Model Projections of the Impact of the PopART Intervention in the HPTN 071 (PopART) Study

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ON BEHALF OF THE POPART MODELLING TEAM

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Primary objectives of modelling within HPTN 071 (PopART)

1. To help interpret the results of the trial.
2. To project longer-term impact.
3. To explore likely impact in different settings.
4. To explore the likely impact of alternative intervention packages.
Individual-based model for HIV transmission

Modelled as two “patches”:

Inside patch = PopART intervention community
Outside patch = surrounding area

Within each patch:

1. Demographics
   - Births, deaths, ageing
   - No explicit migrations

2. Partnerships
   - Dynamic, heterosexual, assortative by risk/age, within/between patch

3. HIV transmission
   - In serodiscordant partnerships
   - Based on Cori et al. AIDS 2015

4. Disease progression and AIDS death

5. Background HIV care
   - HIV testing, ART, VMMC, care cascade

6. PopART Intervention
   - HIV testing, ART, VMMC, care cascade
### Individual-based model for HIV transmission

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| 6. PopART Intervention | HIV testing, ART, VMMC, care cascade |

**Model output**

Projected HIV prevalence, incidence, ART coverage, complete transmission network, etc.
Before trial unblinding:

- Modelling team was blinded to all PC data except PC0 but had access to data from CHiPs.
- Each community was calibrated using the following data (stratified by age and sex):
  - CHiPs prevalence (R3 only)
  - Zambia: CHiPs prop. aware & prop. on ART (3 rounds), DHS prev. (3 rounds)
  - South Africa: CHiPs prop. aware & prop. on ART (R3), HSRC prev. (4 rounds).

- Impact calculated as comparison with counterfactual simulations.
- Modelling projections were lodged in a time-stamped repository.
Trial unblinding (Dec 2018): a unique opportunity to test model predictions

After unblinding:

• Model parameters informed from PC data were updated.
  – Those governing sexual partnerships, uptake of VMMC, TMC

• In addition to the data used before unblinding, each community was calibrated using (stratified by age and sex):
  – PC prevalence (4 rounds), viral suppression at PC24.
  – South Africa: PC proportion aware and proportion on ART (4 rounds).

• Impact calculated as comparison with arm C projections.
PROJECTIONS OF TRIAL IMPACT

Projections are over PC12-36 in PC population (18-44yo)
PROJECTIONS OF TRIAL IMPACT

- **Observed**
- Projection (PC; pre-unblinding)
- Projection (PC; post-unblinding)

Relative reduction in incidence (%)

Projection over PC12-36 in whole community

Arm A

Arm B

Arms A & B
PROJECTIONS OF TRIAL IMPACT

- Projection over 2020-2030 in whole community
What is the projected future impact in different settings?

Four scenarios projected to 2030:

- PopART then continuation of CHiPs intervention to 2030
- PopART then no CHiPs intervention after trial
- CHiPs intervention nationwide
- No CHiPs intervention
SCENARIO DESCRIPTION

Note: Impact measured only in the PopART community.


**SCENARIO DESCRIPTION**

- **PopART/CHiPs continued**
  - PopART社区
  - 周边地区
- **PopART/CHiPs discontinued**
  - PopART社区
  - 周边地区

**Note:** Impact measured only in the PopART community.
**SCENARIO DESCRIPTION**

- **PopART/CHiPs continued**
  - PopART community
  - Surrounding area
- **PopART/CHiPs discontinued**
  - PopART community
  - Surrounding area
- **CHiPs/nationwide**
  - PopART community
  - Surrounding area

**Note:** Impact measured only in the PopART community.
SCENARIO DESCRIPTION

Note: Impact measured only in the PopART community.
HIV incidence per 100 person-years

- Men
- Women

- PopART/CHiPs continued
- PopART/CHiPs discontinued
Greater incidence reductions when a CHiPs intervention is continued for a longer period of time.
Men

Women

HIV incidence per 100 person-years

- PopART/CHiPs continued
- CHiPs/nationwide

2010 2020 2030
Greater incidence reductions when a CHiPs intervention is introduced to a wider area.
What was the impact of different components of the intervention?

Two scenarios were modelled:

- **PopART including VMMC and ART** (primary scenario)
- **PopART including ART** but no VMMC

**Note:** Within the model VMMC reduces HIV susceptibility of an HIV- man by 60%.
HIV incidence per 100 person-years

- Men
  - VMMC and ART
  - ART only

- Women
  - VMMC and ART
  - ART only

Country:
- South Africa
- Zambia
Summary

• Trial unblinding tested the predictive ability of modelling and validated the model against observed trial impact.

• Reductions in cumulative incidence over 2020-2030 consistently predicted to be >50% for PopART-like interventions compared to standard-of-care.

• Increased impact if PopART-like intervention is introduced to a wider area and continued over a longer period of time.

• Substantial impact of VMMC, conditional on high uptake.
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