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# CANCER FACTS

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National Cancer Institute • National Institutes of Health  
Department of Health and Human Services

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## Human Papillomaviruses and Cancer: Questions and Answers

### Key Points

- Human papillomaviruses (HPVs) are a group of more than 100 types of viruses (see Question 1).
- HPVs are the major cause of cervical cancer. HPVs may also play a role in cancers of the anus, vulva, vagina, and penis, and some cancers of the oropharynx (see Question 3).
- Although there is no cure for HPV infection, the warts and lesions these viruses cause can be treated (see Question 9).
- Researchers at the National Cancer Institute and elsewhere are conducting research on HPV-related cancers (see Question 10).

### 1. What are human papillomaviruses, and how are they transmitted?

Human papillomaviruses (HPVs) are a group of more than 100 types of viruses. They are called papillomaviruses because certain types may cause warts, or papillomas, which are benign (noncancerous) tumors. The HPVs that cause the common warts which grow on hands and feet are different from those that cause growths in the throat or genital area. Some types of HPVs are associated with certain types of cancer.

Of the more than 100 types of HPVs, over 30 types can be passed from one person to another through sexual contact. Although HPVs are usually transmitted sexually, doctors cannot say for certain when infection occurred. Most HPV infections come and go over the course of a few years. However, sometimes HPV infection persists for many years, with or without causing cell abnormalities.



**2. What are genital warts?**

Some types of HPVs may cause warts to appear on or around the genitals or anus. Genital warts (technically known as condylomata acuminatum) are most commonly associated with two HPV types, HPV-6 and HPV-11. Warts may appear within several weeks after sexual contact with a person who is infected with HPV, or they may take months or years to appear, or they may never appear. HPVs may also cause flat, abnormal growths in the genital area and on the cervix (the lower part of the uterus that extends into the vagina). However, HPV infections usually do not cause any symptoms.

**3. What is the association between HPV infection and cancer?**

HPVs are now recognized as the major cause of cervical cancer. Studies also suggest that HPVs may play a role in cancers of the anus, vulva, vagina, and some cancers of the oropharynx (the middle part of the throat that includes the soft palate, the base of the tongue, and the tonsils). Data from several studies also suggest that infection with HPV is a risk factor for penile cancer (cancer of the penis).

**4. Are there specific types of HPVs that are associated with cancer?**

Some types of HPVs are referred to as “low-risk” viruses because they rarely develop into cancer. HPVs that are more likely to lead to the development of cancer are referred to as “high-risk.” Both high-risk and low-risk types of HPVs can cause the growth of abnormal cells, but generally only the high-risk types of HPVs may lead to cancer. Sexually transmitted, high-risk HPVs include types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 69, and possibly a few others. These high-risk types of HPVs cause growths that are usually flat and nearly invisible, as compared with the warts caused by types HPV-6 and HPV-11. It is important to note, however, that the majority of high-risk HPV infections go away on their own and do not cause cancer.

**5. What are the risk factors for HPV infection and cervical cancer?**

Having many sexual partners is a risk factor for HPV infection. Although most HPV infections go away on their own without causing any type of abnormality, infection with high-risk HPV types increases the chance that mild abnormalities will progress to more severe abnormalities or cervical cancer. Still, of the women who do develop abnormal cell changes with high-risk types of HPVs, only a small percentage would develop cervical cancer if the abnormal cells were not removed. Studies suggest that whether a woman develops cervical cancer depends on a variety of factors acting together with high-risk HPVs. The factors that may increase the risk of cervical cancer in women with HPV infection include smoking and having many children.

**6. How are HPV infections detected?**

Testing samples of cervical cells is an effective way to identify high-risk types of HPVs that may be present. The U.S. Food and Drug Administration (FDA) has approved an

HPV test that can identify 13 of the high-risk types of HPVs associated with the development of cervical cancer. This test, which looks for viral DNA, is performed by collecting cells from the cervix and then sending them to a laboratory for analysis. The test can detect high-risk types of HPVs even before there are any conclusive visible changes to the cervical cells.

## 7. **How are cervical cell abnormalities classified?**

A Pap test is used to detect abnormal cells in the cervix. It involves the collection of cells from the cervix for examination under the microscope. Various terms have been used to describe the abnormal cells that may be seen in Pap tests.

The major system used to report the results of Pap tests in the United States is the Bethesda System. In this system, samples with cell abnormalities are divided into the following categories:

- **ASC**—atypical squamous cells. Squamous cells are the thin, flat cells that form the surface of the cervix. The Bethesda System divides this category into two groups:
  1. **ASC-US**—atypical squamous cells of undetermined significance. The squamous cells do not appear completely normal, but doctors are uncertain what the cell changes mean. Sometimes the changes are related to HPV infection. An HPV test may be done to clarify the findings.
  2. **ASC-H**—atypical squamous cells cannot exclude a high-grade squamous intraepithelial abnormality. Intraepithelial refers to the layer of cells that forms the surface of the cervix. The cells do not appear normal, but doctors are uncertain what the cell changes mean. ASC-H may be at higher risk of being precancerous compared with ASC-US.
- **AGC**—atypical glandular cells. Glandular cells are mucus-producing cells found in the endocervical canal (opening in the center of the cervix) or in the lining of the uterus. The glandular cells do not appear normal, but doctors are uncertain what the cell changes mean.
- **AIS**—endocervical adenocarcinoma in situ. Precancerous cells are found in the glandular tissue.
- **LSIL**—low-grade squamous intraepithelial lesion. Low-grade means there are early changes in the size and shape of the cells. The word lesion refers to an area of abnormal tissue. LSILs are considered mild abnormalities caused by HPV infection and are a common condition, especially among young women. The majority of LSILs return to normal over months to a few years.

- **HSIL**—high-grade squamous intraepithelial lesion. High-grade means that the cells look very different in size and shape from normal cells. HSILs are more severe abnormalities and may eventually lead to cancer if left untreated.

Pap test results may also be described using an older set of categories called the “dysplasia scale.” Dysplasia is a term used to describe abnormal cells. Although dysplasia is not cancer, it may develop into very early cancer of the cervix. The cells look abnormal under the microscope, but they do not invade nearby healthy tissue.

There are four degrees of dysplasia: mild, moderate, severe, and carcinoma in situ. Carcinoma in situ is a precancerous condition that involves only the layer of cells on the surface of the cervix, and has not spread to nearby tissues. In the Bethesda System, mild dysplasia is classified as LSIL; moderate or severe dysplasia and carcinoma in situ are combined into HSIL.

Cervical intraepithelial neoplasia (CIN) is another term that is sometimes used to describe abnormal tissue findings. Neoplasia means an abnormal growth of cells. The term CIN along with a number (1, 2, or 3) describes how much of the thickness of the lining of the cervix contains abnormal cells. CIN-3 is considered to be a precancerous condition that includes carcinoma in situ.

## **8. What tests are used to screen for and diagnose precancerous cervical conditions?**

A Pap test is the standard way to check for any cervical cell changes. A Pap test is usually done as part of a gynecologic exam. The U.S. Preventive Services Task Force guidelines recommend that women have a Pap test at least once every 3 years, beginning about 3 years after they begin to have sexual intercourse, but no later than age 21.

Because the HPV test can detect high-risk types of HPVs in cervical cells, the FDA approved this test as a useful addition to the Pap test to help health care providers decide which women with ASC-US need further testing, such as colposcopy and biopsy of any abnormal areas. (Colposcopy is a procedure in which a lighted magnifying instrument called a colposcope is used to examine the vagina and cervix. Biopsy is the removal of a small piece of tissue for diagnosis.) In addition, the HPV test may be a helpful addition to the Pap test for general screening of women age 30 and over.

## **9. What are the treatment options for HPV infection?**

Although there is currently no medical cure for papillomavirus infection, the lesions and warts these viruses cause can be treated. Methods commonly used to treat lesions include cryosurgery (freezing that destroys tissue), LEEP (loop electrosurgical excision procedure, the removal of tissue using a hot wire loop), and conventional surgery. Similar treatments may be used for external genital warts. In addition, some drugs may be used to treat external genital warts. More information about treatment for genital warts can be found in the Centers for Disease Control and Prevention’s (CDC) *Sexually*

*Transmitted Diseases Treatment Guidelines 2002*. Copies of the guidelines are available at <http://www.cdc.gov/STD/treatment/> on the Internet.

## 10. What research is being done on HPV-related cancers?

Researchers at the National Cancer Institute (NCI) and elsewhere are studying how HPVs cause precancerous changes in normal cells and how these changes can be prevented. They are using HPVs grown in the laboratory to find ways to prevent the infection and its associated disease and to create vaccines against the viruses. Vaccines for certain papillomaviruses, such as HPV-16 and HPV-18, are being studied in clinical trials for the prevention of cervical cancer; similar trials for other types of cancer are planned. Information about clinical trials is available from the NCI's Cancer Information Service (CIS) (see below) or on the clinical trials page of the NCI's Web site at [http://cancer.gov/clinical\\_trials](http://cancer.gov/clinical_trials) on the Internet.

Laboratory research has indicated that HPVs produce proteins known as E5, E6, and E7. These proteins interfere with the cell functions that normally prevent excessive growth. For example, HPV E6 interferes with the human protein p53. This protein is present in all people and acts to keep tumors from growing. This research is being used to develop ways to interrupt the process by which HPV infection can lead to the growth of abnormal cells.

## 11. How can people learn more about HPV infection?

The following Federal Government agencies can provide more information about HPV infection:

The National Institute of Allergy and Infectious Diseases (NIAID) supports research on HPV infection and offers printed materials. NIAID can be contacted at:

**Organization:** National Institute of Allergy and Infectious Diseases  
**Address:** Office of Communications and Public Liaison  
Building 31, Room 7A-50  
31 Center Drive MSC 2520  
Bethesda, MD 20892-2520  
**Telephone:** 301-496-5717  
**Internet Web site:** <http://www.niaid.nih.gov>

The CDC National Sexually Transmitted Disease (STD) and Acquired Immunodeficiency Syndrome (AIDS) Hotlines provide information on sexually transmitted infections, including HPV, and how to prevent them. The hotlines can be reached by calling toll-free 1-800-227-8922 or 1-800-342-2437. Spanish-speaking specialists are available at 1-800-344-7432 (toll-free). Staff provide referrals to free or low-cost clinics nationwide. Free educational literature about sexually transmitted infections and prevention methods is also available. More information from the CDC

about sexually transmitted infections is available at <http://www.ashastd.org/NSTD/index.html> on the Internet.

The CDC's Division of STD Prevention Web site also has information about HPV, including treatment guidelines and surveillance statistics. This Web site can be found at <http://www.cdc.gov/nchstp/dstd/dstdp.html> on the Internet.

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### **Related Resources**

#### **Publications (available at <http://cancer.gov/publications>)**

- Cancer Facts 3.13, *Oral Contraceptives and Cancer Risk*
- Cancer Facts 5.16, *The Pap Test: Questions and Answers*
- *What You Need To Know About™ Cancer of the Cervix*

### **National Cancer Institute (NCI) Resources**

#### **Cancer Information Service (toll-free)**

Telephone: 1–800–4–CANCER (1–800–422–6237)  
TTY: 1–800–332–8615

#### **Online**

NCI's Web site: <http://cancer.gov>  
*LiveHelp*, NCI's live online assistance:  
<https://cissecure.nci.nih.gov/livehelp/welcome.asp>

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