How will we know if the lymphoma has come back? What would our options be if that happens?

Along with these sample questions, be sure to write down some of your own. For instance, you might want more information about recovery times so that you can plan work and school schedules. Or you may want to ask about [clinical trials](#)⁷ for which your child may qualify.

Keep in mind that doctors aren't the only ones who can give you information. Other health care professionals, such as nurses and social workers, can answer some of your questions. To find out more about communicating with your health care team, see [The Doctor-Patient Relationship](#)⁸.

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/about/types-non-hodgkin-children.html
2. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/treating/by-stage.html
3. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/after-treatment/long-term-effects.html
4. www.cancer.org/treatment/children-and-cancer/when-your-child-has-cancer/late-effects-of-cancer-treatment.html
5. www.cancer.org/treatment/treatments-and-side-effects/physical-side-

[effects/fertility-and-sexual-side-effects/preserving-fertility-in-children-and-teens-with-cancer.html](#)

6. [www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/after-treatment/follow-up.html](#)
7. [www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html](#)
8. [www.cancer.org/treatment/understanding-your-diagnosis/talking-about-cancer/the-doctor-patient-relationship.html](#)

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Treating Non-Hodgkin Lymphoma in Children

If your child has been diagnosed with non-Hodgkin lymphoma (NHL), your child's treatment team will discuss the options with you. It's important to weigh the benefits of each treatment option against the possible risks and side effects.

How is non-Hodgkin lymphoma treated?

The types of treatment used for NHL can include:

- [Chemotherapy for Non-Hodgkin Lymphoma in Children](#)
- [Drugs Other Than Chemo for Non-Hodgkin Lymphoma in Children](#)
- [High-Dose Chemotherapy and Stem Cell Transplant for Non-Hodgkin Lymphoma in Children](#)
- [Radiation Therapy for Non-Hodgkin Lymphoma in Children](#)
- [Surgery for Non-Hodgkin Lymphoma in Children](#)

Common treatment approaches

Chemotherapy (sometimes along with other drugs) is the main treatment for all children with NHL, because it can reach all parts of the body and kill lymphoma cells wherever they may be. Even if the lymphoma appears to be limited to a single swollen lymph node, NHL in a child has often spread by the time it is diagnosed. Lymphoma cells are probably in other organs, but these are too small to be felt by the doctor or seen on imaging tests.

Sometimes high-dose chemotherapy followed by a stem cell transplant might be needed if the lymphoma comes back after treatment.

- [Treatment of Non-Hodgkin Lymphoma in Children, by Type and Stage](#)

Who treats non-Hodgkin lymphoma in children?

Children and teens with NHL and their families have special needs. These needs can be met best by cancer centers for children and teens, working closely with the child's primary care doctor. Being treated in these centers gives you the advantage of having teams of specialists who know the differences between cancers in adults and those in children and teens, as well as the unique needs of younger people with cancer.

For childhood lymphomas, this team is typically led by a pediatric oncologist, a doctor who uses chemotherapy and other medicines to treat children's cancers. Many other specialists may be involved in your child's care as well, including other doctors, physician assistants (PAs), nurse practitioners (NPs), nurses, psychologists, social workers, rehabilitation specialists, and other health professionals.

- [How to Find the Best Cancer Treatment for Your Child¹](#)
- [Navigating the Health Care System When Your Child Has Cancer²](#)

Making treatment decisions

Once lymphoma has been diagnosed and tests have been done to determine its stage, your child's cancer care team will discuss treatment options with you. The most important factors in choosing a treatment include the type and stage of the lymphoma, although other factors, such as where the lymphoma is in the body, can also play a role.

Intensive treatment for childhood lymphoma is often very effective, but it can possibly cause serious side effects. It's important to discuss all of your options as well as their possible side effects with your child's doctors so you can make an informed decision.

If time allows, getting a second opinion from another doctor experienced with your child's type of cancer is often a good idea. This can give you more information and help you feel more confident about the treatment plan you choose. If you aren't sure where to go for a second opinion, ask your doctor for help.

- [What Should You Ask Your Child's Doctor About Non-Hodgkin Lymphoma?³](#)
- [How to Talk to Your Child's Cancer Care Team⁴](#)
- [Seeking a Second Opinion⁵](#)

Thinking about taking part in a clinical trial

Today, most children and teens with cancer are treated at specialized children's cancer centers. These centers offer the most up-to-date treatment by conducting clinical trials (studies of promising new therapies). Children's cancer centers often conduct many clinical trials at any one time, and in fact most children treated at these centers take part in a clinical trial as part of their treatment.

Clinical trials are one way to get state-of-the-art cancer treatment. Sometimes they may be the only way to get access to newer treatments (although there is no guarantee that newer treatments will be better). They are also the best way for doctors to learn better methods to treat these cancers. Still, they might not be right for everyone.

If you would like to learn more about clinical trials that might be right for your child, start by asking the treatment team if your clinic or hospital conducts clinical trials.

- [Clinical Trials](#)⁶

Considering complementary and alternative methods

You may hear about alternative or complementary methods that your doctor hasn't mentioned to treat your child's tumor or relieve symptoms. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

Complementary methods refer to treatments that are used *along with* your regular medical care. Alternative treatments are used *instead of* standard medical treatment. Although some of these methods might be helpful in relieving symptoms or helping people feel better, many have not been proven to work. Some might even be harmful.

Be sure to talk to your child's cancer care team about any method you are thinking about using. They can help you learn what is known (or not known) about the method, which can help you make an informed decision.

- [Complementary and Alternative Medicine](#)⁷

Preparing for treatment

Before treatment, the doctors and other members of the team will help you, as a parent, understand the tests that will need to be done. The team's social worker will also counsel you about the problems you and your child might have during and after treatments such as surgery, and might be able to help you find housing and financial aid if needed.

- [When Your Child Has Cancer](#)⁸

Help getting through cancer treatment

Your child's cancer care team will be your first source of information and support, but there are other resources for help when you need it. Hospital- or clinic-based support services can also be an important part of your care. These might include nursing or social work services, financial aid, nutritional advice, rehab, or spiritual help. For children and teens with cancer and their families, other specialists can be an important part of care as well.

The American Cancer Society also has programs and services – including rides to treatment, lodging, and more – to help you get through treatment. Call our National Cancer Information Center at 1-800-227-2345 and speak with one of our trained specialists.

- [Finding Help and Support When Your Child Has Cancer](#)⁹
- [Find Support Programs and Services in Your Area](#)¹⁰

The treatment information given here is not official policy of the American Cancer Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor. Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

Chemotherapy for Non-Hodgkin Lymphoma in Children

Chemotherapy (chemo) is the main treatment for non-Hodgkin lymphoma (NHL) in children. Chemo uses anti-cancer drugs that are usually given into a vein (IV) or taken by mouth. These drugs enter the bloodstream and reach all areas of the body, making this treatment very useful for cancers that tend to spread widely, such as NHL in children. If the lymphoma may have reached the brain or spinal cord, chemo may also be given into the cerebrospinal fluid (known as *intrathecal* chemo).

Which chemo drugs are used to treat non-Hodgkin lymphoma in children?

Children with NHL get a combination of several chemo drugs over a period of time. The number of drugs, their doses, and the length of treatment depend on the [type](#)¹ and [stage](#)² of the lymphoma. Some of the chemo drugs commonly used to treat childhood lymphoma include:

- Cyclophosphamide (Cytoxan)
- Vincristine (Oncovin)
- Doxorubicin (Adriamycin)
- Prednisone
- Dexamethasone
- Cytarabine, also known as ara-C (Cytosar)
- Methotrexate
- L-asparaginase (Elspar), PEG-L-asparaginase (pegaspargase, Oncaspar)
- Etoposide (VePesid, others)
- 6-mercaptopurine (Purinethol)
- Ifosfamide (Ifex)

Doctors give chemo in cycles, in which a period of treatment is followed by a rest period to allow the body time to recover. Each chemo cycle generally lasts for several weeks.

Most chemo treatments are given in an outpatient setting (in the doctor's office or clinic or hospital outpatient department), but some – especially at the start of treatment – may need to be given while the child stays in the hospital.

Possible risks and side effects

Chemo drugs can cause [side effects](#)³. These depend on the type and dose of drugs given and how long treatment lasts. Common side effects can include:

- [Hair loss](#)⁴
- [Mouth sores](#)⁵
- Loss of appetite
- [Nausea and vomiting](#)⁶
- [Diarrhea](#)⁷
- Increased chance of [infections](#)⁸ (due to low white blood cell counts)
- Easy bruising or bleeding (due to low blood platelet counts)

- [Fatigue](#)⁹ (due to low red blood cell counts)

These side effects usually go away after treatment is finished. If serious side effects occur, the dose of chemo may be reduced or treatment may be delayed.

There are often ways to lessen these side effects. For example:

- Drugs can be given to help prevent or reduce **nausea and vomiting**.
- **Infections** can be very serious in people getting chemo. Drugs known as growth factors can be given to keep the blood cell counts higher.
- **Tumor lysis syndrome** is a possible side effect of chemo in children who have large numbers of lymphoma cells in the body before treatment. It occurs most often with the first cycle of chemo. Killing the lymphoma cells releases their contents into the bloodstream. This can overwhelm the kidneys, which can't get rid of all of these substances at once. Excess amounts of certain minerals may also lead to heart and nervous system problems. This can be prevented by making sure the child gets lots of fluids during treatment and by giving drugs such as bicarbonate, allopurinol, and rasburicase, which help the body get rid of these substances.

Some possible side effects occur only with certain drugs. For example, drugs such as doxorubicin can damage the heart. Your child's doctor may order heart function tests (like a MUGA scan or echocardiogram) if your child is getting one of these drugs.

Be sure to ask your child's doctor or nurse about any specific side effects you should watch for and about what you can do about them.

Along with the side effects listed above, there are possible long-term effects of chemo in children, such as possible effects on fertility later in life. These are described in [Late and Long-term Effects of Treatment for Non-Hodgkin Lymphoma in Children](#)¹⁰.

To learn more about chemotherapy, see the [Chemotherapy](#)¹¹ section of our website.

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/about/types-non-hodgkin-children.html
2. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/staging.html
3. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

4. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/hair-loss.html
5. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/mouth-problems/mouth-sores.html
6. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/nausea-and-vomiting.html
7. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/stool-or-urine-changes/diarrhea.html
8. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/infections/infections-in-people-with-cancer.html
9. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/fatigue.html
10. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/after-treatment/long-term-effects.html
11. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/chemotherapy.html

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Drugs Other Than Chemo for Non-Hodgkin Lymphoma in Children

In recent years, new drugs that target specific parts of cancer cells have been developed. These drugs work differently from standard [chemotherapy](#) (chemo) drugs. They sometimes work when chemo drugs don't, and they often have different side effects. Some of these drugs might be useful in certain cases of childhood non-Hodgkin lymphoma (NHL).

Monoclonal antibodies

Antibodies are proteins normally made by the body's immune system to help fight infections. Man-made versions, called *monoclonal antibodies*, can be designed to attack a specific target, such as a protein on the surface of lymphoma cells.

Several monoclonal antibodies are now being used to treat lymphoma in adults. Some of these are now being studied or used in children as well.

Rituximab (Rituxan): This antibody attaches to a protein called CD20 on the surface of some types of lymphoma cells, which seems to cause the cells to die. Rituximab is being studied for use along with chemotherapy. The treatments are typically given as intravenous (IV) infusions in the doctor's office or clinic.

Common [side effects](#)¹ are usually mild but can include chills, fever, nausea, rashes, fatigue, and headaches during or after the infusion. Even if these symptoms occur with the first rituximab infusion, it is unusual for them to happen with later doses. Rituximab can also increase a person's risk of some types of infections.

Brentuximab vedotin (Adcetris): This is an anti-CD30 antibody attached to a chemotherapy drug. Some lymphoma cells have the CD30 protein on their surface. The antibody acts like a homing signal, bringing the chemo drug to the lymphoma cells, where it enters the cells and kills them when they try to divide into new cells.

Brentuximab can be used to treat anaplastic large cell lymphoma (ALCL) that has come

back after other treatments. So far it has been used mainly in adults, but it's now being studied in children as well. It is given as an infusion into a vein (IV) every 3 weeks.

Common side effects include nerve damage (neuropathy), low blood counts, fatigue, fever, nausea and vomiting, infections, diarrhea, and cough.

Other new drugs

Other drugs that target parts of lymphoma cells are now being studied for use in children as well.

For example, the *anaplastic lymphoma kinase (ALK)* gene is often abnormal in ALCL. Newer drugs called **ALK inhibitors**, such as crizotinib (Xalkori), target cells with an abnormal *ALK* gene. In early studies, these drugs have shown very promising results in children with ALCL that is no longer responding to other treatments. Doctors are now studying the use of these drugs along with chemotherapy or other drugs in treating ALCL.

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects.html

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High-Dose Chemotherapy and Stem Cell Transplant for Non-Hodgkin Lymphoma in Children

High-dose chemotherapy and stem cell transplant is not used as the first treatment for non-Hodgkin lymphoma (NHL) in children, but a transplant may be an option if the first treatment does not work or if the lymphoma comes back after treatment.

The doses of chemotherapy (chemo) drugs normally are limited by the side effects these drugs can cause. Higher doses can't be used, even if they might kill more cancer cells, because they would severely damage the bone marrow, where new blood cells are made.

A stem cell transplant (also known as a bone marrow transplant) lets doctors give higher doses of [chemotherapy](#) (sometimes along with [radiation therapy](#)). This is because after getting high-dose chemo treatment, the child gets a transplant of blood-forming stem cells to restore the bone marrow. The blood-forming stem cells used for a transplant can come either from the blood or from the bone marrow.

Types of transplants

There are 2 main types of stem cell transplants (SCTs), based on the source of the stem cells.

- In an **autologous stem cell transplant**, the child's own stem cells are used. They are collected several times in the weeks before treatment. The cells are frozen and stored while the child gets treatment (high-dose chemo and/or radiation), and then are given back into the child's blood by an IV.

- In an **allogeneic stem cell transplant**, the stem cells come from someone else (a donor). Usually this is a brother or sister, although the source may be another donor or even umbilical cord blood. The donor's tissue type (also known as the HLA type) needs to match the child's tissue type as closely as possible to help prevent the risk of major problems with the transplant. Regardless of the source, the stem cells are frozen and stored until they are needed for the transplant.

Autologous SCTs are used more often than allogeneic SCTs to treat lymphoma in children. Still, using the child's own stem cells may not be an option if the lymphoma has spread to the bone marrow. If that occurs, it may be hard to get a stem cell sample that is free of lymphoma cells.

The use of allogeneic transplants is limited in treating lymphoma because they can have severe side effects that make them hard to tolerate. It can also be hard to find a matched donor.

A stem cell transplant is a complex treatment that can cause serious, possibly even life-threatening side effects. If your child's doctors think he or she might benefit from a transplant, it should be done at a center where the staff has experience with the procedure and with managing the recovery phase.

If your child's cancer care team suggests a stem cell transplant, be sure to talk to them beforehand to learn about possible long-term effects your child may have. More information on possible long-term effects can be found in [Late and Long-term Effects of Treatment for Non-Hodgkin Lymphoma in Children](#)¹.

To learn more about stem cell transplants, including how they are done and their potential side effects, see [Stem Cell Transplant for Cancer](#)².

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/after-treatment/long-term-effects.html
2. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/stem-cell-transplant.html

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Radiation Therapy for Non-Hodgkin Lymphoma in Children

Radiation therapy uses high-energy rays to kill cancer cells. This was once a very common treatment for children with non-Hodgkin lymphoma (NHL). But as doctors have developed more effective [chemotherapy](#) treatments, radiation therapy has been used less.

How is radiation therapy given?

Radiation focused on a cancer from a source outside the body is called *external beam radiation*. This is the type of radiation therapy most often used to treat NHL.

Before treatment starts, the radiation team takes careful measurements to determine

the correct angles for aiming the radiation beams and the proper dose of radiation. This planning session, called *simulation*, often includes getting [imaging tests](#)¹ such as CT or MRI scans.

The treatment itself is much like getting an x-ray, but the radiation is stronger. It is painless, but some younger children might still need to be sedated to help make sure they don't move during the treatment. Each treatment lasts only a few minutes, although the setup time – getting your child into place for treatment – usually takes longer. The number of treatments will depend on the reason they're being given.

When would radiation therapy be used?

There are a few instances in which radiation therapy may be used.

- Sometimes it is used along with chemotherapy. This might be done if the lymphoma has reached the brain or spinal cord.
- It may be used as a form of urgent treatment in children with symptoms caused by large tumors in the chest.
- It may be used as part of treatment for children who are getting [high-dose chemotherapy and a stem cell transplant](#).
- It can be used to relieve symptoms from lymphoma, such as pain from a tumor that's pressing on nerves.

Possible risks and side effects

Short-term side effects of radiation therapy depend on where it is aimed. For example:

- It may cause sunburn-like skin problems or hair loss in the area being treated.
- Radiation therapy that includes large parts of the body can cause fatigue.
- Radiation to the abdomen (belly) can sometimes cause nausea, vomiting, or diarrhea.

Often these effects go away after a short while.

Possible **long-term side effects** of radiation therapy in children can be more serious, and may occur after many years.

- **Radiation therapy to the chest** may damage the lungs or heart, which could raise

the risk of lung or heart problems later in life. In the long term, radiation to the chest may also increase the risk of lung cancer (especially in smokers) and of breast cancer.

- **Radiation therapy to the brain** might cause headaches and problems such as memory loss, personality changes, and trouble learning at school.
- **Radiation to other parts of the body** may slow a child's growth or increase the risks for certain other cancers, such as those of muscle or bone (called sarcomas) or of the digestive tract.

Because of these possible long-term effects, doctors try to avoid using radiation therapy in children or limit the doses used whenever possible. For more on possible long-term effects, see [Late and Long-term Effects of Treatment for Non-Hodgkin Lymphoma in Children](#)².

To learn more about this type of treatment, see [Radiation Therapy](#)³.

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/tests/imaging-radiology-tests-for-cancer.html
2. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/after-treatment/long-term-effects.html
3. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/radiation.html

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Surgery for Non-Hodgkin Lymphoma in Children

Surgery usually does not have much of a role in treating non-Hodgkin lymphoma (NHL) since it's unlikely to cure it by itself, and normal organs might be damaged in the process.

When would surgery be used?

Surgery is sometimes used as the first treatment for early-stage Burkitt lymphoma that is in only one area (such as part of the intestine) to try to remove as much of the tumor as possible before [chemotherapy](#) (chemo). If the lymphoma can be removed completely, doctors might be able to give a less intensive chemo regimen.

Other uses of surgery include:

- To get [biopsy](#)¹ samples for lab tests to determine the exact [type of NHL](#)² a child has, if non-surgical procedures (needle biopsy, bone marrow biopsy, etc.) could not get enough tissue.
- To insert a small plastic tube, called a [central venous catheter](#)³ or *venous access device* (VAD), into a large blood vessel near the heart. The end of the tube stays just under the skin or sticks out in the chest area or upper arm. This is left in place during treatment to give intravenous (IV) drugs such as chemo and to take blood samples. This lowers the number of needle sticks needed during treatment.

- To relieve some emergency situations, such as if a lymphoma has blocked a child's intestines.

Possible risks and side effects

Possible complications of surgery depend on the location and extent of the operation and the child's health beforehand. Serious complications, although rare, can include problems with anesthesia, bleeding, blood clots, wound infections, and pneumonia. Most children will have some pain for a while after the operation, although this can usually be helped with medicines if needed.

To learn more about surgery as a treatment for cancer, see [Cancer Surgery](#)⁴.

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/how-diagnosed.html
2. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/about/types-non-hodgkin-children.html
3. www.cancer.org/treatment/treatments-and-side-effects/central-venous-catheters.html
4. www.cancer.org/treatment/treatments-and-side-effects/treatment-types/surgery.html

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Treatment of Non-Hodgkin Lymphoma in Children, by Type and Stage

In general, all children with non-Hodgkin lymphoma (NHL) are treated with [chemotherapy](#) (chemo), but the exact treatment differs depending on the [type](#)¹ and [stage](#)² of the lymphoma. The treatment for NHL is intense and might cause serious side effects, so it's very important that it is given in a [children's cancer center](#)³, especially when it is first started.

Lymphomas in children (especially Burkitt lymphomas) tend to grow very quickly and may already be quite large by the time they're diagnosed, so it's important to start treatment as soon as possible. These lymphomas usually respond well to chemo, which can kill large numbers of lymphoma cells in a short period of time. A concern is that this can cause **tumor lysis syndrome**, a side effect in which the contents of the dead cells enter the blood and can cause problems with the kidneys and other organs. Doctors try to prevent this by making sure the child gets lots of fluids before and during treatment, and by giving certain drugs to help the body get rid of these substances.

Even children with early-stage (stage I or II) lymphomas are assumed to have more widespread disease than can be detected with exams or imaging tests. Because of this, local treatments such as [surgery](#) or [radiation therapy](#) alone are very unlikely to cure them. Therefore, chemotherapy is an important part of treatment for all children with NHL.

Treatment of lymphoblastic lymphoma (LBL)

Stages I and II: In general, treatment for early-stage LBL is similar to the treatment of [acute lymphoblastic leukemia \(ALL\)](#)⁴. Chemotherapy is given in 3 phases (induction, consolidation, and maintenance) using many chemo drugs. For example, the BFM regimen uses combinations of many different drugs for the first several months, followed by less intense treatment with methotrexate and 6-mercaptopurine in pill form for a total of about 2 years. Shorter and less intensive treatments, such as the chemotherapy combinations called CHOP (cyclophosphamide, doxorubicin, vincristine and prednisone) and COMP (cyclophosphamide, vincristine, methotrexate, and prednisone) have also been used.

Chemotherapy, usually with methotrexate, is also given into the spinal fluid (known as **intrathecal** chemo) for at least 4 doses, each separated by a week. This helps kill any lymphoma cells in the brain or spinal cord.

The total length of treatment may be as long as 2 years.

Stages III and IV: The treatment for children with advanced LBL is similar to that for earlier stage LBL, although it might be more intensive. It is given as 3 phases of chemotherapy (induction, consolidation, and maintenance) using many drugs, and it lasts for about 2 years. This is very similar to the treatment of high-risk acute lymphoblastic leukemia (ALL). For more information, see [Treating Childhood Leukemia](#)⁵.

Intrathecal chemo is also given into the spinal fluid to kill any lymphoma cells that may have reached the brain or spinal cord. In some cases, radiation therapy may be given to the brain and spinal cord as well.

Treatment of Burkitt lymphoma/Burkitt-like lymphoma and diffuse large B-cell lymphoma (DLBCL)

[Chemotherapy](#) (chemo) is the main form of treatment for these lymphomas. Studies are now being done to determine whether adding a [monoclonal antibody](#) such as rituximab to chemotherapy will make treatment more effective.

Stages I and II: While chemo is the main treatment of these lymphomas, [surgery](#) may be done before chemo if the tumor is in only one area, such as a large abdominal (belly) tumor.

Several different chemo drugs are used. The length of treatment ranges from about 9 weeks to 6 months. Most pediatric oncologists feel that the 9-week treatment is adequate if all of the tumor is removed with surgery first.

Chemotherapy into the spinal fluid is needed only if the lymphoma is growing around the head or neck.

Stages III and IV: Children with more advanced lymphomas need more intensive chemotherapy. Because these lymphomas tend to grow quickly, the chemo cycles are short, with little rest between courses of treatment.

For example, a treatment plan known as the French LMB protocol regimen alternates between different combinations of drugs every 3 to 4 weeks for a total of about 6 to 8 months. Other similar treatment regimens are the German BFM protocol and the St. Jude Total B regimen.

Chemotherapy must also be given into the spinal fluid.

Treatment of anaplastic large cell lymphoma (ALCL)

[Chemotherapy](#) is the main form of treatment for these lymphomas. Studies are being done to determine whether adding [other drugs](#) to chemotherapy might make treatment more effective.

Stages I and II: Treatment for these lymphomas usually consists of chemotherapy with 4 or more drugs given for about 3 to 6 months. The usual chemotherapy regimen contains a 4-drug combination of cyclophosphamide, vincristine, prednisone, and either doxorubicin or methotrexate. (These are known as the CHOP or COMP regimens.)

Chemotherapy is given into the spinal fluid only if the lymphoma is near the head or neck.

Stages III and IV: ALCL doesn't often reach the bone marrow or spinal fluid, but if it does, it requires more intensive treatment. Chemotherapy includes several drugs given over 9 to 12 months.

Intrathecal chemotherapy is given into the spinal fluid as well.

Current [clinical trials](#)⁶ are focusing on the length of chemotherapy and which drugs are important in treating ALCL. [Newer drugs](#), such as brentuximab vedotin (Adcetris) and crizotinib (Xalkori), are now being studied.

Treatment of recurrent lymphoma

Generally, if the lymphoma comes back (recurs) after the first therapy, it is much harder

to treat. When possible, more intensive chemotherapy, usually including a [stem cell transplant](#), is recommended. This is often done as part of a [clinical trial](#)⁷. Clinical trials of newer forms of treatment may also be an option.

More treatment information about non-hodgkin lymphoma in children

For more details on treatment options – including some that may not be addressed here – the National Cancer Institute (NCI) and the Children’s Oncology Group (COG) are good sources of information.

The NCI provides information by phone (1-800-4-CANCER) and on its website (www.cancer.gov⁸). Detailed information intended for use by cancer care professionals is also available at www.cancer.gov⁹.

The COG is the world’s largest organization devoted to childhood cancer research. The COG website, www.childrensoncologygroup.org¹⁰, provides information to help support children and their families from diagnosis, through treatment, and beyond.

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/about/types-non-hodgkin-children.html
2. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/staging.html
3. www.cancer.org/treatment/finding-and-paying-for-treatment/choosing-your-treatment-team/pediatric-cancer-centers.html
4. www.cancer.org/cancer/leukemia-in-children.html
5. www.cancer.org/cancer/leukemia-in-children/treating.html
6. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html
7. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html
8. <http://www.cancer.gov>
9. <http://www.cancer.gov>
10. <https://childrensoncologygroup.org/>

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After Childhood Non-Hodgkin Lymphoma Treatment

Living as a Cancer Survivor

For many people, going through cancer treatment often raises questions about next steps as a survivor.

- [What Happens During and After Treatment for Non-Hodgkin Lymphoma in Children?](#)
- [Social, Emotional, and Other Issues in Treating Non-Hodgkin Lymphoma](#)

Cancer Concerns After Treatment

Childhood lymphoma survivors are at risk for possible late effects of their cancer treatment. It's important to discuss what these possible effects might be with your child's medical team so you know what to watch for and report to the doctor.

- [Late and Long-Term Effects of Treatment for Non-Hodgkin Lymphoma in Children](#)
-

What Happens During and After Treatment for Non-Hodgkin Lymphoma in Children?

During treatment for non-Hodgkin lymphoma (NHL), the main concerns for most families are the daily aspects of getting through treatment and beating the lymphoma. After treatment, the concerns tend to shift toward the long-term effects of the lymphoma and its treatment, and concerns about the lymphoma coming back (recurrence)..

It's certainly normal to want to put the lymphoma and its treatment behind you and to get back to a life that doesn't revolve around cancer. But it's important to realize that follow-up care is a central part of this process that offers your child the best chance for recovery and long-term survival.

Follow-up exams

It's very important for your child to go to regular follow-up exams with the cancer care team for many years after treatment. The doctors will continue to watch for possible signs of lymphoma, as well as for short-term and long-term side effects of treatment. Doctor visits will be more frequent at first, but the time between visits may be extended as time goes on.

Checkups after treatment typically include physical exams, lab tests, and sometimes [other tests](#)¹ such as PET or CT scans. If the lymphoma comes back, it is usually while the child is still getting treatment or just after. It is unusual for childhood lymphoma to return if there are no signs of the disease within a year or so after treatment.

A benefit of follow-up care is that it gives you a chance to discuss questions and concerns that come up during and after your child's recovery. For example, almost any cancer treatment can have side effects. Some might last for only a short time, but [others can last longer](#) or might not show up until months or even years later. It's important to report any new symptoms to the doctor right away so that the cause can be found and treated, if needed.

Ask your child's doctor for a survivorship care plan

Talk with your child's doctor about developing a survivorship care plan. This plan might include:

- A suggested schedule for follow-up exams and tests
- A schedule for other tests your child might need in the future, such as early detection (screening) tests for other types of cancer, or tests to look for long-term health effects from the lymphoma or its treatment
- A list of possible [late- or long-term side effects](#) from your child's treatment, including

- what to watch for and when to contact the doctor
- Diet and physical activity suggestions

Keeping records of health insurance and your child's medical care

As much as you might want to put the experience behind you once treatment is done, it's very important to keep good records of your child's medical care during this time. Eventually, your child will grow up, be on his or her own, and have new doctors. It's important for them to be able to give the new doctors the details of their cancer diagnosis and treatment. Gathering the details soon after treatment may be easier than trying to get them at some point in the future. There are certain pieces of information that your child's doctors should have, even into adulthood. These include:

- A copy of the pathology reports from any biopsies or surgeries.
- If your child had surgery, a copy of the operative report(s).
- If your child stayed in the hospital, copies of the discharge summaries that doctors prepare when patients are sent home.
- A list of the final doses of each chemotherapy drug or other drug your child received. (Certain drugs can have specific long-term side effects.)
- If radiation therapy was given, a summary of the type and dose of radiation and when and where it was given.

Ask your cancer care team where and how to get this information. Learn more in [Keeping Copies of Important Medical Records²](#).

It's also important to keep health insurance coverage. Tests and doctor visits can cost a lot, and even though no one wants to think of the lymphoma coming back, this could happen.

Can we lower the risk of the lymphoma progressing or coming back?

If your child has (or has had) lymphoma, you probably want to know if there are things you can do that might lower the risk of the lymphoma growing or coming back, such as eating a certain type of diet or taking nutritional supplements. Unfortunately, it's not yet clear if there are things you can do that will help.

As your child gets older, adopting healthy behaviors such as [not smoking³](#), [eating well](#), [getting regular physical activity⁴](#), and staying at a healthy weight might help, but no one

knows for sure. However, we do know that these types of behaviors can have positive effects on your child's health that can extend beyond their risk of lymphoma or other cancers.

About dietary supplements

So far, no dietary supplements (including vitamins, minerals, and herbal products) have been shown to clearly help lower the risk of lymphoma progressing or coming back. This doesn't mean that no supplements can help, but it's important to know that none have been proven to do so.

Dietary supplements are not regulated like medicines in the United States – they do not have to be proven effective (or even safe) before being sold, although there are limits on what they're allowed to claim they can do. If you're thinking about having your child take any type of nutritional supplement, talk to your child's health care team. They can help you decide which ones can be used safely while avoiding those that might be harmful.

To learn more, see [Dietary Supplements: What Is Safe?](#)⁵

Hyperlinks

1. www.cancer.org/cancer/childhood-non-hodgkin-lymphoma/detection-diagnosis-staging/how-diagnosed.html
2. www.cancer.org/treatment/survivorship-during-and-after-treatment/be-healthy-after-treatment/keeping-copies-of-important-medical-records.html
3. www.cancer.org/healthy/stay-away-from-tobacco.html
4. www.cancer.org/healthy/eat-healthy-get-active.html
5. www.cancer.org/treatment/treatments-and-side-effects/complementary-and-alternative-medicine/dietary-supplements.html

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Social, Emotional, and Other Issues in Treating Non-Hodgkin Lymphoma

Social and emotional issues may come up during and after your child's treatment. Factors such as the child's age when diagnosed and the extent of treatment may play a role here.

Some children may have emotional or psychological issues that need to be addressed during and after treatment. Depending on their age, they may also have some problems functioning normally and with school work. These can often be overcome with support and encouragement. Doctors and other members of the health care team can also often recommend special support programs and services to help children after treatment.

Many experts recommend that school-aged children attend school as much as possible. This can help them maintain a sense of daily routine and keep their friends informed about what is happening.

Friends can be a great source of support, but children and parents should know that some people have misunderstandings and fears about cancer. Some cancer centers have a school re-entry program that can help in these situations. In this program, health educators visit the school and tell students about the diagnosis, treatment, and changes that the child with cancer may go through. They can also answer any questions from teachers and classmates. (For more information, see [Children Diagnosed With Cancer: Returning to School¹](#).)

Centers that treat many children with lymphoma might have programs to introduce new patients to children or teens who have finished their treatment. This can give patients and their families an idea of what to expect during and after treatment, which is very important. Seeing another patient with lymphoma doing well after treatment is often helpful. Support groups also might be helpful.

Parents and other family members can also be affected, both emotionally and in other ways. Some common family concerns during treatment include financial stresses, traveling to and staying near the cancer center, the possible loss of a job, taking care of other siblings, and the need for home schooling. Social workers and other professionals at cancer centers can help families sort through these issues.

During treatment, children and their families tend to focus on the daily aspects of getting through it and beating the lymphoma. But once treatment is finished, emotional concerns can arise. Some could last a long time. They can include things like:

- Dealing with physical changes that can result from the treatment
- Worrying about the lymphoma returning or new health problems developing
- Feeling resentment for having had lymphoma or having to go through treatment when others do not

- Having concerns about being treated differently or discriminated against (by friends, classmates, coworkers, employers, etc.)
- Having concerned about dating, marrying, and having a family later

For teens, another possible issue is having to rely more on their parents at a time when they are normally becoming more independent.

No one chooses to have lymphoma, but for many childhood lymphoma survivors, the experience eventually can be positive, helping to establish strong self-values. Other survivors may have a harder time recovering, adjusting to life after cancer, and moving on.

It's normal to have some anxiety or other emotional reactions after treatment, but feeling overly worried, depressed, or angry can affect many aspects of a young person's growth. It can get in the way of relationships, school, work, and other aspects of life.

With support from family, friends, other survivors, mental health professionals, and others, many people who have survived cancer can thrive in spite of the challenges they've had to face. If needed, doctors and other members of the health care team can often recommend special support programs and services to help children after cancer treatment.

You can learn more about some of these issues in [Children Diagnosed With Cancer: Dealing With Diagnosis](#)² and [When Your Child's Treatment Ends](#)³.

Hyperlinks

1. </content/cancer/en/treatment/children-and-cancer/when-your-child-has-cancer/returning-to-school.html>
2. </content/cancer/en/treatment/children-and-cancer/when-your-child-has-cancer/dealing-with-diagnosis.html>
3. </content/cancer/en/treatment/children-and-cancer/when-your-child-has-cancer/when-your-childs-treatment-ends.html>

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Late and Long-Term Effects of Treatment for Non-Hodgkin Lymphoma in Children

Because of major advances in treatment, most children treated for lymphoma live into adulthood, so their health as they get older has come more into focus in recent years.

Just as the treatment of childhood lymphoma requires a very specialized approach, so does follow-up and monitoring for late effects of treatment. [Careful follow-up](#) after treatment is very important, as some side effects might not show up until many years after treatment. The earlier any problems are recognized, the more likely it is they can be treated effectively.

Childhood lymphoma survivors are at risk, to some degree, for several possible late effects of their cancer treatment. This risk depends on a number of factors, such as the type of lymphoma, the type and doses of treatments, and the child's age when getting treatment. It's important to discuss what these possible effects might be with your child's medical team so you know what to watch for and report to the doctor.

Late effects of treatment can include:

- Heart or lung problems after getting certain chemotherapy drugs or getting radiation therapy to the chest
- Slowed or limited growth and development (especially after a stem cell transplant)
- Bone damage or thinning of bones (osteoporosis)
- Changes in sexual development and ability to have children (see below)
- Changes in intellectual function with learning difficulties
- Development of second cancers, such as leukemia, later in life. These are not common, but they can happen.

Cancer treatment might affect sexual development and the ability to have children later in life. Talk with your child's cancer care team about the risk of treatment affecting fertility, and ask if there are options for preserving fertility. For more information, see [Preserving Fertility in Children and Teens With Cancer](#)¹.

There may be other complications from treatment, as well. Your child's doctor should carefully go over any possible problems with you before your child starts treatment.

Along with physical side effects, survivors of childhood cancer may have [emotional or psychological issues](#). They also may have some problems functioning normally and with school work. These can often be addressed with Support and encouragement often help these issues. Doctors and other members of the health care team can often recommend special support programs and services to help children after cancer treatment.

Long-term follow-up guidelines

To help increase awareness of late effects and improve follow-up care for childhood cancer survivors throughout their lives, the Children's Oncology Group (COG) has developed long-term follow-up guidelines for survivors of childhood cancers. These guidelines can help you know what to watch for, what types of screening tests should be done, and how late effects may be treated.

It's very important to discuss possible long-term complications with your child's health care team, and to make sure there is a plan in place to watch for these problems and treat them, if needed. To learn more, ask your child's doctors about the COG survivor guidelines. You can also download them for free at the COG website: www-survivorshipguidelines.org.² The guidelines are written for health care professionals. Patient versions of some of the guidelines are available (as "Health Links") on the site as well, but we urge you to discuss them with a doctor.

For more about some of the possible long-term effects of treatment, see [Children Diagnosed With Cancer: Late Effects of Cancer Treatment](#)³.

Hyperlinks

1. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/fertility-and-sexual-side-effects/preserving-fertility-in-children-and-teens-with-cancer.html
2. <http://www-survivorshipguidelines.org/>
3. www.cancer.org/treatment/children-and-cancer/when-your-child-has-cancer/late-effects-of-cancer-treatment.html

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