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Ending the HIV epidemic among men who have sex with men in the United States: a modeling analysis

HARVARD MEDICAL SCHOOL

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BACKGROUND

- Men who have sex with men (MSM) comprised 71% of those diagnosed with HIV in the US in 2022.
- The US National HIV/AIDS Strategy identifies MSM as a priority population in reaching Ending the HIV Epidemic (EHE) goals of reducing HIV transmission by 90% by 2030.
- **Objective:** To determine levels of improvement in HIV testing, care, and prevention needed to meet EHE goals for MSM in the US.

METHODS

- **Population:** Adult MSM with and without HIV in the US.
- **Outcomes:** Number of annual transmissions and percent reduction in HIV transmissions.
- **CEPAC Model:** We used the CEPAC microsimulation model of HIV and a dynamic, agent-based approach to project transmissions.
- **Modeled strategies:** *Status quo*, with current levels of HIV testing, care, and pre-exposure prophylaxis (PrEP); *eight single intervention strategies* and *two combination intervention strategies* improving HIV testing, linkage, engagement, viral suppression, and/or PrEP.
- **Scenarios:** We modeled two hypothetical levels of improvement for each strategy: “low” and “high.”
- **Time horizon:** We projected HIV transmissions from 2022 to 2045, with interventions rolling out over 5 years starting in 2026.

Table 1. Select model input parameters

Parameter	Value			Ref
	Status quo	Interventions		
		Low	High	
Total population of MSM, n	4,503,080			1
HIV prevalence, n (%)	601,930 (13.4)			2
MSM at higher risk of HIV transmission, n (%)				
Among MSM without HIV	543,634 (13.5)			3,4
Among MSM with HIV	421,382 (69.8)			5
Average monthly transmission risk, %				
Among MSM at higher risk of HIV transmission	0.382			Der. from 8
Among MSM at lower risk of HIV transmission	0.0816			Der. from 8
Relative risk of transmission among MSM at higher risk of HIV transmission	4.69			Der. from 9
Prevention and care continuum strategies				
HIV testing freq., monthly intervals	82	12	6	10
Probability of linkage to HIV care, %	77	90	98	11
Engagement in HIV care at 24m, %	75	90	98	12
Viral suppression, %	81	93	98	13,14
PrEP coverage, higher-risk/lower-risk, %	40/7	75/15	90/20	15
PrEP effectiveness, %	76	90	96	16

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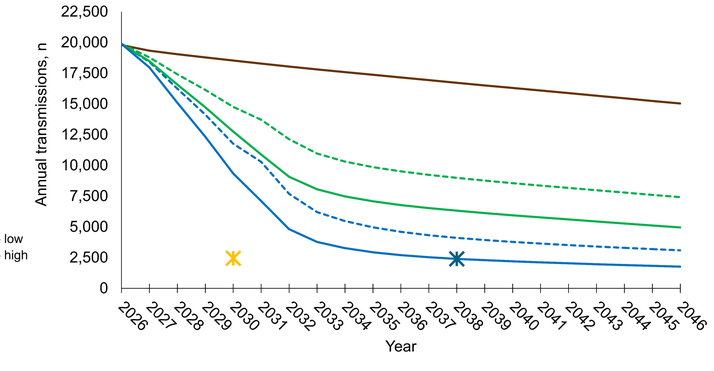
With major improvements in HIV testing, care, and prevention, it would be possible to meet EHE goals to reduce HIV transmissions by 90% among MSM in the US by 2038

RESULTS

Base case

- ***Status quo* would not meet EHE goals.**
  - The current trajectory would reduce HIV transmissions by 30% in 2035 (n=17,156; Figure 1).
- **The only strategy that would meet EHE goals in the next 20 years would be *Combined testing/care; PrEP (MSM higher-risk),* with “high” scenario improvements**.
  - This strategy could achieve an 89% reduction in HIV transmissions in 2035 (n=2,669) and meet the EHE goal of a 90% reduction in 2038 (n=2,398) (Figure 1).
  - This strategy would require HIV testing every 6 months, 98% linkage to HIV care, 98% engagement in HIV care at 2 years, 98% viral suppression, 90% PrEP coverage for MSM at higher risk of acquiring HIV, and 96% PrEP effectiveness.
- **The most successful individual intervention would be *Improved engagement in HIV care.***
  - With no other improvements, increasing engagement in HIV care to 98% at 2 years could achieve 67% reduction in transmissions in 2035 (n=8,172).

Figure 1. Annual HIV transmissions projected among MSM in the US with improvements in HIV prevention and care



Univariate sensitivity analysis assessed the individual influence of each intervention on percent reduction in HIV transmission in the best strategy, which was *Combined testing/care; PrEP (MSM at higher risk)*. The level of engagement in HIV care was the most influential component of this combination strategy (Figure 2).

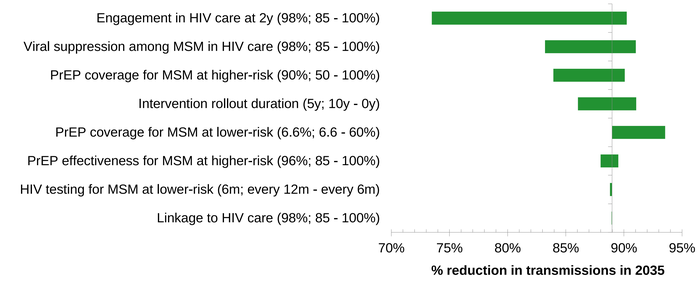
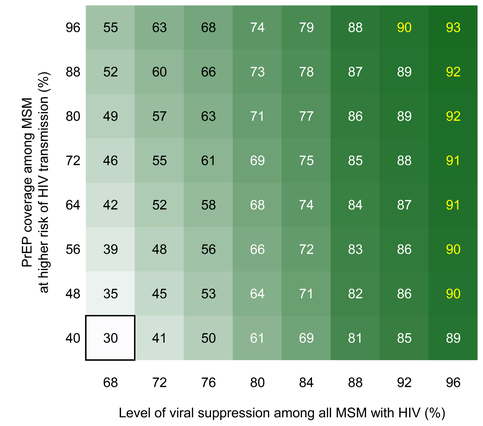


Figure 2. Univariate sensitivity analysis assessing the impact of different levels of intervention included in the *Combined testing/care; PrEP (MSM at higher risk)* strategy

Multivariate sensitivity analysis explored the relative impact of improving viral suppression for all MSM with HIV (achieved by improvements in testing and all levels of care) and improving PrEP coverage for MSM at higher risk. Increasing viral suppression in the population would have a greater impact (Figure 3).

Figure 3. Projected percent reductions in transmissions by 2035 with variation in level of viral suppression among all MSM with HIV and level of PrEP coverage among MSM at higher risk of HIV transmission

The black outline denotes the base case *status quo;* Yellow font indicates achieving the EHE goal of reducing HIV transmissions by 90% by 2035



CONCLUSIONS

- Meeting the EHE goal to reduce HIV transmissions by 90% among MSM is possible but only by 2038.
- Meeting the EHE goal would require substantial and rapid improvement across the entire HIV care continuum for MSM with HIV as well as greater use of PrEP for MSM without HIV.

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