Acute Lymphocytic Leukemia (ALL) Causes, Risk Factors, and Prevention

Learn about the risk factors for acute lymphocytic leukemia and if there are things you might be able to do to help lower your risk.

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 acute lymphocytic leukemia.

- Risk Factors for Acute Lymphocytic Leukemia (ALL)
- What Causes Acute Lymphocytic Leukemia (ALL)?

Prevention

There is no known way to prevent most cases of leukemia at this time. Most people who get acute lymphocytic leukemia have no known risk factors, so there is no way to prevent these leukemias from developing.

Risk Factors for Acute Lymphocytic Leukemia (ALL)

- Radiation exposure

- Certain chemical exposures
- Certain viral infections
- Certain genetic syndromes
- Age
- Race/ethnicity
- Being male
- Having an identical twin with ALL
- Uncertain, unproven or controversial risk factors

A risk factor is something that increases your chance of getting a disease such as cancer. Some risk factors, like smoking, can be controlled. Others, like a person's age or family history, can't be changed.

But having a risk factor, or even several risk factors, does not mean that you will definitely get the disease. And many people who get the disease may have few or no known risk factors.

There are only a handful of known risk factors for acute lymphocytic leukemia (ALL).

Radiation exposure

Being exposed to high levels of radiation[1] is a risk factor for both ALL and acute myeloid leukemia[2] (AML). For example, Japanese atomic bomb survivors had a greatly increased risk of developing acute leukemia.

Treating cancer with radiation therapy also increases the risk of leukemia, although more for AML than ALL. The risk seems to be higher if chemotherapy and radiation are both used in treatment.

The possible risks of leukemia from being exposed to lower levels of radiation, such as from medical imaging tests[3] like x-rays or CT scans, are not well understood. Exposure to such radiation, especially very early in life, may carry an increased risk of leukemia, but this is not clear. If there is an increased risk it is likely to be small, but to be safe, most doctors try to limit radiation exposure from these tests as much as possible, especially in children and pregnant women.

Certain chemical exposures

The risk of ALL may be increased by exposure to certain chemotherapy drugs and

certain other chemicals, including benzene[4]. Benzene is used in many industries to make other products, and is also in cigarette smoke, as well as some glues, cleaning products, detergents, art supplies, and paint strippers.

Chemical exposure is more strongly linked to an increased risk of AML than to ALL.

Certain viral infections

Infection with the **human T-cell lymphoma/leukemia virus-1 (HTLV-1)** can cause a rare type of T-cell ALL. Most cases occur in Japan and the Caribbean area. This disease is not common in the United States.

In Africa, the **Epstein-Barr virus (EBV)** has been linked to Burkitt lymphoma, as well as to a fo96F5d is also in cityted States.

transplant.html
6. www.cancer.org/cancer/risk-prevention/radiation-exposure/extremely-low-frequency-radiation.html
7. www.cancer.org/cancer/risk-prevention/radiation-exposure/cellular-phones.html
8. www.cancer.org/cancer/risk-prevention/chemicals/hair-dyes.html

References

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What Causes Acute Lymphocytic Leukemia (ALL)?

- Inherited versus acquired gene changes

Some people with acute lymphocytic leukemia (ALL) have one or more of the known risk factors, but many do not. Even when a person has one or more risk factors, it can

be very hard to know if it actually caused the leukemia.

Great progress has been made in understanding how certain changes in the DNA in normal bone marrow cells can cause them to become leukemia cells. The DNA inside our cells makes up our **genes**, which control how our cells function. We tend to 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 to make new cells, and die at the right time:

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

Each time a cell divides into 2 new cells, it must make a new copy of its chromosomes (long strands of DNA). This process isn't perfect, and errors can occur that can affect genes within the chromosomes. Cancers (including ALL) can be caused by mutations (changes) that turn on oncogenes or turn off tumor suppressor genes. These types of changes can stop bone marrow cells from maturing the way they normally would, or help the cells grow out of control.

Mutations in many different genes can be found in ALL cells, but larger changes in one or more chromosomes are also common. Even though these changes involve larger pieces of DNA, their effects are still likely to be due to changes in just one or a few genes that are on that part of the chromosome. Several types of chromosome changes may be found in ALL cells:

Translocations are the most common type of chromosome change that can lead to leukemia. A translocation means that DNA from one chromosome breaks off and becomes attached to a different chromosome. The point on the chromosome where the break occurs can affect nearby genes – for example, it can turn on oncogenes or turn off genes that would normally help a cell mature.

The most common translocation in ALL in adults is known as the **Philadelphia chromosome**, which is a swap of DNA between chromosomes 9 and 22, abbreviated as t(9;22). Many other, less common translocations, can occur as well, including those between chromosomes 4 and 11, t(4;11), or 8 and 14, t(8;14).

Other chromosome changes such as **deletions** (the loss of part of a chromosome) and **inversions** (the rearrangement of the DNA within part of a chromosome) are also

sometimes found in ALL cells, although they are less common. In many cases of ALL, the gene changes that lead to the leukemia are not known.

Doctors are trying to figure out why these changes occur and how each of them might lead to leukemia. But there are different subtypes of ALL[1], and even within a subtypes, not all cases of ALL have the same gene or chromosome changes. Some changes are more common than others, and some seem to have more of an effect on a person's prognosis (outlook) than others.

Inherited versus acquired gene changes

Some people with certain types of cancer have inherited DNA mutations from a parent that increase their risk for the disease. Although this can happen sometimes with ALL, such as with some of the genetic syndromes listed in Risk Factors for Acute Lymphocytic Leukemia (ALL), inherited mutations are not a common cause of ALL.

Usually DNA mutations related to ALL are acquired during the person's lifetime, rather than having been inherited. They may result from outside causes like exposure to radiation[2] or cancer-causing chemicals, but in most cases the reason they occur isn't clear. Many of these gene changes are probably just random events that sometimes happen inside a cell, without having an outside cause. These changes can build up as we age, which might help explain why ALL in adults gets more common as people get older.

Hyperlinks

1. www.cancer.org/cancer/types/acute-lymphocytic-leukemia/detection-diagnosis-staging/how-classified.html
2. www.cancer.org/cancer/risk-prevention/radiation-exposure.html

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Appelbaum FR. Chapter 98: Acute Leukemias in Adults. In: Niederhuber JE, Armitage JO, Dorshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 5th ed. Philadelphia, Pa. Elsevier: 2014.

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