Applications of Digital Epidemiology in Wyoming Public Health Lab

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ESCMID Digital Epidemiology with Applications in Public Health
July 16th, 2024

Wyoming Department of Health | PUBLIC HEALTH DIVISION | WYOMING PUBLIC HEALTH LABORATORY



Yo! 👋

I AM ROBERT

Bioinformatician at the Wyoming Public Health Laboratory

Wyoming Department of Health | PUBLIC HEALTH DIVISION | WYOMING PUBLIC HEALTH LABORATORY

Where is Wyoming and the Wyoming PHL?

Wyoming, USA

Total Area 253k km^2

United Kingdom is ~245k km^2

Total Population ~580k

Average elevation of 2,040 meters

Many national parks filled with wildlife
(especially of the large sorts)



Wyoming Public Health Laboratory (WPHL)

Cheyenne, WY

20-30 lab members

Close relationship with:

- State Vet Lab
- State Agriculture Lab
- Game and Fish
- Dept of Environmental Quality

Sequencing capacity includes several Illumina and Oxford Nanopore instruments



Infectious Disease Epidemiology in Wyoming

- 12 epidemiologists working at various levels on infectious diseases
- 96 diseases and conditions are reportable to the Wyoming Department of Health
- Investigations (including patient interviews) are conducted for every reported case
- Patient interviews aim to ascertain:
  - illness onset and exposure dates
  - clinical presentation and risk factors
  - basic demographics
  - etc…
- Clusters and outbreaks are identified by linking epidemiological and laboratory results

Improving epidemiological investigations using genomics

Example: International introduction of SARS-CoV-2 into Wyoming

Early SARS-CoV-2 surveillance in Wyoming

- March 2020 SARS-CoV-2 samples start coming into the lab

- For each sample, the process was:
  - PCR test for SARS-CoV-2
  - PCR+ samples undergo amplicon sequencing
  - Bioinformatic analysis
  - Submission to GISAID

- Rinse and repeat for us and many around the world
  - Became impossible to conduct patient interviews for all positives
  - 20-30% of all positive samples were sequenced at WPHL

Out of the blue, we get asked about 2 of our samples

strain	gisaid_epi_isl	date	country	division	region exposure	country exposure	pangolin lineage	originating_lab	authors	date submitted
USA/WY-WYPHL-00040/2020	EPI_ISL_462932	24/03/2020	USA	Wyoming	North America	USA	A.2	Wyoming Public Health Laboratory	Daryl Domman et al	8/6/2020
USA/WY-WYPHL-00041/2020	EPI_ISL_462933	24/03/2020	USA	Wyoming	North America	USA	A.2	Wyoming Public Health Laboratory	Daryl Domman et al	8/6/2020

An unlikely link made through genomics

- July 2, 2020: Health Authority in Australia contacted WDH about two cases with sequencing that matched a large cruise ship outbreak.
- These cases did not get patient interviews, so we reached out them

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USA/WY-WYPHL-00040/2020	EPI_ISL_462932	24/03/2020	USA	Wyoming	North America	USA	A.2	Wyoming Public Health Laboratory	Daryl Domman et al	8/6/2020
USA/WY-WYPHL-00041/2020	EPI_ISL_462933	24/03/2020	USA	Wyoming	North America	USA	A.2	Wyoming Public Health Laboratory	Daryl Domman et al	8/6/2020

Following up with patient interviews

- Three family members
- Traveled to Australia and boarded the Ruby Princess on March 5, 2020
- Became ill on March 15, 2020 (2) and March 16, 2020
- Disembarked on March 19, 2020
- Returned to Wyoming and samples for testing collected on March 24, 2020
- Samples were sequenced and submitted June 8, 2020

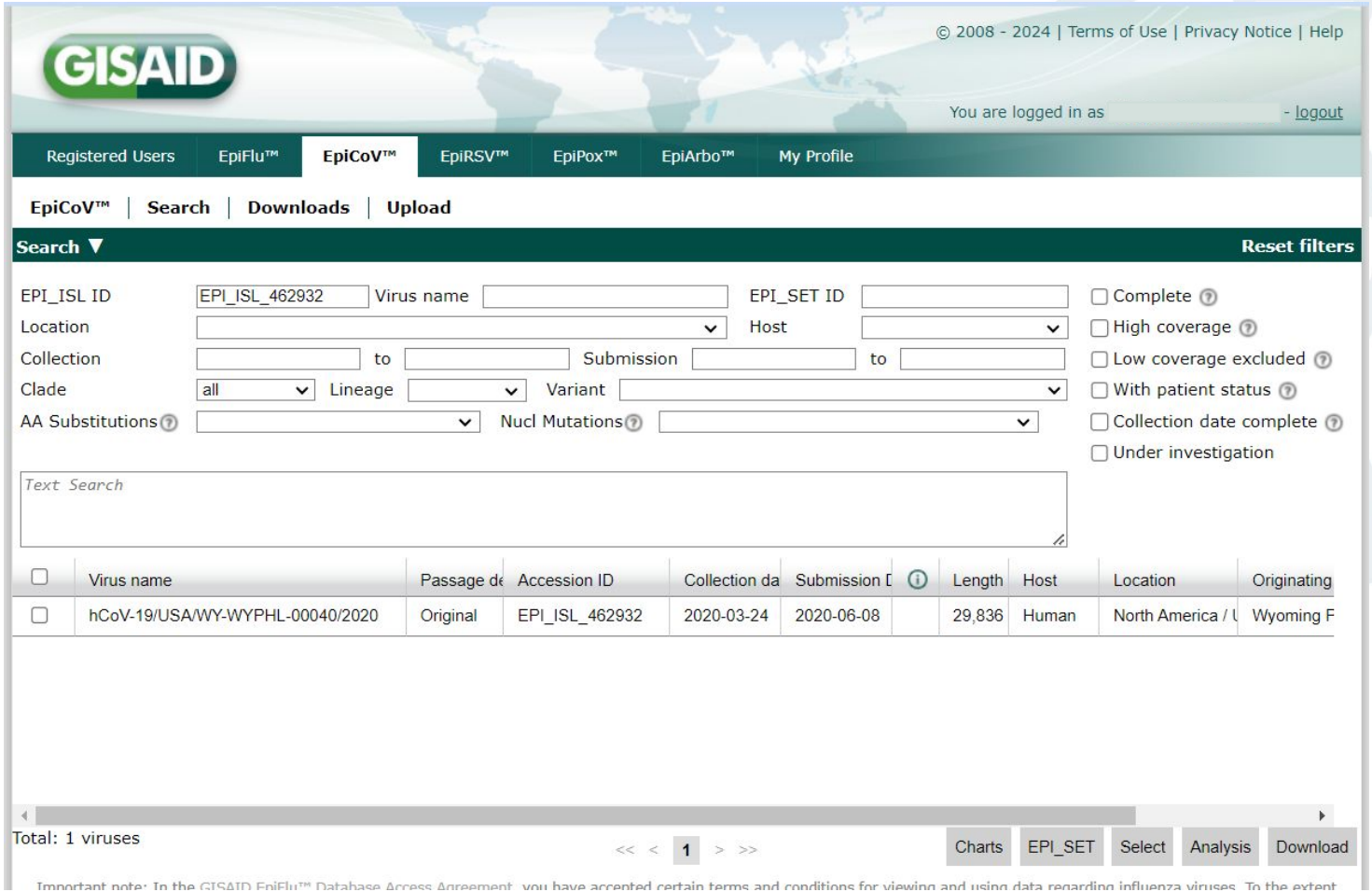

GISAID
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You are logged in as
- logout
Registered Users
EpiFlu™
EpiCoV™
EpiRSV™
EpiPox™
EpiArbo™
My Profile
EpiCoV™ | Search | Downloads | Upload
Search ▼
Reset filters
EPI_ISL ID
EPI_ISL_462932
Virus name
EPI_SET ID
Location
Host
Collection
to
Submission
to
Clade
all
Lineage
Variant
AA Substitutions
Nucl Mutations
Complete
High coverage
Low coverage excluded
With patient status
Collection date complete
Under investigation
Text Search
Virus name
Passage de
Accession ID
Collection da
Submission D
Length
Host
Location
Originating
hCoV-19/USA/WY-WYPHL-00040/2020
Original
EPI_ISL_462932
2020-03-24
2020-06-08
29,836
Human
North America / U
Wyoming F
Total: 1 viruses
<< < 1 > >>
Charts
EPI_SET
Select
Analysis
Download
Important note: In the GISAID EpiFlu™ Database Access Agreement, you have accepted certain terms and conditions for viewing and using data regarding influenza viruses. To the extent

Table of related genomes (showing 266 of 266):

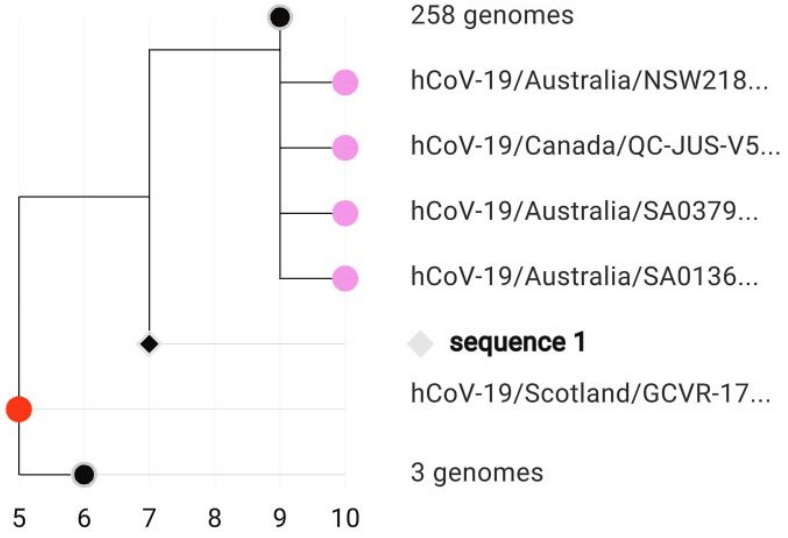
COLLAPSE

Accession ID	Distance	Quality	Location	Collec. date	Subm. date	Lineage
EPI_ISL_3568383	2	0.999	Oceania / Australia / New South Wales / Sydney	2020-03-24	2021-08-23	A.2.2
EPI_ISL_3568393	2	0.998	Oceania / Australia / New South Wales / Sydney	2020-04-04	2021-08-23	A.2.2
EPI_ISL_3568402	2	0.999	Oceania / Australia / New South Wales / Sydney	2020-04-02	2021-08-23	A.2.2
EPI_ISL_3568409	2	0.999	Oceania / Australia / New South Wales / Sydney	2020-04-06	2021-08-23	A.2.2
EPI_ISL_3568411	2	0.989	Oceania / Australia / New South Wales / Sydney	2020-04-09	2021-08-23	A.2.2
EPI_ISL_3568412	2	0.999	Oceania / Australia / New South Wales / Sydney	2020-04-09	2021-08-23	A.2.2
EPI_ISL_3568413	2	0.999	Oceania / Australia / New South Wales / Sydney	2020-04-09	2021-08-23	A.2.2
EPI_ISL_4254497	2	0.998	Oceania / Australia / New South Wales / Sydney	2020-03-23	2021-09-17	A.2.2
EPI_ISL_6386599	2	0.999	Oceania / Australia / Queensland	2020-03-31	2021-11-17	A.2.2
EPI_ISL_7615938	2	0.999	North America / USA / Wyoming	2020-03-24	2021-12-13	A.2.2
EPI_ISL_8767120	2	0.999	Oceania / Australia / New South Wales / Sydney	2020-03-20	2022-01-17	A.2.2

Distributions of related genomes (showing 266 of 266):

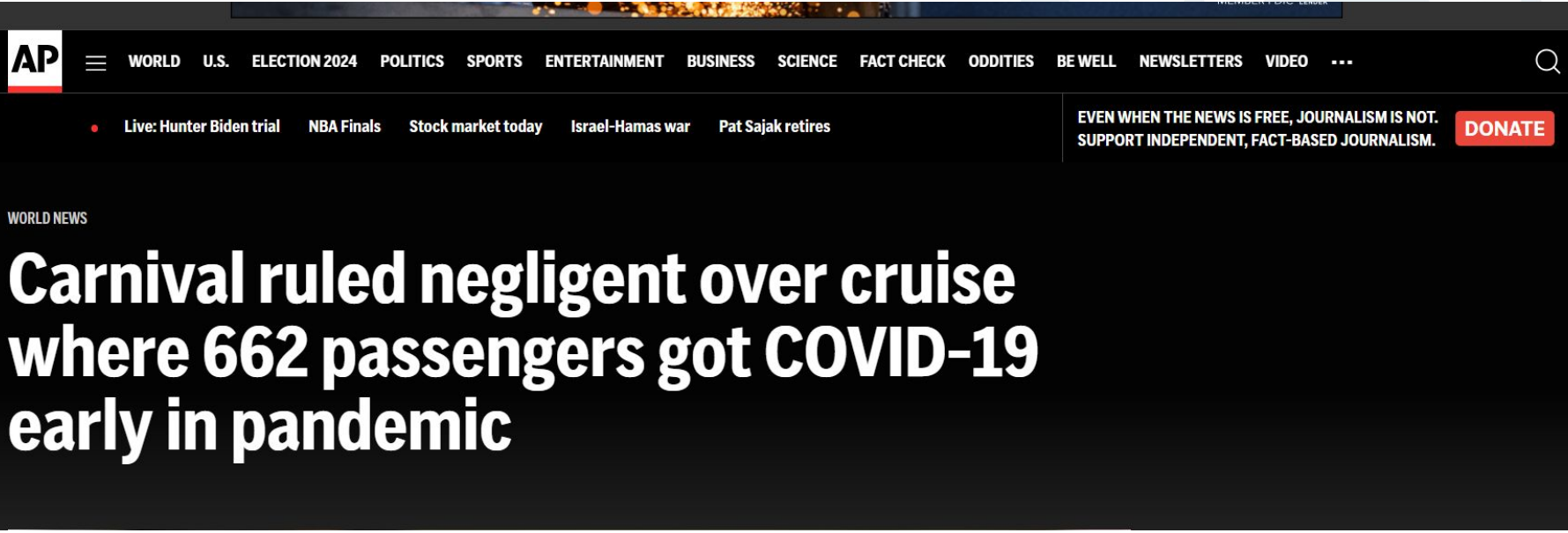
COLLAPSE

Tree by genetic distance from reference (WIV04)



Distribution by Geography




AP
WORLD
U.S.
ELECTION 2024
POLITICS
SPORTS
ENTERTAINMENT
BUSINESS
SCIENCE
FACT CHECK
ODDITIES
BE WELL
NEWSLETTERS
VIDEO
Live: Hunter Biden trial
NBA Finals
Stock market today
Israel-Hamas war
Pat Sajak retires
EVEN WHEN THE NEWS IS FREE, JOURNALISM IS NOT.
SUPPORT INDEPENDENT, FACT-BASED JOURNALISM.
DONATE
WORLD NEWS
Carnival ruled negligent over cruise where 662 passengers got COVID-19 early in pandemic

Genomics improved our epidemiological investigation by linking local cases to international travel that were previously unlinked

Summary

This is just one example

- SARS-CoV-2 demonstrated the effectiveness of genomic epidemiology

- We have used in other investigations including:
  - Viral pathogens
  - Bacterial pathogens
  - Wastewater

- There is still progress to be made:
  - Integrating software such as Microreact
  - Workforce development in our region

Thank you
Questions?

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