Community Health & Socioeconomics Mediate Rurality's Effect on HIV & HCV Rates in the Southern US

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on behalf of the Achieving an End to Tennessee's HIV/HCV/overdose syndemic through Epidemiologic Research (ÆTHER) cohort

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BACKGROUND

- The disparate geography of HIV and hepatitis C (HCV) in the United States has yet to be fully explained.
- We therefore assessed the mediated influence of rurality on rates of new HIV, HCV, and HIV/HCV diagnoses in Tennessee (TN), a largely rural state.

METHODS

- An ecological study from 2018-2023 was conducted using longitudinal surveillance data from the Tennessee Department of Health on those aged ≥16 years, diagnosed with HIV, HCV, or both.
- **Exposure:** Rurality was defined as percentage of county population in residing in non-urban areas in the 2020 US Census.
- **Outcomes:** Annual county numbers of people with newly diagnosed
  1) HIV
  2) laboratory-defined incident HCV (excluding those incarcerated at incident date), or
  3) both HIV and HCV (earliest date with both HIV and HCV confirmed).
- Poisson models with generalized estimating equations and county population offsets were used to estimate incidence rate ratios and 95% confidence intervals (CI) for the **Total Effect** (E_T) and **Direct Effect** (E_D; the effect *not* mediated, also equivalent to E_T minus the mediated effect) of rurality on the outcomes.
- E_D was estimated using year of diagnosis, primary care physician (PCP) density, chlamydia rate, and Social Vulnerability Index (SVI) data from the County Health Rankings and the CDC as modifiable markers of community health and socioeconomics.

After accounting for modifiable mediating factors, the effect of rurality on HIV risk was attenuated and the effect on HCV risk was nullified.

RESULTS

Figure 1. Percentage of population living in a rural area by Tennessee county

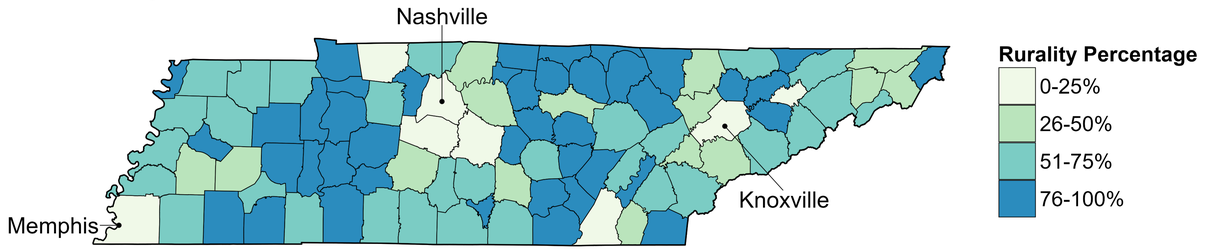
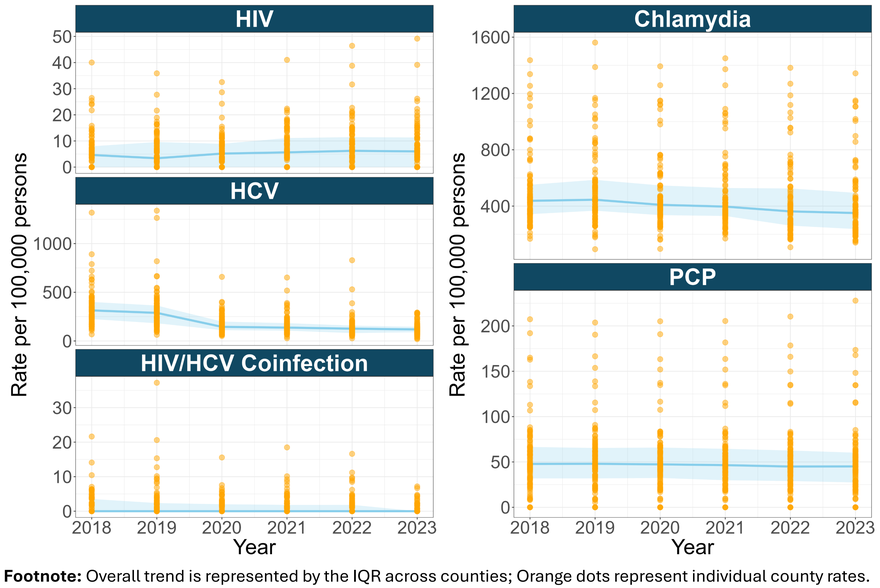
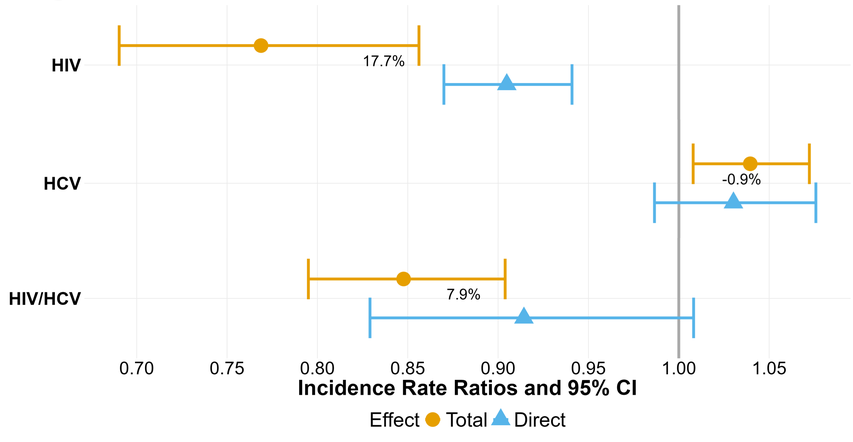


Figure 2. Rate of outcomes and modifiable factors by year



Footnote: Overall trend is represented by the IQR across counties; Orange dots represent individual county rates.

Figure 3. Total Effects and Direct Effects of county rurality on new diagnoses of HIV, HCV, and HIV/HCV coinfection



Footnote: 'Total': Total Effects, including both the direct and indirect (or mediated) effects, are from marginal models; 'Direct': Direct Effects, excluding the portion of the exposure-outcome effect that is mediated, account for primary care physician density, chlamydia rates, and social vulnerability index scores. The percentage displayed between Total and Direct Effects for each outcome reflect the shift in rurality incidence rate ratios that occur under mediation (from the Total to the Direct Effect models).

CONCLUSION

- Rurality's effect on HIV risk was attenuated, and on HCV risk was nullified, after accounting for PCP density, chlamydia rate, and SVI, in a southern US state.
- Our findings suggest HIV and perhaps HCV prevention should be strengthened in areas with poor healthcare access or high socioeconomic vulnerability to narrow rural-urban disparities.

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