Estimating the impact of PrEP regimens containing long-acting injectable cabotegravir or daily oral TDF/FTC among men who have sex with men in the United States: mathematical modelling for HPTN 083

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Background
HIV in the United States

- High HIV incidence among men who have sex with men (MSM)
- Higher HIV incidence among younger MSM, Black and Hispanic MSM, in the Southern US
- Ending the HIV Epidemic (EHE) initiative aims to reduce the number of new HIV infections by improving:
  - HIV diagnosis
  - antiretroviral therapy usage and viral suppression
  - prevention including **pre-exposure prophylaxis (PrEP)**
HPTN 083 PrEP trial

Demonstrated superiority of a regimen containing long-acting injectable cabotegravir (CAB) over daily oral tenofovir disoproxil fumarate/emtricitabine (TDF/FTC) for HIV PrEP among MSM and transgender women.
AIMS

1. Assess the potential **population-level impact** on new HIV infections of daily oral TDF/FTC and long-acting injectable CAB use among MSM in Atlanta, Georgia, US

2. Assess their potential **role in achieving the EHE goals**
Methods
Mathematical model

- Deterministic, compartmental model of HIV transmission, treatment and PrEP use among MSM in the United States
- Population stratified by age, race and PrEP indication

1indication for PrEP: ≥2 male partners AND condomless anal sex OR bacterial STD OR main HIV-infected male partner in past 12 months
Model calibration

- Model parameterised and calibrated with behavioural and HIV prevalence data from NHBS\(^1\) for MSM in Atlanta
- Also calibrated to viral suppression data\(^2\) for MSM in Georgia and PrEP use data\(^3\) for MSM in Atlanta

HIV prevalence

\(\text{% virally suppressed}\)

\(\text{% using PrEP}\)

1. CDC National HIV Behavioral Surveillance; 2. Georgia Department of Public Health surveillance data; 3. multiple sources, incl NHBS
PrEP assumptions

**Oral TDF/FTC**

- Efficacy (≥4 doses/wk): 90-100% (Anderson et al 2012 Sci Transl Med)
- Adherence (% taking ≥4 doses/wk): 79-92% (US PrEP Demo project)
- Effectiveness (efficacy × adherence): 72-89%
- Dropout: 17-44%/yr (US PrEP Demo project)

**Long-acting injectable CAB**

- Effectiveness (efficacy × adherence): 82-96% (HPTN 083 statistics team)
- Dropout: as for oral TDF/FTC

*Main analysis: PrEP only used by MSM with a PrEP indication (~45%)*
PrEP scenarios

1. TDF/FTC use maintained
2. All TDF/FTC users switched to CAB in Jan 2021
3. All TDF/FTC users switched to CAB in Jan 2021 + CAB users increased by 10%
4. All TDF/FTC users switched to CAB in Jan 2021 + CAB users increased by 20%

PrEP expansion among MSM with a PrEP indication

Outcomes:
- % cumulative infections averted over 5 or 10 years from Jan 2021 vs no PrEP
- % reduction in annual infections during 2025 and 2030 vs 2017
RESULTS
Population level impact: HIV infections averted vs. no PrEP
Achieving the EHE goals

PrEP expansion among MSM with a PrEP indication

PrEP expansion among all MSM with or without a PrEP indication

% change in new infections by 2025 by 2030

oral TDF/FTC CAB same usage CAB 20% increased usage oral TDF/FTC CAB same usage CAB 20% increased usage

% change in new infections by 2025 by 2030

oral TDF/FTC CAB same usage CAB 20% increased usage oral TDF/FTC CAB same usage CAB 20% increased usage

% all uninfected MSM using PrEP 2025:

28%  28%  34%  28%  28%  34%  90%  90%  90%  90%
Conclusions

• While continuing TDF/FTC use by Atlanta MSM could prevent 1/3\(^{rd}\) of new HIV infections over the next 5 years...
• CAB estimated to prevent ~20% more infections than TDF/FTC with similar numbers of users, if CAB adherence is the same as in HPTN 083
• With 1/3\(^{rd}\) of uninfected MSM using CAB could get ~60% of the way towards the EHE goals
• To meet EHE goals expanding PrEP alone, need 90% using CAB
• Other measures, e.g. improvements in diagnosis and viral suppression, also likely needed to meet the EHE goals
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