

Using antibiotics to prevent STIs

This research briefing explores the use of antibiotics to prevent sexually transmitted infections (STIs). This self-management approach to sexual health has been used informally for some time, especially by some gay and bisexual men. There is currently a renewed interest in better understanding if antibiotics can and should be used in this way – and what the potential drawbacks to this approach might be – in an era of declining condom use, HIV pre-exposure prophylaxis (PrEP) and rising rates of bacterial STIs.

This technical briefing is based on research that has been carried out with cisgender men who have sex with men (MSM) and transgender women. There is a lack of research in this area with other groups.

It is important to keep in mind that there are currently no clinical guidelines for using antibiotics in this way. The British Association for Sexual Health and HIV (BASHH) state that “the use of antibiotics as STI prophylaxis is not recommended by any national professional organisation because of concerns of antimicrobial resistance in STI and non-STI organisms. Use of antibiotics in this way is off-label and not supported by any guidelines.”

What is STI prophylaxis?

STI prophylaxis involves taking an antibiotic pill to **prevent** bacterial STIs, such as syphilis and chlamydia. One approach would be to take a daily dose of the antibiotic – this would be considered **pre-exposure prophylaxis** (STI PrEP), meaning that there may be enough of the antibiotic in the body before exposure occurs. Another way would be to take a dose soon after sex. In this case, the antibiotic would work as a form of **post-exposure prophylaxis** (STI PEP) – preventing bacterial growth and making it less likely for exposure to lead to infection.

This briefing focuses specifically on using antibiotics to prevent bacterial STIs, which is still an experimental technique. It is not to be confused with HIV PrEP and PEP, which are effective forms of preventing HIV, as outlined below.

	Medication	Does it prevent HIV?	Does it prevent bacterial STIs?
STI pre-exposure prophylaxis (STI PrEP or doxyPrEP)	Doxycycline (antibiotic)	No	Research ongoing, but may work well against chlamydia and syphilis, and possibly to some extent, gonorrhoea
STI post-exposure prophylaxis (STI PEP or doxyPEP)	Doxycycline (antibiotic)	No	Effective in two studies; other research is ongoing. Works against chlamydia and syphilis, and possibly to some extent, gonorrhoea
HIV pre-exposure prophylaxis (HIV PrEP)	Tenofovir/emtricitabine (two antiretrovirals)	Yes	No
HIV post-exposure prophylaxis (HIV PEP)	Raltegravir/tenofovir/ emtricitabine (three antiretrovirals)	Yes	No

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Does taking antibiotics to prevent STIs work?

While there is very limited research on the topic, some findings support the concept of using an antibiotic called doxycycline preventatively among MSM and trans women.

Doxycycline prevents bacteria from reproducing and effectively treats various bacterial infections, including pneumonia, gum disease, skin infections and some STIs. Doxycycline is also used to prevent malaria infection. There is no evidence to suggest that using **any** other antibiotics than doxycycline would prevent STIs.

Research has largely been carried out with MSM who have multiple sexual partners and don't use condoms, as they represent one of the groups at highest risk for recurrent bacterial STIs.

A small US pilot study conducted by Bolan and colleagues in 2015 randomised 30 gay men living with HIV, who had had syphilis twice or more since their HIV diagnosis, to one of two groups. Men who took 100mg of doxycycline by mouth daily were 73% less likely to test positive for gonorrhoea, chlamydia or syphilis during 48 weeks of follow-up, compared to men who had been provided with monetary incentives to remain STI free. There was no significant difference in reported risk behaviours between the two groups. This is an example of doxycycline pre-exposure prophylaxis, or doxyPrEP.

On a larger scale, evidence of doxycycline used after sex comes from a French trial by Molina and colleagues from 2017 with 232 men. Gay men taking PrEP for HIV, and at a high risk for contracting bacterial STIs, were randomised to two groups. Those in the experimental group were instructed to take a 200mg doxycycline dose (two 100mg pills) within 24 hours after sex (and no later than 72 hours after) – this would work as doxycycline post-exposure prophylaxis, or doxyPEP. The men could take up to a maximum of six pills per week. Men allocated to the other group did not take any antibiotics.

Over a follow-up period of around nine months, there were 47% fewer infections with one of the three main bacterial STIs (syphilis, chlamydia and gonorrhoea) in the men taking doxycycline. While the antibiotic had no effect on gonorrhoea, with similar numbers of infection between both groups, there were 70% fewer chlamydia infections and 73% fewer syphilis infections in the men taking doxycycline when compared to those not taking it.

The gonorrhoea finding was not surprising: around half of the French and two-thirds of the UK strains of gonorrhoea, and around a quarter of those in the US, are resistant to tetracycline antibiotics (doxycycline belongs to this class). However, these antibiotics are not usually used in the treatment of gonorrhoea because of the high rates of resistance (see section on **What about resistance?**).

A second large study showing the effectiveness of doxyPEP from the US by Luetkemeyer and colleagues reported results in July 2022. The same doses of doxycycline after sex were taken as in the French study. A total of 501 MSM and trans women living in San Francisco and Seattle, who were either living with HIV (174), or taking HIV PrEP (327), were randomised to either take doxyPEP or to not receive any antibiotics. As with the French study, the participants were at a higher risk of contracting bacterial STIs, with just under half of the group reporting either gonorrhoea, chlamydia or syphilis in the past year. Participants were tested for STIs every three months.

Overall, there was a 65% reduction in the incidence of all STIs per quarter in both those living with HIV and those taking HIV PrEP. In fact, the study was stopped a year early because of the high effectiveness, with a recommendation for participants in the control groups to receive doxyPEP too.

In terms of specific STIs, doxycycline worked well to prevent chlamydia, syphilis **and** gonorrhoea, unlike in the French study. For people living with HIV, there was a 74% reduction in chlamydia, 77% reduction in syphilis and 57% reduction in gonorrhoea. For people taking HIV PrEP, there was an 88% reduction in chlamydia, 87% reduction in syphilis and 55% reduction in gonorrhoea. One of the possible reasons for the gonorrhoea finding is that tetracycline resistance in gonorrhoea is not as widespread in the US as it is in France or the UK.

While two studies have showed positive results for doxyPEP (taking the medication after sex), there is a lack of data on doxyPrEP (daily dosing). While the efficacy of doxyPEP is promising, larger studies with longer follow-up are needed to understand the impact on rates of resistance. Additionally, efficacy for specific sexual acts (oral vs anal) is unclear. Several studies addressing these issues are currently underway in Canada, Australia, France and Kenya.

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Why guidelines don't recommend this, yet

In most instances, healthcare professionals treat STIs based either on symptoms, the results of laboratory tests, or both. As STIs don't always have symptoms (but could still cause long-term damage or complications), it is recommended that people who have sex that puts them at risk test frequently and treat any STIs as soon as they are detected. It is also important to make sure that recent partners are treated.

Taking antibiotics prophylactically (to prevent STIs **before** any symptoms or testing positive) is not recommended yet, mainly due to major concerns about the development of antimicrobial resistance. Taking a drug and then (despite prophylaxis) catching an infection that easily develops resistance to it could further raise rates of resistance to that drug in the wider community. Resistance means that medications that were once effective at treating certain bacterial infections lose their ability to do so. Essentially, the bacterium outsmarts the medication, rendering it ineffective.

Resistant strains circulate within the population, resulting in the failure of treatments that had previously worked – even in people not using antibiotics to prevent STIs. Gonorrhoea has evaded multiple classes of antibiotics, and few options remain available. Most recently, it has become resistant to azithromycin and therefore, this antibiotic is no longer recommended for treatment.

There is a danger of running out of antibiotics that work to treat a resistant strain; this complicates treatment and could negatively impact upon health outcomes. Resistance is a concern both for bacteria that cause STIs and other common infections.

However, when it comes to using specific antibiotics to prevent specific STIs, it's not all bad news – see more under **What about resistance?**

Who could benefit from using antibiotics for STI prophylaxis?

People at the highest risk of contracting bacterial STIs, especially those who may be at risk for repeated infections, might benefit from STI prophylaxis. This includes people who do not use condoms consistently, or at all, have multiple sexual partners and have had bacterial STIs in the past.

Bacterial STI prophylaxis can be taken regardless of HIV status. Many individuals who are HIV negative and on HIV PrEP use condoms less frequently or have stopped using them altogether. Similarly, some who are living with HIV also choose not to use condoms all of the time as an undetectable viral load prevents HIV transmission.

An accepted public health approach promotes the control of STIs among those at highest risk as a way of reducing STIs in the general population. An [Australian modelling study by Wilson and colleagues from 2011](#) supports this notion: it estimated that if half of Australian gay men took doxycycline as PrEP, and it was 70% effective against syphilis, then rates of syphilis would decrease by 50% after a year and 85% after a decade. Interestingly, the same finding applied if only 50% of the highest-risk group (men with more than 20 partners in six months) were taking doxycycline. This indicates that targeted interventions could have widespread community-level benefits.

Surveys in [Australia](#) (Wilson et al., 2011), the [US](#) (Spinelli et al., 2019) and the [UK](#) (O'Hallaran et al., 2020) show high levels of interest among gay men and [some healthcare providers](#) (Park et al., 2021) in using doxycycline to prevent STIs, with some men already using this approach.

A [2020 survey](#) of 1,520 gay and bisexual men living in the UK by Kohli and colleagues found that 20% had heard about STI prophylaxis, approximately 4% had used it at some point and nearly 2% had used it in the previous year. The median age was 38, and most of these men were White and cisgender. Of interest, while over half of the men had used doxycycline (56%), others had used antibiotics such as amoxicillin (20%) and azithromycin (18%). There is no evidence to suggest that antibiotics other than doxycycline would be at all effective in preventing STIs.

However, the use of antibiotics for STI prophylaxis could be much higher among MSM who are on HIV PrEP. A [2019 study](#) by O'Hallaran and colleagues found that 9% of 1,856 HIV PrEP users in the UK reported using antibiotics to prevent STIs. Most were White, gay, living in London and 35 or younger. Those who had had five or more sexual partners in the past six months, engaged in sexualised drug use and

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reported an STI in the past year were more likely to use antibiotics in this way.

For some groups, such as sex workers, negotiating condom use can be challenging and biomedical forms of prevention, such as HIV PrEP, have been a crucial form of protection. STI prophylaxis could be another valuable protective tool in this instance.

There has not been any STI prophylaxis research carried out with cisgender women, and there is some concern over how ongoing antibiotic use may affect the vaginal microbiome more generally. The [Kenyan study](#) mentioned above is focused on recruiting cisgender women aged 18 to 30 currently taking HIV PrEP and will hopefully shed more light on this.

When would be the best time to take antibiotics to prevent an STI?

Based on the available research, those at risk for exposure to bacterial STIs would need to take a 200mg dose after a sexual encounter (ideally within 24 hours and no later than 72 hours). There are fewer data for daily dosing, but a 100mg pill every day has been suggested.

A small qualitative study with Australian MSM by Horn and colleagues (2019) indicated a preference for daily dosing. However, taking doxycycline as doxyPEP – as opposed to taking it daily – might be best in terms of reducing the amount of antibiotics taken.

As there are currently no clinical guidelines on dosage or formulation of doxycycline for STI prophylaxis, further research is required to answer this question with more certainty.

What about resistance?

STIs are caused by different strains of bacteria and are treated with antibiotics that are known to be effective against the specific bacterium that causes the infection. In some cases, an antibiotic that previously worked stops working, because the bacterium has developed resistance to it.

Gonorrhoea: some strains are resistant to doxycycline, so the drug is unlikely to be effective at preventing gonorrhoea, as was documented in the French study. However, doxycycline is not used to **treat** gonorrhoea. This means that use of doxycycline as prophylaxis should not complicate the treatment of a gonorrhoea infection, should one occur.

Syphilis: there is currently no evidence of doxycycline resistance in syphilis, although there is always the concern that it could develop as doxycycline is the first choice for treating syphilis in people who are allergic to penicillin. Recently, syphilis developed high level resistance to the antibiotic azithromycin within a few years of it being used as syphilis treatment.

Chlamydia: doxycycline is the first-line treatment for uncomplicated chlamydia in the UK and other countries. This means that the development of doxycycline resistance would be a serious concern with very few available treatment options remaining. There have been some cases of doxycycline treatment failure, but the studies did not test for resistance and the causes of treatment failure are unclear. Encouragingly, many studies in communities which frequently use doxycycline have not found evidence for resistance in chlamydia.

Mycoplasma genitalium (MG): there is concern about resistance to this STI which is a frequent cause of urethritis (an inflammation of the urethra – the tube that carries urine out of the body) in men. Doxycycline is a recommended alternative medication to treat uncomplicated MG because of emerging resistance to first-line treatments, such as azithromycin. More widespread use of doxycycline among those with high prevalence of MG, such as gay men, could become an issue in future and requires further research.

Other infections: doxycycline is an important treatment for community-acquired pneumonia and other infections. Continued exposure to doxycycline is therefore a concern in terms of causing resistance in other organisms that are not sexually transmitted. This would limit treatment options for the individual and others in the future.

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What about side effects?

Doxycycline is generally safe and well-tolerated. This is true even when it is used for long periods of time, as is the case when it is used to treat acne and as malarial prophylaxis. The most common side effects are gastrointestinal, such as diarrhoea, vomiting and nausea. Increased sensitivity to light can also be a concern with prolonged use. In most instances, side effects resolve once doxycycline is discontinued.

There have been studies that show an association between doxycycline and irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD), but it is not clear if doxycycline is a cause of these conditions (Lee et al., 2013).

Doxycycline should not be used by pregnant people, or those who might become pregnant.

There is also concern regarding how ongoing antibiotic use affects the gut microbiome, including the impact on good bacteria and overall health. In the French study mentioned above, only eight of 232 men discontinued doxycycline due to gastrointestinal side effects. In the more recent US study, there were no serious adverse events reported and only 1.5% of the study group discontinued due to intolerance or participant preference. However, 88% reported that doxyPEP was either acceptable or very acceptable.

The two most common formulations are monohydrate and hyclate, with monohydrate (or coated hyclate) generally better tolerated.

Summing up

While doxycycline to prevent bacterial STIs holds a great deal of promise, especially for those who are most at risk, more robust research on the topic is needed. Its use is not endorsed by the British Association for Sexual Health and HIV (BASHH) or the UK Health Security Agency (UKHSA).

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