Impact of Sexual Healthcare Touchpoints on STI Detection and Prevention Among Men Who Have Sex With Men and Cisgender Heterosexual Women Using HIV PrEP: A Decision-Analytic Model

P019

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Key Takeaways

- **This study estimated the individual and population health impact of 3- vs 2-times-a-year STI screening among people using PrEP in the United States and United Kingdom**
- **Under high adherence, 3- vs 2-times-a-year STI screening increased detected cases by 11%, reduced delayed or missed cases by 26% and onward transmissions by 31% to 38%, and increased partners tracked by 13%; findings showed the same overall pattern under the moderate-adherence scenario and in the subgroup of cisgender heterosexual women**
- **3- vs 2-time-a-year screening yielded more favorable outcomes under both high- and moderate-adherence scenarios, highlighting the importance of structured, regular STI screening within HIV prevention pathways**

Plain Language Summary

- We modeled a group of 10,000 adults receiving HIV prevention medication called PrEP over 2 years to compare 3- vs 2-times-a-year screening for sexually transmitted infections (gonorrhea, chlamydia, and syphilis) and studied how quickly infections were diagnosed and the estimated number of onward infections among partners
- Results showed that 3- vs 2-times-a-year screening diagnosed 11% more infections, lowered the number of infections that were found late or missed entirely by 26%, lowered the number of onward infections among partners by 31% to 38%, and increased the number of partners who were tracked and screened for infections by 13%

Introduction

- Sexually transmitted infection (STI) screening guidelines for people on HIV pre-exposure prophylaxis (PrEP) vary by population and clinical circumstances, with most guidelines recommending screening every 3 to 4 months to support early detection and prevent onward transmissions[1-4]
  - For men on injectable PrEP who have sex with men, the US Centers for Disease Control and Prevention and International Antiviral Society–USA specify conducting bacterial STI screening at least every 4 months[1,4]
  - For people using PrEP who have new or multiple sex partners, the British Association for Sexual Health and British HIV Association recommend conducting STI screening every 3 months[2]
  - The European AIDS Clinical Society recommends integrating regular STI screening into PrEP routine follow-up care[3]
- As some extended-dosing PrEP regimens emerge with intervals that exceed guideline-recommended STI screening frequency, opportunities for timely detection may be reduced, thus reinforcing the value of PrEP programs that maintain regular healthcare professional (HCP) contact
- PrEP follow-up visits create structured opportunities for integrated sexual healthcare, including STI screening and partner tracking, extending public health benefits beyond HIV prevention
  - Evaluating women in PrEP programs is particularly relevant as untreated STIs can lead to multiple adverse reproductive health outcomes[5]
- This model estimated the individual and population health impact of 3- vs 2-times-a-year STI screening among people who use PrEP

Methods

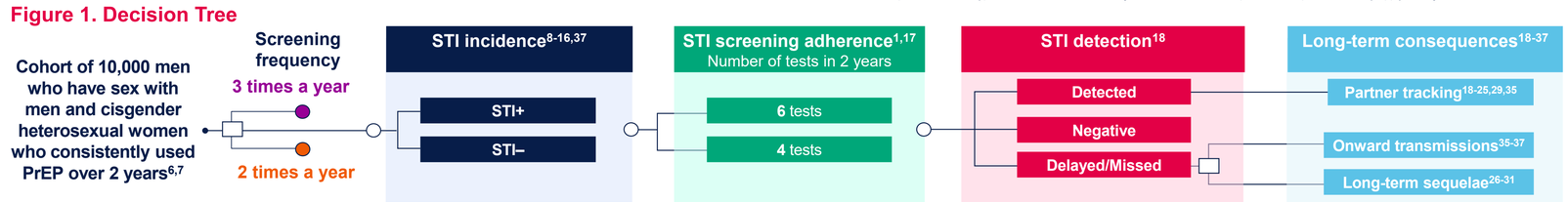
- A decision-analytic model comprising STI-specific decision trees for gonorrhea, chlamydia, and syphilis was used to estimate STI detection, onward transmissions, partner tracking, and long-term sequelae under 3- vs 2-times-a-year screening schedules (Figure 1)[1,6-37]
- The modeled cohort comprised adults (men who have sex with men and cisgender heterosexual women) who consistently used PrEP over 2 years in the United States and United Kingdom
  - PrEP discontinuations were not explicitly modeled
- High adherence (base case)[17] and moderate adherence to visits was explored
  - Within the 2 years of PrEP use, it was assumed that STI screening occurred at every scheduled visit for the high-adherence scenario (ie, 6 and 4 visits for 3- and 2-times-a-year screening, respectively) and every other scheduled visit for the moderate-adherence scenario (ie, 3 and 2 visits for 3- and 2-times-a-year screening, respectively)
- Population- and disease-specific 2-year incidence probabilities were informed by published literature[6,8,9]; selected key model inputs are shown in Table 1[8-10,13-15,18,22,25,29-31,35-37]
  - The population distribution differed between US and UK settings (cisgender heterosexual women: US, 9.8%; UK, 5.0%) and selected behavioral inputs used to estimate onward transmission, including partner numbers
- STI detection rates were informed by a prospective US PrEP demonstration cohort with quarterly STI screening over 48 weeks[18]; this publication was used to estimate the proportion of STIs with delayed detection under less-frequent screening[18] (Table 1; "STI detection probability" input)
- The model assumed that 34.0% of the partners of individuals with gonorrhea or chlamydia were tracked and treated[19]; the corresponding percentage for syphilis was 11.3%[20]
- 3.3% of syphilis cases were assumed to remain undetected and untreated after 30 years[31]
- Uncertainty was explored through scenario analyses

Table 1. Selected Key Model Inputs

Input	Population and values
STI incidence per 100 person-years	
Gonorrhea	Men who have sex with men: 37.1; cisgender heterosexual women: 10.6[8,9]
Chlamydia	Men who have sex with men: 21.5; cisgender heterosexual women: 34.7[8,9]
Syphilis	Men who have sex with men: 11.6[8]; cisgender heterosexual women: 2.2[a] (calculated)
STI detection probability in high and moderate adherence	
Gonorrhea	3 times a year: 74.3%, 51.7%; 2 times a year: 65.7%, 37.7%[18,b]
Chlamydia	3 times a year: 70.0%, 46.0%; 2 times a year: 60.0%, 31.9%[18,b]
Syphilis[c]	3 times a year: 85.7%, 75.0%; 2 times a year: 79.6%, 66.7%[18,b]
Key behavioral and transmission inputs	
Partners per year	Men who have sex with men: 1.0 main, 3.0 casual (US)[18,29]; 1.0 main, 1.8 casual (UK)[29,35] Cisgender heterosexual women: 1.2 (US)[22]; 2.6 (UK)[25]
Sex acts per year	Men who have sex with men: 80.7 per main partner; 4.0 per casual partner[36] Cisgender women: 39.0[22]
Transmission probability per sex act: gonorrhea, chlamydia, and syphilis	Men who have sex with men: 33.5%, 38.1%, 1.4%[d] Cisgender women: 16.2%, 11.4%, 0.5%[d]
Key probabilities of long-term sequelae	
Epididymitis after gonorrhea or chlamydia	Men who have sex with men: 2.0%[30]
PID after gonorrhea or chlamydia	Cisgender heterosexual women: 12.0%[30]
Sequelae after PID	Cisgender heterosexual women Ectopic pregnancy: 7.6%; tubal-factor infertility: 10.0%; chronic pelvic pain: 18.0%[30]
Selected syphilis sequelae	All modeled populations Early neurosyphilis: 3.0%; late benign syphilis: 16.0%; cardiovascular syphilis: 9.0%[31]

PID, pelvic inflammatory disease. [a]Cisgender heterosexual women's syphilis incidence was estimated from the value of men who have sex with men using a correction factor incorporating behavioral and transmission differences. [b]Tang et al[18] found over the course of 1 year with quarterly PrEP visits: 65.7% of gonorrhea cases, 60.0% of chlamydia cases, and 79.6% of syphilis cases. Tang et al[18] also reported the number of infections detected at baseline for 2 of the STIs (23.8% for gonorrhea, 17.9% for chlamydia). Based on these 2 values, and assuming that 100% of STIs would be detected if every-other-month visits were implemented, detection probabilities for 2 and 5 to 12 visits over 2 years were calculated. For syphilis, all values (except the value for 4 visits over 2 years, which were derived from Tang et al[18]) were calculated assuming that the last block of time on PrEP was missed. [c]For syphilis, detection rates apply to the 2-year time horizon; however, only the 3.3% of individuals whose syphilis remains undetected and untreated over a lifetime are at risk of sequelae.[31] [d]Transmission probability per sex act was calculated for gonorrhea and chlamydia based on the gender-specific probability of transmission for each transmission site[10] and the proportion of sex acts by site.[13-15] Transmission probabilities for syphilis were derived[37] assuming that the lower bound reported in the publication may apply to cisgender heterosexual women.

Figure 1. Decision Tree



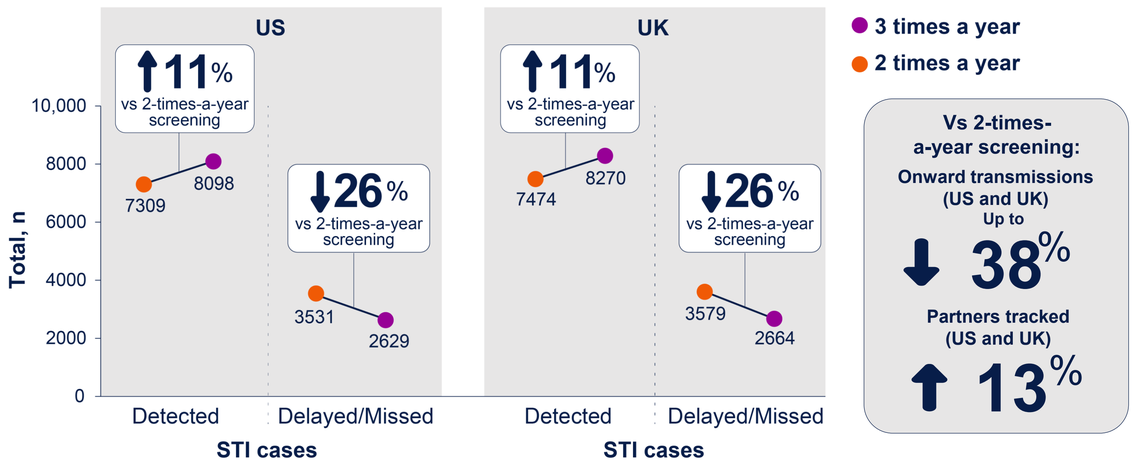
Results

High-Adherence Scenario

STI Detection

- Under the high-adherence scenario, 3- vs 2-times-a-year screening detected 11% more STI cases and reduced delayed or missed STI detection by 26%. This was accompanied by a 31% to 38% reduction in onward transmissions and a 13% increase in partners tracked (Figure 2)
  - Onward transmissions: 3 times a year, 4210 to 19,438 (US) and 3676 to 30,260 (UK); 2 times a year, 6252 to 31,212 (US) and 5343 to 48,913 (UK)
  - Partners tracked: 3 times a year, 5736 to 34,550 (US) and 4612 to 54,912 (UK); 2 times a year, 5074 to 30,706 (US) and 4073 to 48,818 (UK)

Figure 2. STI Cases Detected and Delayed/Missed by Screening Frequency and Region



Long-Term Sequelae

- Long-term sequelae, although infrequent, showed similar patterns. Under high adherence, 3- vs 2-times-a-year screening reduced most key outcomes by 26% to 50% in the United States and by 23% to 50% in the United Kingdom (Table 2)
- Long-term sequelae results should be interpreted considering the model structure, the populations in whom these conditions occur, and the modeled population composition
  - Epididymitis occurs only in men, so this outcome is driven entirely by cases of men who have sex with men, with its range reflecting the range of onward-transmission inputs per case
    - This range is wider for the United Kingdom than the United States because the upper-bound estimate for casual partners of men who have sex with men per year is substantially higher in the United Kingdom (43.9[23,29]) than the United States (28.4[18,29])
  - All other long-term sequelae caused by gonorrhea or chlamydia occur only in cisgender women, who comprise a smaller share of the modeled population; therefore, these outcomes appear to have a lower incidence

Table 2. Long-Term Sequelae by Screening Frequency and Region

Long-term sequelae	3 times a year[a] US	3 times a year[a] UK	2 times a year[a] US	2 times a year[a] UK	3- vs 2-times-a-year difference[a] US	3- vs 2-times-a-year difference[a] UK
Epididymitis[b]	31 to 93	30 to 137	45 to 148	42 to 223	-31% to -37%	-29% to -39%
PID[b]	20	10	27	13	-26%	-23%
Chronic pelvic pain[b]	4	2	5	2	~0%	0%
Infertility[b]	2	1	3	1	~0%	0%
Ectopic pregnancy[b]	2	1	2	1	0%	0%
Early neurosyphilis[c]	0	0 to 1	1	1	-100%	-100% to 0%
Benign late syphilis[c]	2	2 to 3	3 to 4	3 to 5	-33% to -50%	-33% to -40%
Cardiovascular syphilis[c]	1	1 to 2	2	2 to 3	-50%	-50% to -33%
Meningovascular syphilis[c]	0	0 to 1	1	1	-100%	-100% to 0%
General paresis[c]	0	0	0 to 1	0 to 1	NA	NA
Tabes dorsalis[c]	0	0	0 to 1	0 to 1	NA	NA

NA, not applicable; PID, pelvic inflammatory disease. [a]A range is shown if there is variability in the result due to various onward-transmission ranges. [b]Condition a person may develop as a result of having gonorrhea or chlamydia. [c]Condition a person may develop as a result of having syphilis.

Moderate-Adherence Scenario

STI Detection

- When screening adherence decreased to moderate (ie, screening at every other visit), detection declined across both schedules
  - In the United States, the estimated STI detection was 6107 cases with 3-times-a-year and 4904 cases with 2-times-a-year screening, resulting in a 25% higher detection rate for 3- vs 2-times-a-year screening; this difference exceeds the high-adherence scenario because, with half of screening opportunities missed, 2-times-a-year screening left longer gaps than 3-times-a-year screening
    - Reduction in delayed or missed detection was estimated at 22% for 3-times-a-year (4818 cases) compared with 2-times-a-year (6175 cases) screening, alongside an estimated reduction of 22% in onward transmissions (8646 to 43,068 and 11,142 to 55,292, respectively) and an estimated increase of 29% to 31% in partner tracking (4140 to 25,466 and 3151 to 19,771, respectively)
  - In the United Kingdom, 3-times-a-year (6260 cases) vs 2-times-a-year (5044 cases) screening was estimated to increase STI detection by 24%
    - Reduction in delayed or missed detection was estimated at 22% for 3-times-a-year (4882 cases) vs 2-times-a-year (6261 cases) screening, alongside an estimated reduction of 22% to 23% in onward transmissions (7393 to 67,482 and 9539 to 86,610, respectively) and an estimated increase of 29% to 32% in partner tracking (3304 to 40,532 and 2496 to 31,508, respectively)

Long-Term Sequelae

- 3- vs 2-times-a-year screening was associated with reductions of 13% to 50% in long-term sequelae outcomes across the United States and United Kingdom (Supplemental Table accessed via QR code)

Cisgender Heterosexual Women Subgroup in the High-Adherence Scenario

- In the cisgender heterosexual women subgroup, 3- vs 2-times-a-year screening improved STI detection by 13% to 14%, reduced delayed or missed detection by 25%, reduced onward transmissions by 37%, and increased partner tracking by 15%; patterns of long-term sequalae reductions with 3-times-a-year screening were also consistent with those of the overall population (Table 3)

Table 3. STI Detection and Long-Term Sequelae by Screening Frequency and Region

	3 times a year US	3 times a year UK	2 times a year US	2 times a year UK	3- vs 2-times-a-year difference US	3- vs 2-times-a-year difference UK
Cases detected (all)	5343	5820	4678	5154	14%	13%
Cases delayed/missed	2053	2122	2743	2841	-25%	-25%
Onward transmissions	2150	4468	3420	7111	-37%	-37%
Partners tracked	2123	4523	1840	3927	15%	15%
Long-term sequelae						
PID[a]	204	204	272	272	-25%	-25%
Chronic pelvic pain[a]	37	37	49	49	-25%	-25%
Infertility[a]	20	20	27	27	-26%	-26%
Ectopic pregnancy[a]	16	16	21	21	-24%	-24%
Early neurosyphilis[b]	0	0	0	0	NA	NA
Benign late syphilis[b]	0	1	0	1	NA	0%
Cardiovascular syphilis[b]	0	0	0	1	NA	-100%

NA, not applicable; PID, pelvic inflammatory disease. [a]Condition a person may develop as a result of having gonorrhea or chlamydia. [b]Condition a person may develop as a result of having syphilis.

Conclusions

- In this model, increasing STI screening from 2 to 3 times a year was predicted to improve STI detection, reduce delayed or missed diagnoses and onward transmissions, and increase partner tracking under both adherence scenarios
- These findings highlight that beyond HIV prevention, maintaining regular PrEP follow-up visits creates opportunities for integrated sexual healthcare, supporting individual and population health
- STI incidence, behavioral inputs, and real-world STI screening patterns are heterogeneous across populations and subject to uncertainty. The model has been parameterized using published evidence and assumptions relevant to populations using PrEP in the United States and United Kingdom; model inputs and assumptions may not fully reflect underlying risk and care across populations and settings
- Model-predicted STI outcomes were compared with US and UK surveillance data to ensure alignment with observed epidemiologic patterns before cohort-level analyses were conducted

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