Impact and Cost-Effectiveness of 3 Different Long-Acting Pre-Exposure Prophylaxis Products in 3 African Countries: A Mathematical Modeling Study

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Summary

HIV incidence remains high in sub-Saharan Africa despite treatment scale-up. This modeling analysis found that LA-PrEP has the potential to drive rapid reductions in HIV incidence. Low-cost suppliers and delivery models will be required to achieve cost-effectiveness.

Background

Despite high treatment coverage, many countries are off track to achieve HIV epidemic control by 2030. Persistently high HIV incidence demonstrates the need for increased access to effective primary prevention interventions alongside continued treatment scale-up. Oral pre-exposure prophylaxis (PrEP) is effective when taken as directed. However, impact in sub-Saharan Africa has been limited for several reasons, including stigma, challenges with adherence, and the fact that daily oral tablets are not a preferred product form. Though scale-up of oral PrEP has increased in recent years, narrowly-defined target populations and limited investment slowed roll-out. Long-acting PrEP (LA-PrEP) may ameliorate some of these challenges by offering those at risk of HIV acquisition options that enable discreet use and avoid daily dosing. However, questions remain about the potential impact and cost of emerging LA-PrEP products.

This analysis considered 3 LA-PrEP formulations:

Form	Dosing	Status
Injection	2-monthly	Long-acting cabotegravir is approved in 7+ countries
Injection	6-monthly	Lenacapavir is currently in efficacy trials
Oral Pill	Once-monthly	Islatravir was being investigated in efficacy trials, but development has ended due to observed lymphopenia

Objective

To estimate the potential impact of each LA-PrEP formulation on reaching an HIV incidence goal of <1 per 1,000 adults infected per year, and the maximum cost per dose delivered (all-in commodities + delivery cost) for LA-PrEP to be cost-effective in western Kenya (Nyanza region), South Africa, and Zimbabwe.

Methods

We adapted an HIV network transmission model, EMOD-HIV (Figure 1), to estimate:

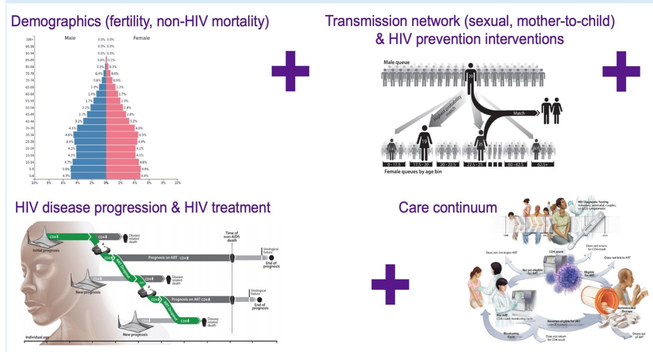
(1) impact on when HIV incidence falls below 1 per 1,000 adults per year by scaling up each LA-PrEP product,

(2) doses required to avert 1 HIV acquisition or disability-adjusted life-year (DALY) over 20 years,

(3) maximum per-dose cost (commodities and delivery) to be cost-effective (an incremental cost-effectiveness ratio (ICER) <US$500 per DALY averted over 20 years)

The model was parameterized with epidemiological data from South Africa, western Kenya (Nyanza), and Zimbabwe including fertility, mortality, and antiretroviral treatment and voluntary medical male circumcision coverage.

Figure 1. EMOD-HIV model



We performed a bounding analysis on user risk profiles:

a) equal distribution of LA-PrEP among sexually active adults.

b) "risk-prioritized" distribution with coverage expanding from highest-risk groups (e.g., sex workers) to lowest.

Assumptions

- Each product was modeled separately with LA-PrEP beginning in 2025, scaling over 5 years, and continuing to 2045.
- Coverage rates were varied between 5% and 20% of adults by 2030.
- For both injectable LA-PrEP products, we assumed an HIV risk reduction of 95%.
- For once-monthly oral PrEP, we assumed an HIV risk reduction of 67% to account for sub-optimal adherence with self-dosing.

Results

- Two-monthly or six-monthly injectable LA-PrEP with 20% risk-prioritized coverage could reduce incidence to <1 per 1,000 per adult per year in western Kenya by 2030 (2034 for monthly oral) and Zimbabwe by 2034 (2039 for monthly oral) (Figure 2 A, B).
- In South Africa, incidence remained >1 per 1,000 for 20 years (Figure 2 C), however, required 5-7x fewer LA-PrEP doses to avert 1 HIV acquisition compared to western Kenya and Zimbabwe.
- In the most efficient setting and population (South Africa with 5% risk-prioritized coverage) LA-PrEP could be cost-effective if delivered at ≤$24 (two-monthly injectable), ≤$70 (six-monthly injectable), and ≤$7 (monthly oral). In a less efficient setting (Kenya) this would be <$3, <$8, <$1, respectively.
- Results were sensitive to prioritization: 1 risk-prioritized dose averted as many HIV acquisitions as 2 non-risk prioritized doses.

Figure 2. HIV incidence reduction in the most aggressive rollout scenario (20% of the adult population covered; 2-monthly or 6-monthly injectable PrEP)

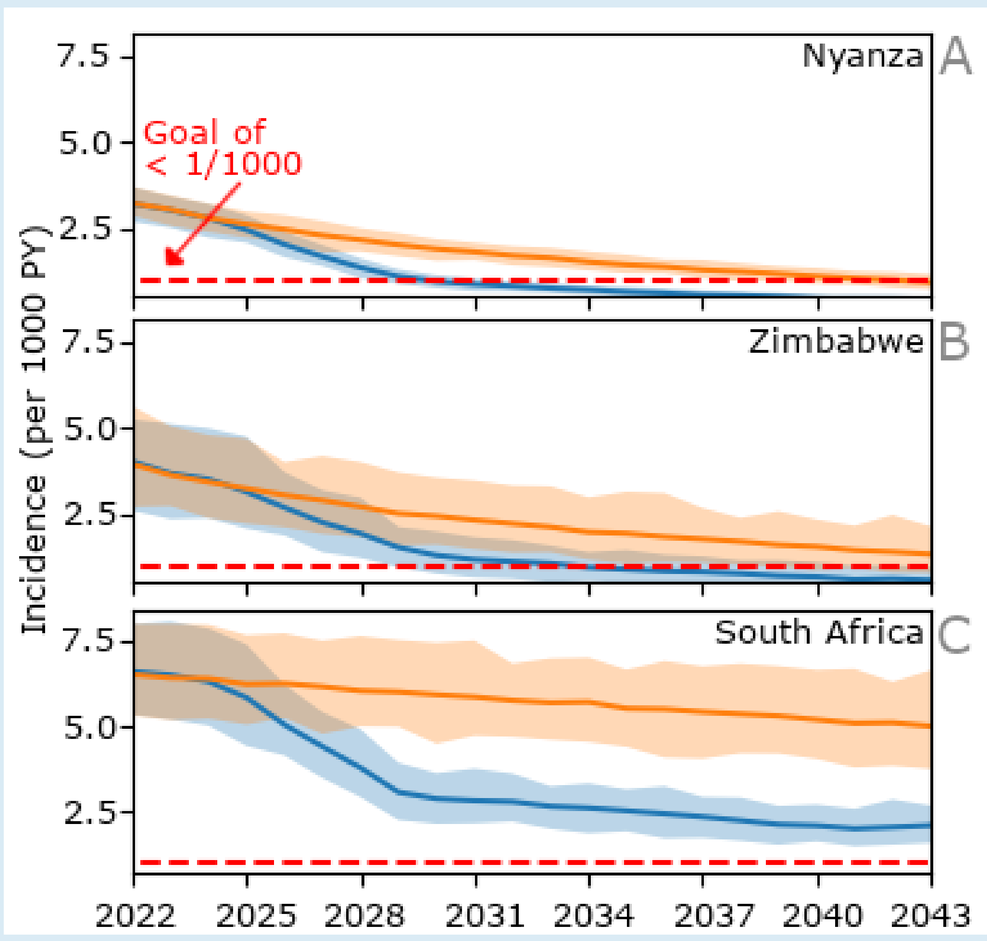


Figure 3. Maximum per-dose cost (commodities and delivery) to be cost-effective in each setting assuming cost-effectiveness threshold of $500 per DALY averted; 5% Coverage; risk-prioritized coverage

Setting	Once-Monthly Pill	2-Monthly Injection	6-Monthly Injection
Nyanza (Kenya)	$1	$3	$8
Zimbabwe	$2	$5	$14
South Africa	$7	$24	$70

Conclusions

LA-PrEP has the potential to significantly accelerate HIV incidence declines in sub-Saharan Africa and contribute to reaching epidemic control. However, identifying low-cost delivery models and executing effective market-shaping interventions to reduce commodity costs will be required for LA-PrEP to be cost-effective.

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