Modeled Impact of HIV Self-testing for PrEP Scale-up on Drug Resistance in Kenya

1051

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BACKGROUND

- Community-based delivery of oral PrEP may increase uptake
- HIV self-testing (HIVST) may expand PrEP access by enabling non healthcare providers to conduct HIV testing.
- However, HIVST may have lower field sensitivity than provider HIV testing
  - Could lead to inappropriate PrEP use in persons with HIV and result in drug resistance to antiretroviral drugs (ARVs)
- Impact of PrEP scale-up with HIVST is not well understood

Objective: **Assess the impact of rapid community-based PrEP scale-up using provider HIV testing vs HIVST on:**

1. HIV infections and HIV deaths averted
2. Persons with HIV inappropriately initiated on PrEP
3. PrEP associated resistance development

METHODS

Model: Parameterized agent-based network model, EMOD-HIV, to project PrEP scale-up in western Kenya[1-2]

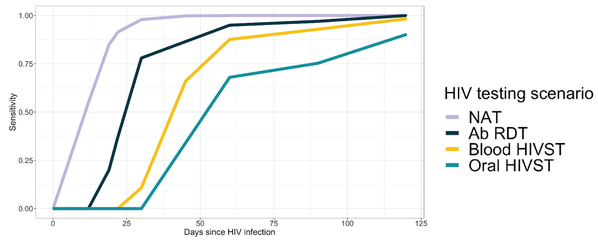
4 HIV test scenarios compared to counterfactual of no PrEP:

1) provider-administered nucleic acid technique (*NAT*)**
2) provider-administered rapid diagnostic tests detecting antibodies (*Ab RDT*)**
3) capillary whole blood-based HIVST (*Blood HIVST*)
4) oral-fluid HIVST (*Oral HIVST*)

**Both provider administered scenarios are theoretical upper bounds to enable us to understand the relative increase in resistance using HIV self testing compared to the most sensitive provider administered HIV testing strategies.

Key assumptions:

- All individuals 18-49 years in a heterosexual partnership had a 75% probability of initiating PrEP and continuing quarterly
  - High PrEP coverage → upper bound resistance estimates
- Probability of developing resistance dependent on stage of HIV infection during PrEP exposure
  - 2.8% in breakthrough infection, 32.6% in the acute HIV phase, 16.3% in the chronic HIV phase[3]
- **Figure 1.** HIV test sensitivity vs. days since infection



Broad community scale-up of oral PrEP supported by HIV self-testing shows a similarly low risk of drug resistance compared to provider-administered testing.

RESULTS

HIV Mortality and Infections Averted *(Figure 2):*
In all HIV testing scenarios, PrEP coverage was approximately 29%, which was projected to **avert 50% of HIV infections and 14% of HIV-related deaths** over 20 years.

ARV Resistance *(Figure 3):*
Of approximately 45 million PrEP initiations, number of individuals with acute HIV who were inappropriately initiated on PrEP were 4,028 (<0.01%) and 4,488 (<0.01%) in the blood and oral HIVST scenarios respectively, compared to 988 (<0.01%) in the Ab RDT and 92 (<0.01%) in the NAT scenarios. Number of individuals with chronic HIV inappropriately initiated on PrEP were 7,645 (<0.02%) and 13,653 (<0.03%) in the blood and oral HIVST scenarios respectively, compared to 1,906 (<0.01%) in the Ab RDT and 141 (<0.01%) in the NAT scenario.

Figure 2. Proportion of HIV deaths and infection averted by scenario

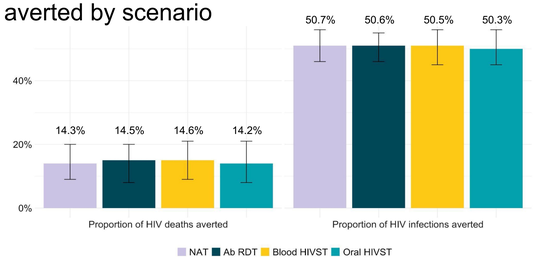
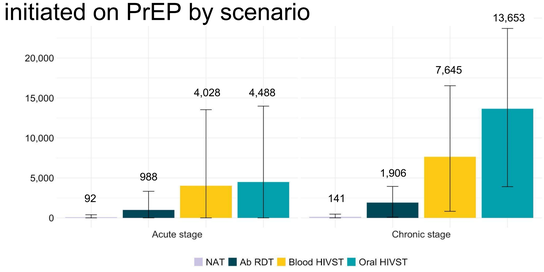


Figure 3. Persons with HIV inappropriately initiated on PrEP by scenario



Average time persons with HIV were inappropriately taking PrEP was short across scenarios (approximately 3 months)

RESULTS CONT.

Table 1. NRTI resistance over 20 years by scenario

Scenario	Total HIV infections with NRTI resistance	HIV infections with PrEP-associated NRTI resistance (%)	Population prevlaence of NRTI resistance (%)
No PrEP	71,167 (48,759 - 90,446)	-	1.4 (1.0 - 1.8)
NAT	63,670 (44,748 - 81,353)	0.1 (0.1 - 0.1)	1.3 (0.9 - 1.6)
Ab RDT	64,288 (45,411 - 81,986)	0.2 (0.1 - 0.2)	1.3 (0.9 - 1.6)
Blood HIVST	66,253 (47,063 - 85,003)	0.5 (0.3 - 0.7)	1.3 (0.9 - 1.7)
Oral HIVST	67,410 (47,279 - 87,255)	0.7 (0.5 - 0.9)	1.3 (0.9 - 1.7)

- HIV infections with PrEP-associated nucleoside reverse transcriptase inhibitor (NRTI) resistance were 0.5% and 0.7% in the blood and oral HIVST scenarios, respectively.
- Accounting for background NTRI resistance, we found **similar proportions of resistance across all scenarios** (1.3% vs. 1.4% in the no PrEP scenario).

CONCLUSIONS

- Increasing PrEP coverage has the potential to avert half of new HIV infections over 20 years.
- We project a low number of persons with HIV inappropriately initiated on PrEP
  - Even with PrEP coverage well beyond realistic targets, we find a low proportion of drug resistance due to PrEP
- **Population prevalence of NRTI resistance was similar across scenarios**, largely due to the reduction in HIV (and thus HIV-related drug resistance) in the PrEP scenarios compared to the no PrEP scenario
  - No substantial difference by HIV test used (including oral vs. blood HIVST)

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