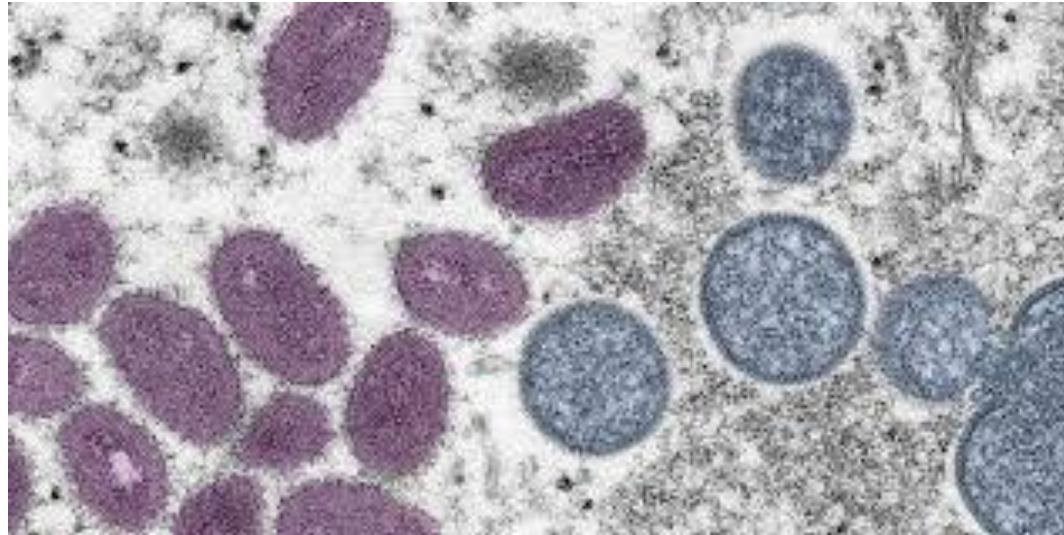




Wisconsin State
Laboratory of Hygiene
UNIVERSITY OF WISCONSIN-MADISON



Monkeypox Outbreak



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University of Wisconsin - Madison

9/7/22



Outline

- Outbreak situational briefing
- The Virus and the Disease
- The Response
- Testing Resources

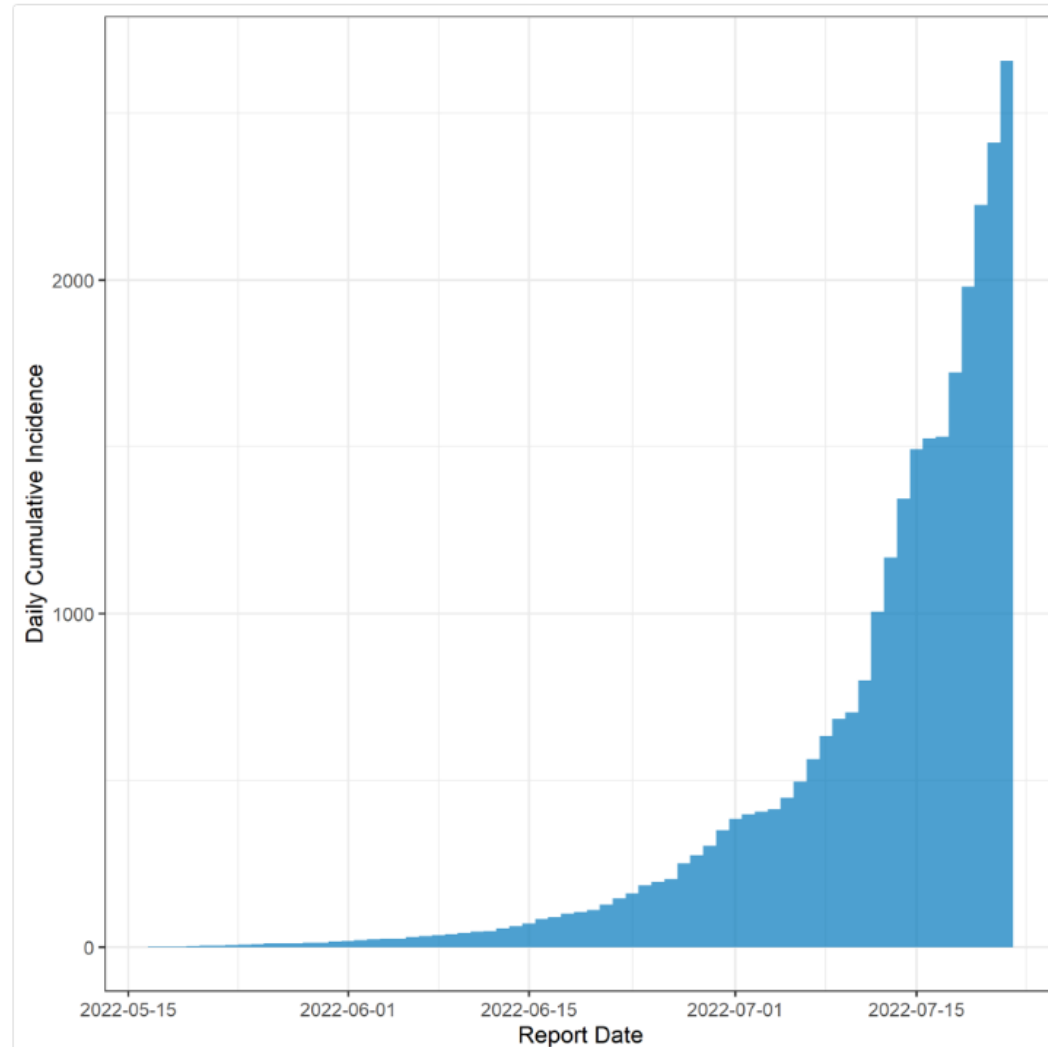




The Outbreak



Monkeypox Epidemic





World Cases

Monkeypox: Daily confirmed cases

7-day rolling average

Our World
in Data

LINEAR LOG

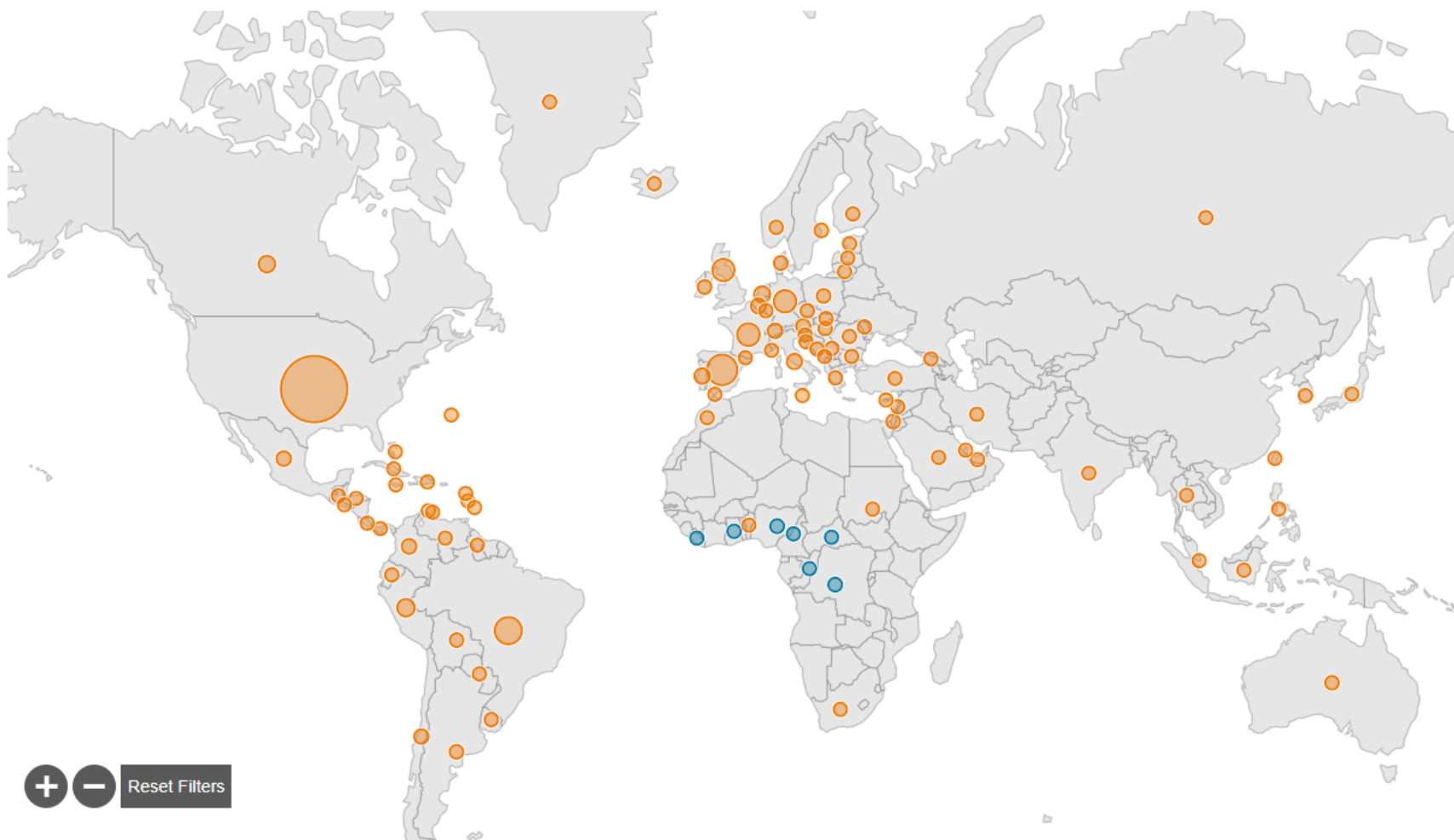


<https://ourworldindata.org/monkeypox>

54,911

Total Cases

World Map of Cases

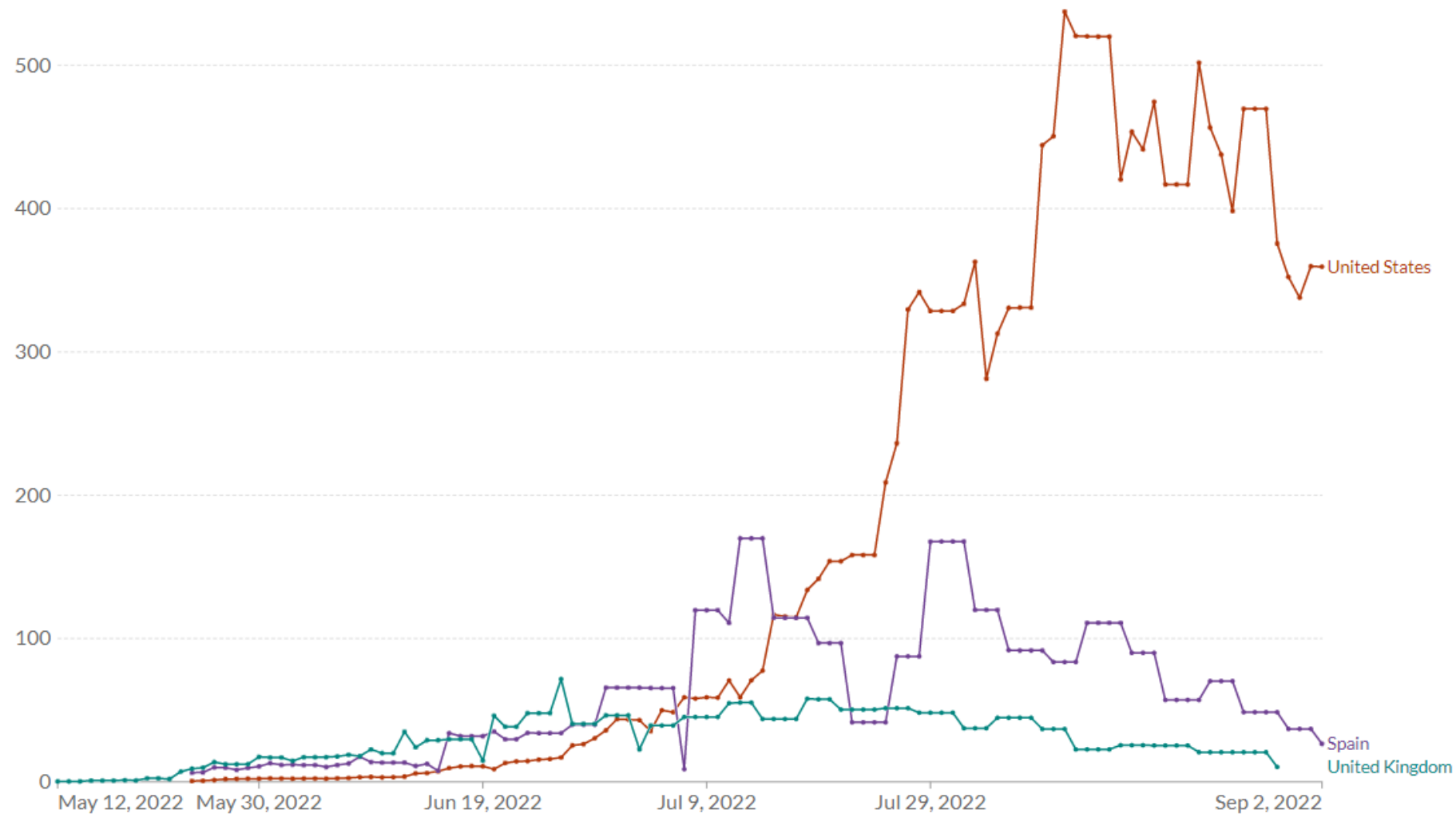


<https://www.cdc.gov/poxvirus/monkeypox/response/2022/world-map.html>

Monkeypox: Daily confirmed cases

7-day rolling average

LINEAR LOG



Source: Data produced by the 'Global.health' team — available at github.com/globaldothealth/monkeypox

CC BY

<https://ourworldindata.org/monkeypox>



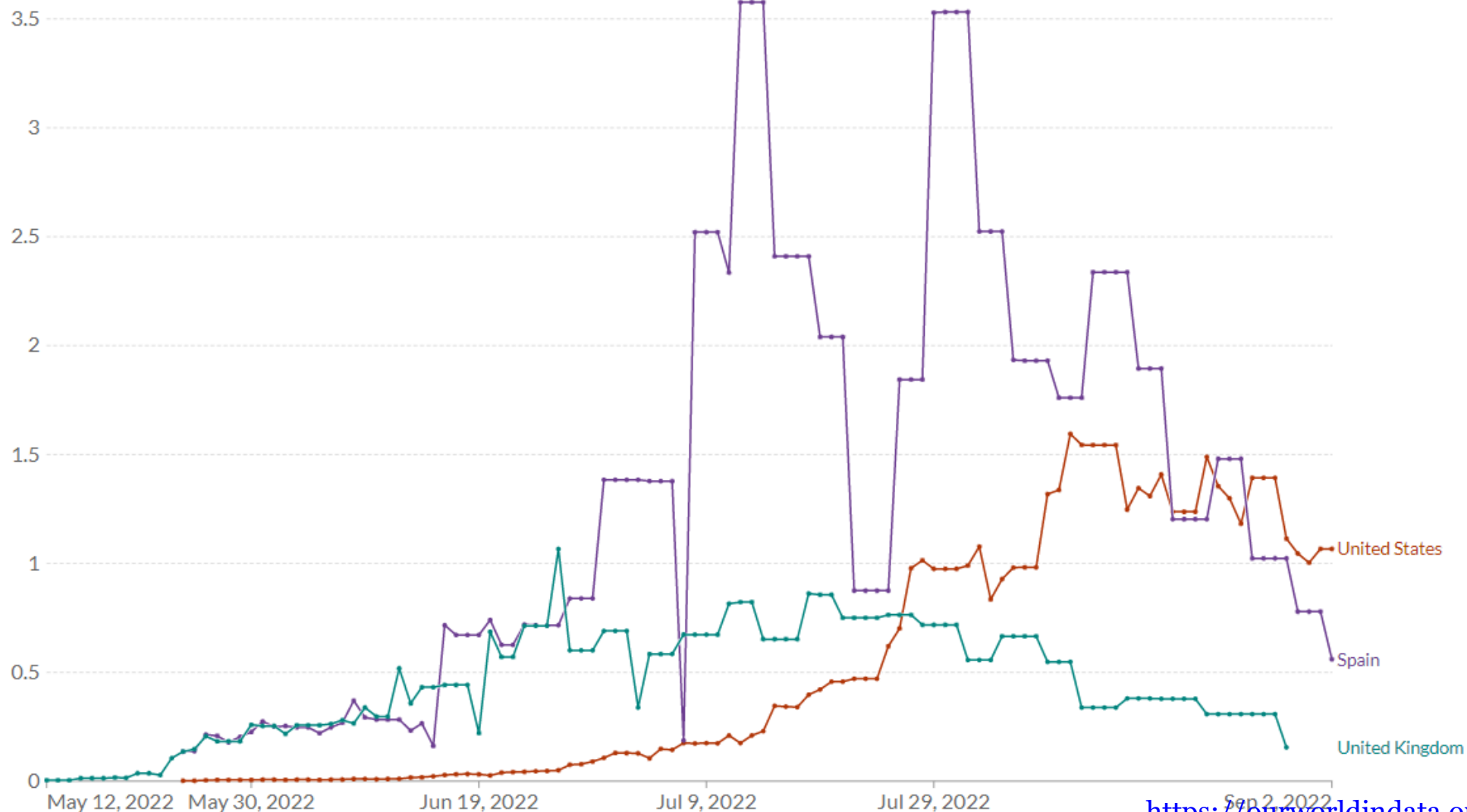


Monkeypox: Daily confirmed cases per million people

7-day rolling average

Our World
in Data

LINEAR LOG



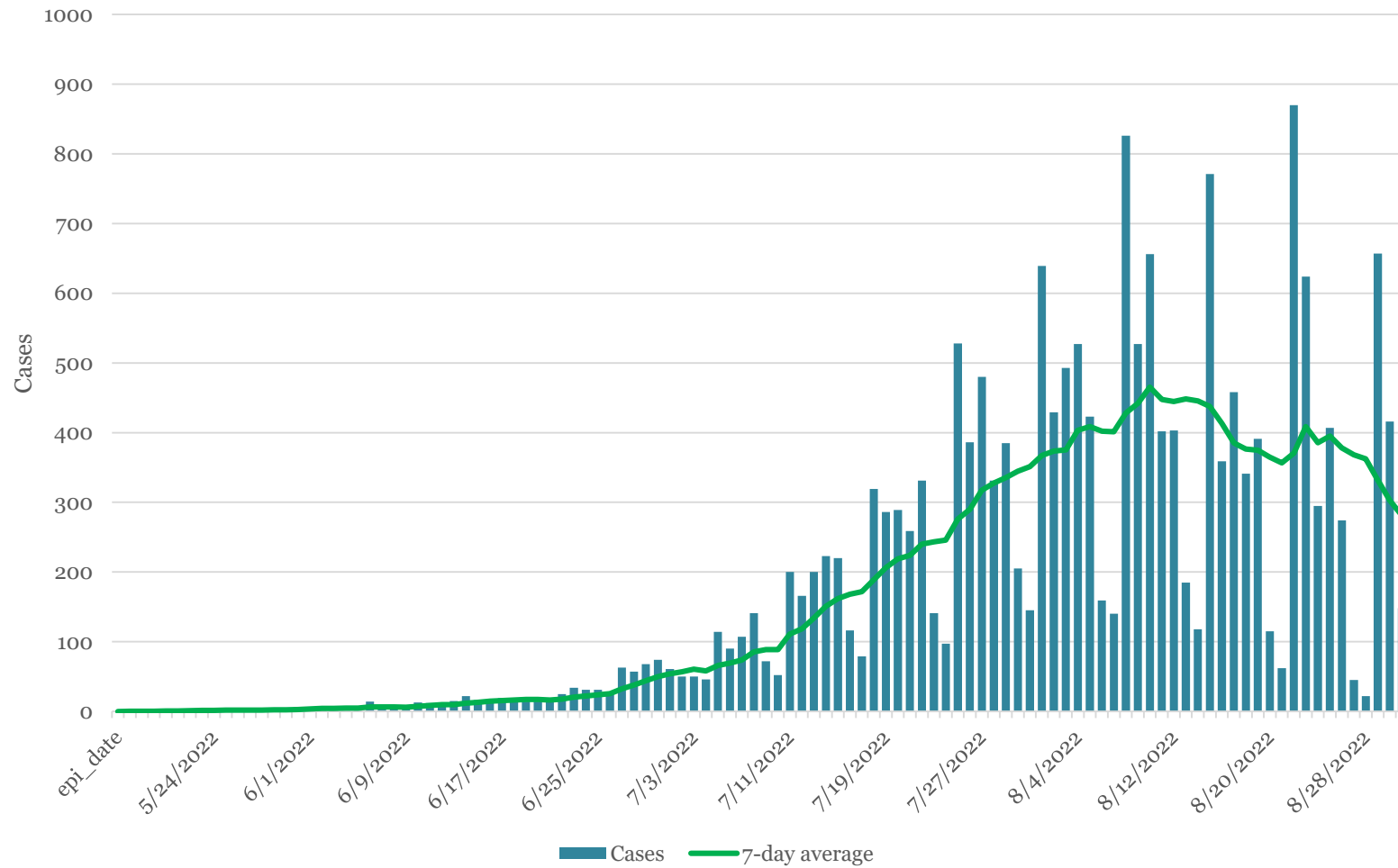
<https://ourworldindata.org/monkeypox>

Source: Data produced by the 'Global.health' team — available at github.com/globaldothealth/monkeypox

CC BY



US Cases

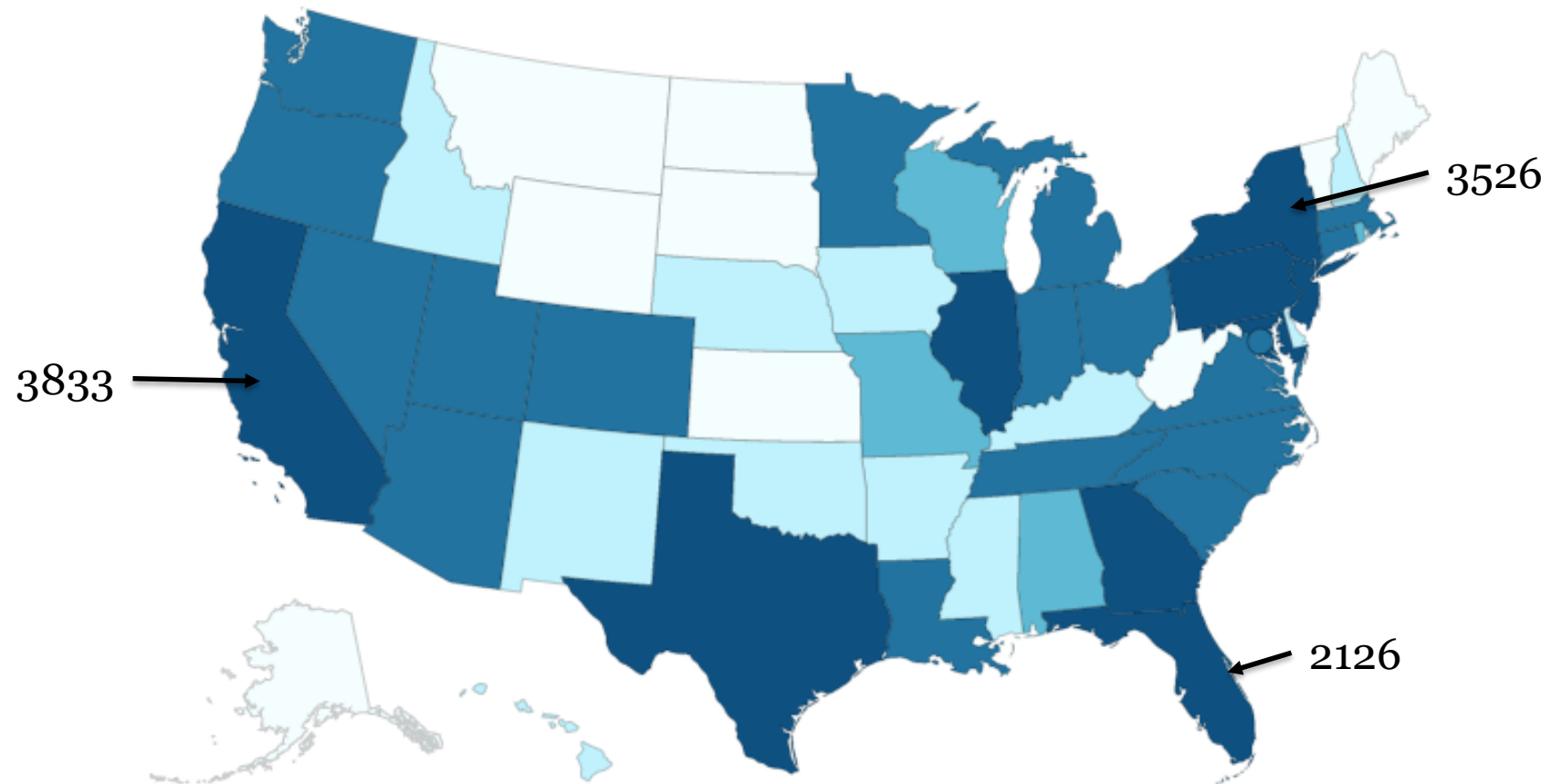


<https://www.cdc.gov/poxvirus/monkeypox/response/2022/us-map.html>



20,733 Total confirmed

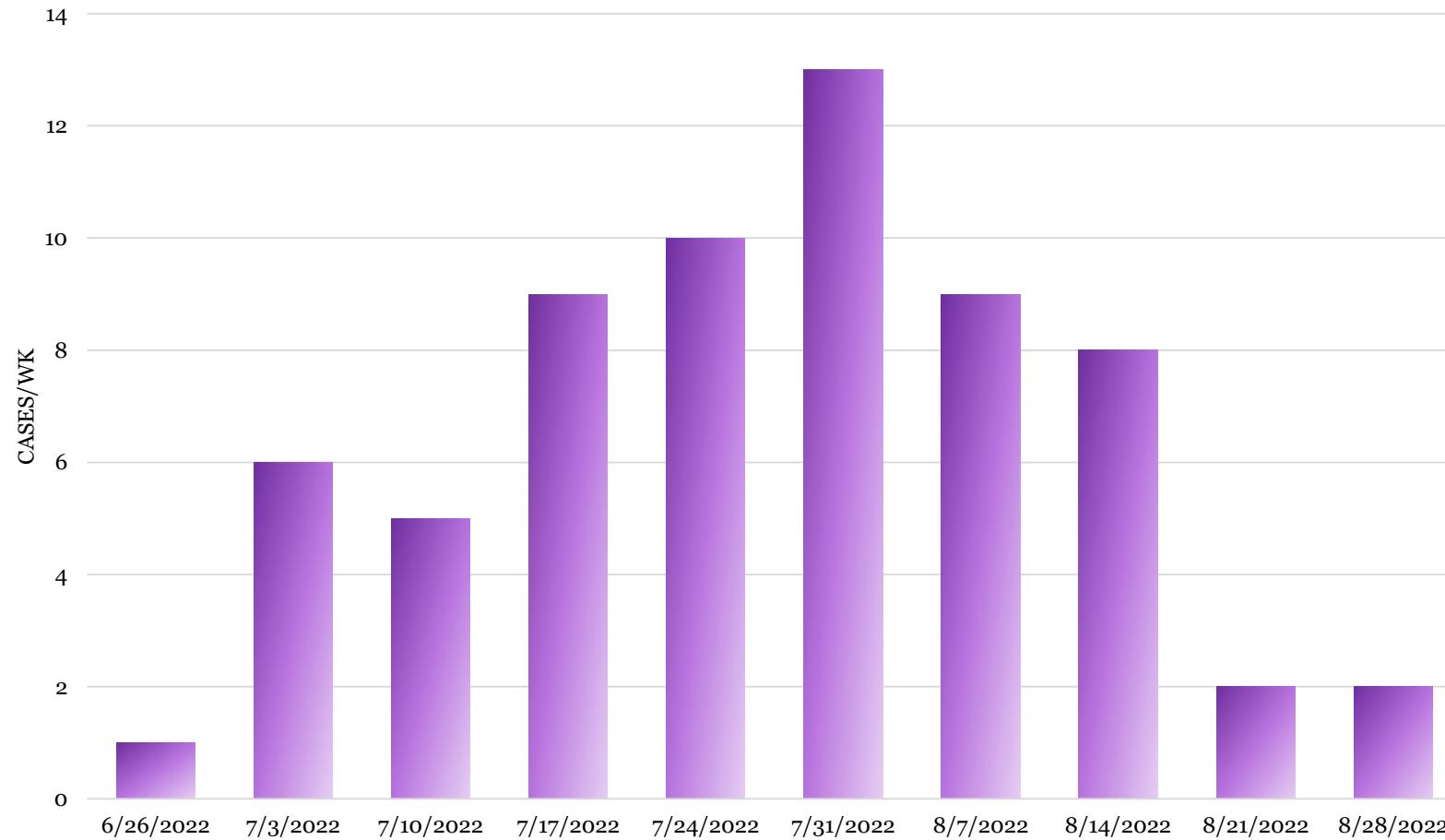
US Map of Cases



<https://www.cdc.gov/poxvirus/monkeypox/response/2022/us-map.html>

63 Confirmed cases

Wisconsin Cases



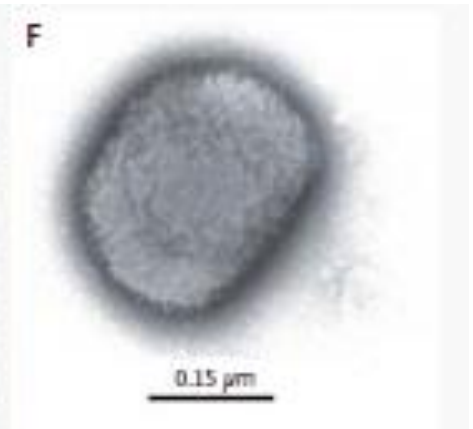
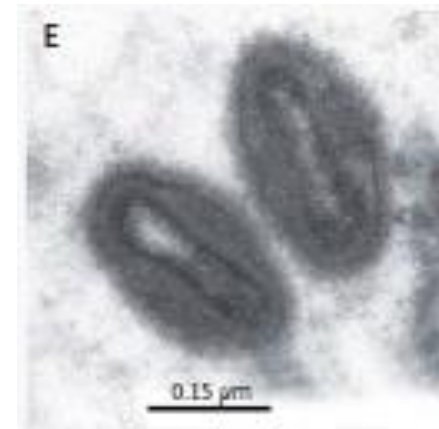
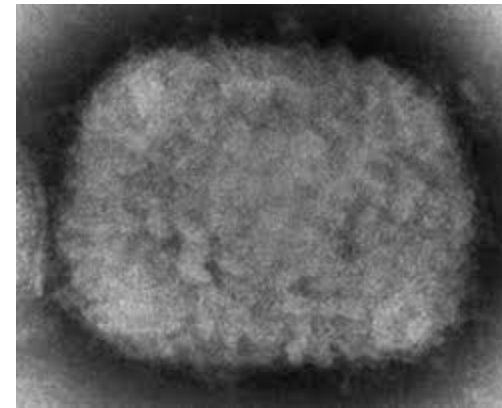


The Disease



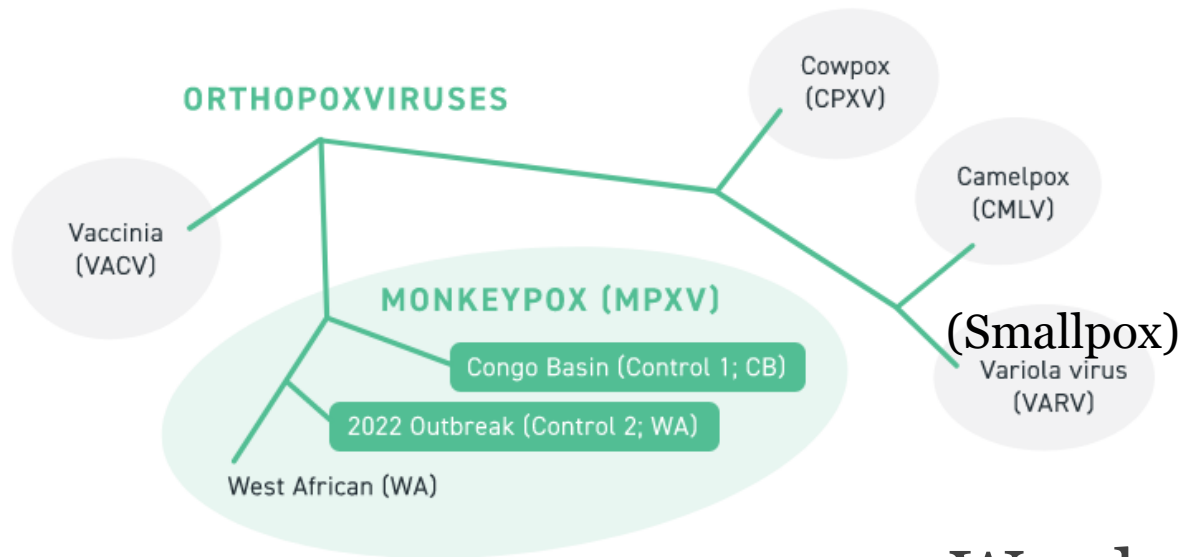
The Virus

- Enveloped, double stranded DNA virus
- Clade 1
 - Higher mortality (~10%)
 - Select Agent
- Clade 2
 - Lower mortality (~1%)
 - Not a Select Agent





Related to Smallpox



Note: This figure is not to scale.

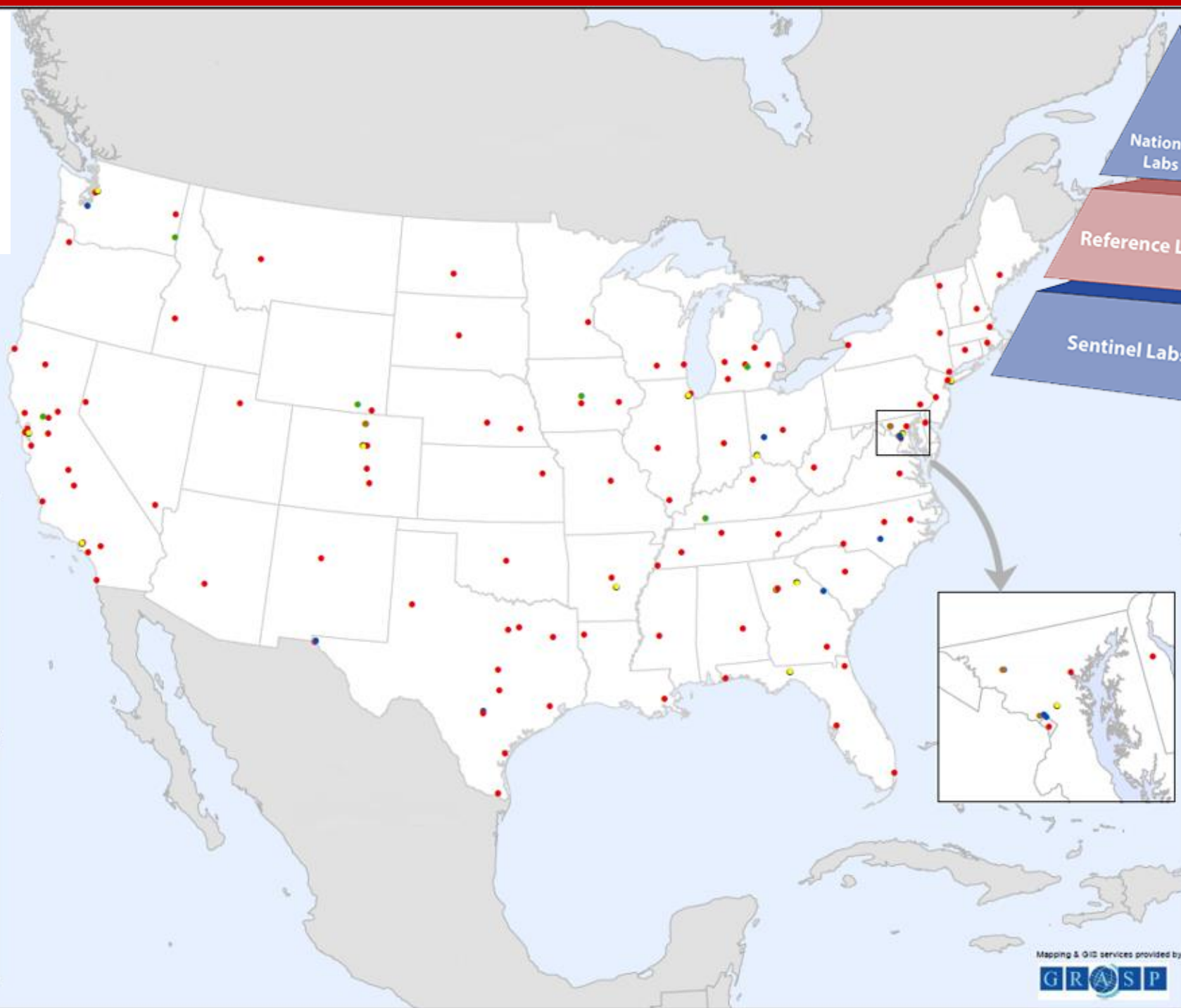


- We already had a test for orthopox viruses
- We already had a vaccine for smallpox that had been evaluated for Monkeypox

LRN

LABORATORY RESPONSE NETWORK

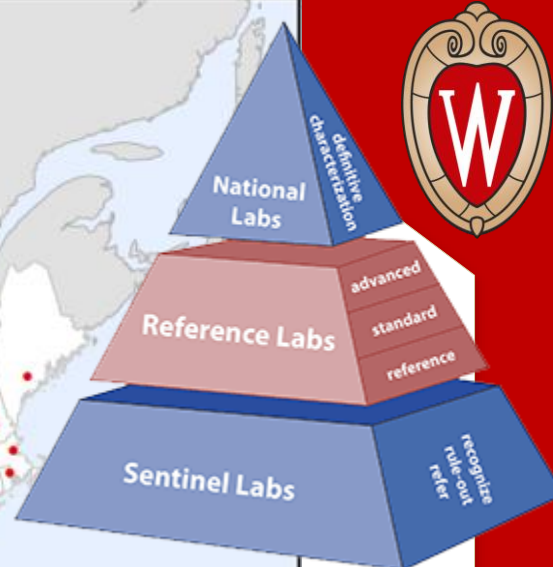
PARTNERS IN PREPAREDNESS



ALASKA



HAWAII



Mapping & GIS services provided by:



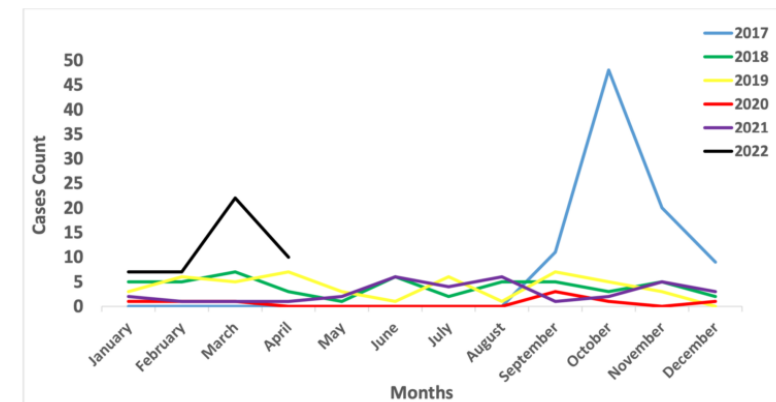


History

- First described in monkeys in 1958
- First human case in 1970. A 9 month old boy in the Democratic Republic of Congo
- Most cases have been in the Congo basin
- A few small outbreaks
- Occasional cases from travelers who had animal contact while in the region



Figure 3: Nigeria confirmed Monkeypox cases by the year of incidence- September 2017- April 2022





2003 US Outbreak

- Gambian pouched rat imported from Ghana
- The rat was co-housed with prairie dogs
- Prairie dogs sold as pets in an exotic animal market
- Sick prairie dogs bite mother and daughter
- Over 70 cases, all associated with animal contact



<https://pubmed.ncbi.nlm.nih.gov/14736926/>



The Disease



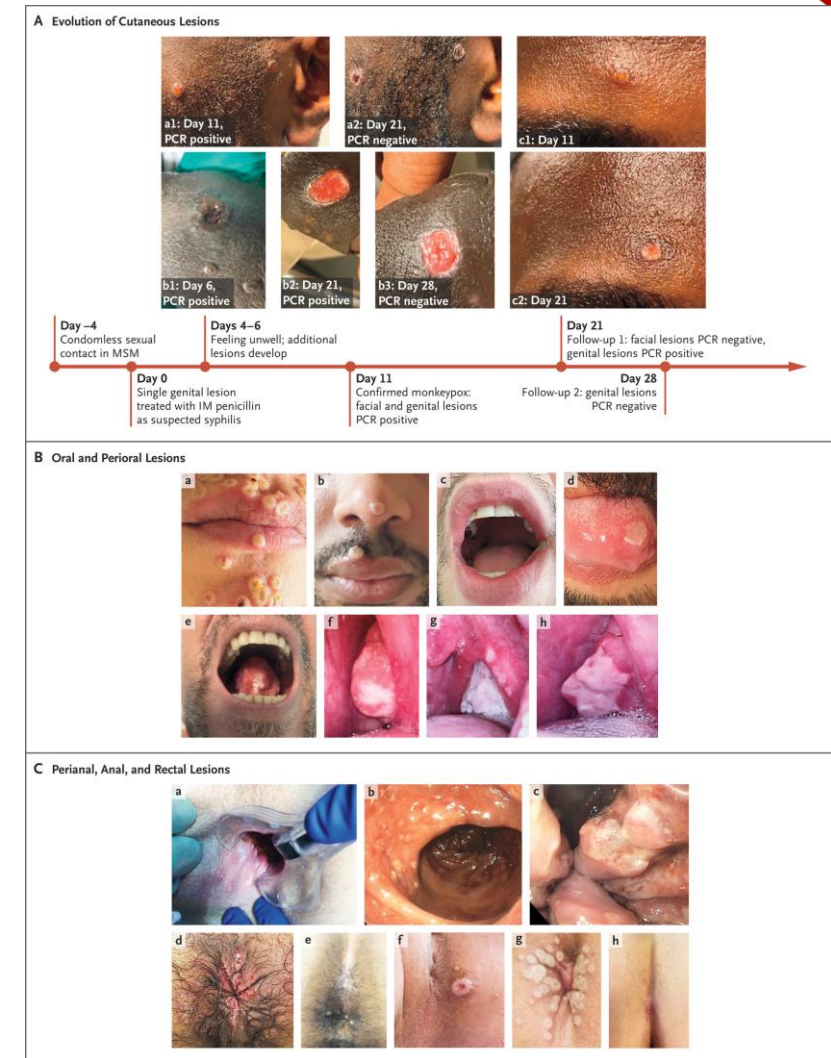
- Transmitted to humans through close contact with an infected person or animal
- Incubation period of 7.6 days
- Fever, chills, swollen lymph nodes, rash
- Firm, well circumscribed, deep-seated, and umbilicated lesions
- Lesions can occur on the palms and soles
- Monkeypox is usually a self-limited disease with the symptoms lasting from 2 to 4 weeks. Severe cases can occur, most often in immunocompromised people.





What's Different about this Outbreak

- 98% of patients identified as gay or bisexual men.
- 73% had anogenital lesions
- 1 in 10 people had a single genital lesion
- Very low death rate $<0.01\%$

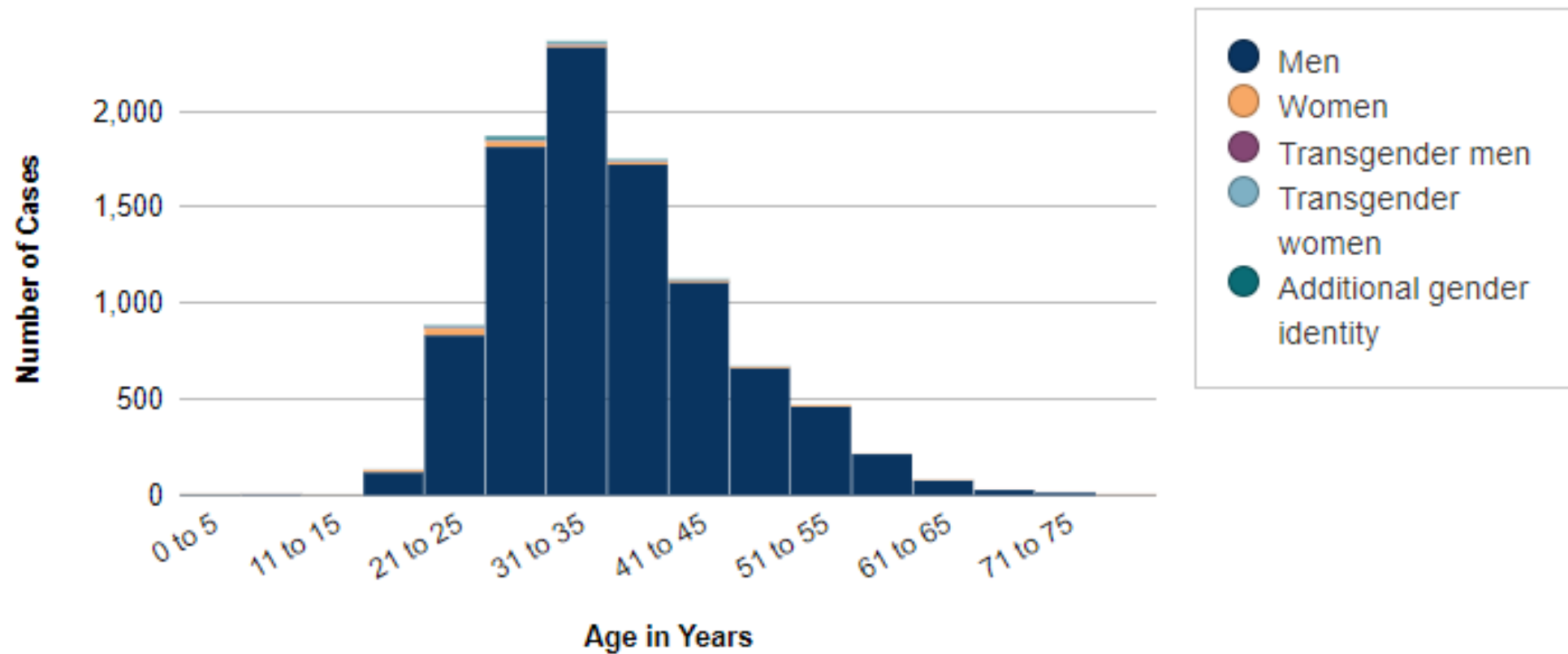


https://www.medscape.com/viewarticle/977770?src=WNL_dne9_220725_MSCPEDIT&uac=166752BK&impID=4461687&faf=1



Demographics

Monkeypox cases reported to CDC: Age and Gender

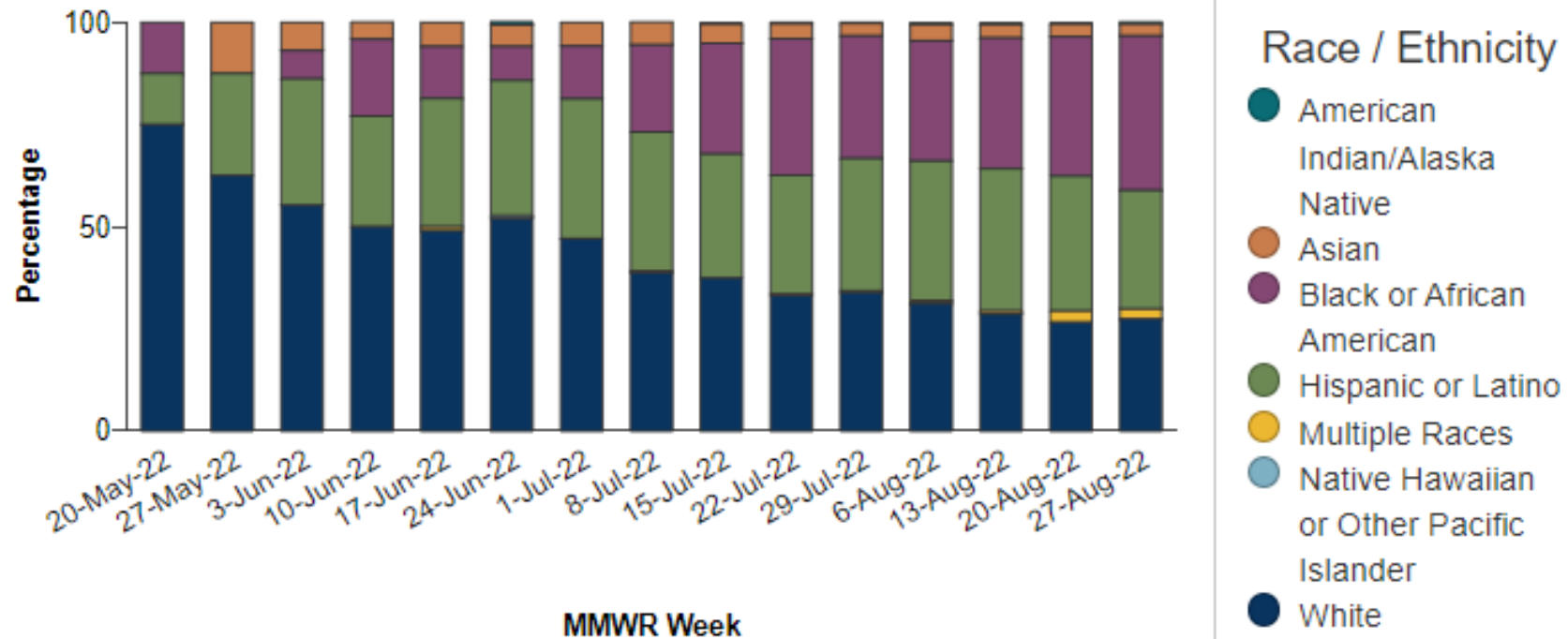


<https://www.cdc.gov/poxvirus/monkeypox/response/2022/demographics.html>



Demographics

Monkeypox cases reported to CDC: Race/Ethnicity by Week



<https://www.cdc.gov/poxvirus/monkeypox/response/2022/demographics.html>



Similar to Other Rashes

Can be confused with other diseases like Herpes, Syphilis, Chickenpox, or Molluscum

How the monkeypox rash differs from other rashes

Here's how lesions associated with monkeypox, shingles and syphilis appear up close.

Molluscum



Monkeypox

caused by the monkeypox virus



Source: Centers for Disease Control

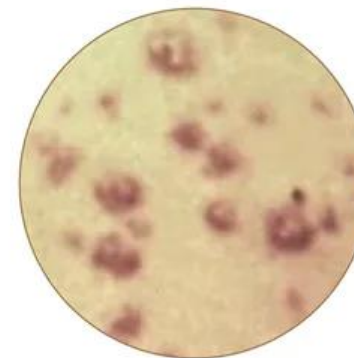
Shingles

caused by the varicella zoster virus (VZV)



Syphilis

caused by the bacterium Treponema pallidum



ALISON SALDANHA / THE SEATTLE TIMES

Chickenpox





The Response

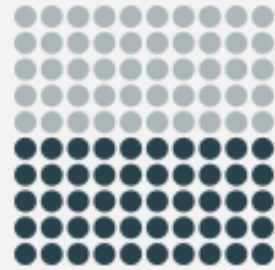


Behavior Changes



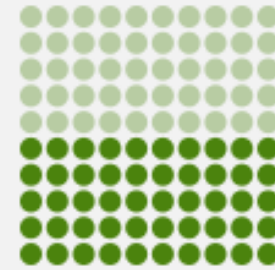
48%

reduced number of sex
partners



50%

reduced one-time sexual
encounters



50%

reported reducing sex
with partners met on
dating apps or at sex
venues

<https://emoryamis.org/>



Treatment

TPOXX (Tecovirimat)

- FDA approved for smallpox
- Over 1000 patients treated so far
- Can shorten duration and severity of symptoms
- Reserved for severely ill or patients at high risk or severe disease

Other treatments include cidofovir and Immune globulin



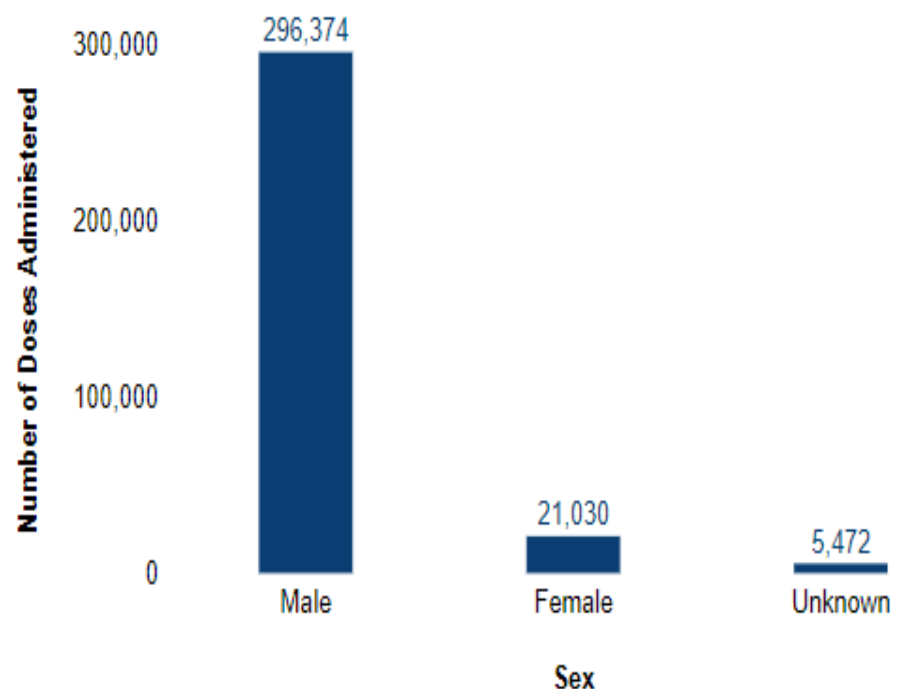
352,675

Doses Administered

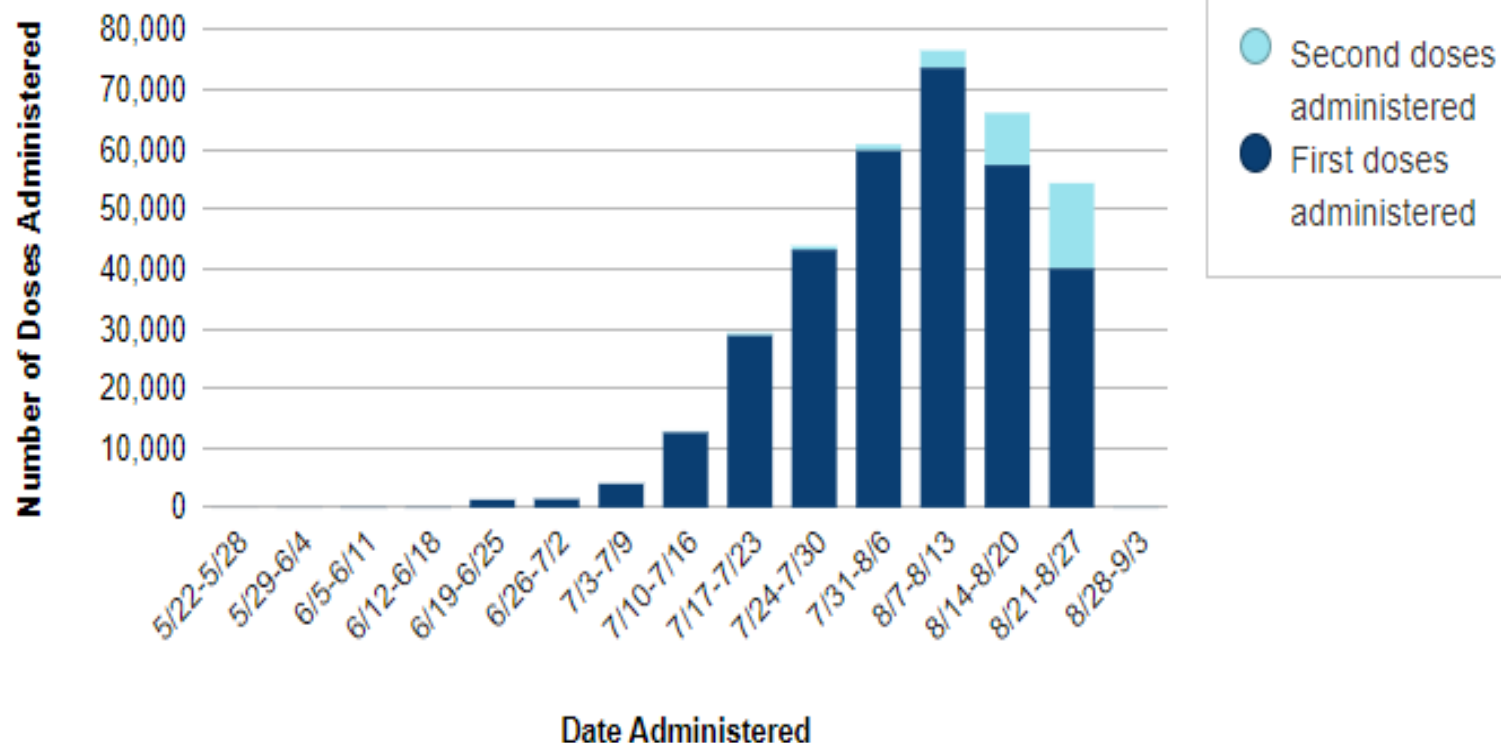
Vaccination



JYNNEOS Vaccine Doses Administered, by Sex



Total JYNNEOS Vaccine Doses Administered and Reported to CDC

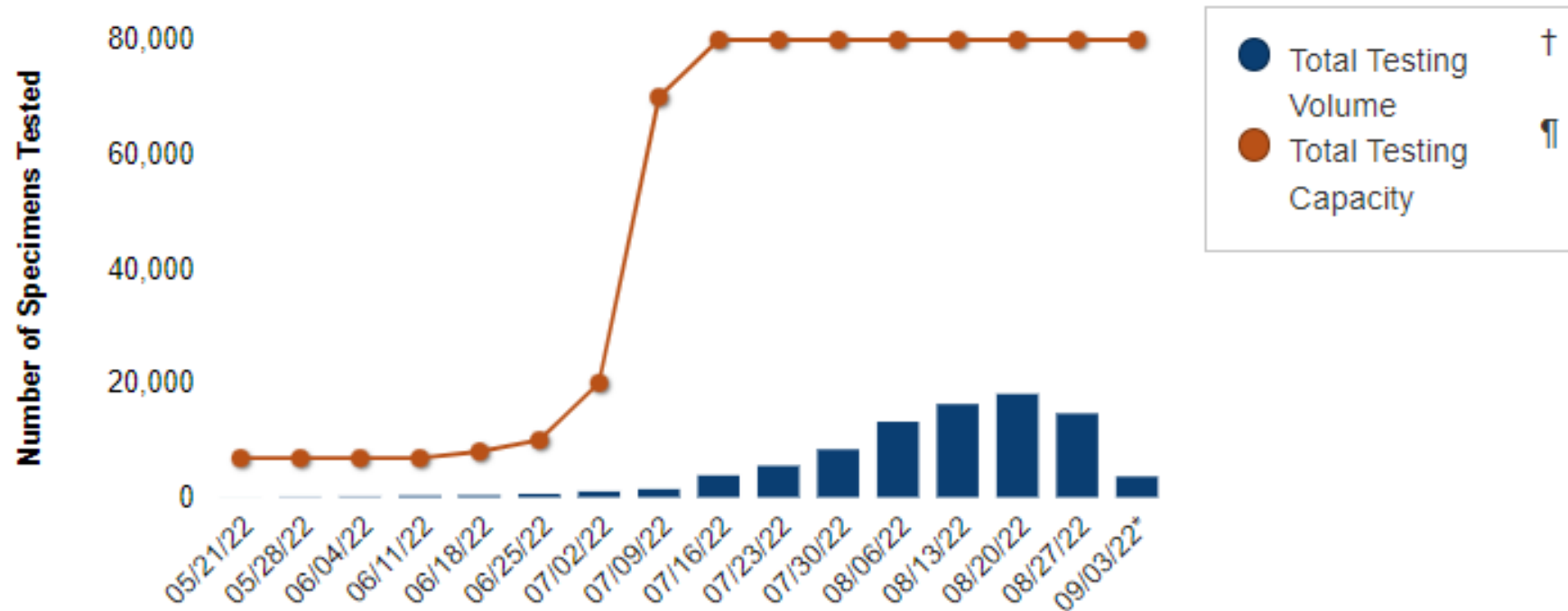


https://www.cdc.gov/poxvirus/monkeypox/response/2022/vaccines_data.html



Testing Capacity

Non-variola orthopox/Monkeypox testing: Volume[†] versus Capacity[¶]



- CDC
- WSLH
- ARUP
- Quest
- LabCorp
- Mayo

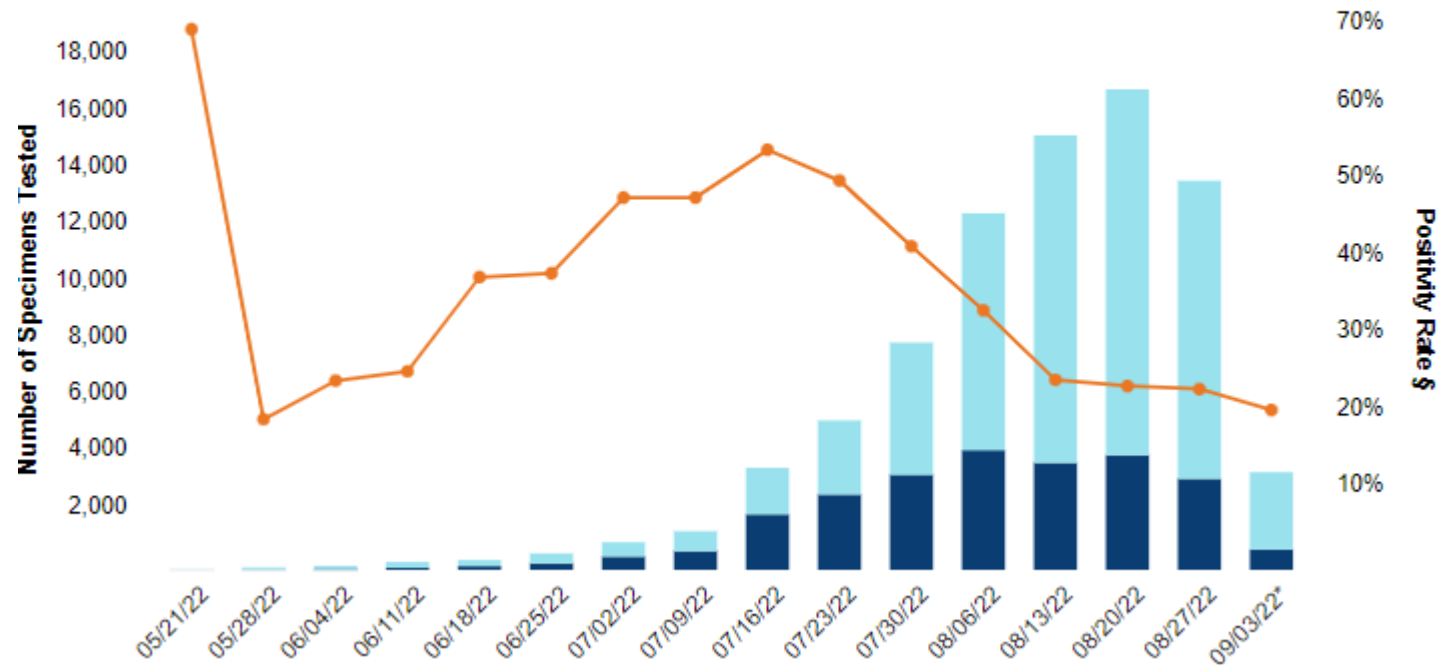


Total Specimens Tested

87,363

Tests Performed

Non-variola orthopox/Monkeypox testing from public health and select commercial laboratories †



<https://www.cdc.gov/poxvirus/monkeypox/response/2022/2022-lab-test.html>



Testing



Public Health Testing Eligibility Criteria

Patients must have lesions and symptoms consistent with monkeypox **and** meet one or more of the following public health testing criteria to qualify for fee-exempt testing at the Wisconsin State Laboratory of Hygiene.

- Patient is uninsured or underinsured (for whom cost would pose a barrier to getting tested).
- The patient's clinician is unable to send specimens to one of the commercial or clinical labs conducting monkeypox testing.
- Patient is a known contact to a monkeypox case.
- Patient reported skin-to-skin contact with someone in a social network experiencing monkeypox activity; this includes men who have sex with men.
- Other priority testing as authorized by DHS.

<http://www.slh.wisc.edu/clinical/diseases/monkeypox-2022/>



Specimen Collection



VTM



Dry,
sterile
tube



Firm,
Synthetic
swabs



Bendy,
Synthetic
swabs



Organic
swabs



Rub vigorously!

Specimen collection supply list:

- ✓ At least 4 synthetic tipped swabs
- ✓ A sterile container for each swab
- ✓ Specimen bags
- ✓ Patient labels
- ✓ Sterile gauze or other absorbent material
- ✓ EPA-registered disinfectant wipes
- ✓ Any supplies needed for basic care of the patient

<https://netec.org/2022/07/26/how-to-collect-a-monkeypox-specimen-for-diagnostic-testing/>



Packaging and Shipping



- Gold Cross Courier: **715-839-9989**
- Order by NOON for same-day pick-up for NEXT DAY delivery (Sun-Fri)
- Please hold specimen at -20C to 4C on Saturday

<https://www.cdc.gov/smallpox/lab-personnel/specimen-collection/pack-transport.html>

http://www.slh.wisc.edu/wp-content/uploads/2020/08/200730_Packaging-and-Shipping-instructions.pdf



Specimen Stability

- Refrigerate (2-8° C) or freeze (−20° C or lower) all specimens within an hour of collection.
- Specimens can be stored for up to seven (7) days from collection at 2-8° C or up to 60 days from collection at −20° C



Monkeypox testing at WSLH

CDD Customer Service: 1-800-862-1013

Clinical Orders: 1-800-862-1088

Gold Cross Courier: 1-715-839-9989

Common Questions:


- Requisition forms
- Packaging materials
- Questions about shipping or testing

WSLH Monkeypox website:

<http://www.slh.wisc.edu/clinical/diseases/monkeypox-2022/>



Want to test in your lab?

| | |
|---|--|
|  | Centers for Disease Control & Prevention Poxvirus & Rabies Branch (PRB) |
| Test Procedure: Non-variola Orthopoxvirus Generic Real-Time PCR Test | |
| Rev. No. 02 | Issued Date: 6/6/2022 |
| Page 1 of 8 | |

1. Disclaimers

The Poxvirus and Rabies Branch (PRB) developed this document as a test procedure for the non-variola *Orthopoxvirus* generic real-time PCR assay. This is not a controlled document. The performance characteristics as generated at Centers for Disease Control and Prevention (CDC) are specific to the version as written. These documents are provided by PRB laboratory solely as an example for how this test performed within the PRB laboratory. **The recipient testing laboratory is responsible for generating validation or verification data as applicable to establish performance characteristics as required by the testing laboratory's policies, applicable regulations, and quality system standards.** These data are only for the sample and specimen types and conditions described in this procedure. Tests or protocols may include hazardous reagents or biological agents. No indemnification for any loss, claim, damage, or liability is provided for the party receiving an assay or protocol. Use of trade names and commercial sources are for identification only and do not constitute endorsement by the Public Health Service, the United States Department of Health and Human Services, or the Centers for Disease Control and Prevention.

2. Purpose / Principle

The purpose of this protocol is to describe the procedure used for the detection of non-variola virus *Orthopoxvirus* DNA in clinical specimens by real-time PCR. This assay detects DNA at varying concentrations, providing a qualitative result of either positive, negative, or inconclusive in the identification of *Orthopoxvirus* infections, other than smallpox (caused by variola virus).

3. Scope

Applies to all personnel who perform *Orthopoxvirus* diagnostic testing by real-time PCR.

4. Definitions / Keywords

| Term | Definition |
|--------|-------------------------------------|
| CT | Cycle threshold |
| DNA | Deoxyribonucleic acid |
| NTC | No template control |
| PPE | Personal protective equipment |
| RNaseP | Ribonuclease P |
| RT-PCR | Real-time polymerase chain reaction |
| SOP | Standard operating procedure |
| TE | Tris-EDTA |

- [FDA approved](#) 510(k) Non-variola Orthopox PCR protocol
- Monkeypox specific PCR (Not FDA approved)

- <https://www.cdc.gov/poxvirus/monkeypox/pdf/Non-variola-Orthopoxvirus-Generic-Real-Time-PCR-Test.pdf>
- <https://www.cdc.gov/poxvirus/monkeypox/pdf/PCR-Diagnostic-Protocol-508.pdf>
- <https://pubmed.ncbi.nlm.nih.gov/20643162/>
- <https://pubmed.ncbi.nlm.nih.gov/16731033/>



Results

- Testing performed M-F
- Most results available the day of receipt
- Average time from collection to results is 2 days
- Reported to submitter and Public Health
- Testing and Shipping is fee-exempt

Positive

Negative

Indeterminate



Lab Safety

- “If a patient is being tested for monkeypox virus infection, testing to evaluate other illnesses on the clinical differential may continue while awaiting orthopoxvirus test results.”- CDC
- CDC is now recommending that any laboratorian that handles specimen suspected to contain monkeypox virus be vaccinated.
- If vaccinated staff are not available work may be conducted in a BSL2 lab with enhanced BSL3 precautions such as working in as BSC when the vessel is open and other barrier practices.

<https://www.cdc.gov/poxvirus/monkeypox/lab-personnel/lab-procedures.html>



Sequencing



- DNA virus mutates slower than COVID
- Monitoring Mutations
 - Sequencing detected a mutation in the viral TNF receptor gene from 3 cases in California.
 - This mutation caused false negative results for Monkeypox specific PCRs at two different labs.

<https://www.cdc.gov/poxvirus/monkeypox/lab-personnel/index.html>



Is it Here to Stay?

- As a zoonosis it has the potential to develop an animal reservoir outside of Africa
- Fortunately, there have only been a few rare cases of animal infections during this outbreak



| Animal | Can be infected? |
|--------------|------------------|
| Prairie Dogs | Yes |
| Squirrels | Yes |
| Grounhogs | Yes |
| Chinchillas | Yes |
| Gambian rats | Yes |
| Mice | Possibly |
| Dogs | Yes |
| Rabbits | Possibly |
| Hedgehogs | Yes |
| Shrew | Yes |
| Monkeys | Yes |
| Cats | Unknown |

[https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(22\)01487-8/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(22)01487-8/fulltext)

<https://www.cdc.gov/poxvirus/monkeypox/veterinarian/monkeypox-in-animals.html#:~:text=Monkeypox%20virus%20can%20infect%20a%20of%20animals%20can%20get%20monkeypox.>



Summary



- The Monkeypox outbreak has spread globally
- This outbreak has been largely within the MSM communities and causes a less severe disease than past outbreaks
- Testing is widely available in both public health labs and national reference centers
- The outbreak has past a peak and could be moving toward resolution.



References

- Thornhill et al. Monkeypox Virus Infection in Humans across 16 Countries — April–June 2022. N Engl J Med 2022; 387:679-691
- Monkeypox specimen collection video:
<https://netec.org/2022/07/26/how-to-collect-a-monkeypox-specimen-for-diagnostic-testing/>
- CDC Monkeypox homepage:
<https://www.cdc.gov/poxvirus/monkeypox/index.html>



Questions?