Community scale-up of oral PrEP in western Kenya across target groups: An economic modeling analysis

IDM Annual Symposium

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DEPARTMENT OF GLOBAL HEALTH

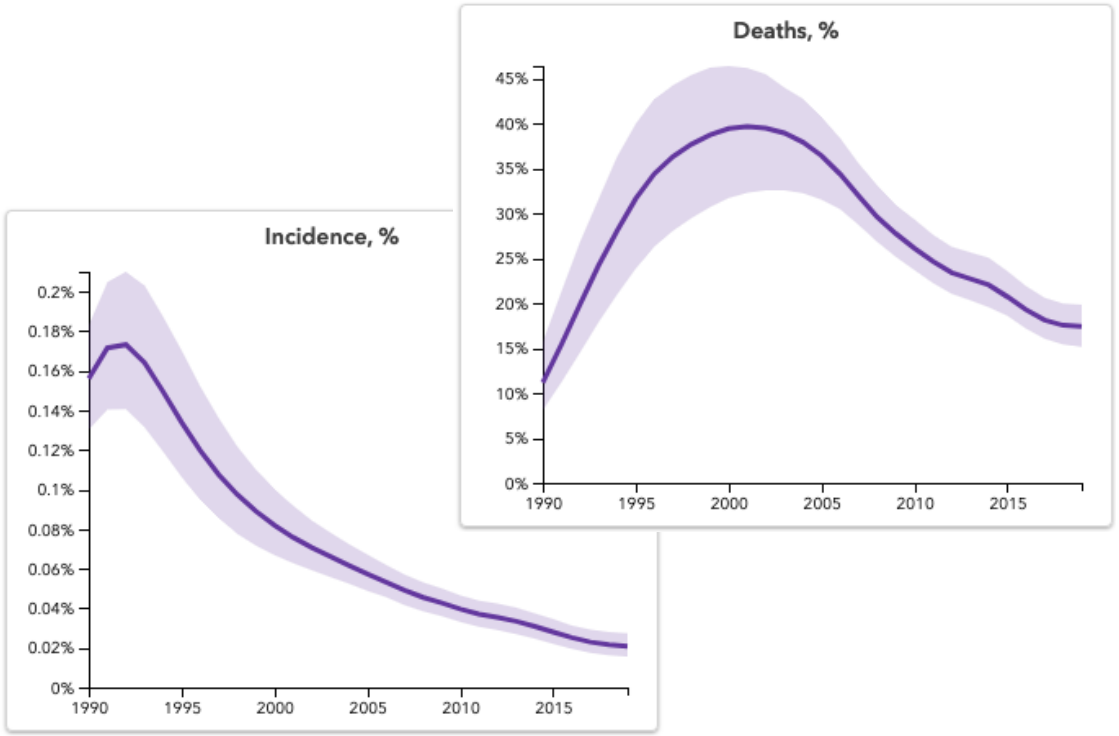
UNIVERSITY of WASHINGTON

Agenda

1. **Background**
2. Methods
3. Results
4. Discussion
5. Wrap-up & questions

HIV epidemic in Kenya

Significant progress



References: 1) Affabati et al 2020; 2) UNAIDS Country Fact Sheet: Kenya; 3) Institute for Health Metrics and Evaluation GBD 2019; 4) Kenya AIDS Strategic Framework II (2020-2024), Kenya Ministry of Health

HIV epidemic in Kenya

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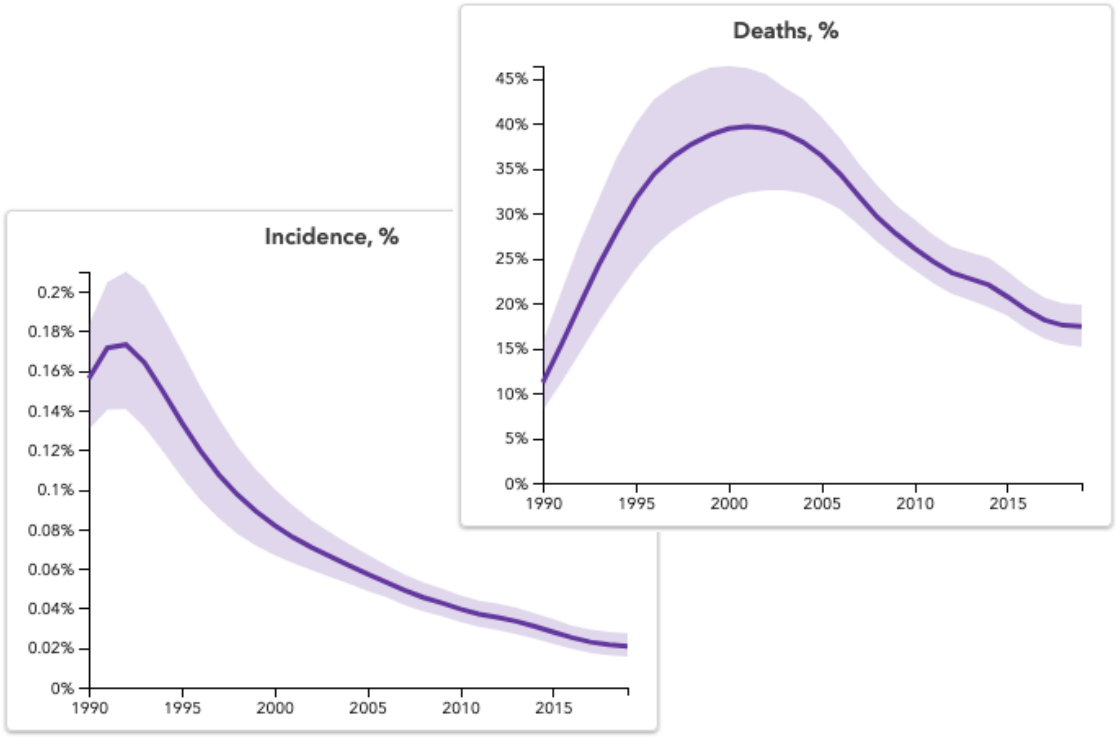
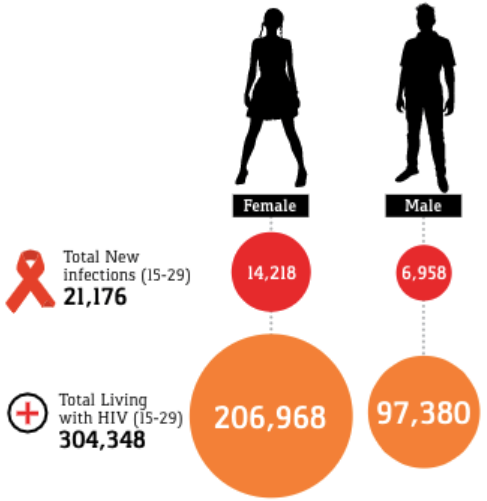
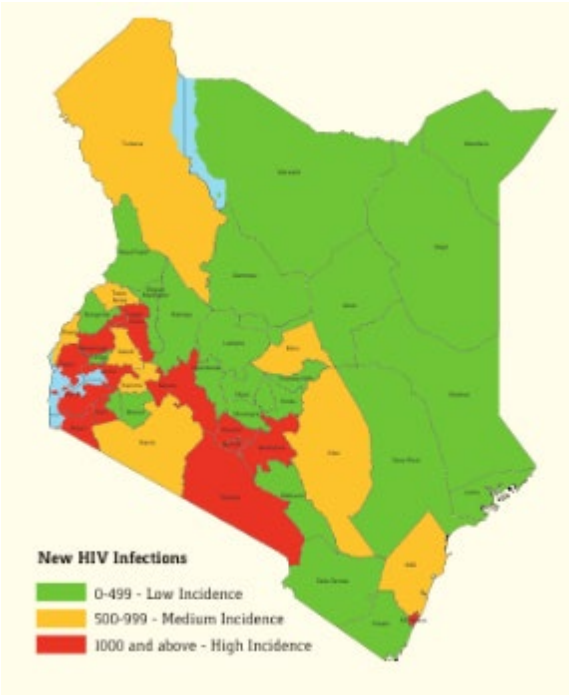


But uneven progress — substantial HIV burden persists





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Oral PrEP

- ✓ Reduces risk of HIV infection by ≥90% with high adherence
- ✓ Currently delivered through health facilities to individuals screened for HIV risk through a risk assessment tool (RAST)

References: 1) Koss et al 2021; 2) Masyuko 2018; 3) Kenya Ministry of Health, Guidelines on Use of Antiretroviral Drugs for Treating and Preventing HIV in Kenya, 2018; 4) World Health Organization, Updated recommendations on first-line and second line antiretroviral regimens: Interim Guidelines., 2018; 5) prepwatch.org, Kenya country profile; 6) Ongolly 2021

The road ahead: PrEP scale up

WHAT?

- **Increased access and use of PrEP**
- **Address client barriers** to initiating and continuing PrEP (e.g., time and travel costs to health facilities)

HOW?

- Kenya MOH strategic plan: "***strengthen differentiated service delivery models to improve access***"
- Utilize patient-centered service delivery channels to reach more individuals and reduce burden on healthcare system
    - Ex. pharmacies, mobile clinics, mHealth

WHO?

?

- Which sub-populations should be targeted with demand generation strategies for PrEP
- What is the cost and health impact of expanding PrEP from narrow to broader target groups?

References: 1) Kenya AIDS Strategic Framework II (2020-2024), Kenya Ministry of Health; 2) Vanhamel 2020; 3) Roche 2021; 4) Mangale 2018; 5) Kuo [in-progress]; 6) Ngure 2022; 7) Gorman et al 2014; 8) Mugo 2016; 9) World Health Organization, Technical Brief on HIV Self-Testing for PrEP Initiation

Objective

Evaluate the cost-effectiveness of community-based PrEP scale-up in western Kenya across different target populations

OUTCOMES: health outcomes (HIV infections & deaths averted),
value for money (ICER) (costs and DALYs averted)

INTERVENTION: targeted PrEP scale up by population for 5 years

- Assume PrEP distribution strategies re-evaluated after 5 years in response to changing HIV prevalence

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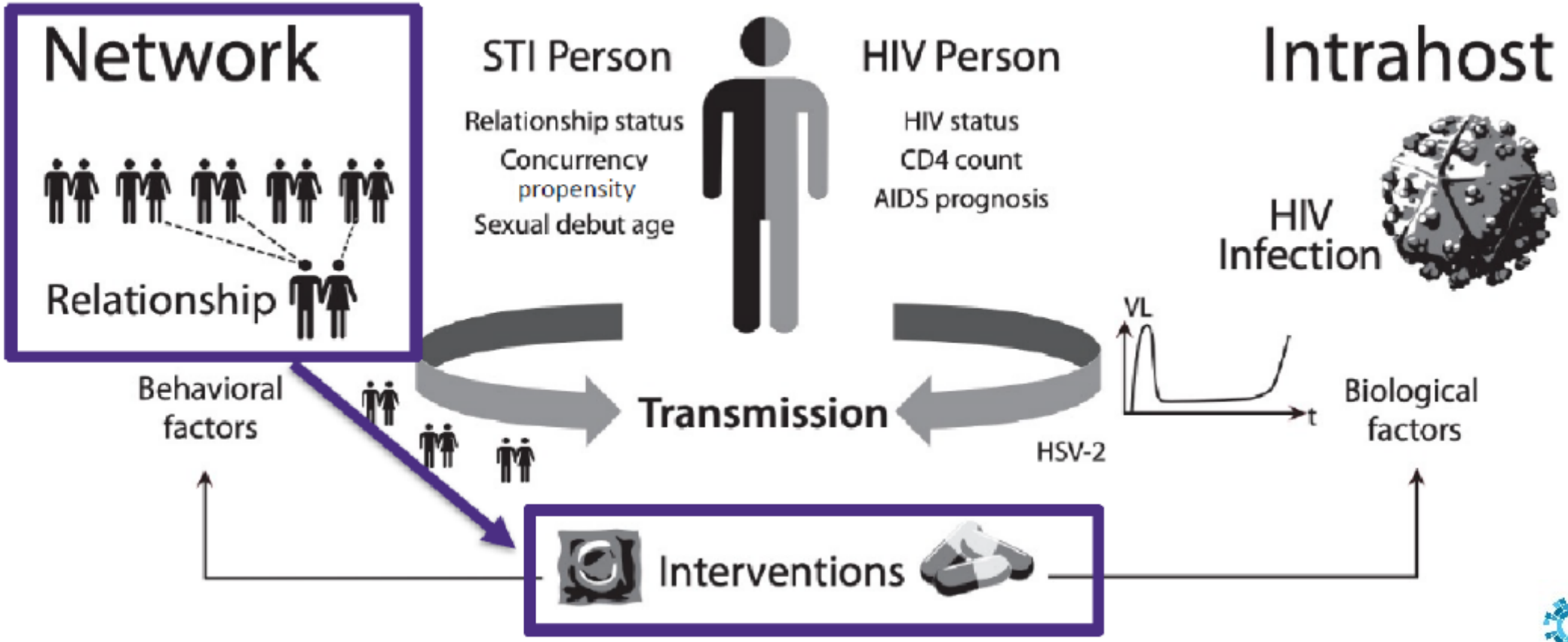
EMOD-HIV



References: EMOD-HIV, Institute for Disease Modeling, Bill and Melinda Gates Foundation. Figure from Bershteyn A, et al. arXiv. 2012. https://arxiv.org/abs/1206.3720.

PrEP scale-up by target population

PrEP eligibility for all scenarios: Age 15 - 49, ≥ 1 sexual partner, not tested HIV positive

Coverage

PrEP effectiveness assumed to be 90%. First PrEP round is 30 day supply -> 75% chance of continuing if still eligible -> 90-day supply.

PrEP scale-up by target population

PrEP eligibility for all scenarios: Age 15 - 49, ≥ 1 sexual partner, not tested HIV positive

Coverage

#	Setting (costs)	Population (groups reached)	Coverage and retention ("penetration"; PrEP use within target populations)
Baseline 0	Facility	**No PrEP**	0% PrEP coverage
Scenario 1	Community	**RAST checklist**	Female sex workers: 80% Male clients of female sex workers: 50% Have a partner who is HIV+ and not on ART: 50% Woman who suspects her partner has HIV: 5%
Scenario 2	Community	**Scenario 1 + AGYW**	AGYW aged 15-24: 15%
Scenario 3	Community	**Scenarios 1 + 2 + Women and men with >=2 partners in a 3-month period**	Women aged 25-40 with >=2 partners: 50% Men aged 15-40 with >= 2 partners: 75%

PrEP effectiveness assumed to be 90%. First PrEP round is 30 day supply -> 75% chance of continuing if still eligible -> 90-day supply.

Economic Inputs

Direct Medical Costs

	Estimate (*Range*)
Unit test cost	$5.00 ($*1 - 10*)
Referral cost if pos. test	$4.00 ($*1 - 10*)
Cost of 30 days of PrEP	$13.50 ($*10 - 20*)
Monthly cost of ART	$16.04 ($*11.75 - 39.17*)
Yearly cost of HIV care	CD4 > 350: $29.10 CD4 200 – 350: $102.95 CD4 <350: $373.76
Cost of end-of-life care HIV	$358.10

Household and Societal Costs

	Estimate (*Range*)
Travel time	15mins (*10 – 45min*)
Transportation costs	$1.96 ($*0.00 – 4.00*)
Informal HIV care costs	$4.68 ($*0.00 – 6.00*)

PrEP delivery costs assume community (eg pharmacy) based PrEP provision

Note: Partial list of inputs. The full list and references are in the appendix slides.

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Health impacts, PrEP coverage, costs

Estimate (*95% CI*)	Scenario 0: No PrEP	Scenario 0.5: FSW	Scenario 1: RAST	Scenario 2: AGYW	Scenario 3: Broad

*Undiscounted costs in the first 5 years of analysis from the MOH perspective, per million population

Health impacts, PrEP coverage, costs

Estimate (*95% CI*)	Scenario 0: No PrEP	Scenario 0.5: FSW	Scenario 1: RAST	Scenario 2: AGYW	Scenario 3: Broad
Deaths Averted (20 -yr)	*(reference)*	**1.18%** (-2.52 - 5.01%)	**6.28%** (2.74 - 8.8%)	**6.1%** (3.22 - 8.72%)	**8.55%** (5.09 - 11.43%)
Infections Averted (20-yr)	*(reference)*	**2.58%** (-2.14 - 7.31%)	**16.6%** (12.2 - 20.98%)	**16.68%** (13.39 - 19.76%)	**23.25%** (19.3 - 27.58%)
Deaths Averted (5-yr)	*(reference)*	**0.23%** (-3.57 - 4.97%)	**0.37%** (-4.18 - 4.15%)	**1.29%** (-3.07 - 5.15%)	**1.41%** (-4.01 - 4.5%)
Infections Averted (5-yr)	*(reference)*	**5.34%** (0.66 - 10.34%)	**30.81%** (27.2 - 35.33%)	**32.98%** (28.95 - 36.5%)	**41.21%** (38.09 - 45.78%)
HIV Prevalence					
AGYW (15-24)	**6.29%** (5.61 - 7.36%)	**6.18%** (5.53 - 7.07%)	**5.54%** (5.1 - 6.53%)	**5.53%** (4.96 - 6.51%)	**5.37%** (4.81 - 6.37%)
All adults (15-65)	**10.68%** (10.08 - 10.06%)	**10.64%** (9.77 - 9.76%)	**10.39%** (9.77 - 9.76%)	**10.36%** (9.72 - 9.71%)	**10.24%** (9.64 - 9.63%)

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GLOBAL HEALTH

Health impacts, PrEP coverage, costs

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PrEP Coverage					
AGYW (15-24)	**0.0%** (0.0 - 0.0%)	**3.29%** (3.16 - 3.4%)	**3.71%** (3.55 - 3.8%)	**9.46%** (9.16 - 9.82%)	**9.42%** (9.14 - 9.77%)
All adults (15-65)	**0.0%** (0.0 - 0.0%)	**0.6%** (0.58 - 0.62%)	**2.3%** (2.22 - 2.35%)	**3.3%** (3.18 - 3.42%)	**6.58%** (6.26 - 6.77%)

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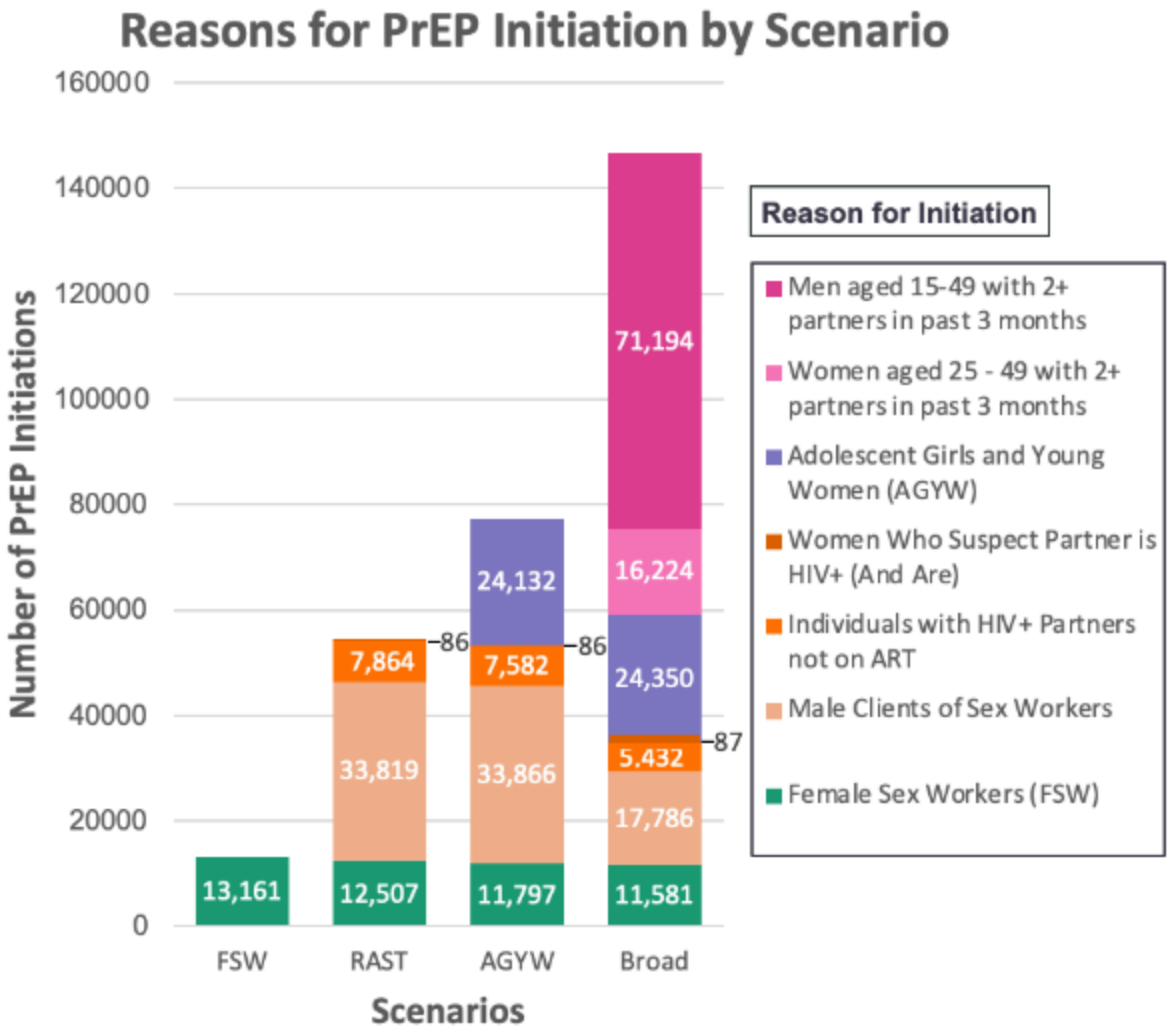
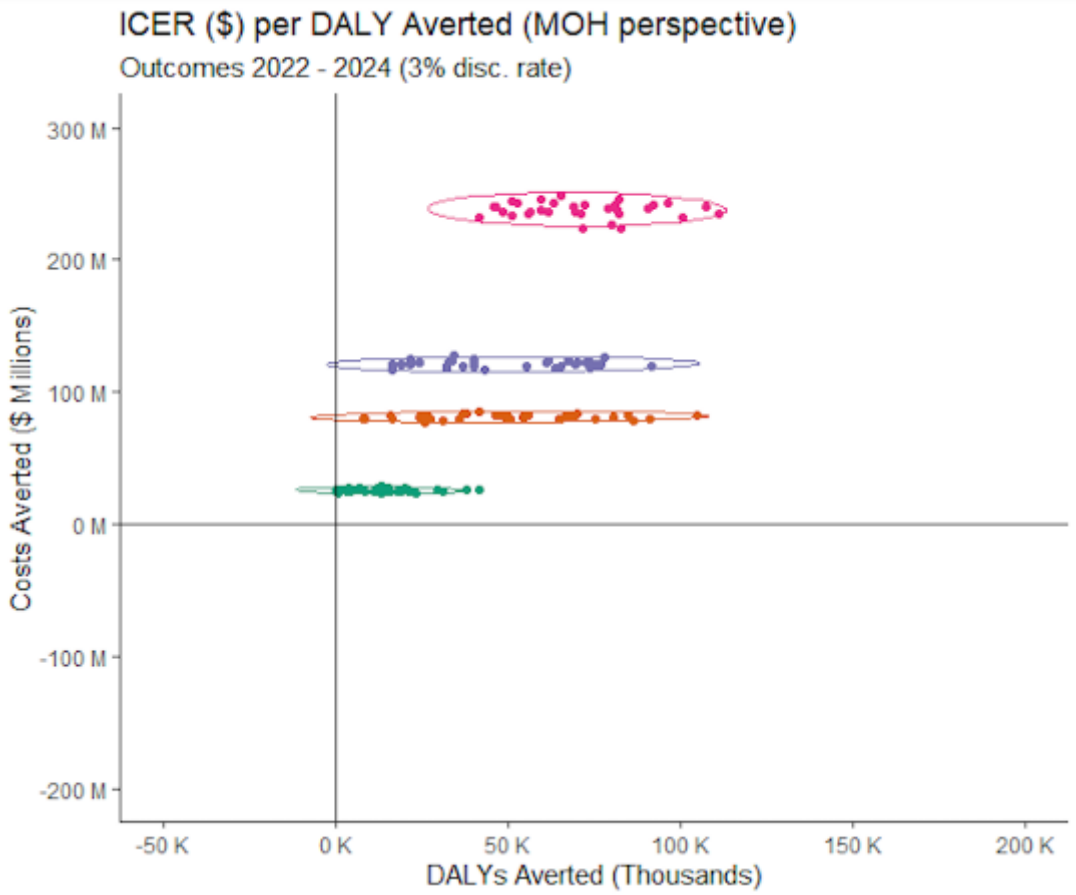
Avg cost/mil pop/ year	**$17.75** (ref)	**$19.04** (1.07x)	**$21.82** (1.23x)	**$23.82** (1.34x)	**$29.65** (1.67x)
5-year Budget Impact*	**$373.61** (ref)	**$417.87** (1.12x)	**$529.53** (1.42x)	**$597.73** (1.6x)	**$804.16** (2.15x)

*Undiscounted costs in the first 5 years of analysis from the MOH perspective, per million population

PrEP initiation by subgroup across scenarios



Cost-effectiveness plane



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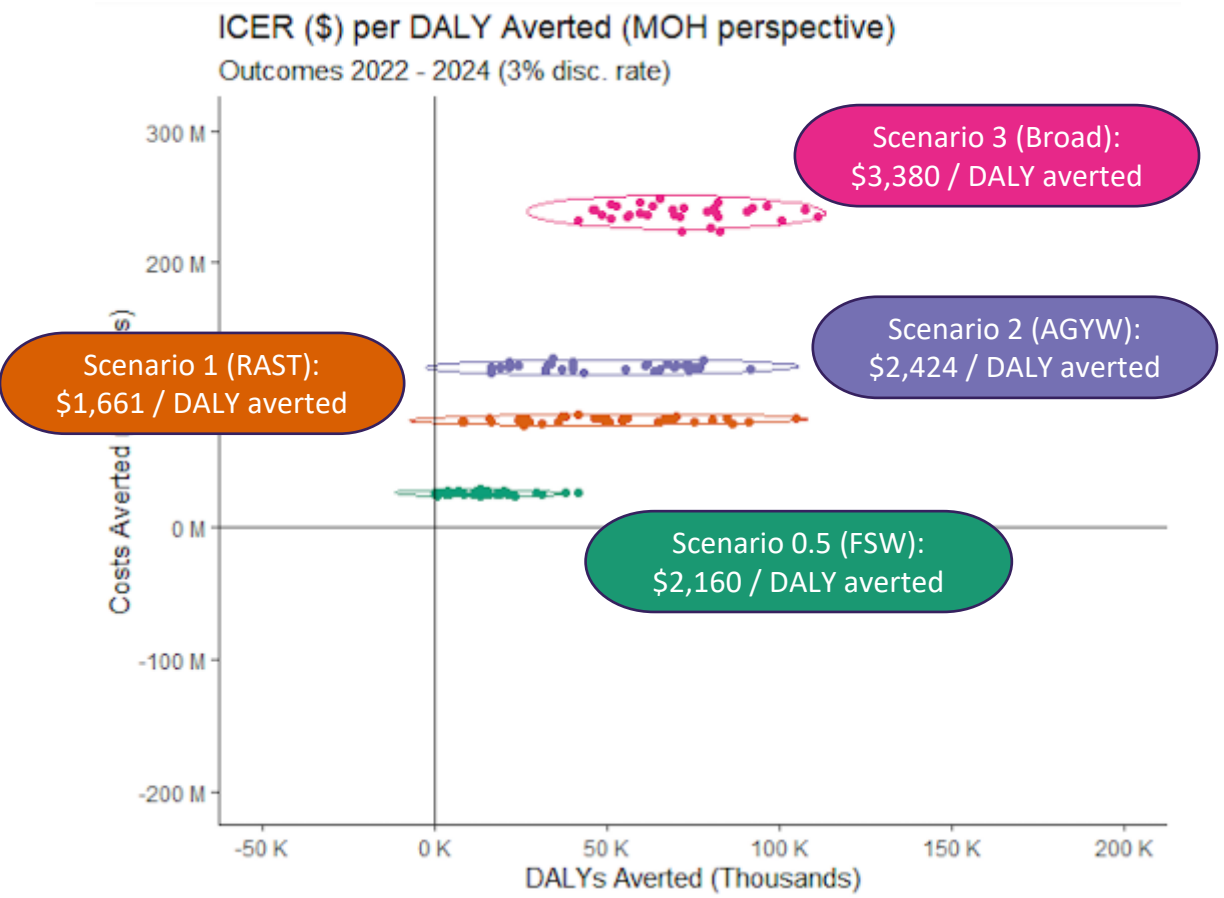

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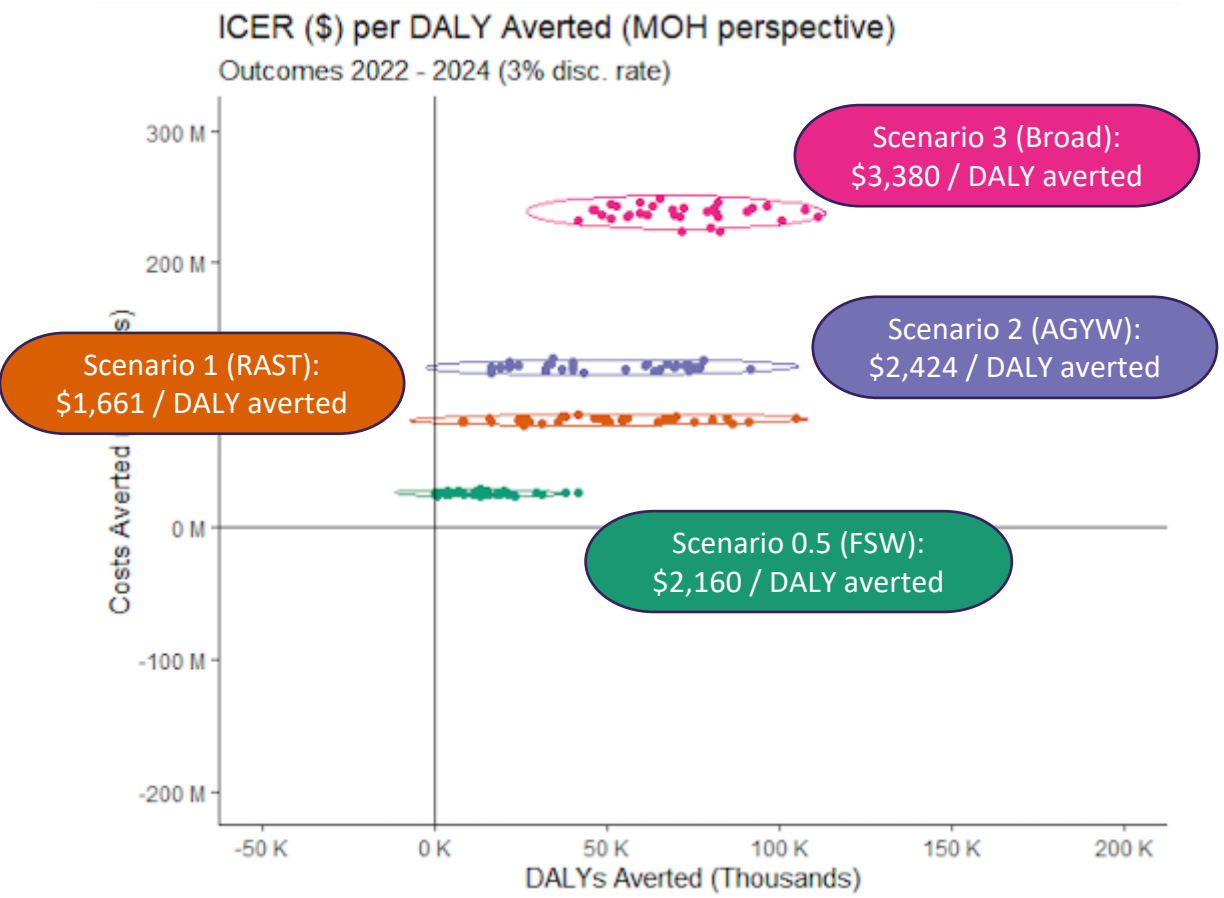
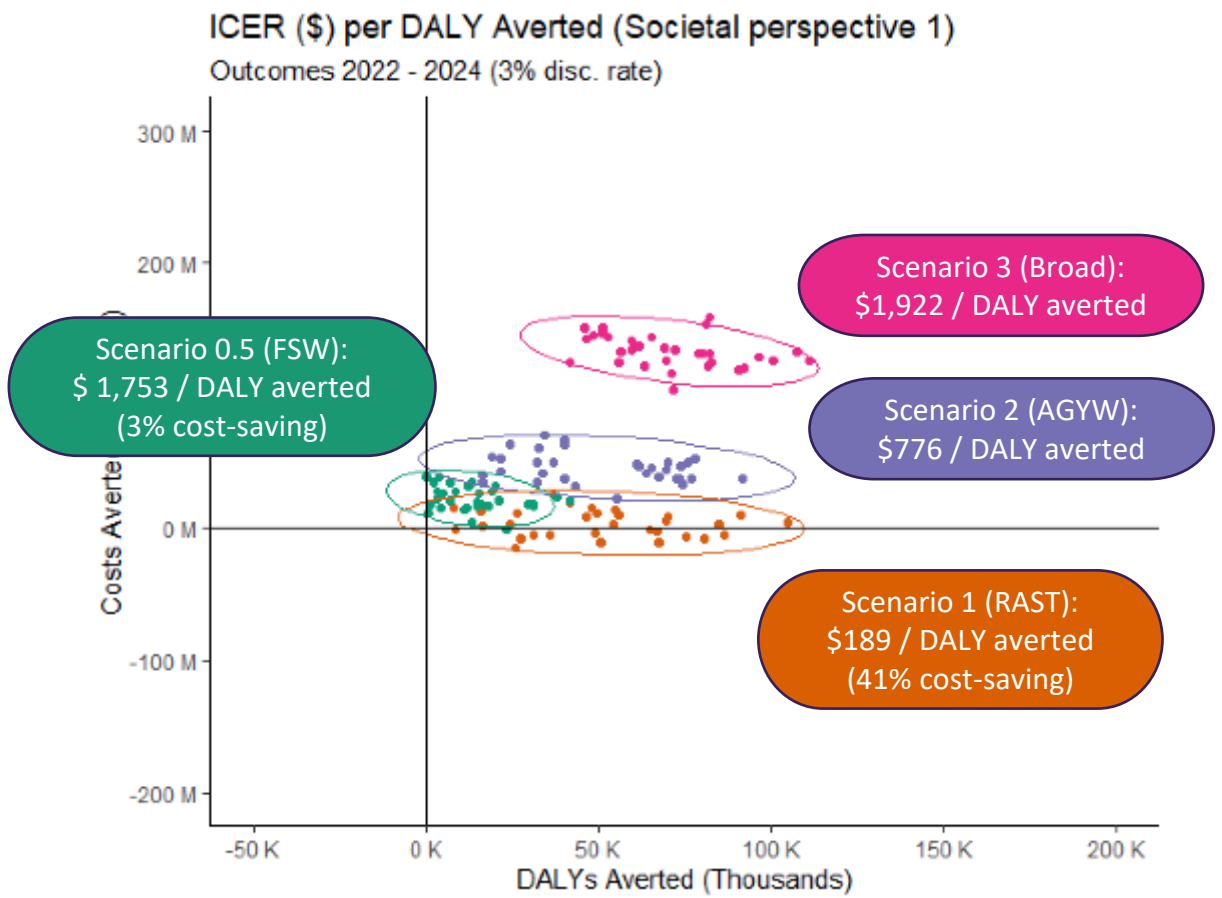


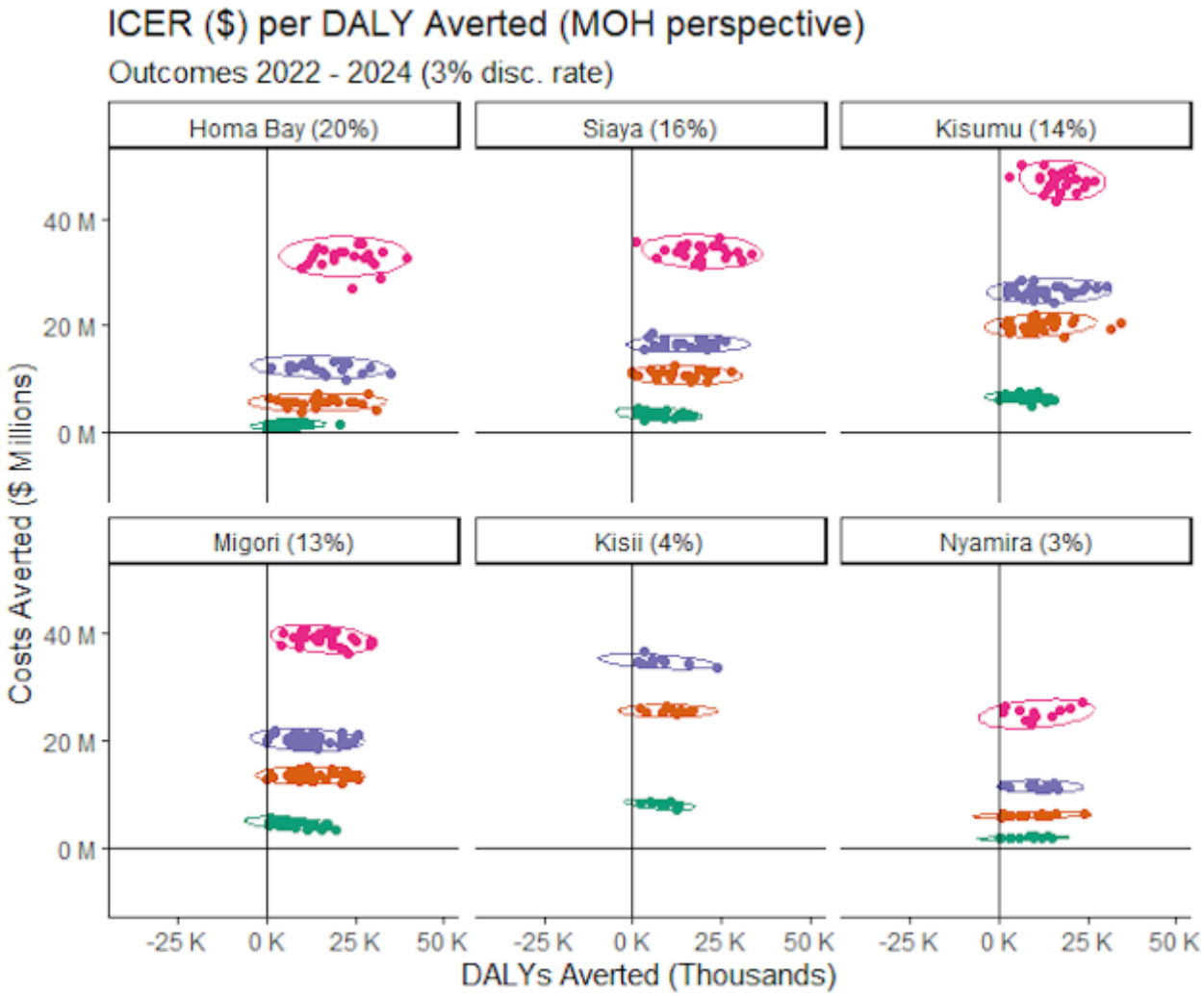


Health and economic impact

Scenario	Infections averted* (95% CI)	Deaths averted* (95%)	DALYs averted (95% CI)	ICERs (95% CI) (*MOH perspective*)	ICERs (95% CI) (*Societal Perspective*)
No PrEP	*(reference)*	*(reference)*	*(reference)*	*(reference)*	*(reference)*
Scenario 1: RAST	**30.9%** (27.1 – 35.5%)	**5.9%** (2.2 - 8.7%)	**49,296** (8,487 - 94,035)	**$1,661** ($862 - $9,404)	**$189**[1] ($43 - $1,487)
Scenario 2: AGYW	**32.5%** (26.6 – 37.2%)	**6.1%** (2.9 - 9%)	**49,253** (16,396 - 80,810)	**$2,424** ($1,522 - $7,158)	**$776** ($403 - $2,690)
Scenario 3: Broad	**41.7%** (38 – 45.6%)	**8.6%** (6.1- 11.3%)	**70,252** (44,602 - 107,856)	**$3,380** ($2,223 - $5,354)	**$1922** ($1,219 - $3,135)

*Infections averted over 5 year time horizon, deaths averted over 20 year time horizon.
[1] 41% of runs were cost-saving

ICERs by geography (prevalence)



- Similar pattern by countries across varying HIV prevalence
- Costs and health benefits increase with broader PrEP coverage

Scenario 3 (Broad)

Scenario 2 (AGYW)

Scenario 1 (RAST)

Scenario 0.5 (FSW)

Cost-effectiveness by geography (prevalence)

County	Baseline adult HIV Prevalence	Scenario 1: RAST	Scenario 2: AGYW	Scenario 3: Women + Men
Homa Bay	21%	$1,319	$1,538	$5,583
Siaya	17%	$2,119	$2,665	$5,317
Kisumu	15%	$3,973	$3,713	$4,871
Migori	14%	$5,595	$79,373	$3,717
Kisii	3%	$6,952	$27,733	$15,571
Nyamira	3%	$3,478	$2,706	$44,826

Over 20-year time horizon & 3% discount rate for DALYs and costs

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Conclusions

- **Health benefits increased with broader PrEP scale up**
  - 10% more HIV infections averted with PrEP coverage of adults compared to those eligible using the RAST
  - PrEP provision to FSWs only had lowest costs but smallest overall health impact since FSWs make up a small proportion of the population
- Health impacts and cost effectiveness **varied by county but overall pattern was same**, with costs and health benefits increasing with broader PrEP scale up
- ICERs associated with PrEP provision to AGYW were **lower in counties with higher HIV prevalence**

Conclusions

- Although broadest scenario of PrEP scale up averted the most HIV infections, targeting to those with high sexual activity in the general population was imprecise and ICERs were **not considered cost-effective** using 50% of Kenya's GDP per capita as threshold of cost-effectiveness.
- Even with broad PrEP scale up, HIV infections were projected to decline by less than 50% over 5 years, suggesting **other interventions are needed** to achieve HIV elimination
- ICERs were more cost-effective using the **societal perspective**, highlighting impact of HIV on individual's time and productivity

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Acknowledgements

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- Monisha Sharma (PI)
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- Clark Kirkman IV
- Jeff Steinkraus
- Josh Herbeck
- Stewart Chang

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- Nicole Young
- Geoff Garnett

World Health Organization
- Cheryl Johnson
- Rachel Baggaley
- Robin Schaeferr
- PrEP-HIVST Working Group

Contact: rwitten1@uw.edu

Thank you!

Questions?

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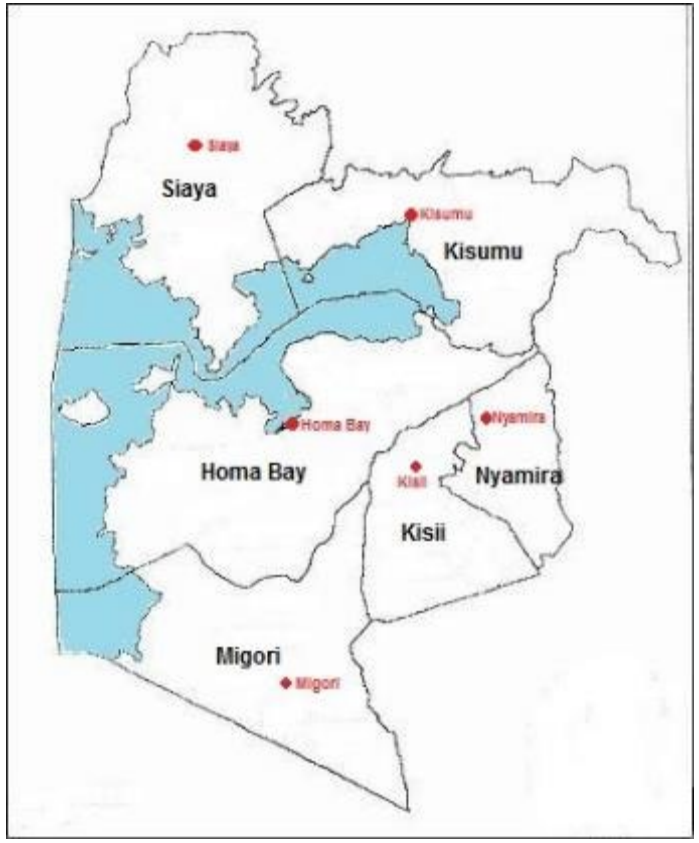
Ask me about…

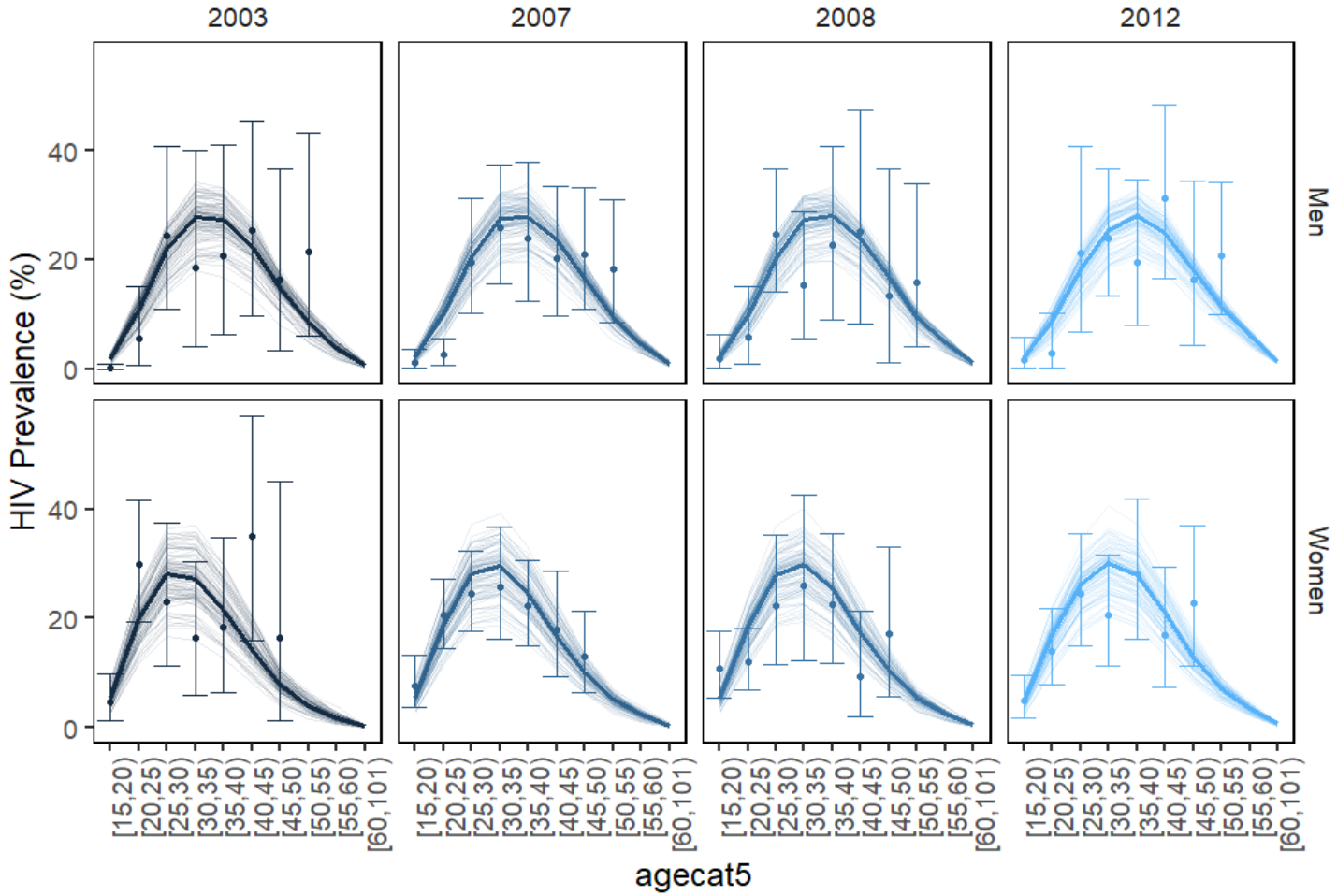
- Implementation scenarios: target populations and proportions of coverage
- Comparing results to other modeling studies
- Societal perspective
- Cost inputs
- Planned sensitivity analyses

Appendix

Model calibrated to western Kenya HIV epidemic



Model estimates for 6 counties



References: EMOD-HIV, Institute for Disease Modeling, Bill and Melinda Gates Foundation.

Comparison: Inputs and results

Study (abbrev. title)	Similarities	Differences
Phillips 2019 "Impact and CE of Condomless-Sex–Concentrated PrEP in KwaZulu-Natal accounting for drug resistance"	• **Inputs:** PrEP effectiveness 70-73%, PrEP given to individuals who have a condomless sex partner (1 scenario is FSW/AGYW, one is all ages 15-64); 3% discount rate • **Results:** Broader scale-up reduces infections and deaths but with diminishing returns	• **Inputs:** higher continuation of 95% (vs. 75% in this study); lower cost per month of PrEP $11.33 (vs. $13.50 in this study); higher cost of ART $367/yr. and not by CD4 count, • **Results:** PrEP coverage of 7.6% for AGYW/FSW (vs. our 32%); PrEP coverage of 3.4% for15-65(vs. our 12.8%); 33% reduction in incidence (vs. our 60%); PrEP roll-out was cost-effective WTP $500
Jamieson 2020 "Self-selection based on HIV risk on the CE of PrEP in South Africa"	• **Inputs:** Broader cov. than Phillips but still narrower than ours (target cov. 18% for adolescents, young adults and pregnant women, 30% for FSWs, 54% for MSM • **Results:** ICER of $2,230 for females age 15-19 and $5,480 for women aged 20-24	• **Inputs:** Lower costs of PrEP $129-134/year (vs. $156/year in our study); cost of HIV test $0.49 (we assume $5); PrEP drug is $3.85 (we assume $6.75);our study doesn't model MSM transmission • **Results:** Lower infections averted over 20yrs (3.2-4.8%)
Phillips 2022 "CE of easy-access, risk-informed oral PrEP in HIV epidemics in SSA"	• **Inputs:** PrEP for those with condomless sex partners • **Results:** Less "risk-informed" PrEP aka not based on condomless sex was less cost-effective; Incidence reduction 49% (vs. our 60%)	• **Inputs:** PrEP cost lower $10/month including the drugs, test, and additional costs (vs. $18.50/month in ours) • **Results:** PrEP cov. 2.2% of AGYW (vs. our 32%) and 2.6% of adults ; PrEP cost-effective; scaled-up PrEP was 1.1x cost of No PrEP
Pretorius 2020 "Modelling impact and CE of oral PrEP in 13 low-resource countries"	• **Inputs:** Target pop FSW, SDC, AGYW in a tiered risk structure of 4 scenarios. • **Results:** Most infections averted were accomplished via rollout to FSWs and SDCs. Results found to not be cost-effective	• **Inputs:** Oral PrEP unit cost higher $17.20/month (vs. our $13.50); PrEP efficacy 90% (vs. our 75); scale up to 50% coverage for all groups; is a compartmental model not microsimulation • **Results:** PrEP averted 3% to 8% of HIV infection (12-yr time horizon)

Not comprehensive

Comparison: PrEP targeting and coverage

Study	Geog.	How was PrEP targeted?	What was the result?
Phillips 2021	ZA	PrEP is offered to people who have at least 1 condomless sex short-term partner in a 3-month period, or a condomless sex on-going primary partner who is diagnosed with HIV but not taking ART. Looked at implementing this policy in 1) all adults aged 15-64yo, and 2) Just all FSW and AWYG age 15-24.% women age 15-24: 1) 7.6%, 2)7.6%; % ppl age 15-64: 1) 3.4%, 2) 1.3%	In the context of PrEP use in adults aged 15–64 years, there was a predicted 33% reduction in incidence and 36% re-duction in women aged 15–24 years. **PrEP scenarios were dominant** (averted DALYs and lowered costs) (WTP $750)
Phillips 2022	SSA	PrEP used during seasons of risk- one or more 3-month periods in which people **have condomless sex with at least one non-primary partner**, when a primary **condomless partner is HIV+ but is not on ART**, or woman aged <50 suspects her primary partner might have unsuppressed HIV. 66% of HIV-negative people with at least one non-primary condomless sex partner take PrEP in any given period, resulting in 2.6% (0.9–6.0) of all HIV negative adults taking PrEP at any given time	Risk-informed PrEP was predicted to reduce HIV incidence by 49% (23–78) over 50 years compared with no PrEP. PrEP was **cost-effective in 71% of all setting-scenarios** (WTP $500), and cost-effective in 76% of setting-scenarios with >2% adult HIV prevalence
Pretorius 2020	13 count-ries	Four PrEP rollout scenarios involving three priority populations— **female sex workers (FSWs), serodiscordant couples (SDCs) and adolescent girls and young women (AGYW)—**both with and without geographic prioritization Coverage was assumed to be S-shaped curve starting at 0% coverage in 2017 and plateauing at 50% coverage by 2030 in the target groups	Oral PrEP averted 3% to 8% of HIV infections across the 13 countries between 2018-2030.Cost-effectiveness varied by HIV incidence and unit costs. In Kenya, cost per inf averted was $20,000.
Jamieson 2020	ZA	Adolescents aged 15 – 19 years, young adults aged 20 – 24 years, pregnant women, MSM and FSW of all ages PrEP scaled-up linearly from 2019 onwards… target coverage of 18% for adolescents, young adults and pregnant women, 30% for FSWs and 54% for MSM by 2021, maintained up until 2038	The incremental cost per HIV infection averted is lower in high-risk vs. all-risk sub-populations **becoming cost saving within 20 years for high-risk adolescents, young women, MSM and FSWs**.

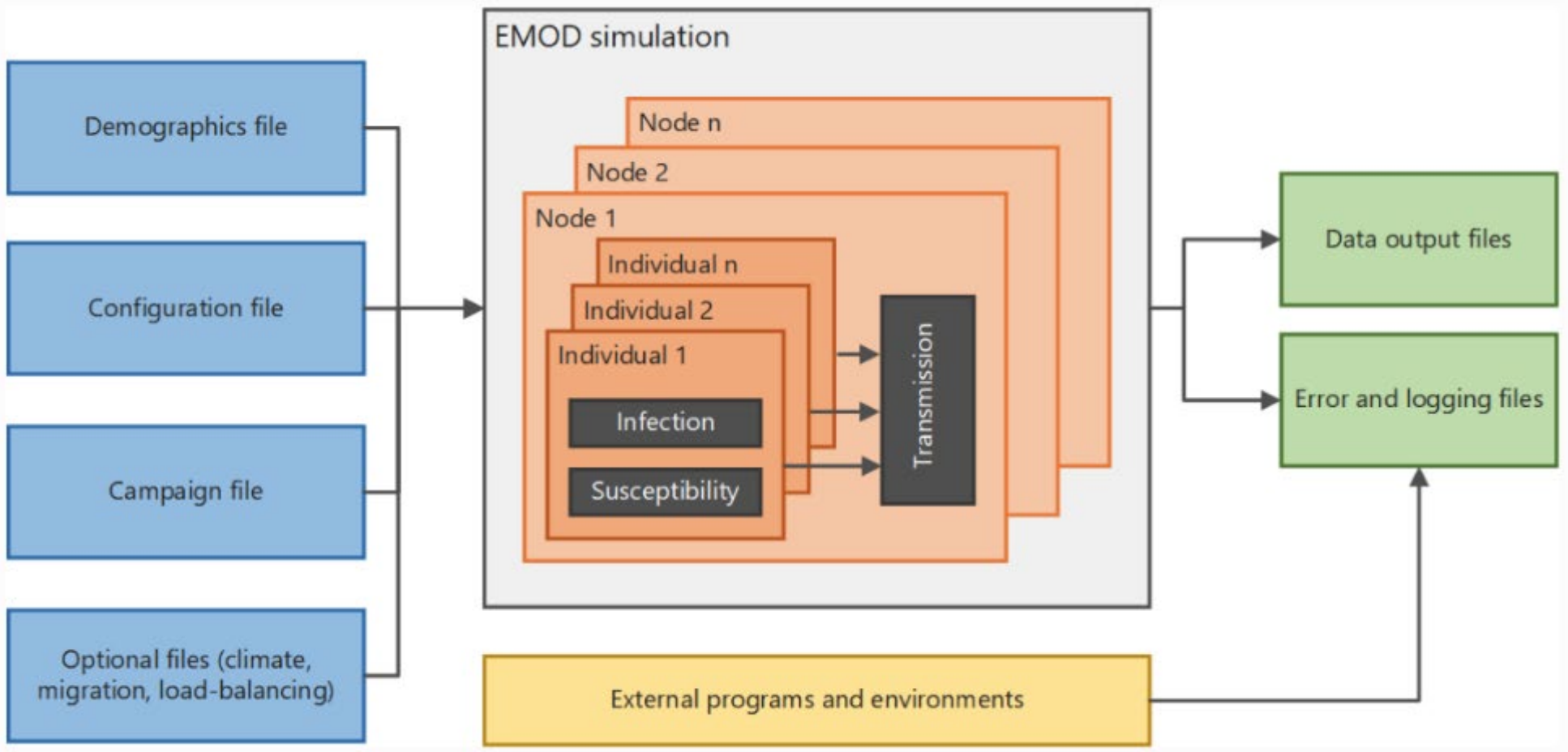
The available evidence considers cost-effectiveness of scaling up PrEP to a (typically) narrow set of individuals with the highest risk of HIV infection and generally finds that this is cost-effective

EMOD Model Architecture

In this analysis, there are 6 “nodes” each representing a specific county in western Kenya

Data source: UN World Population Prospectus 2019, Kenya Population and Housing Census 2009

PrEP, ART, VMMC, and other interventions are incorporated in the campaign file



High-level EMOD system architecture

References: EMOD_HIV, Institute for Disease Modeling. Available at: https://docs.idmod.org/projects/emod-hiv/en/2.20_a/software-overview.html

Calculating resistance to PrEP/ARVs

Background Resistance

HIV Cases

X

Assume 10% have some resistance already

=

Background Resistance

+

Inappropriate PrEP Initiation

Initiate PrEP with a recent, as-yet-undetectable HIV infection

X

32.6% go on to develop PrEP resistance

=

Initiate PrEP with HIV infection due to false negative HIV test

X

16.3% go on to develop PrEP resistance

=

Resistance from inappropriate PrEP initiations

+

Breakthrough Infections

Ongoing PrEP use with HIV because of breakthrough HIV infection

X

2.75% go on to develop resistance to PrEP

=

Resistance from breakthrough HIV infections

Sum of these three mechanisms = total cases of PrEP resistance

References: References from 20+ studies of empiric and modeling data were collected and analyzed to derive these assumptions about resistance proportions (publication in-progress)- please reach out and we are happy to share these sources

Economic inputs: direct medical costs

Category	Estimate (Range)	References
PrEP Initiation		
HIV test unit cost	$5.00 ($1.00-$10.00)	Mangale 2022; Phillips 2022; Kuo 2022 (unpublished)
Referral cost if positive test	$4.00 ($0.50 - $10.00)	Mangale 2022; Meisner 2021
30-day cost of PrEP provision (facility)	$15.00 ($10-$20)	Mangale 2022; Kuo 2022 (unpublished)
30-day cost of PrEP provision (community)	$13.50 ($7-$25)	Mangale 2022; Kuo 2022 (unpublished)
HIV Care		
Monthly cost of ART	$16.04 ($11.75 – $39.17)	Larson 2018; Meyer-Rath 2019
Cost of HIV care: CD4 > 350	$29.10	Eaton, Menzies 2013
Cost of HIV care: CD4 200-350	$102.95	Eaton, Menzies 2013
Cost of HIV care: CD4 < 200	$373.76	Eaton, Menzies 2013
Cost of HIV end-of-life care and death	$358.10	Eaton, Menzies 2013
DALY Weights		
On ART	0.078	IHME GBD 2019
Infected, not on ART, CD4 > 200	0.274	IHME GBD 2019
Infected, not on ART, CD4 < 200	0.582	IHME GBD 2019

Economic inputs: household and societal costs

Category	Estimate (*Range*)	References
Household costs		
Travel time (facility)	60 mins (30 – 90mins)	Kohler 2019, Kemper 2022
Travel time (community)	15 mins (10 – 45mins)	Roche, Ortblad 2021
Transportation costs (facility)	$1.96 ($1.00 - $4.00)	Brennan 2019, Roche 2021
Transportation costs (community)	$0 ($0 - $1)	Roche, Ortblad 2021
Informal care costs per month	$4.68 ($0 - $6)	Katana 2020
Days of lost wages per month (CD4 >200)	2.7 days (0 – 30)	Katana 2020
Days of lost wages per month (CD4 <200)	30 days (0 – 30)	Assumed
Average annual income (assume 3% growth/year)	$1,639	ILO HIES 2019
Societal costs (opportunity costs/ lost productivity)		World Bank, Kenya MOH 2020
Work days lost due to absenteeism, presenteeism	6% of days, 3% of days (*1 – 33%*)	Katana 2020
Average GDP per worker (assume 6% growth/year)	$10,861	World Bank 2021
Labor force participation rate (% pop aged 15+)	73%	World Bank 2021
Employment rate	94.3%	World Bank 2021

Societal cost calculations: productivity loss

Loss from absent/presenteeism

Productivity loss from absenteeism or presenteeism = Percent productive time lost per year x disease prevalence (# of people)$_i$ x GDP per worker$_i$ x labor force participation rate x employment rate.

Where,

i represents the year in the analysis.

GDP per worker is KSh 489,641 in 2017 and grows at a projected rate of six percent annually.

Labor force participation rate is 67.3 percent and remains static throughout the analysis.

Employment rate is 89 percent and remains static throughout the analysis.

Percent productive time lost per year due to a given disease is derived from academic literature, as reported in box 3.2.

Future losses are discounted at a rate of 6.5 percent. The total productivity loss is the sum of productivity losses from mortality, absenteeism, and presenteeism.

Loss from premature mortality*

Productivity loss from premature mortality = Number of NCD deaths$_i$ x GDP per worker$_i$ x labor force participation rate x employment rate x the expected number of years of working life lost

Where,

i represents the year in the analysis.

GDP per worker is KSh 489,641 in 2017 and grows at a projected rate of six percent annually.

Labor force participation rate is 67.3 percent and remains static throughout the analysis.

Employment rate is 89 percent and remains static throughout the analysis.

Expected number of years of working life lost due to each disease is reported in box 3.2.

*To be included in a sensitivity analysis

Reference: "Mensah, Julia, Julius Korir, Rachel Nugent, and Brian Hutchinson. 2020. "Combating Noncommunicable Diseases in Kenya: An Investment Case." Development Knowledge and Learning. World Bank, Washington, DC. Available from this link.

Additional limitations

Further limitations of this study include…

- Don't yet account for **PrEP resistance**, though we will include this in the final analyses by reporting cases of PrEP resistance and cost of 2nd-line ARVs
- **Inputs for the societal perspective** were derived from a small number of studies and have not been validated with other CEAs
- EMOD and this specific analysis are only applicable to **heterosexual transmission**, not generalizable to other transmission types (MSM, PWID)
- Don't yet account for PrEP delivery in a mix of health facilities and community settings with regard to cost inputs
- Results are calculated for HIV dynamics in Western Kenya, might not be generalizable to other settings

Strengths of this analysis

Strengths of this analysis include…

✓ **Model used (EMOD)** is a highly detailed and validated model of HIV transmission dynamics and HIV care cascade, and well-calibrated to empiric data

✓ First PrEP CEA (to our knowledge) in SSA that **considers the societal perspective** in addition to direct medical costs

✓ Inputs are **informed by microcosting results** specific to a pharmacy-based PrEP trial in western Kenya (publication in-progress)

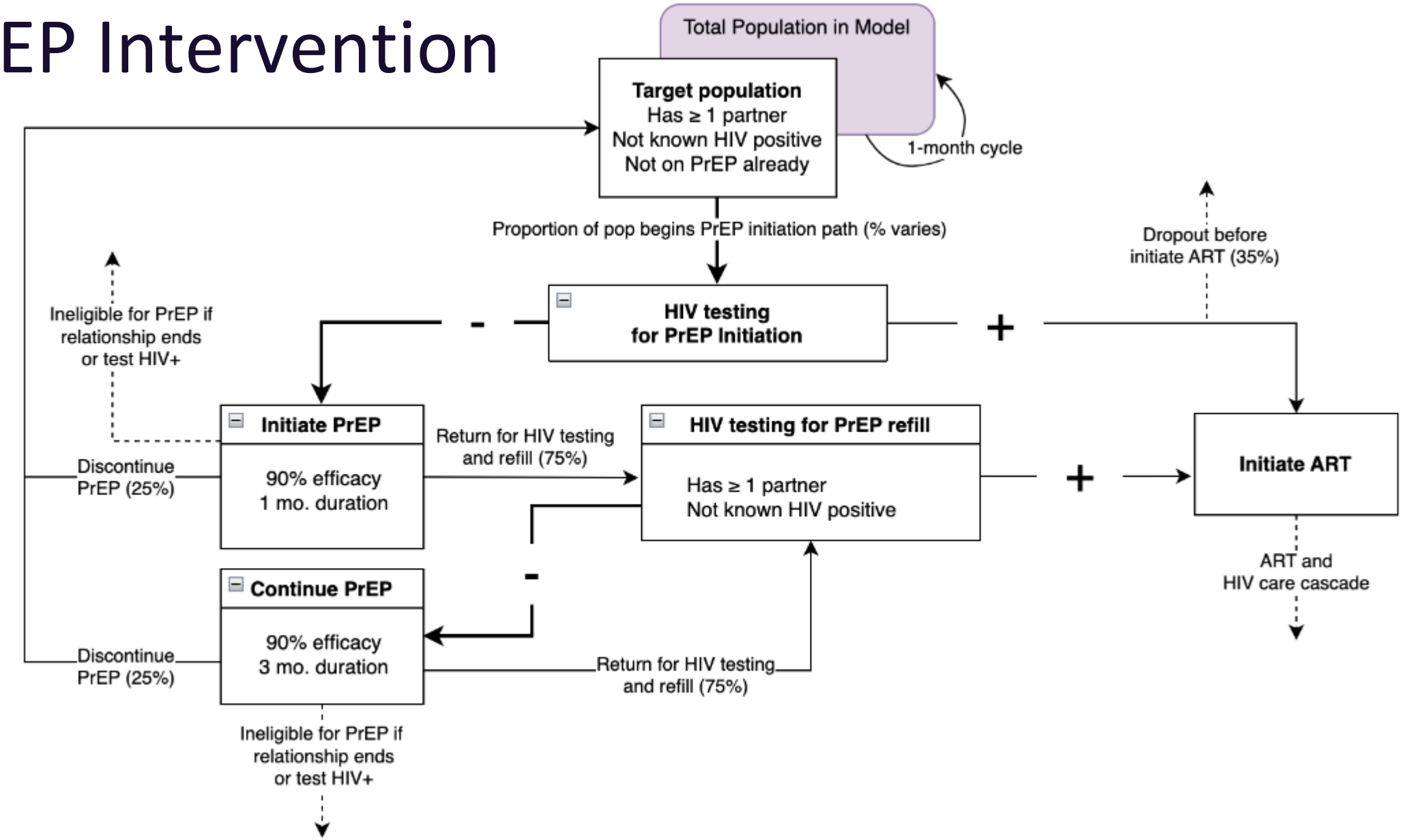
✓ Adheres to Drummond **guidelines for best practices** for conducting cost-effectiveness analyses

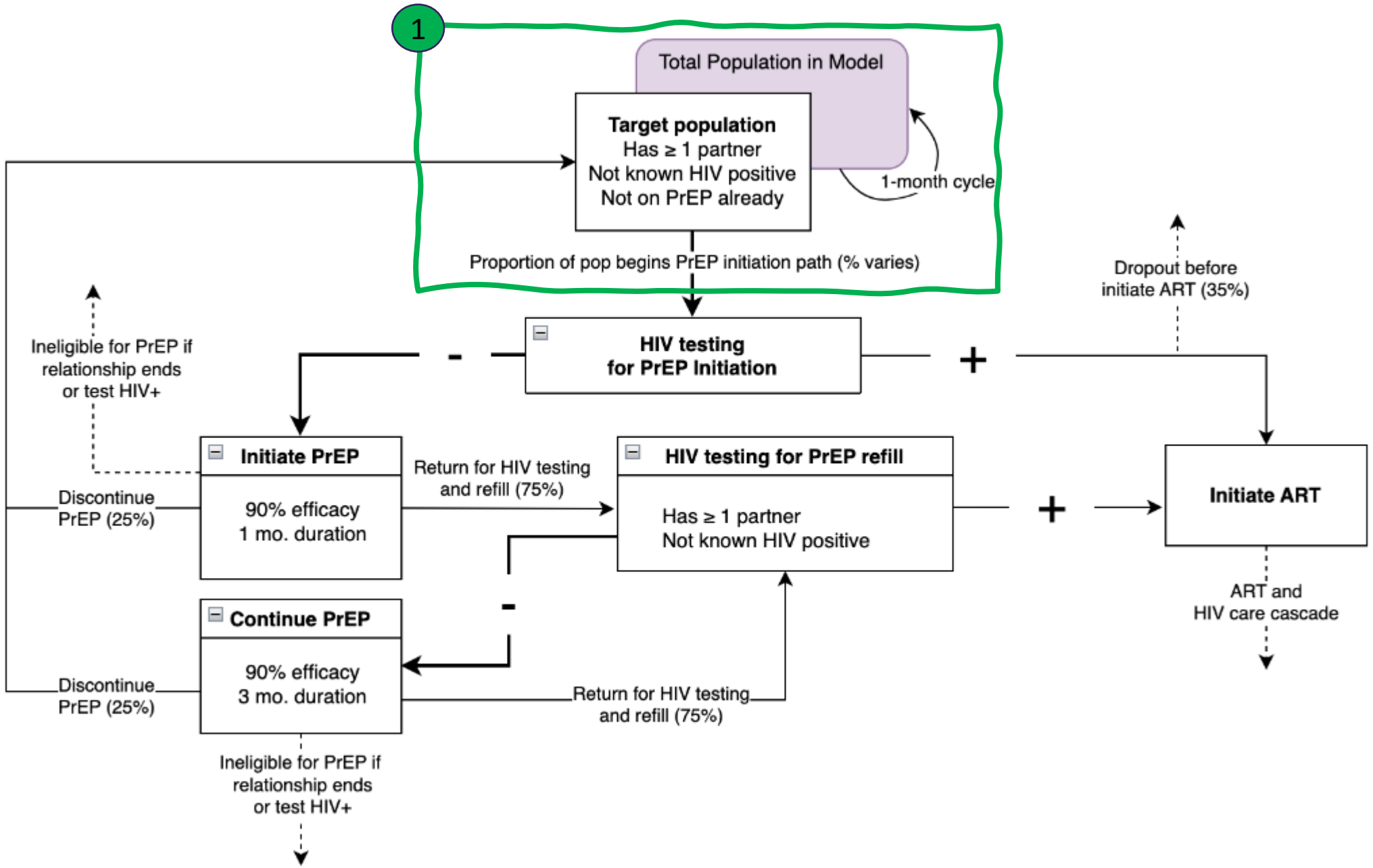
PrEP IMPLEMENTATION STRATEGIES

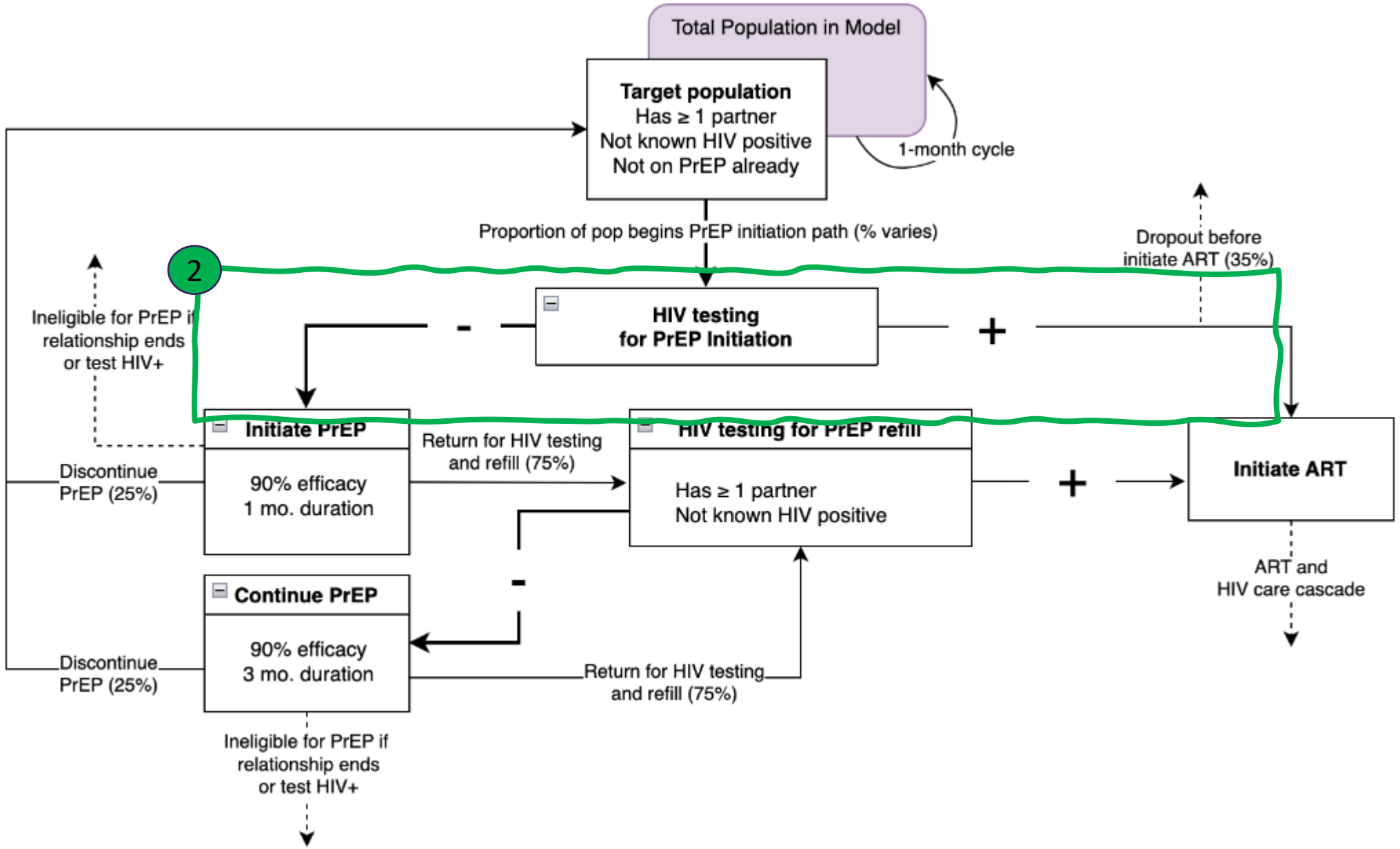
What implementation scenarios or targets are Kenya MOH considering?

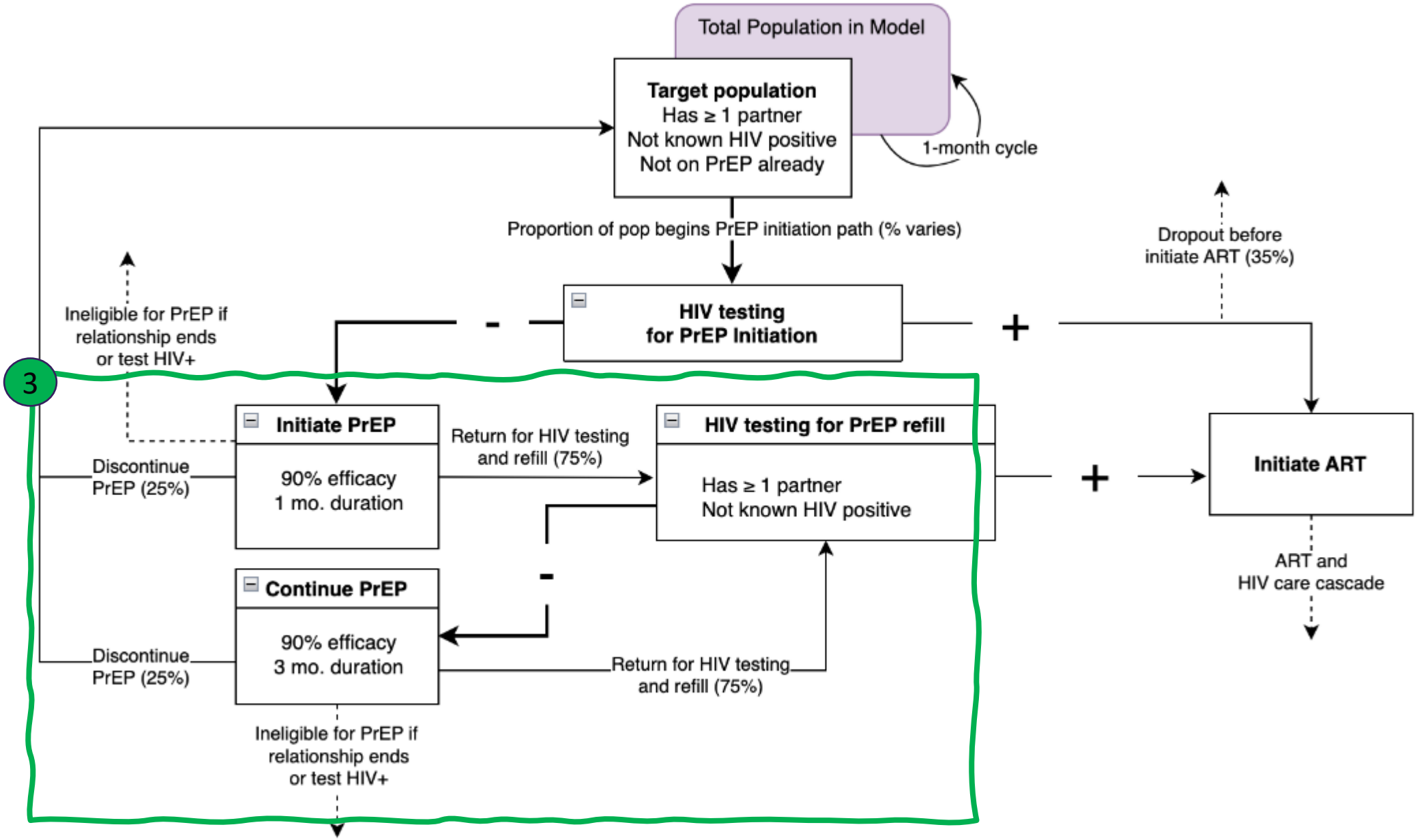
Org.	Document	Priority populations for PrEP
Kenya MOH	Kenya AIDS Strategic Framework II (2020-24). See pages 24-28, esp. Table 8.	**AGYW aged 15-24 years** contribute to a third (30%) of the 41,728 new HIV infections in the country; **Boys and young men aged 15-34** years account for 53% of the 13,320 new HIV infections that occurred among male adults in 2019. The peak of new HIV infections is among young men aged 20-34 years; **Members of Key Populations** (KPs), including MSM, FSWs, PWI/UDs, and transgender people, have higher HIV prevalence, compared to the general population; People in HIV **sero-discordant sexual partnerships-** at least two thirds of infected couples are discordant; **People in prison settings** and internally displaced persons (IDPs), fisher folk, long distance truckers, refugees and migrant populations, people living in large scale agricultural plantations, people with disabilities and members of uniformed services
Kenya MOH	Framework for the Implementation of PrEP in Kenya (2017). See pg. 12	AGYW (15-24) where a third of all new infections in 2015 occurred. Key pops. including **sex workers, men who have sex with men (MSM) and people who inject drugs (PWID)** contribute 35% of the new infections in Kenya; and are therefore a target group for PrEP. Additional groups include **HIV sero-discordant couples. See page 18-19 for scenarios (appendix slides)!**
Kenya MOH	Rapid Assessment Screening Tool (RAST) checklist for PrEP eligibility	People who, anytime in the past 6mos: had condomless sex with person who was HIV pos or unknown status, engaged in sex for money, diagnosed w STI, shared needles, was forcedto have sex, used PEP two or more times

PrEP Intervention




1
Total Population in Model
Target population
Has ≥ 1 partner
Not known HIV positive
Not on PrEP already
1-month cycle
Proportion of pop begins PrEP initiation path (% varies)
HIV testing
for PrEP Initiation
-
+
Dropout before
initiate ART (35%)
Ineligible for PrEP if
relationship ends
or test HIV+
Initiate PrEP
90% efficacy
1 mo. duration
Discontinue
PrEP (25%)
Return for HIV testing
and refill (75%)
HIV testing for PrEP refill
Has ≥ 1 partner
Not known HIV positive
+
Initiate ART
ART and
HIV care cascade
-
Continue PrEP
90% efficacy
3 mo. duration
Discontinue
PrEP (25%)
Return for HIV testing
and refill (75%)
Ineligible for PrEP if
relationship ends
or test HIV+


Total Population in Model
Target population
Has ≥ 1 partner
Not known HIV positive
Not on PrEP already
1-month cycle
Proportion of pop begins PrEP initiation path (% varies)
2
Dropout before initiate ART (35%)
Ineligible for PrEP if relationship ends or test HIV+
HIV testing for PrEP Initiation
-
+
Initiate PrEP
90% efficacy
1 mo. duration
Discontinue PrEP (25%)
Return for HIV testing and refill (75%)
HIV testing for PrEP refill
Has ≥ 1 partner
Not known HIV positive
+
Initiate ART
ART and HIV care cascade
Continue PrEP
90% efficacy
3 mo. duration
Discontinue PrEP (25%)
Return for HIV testing and refill (75%)
Ineligible for PrEP if relationship ends or test HIV+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Has ≥ 1 partner
Not known HIV positive
Not on PrEP already
1-month cycle
Proportion of pop begins PrEP initiation path (% varies)
HIV testing
for PrEP Initiation
-
+
Dropout before
initiate ART (35%)
Ineligible for PrEP if
relationship ends
or test HIV+
3
Initiate PrEP
90% efficacy
1 mo. duration
Discontinue
PrEP (25%)
Return for HIV testing
and refill (75%)
HIV testing for PrEP refill
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Not known HIV positive
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Initiate ART
ART and
HIV care cascade
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Discontinue
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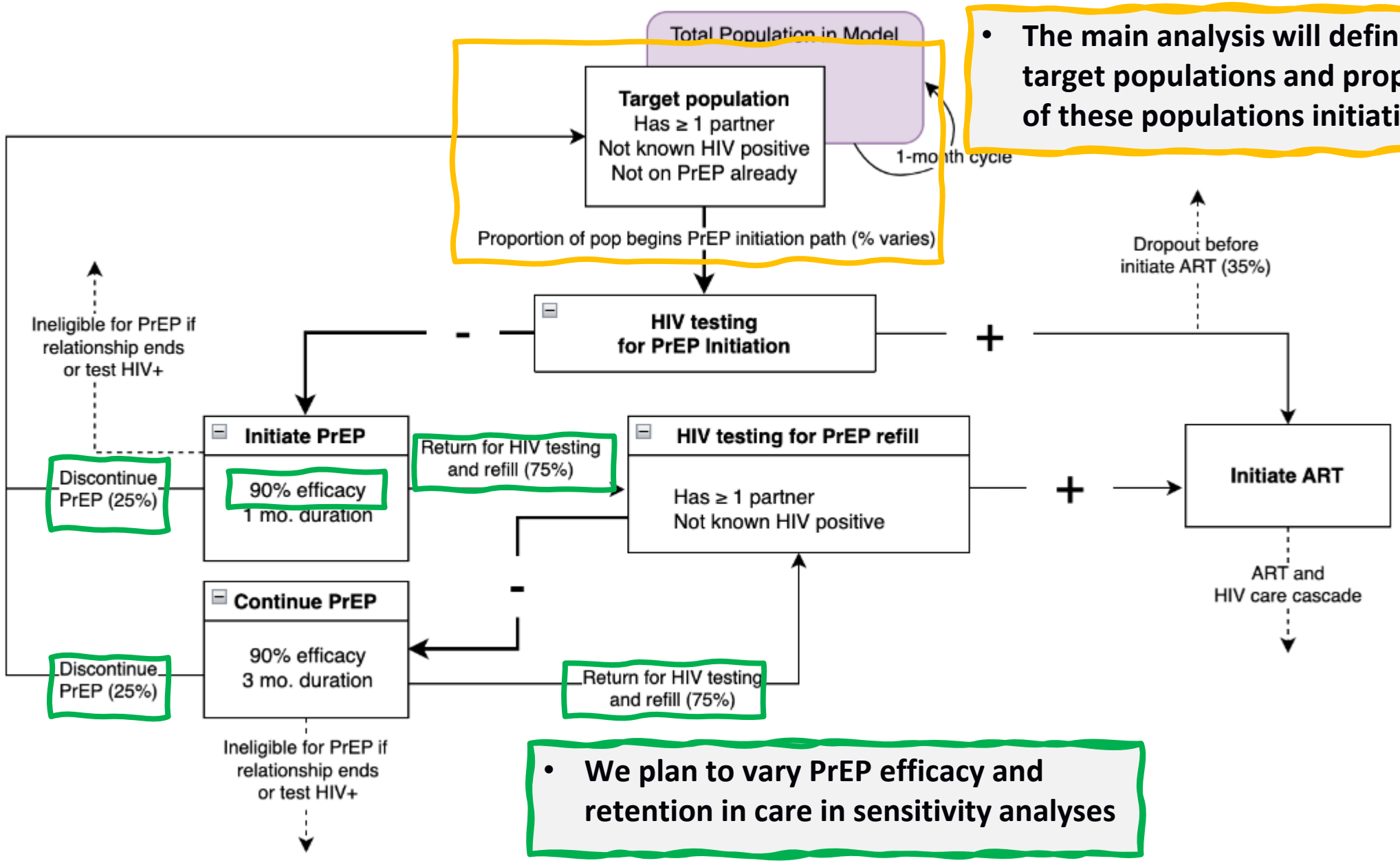

- **The main analysis will define several target populations and proportions of these populations initiating PrEP**

- **We plan to vary PrEP efficacy and retention in care in sensitivity analyses**