HPTN
HIV Prevention
Trials Network

PopART
HPTN 071

# 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**

**IAS 2019**

PEPFAR

3ie International Initiative for Impact Evaluation

BILL & MELINDA GATES foundation

**U.S. NATIONAL INSTITUTES OF HEALTH:**
*National Institute of Allergy and Infectious Diseases*
*National Institute of Mental Health*
*National Institute on Drug Abuse*

# Primary objectives of modelling within HPTN 071 (PopART)

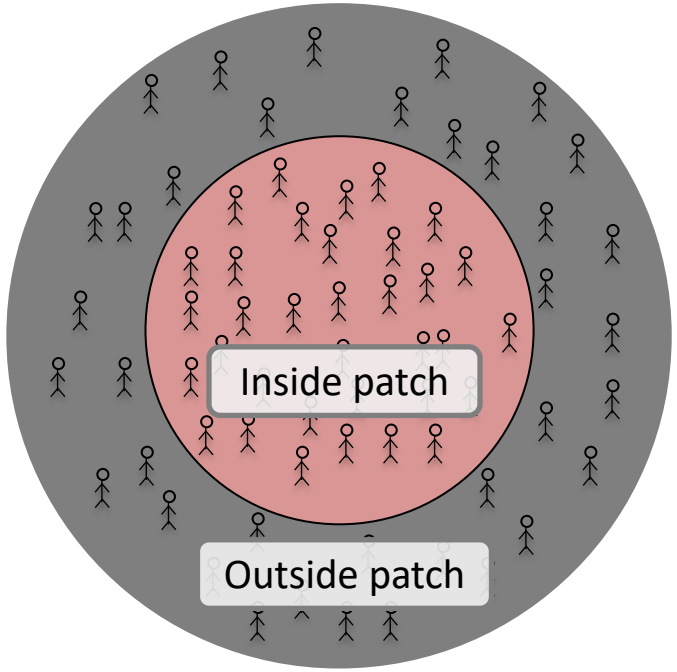
1. To help interpret the results of the trial.
2. To project longer-term impact.
3. To explore likely impact in different settings.
4. To explore the likely impact of alternative intervention packages.

# 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

**4. Disease progression and AIDS death**
based on Cori et al. AIDS 2015

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

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

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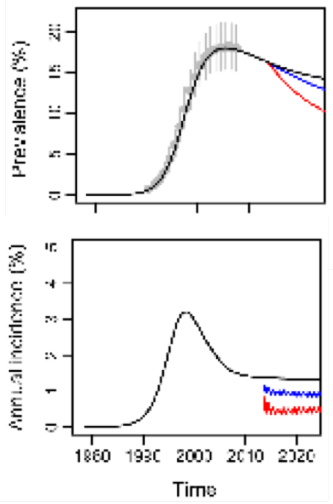
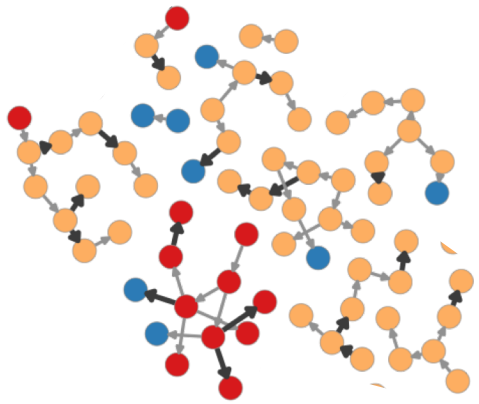
Model output

**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

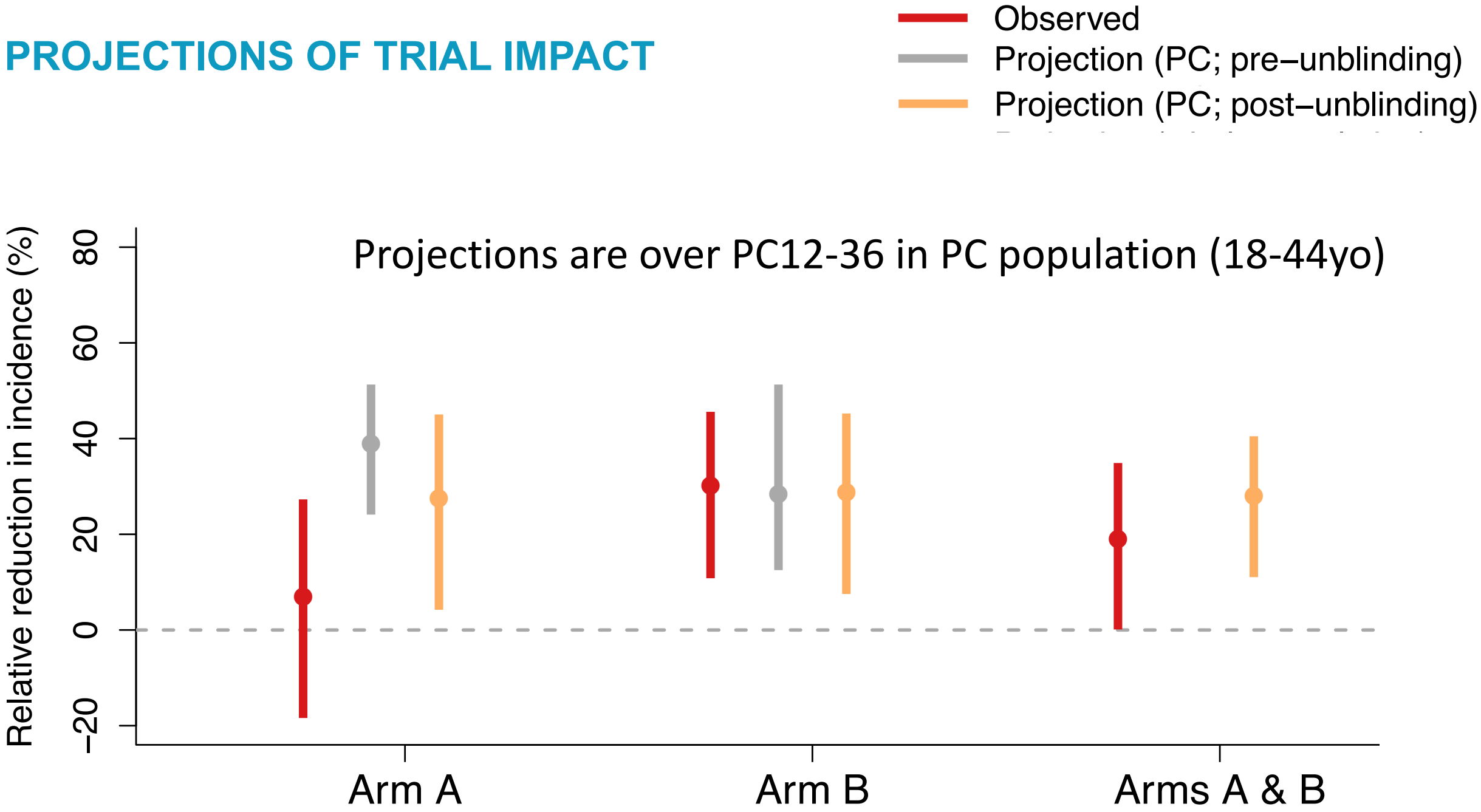
After unblinding:

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

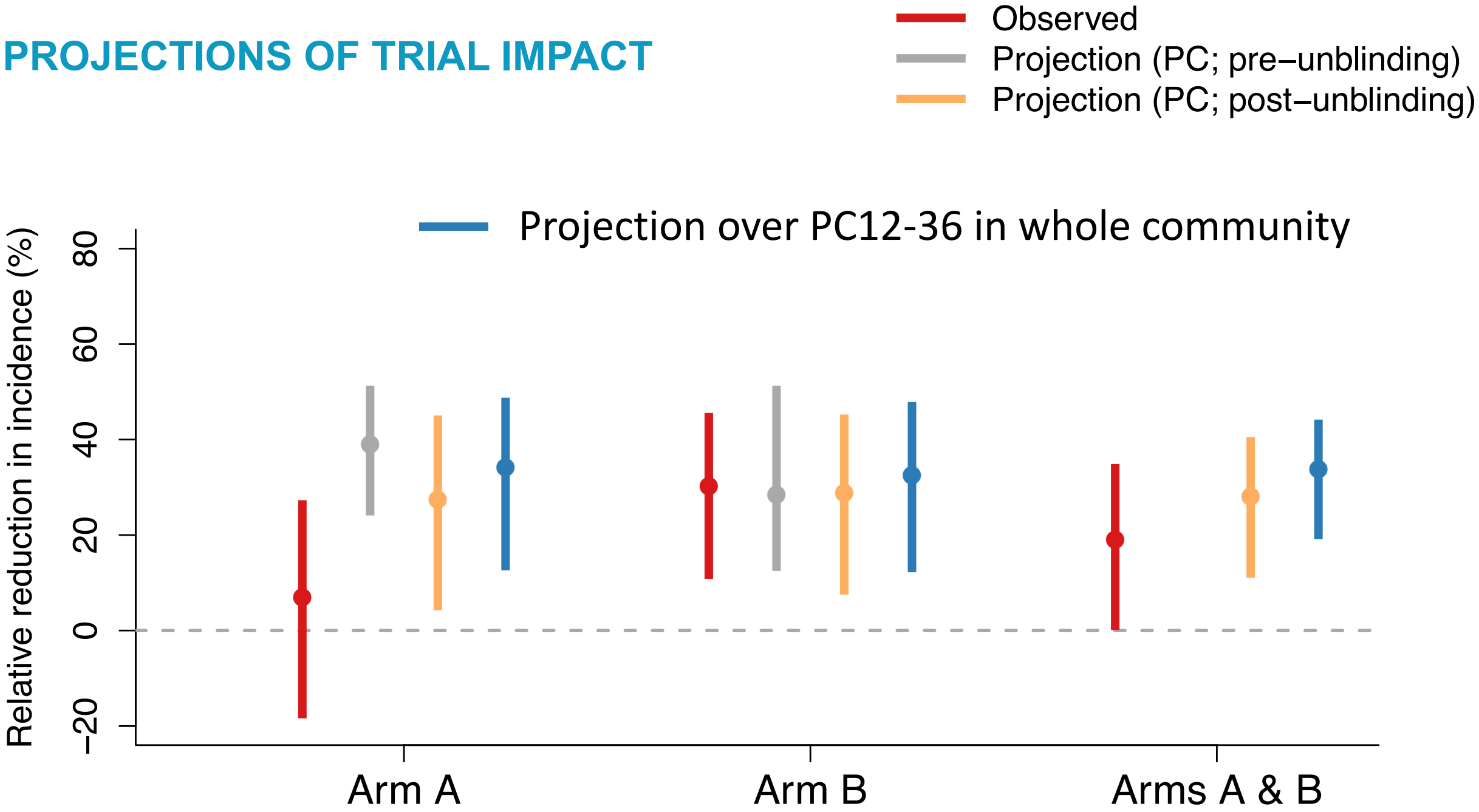
- In addition to the data used before unblinding, each community was calibrated using (stratified by age and sex):
  - PC prevalence (4 rounds), viral suppression at PC24.
  - South Africa: PC proportion aware and proportion on ART (4 rounds).

- Impact calculated as comparison with arm C projections.

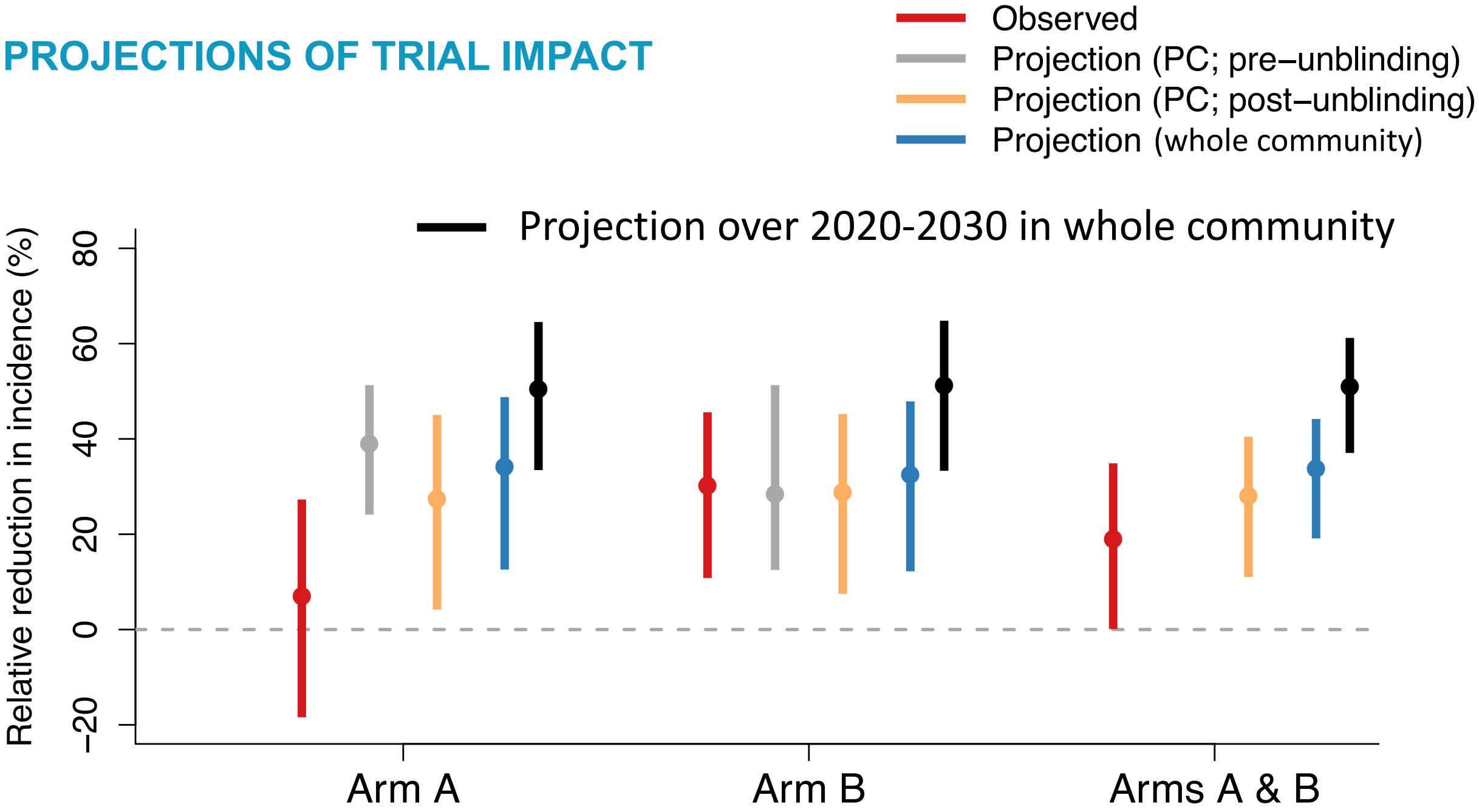
# PROJECTIONS OF TRIAL IMPACT



# PROJECTIONS OF TRIAL IMPACT



# PROJECTIONS OF TRIAL IMPACT

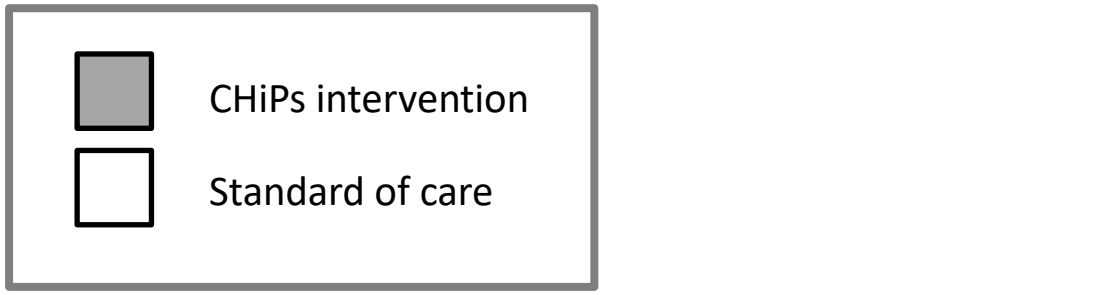


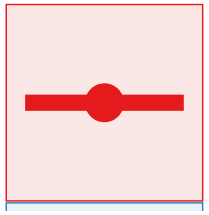
# What is the projected future impact in different settings?

Four scenarios projected to 2030:

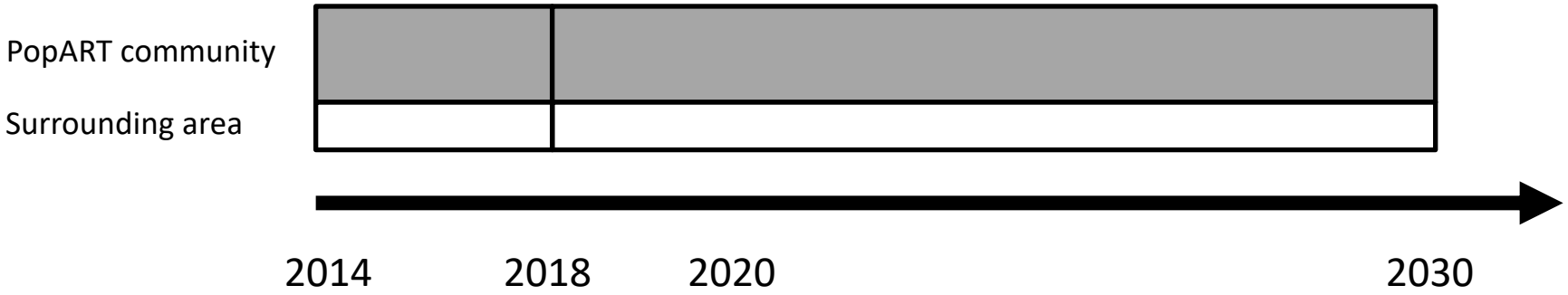
- PopART then continuation of CHiPs intervention to 2030
- PopART then no CHiPs intervention after trial
- CHiPs intervention nationwide
- No CHiPs intervention

# SCENARIO DESCRIPTION



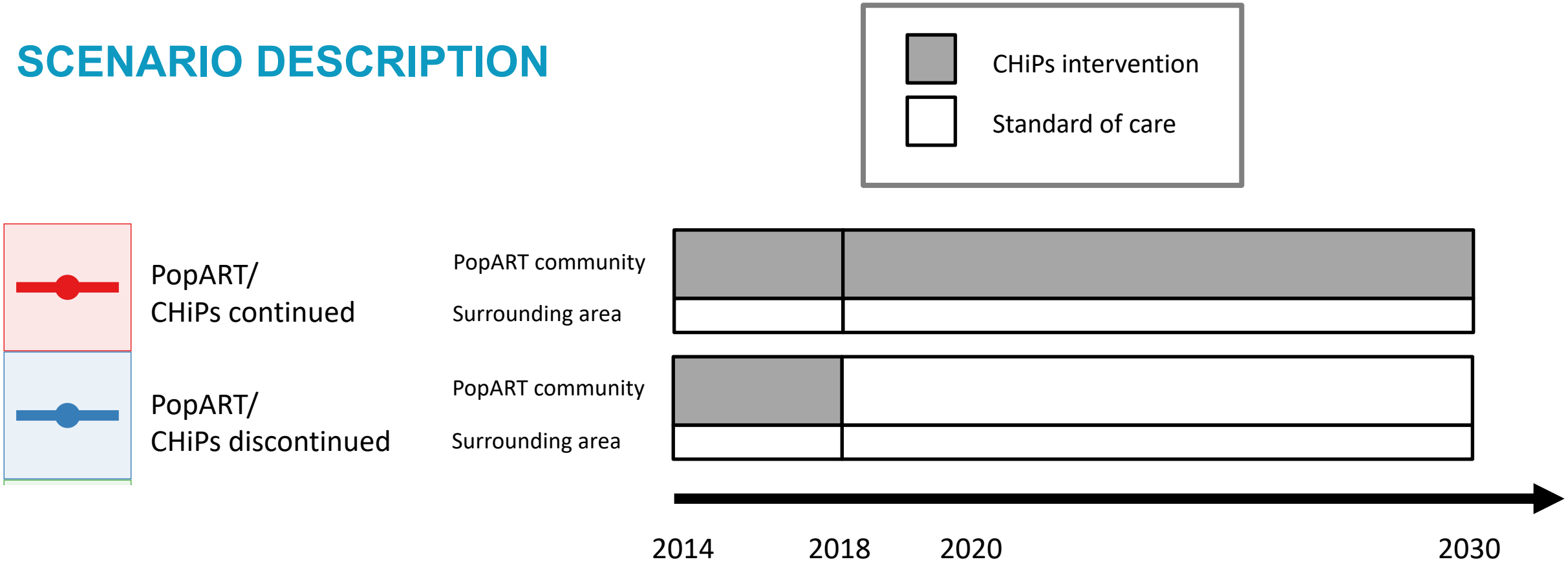



PopART/
CHiPs continued




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

# SCENARIO DESCRIPTION

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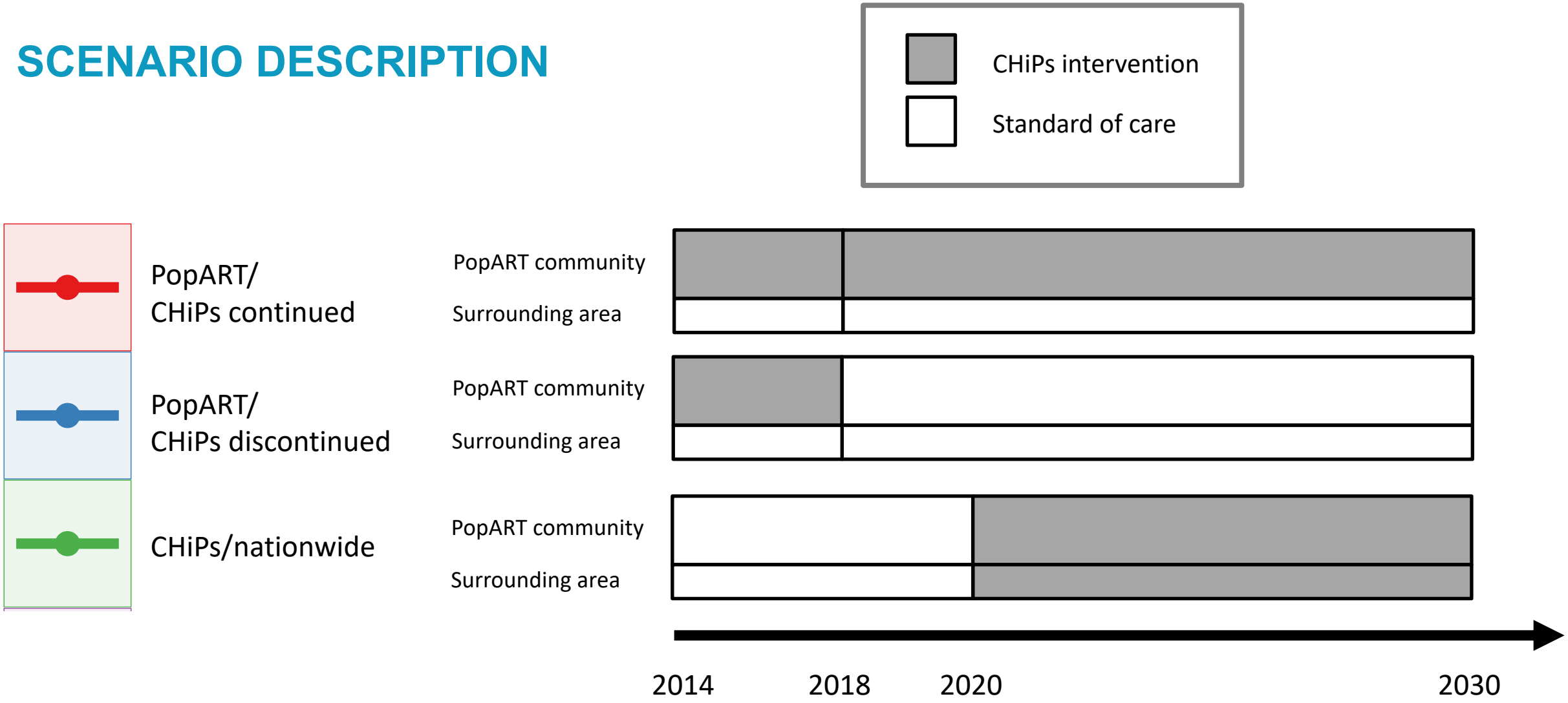


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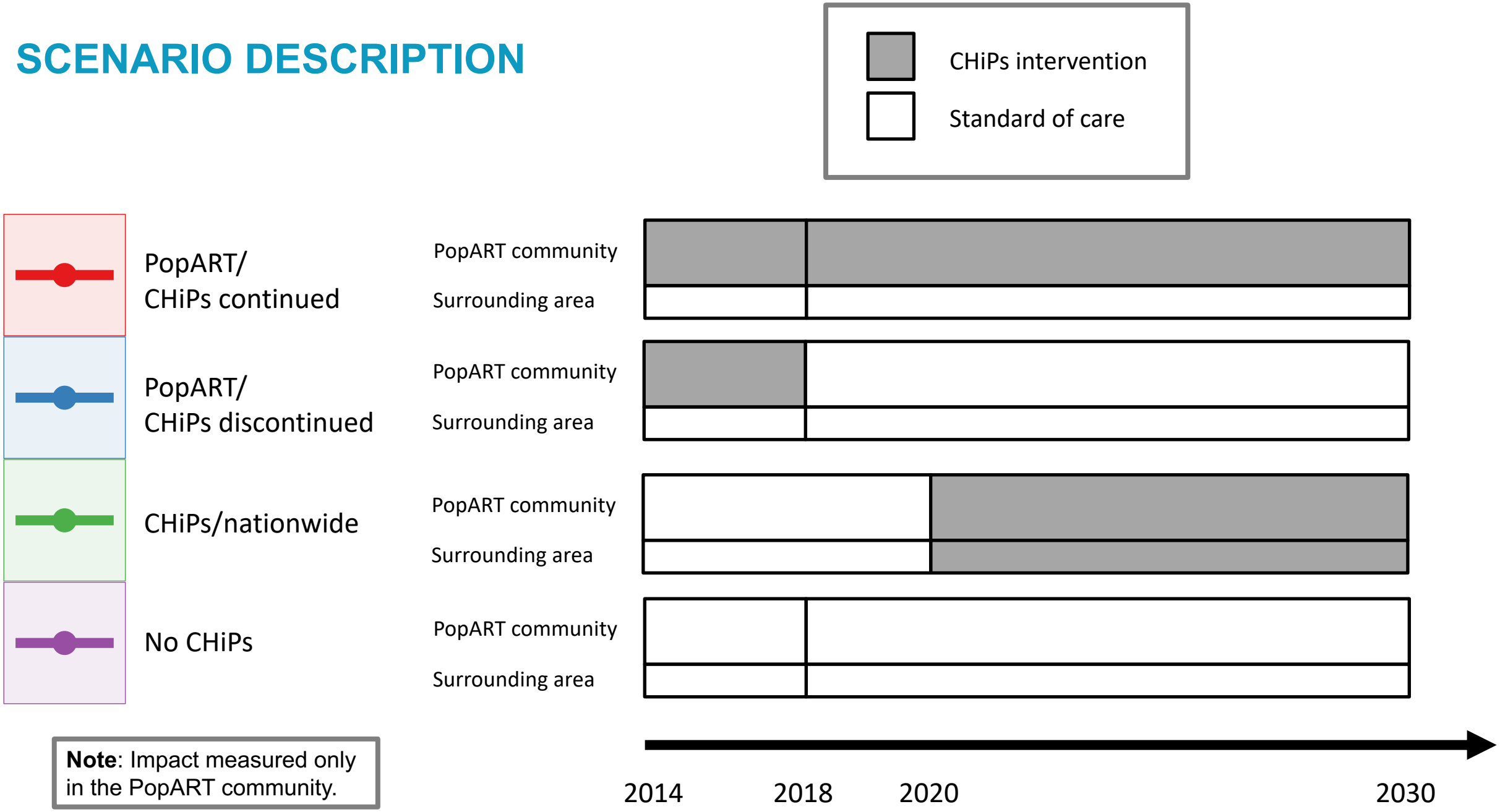


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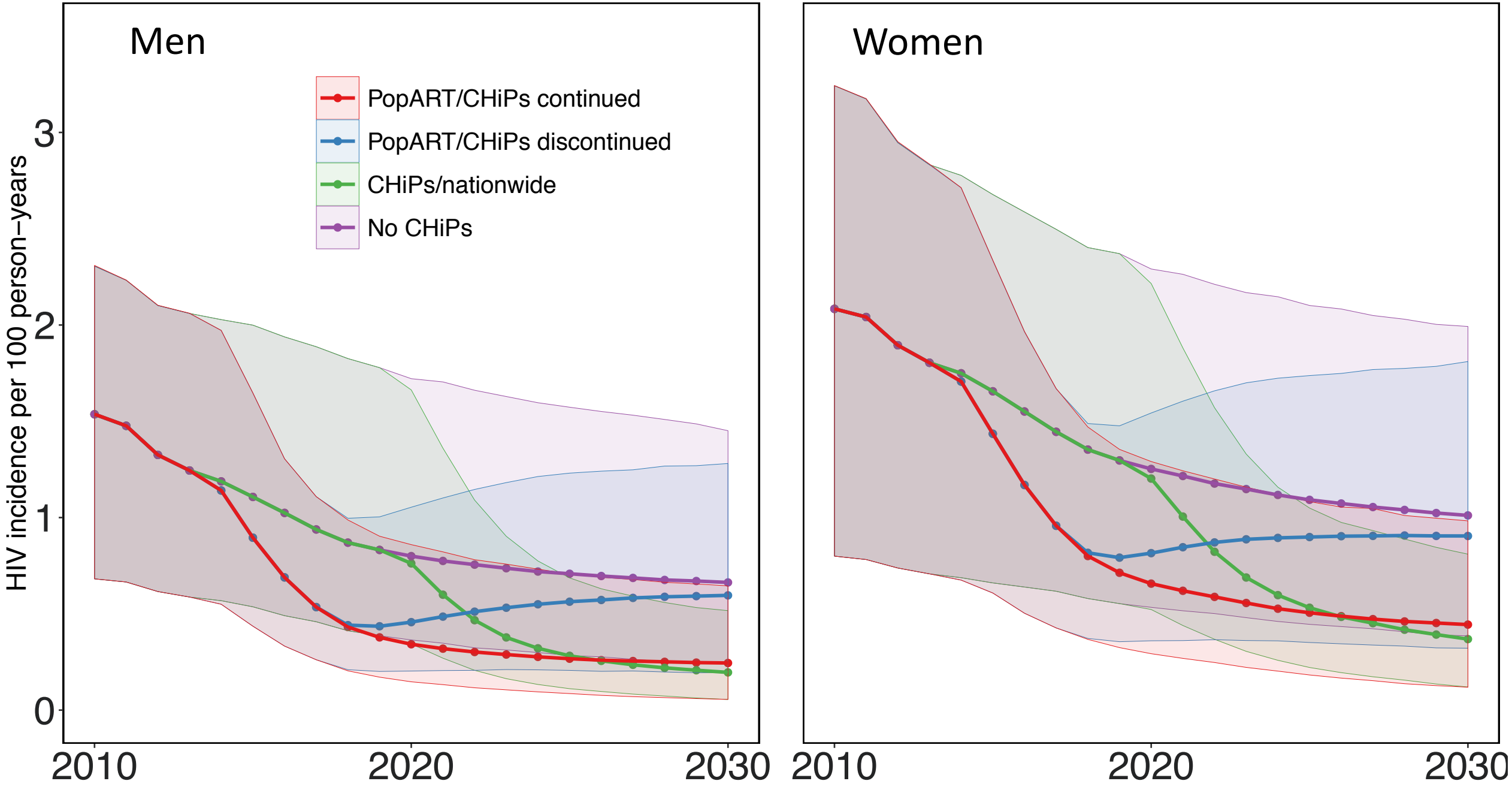
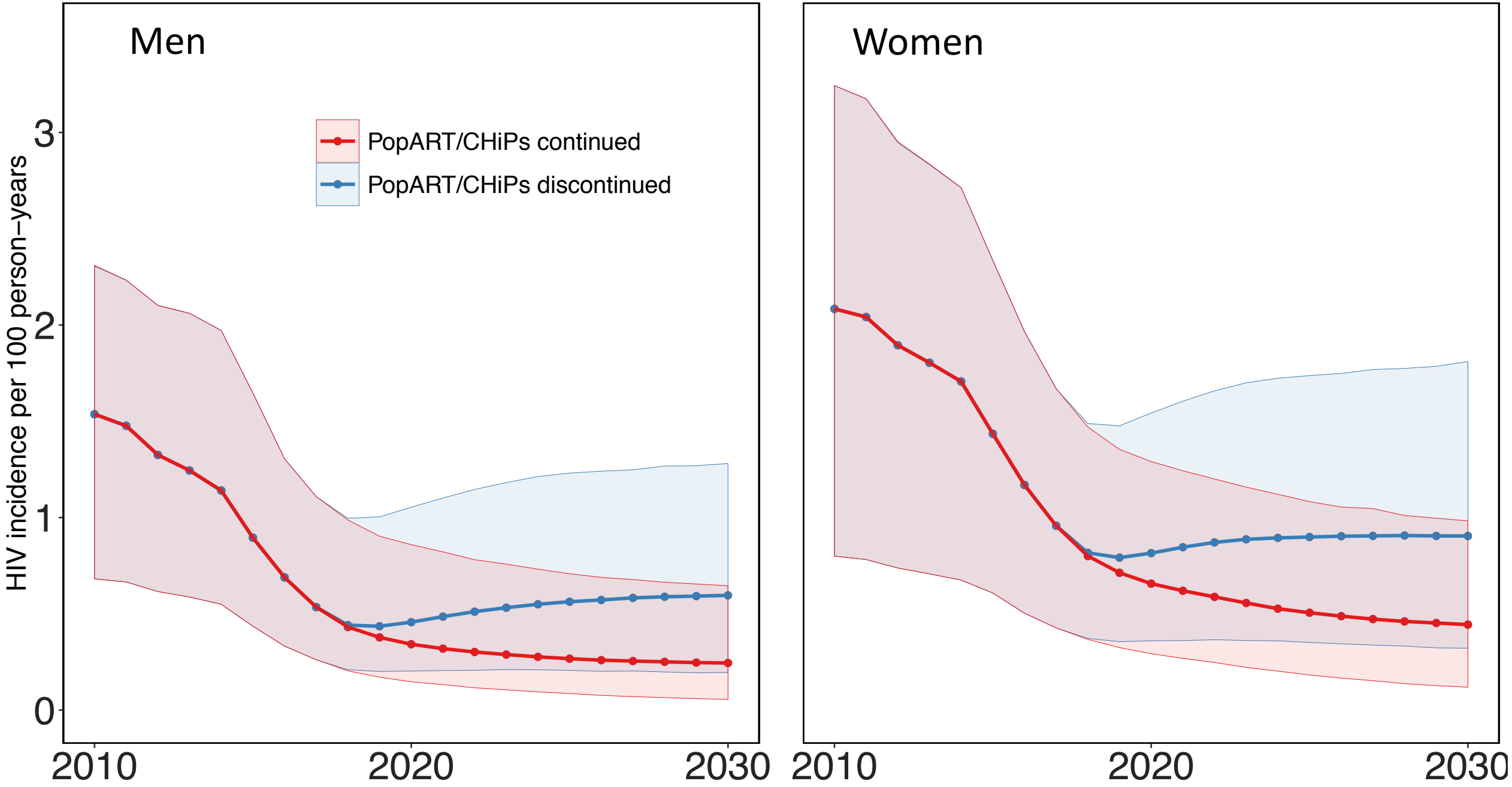
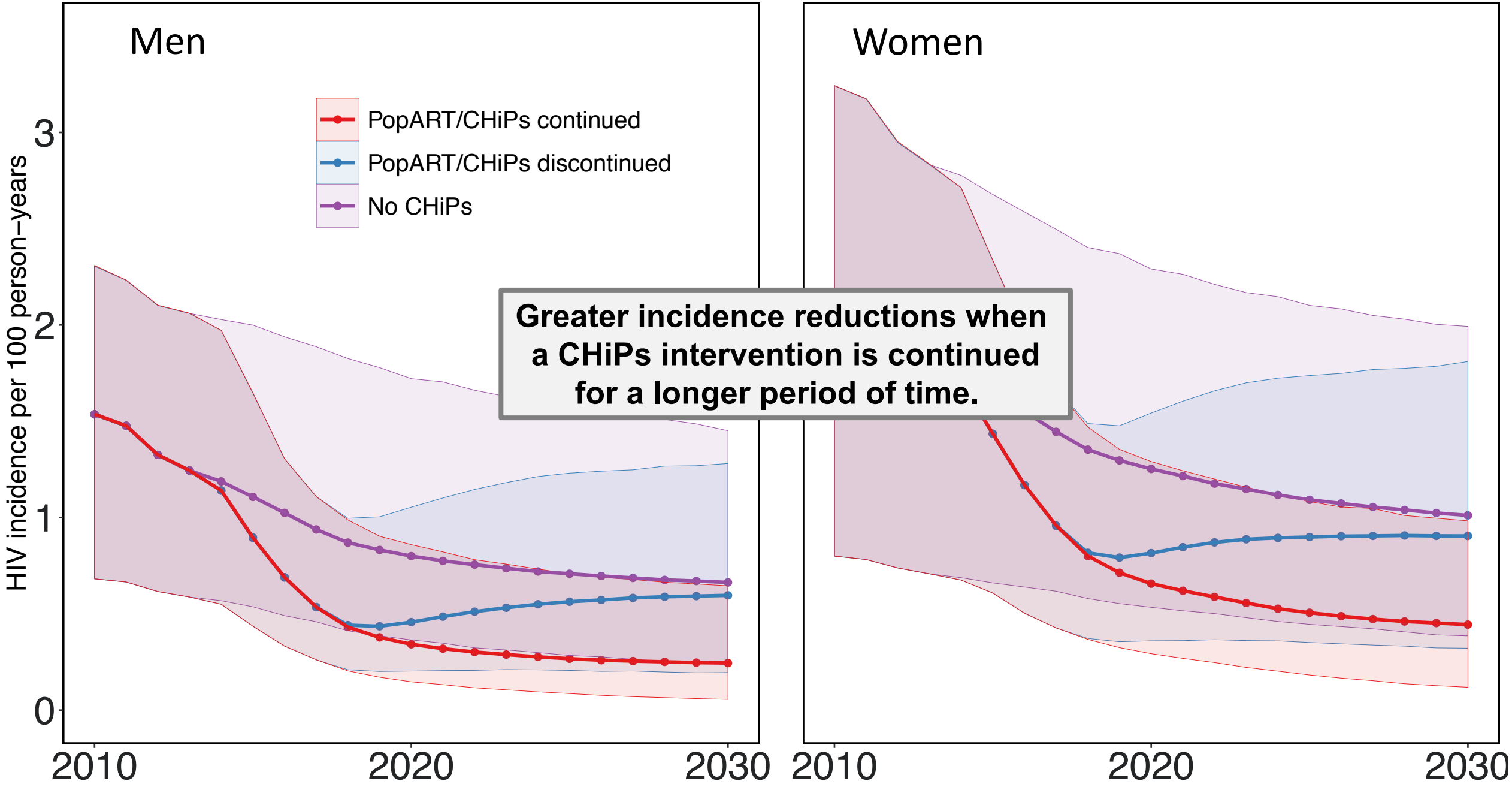
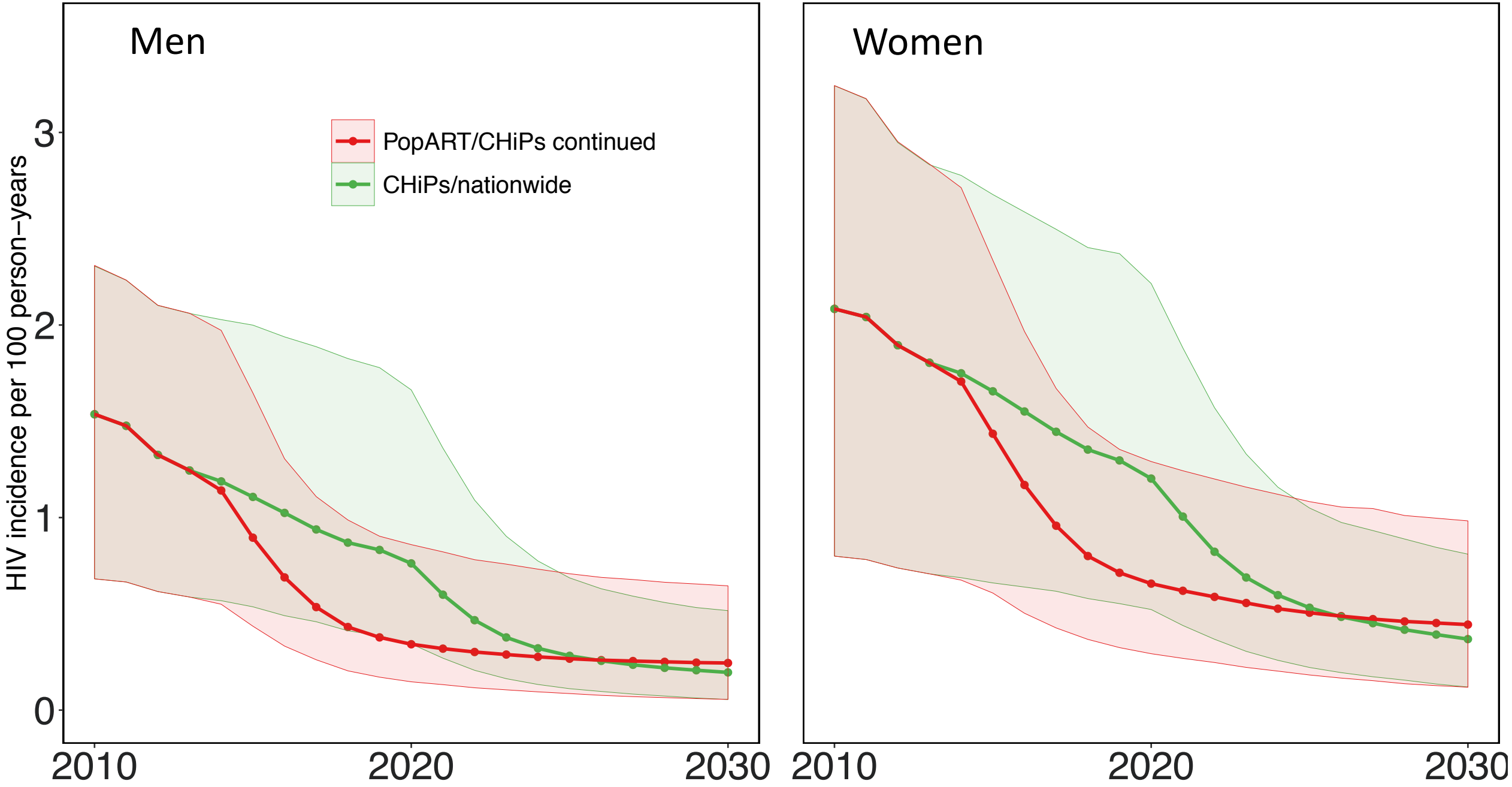
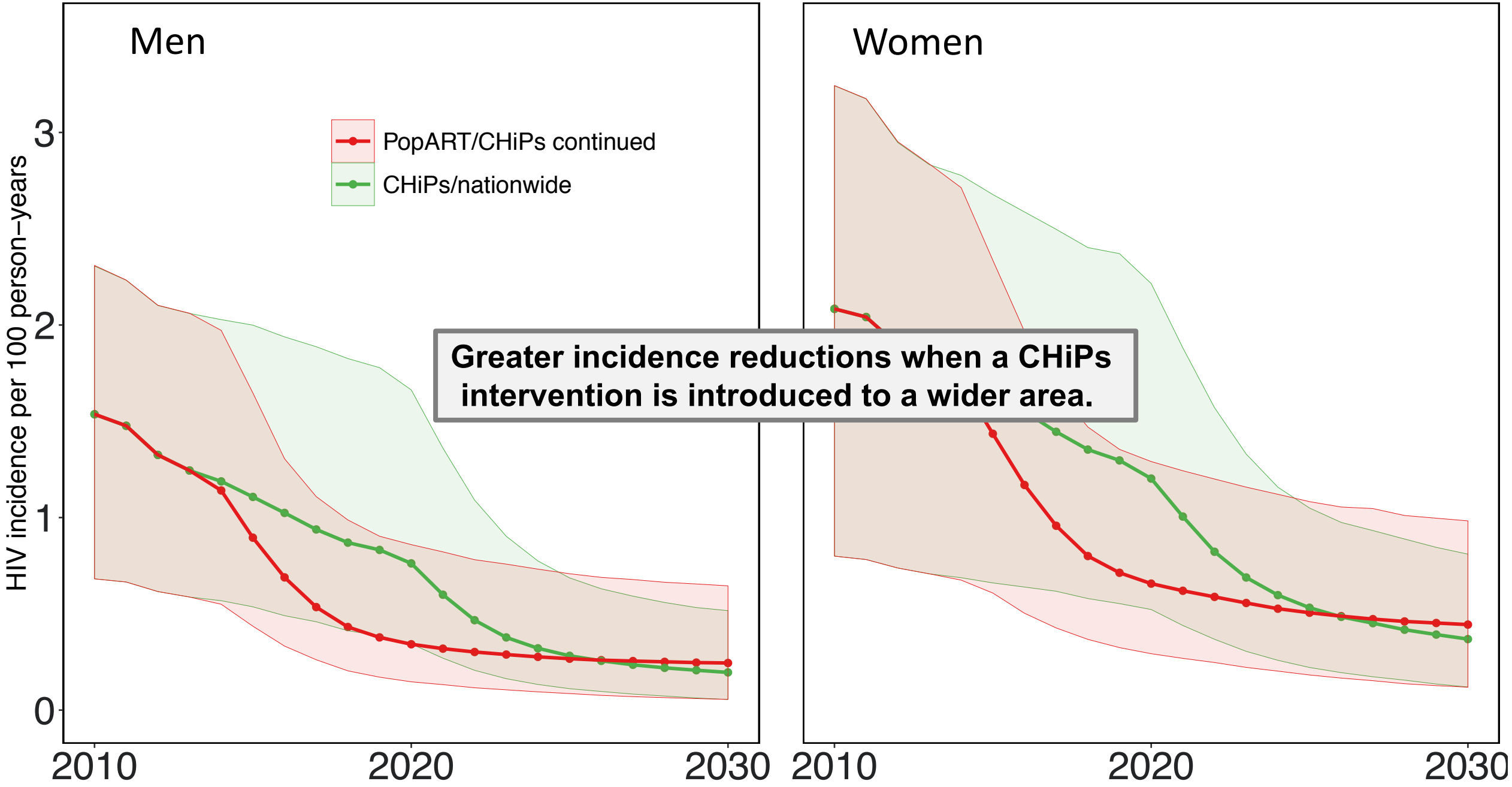

Men
Women
PopART/CHiPs continued
PopART/CHiPs discontinued
CHiPs/nationwide
No CHiPs
HIV incidence per 100 person−years
0
1
2
3
2010
2020
2030
2010
2020
2030


Men
Women
PopART/CHiPs continued
PopART/CHiPs discontinued
HIV incidence per 100 person−years
0
1
2
3
2010
2020
2030
2010
2020
2030


Men
Women
PopART/CHiPs continued
PopART/CHiPs discontinued
No CHiPs
HIV incidence per 100 person−years
0
1
2
3
2010
2020
2030
2010
2020
2030
Greater incidence reductions when a CHiPs intervention is continued for a longer period of time.


Men
Women
PopART/CHiPs continued
CHiPs/nationwide
HIV incidence per 100 person−years
0
1
2
3
2010
2020
2030
2010
2020
2030


Men
Women
PopART/CHiPs continued
CHiPs/nationwide
HIV incidence per 100 person−years
0
1
2
3
2010
2020
2030
2010
2020
2030
Greater incidence reductions when a CHiPs intervention is introduced to a wider area.

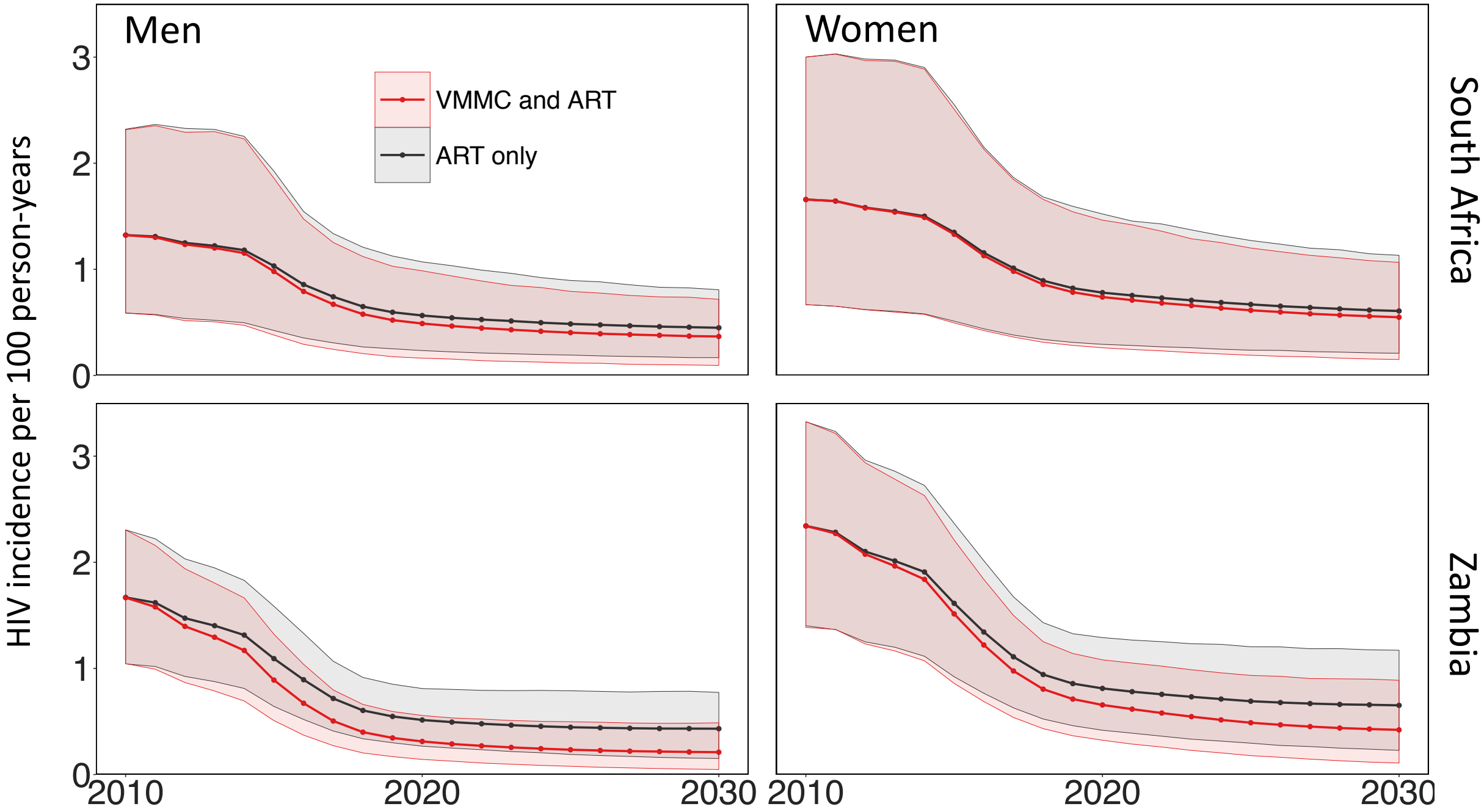
# What was the impact of different components of the intervention?

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%.


Men
Women
VMMC and ART
ART only
South Africa
Zambia
HIV incidence per 100 person-years
0
1
2
3
2010
2020
2030

# 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.

# Acknowledgements

PopART modelling team:

- Christophe Fraser
- Anne Cori
- Michael Pickles
- Rafael Sauter
- Richard Hayes
- Sian Floyd
- David MacLeod
- Ethan Wilson
- Katharina Hauck
- Ranjeeta Thomas