Surveillance of COVID-19

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Key Concepts

• Epidemiology
• Surveillance
Epidemiology

“the study of the distribution and determinants (causes, risk factors) of health-related states and events (not just diseases) in specified populations”

https://www.cdc.gov/careerpaths/k12teacherroadmap/epidemiology.html
Public Health Surveillance

“ongoing systematic collection, analysis, and interpretation of data, closely integrated with the timely dissemination of these data to those responsible for preventing and controlling disease and injury”

Surveillance for COVID-19

• Traditional Passive Reportable Disease Surveillance
• New Approaches
  – Digital epidemiology
  – Genomic epidemiology
  – Wastewater-based epidemiology
Digital Epidemiology

• Use of digital data for epidemiology
  – Social media
  – Online news reports
  – Smartphone data
  – Online blogs and other Web resources

• Data often not generated for public health purposes

JHU Web-based Dashboard

https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6
https://systems.jhu.edu/research/public-health/2019-ncov-map-faqs/
Methodology

• Text mining / NLP / Manual Annotation of News Reports
  – “semi-automated living data stream strategy” pg. 1
• Multiple Languages
• Communication with authoritative sources
• Geospatial mapping and graphing functions

Genomic Epidemiology

- Use of virus sequences to inform understanding on transmission and spread
- Phylodynamics/phylogenetics
- Population genetics
- Requires Next Generation Sequencing (NGS) and reliable sequence metadata
Genomic epidemiology of novel coronavirus

Maintained by the Nextstrain team. Enabled by data from GISAID

Showing 2629 of 2629 genomes sampled between Dec 2019 and Mar 2020.
What we have learned through GE

• One introduction from animal reservoir
• No repeated introductions from animal hosts like MERS
• Wildtype virus: not engineered in a lab
• Mutations as we would expect for an RNA virus

SARS-CoV-2 Work at Arizona State University

- Wastewater-based epidemiology
  - Rolf Halden, Arvind Varsani, Matthew Scotch
- Clinical surveillance from NP swabs of ILI
  - Matthew Scotch, Brenda Hogue, Efrem Lim
- Testing at ASU Health Clinic
  - Josh LaBaer, Center for Personalized Diagnostics, and others
ASU SARS-CoV-2 Surveillance

- Surveillance through ASU Health Services
- NP swab specimens collected since Jan 24th to Now
- Builds on NIH-funded flu surveillance study at ASU (R01LM013129, PIs: Scotch, Halden, Varsani)
- qRT-PCR assays for SARS-CoV-2 (N, E and RdRp genes)
- Current capacity: 48 samples in 4 hrs (from sample to result)
• 5 ASU positives plus 1 ADHS positive
• Pending next generation sequencing (NGS)