# CAN HIV EPIDEMICS AMONG MEN WHO HAVE SEX WITH MEN IN HIGH-INCOME COUNTRIES BE ELIMINATED THROUGH VOLUNTARY PARTICIPATION TO PrEP ROLLOUTS?

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## Introduction

- In many high-income settings, men who have sex with men (MSM) are the most affected by HIV.
- IPERGAY and PROUD clinical trials estimated that pre-exposure prophylaxis (PrEP) can reduce HIV incidence among MSM by 86%.
- According to recent modeling studies, PrEP can curtail and even eliminate HIV epidemics. However, in these studies, PrEP coverage is assumed to reach certain values, which may not be achieved in the real world.
- The decision-making on PrEP adoption may depend on several factors, including the perceived risk of infection and the "cost" of using PrEP (which may include price, access model of PrEP, pill burden, etc.) relative to the consequences of being infected with HIV and undergo lifelong ART.

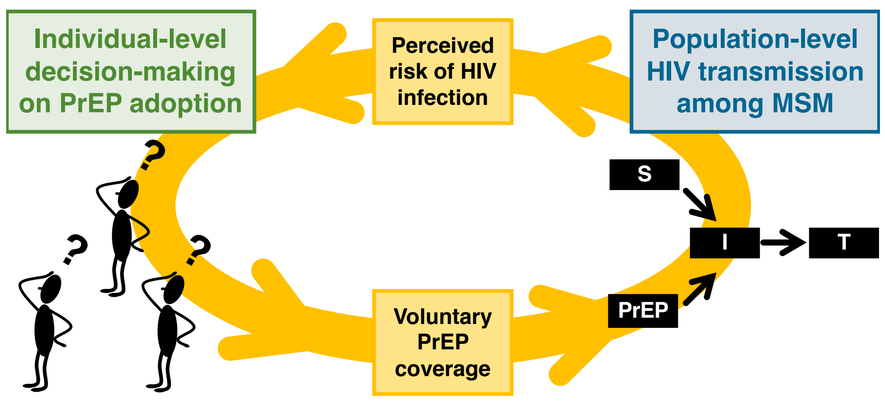
## Objective

To determine what levels of PrEP coverage could be reached **voluntarily** by MSM at high risk of HIV infection, and their impact on the HIV epidemic.

## Mathematical model

A mathematical model of the HIV transmission that takes into account the individual decision-making on whether or not to adopt PrEP.

The model was calibrated to the HIV epidemic in the **Paris region, in 2016**.




- **Individual-level total cost** a function of the perceived risk of infection and the relative cost of PrEP vs. ART
- Decision-making modeled by the **minimization of the total cost**

- Classical **compartmental model**
- Stratification by risk of infection
- Only high-risk MSM use PrEP

## The effective reproduction number ($R$)

$R$ is defined as the number of secondary cases that an infectious individual causes in a disease-naïve population subject to control interventions.

We use $R$ to determine under what conditions an epidemic is eliminated in the long run.

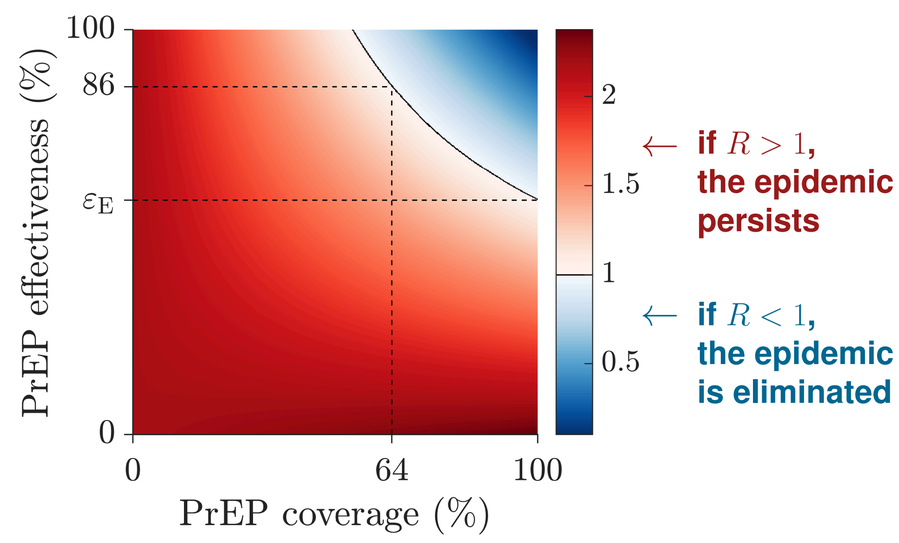



**Fig. 1. The effective reproduction number ($R$) for a typical set of parameters calibrating our transmission model.** The minimum level of PrEP effectiveness that yields epidemic elimination, provided that high levels of PrEP coverage are also met, is $\varepsilon_E = 58\%$.

A PrEP effectiveness of 86% requires a PrEP coverage of at least 64% to ensure $R < 1$.

## Voluntary PrEP coverage among high-risk MSM

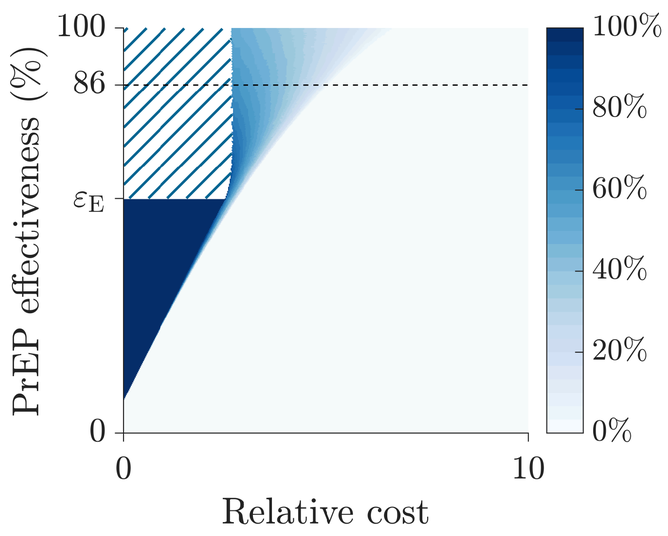



**Fig. 2. The voluntary PrEP coverage among high-risk MSM.** High levels of PrEP effectiveness and a cost of PrEP perceived by individuals as being low yield epidemic elimination (blue stripes); i.e., $R < 1$.

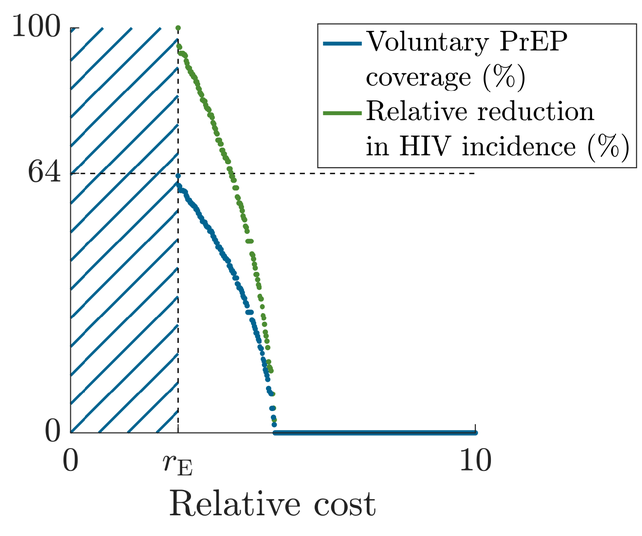



**Fig. 3. The voluntary PrEP coverage among high-risk MSM, for a PrEP effectiveness of 86%, and its impact on the HIV epidemic.** The maximum cost that yields epidemic elimination (blue stripes) is denoted $r_E$.

We found that epidemic elimination is only temporary.

**Epidemic elimination**
⇓
Risk of infection no longer perceived
⇓
Perception of a higher relative cost of PrEP vs. ART
⇓
**Epidemic reemergence**

## Conclusions

1. **Epidemic elimination through voluntary adoption of PrEP is possible** provided that:
   - PrEP effectiveness is high (higher than $\varepsilon_E = 58\%$)
   - The relative cost of PrEP versus ART is perceived as low
   - Individuals have a fair perception of the risk of infection

2. **Epidemic elimination may be only temporary**. Once elimination is reached, public health efforts are required:
   - To fight PrEP-related stigma, low access, high prices, etc.
   - To promote a fair perception of the risk of HIV infection of the pre-elimination era

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