Individual- and Community- Level Predictors of HIV Care Continuum Progression: Clark County, Nevada

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BACKGROUND

- HIV is increasingly disproportionally impacting select groups
- Important to evaluate how social determinants of health (SDOH) impact progression through HIV care continuum.
- Necessary to investigate local factors to develop effective intervention responses.

RESEARCH QUESTION

- What individual-level characteristics and SDOH factors are associated with progression along care continuum? **Figure 1**
- We investigate three stages along the HIV care continuum
  - Late-stage HIV diagnosis
  - Receiving medical care
  - Viral Suppression

Figure 1. HIV care continuum



Source: HIV.gov

STUDY POPULATION

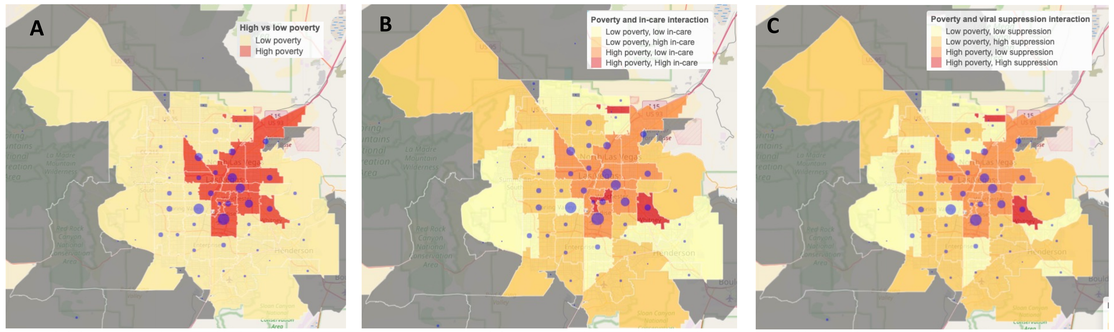
- Clark County is one of the 48 priority jurisdictions in US for Phase I of America's Ending the HIV Epidemic (EHE) initiative.
- Clark County has the highest number and rate of people living with HIV of any county in Nevada
- Analysis includes individuals diagnosed and currently residing in Clark County based on diagnosis and current residence zip code.
- Includes diagnoses from 2011-2022.
- Outcomes are based on 2022 calendar year

METHODS

- De-identified data at individual level obtained from eHARS
  - Demographics, labs (CD4 + viral load), HIV genotype
- 1.5% pairwise genetic distance threshold between HIV sequences used to infer genetic linkage and clustering
  - Individuals without sequence were assumed to be non-clustered
- SDOH factor are represented by zip-code level characteristics obtained from American Community Survey
- Analyses include:
  - Univariate analysis using generalized linear mixed models with logit link function Univariate
  - Machine learning using LASSO with random effects, which was tuned using k-fold cross-validation (multivariate analysis).
  - Geographic maps to examine geospatial relationship of outcomes

Individual and community factors are associated with progression along the care continuum

Figure 2. Geographic plots of poverty and interaction with outcomes



Legend: (A) zip-codes above and below median poverty rate among PHW, (B) Interaction between high vs. low poverty and high vs. low rates of being in-care, (C) Interaction between high vs. low poverty and high vs. low rates of viral suppression. Circles are proportional to number of PWH in zip code. n < 10 excluded from visualization.

Table 2: : Odds ratios from univariate and multivariate logistic regression models.

	Diagnosis		In-care		Viral suppression	
Characteristic	**Uni**	**Multi**	**Uni**	**Multi**	**Uni**	**Multi**
Year of diagnosis	0.95***	0.94***	1.04***	1.02	1.02***	1.02
Age at diagnosis	1.04***	1.04***	1.02***	1.03***	1.02***	1.03***
Hispanic	1.03	1.23*	1.07	1.09	1.22**	1.28**
IDU	0.99	0.9	1.08	-	0.95	-
MSM	0.69***	0.76*	1.45***	1.7***	1.49***	2.18***
Sex	0.75**	1.01	1.05	-	1.02	0.56***
Genetic cluster	0.73*	0.98	2.77***	3.03***	1.28*	1.39**
Zip code level characteristics						
Rate of clustering	0.84	0.93	0.97	1.13	0.86	1.05
Poverty	0.97	-	0.76**	0.62*	0.68***	0.62**
Hispanic	0.83	0.89	0.86	1.21	0.76**	1.05
Education	1.08	1.04	1.21*	-	1.27**	0.98
White	0.79*	0.7***	1.14	1.03	1.14	-
Employment	1.2	1.15	1.17	0.99	1.27**	0.98

Legend: Values indicated with - were removed from multivariate model via LASSO.
* = p <0.05, * *= p <0.01, *** = p <0.001,

RESULTS

Individual-level characteristics

- In our machine learning analysis, we estimate a statistically significant association with individual-level demographic characteristics across multiple HIV care continuum steps.
- In particular, being MSM was associated with improved outcomes in terms of lower rates of late-stage diagnosis, and higher probability of being in care and virally suppressed. **Table 2**
- Older age at HIV diagnosis is associated with higher probability of late-stage diagnosis; however, older HIV diagnosis age is associated with having a higher probability of being in care and being virally suppressed.

RESULTS cont.

- Genetically linked individuals have lower rates of late-stage diagnosis in univariate analysis, and higher probability of being in care and virally suppressed based on machine learning analysis.

Social Determinants of Health:

- Univariate analysis: level of poverty, proportion Hispanic, proportion with high school education (or greater), and higher proportion of employment, are associated with being in care and viral suppression.
- Machine learning: proportion of individuals under the poverty line within a zip code was statistically significant with HIV care continuum stages, specifically, a lower probability of being in care and virally suppressed. **Table 2**

Table 1: Cohort Characteristics

Characteristic	Overall N = 3,596
Age at diagnosis	35.5 (13.7, 80.2)
Year of diagnosis	2017.2 (2011.0, 2,022.0)
Race	
Black	1,049 (29%)
Hispanic	1,266 (35%)
Other	315 (8.8%)
White	966 (27%)
Sex	
Female	518 (14%)
Male	3,078 (86%)
Transmission Risk	
Heterosexual contact	244 (6.8%)
IDU	127 (3.5%)
MSM	2,372 (66%)
MSM & IDU	140 (3.9%)
No reported risk	707 (20%)
Other	6 (0.2%)
Sequence available	
No	2,436 (68%)
Yes	1,160 (32%)
Genetic cluster	
No	3,079 (86%)
Yes	517 (14%)
Zip Code level predictors	
Percentage in cluster	0.1 (0.0, 1.0)
Percentage below poverty level	0.2 (0.0, 0.3)
Percentage Hispanic	0.4 (0.0, 0.7)
Percentage high school education	0.8 (0.6, 1.0)
Percentage White	0.5 (0.3, 0.9)
Percentage employed	0.9 (0.9, 1.0)

Legend: Median (range) shown for continuous variables and count (percentage shown for categorical variables.

CONCLUSIONS

We identify both individual-level demographics (diagnosis year, age at diagnosis, being Hispanic, being a man who has sex with men, sex at birth, and viral genetic similarity) and SDOH at the zip code-level (level of poverty, proportion Hispanic, proportion with high school education, proportion of white residents, and employment) associated with stage of the HIV continuum.

Understanding individual factors and SDOH that influence progression along the care continuum is crucial for equitably distributing effective interventions and optimizing HIV care delivery. An association between levels of poverty by zip code and rates of being in care and virally suppressed emphasizes how HIV is disproportionally affecting select populations and suggests that regionally focused initiatives to increase access to care could be used to inform future interventions.

Acknowledgments: Southern Nevada Health District. Department of Health and Human Services Nevada, Las Vegas. Work supported by CFAR supplement 5P30 AI036214 -28S1 : EHE Supplement to NIH AI036214.