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Infections that Can Lead to Cancer

Get an overview of how infections with some viruses, bacteria, and other germs may increase a person's risk for certain types of cancer.

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Can Infections Cause Cancer?

Since the start of the 20th century, it's been known that certain infections play a role in cancer in animals. More recently, infections with certain viruses, bacteria, and parasites have been recognized as risk factors for several types of cancer in humans.

Worldwide, infections are linked to about 15% to 20% of cancers. This percentage is even higher in developing countries, but it is lower in the United States and other developed countries. This is partly because certain infections are more common in developing countries, and partly because some other risk factors for cancer, such as obesity, are more common in developed countries.

Infections can raise a person's risk of cancer in different ways. For example:

- Some viruses directly affect the genes inside cells that control their growth. These viruses can insert their own genes into the cell, causing the cell to grow out of

control.

- Some infections can cause long-term inflammation in a part of the body. This can lead to changes in the affected cells and in nearby immune cells, which can eventually lead to cancer.
- Some types of infections can suppress a person's immune system, which normally helps protect the body from some cancers.

Any of these changes might lead to a higher risk of cancer.

Even though the infections described here can raise a person's risk of certain types of cancer, most people with these infections never develop cancer. The risk of developing cancer is also influenced by other factors. For example, infection with *Helicobacter pylori* (*H pylori*) bacteria might increase your risk of stomach cancer, but what you eat, whether or not you smoke, and other factors also affect your risk.

Viruses that Can Lead to Cancer

Viruses are very small organisms. Most can't even be seen with an ordinary microscope. They are made up of a small number of genes in the form of DNA or RNA surrounded by a protein coating. A virus must enter a living cell and take over the cell's machinery in order to reproduce and make more viruses. Some viruses do this by inserting their own DNA (or RNA) into that of the host cell. When the DNA or RNA affects the host cell's genes, it can push the cell toward becoming cancer.

- [Human papillomaviruses \(HPVs\)](#)
- [Epstein-Barr virus \(EBV\)](#)
- [Hepatitis B virus \(HBV\) and hepatitis C virus \(HCV\)](#)
- [Human immunodeficiency virus \(HIV\)](#)
- [Human herpes virus 8 \(HHV-8\)](#)
- [Human T-lymphotrophic virus-1 \(HTLV-1\)](#)
- [Merkel cell polyomavirus \(MCV\)](#)
- [Viruses with uncertain or unproven links to cancer in humans](#)

In general, each type of virus tends to infect only a certain type of cell in the body. (For example, the viruses that cause the common cold only infect the cells lining the nose and throat.)

Several viruses are linked with cancer in humans. Our growing knowledge of the role of viruses as a cause of cancer has led to the development of vaccines to help prevent certain human cancers. But these vaccines can only protect against infections if they are given **before** the person is exposed to the cancer-promoting virus.

Human papillomaviruses (HPVs)

[Human papillomaviruses \(HPVs\)](#)¹ are a group of more than 150 related viruses. They are called *papillomaviruses* because some of them cause papillomas, which are more commonly known as warts. Some types of HPV only grow in skin, while others grow in mucous membranes such as the mouth, throat, or vagina.

All types of HPV are spread by contact (touch). More than 40 types of HPV can be passed on through sexual contact. Most sexually active people are infected with one or more of these HPV types at some point in their lives. At least a dozen of these HPV types are known to cause cancer.

While HPV infections are very common, cancer caused by HPV is not. Most people infected with HPV will not develop a cancer related to the infection. However, some people with long-lasting infections of high-risk HPV types are at risk of developing

cancer.

HPV infections of the mucous membranes can cause genital warts, but they usually have no symptoms. There are no effective medicines or other treatments for HPV, other than removing or destroying cells that are known to be infected. But in most people, the body's immune system controls the HPV infection or gets rid of it over time. To learn more, see [HPV and HPV Testing](#)².

HPV and cervical cancer

A few types of HPV are the main causes of [cervical cancer](#)³, which is the second most common cancer among women worldwide. Cervical cancer has become much less common in the United States because the Pap test has been widely available² Tf togtud72 63b810 0 1

are given as a series of injections (shots).

The vaccines can only be used to help prevent HPV infection – they do not stop or help treat an existing infection. To be most effective, the vaccine series should be given before a person becomes sexually active (has sex with another person).

American Cancer Society recommendations for HPV vaccination

- HPV vaccination works best when given to boys and girls between ages 9 and 12.
- Children and young adults age 13 through 26 who have not been vaccinated, or who haven't gotten all their doses, should get the vaccine as soon as possible. Vaccination of young adults will not prevent as many cancers as vaccination of children and teens.
- ACS does not recommend HPV vaccination for persons older than 26 years.

See [HPV Vaccines](#)¹² for more on this.

Epstein-Barr virus (EBV)

EBV is a type of herpes virus. It is probably best known for causing infectious mononucleosis, often called “mono” or the “kissing disease.” In addition to kissing, EBV can be passed from person to person by coughing, sneezing, or by sharing drinking or eating utensils. Most people in the United States are infected with EBV by the end of their teen years, although not everyone develops the symptoms of mono.

As with other herpes virus infections, EBV infection is life-long, even though most people have no symptoms after the first few weeks. EBV infects and stays in certain white blood cells in the body called *B lymphocytes* (also called *B cells*). There are no medicines or other treatments to get rid of EBV, nor are there vaccines to help prevent

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Both HBV and HCV cause viral hepatitis, a type of liver infection. Other viruses can also cause hepatitis (hepatitis A virus, for example), but only HBV and HCV can cause the long-term (chronic) infections that increase a person's chance of [liver cancer](#)¹⁷. In the

and others. (For a more complete list of who should get the HBV vaccine, visit [Hepatitis B Basics](#)²¹ on the CDC website.)

Human immunodeficiency virus (HIV)

HIV, the virus that causes acquired immune deficiency syndrome (AIDS), doesn't appear to cause cancers directly. But HIV infection increases a person's risk of getting several types of cancer, especially some linked to other viruses.

HIV can be spread through semen, vaginal fluids, blood, and breast milk from an HIV-infected person. Known routes of spread include:

- Unprotected sex (oral, vaginal, or anal) with an HIV-infected person
 - Injections with needles or injection equipment previously used by an HIV-infected person
- Prenatal (before birth) and perinatal (during birth) exposure of infants from mothers

Other types of cancer that may be more likely to develop in people with HIV infection include:

- [Anal cancer](#)²⁵
- [Hodgkin disease](#)²⁶
- [Lung cancer](#)²⁷
- [Cancers of the mouth and throat](#)²⁸
- Some types of [skin cancer](#)²⁹
- [Liver cancer](#)³⁰

Some other, less common types of cancer may also be more likely to develop in people with HIV.

Because HIV infection often has no symptoms for years, a person can have HIV for a long time and not know it. The CDC recommends that everyone between the ages of 13 and 64 be tested for HIV at least once as part of their routine health care.

There is no vaccine to prevent HIV. But there are ways to lower your risk of getting it, such as not having unprotected sex or sharing needles with someone who has HIV. For people who are at high risk of HIV infection, such as injection drug users and people whose partners have HIV, taking medicine (as a pill every day) is another way to help lower your risk of infection.

For people already infected with HIV, taking anti-HIV drugs can help slow the damage to the immune system, which may help reduce the risk of getting some of the cancers above.

For more information, see [HIV and Cancer](#)³¹.

Human herpes virus 8 (HHV-8)

HHV-8, also known as **Kaposi sarcoma–associated herpes virus (KSHV)**, has been found in nearly all tumors in patients with Kaposi sarcoma (KS). KS is a rare, slow-growing cancer that often appears as reddish-purple or blue-brown tumors just underneath the skin. In KS, the cells that line blood and lymph vessels are infected with HHV-8. The infection makes them divide too much and live longer than they should. These types of changes may eventually turn them into cancer cells.

HHV-8 is transmitted through sex and appears to be spread other ways, such as through blood and saliva, as well. Studies have shown that fewer than 10% of people in

the US are infected with this virus.

HHV-8 infection is life-long (as with other herpes viruses), but it does not appear to cause disease in most healthy people. Many more people are infected with HHV-8 than ever develop KS, so it's likely that other factors are also needed for it to develop. Having a weakened immune system appears to be one such factor. In the US, almost all people who develop KS have other conditions that have weakened their immune system, such as HIV infection or immune suppression after an organ transplant.

KS was rare in the United States until it started appearing in people with AIDS in the early 1980s. The number of people with KS has dropped in the US since peaking in the early 1990s, most likely because of better treatment of HIV infection.

For more information on KS, see [Kaposi Sarcoma](#)³².

HHV-8 infection has also been linked to some rare blood cancers, such as primary effusion lymphoma. The virus has also been found in many people with multicentric Castleman disease, an overgrowth of lymph nodes that acts very much like and often develops into cancer of the lymph nodes (lymphoma). Further study is needed to better understand the role of HHV-8 in these diseases.

Human T-lymphotropic virus-1 (HTLV-1)

HTLV-1 has been linked with a type of lymphocytic leukemia and non-Hodgkin lymphoma called **adult T-cell leukemia/lymphoma (ATL)**. This cancer is found mostly in southern Japan, the Caribbean, central Africa, parts of South America, and in some immigrant groups in the southeastern United States.

In addition to ATL, this virus can cause other health problems, although many people with HTLV-1 don't have any of them.

HTLV-1 belongs to a class of viruses called *retroviruses*. These viruses use RNA (instead of DNA) for their genetic code. To reproduce, they must go through an extra step to change their RNA genes into DNA. Some of the new DNA genes can then become part of the chromosomes of the human cell infected by the virus. This can change how the cell grows and divides, which can sometimes lead to cancer.

HTLV-1 is something like HIV, which is another human retrovirus. But HTLV-1 cannot cause AIDS. In humans, HTLV-1 is spread in the same ways as HIV, such as unprotected sex with an HTLV-1-infected partner or injection with a needle after an infected person has used it. Mothers infected with HTLV-1 can also pass on the virus to

their children, although this risk can be reduced if the mother doesn't breastfeed.

Infection with HTLV-1 is rare in the United States. Fewer than 1% of people in the US are infected with HTLV-1, but this rate is much higher in groups of people at high risk (such as injection drug users). Since 1988, all blood donated in the United States has been screened for HTLV-1. This has greatly reduced the chance of infection through transfusion, and has also helped control the potential spread of HTLV-1 infection.

Once infected with HTLV-1, a person's chance of developing ATL can be up to about 5%, usually after a long time with no symptoms (20 or more years).

Merkel cell polyomavirus (MCV)

MCV was discovered in 2008 in samples from a rare and aggressive type of skin cancer called **Merkel cell carcinoma**. Most people are infected with MCV at some point (often in childhood), and it usually causes no symptoms. But in a few people with this infection, the virus can affect the DNA inside cells, which can lead to Merkel cell cancer. Nearly all Merkel cell cancers are now thought to be linked to this infection.

It is not yet clear how people become infected with this virus, but it has been found in a number of places in the body, including normal skin and saliva.

For more information, see [Merkel Cell Skin Cancer](#)³³.

Viruses with uncertain or unproven links to cancer in humans

Simian virus 40 (SV40)

SV40 is a virus that usually infects monkeys. Some polio vaccines prepared between 1955 and 1963 were made from monkey cells and were later found to be contaminated with SV40.

Some older studies suggested that infection with SV40 might increase a person's risk of developing [mesothelioma](#)³⁴ (a rare cancer of the lining of the lungs or abdomen), as well as some [brain tumors](#)³⁵, [bone cancers](#)³⁶, and [lymphomas](#)³⁷. But the accuracy of these older studies has been questioned.

Scientists have found that some lab animals, such as hamsters, developed mesotheliomas when they were intentionally infected with SV40. Researchers have also noticed that SV40 can make mouse cells grown in the lab become cancerous.

19. www.cdc.gov/hepatitis-b/testing/index.html
20. www.cdc.gov/hepatitis-c/testing/index.html
21. www.cdc.gov/hepatitis-b/about/?CDC_AAref_Val=www.cdc.gov/hepatitis/hbv/bfaq.htm
22. www.cancer.org/cancer/types/kaposi-sarcoma.html
23. www.cancer.org/cancer/types/cervical-cancer.html
24. www.cancer.org/cancer/types/non-hodgkin-lymphoma.html
25. www.cancer.org/cancer/types/anal-cancer.html
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29. www.cancer.org/cancer/types/skin-cancer.html
30. www.cancer.org/cancer/types/liver-cancer.html
31. www.cancer.org/cancer/risk-prevention/infections/hiv-infection-aids.html
32. www.cancer.org/cancer/types/kaposi-sarcoma.html
33. www.cancer.org/cancer/types/merkel-cell-skin-cancer.html
34. www.cancer.org/cancer/types/malignant-mesothelioma.html
35. www.cancer.org/cancer/types/brain-spinal-cord-tumors-adults.html
36. www.cancer.org/cancer/types/bone-cancer.html
37. www.cancer.org/cancer/types/lymphoma.html

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Bacteria that Can Lead to Cancer

stomach. Some of these changes could lead to cancer over time, especially cancer in the lower part of the stomach. *H pylori* infection is also linked with some types of lymphoma of the stomach.

While *H pylori* infection is a major cause of stomach cancer, most people who have these bacteria in their stomachs never develop stomach cancer. There is also some evidence that people with *H pylori* might have a lower risk of some other types of cancer, although it is unclear exactly what role the bacteria plays in this.

About 2 in 3 adults worldwide are infected with *H pylori*. The rate of infection is higher in developing countries and in older age groups. It's likely spread in a couple of ways. One is the fecal-oral route, such as through contaminated food or water sources. It can also be transmitted from one person to another, mouth to mouth.

Other factors also play a role in whether or not someone develops stomach cancer. For example, nitrites are substances commonly found in cured meats, some drinking water, and certain vegetables. They can be converted by certain bacteria, such as *H pylori*, into compounds that have been found to cause stomach cancer in lab animals.

Antibiotics and other medicines can be used to treat *H pylori* infections. According to the CDC, people who have active ulcers or a history of ulcers should be tested for *H pylori*, and, if they are infected, should be treated. Testing for and treating *H pylori* infection is also recommended after removal of an early stomach cancer.

Chlamydia trachomatis

Chlamydia trachomatis is a very common kind of bacteria that can infect the female reproductive system as well as other parts of the body in both men and women. It is spread through sex.

Although infection of the reproductive organs may cause symptoms in some people, most women have no symptoms. This means that women with chlamydia usually don't know they're infected unless samples are taken during a pelvic exam and tested for chlamydia. It's a common infection in younger women who are sexually active, and can remain for years unless it's detected and treated.

Some studies have found that women whose blood tests showed past or current chlamydia infection may be at greater risk for [cervical cancer](#)² than women with negative blood test results.

Studies have not shown that chlamydia itself causes cancer, but it might work with HPV

in a way that promotes cancer growth. For example, researchers have found that women who had chlamydia along with [HPV³](#) are more likely to still have HPV when they are re-tested later than women who have not had chlamydia. Although more studies are needed to confirm these findings, there are already good reasons to be checked for chlamydia infection and have it treated with antibiotics if it is found.

In women, long-term chlamydia infection is known to cause pelvic inflammation that can lead to infertility, mainly by building up scar tissue in the Fallopian tubes. Like other infections that inflame or cause ulcers in the genital area, chlamydia can also increase the risk of becoming infected with HIV during exposure to an HIV-infected sexual partner.

Hyperlinks

1. www.cancer.org/cancer/types/stomach-cancer.html
2. www.cancer.org/cancer/types/cervical-cancer.html
3. www.cancer.org/cancer/risk-prevention/hpv.html

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Parasites that Can Lead to Cancer

Certain parasitic worms that can live inside the human body can also raise the risk of developing some kinds of cancer. These organisms are not found in the United States, but they can be a concern for people who live in or travel to other parts of the world.

Opisthorchis viverrini and *Clonorchis sinensis* are liver flukes (a type of flatworm) that have been linked to increased risk of developing [cancer of the bile ducts](#)¹. The bile ducts are tubes that connect the liver to the intestines. These infections come from eating raw or undercooked freshwater fish. They occur mostly in East Asia and are rare in other parts of the world.

Schistosoma haematobium is a parasite found in the water of some countries in the Middle East, Africa, and Asia. Infection with this parasite (an illness called *schistosomiasis*) has been linked to [bladder cancer](#)². Possible links to other types of cancer are now being studied as well.

Hyperlinks

1. www.cancer.org/cancer/types/bile-duct-cancer.html
2. www.cancer.org/cancer/types/bladder-cancer.html

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