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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 natural defences.
- Several biological factors can affect the risk of sexual 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 (including pre-ejaculate or pre-cum), vaginal fluid and rectal fluid.

The routes that can be involved in the sexual transmission of HIV include the mucous membranes of the vagina and cervix, urethra and foreskin, the rectum, and the mouth and throat.

Activities that can bring the fluid and route together during the sexual transmission of HIV include vaginal, anal and oral sex.

When a sexual fluid containing HIV comes into contact with the mucous membrane of an HIV-negative person, the virus must overcome the defences of the mucous membrane before it is able to spread throughout the body and cause a permanent infection. These natural defences include mucus (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 first pass through the mucous and epithelial cell layer. Once in the tissue, HIV needs to infect the immune cells and replicate for one to three days without being cleared by the immune system. 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. HIV cannot always overcome the mucosal defences and therefore an exposure does not always lead to infection.

There are several biological factors that can increase the risk of HIV transmission if an exposure occurs, including:

- A high amount of HIV in the sexual fluid. The viral load is the most important factor determining whether transmission occurs. The higher the viral load, the greater the risk of HIV transmission.
- Damage to the epithelial cell layer of a mucous membrane. Damage to the genital, rectal and oral mucous membranes of an HIV-negative person makes it easier for HIV to cross into the tissue of an HIV-negative person. Damage can be caused in a variety of ways including STIs and friction during sex.
- Inflammation. Inflammation can increase the concentration of immune cells in the mucous membranes, which then serve as target cells for HIV to infect and replicate within.
- Certain hormonal changes may also increase the risk of HIV transmission, but the evidence is inconclusive.

An 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 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*

## Sources

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- [Per-act Risk of Sexual HIV Transmission](#)

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