

Assessing the combined Impact of Interventions on the HIV and Syphilis epidemics among gbMSM in British Columbia: a co-interaction model

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Background and Objectives

- Gay, bisexual and other men who have sex with men (gbMSM) remain the most affected by HIV in British Columbia (BC)
- Majority of infectious syphilis cases (over 80% of all cases) in BC were among gbMSM
- Currently, HIV Treatment as Prevention (TasP), Condom use, and Pre-Exposure Prophylaxis (PrEP) have been highly effective for HIV prevention and control in gbMSM
- Similarly, Condom use, Test&Treat diagnosed cases of syphilis have also been effective
- This study assesses how the combination of TasP, Condom use, PrEP, and Test&Treat can be used to prevent/eliminate further HIV-syphilis transmission and co-interaction among the gbMSM population in BC

Methods

- We developed a mathematical model of the co-interaction of HIV/syphilis transmission and progression among gbMSM in BC (Fig. 1)
- The transmission parameters were fitted and calibrated on Public Health Agency of Canada (PHAC) estimates of HIV incidence and Prevalence for gbMSM in BC, HIV annual diagnosis from HIV Cascade of Care in British Columbia Centre for Excellence in HIV/AIDS (BC-CfE), and Syphilis annual diagnosis from British Columbia Centre for Disease Control
- We studied the impact of optimizing TasP, Test&Treat syphilis, increasing condom use, and PrEP access. For TasP, we assessed the effect of decreasing the time to HIV diagnosis, to antiretroviral treatment (ART), and increasing the time retained on ART for individuals with and without syphilis. For Test&Treat syphilis, we studied the impact of decreasing the time from infection to treatment.
- We measure the impact of intervention at the end of 10 years (from 2019 until 2028) on: (1) HIV incident cases; (2) All-cause mortality cases among people living with HIV (PLWH); (3) HIV point prevalence; (4) syphilis incident cases (Fig. 2). In addition, we assessed the scenarios in which we obtained <1 HIV and syphilis new case per 1000 susceptible gbMSM (*WHO threshold for disease elimination*)
- We estimated the univariate sensitivity coefficients for HIV and syphilis incidence changes under three PrEP uptake scenarios at the end of 2028. In addition, we estimated the percent change in cumulative HIV and syphilis incident cases with respect to the Status Quo scenario from 2019 to 2028 (Fig. 3)

Figure 1. Deterministic model of HIV-syphilis co-interaction

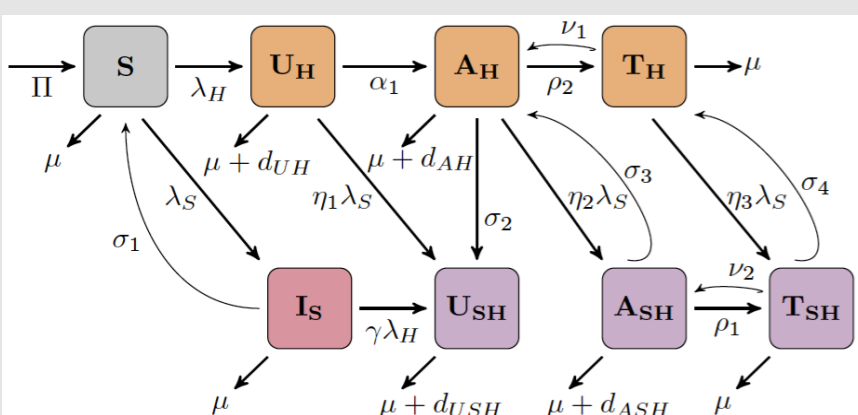
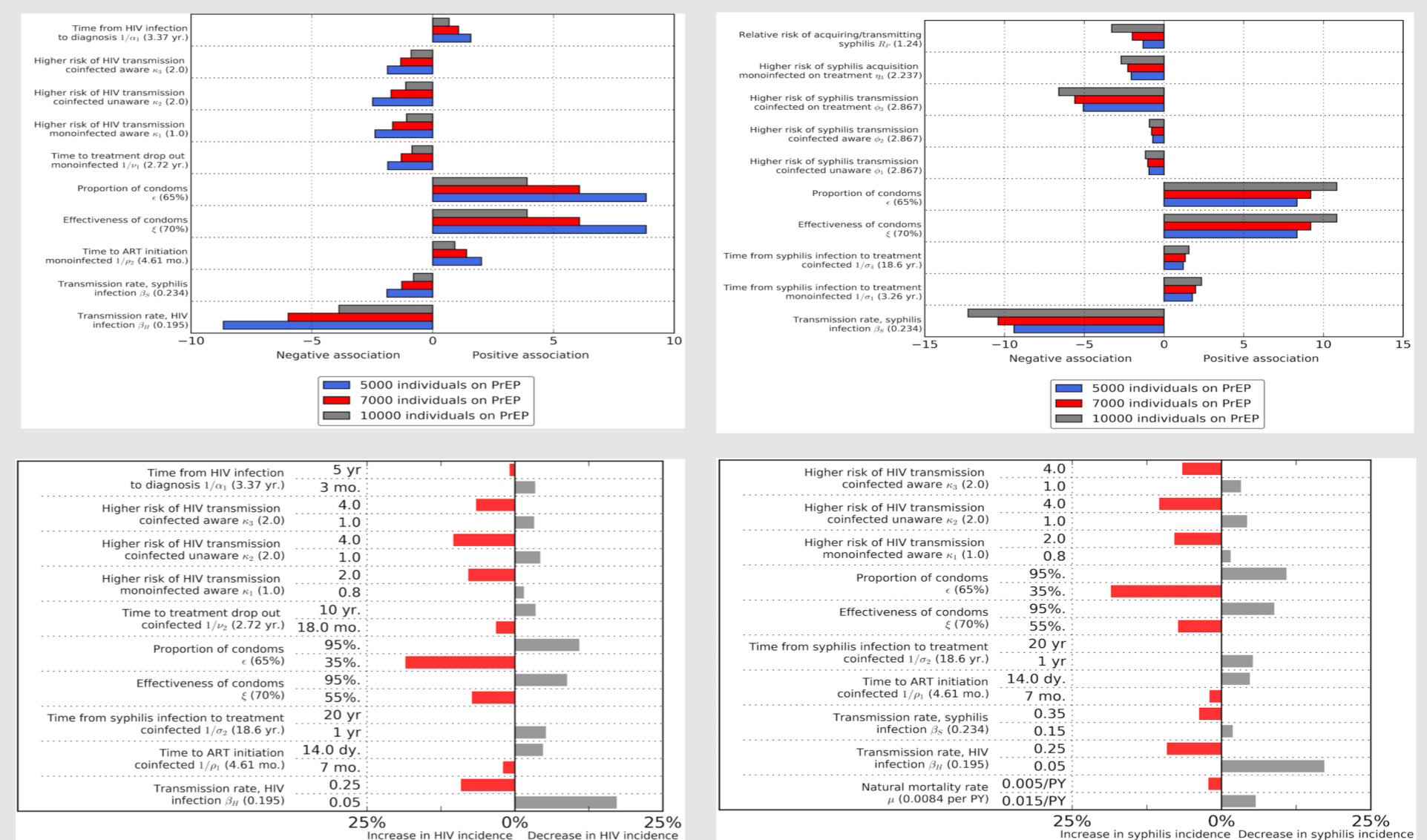


Figure 2. Reduction in HIV point prevalence, incident cases, and all-cause mortality cases (left), and syphilis incident cases (right), among gbMSM living with HIV after 10 years of TasP, PrEP, condom use, and Test & Treat (syphilis) interventions



Figure 3. Univariate Sensitivity Analysis on HIV incidence (left column) and syphilis incidence (right column) for various PrEP strategies (top) and for the top 10 parameters with the most uncertainty (bottom)



Results

- Optimizing TasP, Test&Treat syphilis, and increased provision of PrEP resulted in about 88% reduction in HIV incidence (left of Fig. 2), and HIV incident rate as low as 0.13 per 1000 susceptible gbMSM
- Optimizing Test&Treat syphilis, and increased proportion of condom use resulted in about 80% reduction in syphilis incidence (right of Fig. 2), and syphilis incident rate as low as 0.85 per 1000 susceptible gbMSM
- Optimizing TasP, Test&Treat syphilis, combined with condom use resulted in HIV & syphilis incident rate as low as 0.11 & 0.86 respectively and elimination of both diseases was possible
- Only TasP significantly decreased mortality (Fig. 2) while PrEP increased syphilis incidence by about 5%

Conclusions

- Optimizing TasP, through promotion of timely HIV diagnosis, treatment initiation and higher retention, and improving time from syphilis diagnosis to treatment, combined with the distribution of PrEP was the most successful strategy to control the HIV epidemic
- Optimizing Test&Treat syphilis, and increased condom use was the most successful strategy to control the syphilis epidemic
- Frequent testing of syphilis and other STIs, particularly among gbMSM using PrEP should be prioritized to control the syphilis epidemic
- Consistent use of condoms should continue to be encouraged and promoted to reduce HIV and syphilis transmission particularly among those who may not be eligible to receive PrEP

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