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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?](#)

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# 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](#)<sup>1</sup> (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](http://www.cancer.org/cancer/cancer-causes/infectious-agents/hiv-infection-aids.html)

## References

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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](#)<sup>1</sup>. 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](http://www.cancer.org/cancer/cancer-causes/infectious-agents/hiv-infection-aids.html)

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### Written by

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