

HIV viral load, HIV treatment and sexual HIV transmission

Summary

HIV viral load is the amount of HIV (or number of virus) in the bodily fluids of someone living with HIV. It is measured in the blood as part of routine clinical care. A higher viral load is associated with a higher risk of HIV transmission. Research shows that successful HIV treatment can reduce the viral load to “undetectable” levels and this can significantly reduce the risk of HIV transmission. However, HIV transmission may be possible when the viral load is undetectable because there is still virus present in the blood and other bodily fluids. The risk of HIV transmission for someone taking antiretroviral treatment may increase if sexually transmitted infections (STIs) are present, doses of medications are missed, or drug resistance develops. This risk may also be higher for receptive anal sex (where the HIV-negative partner is the receptive partner, or bottom) than for other types of sex.

What is viral load and how is it affected by HIV treatment?

HIV viral load is the number of copies of HIV in the bodily fluids of someone living with HIV. It is measured as the number of copies of the virus in one millilitre of fluid (copies/ml). Viral load is measured in the blood to monitor the progression of HIV infection and the success of HIV treatment. It is not commonly measured in other bodily fluids, such as semen, vaginal fluid or rectal fluid.

HIV treatment consists of a combination of at least three drugs that are taken daily. The goal of HIV treatment is to reduce the production (also called replication) of HIV,

raise levels of CD4 T-cells, and slow disease progression. HIV treatment is also called highly active antiretroviral treatment (HAART) or antiretroviral therapy (ART).

With successful HIV treatment, the viral load can become very low or “undetectable” in the blood and other bodily fluids.

What is a “normal” viral load?

There is no such thing as a “normal” viral load. The viral load in the bodily fluids can change as a result of several factors, such as the stage of HIV infection and HIV treatment.

During the first few weeks after becoming infected with HIV, the viral load in the blood

and other bodily fluids is very high. At this stage of HIV infection, known as the acute infection stage, the viral load can reach levels higher than 1 million copies/ml.

The acute HIV infection stage only lasts for a few weeks and then the chronic stage of HIV infection begins. During the chronic stage, the viral load begins to decrease and - after a few months - the viral load stabilizes at a lower level.

If HIV treatment is started, the viral load can be reduced to “undetectable” levels in the blood and other bodily fluids within a few months. However, if doses of medications are missed or HIV develops resistance to treatment, then the viral load will increase.

What does it mean to have an “undetectable” blood viral load?

“Undetectable” means that the number of virus in the blood is below the limit that viral load tests can detect. Viral load tests used in Canada cannot detect HIV in the blood if there are less than 40-50 copies/ml. Therefore, an undetectable viral load means the amount of virus in the blood is too low to detect, it does not mean that there is no virus present.

Is the viral load in the blood associated with a person’s risk of transmitting HIV?

Research shows that a lower amount of virus in the blood is usually associated with a lower risk of transmitting HIV to others, and a higher viral load is associated with a higher risk.

The amount of virus in the blood is usually correlated with the viral load in the semen, vaginal fluid and rectal fluid (the fluids commonly involved in the sexual transmission of HIV). This means that when the viral load in the blood decreases, it generally also decreases in the other fluids.

However, the viral load in the different bodily fluids can sometimes be different. For example, the viral load in the semen, vaginal

fluid or rectal fluid can sometimes be higher than the viral load in the blood.

Does HIV treatment reduce the risk of sexual transmission of HIV?

Successful antiretroviral treatment can lower the viral load in the blood and other bodily fluids to undetectable levels and this can significantly reduce the risk of sexual HIV transmission.

A randomized controlled study known as HPTN 052 found that early HIV treatment reduced the risk of HIV transmission between serodiscordant *heterosexual* couples by 96% (equivalent to a 25-fold reduction in risk). A serodiscordant couple is where one partner is HIV-positive and the other is HIV-negative.

Couples in the HPTN 052 study were mostly *heterosexual*, mostly reported having vaginal sex, and were provided with regular adherence counselling, viral load tests, testing and treatment for sexually transmitted infections (STIs), and prevention counselling and free condoms. Therefore, this study demonstrated the effectiveness of treatment in reducing the risk of HIV transmission through vaginal sex when pills are taken regularly, viral load and drug resistance are monitored, and STIs are managed. Antiretroviral treatment may be much less effective than 96% when these conditions are not met.

A preliminary analysis of an ongoing study of gay male serodiscordant couples (known as the PARTNER study) found that treatment can significantly reduce the risk of HIV transmission through anal sex. This risk reduction was similar to the reduction in risk for vaginal sex observed in the HPTN 052 study. Similar to participants in the HPTN 052 study, couples in the PARTNER study were engaged in regular HIV care, received STI testing on an ongoing basis, and took their pills regularly.

Is HIV transmission possible when the viral load in the blood is undetectable?

Although the risk of sexual HIV transmission is significantly reduced when the viral load is undetectable, the risk of HIV transmission may not be eliminated.

Many people who have an undetectable viral load in the blood also have an undetectable viral load in other bodily fluids. However, undetectable does not mean that there is no virus, only that the amount of virus is below the limits that tests can detect. Therefore, HIV transmission may still be possible because low levels of virus are present.

Also, it is possible for people who have an undetectable viral load in the blood to sometimes have detectable (although lowered) levels of virus in their other bodily fluids. A higher level of HIV in the semen, vaginal fluid and rectal fluid may increase the risk of transmission when the blood viral load is undetectable. However, it is unclear how often this happens and how significant it is in terms of HIV transmission. Research shows it may be more common if a person has an STI, but it can also happen in the absence of STIs.

What is the risk of HIV transmission when the blood viral load is undetectable?

Although we know having an undetectable blood viral load can greatly reduce the risk of HIV transmission, it is unclear exactly what this risk is reduced to.

Also, the risk of HIV transmission when the viral load is undetectable may not be the same for all types of sex. This risk may be higher for receptive anal sex (where the HIV-negative person is the receptive partner) than for other types of sex. This is because receptive anal sex carries a higher baseline HIV risk than other types of sex (when the viral load is detectable).

In the research of serodiscordant couples conducted so far, there have been no recorded HIV transmissions where the HIV-positive partner is on treatment and has an undetectable blood viral load. However, in most of these studies, the majority of couples were heterosexual and reported using condoms most of the time. This makes it difficult to determine the risk of HIV transmission when no condom is used.

There are ongoing studies following serodiscordant heterosexual and same-sex male couples who are taking HIV treatment, have an undetectable viral load, and do *not* always use condoms. These studies will provide a better understanding of the risk of HIV transmission through vaginal and anal sex when the viral load is undetectable and no condom is used.

A preliminary analysis of one of these studies (known as the PARTNER study) included information on 485 heterosexual and 282 same-sex male couples who engaged in over 44,000 condomless sex acts when the viral load was undetectable (including 13,728 receptive vaginal sex acts; 14,295 insertive vaginal sex acts; 7,738 receptive anal sex acts; and 11,749 insertive anal sex acts). Despite this large number of sex acts, no HIV transmissions occurred. It was estimated that 15 HIV infections in heterosexual couples and 86 among same-sex male couples would have been expected if the HIV-positive partner had *not* had an undetectable viral load.

The PARTNER study results were the first to provide direct evidence that an undetectable viral load significantly reduces the risk of HIV transmission through anal sex. However, it was not possible for the PARTNER study to conclude that the risk of HIV transmission is zero or rule out the possibility that this risk is higher through receptive anal sex compared to other types of sex (when the viral load is undetectable). The study is continuing in order to reduce the uncertainty associated with these risk estimates.

While these studies have been encouraging it is important to note that there have been two case reports in the published literature of HIV transmission occurring between gay male couples when the HIV-positive partner had an undetectable viral load. However, it is difficult to know for certain whether the viral load was undetectable at the time of HIV transmission.

What does this all mean for people who want to use HIV treatment to prevent HIV transmission?

Treatment can significantly reduce the risk of HIV transmission. However, there may still be a risk of HIV transmission when the viral load is undetectable and this risk may be higher for receptive anal sex or when STIs are present. Below are key messages for those who want to use HIV treatment to reduce their risk of HIV transmission:

- Check to make sure the blood viral load is undetectable before starting this approach and get frequent viral load tests to ensure it remains undetectable while using this strategy. It is generally recommended that the viral load be undetectable for 6 months before using this approach.
- Take pills exactly as prescribed. Adherence to treatment is critical to keep the viral load undetectable in the blood and prevent the development of drug resistance.
- Get tested regularly for STIs (including, syphilis, gonorrhoea, chlamydia and herpes). STIs in either partner may increase the risk of HIV transmission when the viral load is undetectable. If either partner has an STI, start treatment for the STI immediately and consider avoiding condomless sex during this time.
- Ask your doctor about vaccinations for hepatitis A, hepatitis B and human papilloma virus (HPV).

- Using other HIV prevention strategies as much as possible - particularly condoms and lube - will help reduce the overall risk of HIV transmission.

Resources

Community consensus statement on the use of antiretroviral therapy in preventing HIV transmission - European AIDS Treatment Group, NAM

Quebec consensus statement (French only)

Quebec consensus statement: Executive summary

Canadian consensus statement on HIV and its transmission in the context of criminal law

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