Determinants of the Predicted Effectiveness of Universal Test and Treat in a High Prevalence Generalised HIV Epidemic: Insights from the HPTN 071 (PopART) Individual-Based Model

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BACKGROUND

The HPTN 071 (PopART) trial is a 3 arm cluster-randomised trial with 21 communities, 12 in Zambia and 9 in South-Africa, measuring the impact of a combination intervention among the following three strategies: universal testing and treatment (UTT) with ART initiation for those testing positive, comprehensive care for those on ART, and interventions to reduce IPV and female genital mutilation (FGM). The trial is the first to test the impact of UTT in sub-Saharan Africa. The trial impact is measured at 18 and 36 months after the first CHiPs round in 2014.

INDIVIDUAL-BASED MODEL (IBM)

Calibrated IBM

The IBM output is calibrated to historical surveys and community-level data from each of the 12 communities. The IBM model is used to simulate the impact of the intervention in each community, taking into account the baseline epidemiology, demographics, and other factors specific to each community. The model is calibrated to observed data by running 10 repetitions for each of the 10 best fitting parameter combinations, as 9 IBM simulations in total.

Full PopART intervention including irreducible ART irrespective of CD4 count

The following analyses investigate how the primary outcome is affected if selected model parameters change. Other parameters remain unchanged (no recalibration).

SENSITIVITY ANALYSES

The following analyses investigate how the primary outcome is affected if selected model parameters change. Other parameters remain unchanged (no recalibration).

Country-specific differences:

- Sensitivity analyses: if the two parameters are set to be equal to the ones in Zambia than the trial impact increases by 2% in South Africa for model stochasticity based on 100 IBM simulations.

Table 2. Projected primary endpoint impact on primary endpoint relative reduction in HIV incidence between arm A and counter-factual arm C communities aggregated by country as mean (and range) based on 100 IBM simulations.

CONCLUSION

- The IBM predicts a variable, but potentially substantial impact in PC12-PC18.
- The IBM addresses age-specific and sex specific heterogeneities and replicates historical data accurately.
- Important determinants of the UTT impact can be identified by using sensitivity analyses.
- The efficient and fast IBM implementation allows exploration of the parameter space and uncertainty.
- The long-term IBM projections offer insight into developments far beyond the trial horizon.

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