

# Association of Social Determinants of Health and HIV Pre-Exposure Prophylaxis (PrEP) to Need Ratio on the County Level in the United States

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## KEY POINTS

In this study, several social determinants of health (SDoH) related factors pertaining to health behaviors, clinical care, and physical environment were found to be significantly associated with county-level PrEP-to-need ratio (PnR).

Programs and policy-level interventions targeting the same are needed to improve PnR.

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### REFERENCES

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### CONFLICT OF INTEREST

- No funding was received from any external organization
- The authors report no other conflicts of interest in this work

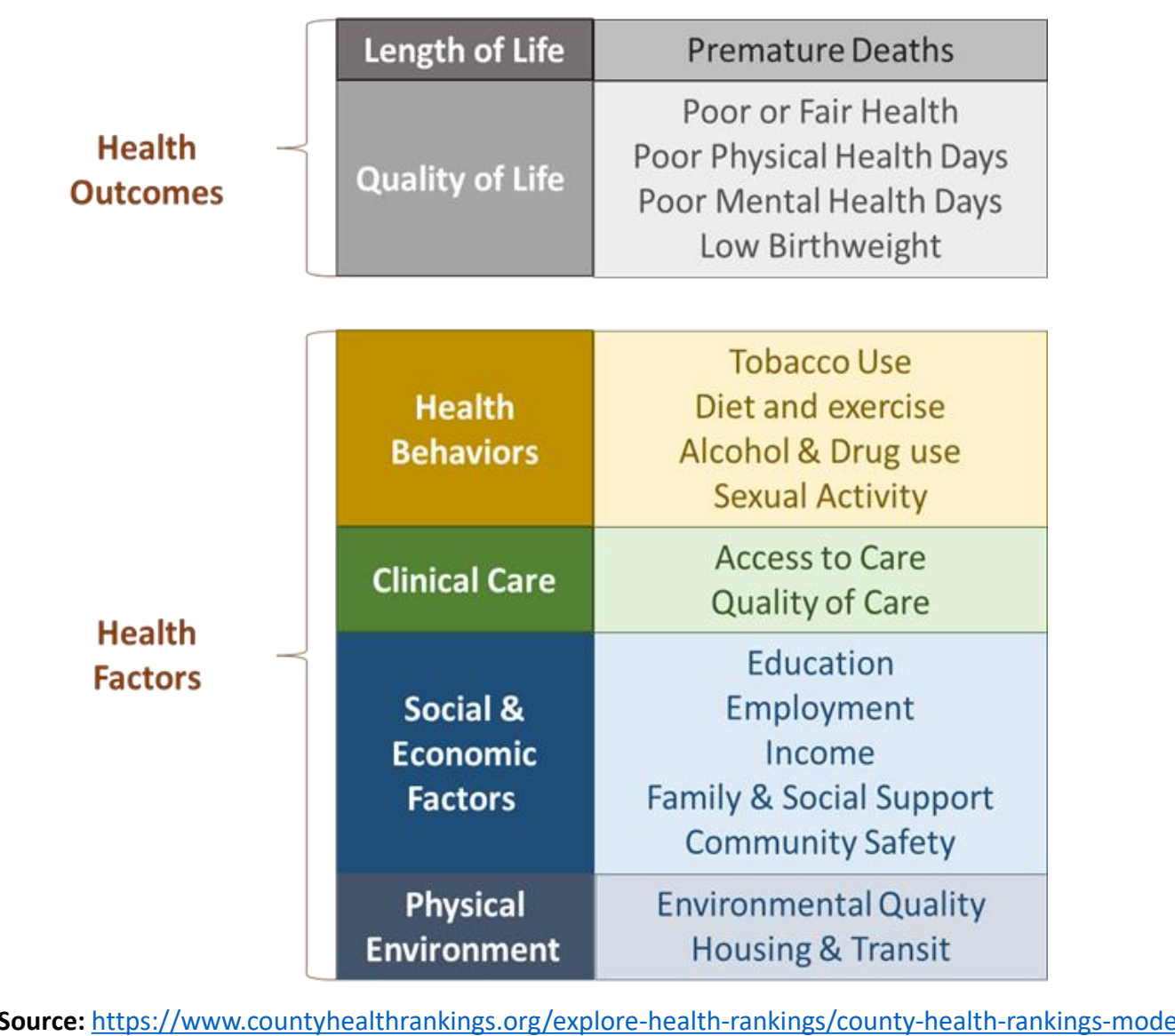
## BACKGROUND

- Approximately 1.2 million people in the United States of America (US) are currently living with human immunodeficiency virus (HIV) (1,2)
- Although, Pre-Exposure Prophylaxis (PrEP) when taken as prescribed, by people at risk of acquiring HIV, can help prevent HIV infections in the future, its uptake is low
- A better understanding of the Social Determinants of Health (SDoH) that affect county-level PrEP to Need Ratio (PnR), can help in identifying areas of need for interventions.

## OBJECTIVE

- To assess the impact of SDoH variables on PnR (i.e., the ratio of PrEP users to new HIV cases in a county)
- A higher PnR indicates better PrEP utilization in the county

Figure 1: Social Determinants of Health variables in the County Health Rankings model



Source: <https://www.countyhealthrankings.org/explore-health-rankings/county-health-rankings-model>

Table 1: Descriptive and Regression Analysis Results for Determining the Association of SDoH with PnR (N=691)

Category*	Factors	Measures*	Descriptive		OLS	
			Mean	SD	$\beta_z$	p
Health Outcomes	Length of Life	Premature death (years)	8,370.00	2,550.00	-0.06	0.404
		Poor or fair health (%)	20.00	4.42	0.50	<b>0.003</b>
		Poor physical health days	4.19	0.62	-0.19	0.229
		Poor mental health days	4.76	0.58	0.13	0.233
		Low birthweight (%)	8.71	1.70	-0.15	<b>0.024</b>
Health Behaviors	Tobacco Use	Adult smoking (%)	18.40	3.94	-0.25	<b>0.004</b>
		Adult obesity (%)	34.30	4.74	-0.03	0.550
	Diet and Exercise	Food environment index	7.64	0.97	-0.02	0.777
		Physical inactivity (%)	28.80	5.33	-0.24	<b>0.001</b>
		Access to exercise opportunities (%)	72.60	17.90	0.02	0.663
		Excessive drinking (%)	18.90	2.86	0.07	0.078
	Alcohol and Drug Use	Alcohol-impaired driving deaths (%)	47.40	66.80	-0.21	<b>0.003</b>
		Sexually transmitted infections (STDs) (chlamydia cases per 100,000)	2,160.00	4,440.00	-0.45	<b>0.001</b>
	Sexual Activity	Teen births (rate)	22.80	11.60	-0.04	0.609
		Uninsured (%)	11.50	4.91	-0.13	<b>0.009</b>
Clinical Care	Access to Care	Primary care physicians (ratio)	299.00	533.00	-0.57	<b>0.000</b>
		Mental health providers (ratio)	1,100.00	2,340.00	0.38	<b>0.000</b>
		Preventable hospital stays (rate)	4,080.00	1,110.00	0.01	0.773
	Quality of Care	Mammography screening (%)	43.40	6.14	0.01	0.848
		Flu vaccinations (%)	48.30	6.74	0.04	0.338
Social & Economic Factors	Education	High school completion (%)	88.30	5.13	0.11	0.153
		Some college (%)	63.60	10.70	0.04	0.539
	Employment	Unemployment (%)	7.56	2.01	0.02	0.585
		Children in poverty (%)	17.60	8.08	0.10	0.206
	Income	Income inequality (ratio)	4.62	0.73	-0.06	0.173
		Children in single-parent households (%)	27.20	8.58	-0.02	0.736
	Family and Social Support	Social associations (per 10,000)	301.00	418.00	0.56	<b>0.000</b>
Physical Environment	Community Safety	Violent crime (per 100,000)	1,490.00	3,420.00	-0.04	0.689
		Injury deaths (per 100,000)	1,330.00	1,950.00	0.35	<b>0.002</b>
	Environmental Quality	Air pollution – particulate matter (PM2.5)	8.73	1.80	-0.07	<b>0.041</b>
		Severe housing problems (%)	15.80	4.12	-0.15	<b>0.007</b>
		Driving alone to work (%)	79.10	7.53	-0.18	<b>&lt;0.001</b>
	Housing and Transit	Long commute – driving alone (%)	33.90	11.90	0.08	0.050

p-value<0.05; \*As per the County Health Rankings model;  $\beta_z$ : Standardized coefficient; PnR: PrEP -to- need ratio; SDoH: Social determinants of health ; OLS – Ordinary least squares regression

## METHODS

A cross-sectional study was conducted by linking data for the year 2021, from two publicly available datasets using county level FIPS ID (3,4):

1. Independent variables in the analysis were SDOH variables taken from the CHR dataset [developed by the University of Wisconsin Population Health Institute containing SDOH information for US counties as per their model of conceptual model of population health (Figure 1) ]
2. The outcome was county-level PnR which was taken from the AIDSvu dataset (developed by the Emory University’s Rollins School of Public Health)

## STATISTICAL ANALYSIS

- Descriptive statistics were used to examine the county-level PnR across 34 SDOH variables; Mean and standard deviation [SD] were reported
- Lasso regression was conducted for variable selection; predictors having p-value less than 0.05 were considered significant and were included in the multiple regression models
- Multiple regression using ordinary least square (OLS) was conducted using the selected variables to assess the association of SDOH with PnR; Standardized beta coefficients and p values were reported

## RESULTS

- The study included 691 counties with valid PnR and a valid estimate of the SDOH measures; the mean county-level PnR was 8.9 (SD)=7.5
- Among all variables entered into the LASSO model, 33 variables were retained
- The following were found to be significantly associated with higher PnR:
  - Percentage of people with poor/fair health ( $\beta_z$  =0.50, p=0.003), number of mental health providers ( $\beta_z$  =0.38, p<0.01), number of social associations ( $\beta_z$  =0.56, p<0.01)
- In contrast, the following were associated with lower PnR:
  - Percentage of the following: births with low birthweight ( $\beta_z$  =-0.15, p=0.024), smokers ( $\beta_z$  =-0.25, p=0.004), chlamydia cases ( $\beta_z$  =-0.45, p<0.01), physically inactive individuals ( $\beta_z$  =-0.24, p=0.001), alcohol-impaired driving deaths ( $\beta_z$  -0.21, p=0.003) and uninsured individuals ( $\beta_z$  =-0.13, p=0.009); poor air quality ( $\beta_z$  =-0.07, p=0.040), percentage of people having severe housing problems ( $\beta_z$  =-0.16, p=0.006) and percentage of people driving alone to work ( $\beta_z$  =-0.18, p<0.001)

## CONCLUSIONS

Our study revealed several SDOH factors associated with county-level PnR. Mentioned below are some strategies which should be prioritized to improve county-level PrEP uptake in the US:

- Strategies to address **health behavior related factors**:
  - More opportunities and resources for the physical activity of residents in a county
  - Development and implementation of programs to improve smoking cessation and target STDs and drug and alcohol abuse
- Strategies to address **clinical care related factors**:
  - Policies to facilitate enrolment in health insurance and improve healthcare access
- Strategies to address **social and physical environment related factors**:
  - Programs to improve social associations and foster peer support among people at risk of HIV
  - Policies targeting environmental quality and housing and transit issues

## LIMITATIONS

- Given the number of variables in the current study, there may be a trade-off between comprehensiveness and concision
- The county served as our unit of analysis. As a result, aggregation bias should be considered because the associations seen at the county level may not be reflected at the individual level