Portuguese Journal of Dermatology and Venereology

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REVIEW ARTICLE

Pre-exposure prophylaxis (PrEP) efficacy to reduce HIV/AIDS incidence rate among male sex to male (MSM) in Asia

Eficácia da Profilaxia Pré-Exposição (PrEP) para reduzir a taxa de incidência de HIV/AIDS entre sexo masculino para homem (HSH) na Ásia

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Abstract

Human immunodeficiency virus (HIV) infection is a global epidemic, with the Asia-Pacific area as the second largest contributor of cases in the world. Men sex to men (MSM) are a key population in the epidemy. One strategy to control the incidence of HIV infection is the use of pre-exposure prophylaxis (PrEP). Until now, World Health Organization (WHO) recommended two drug combinations for use PrEP containing tenofovir disoproxil fumarate and emtricitabine (TDF/FTC), which can be taken daily or as needed (on-demand). PrEP is highly effective in preventing HIV infection among the MSM group. However, the use of PrEP in Asian countries is still very low.

Keywords: Emtricitabine. HIV. MSM. PrEP. Tenofovir.

Resumo

A infeção pelo Vírus da Imunodeficiência Humana (HIV) é uma epidemia global com a região da Ásia-Pacífico como o segundo maior número de casos no mundo. O grupo de homens que fazem sexo com homens (HSH) é uma das população-chave nesta epidemia. Uma das estratégia para controlar a incidência da infeção pelo HIV é o uso da Profilaxia Pré-Exposição (PrEP). A Organização Mundial da Saúde (OMS) recomenda duas combinações de medicamentos para uso como PrEP contendo tenofovir e emtricitabina (TDF/FTC) que podem ser tomadas diariamente ou conforme necessário (sob demanda). A PrEP é altamente eficaz na prevenção da infeção pelo HIV entre o grupo HSH. No entanto, o uso de PrEP em países asiáticos ainda é muito reduzido.

Palavras-chave: Emtricitabina. HIV. HSH. PrEP. Tenofovir.

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Received: 19-10-2022
Accepted: 25-11-2022
DOI: 10.24875/PJDV.22000036

Available online: 09-02-2023
Port J Dermatol and Venereol. 2023;81(1):38-45
www.portuguesejournalofdermatology.com

Introduction

HIV was first discovered about 40 years ago, and in 2001, strategies to overcome HIV infection were launched globally by the United Nations (UN) General Assembly for the first time. However, to date HIV infection remains a global health crisis affecting all countries in the world, with 1.5 million new infections and 680,000 acquired immunodeficiency syndrome (AIDS) related deaths in 2020[1,2]. Total of 37.7 million people living with HIV in 2020, including 10.2 million who were not on HIV treatment[1]. The Asia-Pacific region is the second largest contributor, with 15% of HIV cases found in this region, including Cambodia, China, India, Indonesia, Myanmar, Nepal, Thailand, and Vietnam, which accounted for 70% of new cases across Asia in 2020[3]. Meanwhile, it was only 4.2% in the Western Europe and Central Asia regions[1,3].

The majority of people living with HIV are key populations, including men sex to men (MSM), transgender women, the person who inject drugs, sex workers, and prison inmates.[4] Globally, among key populations, homosexuals and MSM have the highest proportion of HIV infection (23 of 65%)[1]. The MSM group consists of homosexual men, bisexual men, and transgender people (male to a female)[5].

Pre-exposure prophylaxis (PrEP) is one of the strategies to prevent HIV infection, especially in populations who are at extremely high risk of acquiring HIV infection, such as MSM and transgender[6,7]. Although PrEP has been introduced for more than a decade, PrEP is still underutilized, especially in Asian countries[4]. Various factors were identified as the cause of low PrEP utilization in key populations. PrEP services have not been integrated with the existing HIV services, lack of knowledge about PrEP among key populations, and high prices are the most challenging problem in expanding the use of PrEP[3,8].

Various studies have shown the very high efficacy of PrEP to prevent HIV infection in key populations, such as MSM, and non-key populations, such as heterosexual men[9,10]. PrEP efficacy is closely related to detectable drug levels in plasma, so adherence is an important factor. PrEP has also been shown to have a good safety profile, with side effects mostly related to gastrointestinal complaints[11]. This study examines the PrEP efficacy in reducing the incidence of HIV/AIDS among MSM groups in Asian countries.

Prevalence of HIV/AIDS in Asia

HIV is part of the Retroviridae family that causes AIDS. HIV infects various cell types in the body, one of them being the surface molecule of CD4 + lymphocytes. HIV replication promotes CD4 + lymphocyte cell death. There are four stages of HIV infection that is, acute, early, chronic and late. Acute infection usually lasts for three weeks, while early infection lasts for seven weeks. Viral load indicates the risk of viral transmission and tends to be high in the acute and early phases. Long-term HIV infection causes a selective decrease in the number of CD4 + lymphocytes, resulting in an immunosuppressed condition[11].

United Nations Program on HIV and AIDS data shows a 21% decrease in new HIV infections in 2020 compared to 2010 in the Asia-Pacific region. In addition, AIDS-related deaths also decreased by 56% over the same time period. However, progress in dealing with HIV in the Asia-Pacific region is still uneven, with countries such as Thailand and Vietnam reporting a 50% reduction in infections in 2020 compared to 2010. On the other hand, Indonesia, the Philippines, and Pakistan reported an increase in HIV infections, especially in key populations such as MSM[1,4]. In addition to the significant differences between countries, the prevalence of HIV infection in Indonesia also varies between islands, where the prevalence of HIV in Java is known to be 0.5% compared to 5% in Papua[2]. As of March 2021, there were 427,201 persons living with HIV, and 131,147 people suffered from AIDS[12].

The majority of people living with HIV in the Asia-Pacific region are key populations, including homosexual men and MSM (53%), the person who inject drugs (18%), sex workers (18%), sex workers inmates, and other key populations (9%), and transgender women (2%). HIV prevalence among non-key populations in 2020 is 6%[1]. In Indonesia, HIV prevalence in the MSM group was 17.9% and became the highest among other risk groups, such as a person who inject drugs (13.7%), transgender women (11.9%), sex workers (2.1%), and prisoners (0.7%)[1,13].

HIV/AIDS infection among MSM groups

Based on UNAIDS data in 2020, MSM groups aged 15-49 accounted for an estimated 53% of new HIV infections in Asia[3]. Homosexuals and MSM are known to have a 25-fold increased risk of HIV infection compared to heterosexual men[1]. An increased risk of

HIV infection in MSM is associated with their higher numbers of sexual partners[5,14-16].

He et al., in China, found that 56.2% of study participants had more than one sexual partner[15]. Based on a study conducted in Palu, Central Sulawesi, on 90 MSM, one who had more than one sexual partner had an increased risk of HIV infection by 12.8 times compared to MSM who have only one sexual partner[16].

The higher risk of HIV infection in MSM is also caused by anal sex, which allows for rectal injury due to a lack of lubrication in the vagina. The high absorption capacity of the rectum for semen deposition also increases the risk of HIV transmission in MSM[14]. This risk increases with the lower use of condoms in anal sex[3,8]. The prevalence of unprotected anal sex in MSM with multiple partners is still very high[5,15,16]. In the United States, China, Israel, and Vietnam, the prevalence of unprotected anal sex in MSM is 11-45, 20.7, 30.3, and 51%, respectively[17]. Chen et al., in Guangzhou, China, among 204 MSM couples, 58.82% admitted to having unprotected anal sex[17]. Unprotected anal sex among MSM could increase the risk of HIV infection by 3.6 times compared to protecting one[16].

Based on the Integrated Biological and Behavioral Survey (IBBS) conducted by the Indonesian Ministry of Health in 2013, the highest HIV prevalence among MSM between 19-20% was found in Tangerang, Yogyakarta, and Makassar. The prevalence of STI (sexually transmitted infections) gonorrhea also increased in the three districts/cities from 17% in 2009 to 21% in 2013. Similar data regarding chlamydia also increased from 17 to 23%. The high prevalence of STIs and HIV among MSM in these cities may be related to the low consistency of condom use during anal sex[18]. Apart from gonorrhea and chlamydia, syphilis is also common in MSM. A meta-analysis found that the prevalence of HIV and syphilis in Indonesia is among the highest in Southeast Asia[5].

The role of PrEP in HIV/AIDS prevention

In 2015, the WHO recommended the use of oral PrEP in populations at high risk of HIV infection with an HIV incidence of more than three per 100 person-years. WHO recommends the use of PrEP containing TDF[6,7,19,20]. The PrEP regimen that was approved by the United States Food and Drug Administration (FDA) in 2012 is a tablet containing two antiretrovirals [antiretroviral drugs (ARV)], TDF (300 mg) and FTC (200 mg). In 2019, the FDA issued a permit for the use of FTC/tenofovir alafenamide (TAF) as PrEP[21-23]. In addition to TDF/FTC, lamivudine (3TC) (300 mg) can also be used as PrEP. In 2019, in addition to daily oral PrEP use, WHO added the option of using on-demand or "2 + 1 + 1" PrEP, two tablets 24 h before, one tablet 24 h after, and one tablet 48 h after sexual intercourse[3]. PrEP is now considered an important part of a combination HIV prevention program in MSM which includes the use of 100% condoms, voluntary HIV testing and counseling (volumetric computed tomography) services, and HIV treatment as prevention[6,7,24]. Currently, the administration of PrEP has been included in HIV prevention guidelines in the United States and Europe. However, it has not been done in many countries across Southeast Asia[22].

Tenofovir disoproxil fumarate (TDF) and FTC belong to the class of analog nucleoside reverse transcription inhibitors (NRTIs)[11,25]. Both TDF and FTC must be able to enter cells to then undergo phosphorylation into their active metabolites, tenofovir diphosphate, and FTC triphosphate, respectively[25]. NRTIs act intracellularly by binding directly to the nucleoside binding component. This, in turn, causes inhibition of the reverse transcriptase enzyme to form HIV deoxyribonucleic acid (DNA) from HIV ribonucleic acid. Thus, NRTIs can slow or stop viral replication in cells[11]. The clinical pharmacology of TDF and FTC depends on the intracellular half-lives of their active metabolites, where a longer half-life may decrease the frequency of drug consumption. The half-life of the TDF metabolite is about 150 h, while the FTC is about 39 h. Both are NRTI groups with the longest half-life, so they can improve patient compliance in taking medication when used as PrEP[25].

The combination of TDF and FTC as PrEP has until now been considered a practical option with a good safety and tolerability profile, cost-effectiveness, and good penetrability to targets[25]. A systematic review and a meta-analysis of 15 randomized clinical trials and three real-world observational studies showed that PrEP is safe and highly effective in reducing the risk of HIV infection[7]. The TDF/FTC combination was the first oral agent to show clinical efficacy in reducing HIV transmission in multiple randomized clinical trials. One of the disadvantages of using TDF and FTC as PrEP is their important role as a therapeutic strategy in HIV-infected patients. Thus, if the patient experiences HIV infection during PrEP, the efficacy of HIV therapy with TDF/FTC may decrease due to the presence of HIV resistance to these drugs at the time of infection[25].

After more than 1 decade since it was first introduced, PrEP use has been increasing globally. A total of 845,000 people in 54 countries received PrEP in 2020. It has increased 43% compared to 2019 and

182% compared to 2018. However, PrEP use is still concentrated in a few countries, such as the United States and other countries in East and South Africa. In addition, the current number of PrEP recipients is only 28% of the 3 million targets of PrEP recipients in low and middle incomes countries. Access to PrEP is still severely lacking in West and Central Africa, as well as Asia and the Pacific[1]. Nowadays, Australia, Thailand, and Vietnam have the highest cumulative PrEP users in Asia-Pacific[26].

Several factors affected the lack of willingness to use PrEP. These factors include lack of awareness, fear of side effects, difficulty in maintaining compliance, high costs, and societal stigma[21]. In most Asian countries, due to negative stigma, discrimination, and criminal sanctions, MSM remains a hidden population and are difficult to reach through existing HIV prevention programs[5]. The high-risk population of MSM in India, transgender women in the United States, and sex workers in Zimbabwe reported difficulties in accessing PrEP in their countries[21].

Awareness regarding the presence of PrEP is low, as shown in 93% of MSM and transgender women in India. Meanwhile, only 15.1% of sex workers in China, and 5% of homosexual men (other MSM and transgender) in Myanmar are aware of PrEP[10]. The strong stigma due to homophobia and transphobia from healthcare providers prevents key populations from accessing PrEP[5]. The success of Australia, Vietnam, and Thailand in increasing the number of PrEP users demonstrate the success of community-based strategies that can avoid stigma against key populations. Thailand launched a program entitled "Princess PrEP," in which HIV-related services are provided by trained and certified members of the key population. This ensures that HIV-related services, including the provision of PrEP, are nonjudgmental and free from stigma and discrimination. Through this program, PrEP recipients have reached 58% of the total recipients in Thailand and higher than PrEP recipients through government programs (17%) or paid programs (PrEP-15) (25%)[26].

The desire to consume PrEP is known to be quite high in key populations who already know about PrEP. A study in Wuhan, China, on 301 MSM showed that only 17% of study participants were aware of PrEP, of which 74% of study participants were willing to take PrEP if they had been given information about its effectiveness and side effects. A number of other studies have also found similar results, where the desire to consume PrEP is increased when PrEP is provided for free. In Vietnam, out of 548 MSM surveyed, only 26.8% were aware of the PrEP, but 65.7% of the participants later stated that they were willing to consume PrEP[22]. In Indonesia, PrEP has not yet been included in national regulations or programs, quite lagging far behind other emerging countries such as Thailand, which has integrated PrEP into Universal Health Coverage since 2018[8]. Apart from Thailand, Vietnam is also doing the same. Cambodia started to administer PrEP nationally in 2019[3]. PrEP is still not accessible through the national health care system and regulations regarding the availability of PrEP in Indonesia. However, PrEP can be purchased online without a prescription. However, the cost of PrEP in Indonesia is still quite high[3,8]. This relatively high price could reduce the desire of key populations to consume PrEP[8]. The estimates of PrEP users in Cambodia, Indonesia, and Myanmar were < 500 based on UNAIDS and WHO[3].

Study of PrEP efficacy in MSM groups

Based on various clinical trials, PrEP has shown an excellent efficacy and safety profile (Table 1)[9,10,20,21,27-30]. Regular use of PrEP is highly effective for preventing HIV (> 90%) and is the most effective HIV prevention currently available[21,24,31]. The efficacy of PrEP in reducing the risk of HIV transmission when combined with condom use and sex-related education ranges from 6-92%. Various studies have proven the high efficacy of PrEP in MSM[9,28,30]. High efficacy was found in the MSM population with a risk reduction rate of 44-92%. The high efficacy of PrEP in MSM is thought to be due to the better penetration of tenofovir into the anal mucosa than the vaginal mucosa[10]. Early ARV administration is known to reduce HIV transmission by 93% in non-HIV sexual partners (serodiscordant partners). Viral load suppression using PrEP has been shown to be closely associated with lower viral concentrations in genital secretions[24]. Kazemian et al., in India, estimate an increase of 0.90 life-years in MSM receiving PrEP[32].

Patient adherence to PrEP is known to be closely associated with increased PrEP efficacy.[6] The Pre-exposure Prophylaxis Initiative (iPREX) study by Grant et al., the first randomized controlled trial (RCT) of PrEP started in 2010, showed that PrEP efficacy increased by up to 92% in subjects with detectable plasma tenofovir levels. In this study, 4905 subjects from six countries were instructed to take tenofovir daily. The only Southeast Asian country that contributed to this study was Thailand (5% of the total subjects)[9,22]. Similar results were also found in the Bangkok tenofovir study, where efficacy increased from 49 to

Table 1. Study of PrEP efficacy in MSM group

Study	Methods	Subjects	Intervention	Outcomes	Results
iPrEx (2010)[9]	Randomized, placebo-controlled trial (Peru, Ecuador, South Africa, Brazil, Thailand, and the United States)	2499 HIV-seronegative MSM	1251 subjects were received TDF/FTC, 1248 subjects were received placebo. It was consumed once daily	New HIV infection, plasma drug levels, and side effects	A 44% reduction in the incidence of HIV in PrEP group (36 subjects) vs placebo (64 subjects). TDF/FTC was detected in 51% seronegative subjects vs 9% HIV-infected subjects. Nausea was reported more frequently in PrEP group vs placebo. The two groups had similar rates of serious adverse events.
TDF2 (2012)[29]	Randomized, double-blind, placebo-controlled trial (Bostwana)	1219 heterosexual adults (577 women, 642 men)	611 subjects were received TDF/FTC (331 men), and 608 subjects were received placebo (331 men)	New HIV infection, plasma drug levels, and side effects	A 62.2% reduction of HIV infection in PrEP (nine subjects) vs placebo (24 subjects). Detectable levels of plasma tenofovir and emtricitabine were found in 50% HIV-infected subjects and 80% and 81% in HIV-uninfected subjects, respectively. Nausea, vomiting, dizziness and decline in bone mineral density were more frequently in PrEP vs placebo, but the rates of serious adverse events were similar.
Partners PrEP (2012)[27]	Randomized, double-blind, three-arm, placebo-controlled trial (Kenya, Uganda)	4758 serodiscordant couple (62% HIV-1-seronegative male)	1584 randomly assigned to TDF, 1583 assigned to TDF/FTC, 1586 assigned to placebo. The drugs was consumed once daily	Adherence to therapy, new HIV infection, resistance, plasma drug levels, side effects	Treatment adherence was high (97% of dispensed study tablets were taken). The efficacies of TDF and TDF/FTC for HIV prevention in men were 63 and 84%, respectively. There was no difference in the efficacy of TDF and TDF/FTC between men and women. No participants who acquired HIV-1 after randomization were infected with an HIV-1 strain with the K65R or M184V mutation. One in the TDF group had a TDF-resistant virus K65N mutation. Tenofovir level in a plasma sample was detected in 31% seroconverted-subjects vs 82% in nonseroconverted subjects. Estimated reductions in the relative risk of acquiring HIV-1 was 86% (TDF) and 91% (TDF/FTC). There were modestly increased reports of gastrointestinal side effects and fatigue as compared with placebo but the adverse events were similar.
IPERGAY (2015)[28]	Randomized, double-blind, placebo-controlled trial (France, Canada)	414 HIV-negative MSM	206 were received TDF/FTC, 208 were received placebo. The drugs were consumed on-demand	New HIV infection, number of pills taken per month, and side effects	Relative reduction of HIV-1 infections in the PrEP group (two subjects) vs placebo (14 subjects) of 86%. Subjects took a median of 15 pills per month. There were higher rates of gastrointestinal and renal adverse events in PrEP group without any difference between two groups.
PROUD (2016)[30]	Open-label, randomized controlled-trial (United Kingdom)	544 HIV-negative MSM	275 randomly assigned to immediate group (receiving TDF/FTC at the enrollment visit), 269 assigned to deferred group(receiving TDF/FTC after a deferral period of 1 year)	New HIV infection, drug side effects, compensation risk	The incidence of HIV-infections in immediate group was lower (three subjects) than deferred group (20 subjects) with absolute difference of 7.8/100 person years. 13 men in a similar population would need access to 1 year of PrEP to avert one HIV infection. No adverse events between two groups. No difference in the occurrence of sexually transmitted infections between groups which shows no compensation risk.

74% in subjects with detectable plasma tenofovir levels[10]. In the TDF2 study, tenofovir and FTC were detected in 80% of nonseroconverters compared to seroconverters (50%)[25]. Detection of tenofovir in plasma was associated with regular tenofovir consumption[11,22].

Adherence to PrEP could be associated with PrEP-related knowledge and self-perceived level of risk of acquiring HIV. Cempaka et al. study in Bali, including 220 MSM and transgender, showed an increase in the desire to take PrEP occurred after study participants

were provided with information about the benefits of PrEP, especially in high-risk participants who had more than one sexual partner and did not use condoms consistently[8].

To date, the recommended regimen was daily PrEP consumption for high-risk populations. However, a number of studies have shown that on-demand PrEP use could also achieve similar effectiveness to daily consumption. The Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD) study by McCormack et al., in 544 high-risk MSM who had unprotected anal sex (29 Asian) showed that in a setting close to real-world conditions, regular daily consumption of PrEP could provide higher protection against HIV infection in populations-at-risk than MSM who had not taken PrEP[22,30]. The on-demand Antiretroviral pre-exposure prophylaxis for HIV infection in men who have sex with men (IPERGAY) study using an on-demand PrEP regimen also showed similar results. Study participants only took two tablets of TDF/FTC 24 h before sex, one tablet 24 h after sex, and one tablet 48 h after sex. The results of the study showed that there was a decrease in the incidence of HIV by 86%, with a median 16 tablets consumed per month. This regimen requires lower costs, improves adherence, and facilitates discontinuation of consumption when the patient is no longer exposed to high-risk[22,28].

The basis of the on-demand regimen is the knowledge about the concentration of the HIV virus in the vaginal or anal mucosa after sexual activity. The study found that HIV was concentrated in the peri-cervical region and the rectosigmoid colon for 24 h after sexual activity. Thus, optimal administration of PrEP should be able to ensure adequate concentrations of ARVs in the peri-cervical and rectosigmoid areas before and 24 h after sexual activity[25]. Thus, the main key to reaching PrEP effectivity in preventing HIV infection is to maintain therapeutic levels of plasma drugs either through daily consumption regimens or on-demand-based regimens. Both regimens have their respective drawbacks. Daily regimens can reduce the desire to take PrEP. On the contrary, on-demand regimens will be difficult to implement for those who frequently engage in unplanned sex[22].

The combination of TDF/FTC is known to have better efficacy than monotherapy with TDF[10]. The results of RCT conducted in Kenya and Uganda involving 4,747 serodiscordant HIV partners showed that TDF/FTC PrEP reduced the risk of infection by 73%, while monotherapy with TDF alone showed a 62% reduced risk of infection[33]. A study on levels of tenofovir-diphosphate and FTC triphosphate, the active metabolites of TDF and FTC, found that a third daily dose of TDF/FTC created a protective mucosal layer in 98% of subjects. However, this must be supported by sufficient adherence, where 85 and 28% compliance is required to obtain the protective effect in women and men subjects, respectively. Thus, the TDF/FTC combination is considered to be more effective in men than women[11].

The combination of TDF/FTC as PrEP can also reduce acute plasma viremia in HIV-infected experimental animals and successfully minimize acute viral replication. However, the effect of TDF/FTC on cell-associated DNA levels was only temporary. Thus, in people with suboptimal PrEP levels and infected with HIV, the effect of PrEP is not able to reduce the number of HIV-infected cells in the body. Besides, PrEP can also prevent STIs that can increase the risk of HIV infection. A study investigated the effect of TDF/FTC consumption in the MSM group on herpes simplex virus (HSV)-2 infection. It showed that TDF/FTC could reduce the incidence of ulcers due to HSV-2 infection but not the acquisition of HSV-2 infection in MSM. Another study in a heterosexual population found that daily oral intake of PrEP TDF/FTC may reduce the risk of HSV-2 infection. This suggests additional benefits of taking PrEP for populations at risk[11].

The implementation of PrEP had a direct impact on health and economic aspect. Ten Brink et al. used data from eight countries in Asia (Cambodia, China, India, Indonesia, Myanmar, Nepal, Thailand, and Vietnam) to find that if the implementation of PrEP among MSM in 2022 could be increased and expanded, there will be an increase in the coverage of PrEP use by 15% among MSM at the end of 2026, prevention of 100,000 cases of HIV infection and 300,000 DALYs in 2022-2031. This could also save the cumulative cost of providing ARVs for 5 years of therapy as much as 12.3 million USD[3]. Similar results were previously stated by Suraratdecha et al., where giving PrEP to high-risk MSM is a cost-effective strategy[20].

The use of PrEP generally showed a good tolerable profile. Most PrEP side effects are related to gastrointestinal complaints such as vomiting, loose stools, and diarrhea. Only 1.0-18.5% of patients experienced these side effects[10]. A mild decrease in bone density can be found mainly in the spine[10,11,29]. Decreased bone density in young male patients after PrEP consumption is thought to be caused by an endocrine disorder, parathyroid hormone-vitamin D-fibroblast

growth factor 23. The decrease in bone mineral density due to PrEP consumption is considered insignificant compared to the success of TDF in preventing HIV infection[11]. The development of new tenofovir preparations, such as TAF is expected to further reduce side effects and increase PrEP tolerability. Further studies are needed to assess the long-term side effects of using PrEP[10].

Tubulopathy (proximal tubular dysfunction) is one of the TDF side effects. However, studies have shown that daily oral PrEP TDF/FTC consumption is not associated with tubulopathy within 24 months of PrEP consumption[34]. Another study found that PrEP may cause subclinical tubular dysfunction characterized by increased urinary a1-microglobulin (a1m) levels and proteinuria[35]. A randomized clinical trial found a minimal and nonprogressive decrease in the estimated glomerular filtration rate (eGFR) due to TDF/FTC consumption for 18-36 months in the heterosexual HIV-1-uninfected population. The decrease in mean eGFR is known to be reversible a few weeks after the discontinuation of PrEP consumption. However, a meta-analysis showed an increased risk of renal failure with daily oral TDF/FTC consumption, as indicated by an increase in serum creatinine levels[11].

Conclusion

HIV infection is still a major global health crisis, especially regarding key populations, such as MSM. PrEP is an HIV prevention option for people who are at high risk of HIV infection. The effectiveness of PrEP in preventing HIV infection has been shown to be very high, especially in combination with other preventive methods. In addition, the WHO recommendation on PrEP (TDF/FTC) has a good safety profile. Related to the diversity of social and cultural backgrounds in Asian countries, further studies on the implementation of PrEP are required to determine its efficacy in reducing the incidence of the HIV epidemic in this region.

Funding

None.

Conflicts of interest

None.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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