90-90-90
Targets Workshop

July 22-23, 2017 • Paris

Sponsored by

IAPAC INTERNATIONAL ASSOCIATION OF PROVIDERS OF AIDS CARE

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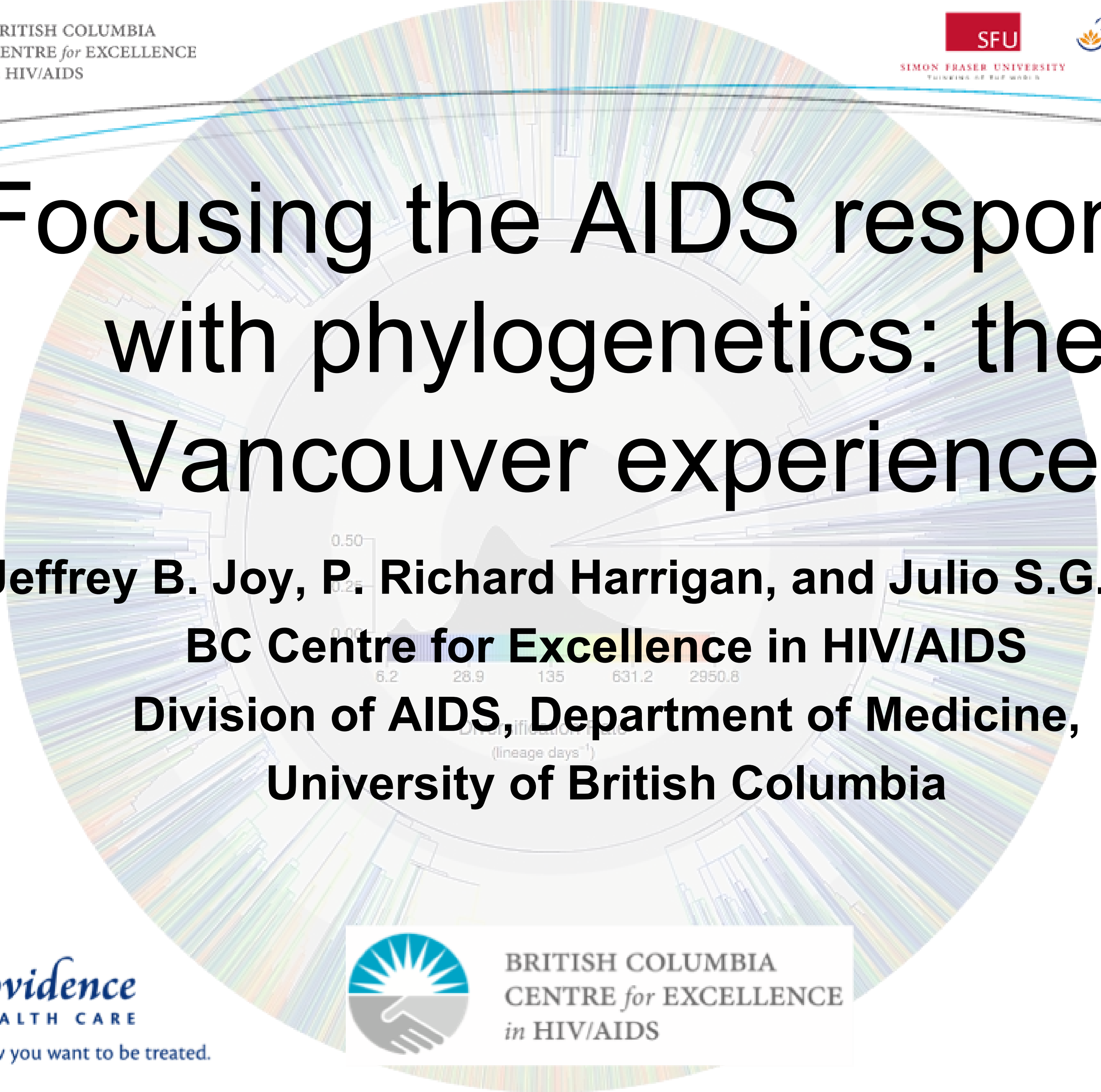
In partnership with

GNP+ GLOBAL NETWORK OF PEOPLE LIVING WITH HIV

IAS



Focusing the AIDS response with phylogenetics: the Vancouver experience

Drs. Jeffrey B. Joy, P. Richard Harrigan, and Julio S.G. Montaner

BC Centre for Excellence in HIV/AIDS

Division of AIDS, Department of Medicine,

University of British Columbia

Critical Questions for Deployment of Public Health Resources

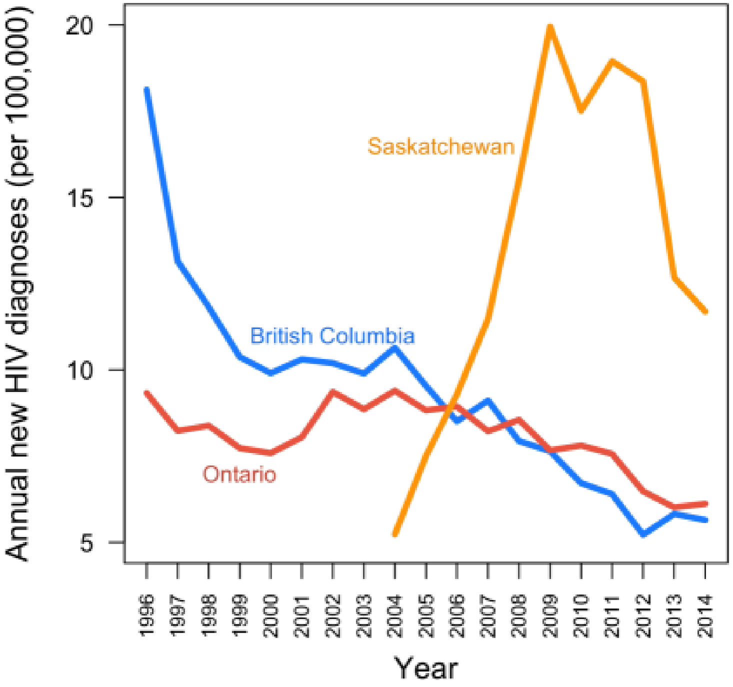
- Public health officials are frequently faced with questions surrounding the efficient focus of limited resources.

- How to most efficiently choose places and populations to prioritize the deployment of interventions for maximum effect?

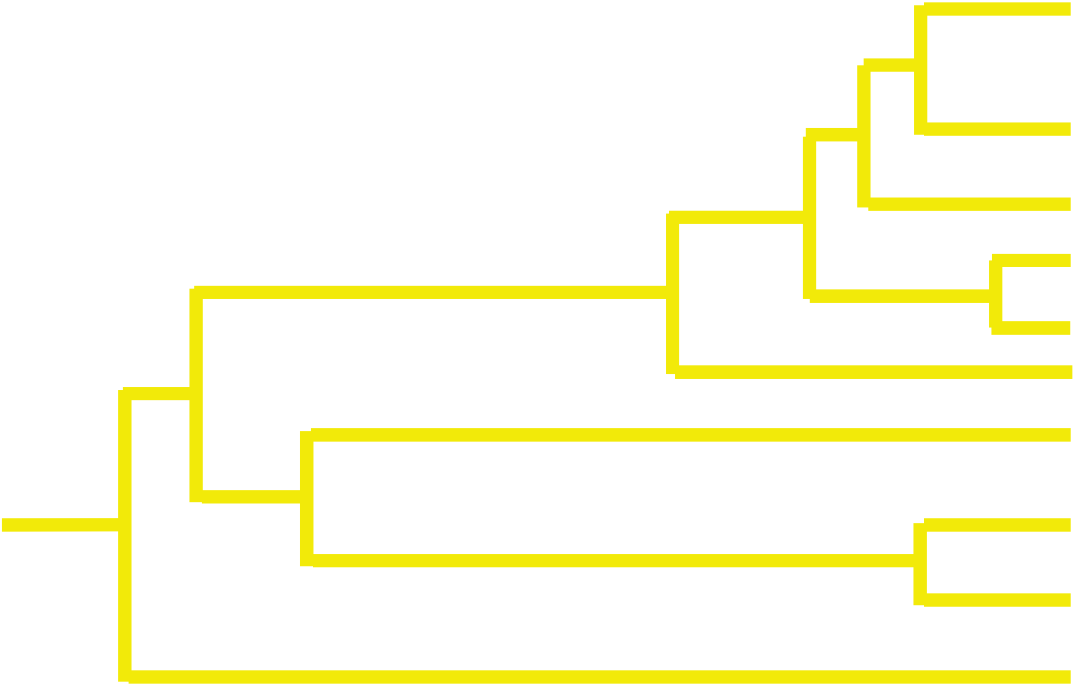
- How to find additional HIV positives?

HIV in British Columbia

- BC is the 3rd most populous province of Canada.
- Historically, highest rates of new HIV diagnoses.
- Marked decline attributed to large-scale rollout of fully subsidized TasP.



What is phylogenetics and how can a virus phylogeny help?

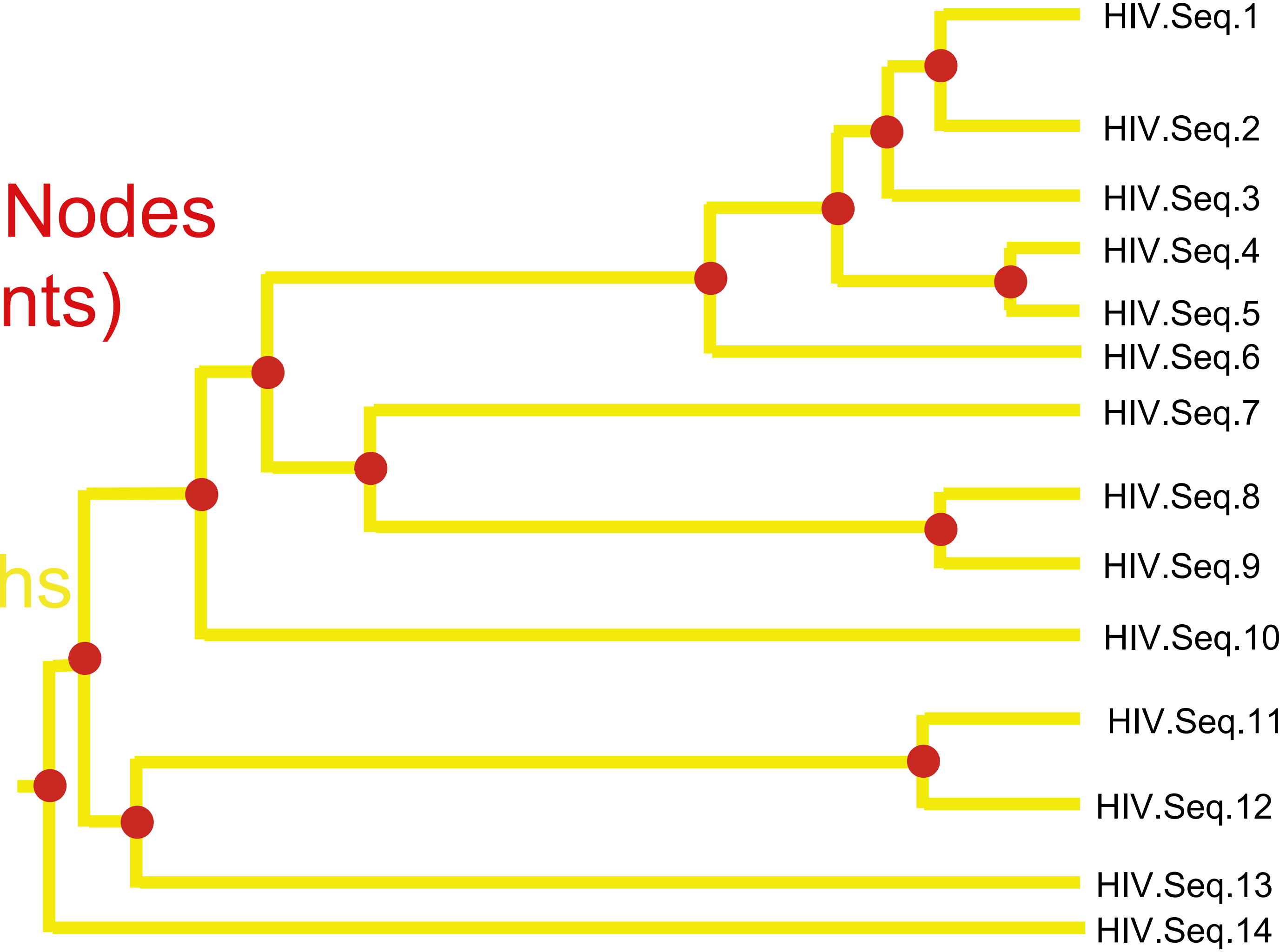


A virus phylogeny is a family tree of virus sequences

Phylogenetic Epidemiological Inferences

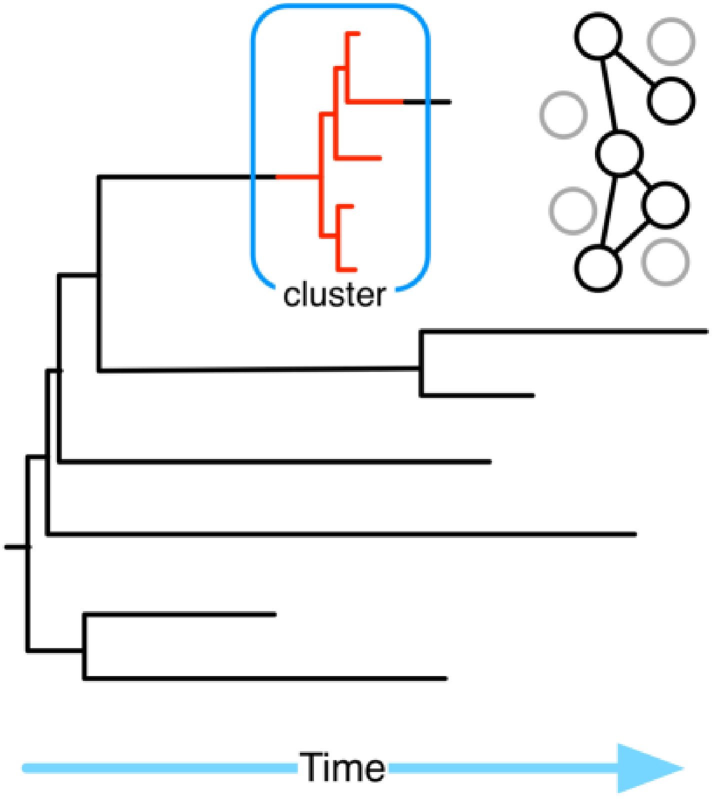
Temporal
Distribution of Nodes
(branching points)

Distribution of
Branch Lengths



Phylogenetic Clustering

- HIV evolves very rapidly.
- Infections that retain significant genetic similarity are likely related by **recent transmissions**.
- Clusters of genetically similar infections can represent **localized outbreaks** of HIV transmission.



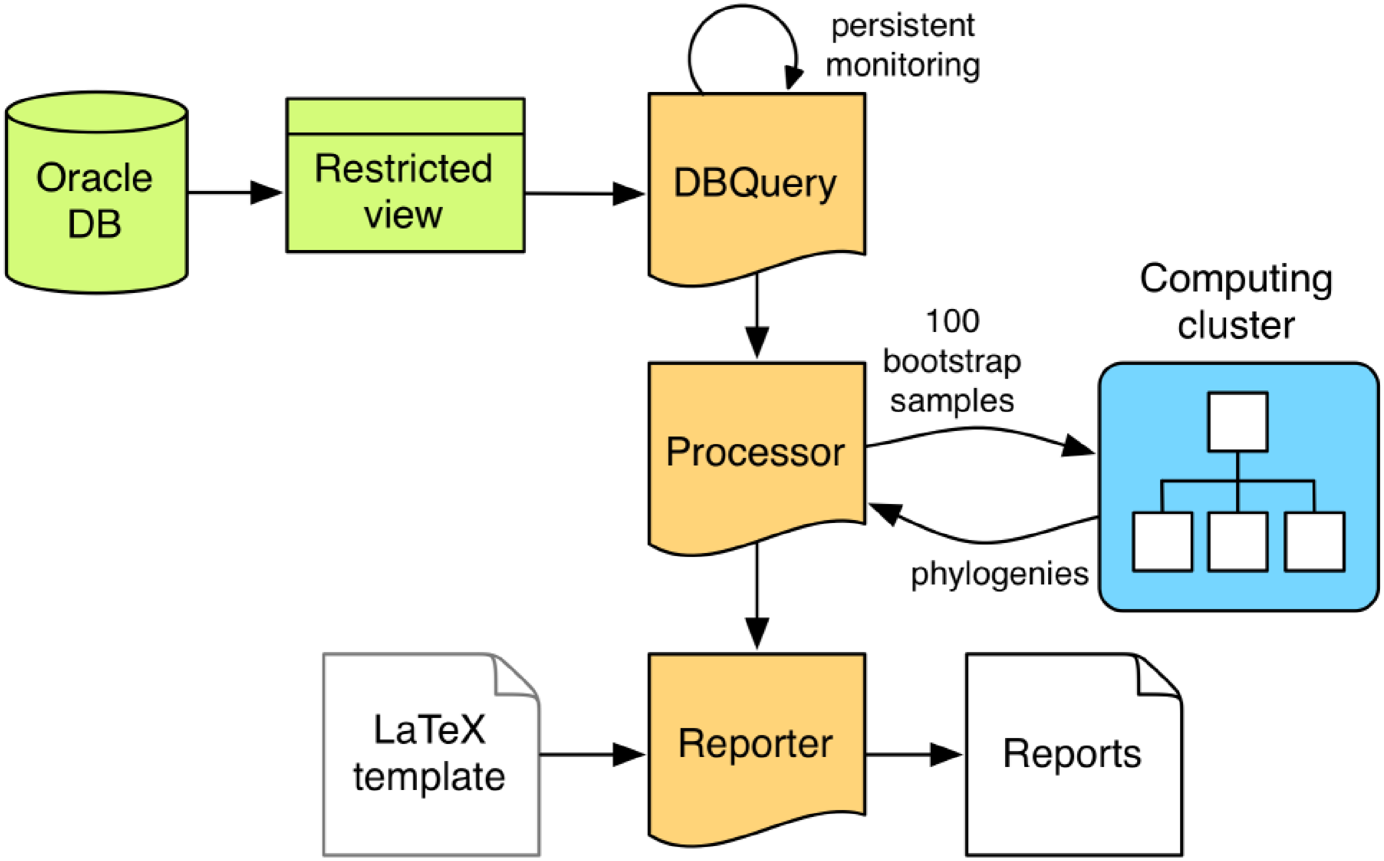
Caveats

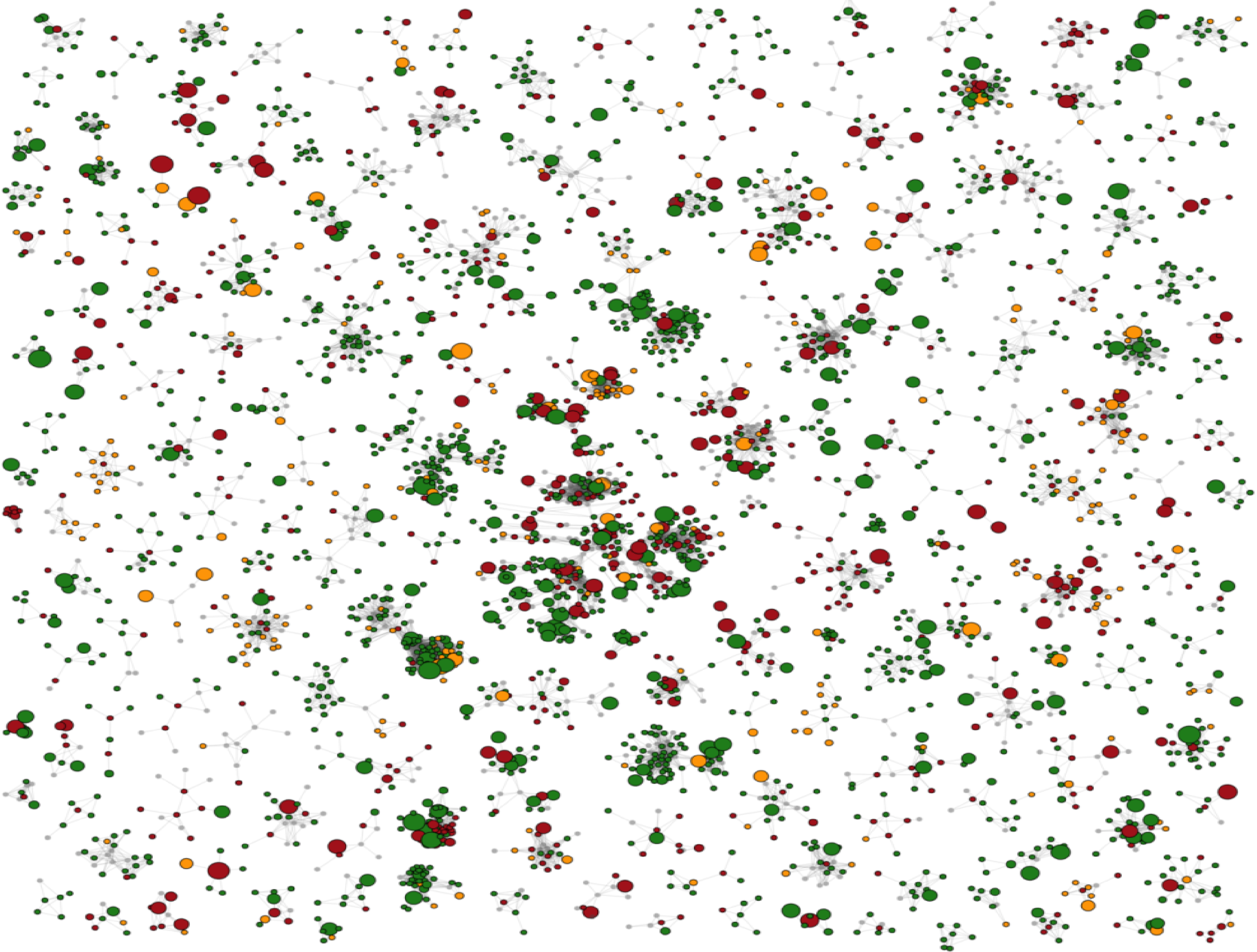
- A "network" of genetic similarity is <u>not</u> a transmission network.
- We can't exclude the possibility of intervening unidentified infections.
- Thus, branching events in a virus phylogeny <u>do not</u> represent transmission events.
- We consider only clusters of size 5+.
- Thus, we are considering things at the **group** level rather than at an individual level.

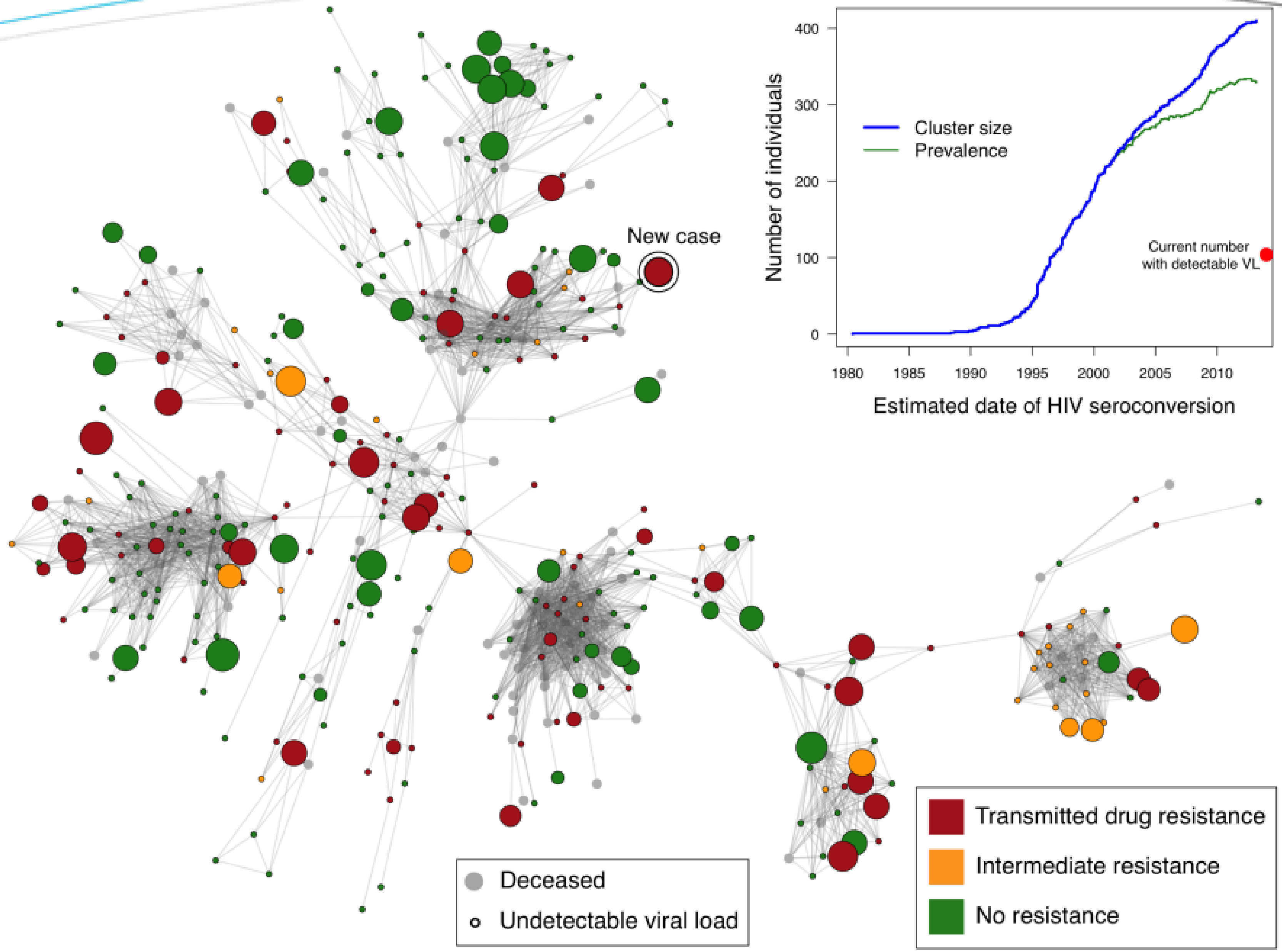
Phylogenetic Monitoring system

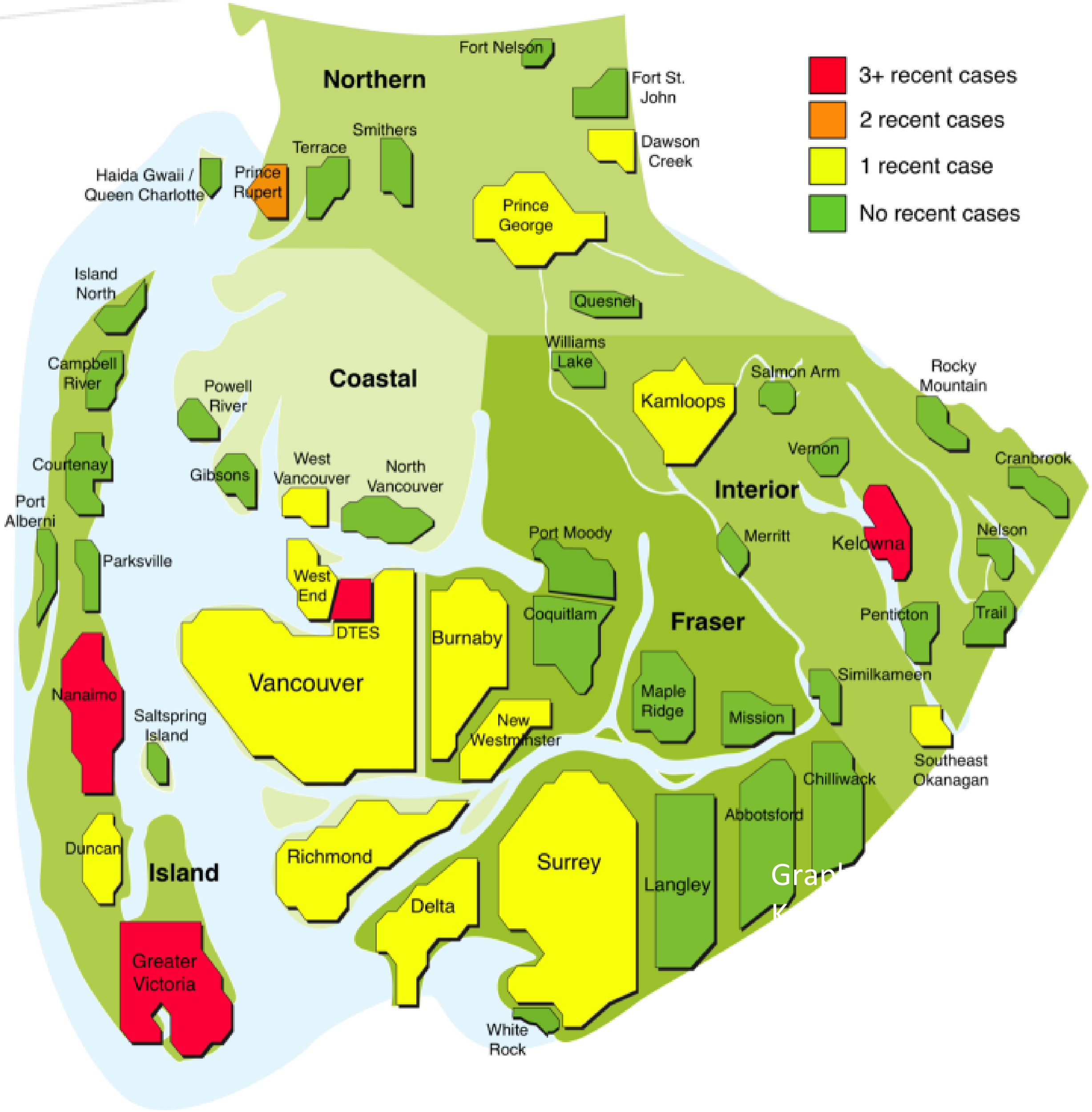
- Over 42,000 HIV genotypes from nearly 9,000 residents of BC living with HIV.
- Nearly 75% of estimated HIV prevalence in the province.
- All HIV genotypes automatically linked to clinical, demographic, and epidemiological variables.
- Including sub-populations (risk factors) and geography.
- De-identified prior to analysis.
- **Phylogenetic trees and clusters regenerated daily.**
- Currently tracking 170 clusters.

Monitoring system

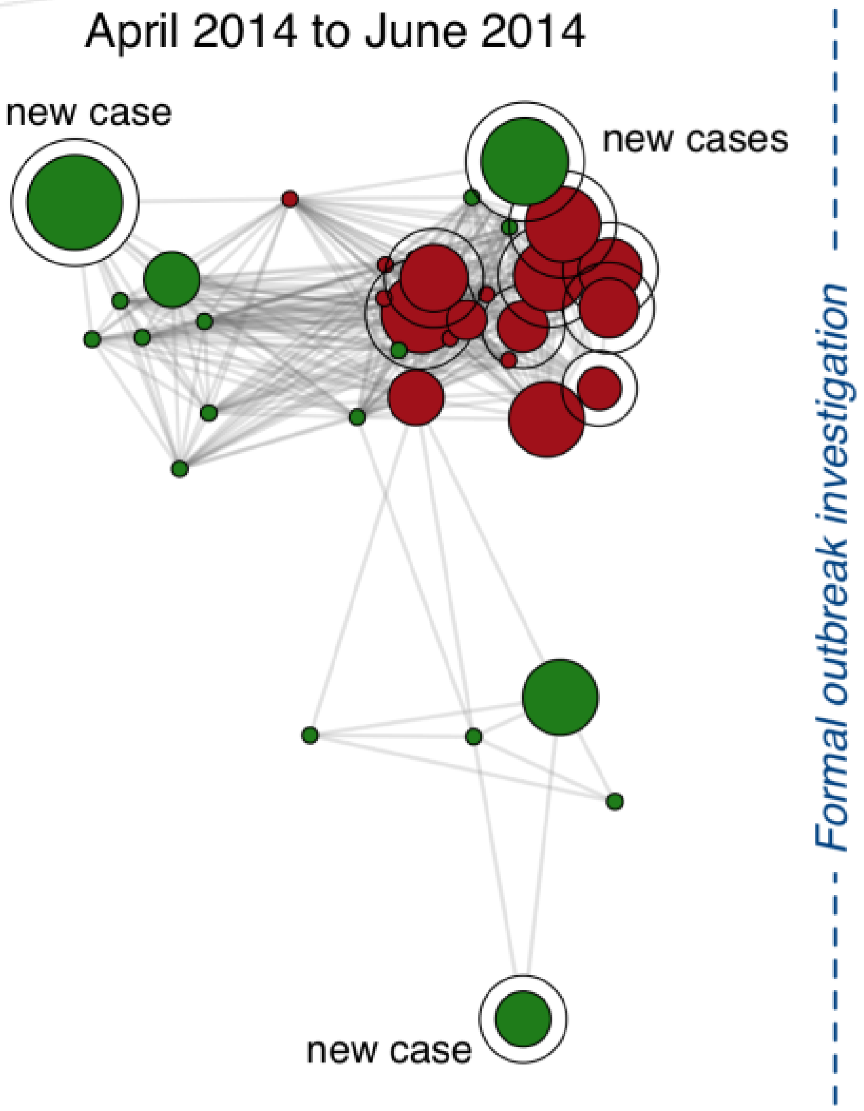





New case
400
300
200
100
0
Number of individuals
Cluster size
Prevalence
Current number with detectable VL
1980
1985
1990
1995
2000
2005
2010
Estimated date of HIV seroconversion
● Deceased
○ Undetectable viral load
🟥 Transmitted drug resistance
🟧 Intermediate resistance
🟩 No resistance


🟥 3+ recent cases
🟧 2 recent cases
🟨 1 recent case
🟩 No recent cases
Northern
Fort Nelson
Fort St. John
Dawson Creek
Smithers
Terrace
Prince Rupert
Haida Gwaii / Queen Charlotte
Prince George
Quesnel
Williams Lake
Island North
Campbell River
Courtenay
Port Alberni
Parksville
Coastal
Powell River
Gibsons
West Vancouver
North Vancouver
West End
DTES
Vancouver
Burnaby
New Westminster
Richmond
Delta
Surrey
White Rock
Port Moody
Coquitlam
Fraser
Maple Ridge
Mission
Langley
Abbotsford
Chilliwack
Interior
Kamloops
Salmon Arm
Rocky Mountain
Vernon
Cranbrook
Merritt
Kelowna
Nelson
Penticton
Trail
Similkameen
Southeast Okanagan
Nanaimo
Saltspring Island
Duncan
Island
Greater Victoria

Cluster 55



April 2014 to June 2014

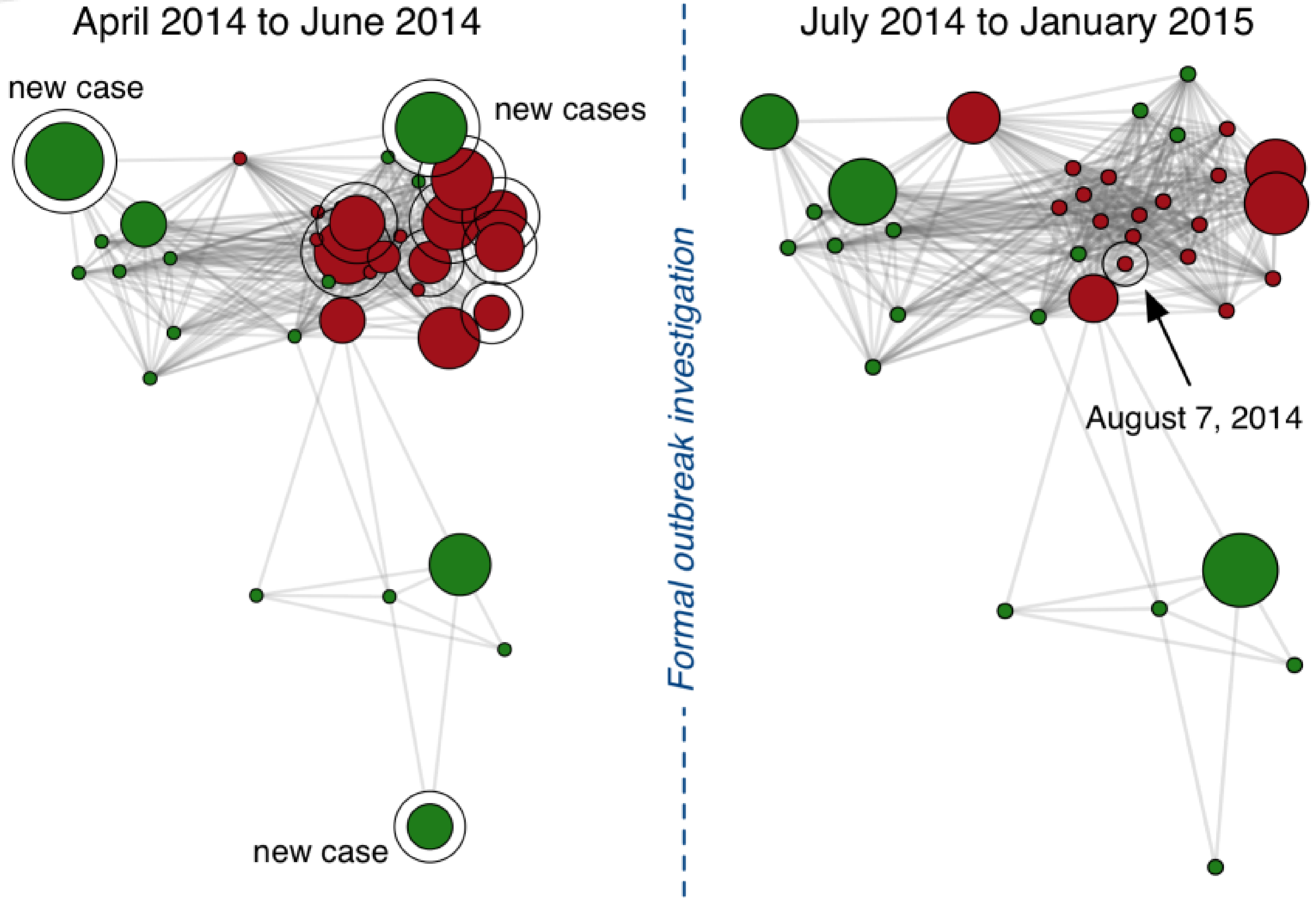
🟥 HIV drug resistance 🟩 no resistance ○ undetectable viral load

Cluster 55 Follow-up

- Enhanced public health follow-up for 9 individuals (8 with TDR*) to ensure linkage to care.
- Prior to follow-up, only 5 of 9 were on ART, only one with suppressed viral load.
- By end of follow-up, 8 had started ART, 6 suppressed viral loads.

* Transmitted drug resistance, K103N

Cluster 55



🟥 HIV drug resistance 🟩 no resistance ○ undetectable viral load

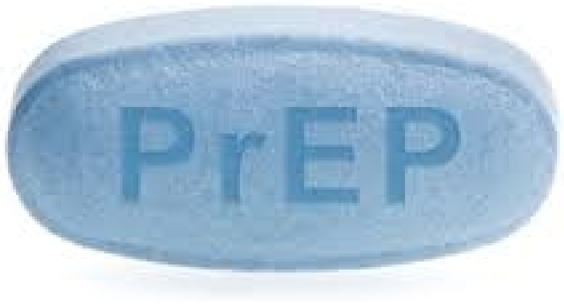
Cluster 55 Conclusions

- Marked reduction of TDR in cluster 55.
- Large reduction in viral load of the cluster.
- Phylogenetics facilitated the prioritization and cost-effective delivery of:
  - connection to care
  - HIV testing
  - enhanced partner care
  - Treatment

to populations with greatest risk.

Phylogenetically Targeted PrEP

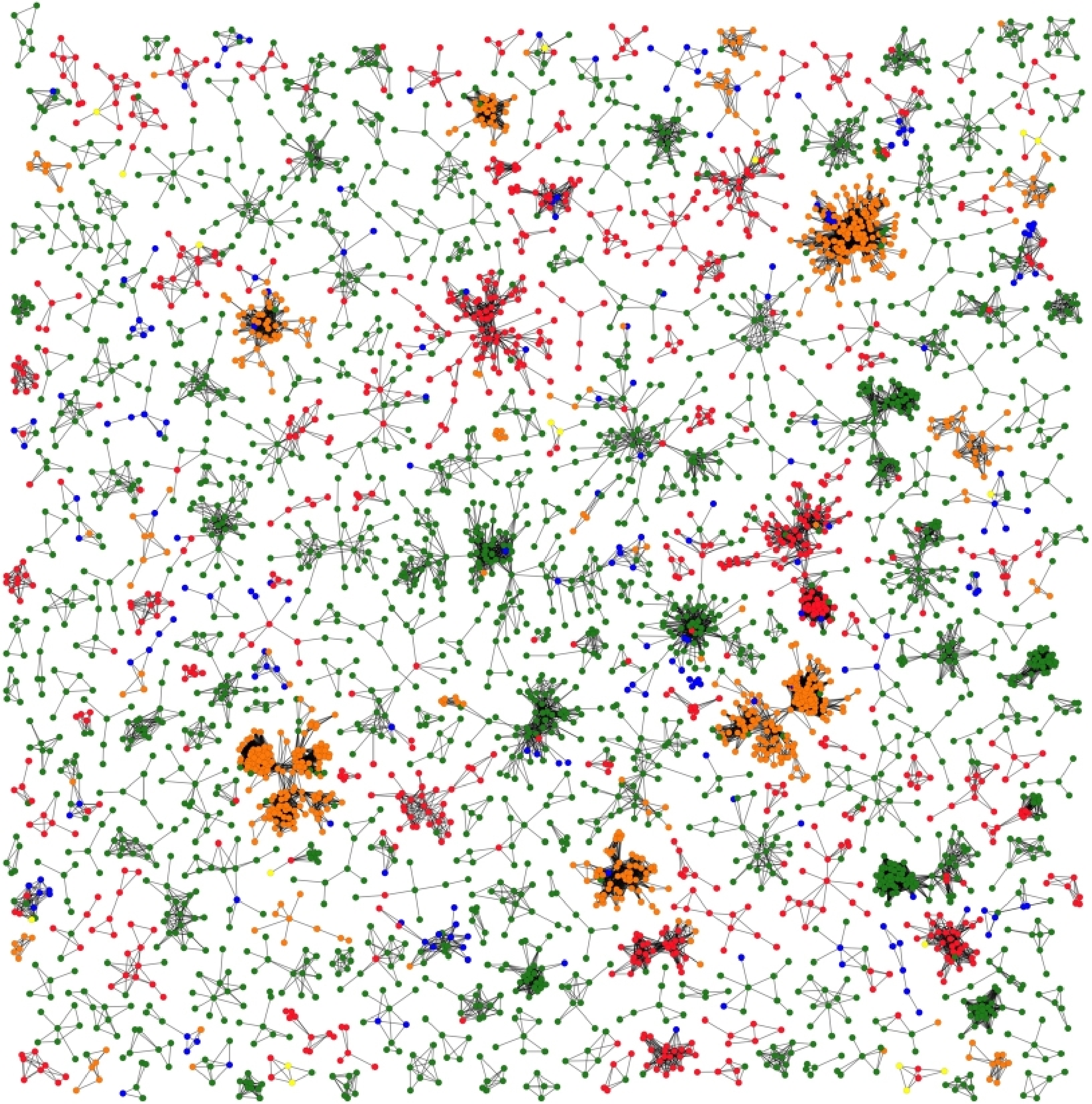
- We have begun offering PrEP at no cost to partners of individuals in active HIV transmission clusters.



Next Steps

- In BC, phylogenetics has proven to be an efficient way to:
  - Identify populations at high risk of exposure to HIV transmission
  - Target public health interventions
    - HIV testing
    - PrEP
    - Enhanced partner care
- With the support of the Public Health Agency of Canada we are currently offering phylogenetic monitoring to other Provinces and Territories of Canada

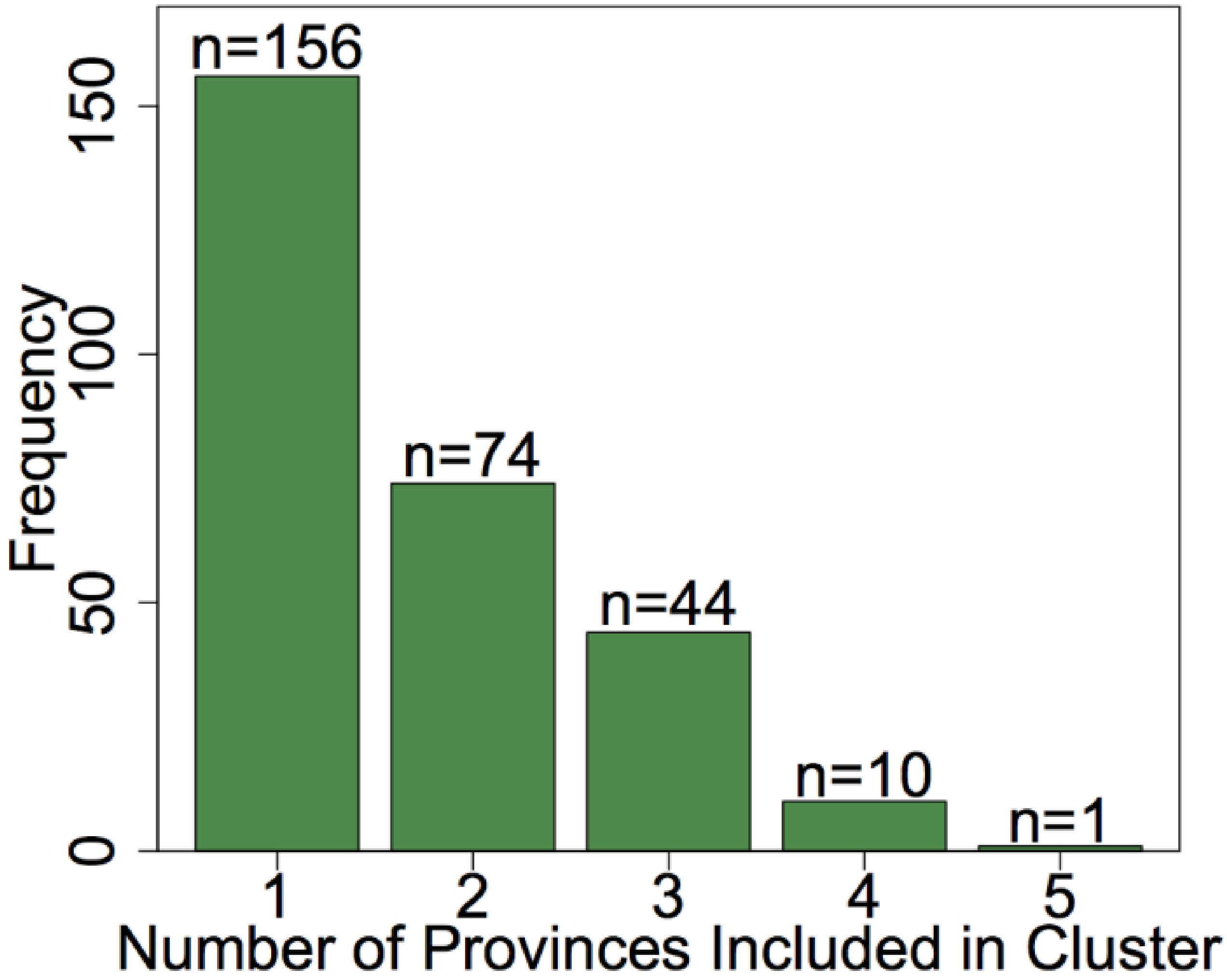
Phylogenetic Clustering of HIV in Canada



Canadian Province

- 🟢 British Columbia
- 🔵 Alberta
- 🟠 Saskatchewan
- 🔴 Ontario
- 🟡 Quebec

Most Clusters Province Specific



Conclusions

- Most clustering occurs within provinces through local transmission.
- Some interprovincial clustering.
- Provinces with lots of data display similar patterns:
  - Some large clusters - predominated by IDUs
  - Lots of smaller clusters
- **Phylogenetic monitoring provides practical,**

Conclusions

- As we reach 90-90-90 it will be increasingly difficult to find remaining pockets of HIV transmission.
- Phylogenetics provides rapid, real time, methods of:
    - Identifying additional HIV positive individuals and at risk subpopulations
    - Allows HIV testing, PrEP, partner care, and prevention efforts to be most efficiently deployed.
- Phylogenetic methods developed to combat the

Acknowledgements

CDC
BC Centre for Disease Control
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First Nations Health Authority

fraserhealth

Interior Health
For your whole life

CANOC

Jewish General Hospital
Lady Davis Institute for Medical Research

CRCHUM
CENTRE DE RECHERCHE
Centre hospitalier de l'Université de Montréal

northern health
the northern way of caring

Providence
HEALTH CARE
How you want to be treated.

Vancouver CoastalHealth
Promoting wellness. Ensuring care.

VANCOUVER ISLAND
health authority

Michael Smith Foundation for
Health Research

First Nations Health Authority

CIHR IRSC

NIH
National Institute on Drug Abuse

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