Achieving 95-95-95 may not be enough to end AIDS epidemic in South Africa

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HPTN — HIV Prevention Trials Network

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BACKGROUND

The ambitious 95-95-95 strategy was announced by UNAIDS in 2014, aiming to end the AIDS epidemic by 2030 by achieving **95% diagnosed among all people living with HIV (PLHIV), 95% on antiretroviral therapy (ART) among diagnosed, and 95% virally suppressed (VS) among treated**. An intermediate goal of 90-90-90 was set for 2020. These targets have been adopted by many countries implying that treatment should be prioritized in resource allocation.

MODELING OBJECTIVES

We explore the importance of the **heterogeneity in ART and VS coverage** among different PLHIV groups by sexual risk behavior for the expected **reduction in HIV incidence if the UNAIDS targets are met in South Africa by 2030**.

RISK EQUATION MODEL

- A risk equation model was used to simulate annual HIV incidence by tracking the transmission from PLHIV assuming that **30% of them are engaged in high-risk behavior** with more frequent sexual activity (100 vs.40 sex acts annually);
- **The model** was parameterized with the 2015 South African HIV prevalence and **85-58-76 treatment cascade** (i.e. **37% viral suppression of PLHIV**)[1], and calibrated to 2015 HIV incidence among the adult population 15-49 years[2];
- Condom use was not explicitly modeled but accounted for in the estimated HIV transmission risk per act during calibration;
- Estimated transmissions from each PLHIV are calculated as one minus the probability to avoid transmission in multiple exposures when the PLHIV is has a given ART and VS status;
- HIV prevention is implemented as reduction in per-act risk for assumed proportion (coverage) of partners of high-risk PLHIV.

Model parameters	Value
Proportion of high-risk PLHIV	30%
HIV prevalence in 2015	17%
HIV prevalence in 2030	10%, 17%
Annual number of partners of high-risk PLHIV	5
Annual number of partners of low-risk PLHIV	1
Number of acts per partner (high-risk PLHIV)	20
Number of acts per partner (low-risk PLHIV)	40
Transmission probability per act	0.16%
ART efficacy if the user is virally suppressed	100%
ART efficacy if the user is not virally suppressed	50%
HIV prevention coverage when simulated (high-risk only)	50%
HIV prevention efficacy when simulated	90%

- Our model suggests 25% higher HIV incidence when high-risk PLHIV remain uncovered by the HIV treatment cascade
- Achieving 95-95-95 UNAIDS target in South Africa by 2030 will result in 86% overall viral suppression (VS). Estimated reduction in the HIV incidence (64%-89%) compared to 2015 levels strongly depends on the ART and VS coverage achieved among high-risk PLHIV
- It is unlikely to end the AIDS epidemic if the reduction in HIV incidence does not result in significant HIV prevalence reduction
- Scale-up of HIV prevention among high-risk people will help bridging the gap to AIDS elimination

SIMULATED SCENARIOS

- **Two baseline scenarios** simulated the treatment cascade in 2015 with diagnosed, on treatment or virally suppressed PLHIV being either:
  i. **proportionally distributed** between risk groups **(black/dark-shaded)**
  ii. **predominately** chosen from **low-risk group (grey/light-shaded)**
- **Three scenarios of treatment cascade expansion** are simulated with **n**ewly diagnosed, treated and virally suppressed PLHIV being either:
  i. **proportionally distributed** between risk groups **(proportional)**;
  ii. **predominately** recruited from the **high-risk group (optimistic)**;
  iii. **predominately** recruited from the **low-risk group (pessimistic)**.
- **Three intervention scenarios** of reaching UNAIDS targets in 2030 are designed using HIV prevalence projections from published studies[3]:
  i. **HIV prevalence** remains **stable at 17%**, no HIV prevention **(Panel A)**;
  ii. **HIV prevalence** decreases to **10%**, no HIV prevention **(Panel B)**;
  iii. HIV prevalence decreases to **10% + extra HIV prevention (Panel C)**.

REFERENCES
[1] aidsinfo.unaids.org
[2] Mid-year population estimates, Department of Statistics South Africa, 2019
[3] Eaton et. al, Lancet Global Health, 2(1), e23-e34, 2014

PREDICTED HIV INCIDENCE DECLINE IN SOUTH AFRICA

A — HIV prevalence remains stable at 17%

B — HIV prevalence decreases to 10%

C — HIV prevalence decreases to 10% + HIV prevention
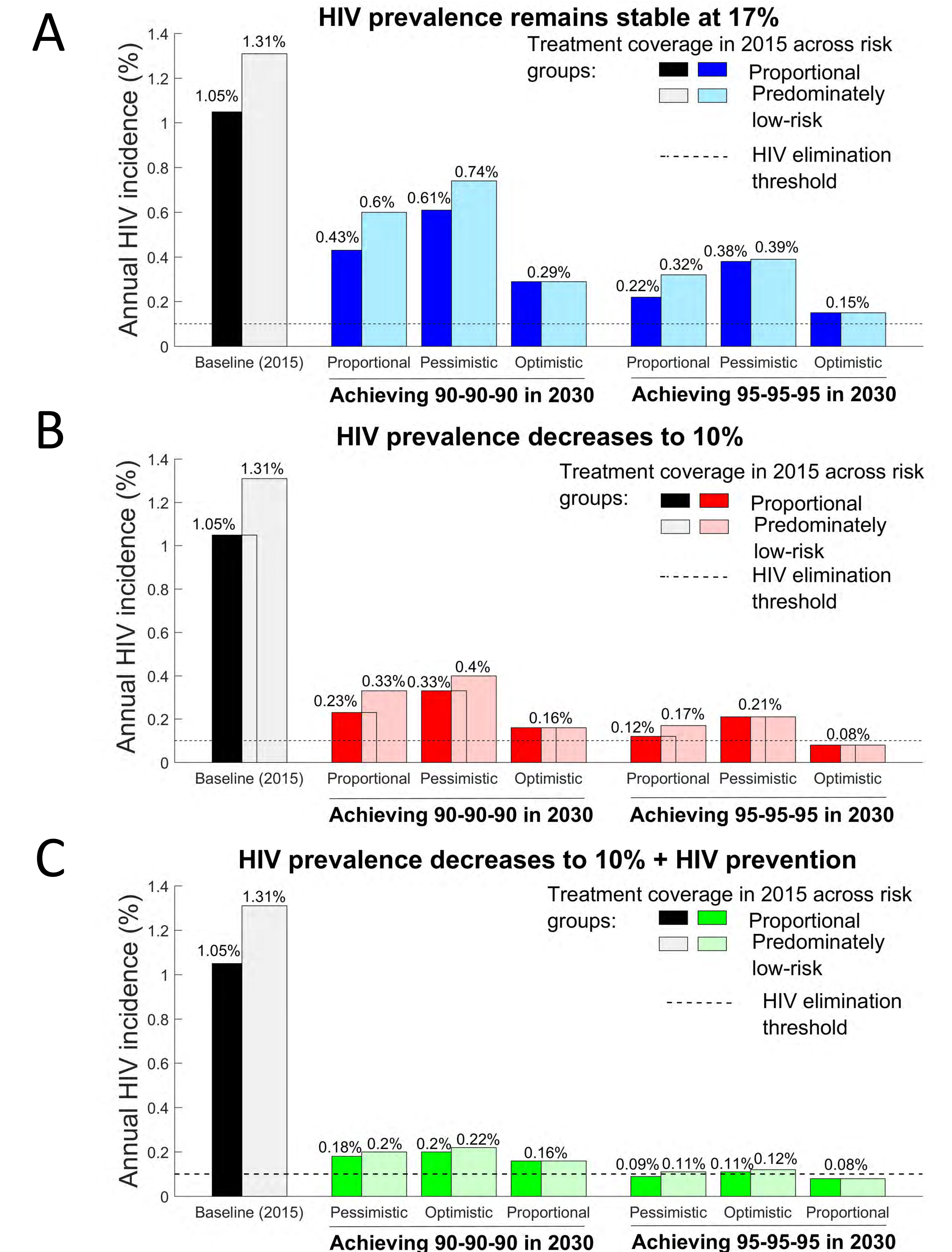
CONCLUSIONS

- Reaching UNAIDS targets **will not necessarily be sufficient to end the HIV epidemic in South Africa** especially if the reduction in HIV incidence do not results in HIV prevalence reduction (e.g. if increased PLHIV longevity is not rapidly counterbalanced).
- Our analysis suggests that **without HIV prevention** scale-up practically **all high-risk PLHIV** may need to be virally suppressed for HIV incidence to fall below **AIDS elimination threshold**.
- More **detailed, dynamic modeling studies are needed** to understand the contribution of different high-risk groups and **identify optimal combinations** between treatment and prevention with a chance to end the HIV epidemic in South Africa.