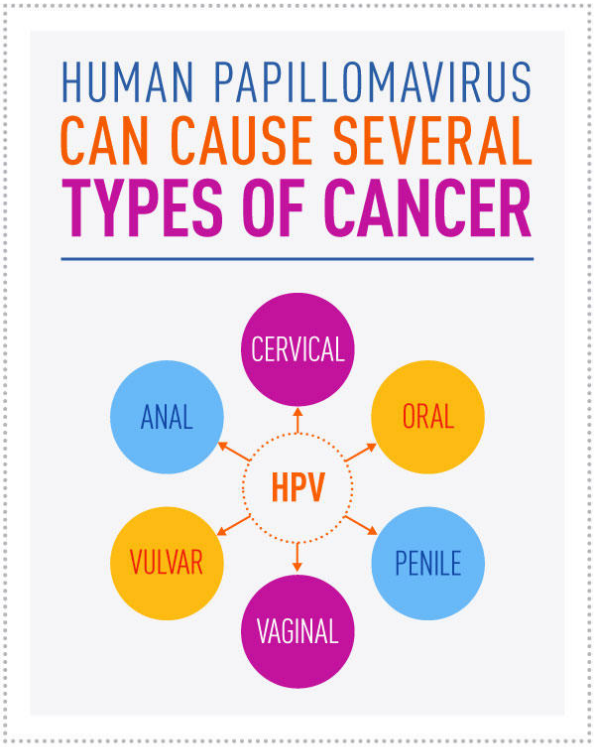
NIH NATIONAL CANCER INSTITUTE

HPV and Cancer

What is HPV (human papillomavirus)?

HPV is a group of more than 200 related viruses, some of which are spread through vaginal, anal, or oral sex. Sexually transmitted HPV types fall into two groups, low risk and high risk.

- Low-risk HPVs mostly cause no disease. However, a few low-risk HPV types can cause warts on or around the genitals, anus, mouth, or throat.
- High-risk HPVs can cause several types of cancer. There are about 14 high-risk HPV types including HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, and 68. Two of these, HPV16 and HPV18, are responsible for most HPV-related cancers.



HPV infection is common: Nearly all sexually active people are infected with HPV within months to a few years of becoming sexually active. Around half of these infections are with a high-risk HPV type.

HPV can infect both males and females. Both men and women can become infected with HPV and develop HPV-caused cancers.

Most HPV infections don't cause cancer: Your immune system usually controls HPV infections so they don't cause cancer.

High-risk HPV infections that persist can cause cancer: Sometimes HPV infections are not successfully controlled by your immune system. When a high-risk HPV infection persists for many years, it can lead to cell changes that, if untreated, may get worse over time and become cancer.

HPV vaccination can prevent cancer: HPV vaccines can prevent infection with disease-causing HPV types, preventing many HPV-related cancers and cases of genital warts.

What Cancers Are Caused by HPV Infection?

Long-lasting infections with high-risk HPVs can cause cancer in parts of the body where HPV infects cells, such as in the cervix, oropharynx (the part of the throat at the back of the mouth, behind the oral cavity that also includes the back third of the tongue, the soft palate, the side and back walls of the throat, and the tonsils), anus, penis, vagina, and vulva.

HPV infects the squamous cells that line the inner surfaces of these organs. For this reason, most HPV-related cancers are a type of cancer called squamous cell carcinoma. Some cervical cancers come from HPV infection of gland cells in the cervix and are called adenocarcinomas.

HPV-related cancers include:

- Cervical cancer: Virtually all cervical cancers are caused by HPV. Routine screening can prevent most cervical cancers by allowing health care providers to find and remove precancerous cells before they develop into cancer. As a result, cervical cancer incidence rates in the United States are decreasing. Learn more about trends and statistics for cervical cancer.
- Oropharyngeal cancers: Most of these cancers, which develop in the throat (usually the tonsils or the back of the tongue), are caused by HPV (70% of those in the United States). The number of new cases is increasing each year, and oropharyngeal cancers are now the most common HPV-related cancer in the United States. Learn more about trends in diagnosis and survival rates of oral cavity and pharynx cancer.
- Anal cancer: Over 90% of anal cancers are caused by HPV. The number of new cases and deaths from anal cancer are increasing each year. Anal cancer is nearly twice as common in women as in men. Learn more about anal cancer statistics.
- Penile cancer: Most penile cancers (over 60%) are caused by HPV. Learn about the importance of getting recommended treatments for penile cancer, a rare type of cancer.
- Vaginal cancer: Most vaginal cancers (75%) are caused by HPV. Learn about symptoms of, and treatment for, vaginal cancer, a rare type of cancer.
- Vulvar cancer: Most vulvar cancers (70%) are caused by HPV. Learn about new cases and death rates from vulvar cancer, a rare type of cancer.

In the United States, high-risk HPVs cause 3% of all cancers in women and 2% of all cancers in men. Each year, there are about 45,000 new cases of cancer in parts of the body where HPV is often found, and HPV is estimated to cause about 36,000 of these, according to the Centers for Disease Control (CDC).

Worldwide, the burden of HPV-related cancers is much greater. High-risk HPVs cause about 5% of all cancers worldwide, with an estimated 570,000 women and 60,000 men getting an HPV-related cancer each year. Cervical cancer is among the most common cancers and a leading cause of cancer-related deaths in low- and middle-income countries, where screening tests and treatment of early cervical cell changes are not readily available.

How is HPV Transmitted?

HPV passes easily between sexual partners. It can be transmitted through any intimate skin-to-skin contact, including vaginal–penile sex, penile–anal sex, penile–oral sex, vaginal–oral sex, and use of sex toys or other objects. The infection passes easily between sexual partners. Condoms and dental dams can lower the chance of HPV transmission but do not prevent it completely.

Does HPV Infection Cause Symptoms?

Infection with high-risk HPV does not usually cause symptoms. The precancerous cell changes caused by a persistent HPV infection at the cervix rarely cause symptoms, which is why regular cervical cancer screening is important. Precancerous lesions at other sites in the body may cause symptoms like itching or bleeding. And if

an HPV infection develops into cancer, the cancer may cause symptoms like bleeding, pain, or swollen glands. Learn more about signs and symptoms of cervical, vaginal, vulvar, penile, anal, and oropharyngeal cancers.

HPV Vaccination: Preventing HPV Infection

Study Confirms HPV Vaccine Prevents Cervical Cancer

A large study of vaccinated females showed a nearly 90% reduction in cervical cancer.

The HPV vaccine Gardasil 9® protects against infection from nine HPV types: the two low-risk HPV types that cause most genital warts, plus the seven high-risk HPV types that cause most HPV-related cancers.

HPV vaccination is recommended by the Centers for Disease Control and Prevention (CDC)'s Advisory Committee on Immunizations Practices (ACIP) to prevent new HPV infections and HPV-associated cancers and other diseases.

HPV vaccination provides strong protection against new HPV infections. Vaccination is prevention and does not cure an infection once you have it. The HPV vaccine is not used to treat HPV infections or diseases caused by HPV. HPV vaccination offers the most protection when given at ages 9-12. HPV vaccination is estimated to prevent up to 90% of HPV-related cancers.

Who should get the HPV vaccine?

The HPV vaccine series is recommended for girls and boys, at the age of 11 or 12, and the series can be started at age 9. It is important for males as well as females to get vaccinated, because both men and women can develop cancers of the mouth and throat, anal cancers, and genital warts. Women are also at risk for cervical cancer, and men for penile cancer. Vaccination can also reduce the spread of HPV that causes cancer to other people.

Children who start the vaccine series before age 15 need two doses to be protected. For young people who weren't vaccinated within the age recommendations, HPV vaccination is recommended up to age 26. Those who receive their first dose at age 15 or older need three doses to be protected.

Can the HPV vaccine be given at older ages?

Yes, the vaccine can be given to adults between the ages of 27 and 45 who didn't receive all vaccine doses earlier. Adults in this age group benefit less from the vaccine because they are more likely to have been exposed to HPV already. Therefore vaccination is not routinely recommended for people in this age group. If you are concerned that you are at risk for a new HPV infection, talk with your health care provider about whether HPV vaccination may be right for you.

Learn more about the human papillomavirus (HPV) vaccine.

Screening for HPV and Cell Changes Caused by HPV

Screening tests are used to check for disease when there are no symptoms. The goal of screening for cervical cancer is to find precancerous cell changes at an early stage, before they become cancer and when treatment can prevent cancer from developing.

Currently, cervical cancer is the only HPV-caused cancer for which FDA-approved screening tests are available. Screening for cervical cancer is an important part of routine health care for people who have a cervix. This includes women and transgender men who still have a cervix. Cervical cancer screening tests include the HPV test that checks cervical cells for high-risk HPV, the Pap test that checks for cervical cell changes that can be caused by high-risk HPV, and the HPV/Pap cotest that checks for both high-risk HPV and cervical cell changes.

Learn more about HPV and Pap testing and find out about next steps after an abnormal Pap test or positive HPV test.

Sometimes an HPV infection can become active again after many years. Learn more about what it means if a woman has a positive HPV test after many years of negative tests.

Screening for Other HPV-Related Cancers

There are no Food and Drug Administration (FDA) approved tests to detect HPV infections or HPV-caused cell changes in anal, vulvar, vaginal, penile, or oropharyngeal tissues. Research studies are ongoing to identify tests that can detect precancers in these areas or find cancer in an earlier, more treatable stage.

Anal cancer screening: Among populations that are at higher risk for HPV infection, such as men who have sex with men or men who are HIV positive, some research has found that an anal Pap test (also called an anal Pap smear) may help to detect early cell changes or precancerous cells. Research is ongoing to see if treating anal precancer prevents anal cancer.

Learn more about Anal Cancer Prevention (PDQ®).

Oral cancer screening: Currently, there are no standard screening tests for oral cancer. The United States Preventive Services Task Force (USPSTF) has found that the current evidence is insufficient to assess the balance of benefits and harms of screening for oral cancer in asymptomatic adults. However, dentists usually check for signs of oral and oropharyngeal cancer as part of a routine dental check-up.

Learn more about Oral Cavity, Pharyngeal, and Laryngeal Cancer Screening (PDQ®) and about symptoms in Oropharyngeal Cancer Treatment (Adult) (PDQ®).

Treatment for Cell Changes Caused by HPV Infection

Although HPV infection itself cannot be treated, there are treatments for the precancerous cell changes caused by infection with high-risk HPV.

Precancerous cervical cell changes: Most women who have precancerous cervical cell changes are treated with the loop electrosurgical excision procedure (LEEP), which is a method to remove the abnormal tissue.

Learn more about treatments for abnormal cervical cell changes.

Precancerous vaginal, vulvar, penile, and anal lesions and genital warts: Treatment methods include topical medicines, surgical excision, cryosurgery, and laser therapy.

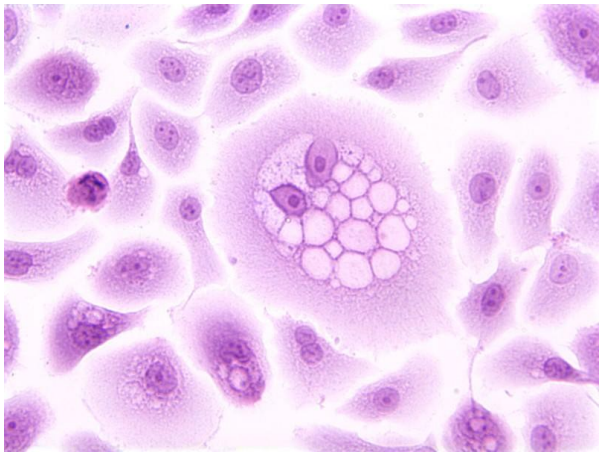
HPV-related cancers: Individuals who develop an HPV-related cancer generally receive the same treatment as patients with tumors at the same site that are not related to HPV infection. However, patients with HPV-positive

oropharyngeal cancer may receive different treatments than patients whose oropharyngeal cancers are not caused by HPV.

Learn more about treatment options for oropharyngeal cancer, including targeted therapy and new types of treatment such as immunotherapy being tested in clinical trials.

How Does HPV Cause Cancer?

Once high-risk HPV infects cells, it interferes with the ways in which these cells communicate with one another, causing infected cells to multiply in an uncontrolled manner. These infected cells are usually recognized and controlled by the immune system. However, sometimes the infected cells remain and continue to grow, eventually forming an area of precancerous cells that, if not treated, can become cancer. Research has found that it can take 10 to 20 years, or even longer, for HPV-infected cervical cells to develop into a cancerous tumor.



HPV infection causes cells to undergo changes. If not treated these cells can, over time, become cancer cells.
Credit: National Cancer Institute

Among women whose cervical cells are infected with high-risk HPV, several factors increase the chance that the infection will be long lasting and lead to precancerous cervical cells. These include:

- Having a very aggressive HPV type, particularly HPV 16 or HPV 18. If you have either of these HPV types, make sure you receive diagnostic testing with a colposcopy.
- Smoking cigarettes. Quitting smoking can help your body to fight HPV.
- Having a weakened immune system. If you have HIV or are taking medicines that suppress your immune system, talk to your health care provider about diagnostic testing and follow-up.

NCI and HPV-Related Research

Clinical trials are an important step in learning about better ways to prevent, diagnose, and treat diseases, such as cancers caused by HPV. NCI's Cancer Information Service can help you learn about HPV-related trials in the United States.

The National Cancer Institute is conducting and funding research to learn more about HPV:

- The Division of Cancer Epidemiology and Genetics (DCEG) conducts research into cervical and other HPV-related cancers to advance our understanding of how HPV causes cancer, evaluates screening practices to determine the most effective methods to detect precancerous changes early, develops and tests new approaches to screening that may be easier to use in low-resource settings, and refines tools for risk assessment in the clinic to help health care providers follow up on abnormal screening test results. Investigators in DCEG conducted the first population-based clinical trial of HPV vaccines.

- The Division of Cancer Prevention (DCP) conducts and fosters the development of research on the prevention and early detection of human papillomavirus (HPV)-related cancers and related conditions.
- The Division of Cancer Control and Population Sciences (DCCPS) supports research-tested intervention programs related to HPV and the investigation of implementation strategies to promote the HPV vaccine in regions with low HPV vaccine rates.
- The Center for Cancer Research (CCR) is home to scientists and clinicians who are exploring the cutting-edge of cancer-related research. CCR scientists work on a wide spectrum of biological and biomedical problems, including HPV. Investigators in CCR conducted the research that led to the initial development and characterization of the human papillomavirus (HPV) vaccines.

Related Resources

HPV and Pap Testing

Human Papillomavirus (HPV) Vaccines

Understanding Cervical Changes: A Health Guide

Cervical Cancer Screening (PDQ®)–Patient Version

Cervical Cancer Prevention (PDQ®)–Patient Version

Despite Proven Safety of HPV Vaccines, More Parents Have Concerns

Szent-Györgyi Prize to honor NCI's Douglas R. Lowy and John T. Schiller

Human Papillomavirus (HPV) Vaccines: An Interview with Douglas R. Lowy, M.D.

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