Using Lorenz Curves to Measure Viral Load Distribution in Missouri

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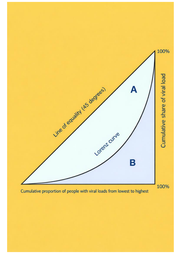
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BACKGROUND

- Traditional metrics of viral suppression fail to describe viral load (VL) control within a population.
- Understanding the distribution of poor outcomes can help target resources to the populations that need it most.
- The Lorenz curve (**Figure 1**) and Gini coefficients are established tools from Economics for measuring inequities within a group.
- We applied these methods to quantify disparities in viremia in Missouri, an Ending the HIV Epidemic priority state.

METHODS

- **Setting:** A large Ryan White-funded academic HIV primary care clinic in St. Louis, Missouri.
- **Population:** People living with HIV ≥ 18 years with at least one VL measurement between January 1, 2013 – December 31, 2024
- **Data:** Electronic health record clinical and lab data
- **Analyses**:
  - Estimated daily VL by averaging two most proximal VL's and total VL exposure in two-year windows
  - Calculated the **outcomes** of **1)** days with a VL > 1000 copies/mL, **2)** viremia copy-days, and **3)** Gini coefficients
    - 1,000 viremia copy-days = 1 day of 1,000 copies/mL or 10 days of 100 copies/mL
    - Gini coefficient: 0 (equality) → 1 (inequality)
  - Applied a cumulative distributive function to individuals ranked in order of viremia copy-days and plotted the cumulative proportion of the above outcomes within the 1st, 5th, and 10th percentiles of the population.
    - E.g., 1st percentile holds the highest VL values in a population.



*An increasingly convex curve represents heightened disparities in viral load distribution.

Figure 1. Example of a Lorenz Curve

Between 2013 – 2024, viremia within a clinic population in Missouri remained **static with limited improvement** for a small subpopulation, suggesting the need for intensive targeted efforts to reduce HIV morbidity and transmission to end the epidemic.

RESULTS

- 3,629 PLWH had at least one VL measurement between 2013 – 2024.
- Median age was 38 years (IQR 27-49), 2649 (73%) were male, 2516 (69.3%) were non-Hispanic Black.
- 44.7% of days with VL > 1000 copies/mL was attributed to the 10th percentile in 2013 - 2015. This increased to 47.6% in 2022 - 2024 (**Figure 2**).
- The proportion of days with VL > 1000 copies/mL attributable to the 5th percentile of the clinic population increased from 24.9% to 26.2%, and to the 10th percentile from 44.7% to 47.6%, between 2013 – 2024 (**Figure 3**).

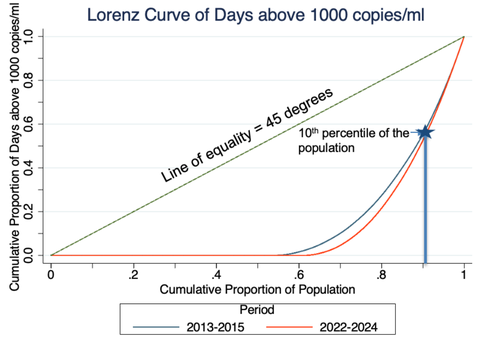


Figure 2

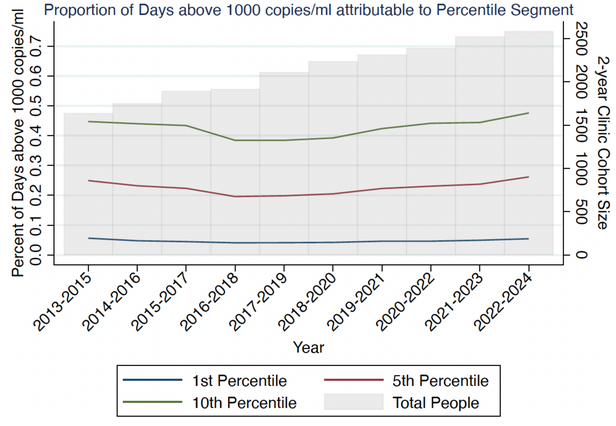


Figure 3

RESULTS

- Gini coefficients regarding viremia copy-days and days with VL >200 and >1000 copies/mL increased between 2013 – 2024, representing worsening disparities in VL distribution in the population.

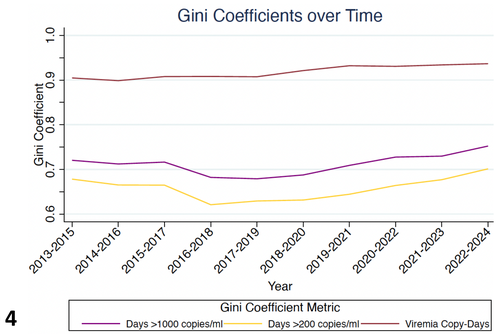


Figure 4

- Between 2022 – 2024, within the 10th percentile of days with VL >1000 copies/mL: 31.2% were cisgender women; 42.3% were age 25 – 34 years; 60% of individuals had been linked to the clinic more than 5 years prior.

CONCLUSION

- Viremia in a clinic population in Missouri remained static within a smaller subpopulation.
- Lorenz curve metrics highlight underlying disparities in VL control and reveal an opportunity for more intense interventions directed towards groups who may benefit the most.

ACKNOWLEDGEMENTS

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PLAIN LANGUAGE SUMMARY

Understanding viral load (VL) distribution in a population is important for directing resources to those who would benefit most, yet traditional approaches are limited. Using methods from Economics, we found that higher VLs failed to improve within a smaller group of individuals over time in Missouri, suggesting that focusing more support to this group would have a greater impact in reducing HIV transmission.