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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Model output

Projected HIV prevalence, incidence, ART coverage, complete transmission network, etc.
Trial unblinding (Dec 2018): a unique opportunity to test model predictions

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

- Relative reduction in incidence (%)

- Observed
- Projection (PC; pre-unblinding)
- Projection (PC; post-unblinding)
- Projection (whole population)
- Projection (2020–2030)

Projection over PC12-36 in whole community
PROJECTIONS OF TRIAL IMPACT

- Observed
- Projection (PC; pre–unblinding)
- Projection (PC; post–unblinding)
- Projection (whole population)
- Projection (2020–2030)

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.
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Greater incidence reductions when a CHiPs intervention is continued for a longer period of time.
HIV incidence per 100 person-years

- Men
  - PopART/CHiPs continued
  - CHiPs/nationwide

- Women
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%. 
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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