



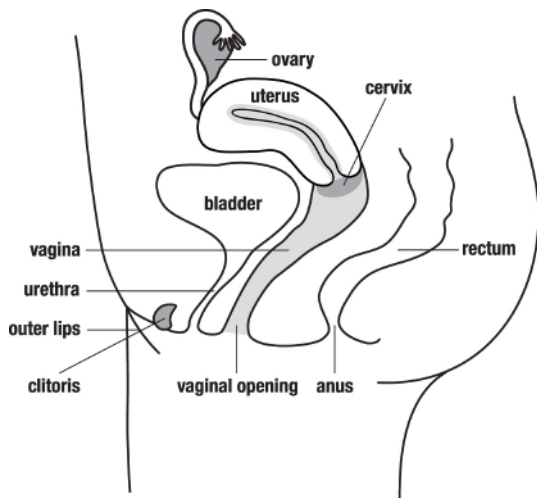
FACTSHEET

Women and the Biology of HIV Transmission

The majority of HIV infections are transmitted sexually and so most of the transmission occurs through the genital or reproductive systems of men and women. In this fact sheet we review specific biological factors in women that make it more or less likely that HIV can be sexually transmitted. This is one of a series of fact sheets about the biology of HIV transmission.

What is the female genital tract?

The female genital tract is another name for a woman's reproductive system. It includes the vagina, cervix, uterus, fallopian tubes and ovaries.



Researchers think that most HIV transmission in women happens through the vagina, the cervix and, possibly, the uterus.

Many researchers at first thought that the chance of acquiring HIV sexually through the female genital tract was quite low. However, a lot of the studies did not account for various biological and social risk factors that can make a woman more susceptible to HIV. This means that the probability of sexually transmitting and acquiring HIV in the “real world” may be a lot higher than has been estimated.

This fact sheet gives an overview of some of the biological and social factors that are thought to play an important role in determining a woman's sexual risk for HIV infection or transmission.

Why are women at greater risk of HIV?

The risk of transmitting HIV from men to women is much higher than from women to men. This is in part because of the much larger surface area of the vagina and cervix compared to the areas of the penis where transmission can happen (foreskin, urethra and small tears on the head of the penis)—see the fact sheet on HIV Transmission: an Overview.

Women are exposed to considerable amounts of seminal fluid during sex, if ejaculation occurs.

The vagina is particularly vulnerable to invasion by bacteria, viruses and other germs. It is an ideal place for bacteria to grow, as it is warm and moist. It also provides an easy entrance into the body.

Women with low levels of the hormone estrogen may be at increased risk for transmission of HIV because low estrogen levels directly affect the vaginal wall, making it thinner so HIV can more easily pass through the wall.

How does HIV get into the body through the female genital tract?

The vagina has various defence mechanisms against infection. These help to protect a potential fetus developing in the uterus.

The walls of the vagina are made up of mucous membrane that is thicker than the mucous membrane in other places where HIV transmission often happens, such as the rectum or cervix (see the fact sheet on HIV Transmission: an Overview). The walls of the vagina have ten to twelve overlapping layers of epithelial cells, which create a strong barrier against germs such as viruses and bacteria.

The vagina is also home to a number of “friendly” bacteria species (for example, Lactobacilli) which are thought to give some protection against less friendly bacteria (for example, *Gardnerella vaginalis*) as well as viruses that might infect the body.

It used to be thought that HIV can only get through the walls of the vagina

through small tears or sores in the mucous membrane. Recent research suggests that HIV can pass between or through healthy cells. This means that HIV can still infect women even if the vaginal mucous membranes are healthy and intact.

Unlike the vagina, the mucous membranes lining the cervix and uterine walls have only a very thin layer of cells (often just one layer thick) and so it is much easier for viruses like HIV to cross into the body through the cervix and possibly the uterus.

Because the cervix acts as a barrier to protect a potential fetus, it is home to a large number of immune cells. Many of those immune cells are CD4+ cells, which are the cells that HIV is most able to infect.

What factors alter a woman’s susceptibility to HIV?

The level of biological risk is not necessarily the same for every woman. A person’s risk is affected by many factors, some of which can be known and some that are difficult to measure. A woman’s risk during vaginal sex is affected by the general health of her genital tract, as well as her age and hormones. Below are some of the most common biological factors that have been shown to play a role in increasing a woman’s sexual risk of HIV infection.

Hormonal changes: Although the impact of the menstrual cycle and hormonal changes on the female genital tract is not clear, animal studies have suggested that the lining of the vagina gets thinner closer to menstruation than during other periods of a woman’s cycle. This suggests that the risk of HIV infection

over the course of her menstrual cycle may change.

Bacterial vaginosis: The vagina has many “friendly” bacteria that are thought to play a role in the health of the female genital tract. Changes in the vaginal bacteria (a decrease in good bacteria and an increase in bad bacteria) have been found to increase a woman’s risk of HIV infection by as much as 2.5 times. This alteration in the vaginal bacteria is referred to as altered vaginal flora (AVF) or bacterial vaginosis (BV). It is very common and sometimes has no symptoms, but symptoms may include abnormal discharge and a “fishy” odour.

Age: Young women, particularly below the age of 24, appear to be much more vulnerable to HIV. This is because their genital tracts are not mature and may be more prone to tears and abrasions during sexual intercourse. Women who have gone through menopause are also at a higher risk of HIV infection, because the lining of the uterus thins, and the vagina becomes drier.

Immature cervix (cervical ectopy): Up until the age of 18, a woman’s cervix is still developing. During this time, the thinner cells that line the cervix are found further down into the vagina than they are in older women. This is called “cervical ectopy” or an “immature cervix.” Since the cells lining the cervix provide a thinner and weaker barrier to HIV, young women with cervical ectopy have a much greater risk of HIV infection.

Pregnancy: Some researchers have found that pregnant women may be more at risk for HIV because of increased hormones and changes to the immune system that help protect a fetus.

Can some forms of hormonal birth control make a woman more susceptible to HIV?

There is no clear answer to this question, and research is still ongoing.

Animal studies have shown that progesterone-based contraceptives, such as Depo-Provera, seem to reduce the thickness of the vaginal lining. If this were also the case in humans, it would weaken the defensive barrier of the vagina.

However, the results of clinical studies in women are unclear. Several contradictory reports have been published about the impact of Depo-Provera on the female genital tract and increased risk of HIV infection. Some studies found it does increase the risk, and others found it does not.

Although the direct relationship between progesterone-based contraceptives and risk of HIV infection is not known, women using Depo-Provera are more at risk of acquiring other sexually transmitted infections, such as gonorrhea. Being infected with gonorrhea significantly increases a woman’s risk of HIV infection and transmission.

The use of Depo-Provera has also been linked to irregular vaginal bleeding, which may potentially increase the risk of acquiring and transmitting HIV.

What about sexually transmitted infections?

Women are at more risk for sexually transmitted infections (STIs) than men (see the fact sheet on Sexually Transmitted Infections and HIV Transmission). In addition, women often

have fewer obvious symptoms, and therefore don't get treatment until the infection has been present for a long time. Having an STI increases the risk of HIV transmission in several ways:

- All STIs cause inflammation of the mucous membrane. Inflammation is the body's immune response to an infection or irritation. When the mucous membrane is inflamed, a large number of immune cells come to the area to fight the infection.
- Many of those immune cells will be CD4+ cells or other immune cells that are involved in HIV transmission. In addition, when cells are fighting off an infection, they become activated. Activated CD4+ cells are more easily infected by HIV.
- Some STIs also cause open lesions or sores, which offer an easy way for the virus to get into the body and cause an infection.

Does vaginal douching have an effect on HIV transmission?

Some women douche or wash the vagina after or before sex.

Women use various combinations that include water, soap, lemon juice, vinegar and antiseptics. Some of the most common reasons given by women as to why they douche are to:

- clean the vagina;
- rinse away blood after their monthly periods;
- get rid of odour from the vagina;
- prevent pregnancy;
- reduce the risk of sexually transmitted infections.

Research has shown that douching is not an effective method to prevent pregnancy nor does it provide protection from sexually transmitted infections. In fact studies have shown that women who douche typically have more sexual health problems than those that do not. One reason for this may be that douching can alter or kill the "friendly" bacteria that protect the vagina. In addition, the use of antiseptic or acidic liquids such as rubbing alcohol or lemon juice can irritate the lining of the vagina and can create microscopic tears that HIV can pass through.

Key points

Women are more likely than their male partners to have STIs, which have been shown to increase HIV transmission.

Practices like douching can disrupt the natural defences of a woman's genital tract, increasing the risk of HIV transmission.

Maintaining good vaginal and reproductive health can be an important tool for reducing the risk of HIV transmission. It is a good idea to get tested regularly for STIs and bacterial vaginosis, and to find ways to practice safer sex.

Other fact sheets in this series are:

- HIV Transmission: an Overview;
- Sexually Transmitted Infections and HIV Transmission;
- HAART and HIV Transmission.

Credits

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Recommended reading

Sexual transmission

Coombs RW, Reichelderfer PS, Landay AL. Recent observations on HIV type-1 infection in the genital tract of men and women. *AIDS* 2003;17:455.

An excellent editorial review for people that want an in-depth review of the female and male genital tract. This paper goes into great detail explaining the anatomy of the female genital tract and how it relates to susceptibility to and infectiousness of HIV infection.

Quayle AJ. The innate and early immune response to pathogen challenge in the female genital tract and the pivotal role of epithelial cells. *Journal of Reproductive Immunology* 2002;57(1-2):61-79.

A review paper that discusses the biology of the female genital tract and the role various cells play in protecting against and preventing sexually transmitted infections.

Quinn TC, Wawer MJ, Sewankambo N, Serwadda D, Li C, Wabwire-Mangen F, et al. Viral load and heterosexual transmission of human immunodeficiency virus type 1. Rakai Project Study Group. *New England Journal of Medicine* 2000;342(13):921-929.

The most comprehensive large scale study looking at rates of HIV transmission between sero-discordant couples (one person in a couple is HIV positive while the other is HIV negative). One of the first studies to break down rates of transmission by blood HIV levels.

Bacterial vaginosis

Myer L, Kuhn L, Stein ZA, Wright TC Jr, Denny L. Intravaginal practices, bacterial vaginosis, and women's susceptibility to HIV infection: epidemiological evidence and biological mechanisms. *Lancet Infectious Disease* 2003;5(12):786-794.

This article describes factors, both biological and social, that may increase a woman's susceptibility to HIV.

Hormonal contraceptives

Hild-Petito S, Veazey RS, Larner JM, Reel JR, Blye RP. Effects of two progestin-only contraceptives, Depo-Provera and Norplant-II, on the vaginal epithelium of rhesus monkeys. *AIDS Research and Human Retroviruses* 1998;1:S125-S130.

This study examines the risk of progesterone contraceptives on the vaginal epithelium in an animal model. The authors found that the use of progesterone contraceptives was associated with significant thinning of the vaginal epithelium.

Kaul R, Kimani J, Nagelkerke NJ, Fonck K, Ngugi EN, Keli F, et al; Kibera HIV Study Group. Monthly antibiotic chemoprophylaxis and incidence of sexually transmitted infections and HIV-1 infection in Kenyan sex workers: a randomized controlled trial. *Journal of the American Medical Association* 2004; 291(21): 2555-2562.

A study done initially to investigate the impact that treating sexually transmitted infections would have on HIV acquisition in Kenyan sex workers. The study found that herpes simplex virus-2 was associated with an increased risk of acquiring HIV.

Sexually transmitted infections

Donovan B. Sexually transmissible infections other than HIV. *Lancet* 2004;363:545-556.

A review article highlighting the most prevalent sexually transmitted infections. A great read for people that want to know about what's out there and what symptoms to look for, along with some information on treatment options.

Corbett EL, Steketee RW, Kuile FO, Latif AS, Kamali A, Hayes RJ. HIV-1/AIDS and the control of other infectious diseases in Africa. *Lancet* 2002; 359:2177-2187.

This paper provides an overview of HIV/AIDS in Africa. It gives a comprehensive review of HIV and other major diseases including malaria, tuberculosis and various STIs. It describes the impact of the high prevalence of untreated STIs and their role in the spread of HIV-1.

Fenton K, Breban R, Vardavas R, Okano J, Martin T, Aral S, Blower S. Infectious syphilis in high-income settings in the 21st century. *Lancet Infectious Diseases* 2008;8(4):244-253.

A recent review providing an outline of the current state of syphilis in developed high-income countries. A look into social and biological aspects underpinning for the recent resurgence of syphilis.

Additional resource

The Canadian AIDS Society's HIV Transmission—Guidelines for assessing risk: a resource for educators, counsellors and health care professionals (2005) is available from the CATIE Ordering Centre (<http://orders.catie.ca>).

Disclaimer

Decisions about particular medical treatments should always be made in consultation with a qualified medical practitioner knowledgeable about HIV-related illness and the treatments in question.

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