

# Factsheet Do condoms work?

## Key points

- Laboratory testing shows that condoms are impermeable to viruses, but protection rates are lower in real-world studies.
- Condoms can only protect against HIV and other sexually transmitted infections (STIs) if used correctly.
- Protection rates can be significantly improved by combining condoms with other forms of prevention.



Studies show that if used correctly, condoms offer strong protection against HIV, as well as having the added benefit of reducing the risk of other STIs. To best protect against HIV they can be used in combination with other prevention methods such as [pre-exposure prophylaxis \(PrEP\)](#) or an [undetectable viral load](#).

[You can read an overview of condoms here.](#)

Laboratory studies and product testing have shown that reputable condoms tested in the laboratory are completely impermeable to micro-organisms as small as viruses. The British Association for Sexual Health and HIV say that it is reasonable to suggest that the effectiveness of condoms against HIV *when used reliably and consistently* may be over 95%.

However, this is based on condoms being used as recommended. How well do condoms actually work in preventing HIV in the real world?

Producing an accurate estimate is difficult for researchers. One reason for this is that they rely on study participants accurately reporting their use of condoms, frequency of sex and the HIV status of their sexual partners. People may not be entirely honest about such issues if they fear judgement from researchers, which will skew results. For example, if people who occasionally use condoms tell researchers that they always use them, results for “consistent condom users” will include data from people who are actually inconsistent users. These individuals are more likely to acquire HIV and condom effectiveness will be underestimated.

## Do condoms protect against HIV when used by gay couples?

Two recent analyses are worth highlighting. In 2015, Dr Dawn Smith and three other researchers from the Centers for Disease Control and Prevention (CDC) looked at anal sex between men by analysing the results of two studies conducted in the USA: VAX 004 (a study of 4492 men between 1998 and 1999) and EXPLORE (a study of 3233 men between 1999 and 2001). Both studies, conducted before the introduction of PrEP, recruited HIV-negative men who reported having sex with at least one HIV-positive partner.

Analysis found that among those who reported consistently using condoms (i.e. 100% of the time), condoms prevented 70% of HIV infections.

However, for those who reported only “sometimes” using condoms, the studies showed that there was “minimal or no protection” from HIV, with just 8% of HIV infections prevented. Consistent use is challenging for many people: only 16% of men across the two studies reported always using condoms with all sexual partners over the year or more they provided data.

While condomless sex with an HIV-positive top (insertive partner) is more risky than condomless sex with an HIV-positive bottom (receptive partner), in this study infection rates were not statistically different between receptive and insertive partners.

In 2018, Dr Wayne Johnson and colleagues, also from the CDC, published a new analysis with different findings. The researchers conducted a new meta-analysis of four studies: the two previously mentioned studies as well as JUMP-START and the HIVNET vaccine preparedness study, each conducted in the mid-1990s. Data were included on a total of 3262 participants (different inclusion and exclusion criteria were used from the previous analysis). As with the previous paper, the studies relied on the self-reporting of condom use.

Johnson found that the headline 70% figure outlined in Smith’s 2015 study may in fact be an underestimate. He estimated that, if consistently used, condoms prevent 92% of HIV infections in anal sex between men.

Why, then, is this higher than the previous 2015 estimate? Firstly, the 2018 paper analysed condom efficacy across four different studies, whereas the previous estimate resulted from analysis of just two. However, the researchers argue that the key difference between the two studies can be explained by differing methodologies.

While the 2015 estimate is based on condom efficacy per sex act, the 2018 estimate is based on efficacy per number of partners. They calculated the risk *per extra partner* of HIV infection in people sometimes or never using condoms for receptive anal sex, compared to people who always used them. The per-partner risk in people who sometimes or never used condoms was 83% (i.e. for every additional partner with HIV they had condomless receptive sex with, their risk of HIV infection rose by 83%). In people who always used condoms, it only rose by 7.3%. This leads to the headline condom efficacy of 92%.

Analysis by number of partners, rather than by number of sex acts, may be a more reliable guide to risk because in cases where there are multiple sex acts between one couple, the risk of transmission tends to go down with time. This may be because an HIV-positive partner with a

high viral load is likely to transmit in the first few months of a relationship, while a partner with a low viral load may never transmit HIV. Because there is less risk of infection as time goes on, the risk of not using condoms also diminishes over time – and so, therefore, does their apparent efficacy. On the other hand, if someone continues having sex with multiple partners, their infection risk does not diminish over time because their chances of encountering someone with a high viral load stays constant – as does the efficacy of condoms.

## Do condoms protect against HIV when used by heterosexual couples?

Foteini Giannou and a group of European researchers [published a meta-analysis in 2016](#) that examined 25 studies that recruited a total of 10,676 couples with one HIV-positive and one HIV-negative partner. These studies were done in a range of countries between 1987 and 2013. They found that consistent condom users were 71 to 77% less likely than never or intermittent users to acquire HIV following repeated encounters with the same partner. This is a slightly lower level of protection to that found by [an earlier meta-analysis](#), which reviewed many but not all of the same studies, and found that consistent condom use afforded an 80% reduction in HIV incidence.

In the 2016 review, the protective effect of consistent condom use was slightly greater when the male rather than the female partner was HIV positive. There was also geographic variability, with much greater levels of protection reported in two Asian studies than in eleven studies conducted in North and South America. The researchers comment that this raises questions about social, cultural, biological or methodological differences that are not fully understood. For example, study participants in the USA may be more likely to engage in anal (as well as vaginal) sex, which carries a much greater risk of HIV transmission. Some researchers may have been more able to elicit accurate reports of participants' sexual behaviour than others. Due to genetic differences, there could be geographic variations in susceptibility to HIV.

The evidence therefore shows that while condoms are highly effective against HIV transmission under laboratory conditions, unsurprisingly in the real-world they are not always used perfectly. This lowers protection levels for both heterosexual and gay couples. It's therefore worth taking a closer look at ineffective and incorrect use of condoms.

## Mistakes using condoms

Condoms are much less effective if they're used incorrectly. Condom use errors (which include breakage, slippage and incomplete use) occur in up to 40% of sexual encounters.

In 2012, Dr Stephanie Sanders of the Kinsey Institute and colleagues published [an analysis of 50 studies concerning condom use in 14 countries](#). This revealed that between 17 and 51% of people asked said they had put on a condom partway through intercourse. In total, between 1.5 and 25% of sexual experiences involved putting a condom on too late in the process of intercourse. This negates the protective benefits of condoms, since fluids are exchanged throughout intercourse and not just during ejaculation.

The other most common mistakes when using condoms included:

- **Early removal:** Between 14 and 45% of individuals in the studies had taken a condom off before intercourse was over. Other studies found that early removal happens in between 1 and 27% of sexual encounters.
- **Unrolling a condom before putting it on:** Between 2 and 25% of people reported completely unrolling a condom before putting it on.
- **No space at the tip:** Failing to leave a reservoir for semen was reported by between 24 and 46% of respondents.
- **Failing to remove air:** Almost half (48%) of women and 42% of men reported sexual encounters in which air wasn't squeezed from the tip of the condom.
- **Inside-out condoms:** Between 4 and 30% of people reported rolling on a condom inside out and then flipping it the other way around, potentially exposing their partner to bodily fluids.

Avoiding such mistakes is important to prevent condom breakage and ensure that you are best protected against HIV transmission. For a step-by-step guide on how to use condoms correctly, [read our factsheet](#).

## How often do condoms break?

Figures for the frequency of condoms breaking, slipping off or leaking vary widely between studies. In Sanders' review (mentioned above), between 0.8 and 41% of participants had *ever* experienced a condom breaking. While a few studies report much higher rates, the breakage rate *per sexual act* in most studies was between 0 and 4%.

For example, a recent American [study of 8603 men who have sex with men](#) found that 4% of participants reported a condom breaking the last time they used one. There was no difference between men reporting receptive or insertive sex, but younger men, men who had more sexual partners and men who were 'high' when they had sex were more likely to experience a breakage.

Up to a third of men report problems with the fit and feel of condoms, which are in turn [associated with condoms breaking or slipping off](#). Choosing a condom that is an appropriate size for the penis reduces the risk of breakage.

## Condoms in combination with PrEP or undetectable viral load

Condoms work most effectively if they are combined with other forms of prevention.

A 2015 modelling [study](#) found that African-American men who have sex with men who always use condoms and who take PrEP on 90% of days would have an estimated 92% lower HIV risk than those who never use condoms or PrEP. This study assumed that consistent condom use prevents 70% of infections, as in Dawn Smith's study. We are not aware of similar studies in other populations.

In a person living with HIV, effective HIV treatment that maintains an undetectable viral load is a more effective form of HIV prevention than consistent condom use. The risk of HIV transmission is zero. However, condoms provide additional benefits in terms of preventing sexually transmitted infections and unwanted pregnancy.

## References

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