Characterizing Geospatial Mobility Among People Living with HIV in Tennessee and Its Impact on HIV Care Outcomes

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BACKGROUND

- The United States (US) population experiences regular mobility, but key populations at risk of poor outcomes are more frequently mobile.
- Mobility is associated with increased risk of HIV infection, but few data have assessed the relationship with care continuum outcomes, especially among persons living with HIV (PLWH) in the United States.
- Mobility may impact care continuum outcomes by disrupting access to care and treatment services and hampering accurate outcome ascertainment for patients who move across borders.
- Tennessee (TN) has underperformed relative to other states in the US on continuum of care outcomes (especially linkage to care) and shares its borders with 8 states, making in an ideal location for a study on mobility.

OBJECTIVE

- To determine the prevalence and spatial variation of across and within-state mobility among PLWH in TN between 2016 and 2017.
- To assess the impact of within-state mobility between 2016 and 2017 on engagement in care and virologic suppression in the subsequent year among PLWH in TN.

METHODS

INCLUSION CRITERIA

- Analysis included adults (≥18 years) PLWH in TN between 2016 and 2017, follow-up laboratory and demographic data was included through 2019

DATA SOURCES

- Patient age, sex, race/ethnicity, HIV transmission risk factor, and HIV laboratory values (CD4 cell count, HIV RNA) obtained from the enhanced HIV/AIDS Reporting System (eHARS)
- Longitudinal address data obtained from ACCURINT (nationwide, searchable Lexis-Nexis dataset containing addresses and phone numbers associated with individuals residing in the US, updated quarterly by TN Department of Health and merged with eHARS data)

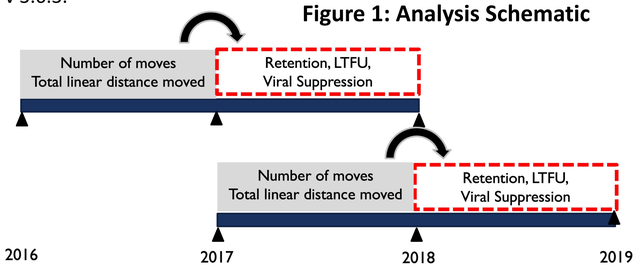
STUDY DESIGN/STATISTICAL ANALYSIS

- Retrospective cohort study
- Assessed the association between mobility during a calendar year (2016-2017 or 2017-2018) and continuum of HIV care outcomes (retention in care, loss to follow-up [LTFU], viral suppression) in the subsequent calendar year using separate multivariable modified Poisson regression models [see Figure 1].
- Analyses conducted using R v 3.6.3.

DEFINITIONS

- Mobility:
  1) total number of unique addresses during follow-up period
  2) total miles moved during follow-up period
- Retention in care: ≥2 HIV labs (viral load &/or CD4) per year, with visits separated by ≥90 days
- Loss to follow-up: no HIV lab during the calendar year
- Viral Suppression: VL<200 during follow-up period

Figure 1: Analysis Schematic



GEOSPATIAL ANALYSIS:

- Identified all unique patient addresses during follow-up period
- De-identified patient addresses to census tract and geocoded using ArcGIS Pro
- Applied a kernel density estimator to origin-destination lines representing changes in address to visualize mobility patterns, and stratified transit density visualizations by demographic subgroup.

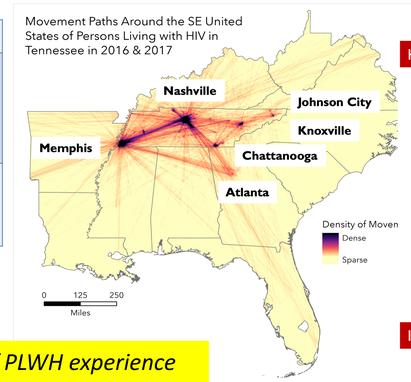
RESULTS

Table 1. Cohort Demographics, N=17,428

Variables	No (%)
Age at baseline (mean, SD)	44.2 [12.2]
Race Ethnicity	
Not Hispanic, White	6409 (26.8%)
Not Hispanic, Black	9761 (56.0%)
Hispanic, All Races	761 (4.4%)
Other/Unknown	497 (2.9%)
Gender/HIV Transmission RF	
Cis Female/Heterosexual	2881 (16.5%)
Cis Female/IDU	423 (2.4%)
Cis Female/Other	973 (5.6%)
Cis Male/Heterosexual	1132 (7.6%)
Cis Male/IDU	1185 (6.8%)
Cis Male/MMS	8830 (50.7%)
Cis Male/Other	1625 (9.3%)
Transgender	179 (1%)

Table 2. Frequency and Spatial Distribution of Mobility among PLWH in TN

Mobility Measures	
No of Addresses	No (%)
1	11033 (63.3%)
2	6349 (36.4%)
3	46 (0.3%)
Total Miles Moved *(among patients with >1 address)*	Mean, IQR 8.9 [2.6, 143]



***Key Points**: More than one-third of PLWH experience mobility. We observed in-state movement corridors between four major cities in TN, and out-of-state movement corridors between TN and Atlanta, Georgia and between TN and Florida.*

Figure 3: Movement Paths Among Subgroups of PLWH in TN

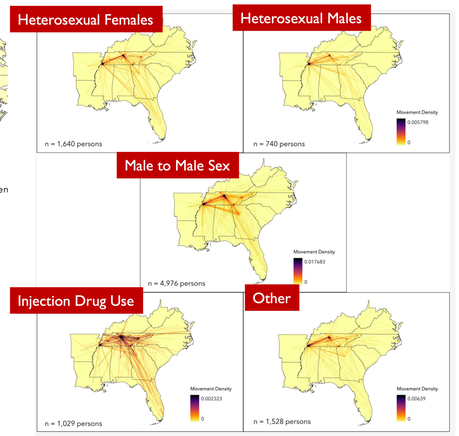
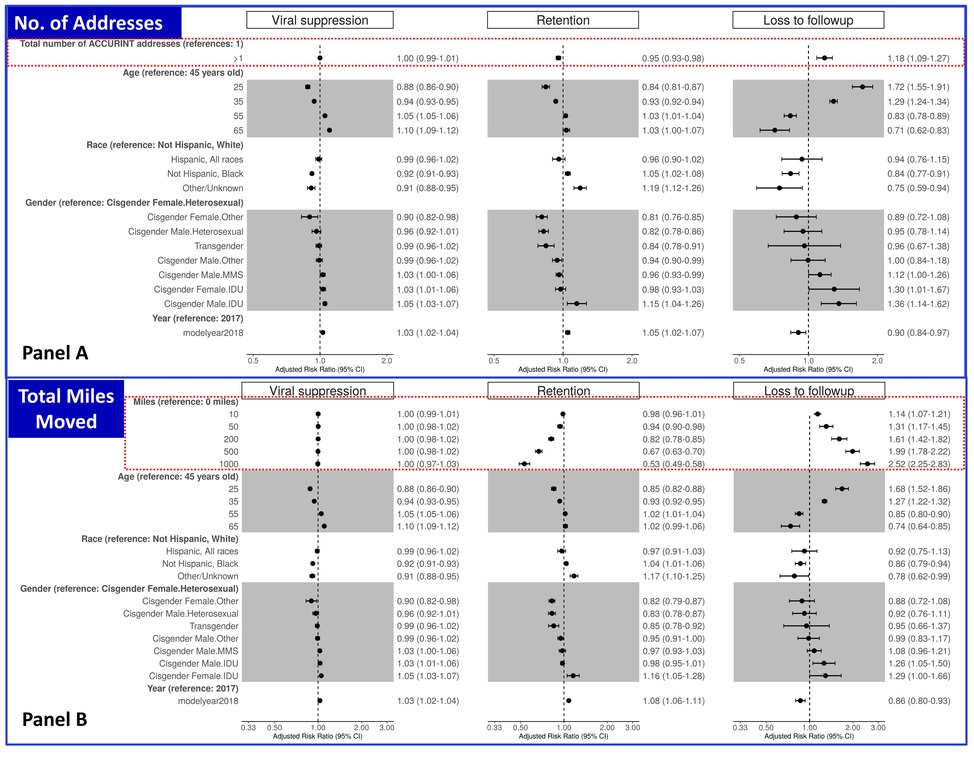
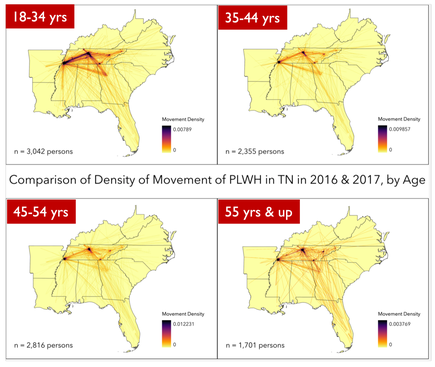


Figure 2: Risk of Viral Suppression, Retention, Loss-to Follow Up Among Mobile PLWH in TN



***Key Points**: Greater mobility was associated with a decreased likelihood of retention and an increased likelihood of LTFU, but not with viral suppression. There was a dose-response relationship between total miles moved and retention/loss to follow-up.*



Comparison of Density of Movement of PLWH in TN in 2016 & 2017, by Age

***Key Points:** Homogenous movement patterns within these corridors existed for some subgroups with more heterogenous movement patterns among others (e.g. IDU, older individuals).*

LIMITATIONS

- Our approach could have underestimated mobility for unstably housed and homeless individuals
- This analysis relied on existing databases to identify mobility; moves that were not captured as new addresses in eHARS would not be identified.

CONCLUSIONS/IMPLICATIONS

- Mobility is common among PLWH in TN and associated with poor engagement in care
- Geospatial analysis can help identify movement patterns of highly mobile groups to inform novel interventions to improve continuum of care outcomes
- Policies to ensure care access among highly mobile populations may be critical for meeting Ending the HIV Epidemic goals