HIV Spread in Miami-Dade County

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BACKGROUND

Hypothesis: Molecular epidemiologic analysis to evaluate viral migration within a regional epidemic can guide the allocation of public health resources to improve impact.

The Miami-Dade HIV epidemic is one of the largest and most active regional epidemics in the US. While predominantly an epidemic among men who have sex with men (MSM), there is significant diversity across ethnicity, race, risk group and geography. We characterized the dynamics of HIV transmission between neighborhoods and risk groups in the Miami-Dade region to inform the allocation of focused interventions.

METHODS

- 7,274 HIV-1 partial *pol* subtype B sequences from unique individuals with associated demographic and geographic data between 1/1/2015 and 12/31/2021 from Miami-Dade County were included in the analysis.
- These were combined with the 4,250 genetically most closely related sequences from public databases.
- Maximum likelihood phylogenetic inference was performed to identify all well-supported monophyletic clades (≥2) within each neighborhood health district (NBHD); See **Figure 1**.
- These "local" clades corresponded to distinct introduction events into a NBHD, and the most recent common ancestor from outside the NBHD was inferred to be the source of the clade.
- Putative source risk group inferred when data were available

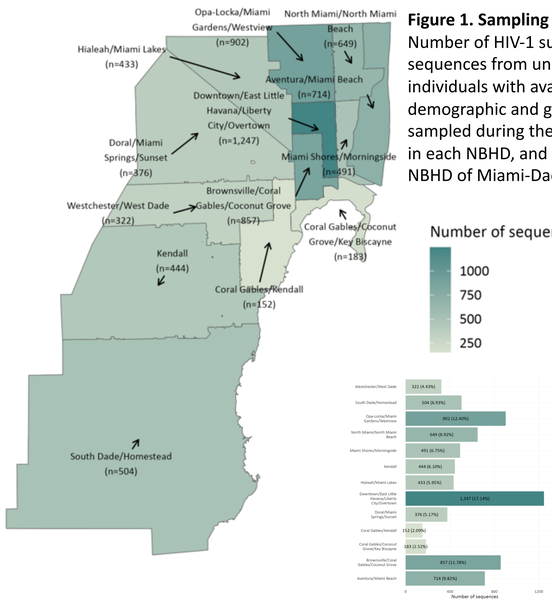


Figure 1. Sampling by NBHD – Number of HIV-1 subtype B sequences from unique individuals with available demographic and geographic data sampled during the study period in each NBHD, and map of the NBHD of Miami-Dade County.

Molecular epidemiologic analyses to evaluate the flow of HIV between populations and regions identifies more focused opportunities for prevention efforts.

RESULTS

- Multiple introductions fostered the emergence of localized transmission clusters.
- International introductions:
  - The majority (45/86, 52%) of the external introductions (8% of the total; i.e. from outside Miami) originated from North America (**Figure 2**). (19/86, 22%) were inferred to be from the Caribbean, Central and South America.
  - A predominance of international introductions (non-US) were inferred in 4 NBHDs; Brownsville/Coral Gables/Coconut Grove (Brownsville), Aventura/Miami Beach (Aventura), Hialeah/Miami Lakes (Hialeah), and North Miami/North Miami Beach (North Miami).
- Local dynamics:
  - 806 (92%) introductions into Miami-Dade NBHDs originated from other NBHDs in the county.
  - Higher ratios of local introductions, compared to viral egress (i.e.,. source of local clusters in other NBHDs) were observed in three NBHDs (Downtown/East Little Havana/Liberty City/Overtown [Downtown], Opa-Locka/Miami Gardens/Westview [Opa-Locka], and North Miami) [range 1.9-2.5]. (**Figure 3**)
  - By contrast, one NBHD, South Dade/Homestead (South Dade) had a low ratio (0.3) of local introductions compared to egress.
  - While heterosexuals (HET) make up only approximately 1/3 of the Miami-Dade epidemic[1], we observed nearly as many introductions from HET individuals (n=146) as from MSM (n=169), with more seeding events from HET than MSM in two neighborhoods (Downtown and Opa-Locka).

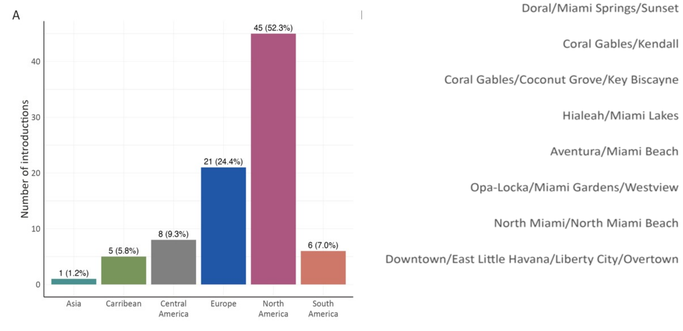


Figure 2. Viral Introductions into Miami-Dade – Number of HIV-1 subtype B introductions resulting in new local (within NBHD) transmission clusters

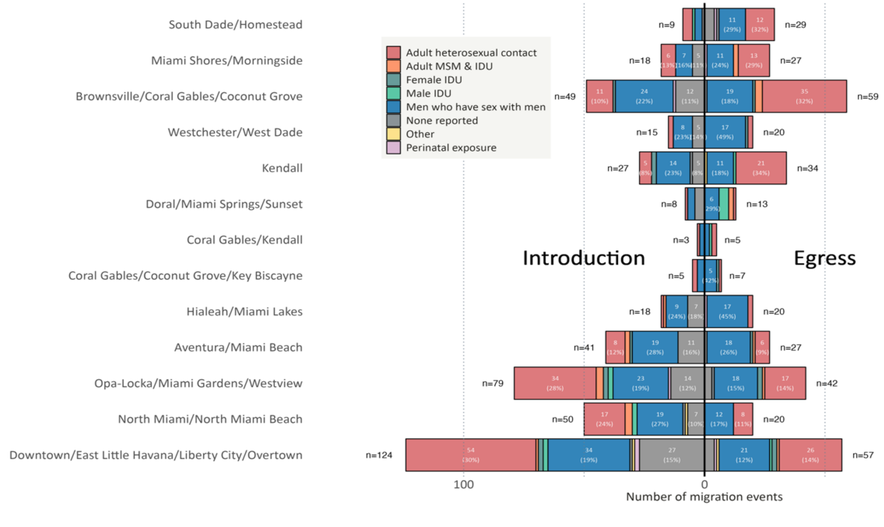


Figure 3. Viral Introduction and Egress by NBHD – Number of viral introductions into each NBHD is shown on the left of the diagram. On the right are viral egress events (where the NBHD acted as the source for an introduction event into another NBHD). Both are color coded by the risk group of the inferred source of the viral introduction.

CONCLUSIONS

A) Geospatially Focused Screening
- The low ratio of introduction to egress in some NBHDs (e.g., South Dade) might suggest that later diagnosis and less durable viral suppression may contribute to regional spread from the NBHD (although not supported by the available collected data.)
- NBHDs with this pattern may be prime for increased testing.

B) Geospatial and Risk Factor Focused Screening
- We observed more viral egress events from NBHD by individuals reporting HET risk as their primary risk for HIV acquisition, than proportionally expected from the prevalent population[1] ($p<0.001$).
- This imbalance might suggest later diagnosis, or worse viral suppression among HET (as shown in other studies).[2]
- These results could be tested by increasing testing and engagement in care efforts in HET, in the the six NBHD with the highest viral egress from HET.

C) Geospatial Focused PrEP
- High ratios of introductions to both HET and MSM were observed in three NBHD (e.g. Downtown).
- This imbalance might suggest more susceptible persons with inadequate use of PrEP.
- To test this hypothesis, one could evaluate the impact of scale up of PrEP in these NBHD

ADDITIONAL KEY INFORMATION

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