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The Association between PrEP-to-Need Ratio and HIV Incidence Rates in the United States: County-level Analyses From 2012 to 2021

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BACKGROUND

- The scale-up of **Pre-exposure Prophylaxis (PrEP)** has been associated with reduced **community HIV transmission**.
- The **population-level impact** of PrEP coverage, particularly the extent to which PrEP needs were met, on HIV incidence, is still not well understood.
- This study aims to explore the **longitudinal associations** between PrEP-to-Need Ratio (PNR) and changes in HIV incidence rates across all the counties in the United States (US).

METHODS

- The **PNR**, which was retrieved from **AIDSVu**, was calculated as the ratio of PrEP prescriptions (numerator) to new HIV diagnoses (denominator) in each county per year between 2012 and 2021.
- Our outcome of interest was the percent **change in HIV incidence** between two consecutive years.
- **Correlation analyses** were performed to assess the relationship of the percent change of PNR with the change in HIV incidence overall and HIV incidence racial disparities between 2012 and 2021.
- **Linear mixed effects (LMM) models** were performed to use PNR value in one calendar year to predict the HIV incidence change in the subsequent year in both "Ending the HIV epidemic initiative" **(EHE) areas** and **across the USA**, adjusting key demographic characteristics.

RESULTS

Table 1 Linear mixed-effect model of HIV incidence

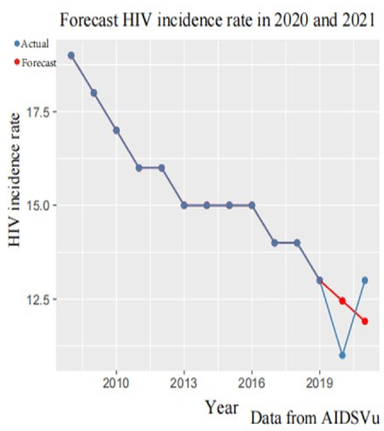
Region	Variable	Estimate	95%CI	Pr>|t|
EHE	Population density	3.999E-6	(−0.00004,0.000046)	0.8558
	Urbanization index	0.2758	(0.0230,0.5286)	0.0329
	Male ratio	0.7126	(0.3892,1.0360)	<.0001
	PrEP-to-Need Ratio	-0.1297	(−0.2110,−0.0484)	0.0018
USA	Population density	-0.00005	(−0.000081,−0.000019)	0.0015
	Urbanization index	-0.00982	(−0.1413,0.1217)	0.8837
	Male ratio	0.1252	(0.0198,0.2306)	0.0200
	PrEP-to-Need Ratio	-0.08763	(−0.1214,−0.0539)	<.0001

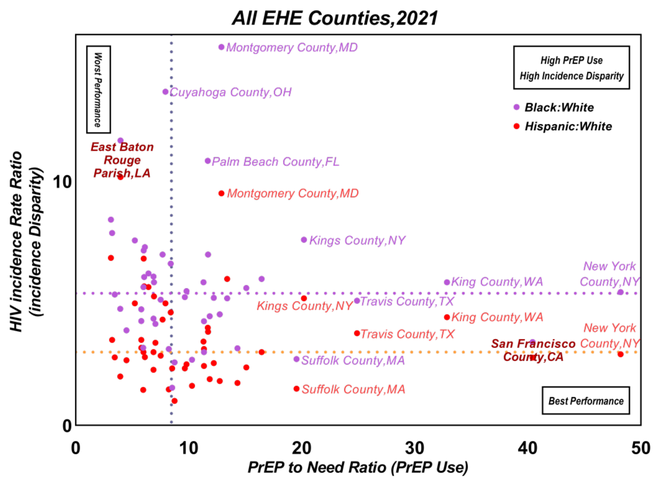
Note: Year, population density, urbanization index, and male ratio were controlled for confounding factors for all models

As more PrEP needs were met, HIV transmission decreased across EHE areas and nationwide; however, the protective effect varied by race, particularly between Hispanic and White populations.

RESULTS (Cont.)

- **San Francisco** County in California demonstrates overall good performance, with a PNR of 40.42, a Black-to-White incidence rate ratio (IRR_BW) of approximately 3.41, and a Hispanic-to-White incidence rate ratio (IRR_HW) of approximately 2.77. In contrast, **East Baton Rouge Parish** in Louisiana demonstrates overall poorer performance,





RESULTS (Cont.)

- The correlation analysis from the 48 EHE counties revealed that **percent change of PNR** between 2012 and 2021 was negatively associated with the **overall HIV incidence change** (ρ=-0.34, P=0.0165) and positively associated with the **change of racial disparities of HIV incidence between Hispanic and White populations** (ρ=0.31, P=0.0304), but not associated with **the change of White to Black disparities** (ρ=0.23, P=0.1124).
- **PNR** has a significant negative impact on the change in **HIV incidence rates** across EHE areas (β=-0.1297, P=0.0018) and the whole US (β=-0.08763, P<0.0001).

CONCLUSIONS

- Increases in PNR are significantly associated with reductions in HIV incidence in these areas, underscoring **the protective role of expanded PrEP access in reducing HIV transmission**, as exemplified by San Francisco County's success.
- Our study emphasizes the need for culturally sensitive interventions that consider **community-specific barriers to PrEP adoption**, such as racial bias and limited resources in communities of color
- Future studies should continue to refine the LMM framework with **more granular data** to further explore the impact of PNR on HIV incidence across diverse demographic groups and enhance HIV prevention efforts on a national scale.

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