

Human Immunodeficiency Virus

What is HIV?

HIV (human immunodeficiency virus) is the **virus** that causes AIDS (acquired immunodeficiency syndrome). By killing or damaging cells of your body's immune system, HIV progressively destroys your body's ability to fight infections and certain cancers. People diagnosed with AIDS may get life-threatening diseases called **opportunistic infections**, which are caused by microbes such as viruses, **bacteria**, or **fungi**. These infections do not usually make healthy people sick. Those with HIV/AIDS are also at an increased risk of developing certain cancers, neurological disorders, and a variety of other conditions.

In the United States, more than 980,000 diagnosed cases of AIDS were reported to the Centers for Disease Control and Prevention & Treatment (CDC) between 1981 (when the first case was reported) and 2006. The CDC estimates that more than one million people in America may be infected with HIV and that as many as 250,000 of these may not know that they are infected and can pass on the virus to others.

Signs and Symptoms

HIV initially causes an **acute** illness with nonspecific or flu-like symptoms such as fatigue, headache, fever, and enlarged lymph nodes. Some people will not experience any noticeable symptoms. During this time period, the virus is present in large numbers and is carried throughout the body. HIV infects immune cells called CD4 T-cells (also called helper T cells) and slowly begins to decrease their numbers. The virus sets up house in places such as the brain and lymph nodes, where it will linger even during future drug treatment.

The patient's immune system responds to the acute HIV infection by producing **antibodies** against the virus. In most people, the initial symptoms go away after a short time period. The patient may be apparently healthy for a decade or more but behind the scenes HIV is still replicating and destroying CD4 T-cells. Eventually, the affected person's immune system is compromised to the extent that they begin having symptoms such as persistently enlarged lymph nodes, weight loss, sweating, recurrent yeast infections, fever, herpes infections, rashes, and memory loss or difficulty concentrating.

In children who are infected with HIV at or before birth, symptoms may emerge within a couple of years. They may have delayed development and be frequently ill.

When does AIDS develop?

The term AIDS applies to the most advanced stages of HIV infection. According to the CDC, AIDS is diagnosed when your **CD4 T-cell count** drops below 200 or when you have HIV and an AIDS-related illness such as **tuberculosis** or pneumonia caused by the **microorganism** *Pneumocystis jirovecii* (*carinii*). In people with AIDS, **opportunistic infections** are often severe and sometimes fatal because the immune system is so damaged by HIV that the body cannot fight off certain bacteria, viruses, fungi, and **parasites**.

Opportunistic infections common in people with AIDS cause symptoms such as:

- coughing and shortness of breath
- seizures and lack of coordination
- difficult or painful swallowing
- mental symptoms such as confusion and forgetfulness
- severe and persistent diarrhea
- fever
- vision loss
- nausea, abdominal cramps, and vomiting
- weight loss and extreme fatigue
- severe headaches
- coma.

How is HIV transmitted?

HIV is spread most commonly in these ways:

- By having sex with an infected partner. The virus can enter the body through the lining of the vagina, vulva, penis, rectum, or mouth during sex.
- Through contact with infected blood. Before blood was screened for evidence of HIV infection and before heat-treating techniques were introduced to destroy HIV in blood products, such as factor 8 and albumin, HIV was transmitted through transfusions of contaminated blood or blood components. Today, because of blood screening and heat treatment of blood derivatives, the risk of getting HIV from such transfusions is extremely small.
- By sharing needles or syringes (such as with **intravenous** injection drug abuse), which can be contaminated with very small quantities of blood from someone infected with the virus. It is rare, however, for a patient to give HIV to a health care worker or vice-versa by accidental sticks with contaminated needles or other medical instruments.
- During **pregnancy** or birth. Approximately one-quarter to one-third of all untreated pregnant women infected with HIV will pass the infection to their babies. HIV also can be spread to babies through the breast milk of mothers infected with the virus. If the mother takes the drug AZT during pregnancy, she can significantly reduce the chances that her baby will be infected with HIV. If doctors treat mothers with AZT

and deliver their babies by cesarean section, the chances of the baby being infected can be reduced to a rate of one percent.

- Having a **sexually transmitted disease** such as syphilis, genital herpes, chlamydia, gonorrhea, or **bacterial vaginosis**, which appears to make people more susceptible to and at higher risk for acquiring HIV infection during sex with infected partners.

Tests

Laboratory Tests

Testing associated with HIV/AIDS involves either measuring the affected patient's response to HIV (**antibodies**) or measuring and evaluating the virus itself. Most tests are performed using the patient's blood. The goals of HIV testing are to:

- screen for and diagnose HIV infection – confidential or anonymous testing is available for those who think they may have been exposed. Initial tests often involve testing a small sample of blood from a fingerstick or an oral sample for HIV antibodies produced by the patient's immune system. Results are often available within minutes; however, a positive screening result needs to be confirmed by another test.
- measure and monitor the amount of virus in the patient's blood (the viral load)
- evaluate and monitor the patient's immune function status
- evaluate HIV's resistance to available drug therapies

Specific tests may include:

- **HIV antibody testing**—ordered to diagnose HIV infection.
- **p24 protein testing**—may be used to detect early HIV infection and to screen blood products for HIV.
- **HIV viral load testing**—measures the quantity of HIV virus in the blood. Ordered to help decide when to start therapy and ordered at intervals to monitor the effectiveness of therapy.
- **CD4 count**—measures the number of CD4 T-cells in the blood. Ordered at intervals to determine when to start HIV therapy. Also ordered to monitor therapy, HIV progression, and the status of the immune system.
- **HIV genotypic resistance testing**—ordered to determine whether the particular strain(s) of HIV that the patient has are resistant to available antiretroviral drug therapies. Ordered when a patient is initially diagnosed to determine whether, and to which drugs, the HIV is resistant. Also ordered when treatment is initiated, changed, and when there is evidence of treatment failure.

- Phenotypic resistance testing—sometimes ordered on patients who are resistant to multiple antiretroviral drugs to help guide treatment. This test evaluates whether the patient's strain(s) of HIV can grow in various concentrations of antiretroviral drugs.

Other laboratory testing may be performed to identify and monitor the treatment of **opportunistic infections**, complications, and drug toxicities. Testing may also be ordered at intervals to evaluate the patient's state of health and organ function. Some tests are ordered to evaluate risks associated with using a specific HIV treatment. For instance, the drug abacavir can cause a potentially severe hypersensitivity reaction in some patients. Those who are planning to take the drug may be tested first for the gene **allele**, HLA-B*5701. If they are positive for it, they are at an increased risk of having a reaction and another drug should be considered.

Non-Laboratory Tests

Testing such as a chest x-ray or an imaging scan may sometimes be performed to help evaluate the patient's health status.

Prevention

There is currently no cure for HIV infection, but avoiding high-risk activities such as unprotected sex and sharing needles can prevent most cases. Routine screening for HIV antibodies has been recommended by the CDC to help identify HIV infections in those who may have no symptoms. The early diagnosis of HIV infection is important to prevent its transmission to others and to allow evaluation, monitoring, and early treatment of the affected person.

Treatment of HIV-infected mothers during **pregnancy**, precautions at birth, and avoiding breast-feeding can minimize the risk of passing the infection from mother to child.

Health care workers can protect themselves from HIV infection by following universal precautions, such as wearing gloves and avoiding needle sticks.

Treatment

The goals of HIV and AIDS treatment are to suppress viral replication to undetectable levels and to preserve the patient's immune function and health. Suppressing viral replication prevents or inhibits HIV mutation and the development of drug resistance. It slows the progression of the disease and allows the number of CD4 T-cells to increase, improving immune function. Treatment of complications and **opportunistic infections** is also important, as is addressing drug therapy side effects and toxicity.

There are two key considerations with HIV/AIDS treatment. The first is when to begin treatment and the second is which specific medications to prescribe. A Department of Health and Human Services (DHHS) Panel on Antiretroviral Guidelines for Adults and Adolescents recommends initiating treatment in a patient with HIV when the person has an AIDS-defining illness or when their **CD4 T-cell count** is less than 200 cells/mm³. They also recommend consideration of treatment for patients whose CD4 T-cell count is between 200 and 350 cells/mm³ and recommend treatment for all patients regardless of CD4 T-cell count if they:

- are pregnant
- have HIV-associated **kidney disease**
- also have a **hepatitis B** infection.

Pregnant women who do not otherwise meet treatment criteria may consider whether or not to continue drug therapy after their baby is born. In most other cases, once treatment has been started in a patient, it is important that it be consistently adhered to throughout the patient's life. Interruptions in treatment can lead to increases in the amount of virus (viral load) and can increase the risk of developing drug resistance, decrease immune function, and allow disease progression.

Drug selection

Depending on the source of their HIV infection, a person may start with a drug susceptible or resistant strain of HIV. Because HIV mutates readily as it replicates and is exposed to drug therapy, the HIV "population" that a person is infected with is mixed (heterogeneous). Without drug treatment, a drug susceptible **wild-type** of HIV generally predominates. As the patient is treated with HIV drugs, the population changes, with a decrease in the susceptible wild-type virus and an increase in drug resistant virus. In order to prevent or minimize viral replication and the emergence of drug resistant HIV, multiple drugs are combined for therapy.

There are several classes of antiretroviral drugs that are currently used to treat HIV/AIDS. Patients take at least two drugs from different classes. Combinations of three or more antiretroviral drugs are referred to as HAART (highly active antiretroviral therapy). Additional medications may be prescribed to address complications, co-infections, and drug side effects such as gastrointestinal upset. There are preferred treatment regimens, but the specific drugs given must be tailored to the individual and to the strain(s) of HIV that they are infected with. HIV drug resistance is usually evaluated when a person is first diagnosed with HIV and again prior to the initiation of treatment.

Drug therapies are then evaluated and changed as necessary if the patient experiences treatment failure – indicating the development of resistance to one or more of the drugs the person is taking, or if there are changes in the person's ability to absorb and metabolize the drug(s).

Patients with HIV/AIDS will need to work closely with their doctor(s) throughout their lifetime to adjust their medications to their changing needs. Treatment of people who have developed resistance to one or more drugs or classes of drugs can become challenging. Those affected may need to consult with doctors who specialize in the management of "treatment-experienced" patients. New HIV/AIDS drug treatments are continually being developed and brought into clinical use.