Implementation of a near real-time phylogenetic monitoring program for HIV transmission outbreaks

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Phylogenetic clustering

- A popular method for characterizing the transmission history of an epidemic.
- HIV evolution and transmission unfold on similar time scales.
- Clusters of genetically similar infections can represent localized outbreaks of HIV transmission.
HIV treatment in BC, Canada

- BC Centre for Excellence in HIV/AIDS is responsible for all routine HIV drug resistance genotyping in the province.

- HIV genotyping is automatically performed on all new patients’ baseline samples submitted for viral load testing.

- Data are already available from ~75% of the 11,000 people ever enrolled in Drug Treatment Program (DTP)*.

- All de-identified sequences deposited in DTP database with anonymous clinical, demographic, and risk factor data.

*Estimated HIV prevalence in BC: ~15,000 persons
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BC Centre monitoring system

- Automated system queries the drug resistance database hourly.

- If new records exist, it performs a phylogenetic analysis of entire database and maps clusters.

- Determines if new cases appear within clusters, defined at a minimum size of 5 individuals.

- Monthly and quarterly reports† on cluster growth and characteristics issued to Centre directors, BC Centre for Disease Control, BC Ministry of Health.

†Daily reports to lab director.
An ‘actionable’ cluster

- Detected growth of a cluster by 9 new cases in 3 months.
- All but one carried transmitted HIV drug resistance‡ (TDR).
- Prompted a formal outbreak investigation, currently ongoing.
- Majority of viral loads have since changed from high to undetectable.

‡K103N, NNRTI resistance
Concluding remarks

▶ Difficult to obtain timely information on recent changes in an epidemic.

▶ Real-time monitoring of population-wide resistance data can inform targeted HIV prevention efforts.

▶ Preserving treatment options by detecting and averting transmission of HIV drug resistance.

▶ Knowledge translation was driven by a recent local outbreak of transmitted drug resistance.
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