

Research Article

Sexually Transmitted Infections in Pre-Exposure Prophylaxis Patients

Ferdous Ara Ahmed^{1*}, Shima Ali Sadia², Beatrice Onyinyechi Mkpa³, Md. Naimul Islam Nakib⁴

¹Master of Public Health (7th Semester Student at Monroe University, USA), Bachelor of Medicine and Surgery (University of Dhaka), Bangladesh

²Master of Public Health (Second Semester Student at Monroe University, USA), Bachelor of Medicine and Surgery (University of Dhaka), Bangladesh

³Bachelors in Microbiology- University of Nigeria Nsukka Masters in Public Health (Epidemiology and Biostatistics) - Monro University (7th Semester Student), USA

⁴MBBS(China), Master of Public Health (Monroe University, USA)

*Correspondence author: Ferdous Ara Ahmed, Master of Public Health (7th Semester Student at Monroe University, USA), Bachelor of Medicine and Surgery (University of Dhaka), Bangladesh; Email: drferdousaraahmed@gmail.com

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Abstract

Background: Pre-exposure Prophylaxis (PrEP) has revolutionized HIV prevention, but concerns exist about its potential impact on other Sexually Transmitted Infections (STIs). This study aimed to assess the prevalence and patterns of STIs among PrEP users at a single urban clinic.

Methods: We conducted a retrospective analysis of 100 patients on PrEP, evaluating STI diagnoses over a 12-month period. Comprehensive STI screening was performed quarterly, including nucleic acid amplification tests for chlamydia and gonorrhea at multiple anatomical sites, and serological testing for syphilis.

Results: Of the 100 participants (mean age 32.5 years, 82% men who have sex with men), 42% were diagnosed with at least one STI during the study period. The most common infections were chlamydia (28%), gonorrhea (18%), and syphilis (8%). Among chlamydia and gonorrhea cases, 60.9% were rectal infections. Fifteen percent of patients experienced multiple STI diagnoses. Factors independently associated with STI diagnosis included age <30 years (OR 2.1, 95% CI: 1.3-3.4), ≥5 sexual partners in the past 6 months (OR 2.8, 95% CI: 1.7-4.6), and inconsistent condom use (OR 1.9, 95% CI: 1.2-3.0).

Conclusion: This study demonstrates a high prevalence of STIs among PrEP users, emphasizing the need for comprehensive STI prevention, frequent screening, and prompt treatment in this population. While PrEP effectively prevents HIV transmission, it must be implemented as part of a holistic approach to sexual health to address the risk of other STIs.

Keywords: Pre-exposure Prophylaxis (PrEP); Sexually Transmitted Infections (STIs); HIV Prevention; Sexual Health; Men who have Sex with Men (MSM); Risk Factors

Introduction

Pre-exposure Prophylaxis (PrEP) has emerged as a groundbreaking strategy in the global effort to combat HIV transmission. By providing antiretroviral medications to individuals at high risk of HIV exposure, PrEP has demonstrated remarkable efficacy in preventing new infections [1]. The World Health Organization reported a 68% reduction in HIV incidence among PrEP users compared to non-users in various population groups [2]. However, as PrEP use has become more widespread, the scientific community has raised concerns about its potential impact on the incidence and prevalence of other sexually transmitted infections (STIs) [3]. These concerns stem from several factors:

1. **Risk Compensation:** Some studies suggest that PrEP users may engage in riskier sexual behaviors due to a reduced fear of HIV transmission, potentially increasing their exposure to other STIs [4]
2. **Reduced Condom Use:** There is evidence of decreased condom use among some PrEP users, which could lead to higher rates of non-HIV STIs [5]
3. **Increased STI Detection:** More frequent testing associated with PrEP programs may lead to higher rates of STI diagnosis,

although this may reflect improved detection rather than true increased incidence [6]

4. Biological Factors: There is ongoing research into whether the use of antiretroviral medications could potentially affect susceptibility to certain STIs, although evidence in this area remains inconclusive [7]

Understanding the relationship between PrEP use and STI rates is crucial for developing comprehensive sexual health strategies. While PrEP effectively prevents HIV transmission, a potential increase in other STIs could have significant public health implications, including the spread of antibiotic-resistant gonorrhea strains and increased risk of HIV transmission in cases where PrEP adherence is suboptimal [8].

Aim

The primary aim of this study is to assess the prevalence and patterns of sexually transmitted infections among individuals using Pre-exposure Prophylaxis (PrEP) in an urban clinic setting.

Objectives

1. To determine the overall prevalence of STIs among PrEP users over a 12-month period
2. To identify the most common types of STIs diagnosed in this population
3. To analyze the anatomical distribution of chlamydia and gonorrhea infections (urethral, rectal, pharyngeal)
4. To evaluate the frequency of multiple STI diagnoses within individual patients during the study period
5. To examine any potential correlations between patient demographics or sexual behaviors and STI diagnoses
6. To compare the observed STI prevalence in our PrEP cohort with available data on STI rates in the general population and other high-risk groups not using PrEP

By achieving these objectives, we aim to contribute valuable data to the ongoing discussion about comprehensive sexual health care for PrEP users. Our findings may inform strategies for STI prevention, screening, and treatment in the context of PrEP programs, ultimately leading to improved overall sexual health outcomes for individuals at high risk of HIV and other STIs.

Materials and Methods

Study Design and Setting

We conducted a single-center, retrospective cohort study at the Urban Sexual Health Clinic, a comprehensive sexual health facility located in a major metropolitan area. The clinic serves a diverse population and has been providing PrEP services since 2016.

Study Population

We reviewed the electronic medical records of 100 consecutive patients who were actively using PrEP between January 1, 2023, and December 31, 2023.

Inclusion criteria

1. Age ≥ 18 years
2. Consistent PrEP use for at least 6 months prior to the study period
3. Attendance of at least two clinic visits during the study period
4. Documented HIV-negative status throughout the study period

Exclusion criteria

1. Patients who discontinued PrEP during the study period
2. Patients with missing STI screening data for more than one scheduled visit

Data Collection

A standardized data extraction form was used to collect the following information from electronic medical records:

1. Demographics: Age, gender identity, sexual orientation, race/ethnicity
2. PrEP regimen and duration of use

3. Sexual behaviors: Number of partners, types of sexual practices, condom use
4. STI screening results and diagnoses
5. Anatomical sites of STI infections
6. Treatment provided for diagnosed STIs
7. Relevant medical history, including prior STI diagnoses

STI Screening Protocol

STI screening was performed according to the 2021 CDC Sexually Transmitted Infections Treatment Guidelines [4]. The screening protocol included:

1. Chlamydia and Gonorrhea:

- Nucleic Acid Amplification Tests (NAATs) were performed on urine samples for urethral infections in all patients.
- For men who have sex with men (MSM) and other patients reporting receptive anal or oral sex, additional rectal and pharyngeal swabs were collected for NAAT testing.

2. Syphilis:

- Serological screening was conducted using a reverse sequence algorithm, starting with a treponemal test (e.g., enzyme immunoassay) followed by a nontreponemal test (e.g., rapid plasma reagin) if positive.

3. HIV:

- Fourth-generation antigen/antibody combination immunoassays were performed at each visit to confirm ongoing HIV-negative status.

4. Hepatitis B and C:

- Serological screening was conducted annually or more frequently based on individual risk factors.

5. Other STIs:

- Screening for Herpes Simplex Virus (HSV) and Human Papillomavirus (HPV) was performed based on clinical presentation and patient-reported symptoms.

Frequency of Screening

Patients were scheduled for STI screening every 3 months, aligning with their PrEP follow-up visits. Additional screening was performed if patients reported symptoms or potential exposure between scheduled visits.

Data Analysis

Statistical analysis was performed using SPSS version 28.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize patient characteristics and STI prevalence. We calculated the following:

1. Overall prevalence of STIs in the study population
2. Prevalence of individual STI types
3. Proportion of patients with multiple STI diagnoses
4. Anatomical distribution of chlamydia and gonorrhea infections

Chi-square tests or Fisher's exact tests (for cell counts <5) were used to assess associations between categorical variables. Independent t-tests or Mann-Whitney U tests were used for continuous variables, depending on the normality of distribution. Multivariable logistic regression was performed to identify factors independently associated with STI diagnosis, adjusting for potential confounders such as age, number of sexual partners, and condom use. A p-value <0.05 was considered statistically significant for all analyses.

Sample Size Justification

The sample size of 100 patients was chosen based on a power analysis assuming an expected STI prevalence of 30% (based on previous studies in similar populations), with a 95% confidence level and a margin of error of $\pm 9\%$.

Data Management and Confidentiality

All data were de-identified before analysis and stored on encrypted, password-protected devices. Access to the data was restricted to authorized study personnel only.

Results

1. Patient Demographics

A total of 100 patients met the inclusion criteria for this study. The demographic characteristics of the study population are summarized in Table 1.

Characteristic	n (%)
Age (years)	
Mean $\pm$ SD	32.5 $\pm$ 8.7
Range	19-56
Gender Identity	
Male	85 (85%)
Female	12 (12%)
Non-binary/Other	3 (3%)
Sexual Orientation	
Men who have sex with men	82 (82%)
Heterosexual	18 (18%)
Race/Ethnicity	
White	45 (45%)
Black	25 (25%)
Hispanic/Latino	20 (20%)
Asian	8 (8%)
Other	2 (2%)

Table 1: Demographic Characteristics of Study Population (N=100).

2. PrEP Usage

All patients were on daily oral PrEP regimens. The mean duration of PrEP use prior to the study period was 18.3 months (range: 6-48 months).

3. Overall STI Prevalence

During the 12-month study period, 42 patients (42%, 95% CI: 32.3%-52.3%) were diagnosed with at least one STI.

4. Prevalence of Specific STIs

STI Type	n (%)	95% CI
Chlamydia	28 (28%)	19.5%-37.9%
Gonorrhea	18 (18%)	11.0%-26.9%
Syphilis	8 (8%)	3.5%-15.2%
Genital Herpes (new diagnosis)	3 (3%)	0.6%-8.5%
Genital Warts (new diagnosis)	2 (2%)	0.2%-7.0%

Table 2: Prevalence of specific STIs (N=100).

5. Anatomical Distribution of Chlamydia and Gonorrhea

Among the 46 cases of chlamydia or gonorrhea:

- Rectal infections: 28 (60.9%, 95% CI: 45.4%-74.9%)
- Urethral infections: 14 (30.4%, 95% CI: 17.7%-45.8%)
- Pharyngeal infections: 4 (8.7%, 95% CI: 2.4%-20.8%)

6. Multiple STI Diagnoses

Fifteen patients (15%, 95% CI: 8.6%-23.5%) were diagnosed with multiple STIs during the study period:

- Two separate STI diagnoses: 8 patients (8%)
- Three or more STI diagnoses: 7 patients (7%)

7. STI Prevalence by Demographic Factors

Factor	STI Prevalence	p-value
Age		0.032
<30 years (n=45)	24 (53.3%)	
≥30 years (n=55)	18 (32.7%)	
Sexual Orientation		0.041
MSM (n=82)	38 (46.3%)	
Heterosexual (n=18)	4 (22.2%)	
Number of Sexual Partners		<0.001
<5 in past 6 months (n=60)	18 (30.0%)	
≥5 in past 6 months (n=40)	24 (60.0%)	

Table 3: STI prevalence by demographic factors.

8. Condom Use

Reported consistent condom use (defined as use during >90% of sexual encounters):

- For anal sex: 28% of MSM
- For vaginal sex: 22% of heterosexual participants

9. Multivariable Analysis

In the multivariable logistic regression model, factors independently associated with STI diagnosis were:

- Age <30 years (OR 2.1, 95% CI: 1.3-3.4, p=0.003)
- ≥5 sexual partners in past 6 months (OR 2.8, 95% CI: 1.7-4.6, p<0.001)
- Inconsistent condom use (OR 1.9, 95% CI: 1.2-3.0, p=0.007)

10. Comparison to General Population

The overall STI prevalence in our cohort (42%) was significantly higher than the estimated prevalence in the general adult population of the same metropolitan area (7%, p<0.001) based on local health department data.

Discussion

This single-center study of 100 PrEP users revealed a high prevalence of Sexually Transmitted Infections (STIs), with 42% of patients diagnosed with at least one STI over a 12-month period. This finding underscores the complex relationship between PrEP use and sexual health outcomes, highlighting the need for comprehensive STI prevention and management strategies in PrEP programs.

STI Prevalence and Patterns

The overall STI prevalence in our cohort (42%) is substantially higher than estimates for the general population in our area (7%) and aligns with previous studies suggesting increased STI risk among PrEP users [6,9]. Chlamydia and gonorrhea were the most frequently diagnosed infections, consistent with national trends [10]. The high proportion of rectal infections (60.9% of chlamydia/gonorrhea cases) emphasizes the importance of extragenital testing, particularly for men who have sex with men (MSM). The finding that 15% of patients experienced multiple STI diagnoses during the study period is concerning and suggests a subgroup at particularly high risk. This pattern of repeated infections may contribute to the spread of STIs within sexual networks and increases the risk of complications such as pelvic inflammatory disease or epididymitis [11].

Factors Associated with STI Risk

Our multivariable analysis identified younger age (<30 years), higher number of sexual partners (≥ 5 in 6 months), and inconsistent condom use as independent risk factors for STI diagnosis. These findings are consistent with previous research on STI risk factors in both PrEP users and the general population [12,13]. The association between younger age and STI risk may reflect differences in sexual behavior patterns or risk perception between age groups.

The low rates of consistent condom use reported by our participants (28% for anal sex, 22% for vaginal sex) are concerning but not unexpected. Several studies have documented decreased condom use among PrEP users, often attributed to a phenomenon known as risk compensation [14,15]. While PrEP effectively prevents HIV transmission, this behavioral change may contribute to increased STI incidence.

Implications for PrEP Programs

Our findings highlight the critical importance of integrating comprehensive STI services into PrEP programs. This integration should include:

1. **Enhanced STI Education:** PrEP users should receive thorough education about STI risks, symptoms, and prevention strategies. This education should emphasize that while PrEP prevents HIV, it does not protect against other STIs.
2. **Frequent and Comprehensive Screening:** The high STI prevalence in our cohort supports the current CDC recommendation for quarterly STI screening in PrEP users [16]. Our results also underscore the importance of multi-site testing, particularly for MSM.
3. **Prompt Treatment and Partner Notification:** Rapid identification and treatment of STIs, coupled with efficient partner notification systems, are crucial to breaking chains of transmission.
4. **Targeted Interventions:** Given the identified risk factors, PrEP programs should consider implementing age-specific interventions and strategies to address high-risk sexual behaviors.
5. **Promotion of Combination Prevention:** While recognizing the challenges of promoting condom use in the context of PrEP, healthcare providers should continue to emphasize the benefits of combining PrEP with other prevention methods, including condoms and regular testing.

Broader Public Health Implications

The high STI prevalence observed in our PrEP cohort raises concerns about the potential for increased STI transmission at a population level as PrEP use expands. This could have significant public health implications, including:

1. **Antibiotic Resistance:** Increased STI incidence may contribute to the development and spread of antibiotic-resistant strains, particularly of *Neisseria gonorrhoeae* [17].
2. **HIV Transmission Risk:** While PrEP is highly effective, suboptimal adherence combined with high STI rates could theoretically increase HIV transmission risk in some cases, as STIs can facilitate HIV transmission [18].
3. **Healthcare Resource Utilization:** Higher STI rates among PrEP users may lead to increased demand for STI testing and treatment services, potentially straining healthcare resources.
4. **Long-term Complications:** Repeated or untreated STIs can lead to various complications, including infertility and increased risk of certain cancers [19].

Limitations and Future Directions

Our study has several limitations that should be considered. The single-center design and relatively small sample size limit the generalizability of our findings. The retrospective nature of the study may have introduced selection bias, and we relied on self-reported sexual behaviors, which can be subject to recall and social desirability biases.

Future research should focus on larger, multi-center prospective studies to better characterize STI trends among PrEP users over time. Studies comparing STI rates between PrEP users and matched non-users would help clarify the specific impact of PrEP use on STI risk. Additionally, research is needed to develop and evaluate interventions aimed at reducing STI risk in the context of PrEP use, such as novel approaches to promoting combination prevention strategies.

Conclusion

This single-center study of 100 Pre-Exposure Prophylaxis (PrEP) users reveals a high prevalence of Sexually Transmitted

Infections (STIs), with 42% of patients diagnosed with at least one STI over a 12-month period. These findings underscore the complex interplay between HIV prevention strategies and broader sexual health outcomes, highlighting both the successes and challenges of PrEP implementation. The effectiveness of PrEP in preventing HIV transmission is well-established and represents a significant advancement in public health. However, our results suggest that PrEP use may be associated with an increased risk of other STIs, possibly due to behavioral changes such as reduced condom use and increased number of sexual partners. This emphasizes the critical need for a comprehensive approach to sexual health in the era of PrEP.

Key takeaways from our study include:

1. High STI prevalence: The observed 42% STI prevalence rate is substantially higher than in the general population, indicating a need for enhanced STI prevention efforts among PrEP users.
2. Multiple infections: 15% of patients experienced multiple STI diagnoses during the study period, suggesting a subgroup at particularly high risk.
3. Anatomical distribution: The high proportion of rectal infections highlights the importance of multi-site testing, especially for men who have sex with men (MSM).
4. Risk factors: Younger age, higher number of sexual partners, and inconsistent condom use were identified as independent risk factors for STI diagnosis.

These findings have important implications for PrEP programs and public health strategies:

1. Integration of services: PrEP provision should be fully integrated with comprehensive STI prevention, screening, and treatment services
2. Enhanced education: PrEP users need thorough education about STI risks and the importance of combination prevention strategies
3. Frequent screening: Our results support current guidelines recommending quarterly STI screening for PrEP users
4. Targeted interventions: Age-specific and risk-based interventions should be developed to address high-risk sexual behaviors in the context of PrEP use
5. Public health considerations: The potential for increased STI transmission at a population level as PrEP use expands must be carefully monitored and addressed

While our study has limitations, including its single-center design and relatively small sample size, it provides valuable insights into the sexual health challenges faced by PrEP users. Future research should focus on larger, multi-center prospective studies to better characterize STI trends among PrEP users over time and to develop and evaluate targeted interventions.

In conclusion, PrEP represents a powerful tool in the fight against HIV, but it must be implemented as part of a holistic approach to sexual health. By addressing both HIV and other STIs concurrently, we can maximize the public health benefits of PrEP while minimizing potential unintended consequences. Healthcare providers, public health officials, and PrEP users must work together to ensure that HIV prevention efforts do not come at the cost of increased vulnerability to other STIs. Only through such a comprehensive approach can we achieve optimal sexual health outcomes in the PrEP era.

Conflict of Interest

The authors declare that they have no conflict of interest.

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