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CA Idris
Department of Internal Medicine, Murtala Mohammed Specialist Hospital, Kano, Nigeria

A Fapohunda
Department of Internal Medicine, Murtala Mohammed Specialist Hospital, Kano, Nigeria

Corresponding Author:
CA Idris
Department of Internal Medicine, Murtala Mohammed Specialist Hospital, Kano, Nigeria

Sexually transmitted infections in the era of PrEP

CA Idris and A Fapohunda

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Abstract
Pre-exposure prophylaxis (PrEP) has revolutionized the prevention of HIV infection, providing a highly effective means of reducing the risk of acquiring HIV among high-risk populations. However, the introduction and widespread use of PrEP have raised concerns about its impact on the incidence of other sexually transmitted infections (STIs). This review examines the current landscape of STIs in the era of PrEP, exploring the epidemiological trends, behavioral factors, and clinical implications. It also addresses the strategies needed to manage and mitigate the potential rise in STIs associated with PrEP use.

Keywords: Pre-exposure prophylaxis, PrEP, HIV prevention

Introduction
The advent of pre-exposure prophylaxis (PrEP) has marked a significant milestone in the fight against HIV/AIDS. PrEP, which involves the daily use of antiretroviral medications by HIV-negative individuals, has proven to be highly effective in preventing HIV infection among high-risk populations. Since its approval by the FDA in 2012, PrEP has been a transformative tool in public health, significantly reducing HIV transmission rates, particularly among men who have sex with men (MSM), serodiscordant couples, and individuals with multiple sexual partners. However, the introduction and widespread use of PrEP have brought new challenges, particularly regarding the incidence of sexually transmitted infections (STIs). While PrEP provides robust protection against HIV, it does not guard against other STIs such as gonorrhea, chlamydia, and syphilis. As a result, there has been a growing concern among healthcare providers and public health officials about the potential increase in STI rates among PrEP users. Epidemiological studies have indicated a notable rise in the incidence of STIs coinciding with the increased uptake of PrEP. Several factors contribute to this trend, with risk compensation being one of the most significant. Risk compensation refers to the phenomenon where individuals adjust their behavior in response to their perceived level of risk. In the context of PrEP, the high level of protection against HIV may lead some users to engage in riskier sexual practices, such as reducing condom use or increasing their number of sexual partners, thereby elevating their risk of contracting other STIs. The behavioral dynamics of PrEP users are complex and multifaceted. While some individuals maintain or even increase their use of condoms and other protective measures, others may feel a false sense of security and become more lax in their sexual health practices. This divergence in behaviors underscores the need for targeted and nuanced public health interventions that address the specific needs and behaviors of different subgroups within the PrEP-using population.
The clinical implications of rising STI rates among PrEP users are significant. Increased STI incidence not only affects individual health but also poses broader public health challenges. STIs can lead to serious health complications if left untreated, including infertility, chronic pain, and increased susceptibility to HIV infection. Moreover, the spread of antibiotic-resistant strains of STIs, such as drug-resistant gonorrhea, represents a growing threat that complicates treatment efforts.
Addressing the rising incidence of STIs in the era of PrEP requires a comprehensive and integrated approach. Regular and frequent STI screening is paramount for early detection and treatment, helping to curb the spread of infections. Healthcare providers must engage in continuous education and counseling with PrEP users to reinforce the importance of

maintaining safe sex practices, even while on PrEP. This includes emphasizing the continued use of condoms and other protective measures to guard against STIs.

Public health campaigns play a crucial role in raising awareness about the risks of STIs and promoting regular screening. These campaigns should target high-risk populations and deliver clear, culturally sensitive messages that encourage responsible sexual behaviors. Additionally, integrating comprehensive sexual health services with PrEP programs can enhance the overall effectiveness of prevention efforts. Clinics offering PrEP should also provide access to STI testing, treatment, risk reduction counseling, and vaccinations for preventable infections such as human papillomavirus (HPV) and hepatitis B.

Research and surveillance are essential components in understanding and managing the epidemiological trends of STIs among PrEP users. Ongoing research helps identify emerging patterns, evaluates the effectiveness of interventions, and informs public health strategies. Enhanced surveillance systems can provide timely data on STI incidence and resistance patterns, enabling proactive and responsive public health actions. In conclusion, while PrEP has significantly advanced HIV prevention, it has also introduced new challenges in managing the incidence of other STIs. A multifaceted approach that combines regular screening, behavioral interventions, public health campaigns, and integrated sexual health services is necessary to address these challenges. By adopting comprehensive strategies, healthcare providers and public health officials can optimize the benefits of PrEP while minimizing the risks associated with other STIs, ensuring a holistic approach to sexual health in the PrEP era.

Objective

The main objective of this review is to examine the impact of pre-exposure prophylaxis (PrEP) on the incidence of sexually transmitted infections (STIs), explore the behavioral factors contributing to these trends, and propose comprehensive strategies for managing and mitigating STIs in the era of PrEP.

Epidemiological Trends of STIs in the PrEP Era

Since the introduction of pre-exposure prophylaxis (PrEP) for HIV prevention, there has been a notable shift in the epidemiological landscape of sexually transmitted infections (STIs). PrEP has been highly effective in reducing HIV transmission among high-risk populations, such as men who have sex with men (MSM), serodiscordant couples, and individuals with multiple sexual partners. However, its widespread use has coincided with rising rates of other STIs, including gonorrhea, chlamydia, and syphilis. Understanding these trends is crucial for developing comprehensive sexual health strategies that address both HIV and other STIs.

Several studies have reported an increase in the incidence of STIs among PrEP users. This trend may be attributed to various factors, including changes in sexual behavior and risk compensation. Risk compensation refers to the phenomenon where individuals adjust their behavior in response to perceived changes in risk. In the context of PrEP, the protection against HIV may lead some users to engage in riskier sexual practices, such as reduced condom use and increased number of sexual partners, because they feel less vulnerable to HIV infection.

A systematic review and meta-analysis conducted by Traeger *et al*. (2019) [1] highlighted that PrEP users had a higher incidence of STIs compared to non-users. The study found significant increases in the diagnoses of gonorrhea and chlamydia among PrEP users. Similarly, research by Marcus *et al*. (2019) [2] in a large healthcare system in San Francisco reported substantial rises in STI incidence rates among MSM using PrEP. These findings suggest that while PrEP is effective in preventing HIV, it may inadvertently contribute to the spread of other STIs due to changes in sexual behavior.

The increased incidence of STIs among PrEP users has been observed across various geographic regions and populations. For example, a study by Lal *et al*. (2017) [3] in Australia found that MSM on PrEP were more likely to report condomless sex and a higher number of sexual partners compared to their behavior before starting PrEP. This change in behavior underscores the need for integrated sexual health services that address the prevention and treatment of all STIs, not just HIV.

The rise in STI rates among PrEP users also reflects broader public health trends. Enhanced STI screening and surveillance practices have likely contributed to the increased detection of STIs. PrEP programs often include regular and frequent STI screenings, which can identify asymptomatic infections that might otherwise go undiagnosed. This increased screening frequency, recommended by guidelines, ensures early detection and treatment of STIs, reducing the likelihood of further transmission.

Moreover, the social and sexual networks of high-risk populations play a role in the spread of STIs. PrEP users often belong to interconnected networks where high rates of partner change and overlapping sexual relationships facilitate the transmission of STIs. The clustering of STIs within these networks underscores the importance of targeted interventions that address the specific behaviors and dynamics of these communities.

Despite the concerning rise in STIs, it is essential to recognize that PrEP has significantly reduced HIV incidence, which remains a critical public health goal. The challenge lies in balancing the benefits of PrEP for HIV prevention with the need to mitigate the unintended consequences of rising STI rates. This requires a multifaceted approach that includes regular STI screening, behavioral interventions to promote safer sex practices, and integrated sexual health services that provide comprehensive care for all STIs.

In conclusion, the epidemiological trends of STIs in the PrEP era reveal a complex interplay between HIV prevention and the incidence of other STIs. While PrEP has been highly successful in reducing HIV transmission, it has been associated with increases in gonorrhea, chlamydia, and syphilis. Understanding these trends and the factors driving them is essential for developing effective public health strategies that address the broader spectrum of sexual health. Integrating STI prevention and treatment with PrEP programs is crucial to maximizing the overall benefits of PrEP while minimizing the risks associated with other STIs.

Behavioral Factors and Risk Compensation

Behavioral factors and risk compensation play significant roles in the context of PrEP use and the incidence of sexually transmitted infections (STIs). Risk compensation

refers to the phenomenon where individuals modify their behavior in response to their perceived level of risk. When it comes to PrEP, the protection it offers against HIV may lead some users to engage in behaviors that increase their risk of contracting other STIs. Understanding these behavioral dynamics is crucial for developing effective interventions to mitigate the unintended consequences of PrEP use. PrEP has been a groundbreaking development in HIV prevention, providing near-complete protection against HIV when taken consistently. However, the assurance of this protection can influence users' sexual behaviors. Studies have shown that some individuals on PrEP may reduce their use of condoms, increase their number of sexual partners, or engage in riskier sexual practices because they feel safeguarded against HIV. This shift in behavior, often referred to as risk compensation, can inadvertently elevate their risk of contracting STIs like gonorrhea, chlamydia, and syphilis, which PrEP does not prevent. Research has provided evidence of these behavioral changes among PrEP users. For instance, a cohort study by Lal *et al*. (2017) [3] found that men who have sex with men (MSM) on PrEP reported higher rates of condomless sex and a greater number of sexual partners compared to their behavior before starting PrEP. This suggests that the perceived reduction in HIV risk can lead to less cautious sexual behavior, increasing the likelihood of STI transmission. Behavioral factors contributing to risk compensation include a sense of security and invulnerability provided by PrEP. This perceived safety may lead to decreased vigilance in other protective measures, such as regular condom use. Additionally, the social dynamics within high-risk communities, where PrEP is commonly used, can reinforce these behaviors. Social norms and peer behaviors can influence individuals' sexual practices, leading to broader changes in risk-taking behaviors within these communities. Another important factor is the frequency and nature of sexual encounters among PrEP users. High-risk populations, such as MSM, often have more frequent and varied sexual interactions, which can increase the potential for STI transmission. The use of dating apps and social media platforms to facilitate sexual encounters can further contribute to higher rates of STI exposure. In this context, the use of PrEP may embolden individuals to engage in sexual activities with new or multiple partners without adequate protective measures. Moreover, the psychological impact of PrEP use should not be overlooked. The confidence gained from being on PrEP can lead to a more relaxed attitude toward sexual health practices. While this can have positive effects, such as reduced anxiety about HIV, it can also result in a decreased emphasis on other preventive measures. This highlights the need for comprehensive sexual health education that emphasizes the importance of continuing protective behaviors, even when on PrEP. The phenomenon of risk compensation is not uniform across all PrEP users. Some individuals maintain or even increase their use of condoms and other preventive measures while on PrEP. The diversity in behavioral responses underscores the importance of personalized and targeted interventions to address the specific needs and behaviors of different subgroups within the PrEP-using population. To mitigate the impact of risk compensation, it is essential to integrate behavioral interventions with PrEP programs. Healthcare providers should engage in open and non-judgmental discussions with PrEP users about sexual behaviors and the risks of STIs. Regular counseling sessions can help reinforce the importance of condom use, STI testing, and other protective measures. Additionally, promoting a comprehensive approach to sexual health that includes PrEP, condoms, and routine STI screenings can help balance the benefits of HIV prevention with the need to prevent other STIs. Behavioural factors and risk compensation significantly influence the incidence of STIs among PrEP users. The sense of security provided by PrEP can lead to riskier sexual behaviors, increasing the potential for STI transmission. Understanding these behavioral dynamics is crucial for developing effective public health strategies that promote safer sex practices and comprehensive sexual health. By addressing these behavioral factors and integrating STI prevention measures with PrEP programs, we can enhance the overall effectiveness of PrEP and reduce the incidence of STIs.

Strategies for Managing STIs in the PrEP Era

Managing the rising incidence of sexually transmitted infections (STIs) in the era of pre-exposure prophylaxis (PrEP) requires a multifaceted approach that addresses both behavioral and clinical aspects of sexual health. One of the most effective strategies is enhancing screening and monitoring practices. Regular and frequent STI screenings for PrEP users are essential to detect infections early and initiate timely treatment. This approach helps prevent the further spread of STIs and reduces the risk of complications associated with untreated infections. Guidelines recommend STI screening every three months for individuals on PrEP, ensuring that asymptomatic infections are identified and managed promptly.

Behavioral interventions play a crucial role in managing STIs among PrEP users. Education and counseling about the importance of maintaining safe sex practices, such as consistent condom use, even while on PrEP, are vital. Healthcare providers should emphasize that PrEP protects against HIV but not other STIs. Counseling sessions can address risk compensation behaviors and encourage practices that reduce the likelihood of STI transmission. Additionally, promoting awareness about the symptoms of common STIs and the importance of seeking medical attention promptly can empower PrEP users to take proactive steps in their sexual health.

Integrating comprehensive sexual health services with PrEP programs is another effective strategy. Clinics offering PrEP should also provide STI testing and treatment, risk reduction counseling, and access to other preventive measures, such as vaccinations for human papillomavirus (HPV) and hepatitis B. This integrated approach ensures that PrEP users receive holistic care that addresses all aspects of their sexual health. By combining PrEP with regular STI screenings and other preventive services, healthcare providers can offer a more effective and cohesive sexual health strategy.

Public health campaigns are crucial for raising awareness about the risks of STIs and the importance of regular screening. These campaigns can target high-risk populations and promote messages about maintaining safe sexual practices while using PrEP. Public health initiatives can also address the stigma associated with STIs and encourage open discussions about sexual health, making it easier for individuals to seek testing and treatment. Effective communication strategies can include social media campaigns, community outreach programs, and

collaboration with organizations that serve at-risk populations.

Research and surveillance are essential components of managing STIs in the PrEP era. Ongoing research helps monitor trends in STI incidence among PrEP users and evaluates the effectiveness of various interventions. Enhanced surveillance systems can identify emerging patterns and inform public health strategies, allowing for timely responses to changes in STI prevalence. Research can also explore new diagnostic methods, treatment options, and preventive measures, contributing to a better understanding of how to manage STIs effectively in the context of PrEP use.

Healthcare providers play a pivotal role in implementing these strategies. They must be well-informed about the latest guidelines and best practices for managing STIs in PrEP users. Providers should engage in continuous education and training to stay updated on new developments in sexual health and PrEP management. Building strong patient-provider relationships based on trust and open communication is crucial for encouraging PrEP users to adhere to screening recommendations and adopt safer sexual behaviors.

Incorporating technology and digital health tools can enhance the management of STIs in the PrEP era. Mobile health applications and online platforms can facilitate appointment scheduling, reminders for STI screenings, and the dissemination of educational materials. These tools can also provide anonymous and confidential services, reducing barriers to accessing care and encouraging more individuals to engage in regular STI testing and treatment.

In conclusion, managing STIs in the era of PrEP requires a comprehensive and integrated approach that combines regular screening, behavioral interventions, public health campaigns, research, and the use of digital health tools. By addressing both the clinical and behavioral aspects of sexual health, healthcare providers and public health officials can effectively mitigate the rise in STI rates among PrEP users and enhance the overall success of PrEP as an HIV prevention strategy.

Conclusion

The era of pre-exposure prophylaxis (PrEP) has significantly transformed HIV prevention, offering effective protection against the virus for high-risk populations. However, this advancement has brought new challenges, particularly the rising incidence of sexually transmitted infections (STIs) among PrEP users. The interplay between PrEP use and STI incidence necessitates a comprehensive approach to sexual health that addresses both HIV and other STIs.

Understanding the epidemiological trends reveals a concerning increase in STIs such as gonorrhea, chlamydia, and syphilis among PrEP users. Behavioral factors and risk compensation play crucial roles in this rise, as some individuals engage in riskier sexual behaviors due to the perceived protection against HIV. Effective management of STIs in the PrEP era requires multifaceted strategies.

Enhancing screening and monitoring practices is essential, with regular and frequent STI screenings ensuring early detection and timely treatment. Behavioral interventions, including education and counselling on safe sex practices, must be emphasized to mitigate risk compensation behaviors. Integrating comprehensive sexual health services with PrEP programs ensures holistic care, addressing all aspects of sexual health.

Public health campaigns are vital for raising awareness and reducing stigma, promoting regular STI testing and safer sexual behaviors. Ongoing research and enhanced surveillance systems are critical for monitoring trends, evaluating interventions, and informing public health strategies. Healthcare providers play a pivotal role, requiring continuous education and strong patient-provider relationships to encourage adherence to screening recommendations and safer sexual practices.

Incorporating digital health tools can further enhance management efforts by facilitating appointment scheduling, reminders, and educational dissemination. By adopting these comprehensive strategies, healthcare providers and public health officials can effectively manage the rising STI rates among PrEP users, ensuring the continued success of PrEP as a cornerstone of HIV prevention while safeguarding overall sexual health.

Conflict of Interest

Not available.

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