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

Learn about the risk factors for non-Hodgkin lymphoma in children and teens, and if there are things that might help lower risk.

Risk Factors

A risk factor is anything that increases the chances of getting a disease such as cancer. Learn more about the risk factors for childhood non-Hodgkin lymphoma.

- 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 increase a person's chances of getting cancer. Different cancers have different risk factors.

Lifestyle-related risk factors such as body weight, physical activity, diet, and the use of tobacco or alcohol 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, sex, 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 differences are not clear.

Having a weakened immune system

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

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
- Nijmegen syndrome
- 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 organ. 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.

Human immunodeficiency virus (HIV) infection and AIDS

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

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 almost all Burkitt lymphomas in Africa. In the United States, EBV has been linked with about 15% of Burkitt lymphomas. It is also linked to most 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?)

Radiation exposure

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

Survivors of atomic bomb exposures and nuclear reactor accidents have an increased risk of developing some types of cancer. Leukemia[2] and thyroid[3] 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

- Genes that help keep cell division under control, repair mistakes in DNA, or cause cells to die at the right time are called **tumor suppressor genes**.

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

Inherited versus acquired gene changes

Some people **inherit** DNA changes from a parent that increase their risk for certain types of cancer. For example, some children inherit DNA changes that result in them having a weakened immune system, which can increase their risk for NHL. But this is not common.

More often, DNA changes related to NHL occur during life rather than having been inherited before birth. In some cases, these **acquired** changes result from an outside exposure to radiation or other factors, such as treatment for another condition that results in a weakened immune system. But in many cases, acquired gene changes seem to occur randomly, without having an outside cause.

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.

Most children and teens 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 and teens who don't have these risk factors.

References

Gross TG, Kamdar KY, Bollard CM. Chapter 19: Malignant Non–Hodgkin Lymphomas in Children. In: Blaney SM, Adamson PC, Helman LJ, eds. *Pizzo and Poplack’s Principles and Practice of Pediatric Oncology.* 8th ed. Philadelphia Pa: Lippincott

Williams & Wilkins; 2021.

National Cancer Institute Physician Data Query (PDQ). Childhood Non-Hodgkin Lymphoma Treatment. 2021. Accessed at https://www.cancer.gov/types/lymphoma/patient/child-nhl-treatment-pdq on June 10, 2021.

Termuhlen AM, Gross TG. Overview of non-Hodgkin lymphoma in children and adolescents. UpToDate. 2021. Accessed at https://www.uptodate.com/contents/overview-of-non-hodgkin-lymphoma-in-children-and-adolescents on June 10, 2021.

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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 having a weakened immune system.

The most common cause of acquired immune system problems is HIV infection[1]. HIV is spread among adults mostly through unprotected sex and sharing contaminated needles. Children generally get HIV infection from contact with their mother's blood, usually before or during birth. Treating a pregnant woman who is HIV-positive 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 result from children being given immune-suppressing drugs to avoid rejection of transplanted organs, or from children getting chemotherapy or

cancer care as well as journalists, editors, and translators with extensive experience in medical writing.