

Translating community-level HIV prophylactic drug concentration into epidemic impact in Young women in western Kenya

David Kaftan, Jessica Haberer, Nicholas Musinguzi, Waitito Ngugi, Ruanne Barnabas, Anna Bershteyn

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2. Methods

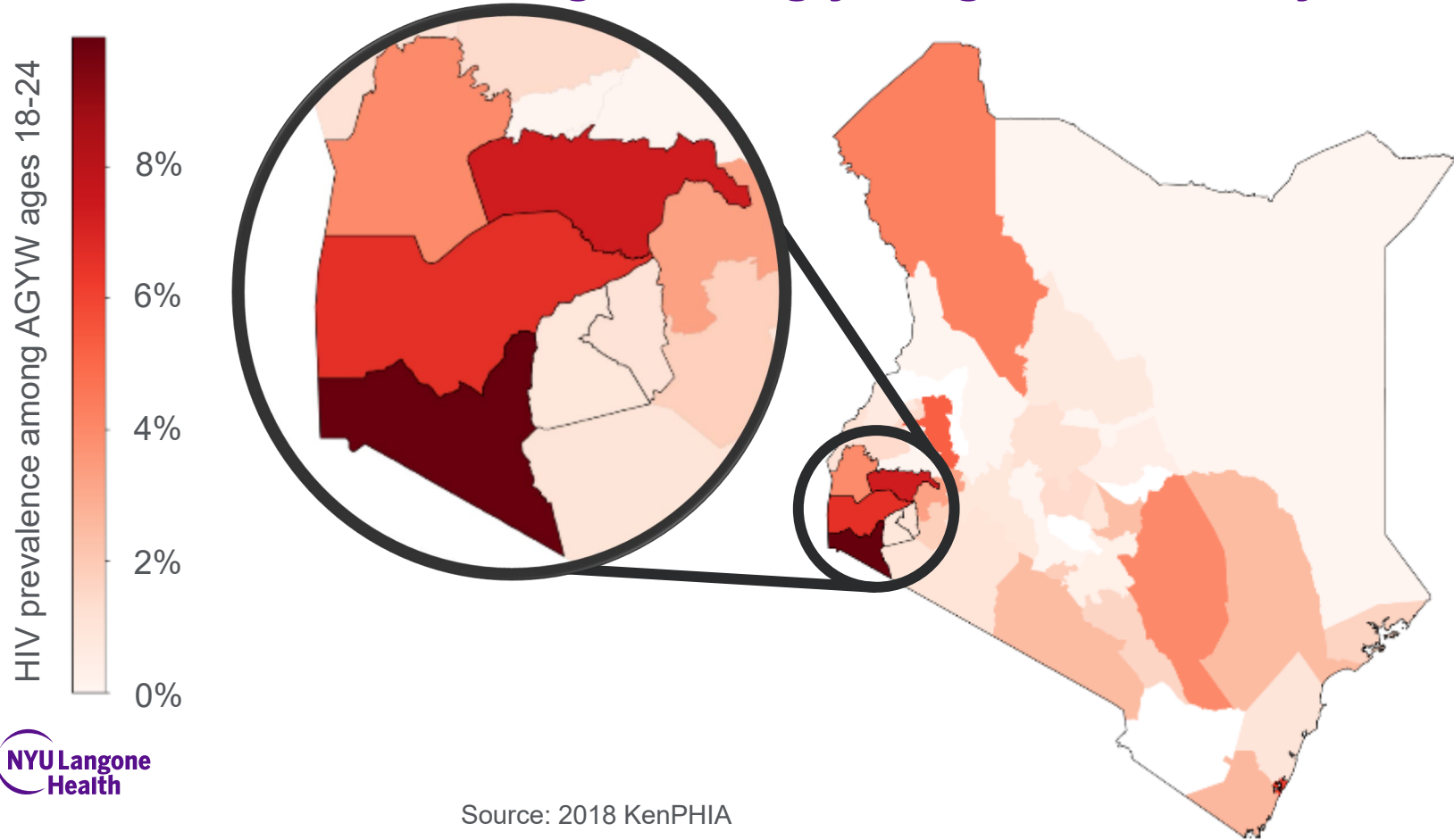
- Parameterizing our model with prior work
- Modeling PrEP impact

3. Results

- PrEP use parameters from prior work.
- Model outcomes
 - How effective is PrEP as used in MPYA?
 - Could such PrEP use achieve epidemic goals?
 - What community-level prophylactic drug concentration would indicate being on track to goal?

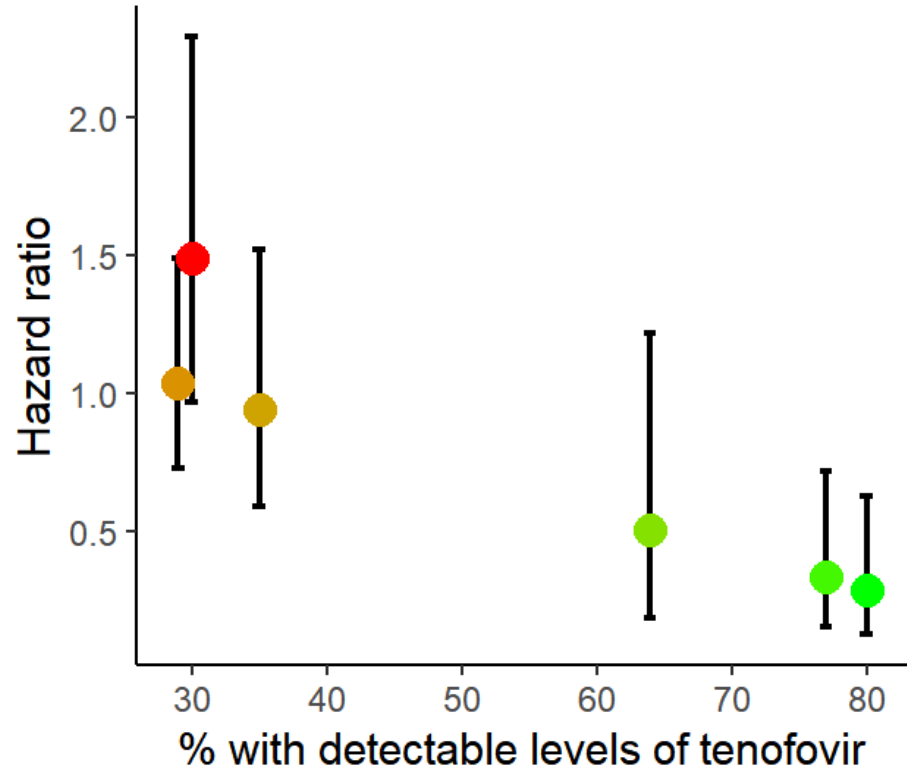
4. Key Takeaways and Discussion

HIV burden remains high among young women in Nyanza, Kenya



PrEP can reduce incidence when taken as prescribed

PrEP is 99% effective at preventing HIV transmission when taken as prescribed. However, **adherence remains a major limiting factor**. Understanding adherence is essential for estimating PrEP's impact.



Weighing the Evidence of Efficacy of Oral PrEP for HIV Prevention in Women in Southern Africa, 2018 Janes et al.

The MPYA Study - Monitoring PrEP in Young Adult women

- **348 young women in Kenya were enrolled to receive PrEP**
 - Ages 18-24
 - Elevated risk (i.e., multiple partners)
- **Adherence was monitored using**
 - tenofovir-diphosphate (TFV-DP) levels
 - derived from dried blood spots (DBS)
 - Sampled every 3 months.
- **Adherence data was stratified by demographic characteristics**
 - Age group
 - Number of partners
- **No negative control**
 - Difficult to know the effectiveness of PrEP

Using adherence data from MPYA, we use modeling to answer:

1. How effective is PrEP as used in MPYA?

- Taking into account adherence level
- Taking into account alignment with risk.

2. Could such PrEP use achieve epidemic goals?

- & how much is required
- Epidemic goal: incidence < 0.1% by 2040
- Target population: AGYW ages 18-24
- Setting: Nyanza, Kenya
- PrEP use patterns according to MPYA

3. What community-level prophylactic drug concentration would indicate being on track to goal?

- Community-level prophylactic drug concentration =
% of AGYW with TFV-DP > 400 fmol/punch

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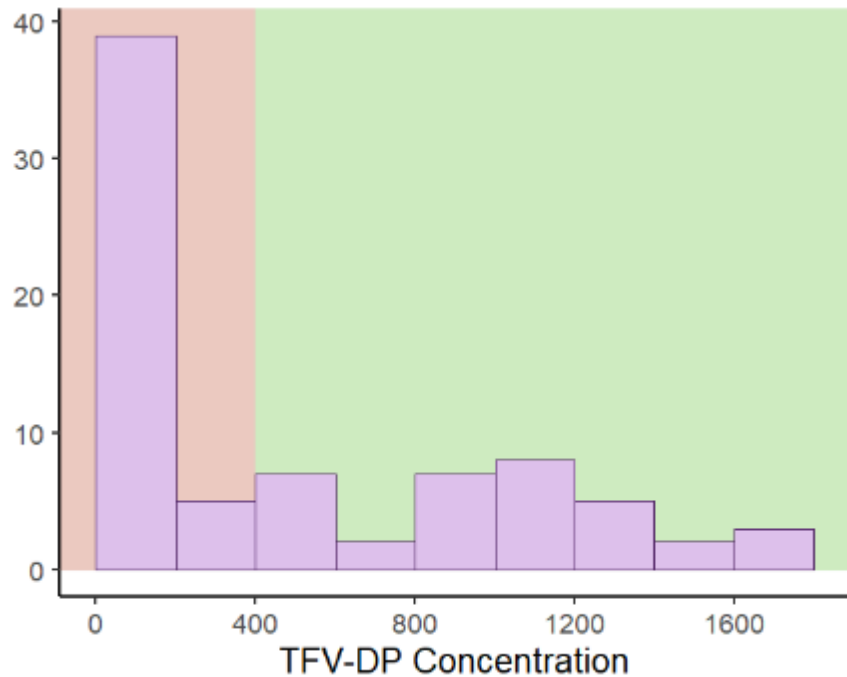
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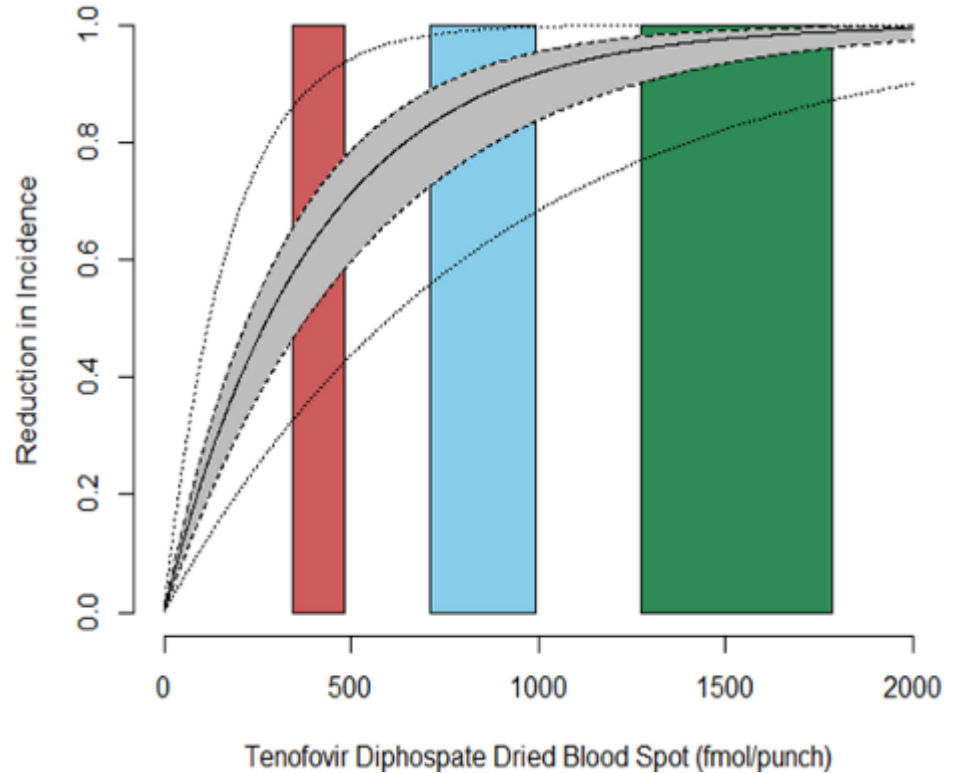
Adherence

- Adherence was quantified using dried blood spots
- Adherence was binned into 2 levels: High and Low
 - High = TFV-DP > 400 fmol/punch
- Logistic regression was used to estimate the relationship:
 - Age and # of partners vs adherence level.



Effectiveness

- DBS data was used to evaluate the tenofovir-incidence reduction model developed by Moore (2019).
- Effectiveness was estimated for high and low adherence levels.



Source: Mia Moore et. al, Predicting PrEP Efficacy in Women with Partial Adherence to Tenofovir/Emtricitabine, 4th Annual Research for Prevention Conference, 2020

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Modeling Framework

Population	Women ages 18-24 in Nyanza, Kenya
Intervention	PrEP, with MPYA-based effectiveness
Counterfactual	No PrEP distributed
Outcomes	<ul style="list-style-type: none">• % of infections averted• Coverage required to reduce incidence below 1 / 1000 by 2040• Corresponding % of young women with high adherence
Time	PrEP scaled up from 2023-2026, held constant through 2040

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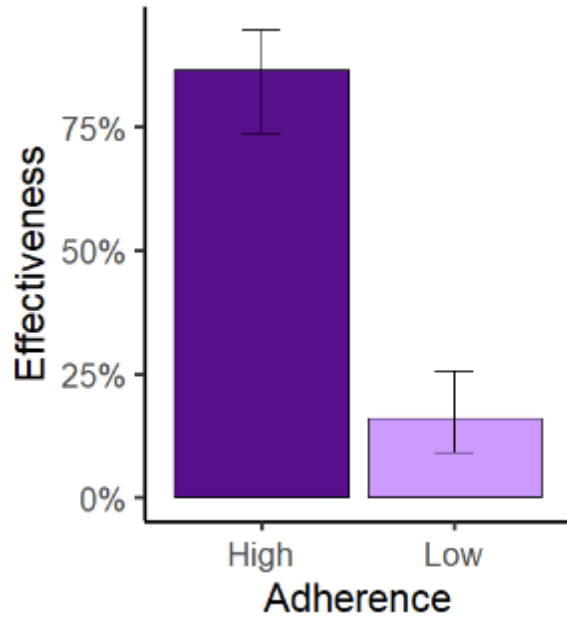
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PrEP use parameters from prior work.

Probability of high adherence

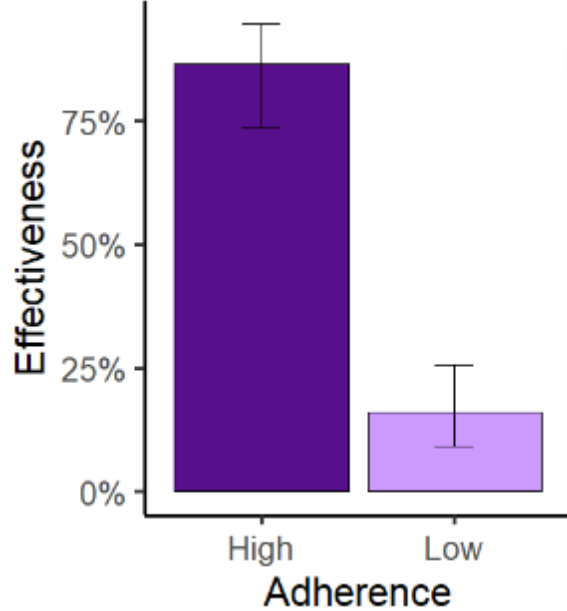
	Number of Partners		
Age	1	2	3+
18-20	40%	30%	19%
21-24	56%	45%	30%



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Expected effectiveness by group

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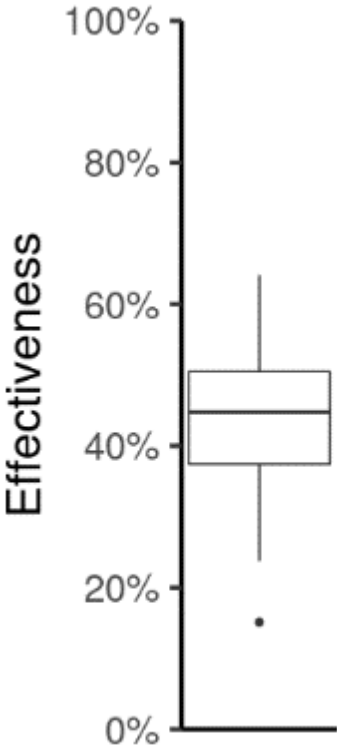
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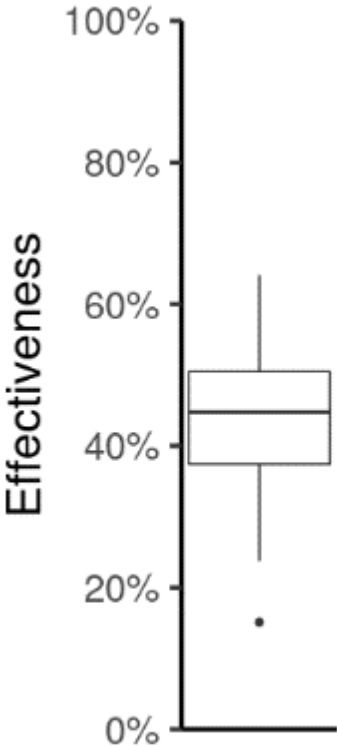
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Accounting for measured adherence and its alignment with risk, we estimate PrEP had a net **effectiveness of 45%** in MPYA

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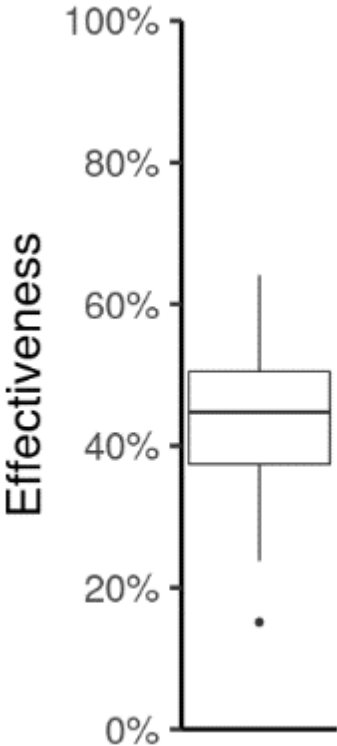


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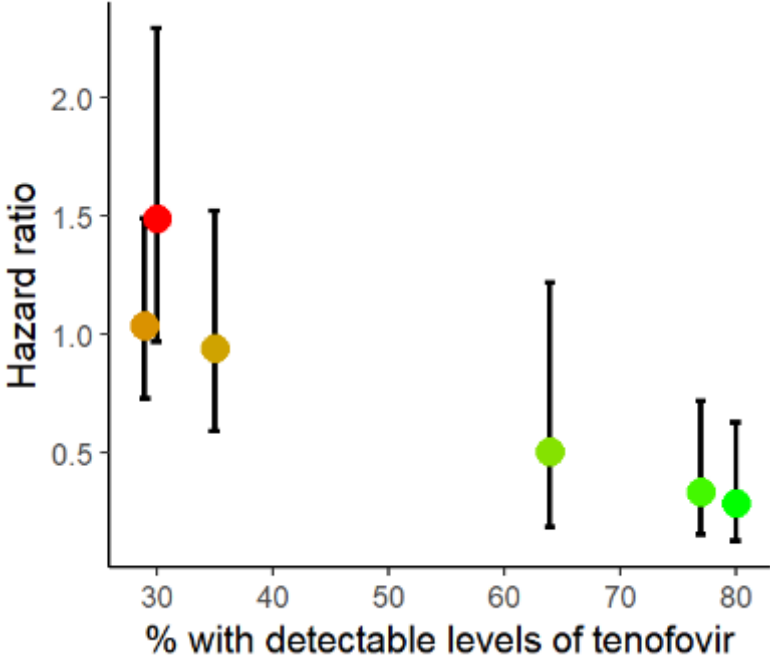
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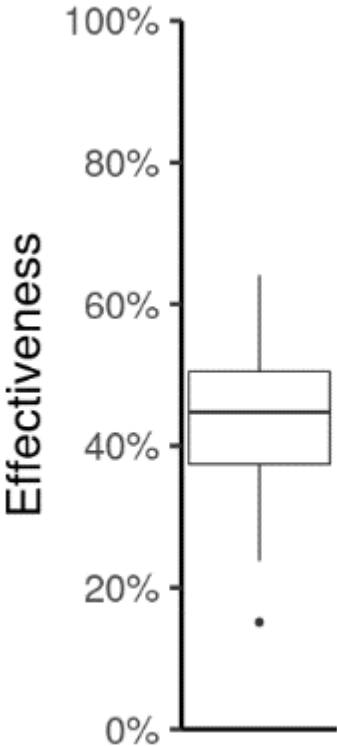
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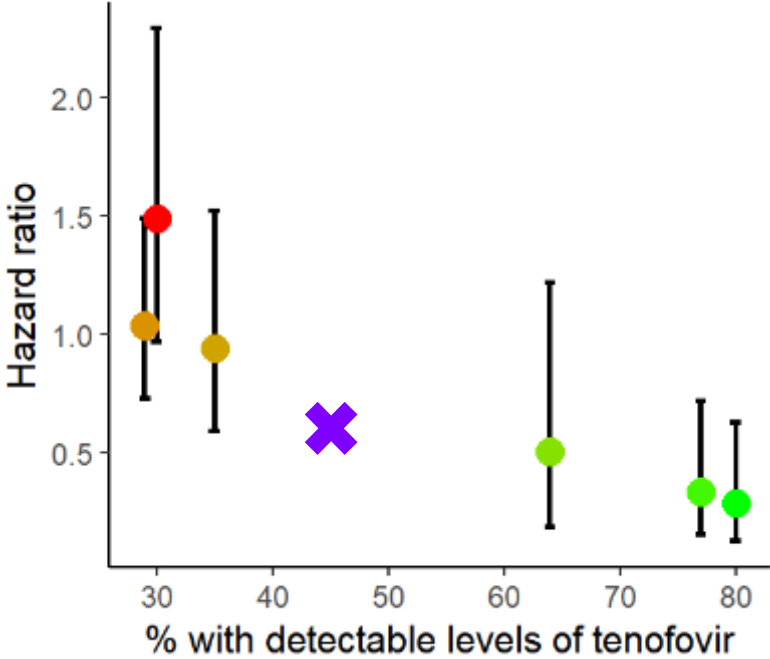
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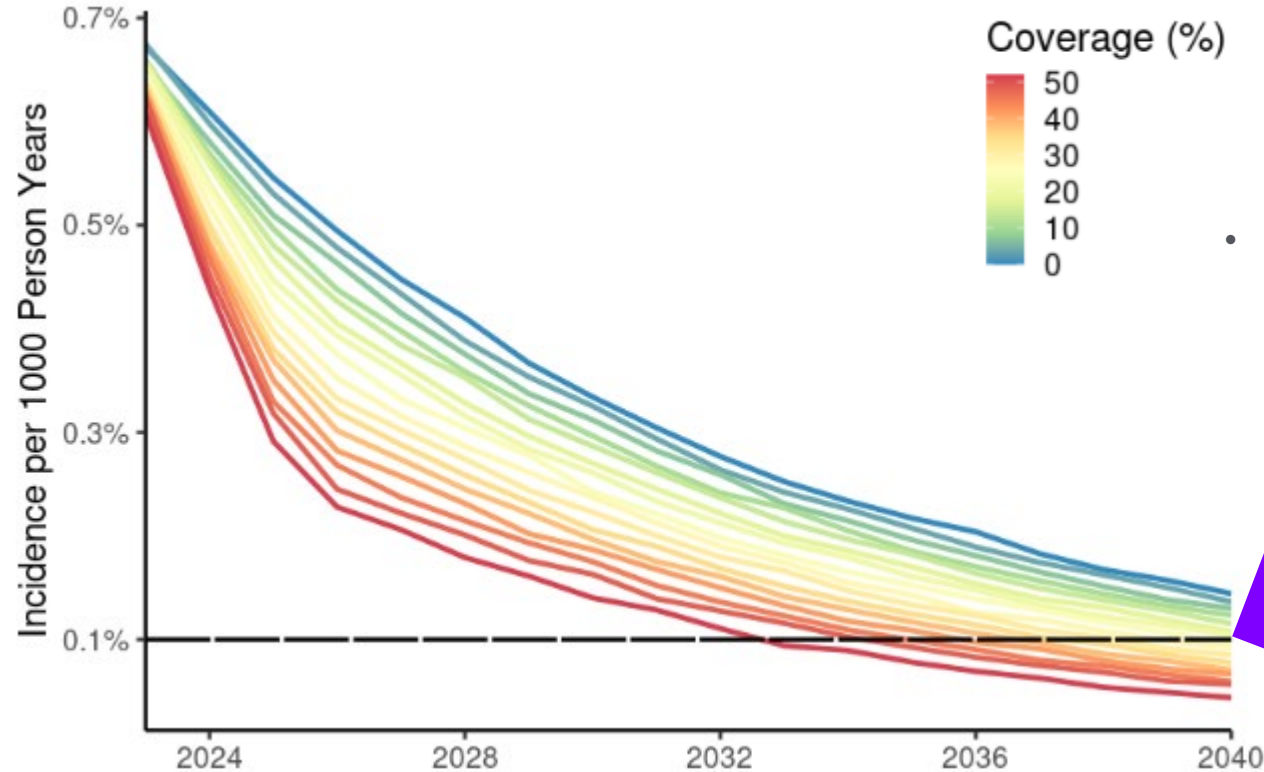
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PrEP in as used in MPYA can achieve epidemic goals if high coverage levels are met



- Roughly 42% of young women would need to be on PrEP to reduce incidence below 0.1%
 - Denominator: all AGYW ages 18-24
- Target incidence of < 0.1% by 2040 represents a 50% reduction in incidence when compared to scenarios without PrEP.

42% line crosses threshold @ 2040

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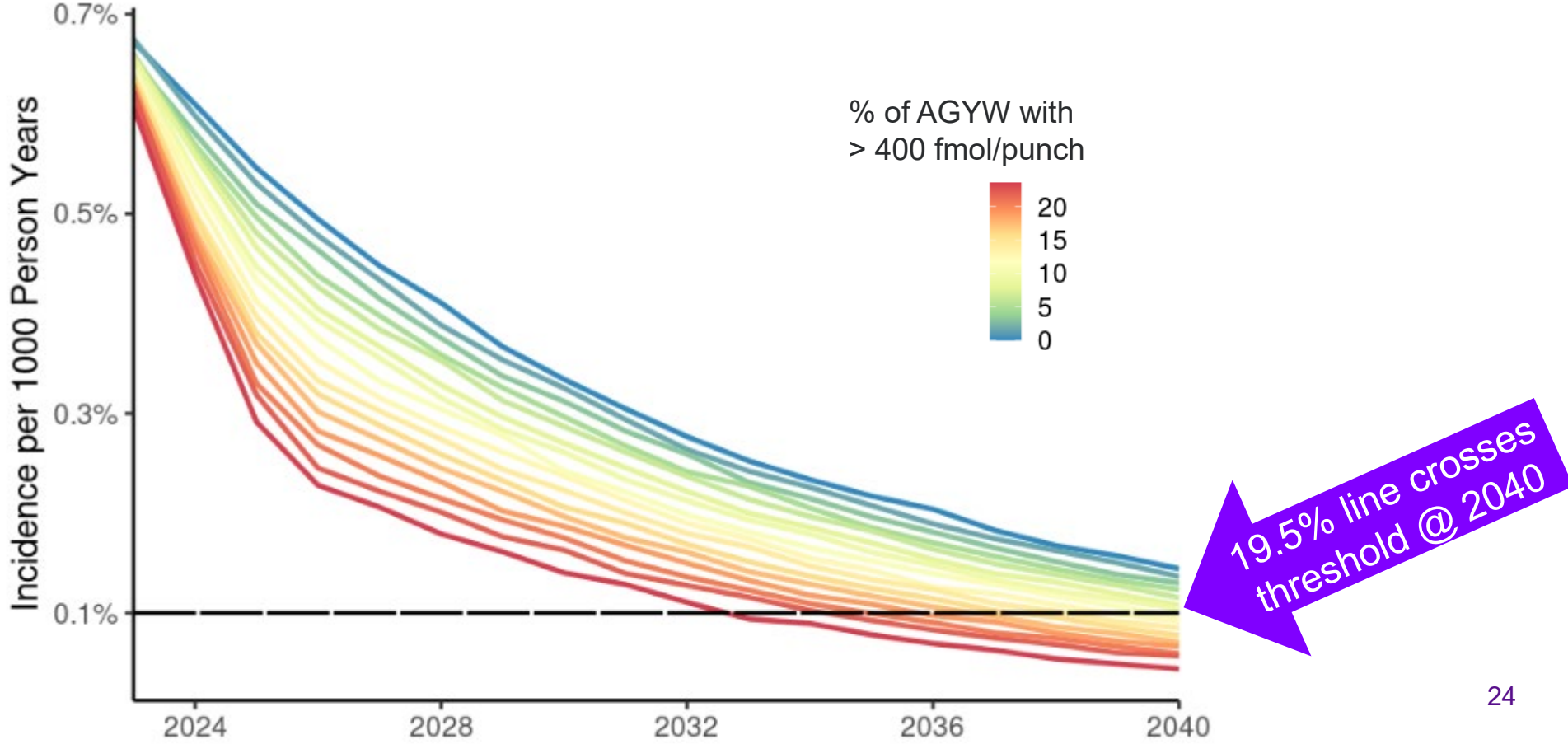
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19.5% of AGYW with high adherence aligned with incidence target



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Takeaways & discussion

- We estimate PrEP effectiveness was 45% in MPYA.
- MPYA approach could reduce incidence among AGYW below 0.1% by 2040 if PrEP coverage exceeds 42%
- High (> 400 fmol/punch) prophylactic drug levels in over 19.5% of the population would indicate being on track to lower incidence below 0.1% by 2040.
- Population HIV Impact Assessments already perform community level drug measurements in 13 African countries.
 - Blood samples taken from all participants
 - Drug concentration currently only measured in HIV Positives
- Future PHIA surveys could consider measuring Prophylactic Drug concentrations among HIV negatives.
- Modeling can inform setting specific targets for prophylactic drug concentration.



Thank you

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