



Canada's source for
HIV and hepatitis C
information

La source canadienne
de renseignements sur
le VIH et l'hépatite C

From *HIV in Canada: A primer for service providers*

Biology of Sexual Transmission of HIV

Key Points

- For sexual HIV transmission to occur there are three necessary components: fluid, route, and activity.
- Not all exposures to HIV lead to infection because of the body's mucosal defences.
- Several factors can affect the biological risk of HIV transmission.

For sexual HIV transmission to occur there are three necessary components: fluid, route, and activity. There needs to be a fluid from a person living with HIV that contains enough HIV to cause infection, a route within an HIV-negative person that HIV can use to enter that person's body and an activity that brings the fluid and route together.

The fluids most commonly involved in the sexual transmission of HIV are: semen, pre-ejaculate or pre-cum, vaginal fluid and rectal fluid. The routes that are involved in the sexual transmission of HIV include the mucous membranes of the mouth and throat, vagina and cervix, urethra and foreskin, and the rectum. The activities that bring the fluid and route together during the sexual transmission of HIV include vaginal, anal, and oral sex.

After a sexual fluid containing HIV comes into contact with a mucous membrane, the virus must overcome the protective defences of the mucous membrane before it is able to spread throughout the body to cause a permanent infection. HIV cannot always overcome the mucosal defences and therefore an exposure does not always lead to infection.

The mucous membranes have several protective defences, including mucous (a slimy substance that covers the membrane, which can trap and kill germs), an epithelial cell layer (a tight layer of cells that can prevent germs from entering the body), and immune cells, which can fight and clear germs that enter the body. For HIV to cause infection after an exposure, it must pass the mucous and epithelial cell layer and replicate for one to three days in the mucous membrane tissue without being cleared by immune cells. If the virus can replicate for a sufficient period of time, it is then able to spread from the initial site of replication to other parts of the body and cause a permanent infection.

The amount of HIV in the fluid to which an individual is exposed may be the most important factor determining whether transmission occurs. This is known as the viral load. A higher viral load can increase the risk of HIV transmission.

Tearing and/or inflammation can also increase the risk for HIV transmission. Tearing can allow HIV to pass the epithelial cell layer and enter the body more easily. Inflammation can increase the concentration of immune cells in the mucous membranes of the oral, genital and rectal tissues. These immune cells can serve as target cells that help HIV pass the epithelial cell layer and allow for faster replication once the virus enters the mucous membrane tissue.

Tearing and/or inflammation can happen as a result of irritation, friction, douching/enemas, brushing teeth/flossing, spermicides, vaginal conditions (such as bacterial vaginosis or yeast infections), and sexually transmitted infections (STIs). While tearing and inflammation can increase risk, HIV is able to pass through the epithelial cell layer even if no tearing or inflammation is present.

It has been suggested that hormonal changes resulting from the use of hormonal contraceptives or from pregnancy and the hormonal changes associated with the menstrual cycle may increase the risk of HIV transmission, but the evidence is inconclusive. Several mechanisms have been suggested for how hormonal changes may increase the risk of HIV infection, including thinning of the cervical and vaginal lining and increasing the number of HIV target cells at the vagina and cervix.

This improved understanding of the biology of HIV transmission and factors that increase risk has led to the development of new [biomedical HIV prevention interventions](#). These reduce the risk of HIV transmission by mitigating factors that increase risk, by maintaining the mucosal defences or by intervening in the steps that HIV must complete to cause infection.

Resources

[From exposure to infection: The biology of HIV transmission](#) - *Prevention in Focus*

[HIV and the female genital tract - what does it mean for HIV prevention?](#) - *Prevention in Focus*

Sources

1. Zuckerman RA, Whittington WLH, Celum CL et al. Higher concentration of HIV RNA in rectal mucosa secretions than in blood and seminal plasma, among men who have sex with men, independent of antiretroviral therapy. *Journal of Infectious Diseases* . 2004 Jul 1;190(1):156-61.
 2. Fox J, Fidler S. Sexual transmission of HIV-1. *Antiviral Research* . 2010 Jan;85(1):276-85.
 3. Haase AT. Early events in sexual transmission of HIV and SIV and opportunities for interventions. *Annual Review of Medicine*. 2011 Feb 18;62:127-39.
 4. Hladik F, Doncel GF. Preventing mucosal HIV transmission with topical microbicides: Challenges and opportunities. *Antiviral Research* . 2010 Dec;88 (Supplement 1):S3-9.
 5. Wilton J. From exposure to infection. The biology of HIV infection. *Prevention in Focus* . Fall 2011. Available from: <http://www.catie.ca/en/pif/fall-2011/exposure-infection-biology-hiv-transmission>
- [Per-act Risk of Sexual HIV Transmission](#)

Produced By:



Canada's source for
HIV and hepatitis C
information

555 Richmond Street West, Suite 505, Box 1104
Toronto, Ontario M5V 3B1 Canada
Phone: 416.203.7122
Toll-free: 1.800.263.1638
Fax: 416.203.8284
www.catie.ca
Charitable registration number: 13225 8740 RR

Disclaimer

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

CATIE provides information resources to help people living with HIV and/or hepatitis C who wish to manage their own health care in partnership with their care providers. Information accessed through or published or provided by CATIE, however, is not to be considered medical advice. We do not recommend or advocate particular treatments and we urge users to consult as broad a range of sources as possible. We strongly urge users to consult with a qualified medical practitioner prior to undertaking any decision, use or action of a medical nature.

CATIE endeavours to provide the most up-to-date and accurate information at the time of publication. However, information changes and users are encouraged to ensure they have the most current information. Users relying solely on this information do so entirely at their own risk. Neither CATIE nor any of its partners or funders, nor any of their employees, directors, officers or volunteers may be held liable for damages of any kind that may result from the use or misuse of any such information. Any opinions expressed herein or in any article or publication accessed or published or provided by CATIE may not reflect the policies or opinions of CATIE or any partners or funders.

Information on safer drug use is presented as a public health service to help people make healthier choices to reduce the spread of HIV, viral hepatitis and other infections. It is not intended to encourage or promote the use or possession of illegal drugs.

Permission to Reproduce

This document is copyrighted. It may be reprinted and distributed in its entirety for non-commercial purposes without prior permission, but permission must be obtained to edit its content. The following credit must appear on any reprint: *This information was provided by CATIE (the Canadian AIDS Treatment Information Exchange). For more information, contact CATIE at 1.800.263.1638.*

© CATIE

Production of this content has been made possible through a financial contribution from the Public Health Agency of Canada.

Available online at:
<http://www.catie.ca/en/hiv-canada/4/4-2/4-2-1/4-2-1-1>