



# Monkeypox: An Overview

DUKE  CFAR  
Duke Center for AIDS Research



**DukeHealth**



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# Disclosures

- No relevant disclosures
- Discussion of off-label use of medications



## Poxviridae

Parapoxvirus

Yatapoxvirus

Molluscipoxvirus

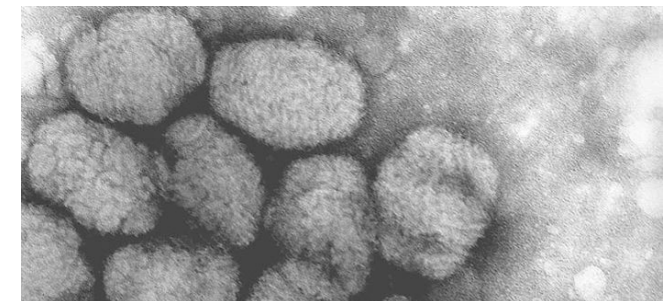
Orthopoxvirus

- Cowpox
- Horsepox
- Camelpox
- **Variola (smallpox)**
- **Vaccinia**
- **Monkeypox**



# Smallpox

- Caused by the variola virus
- Two diseases:
  - Variola major (30-50% mortality rate)
  - Variola minor (< 1% mortality)
- Spread to prolonged exposure to respiratory droplets if direct skin-to-skin contact
- Estimated 300 million people died from smallpox in the 20<sup>th</sup> century
- Variolation
- Concepts of vaccination originated from effort to protect against smallpox
- Eradicated from the US in 1940s
- Last natural case in the world: October 1977 (Somalia)
- Last reported case: September 1978 (England)

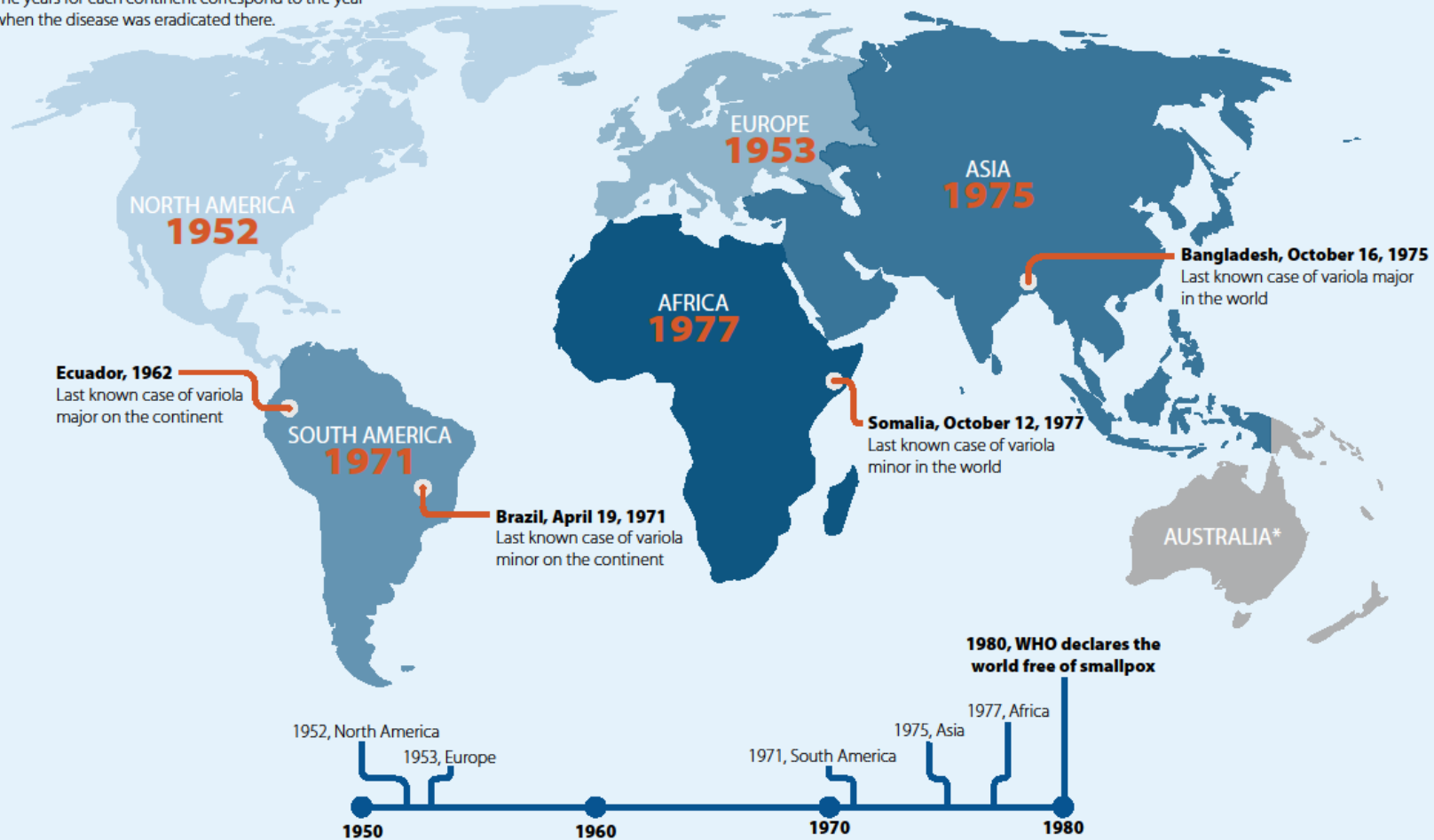




# GLOBAL SMALLPOX ERADICATION

The historically important dates highlighted in the map show countries in which the last naturally acquired cases of smallpox occurred.

The years for each continent correspond to the year when the disease was eradicated there.



\* Smallpox was never endemic (widespread) in Australia  
CS265471-A



# What happened to all the leftover vaccines?

World Health Organization (WHO)  
destroyed 99% of vaccine stockpile in late  
1980s

After September 11, many countries started  
to reaccumulate doses of smallpox vaccine  
US stockpile at the beginning of monkeypox  
outbreak

- 85 million (1<sup>st</sup> generation)
- 100 million ACAM2000 (2<sup>nd</sup> generation)
- 65,000 Jynneos (3<sup>rd</sup> generation)





## Early days: Monkeypox cases in Europe

May 7, 2022: case reported in UK in traveler from Nigeria

May 14, 2022: Two cases in a family in UK (no relation to traveler from Nigeria)

May 16, 2022: Four more cases in UK

- All among young men who have sex with men (MSM)

May 18, 2022: Five cases reported in Portugal (all MSM)

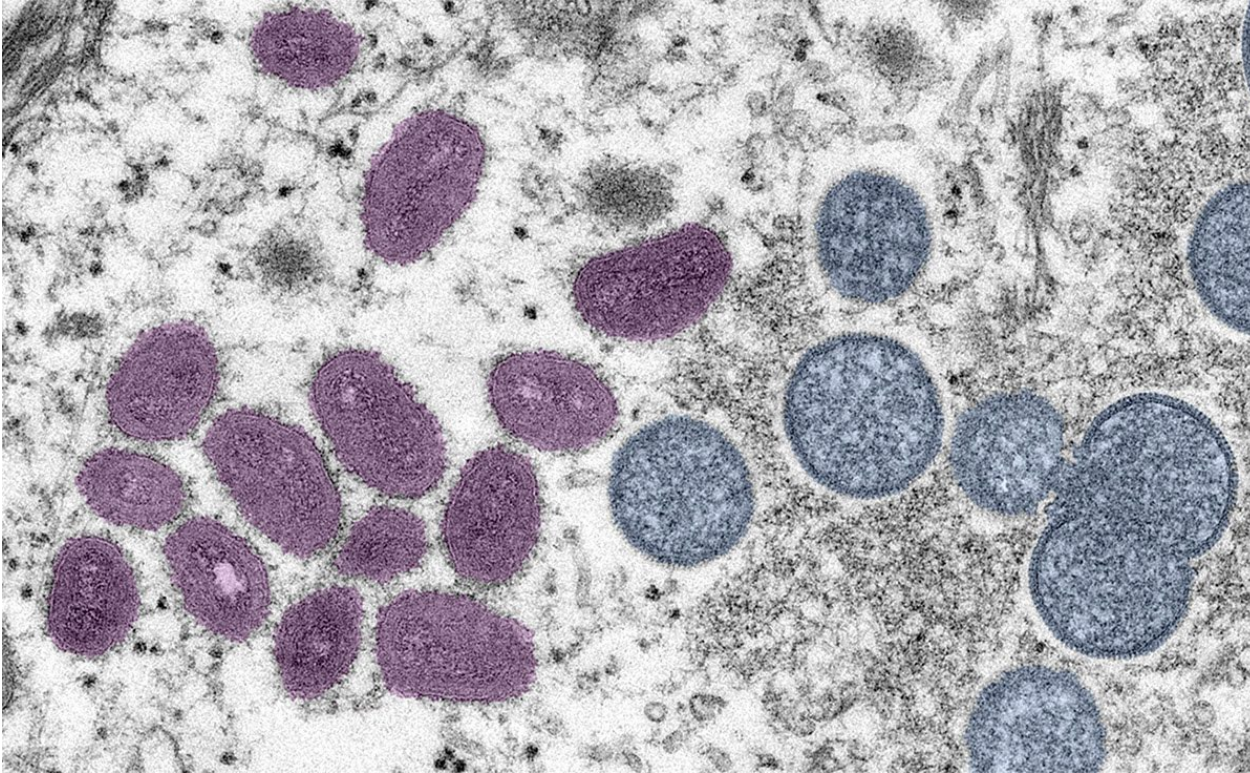
May 19, 2022: 38 confirmed cases worldwide

- Mostly in Europe (2 in Canada, 1 in US)

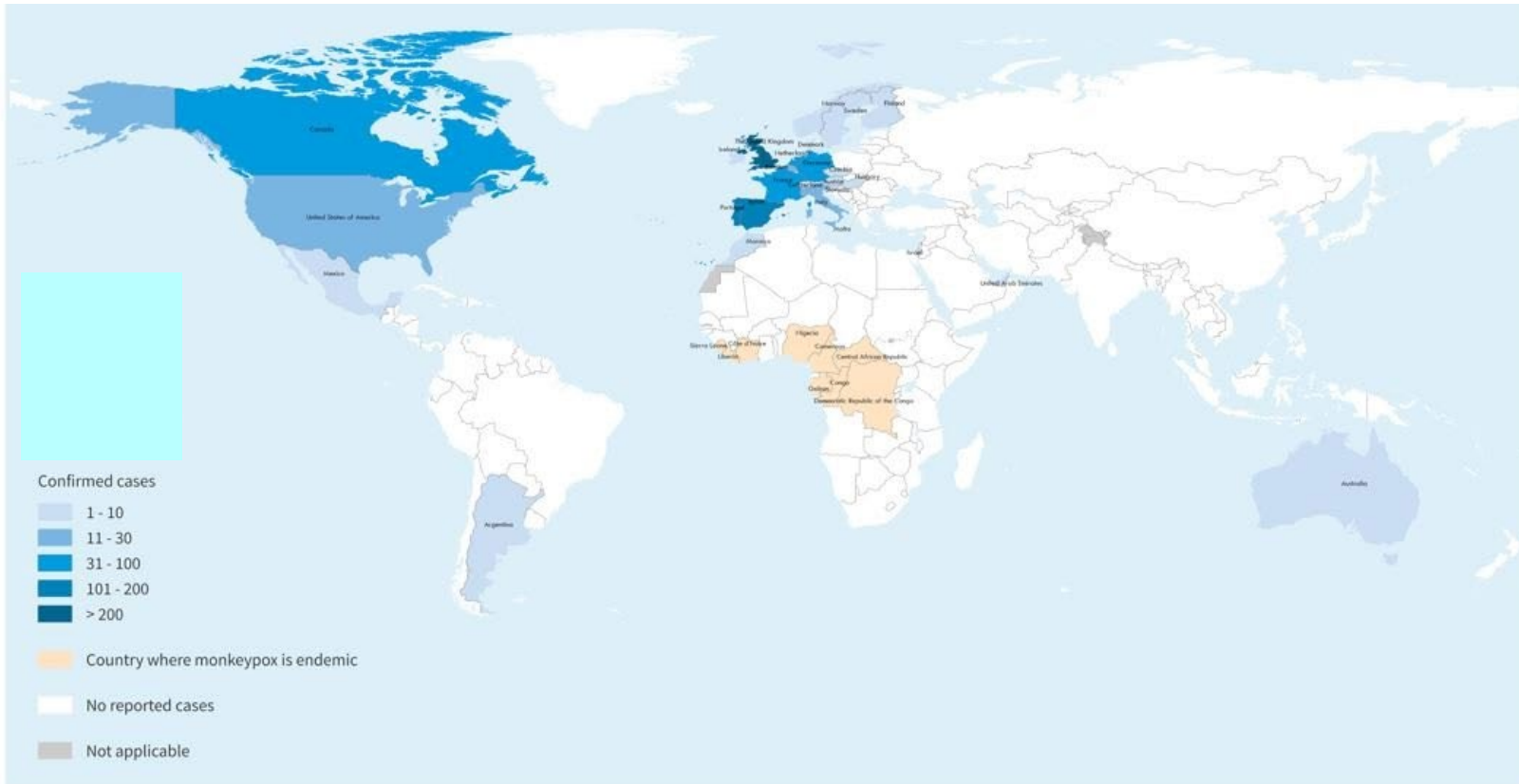


What is monkeypox?





- First identified in 1958 in Denmark, among monkeys being used for polio research (“monkeypox”)
- First human case was detected in 1970 in the Democratic Republic of Congo
- Where the virus persists in nature is unknown, but large rodents indigenous to Africa are suspected
- Virus can affect a wide range of mammals including monkeys and humans
- Sporadic outbreaks among travelers to endemic areas
  - 2003 outbreak in six Midwestern states
    - 71 total cases (35 confirmed)
    - No deaths
    - Linked to prairie dog distribution center in Illinois (shipment from Ghana in April 2003)



## Two clades of virus:

- Clade 1 (predominant in Central Africa)
  - More severe disease
- Clade 2 (predominant in West Africa)
  - Less severe disease

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization  
Map Production: WHO Health Emergencies Programme  
Map Date: 3 June 2022



# Transmission

- Although monkeypox can be transmitted by prolonged skin-to-skin contact (including sex), **monkeypox is NOT a sexually transmitted disease**
- Animal-to-human transmission, human-to-animal and human-to-human transmission are possible

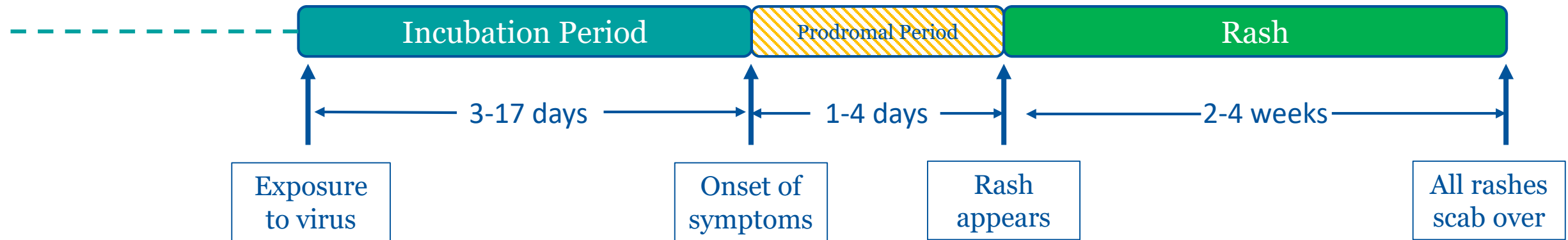


## Human-to-human transmission

- Direct contact with skin lesions or body fluids of infected person
- Contact with clothing, bedding or towels of someone with monkeypox
- Contact with respiratory secretions of someone with monkeypox in their mouth
- Hugging, kissing, massage
- Oral, anal and vaginal sex of someone with monkeypox
- Prolonged face-to-face contact
- Pregnant mothers can transmit to their fetus



- Fever
- Fatigue
- Swollen lymph nodes
- Headache
- Muscle aches

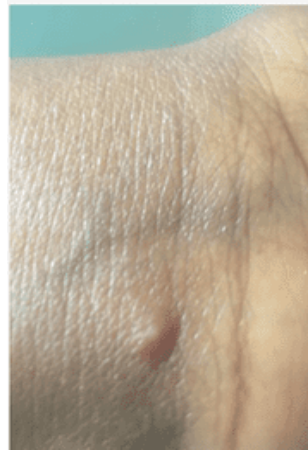


- Only about 72% of patients report prodromal symptoms
- Almost half report rectal symptoms (proctitis, rectal bleeding, rectal pain)



Macule

1-2 days



Papule

1-2 days



Vesicle

1-2 days



Pustules

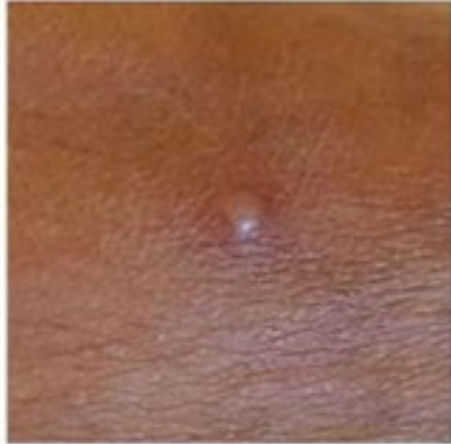
5-7 days



Scabbed lesion

7-14 days

2-4 weeks





- Genital lesions are possible and common
- Lesions are very painful





# CDC Isolation Recommendations

During prodromal period: stay at home

While rash is present:

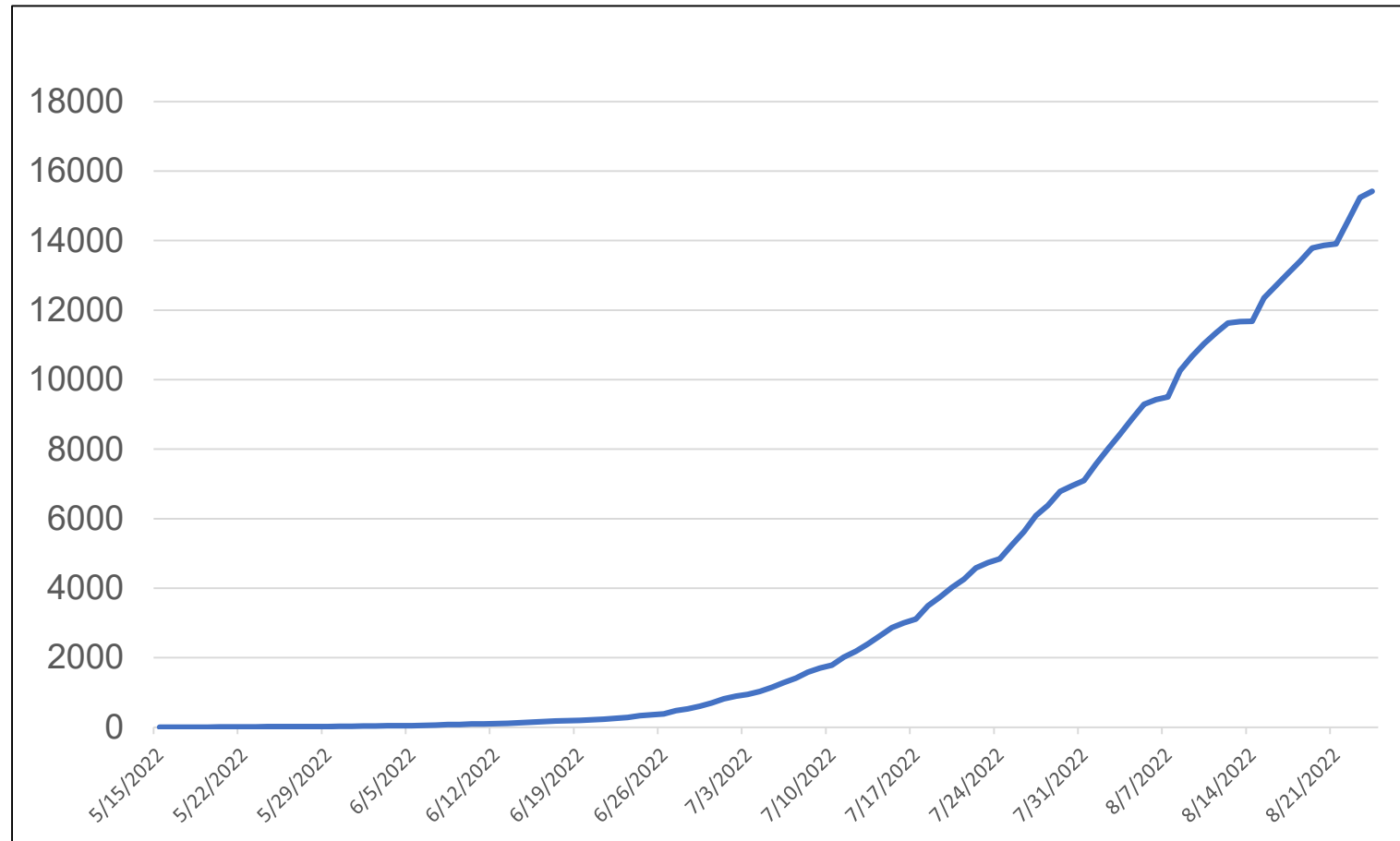
- If you can, stay at home
- If you can't stay at home
  - Cover all lesions with clothing
  - Wear a well-fitting mask
  - Do not share items of clothing, utensils, beddings with others
  - Avoid large crowds

You can discontinue all precautions once all lesions have scabbed over

Typical duration: 2-4 weeks



How worried should I be about this?



Confirmed Monkeypox Cases, United States (May 15 – Aug 24, 2022)



## Confirmed Cases

**41,358**

Total Cases

**40,971**

in locations that have not historically reported monkeypox

**387**

in locations that have historically reported monkeypox

## Locations with cases

**94**

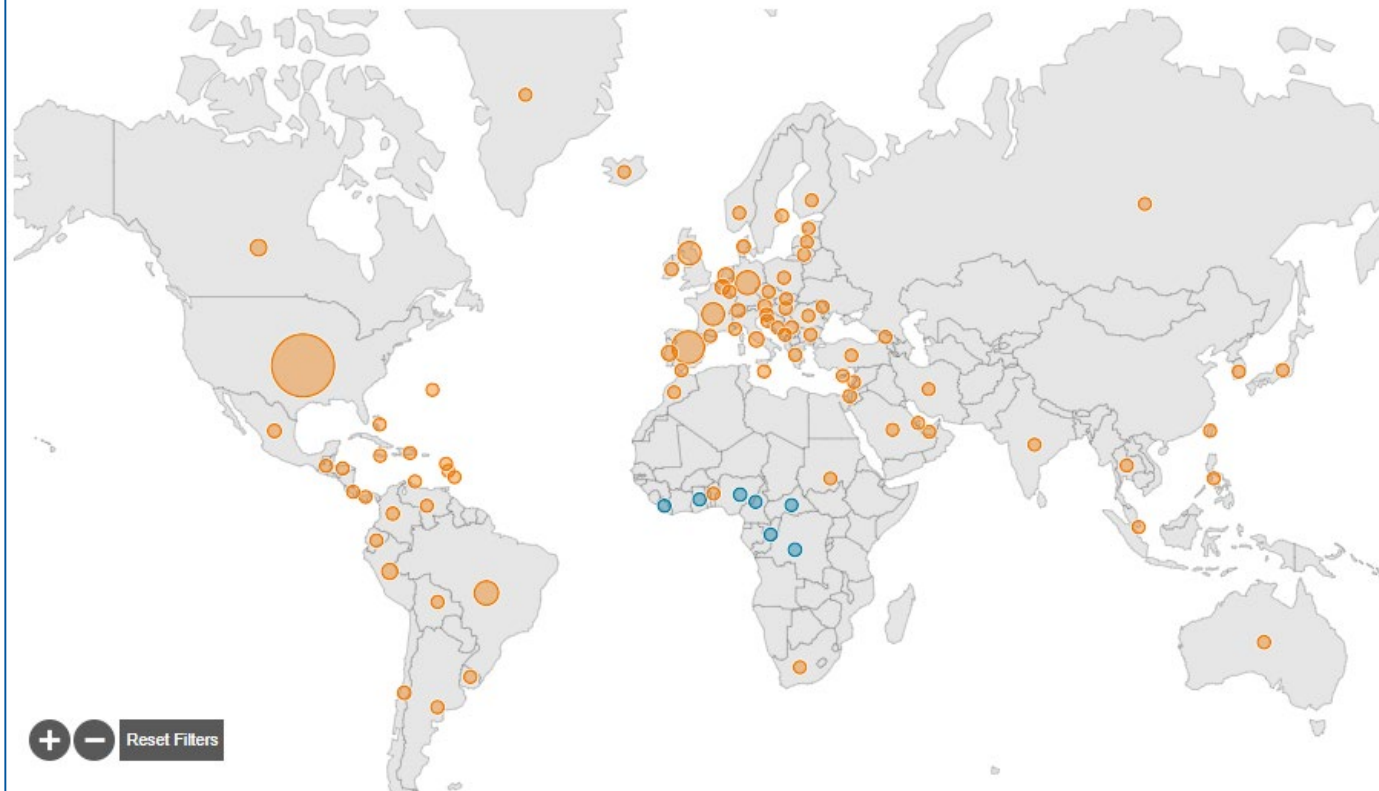
Total

**87**

Has not historically reported monkeypox

**7**

Has historically reported monkeypox



Legend

● Has not historically reported monkeypox

● Has historically reported monkeypox



# Prognosis

## United States:

- 14,594 cases as of 8/19/2022
- No deaths
- Most hospitalizations due to need for isolation, and symptom relief (ie pain control)

## Risk factors for severe disease

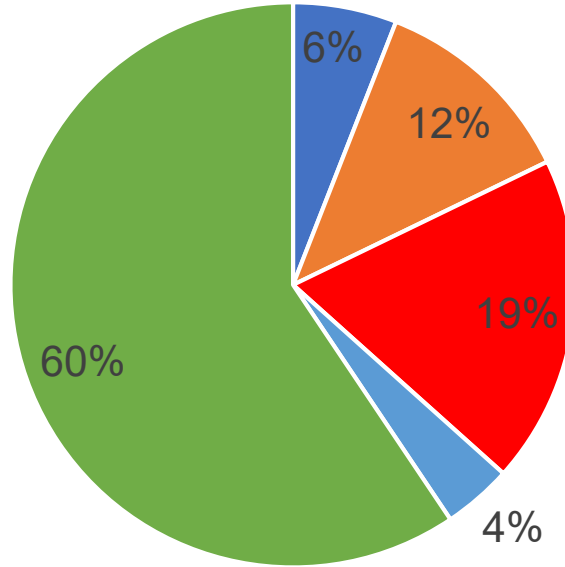
- Immunocompromised
- Children
- Pregnant or breastfeeding women
- People with eczema or other severe skin conditions



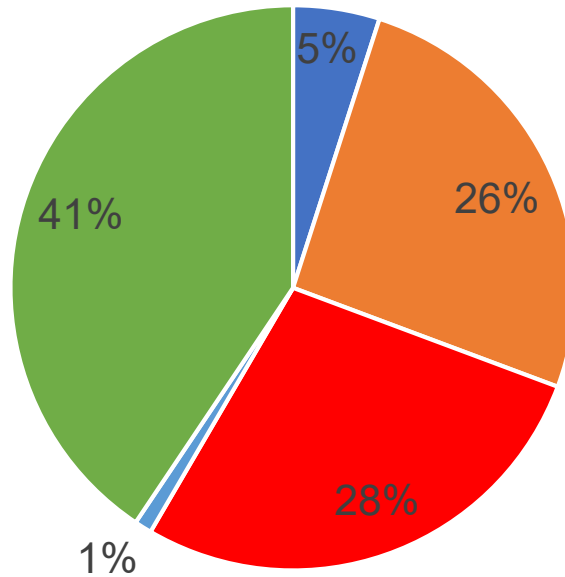
# Racial Disparities in Monkeypox Outbreak, 2022



- Asian, not Pacific Islander
- Black/African American
- Hispanic/Latinx
- Other/Multiracial
- White
- Not available



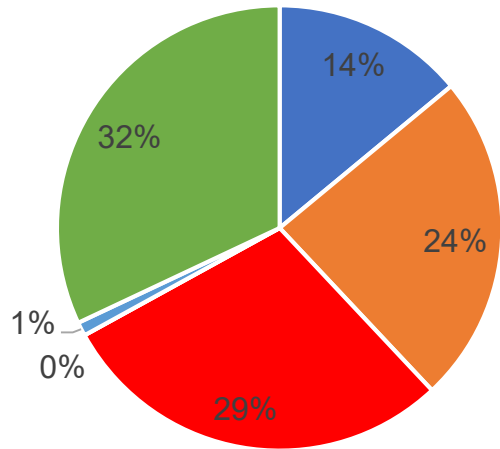
US Population



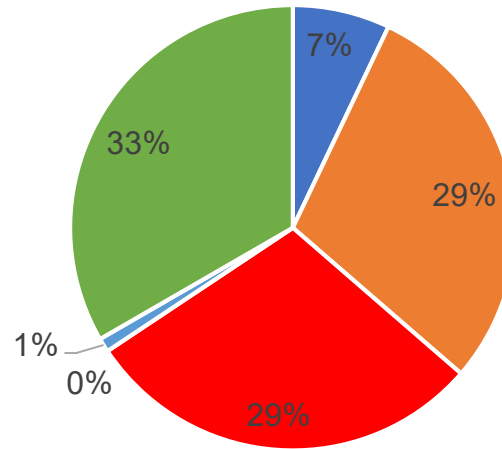
Monkeypox Cases, US



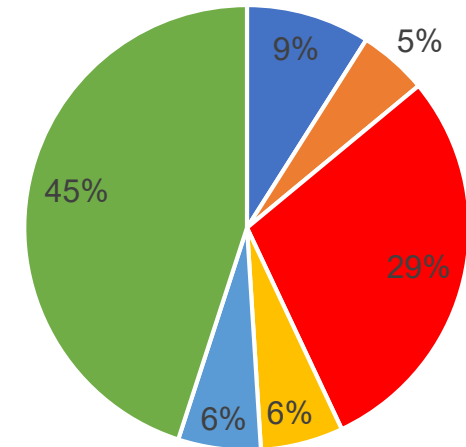
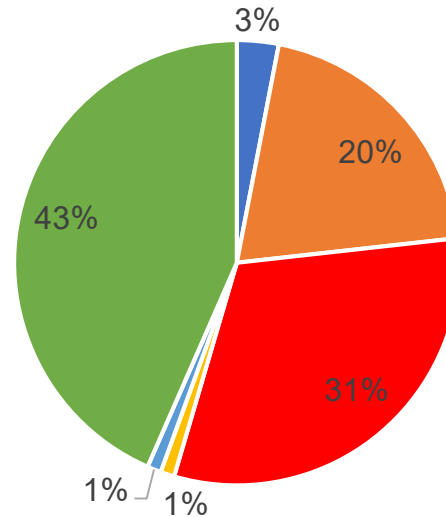
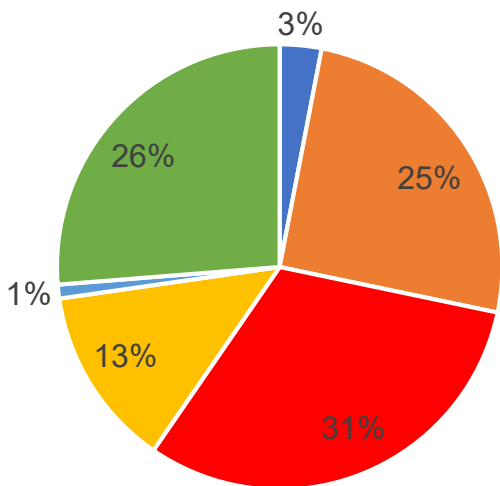
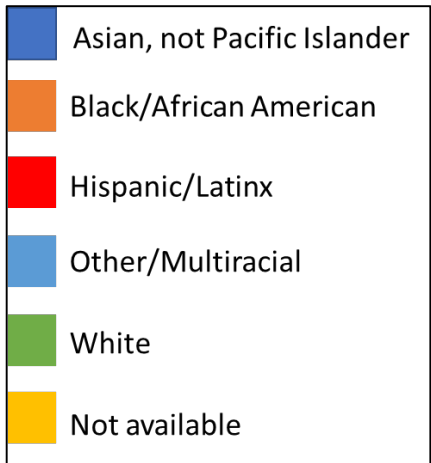
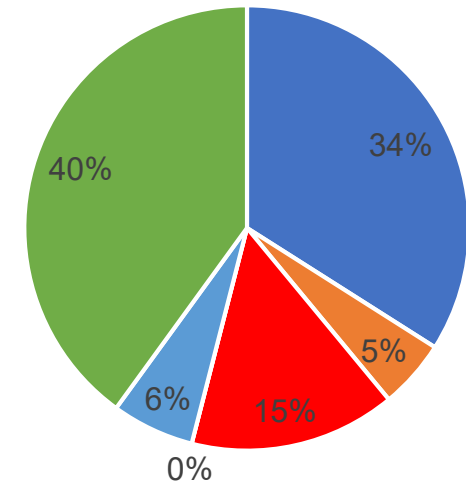
New York



Chicago



San Francisco

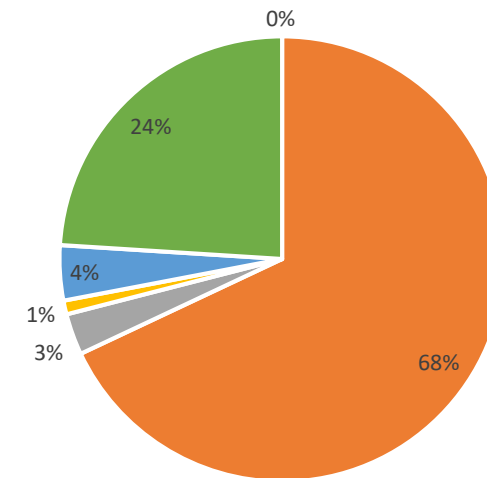
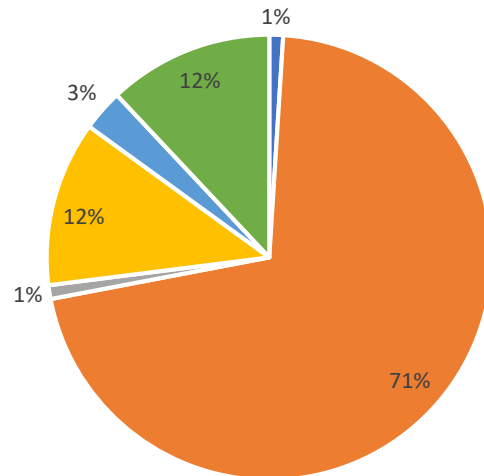
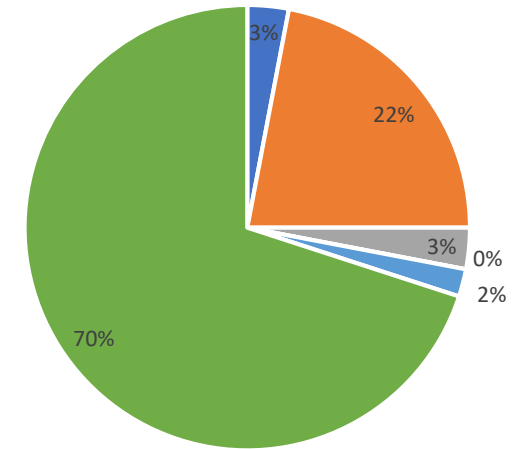
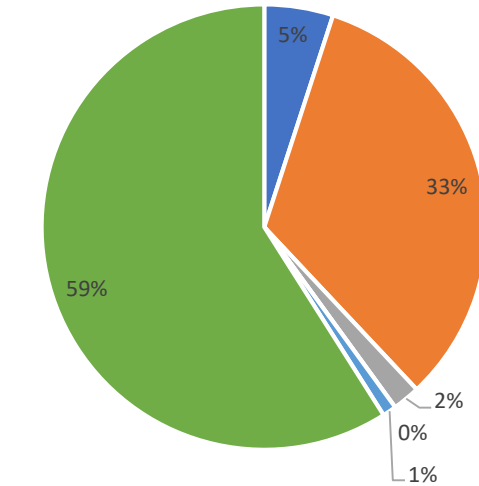






## Georgia

## North Carolina





What about the vaccines?



## Poxviridae

Parapoxvirus

Yatapoxvirus

Molluscipoxvirus

Orthopoxvirus

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- Horsepox
- Camelpox
- **Variola (smallpox)**
- **Vaccinia**
- **Monkeypox**



# What happened to all the leftover vaccines?

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US stockpile at the beginning of monkeypox outbreak

- 85 million (1<sup>st</sup> generation)
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# Vaccination against Monkeypox

- Smallpox vaccines are generally effective in preventing monkeypox
- Smallpox vaccines are amongst the oldest, most-established vaccines available
  - **These ARE NOT new vaccines**
- Both vaccines available use vaccinia virus
  - ACAM2000
  - Jynneos
- Available through emergency use authorization through the FDA



# Modified vaccinia Ankara (Jynneos)

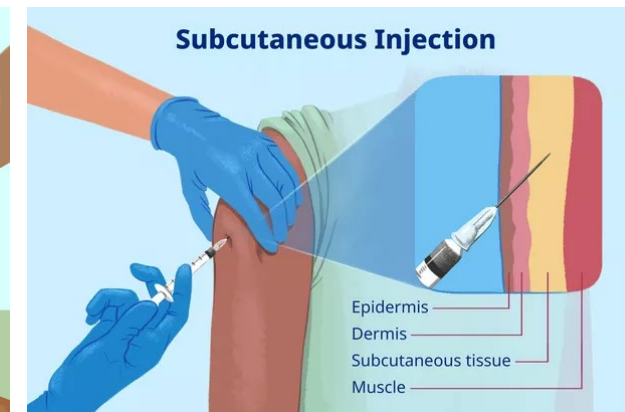
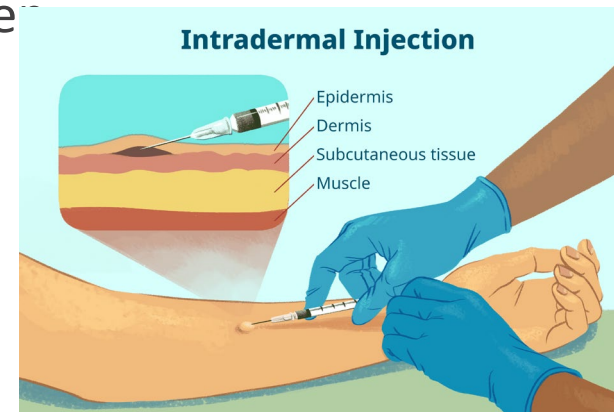
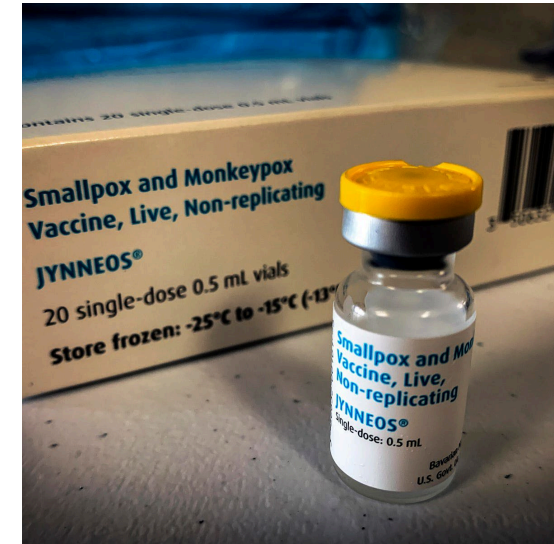
Made with a live, non-replicating vaccinia virus

Injected as two subcutaneous or intradermal doses at four weeks apart

Excellent safety profile; common side effects include

- Injection site reactions
- Headache
- Muscle pain
- Swollen lymph nodes

Duration of immunity given by this vaccine has not been studied





## Vaccinia Virus Vaccine (ACAM 2000)

Uses live, replication-competent virus

Administered **as a single dose** by scarification

- Two-pronged needle penetrates outer skin 15 times over shoulder
- Papule → Vesicle → Scar

Mild fever within two weeks of vaccination is common (10-15%)

- Severe complications in 75 per million doses administered

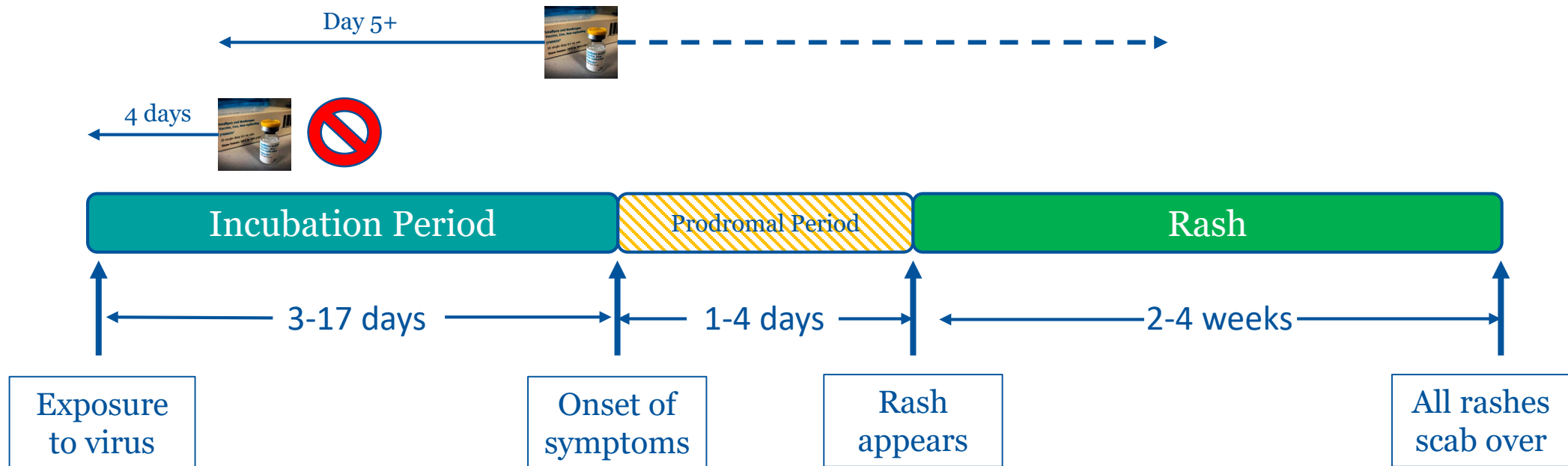
Vaccination site holds transmissible live virus for up to two weeks

**CDC recommends against its use in persons with HIV**





# Post-exposure prophylaxis (PEP)







# Tecovirimat (Tpoxx)

- Can be considered for persons at high-risk for severe disease
  - Children under age 8
  - Immunocompromised
  - Pregnant or breastfeeding women
  - Persons with severe skin conditions
- Typically administered as capsule 600mg every 12 hours for 14 days
- Data on efficacy is mostly from animal studies
- Can be requested from state/local health departments by your provider
- The earlier given the better
- Adverse reaction: Headaches, nausea, abdominal pain, vomiting





# Special Considerations: HIV and Monkeypox

- 28-51% of monkeypox cases in current outbreak are amongst persons with HIV
- Persons with advanced or uncontrolled HIV are at higher risk of severe disease from monkeypox
- No evidence that persons with well-controlled HIV and a robust CD4 count are at higher risk of severe disease

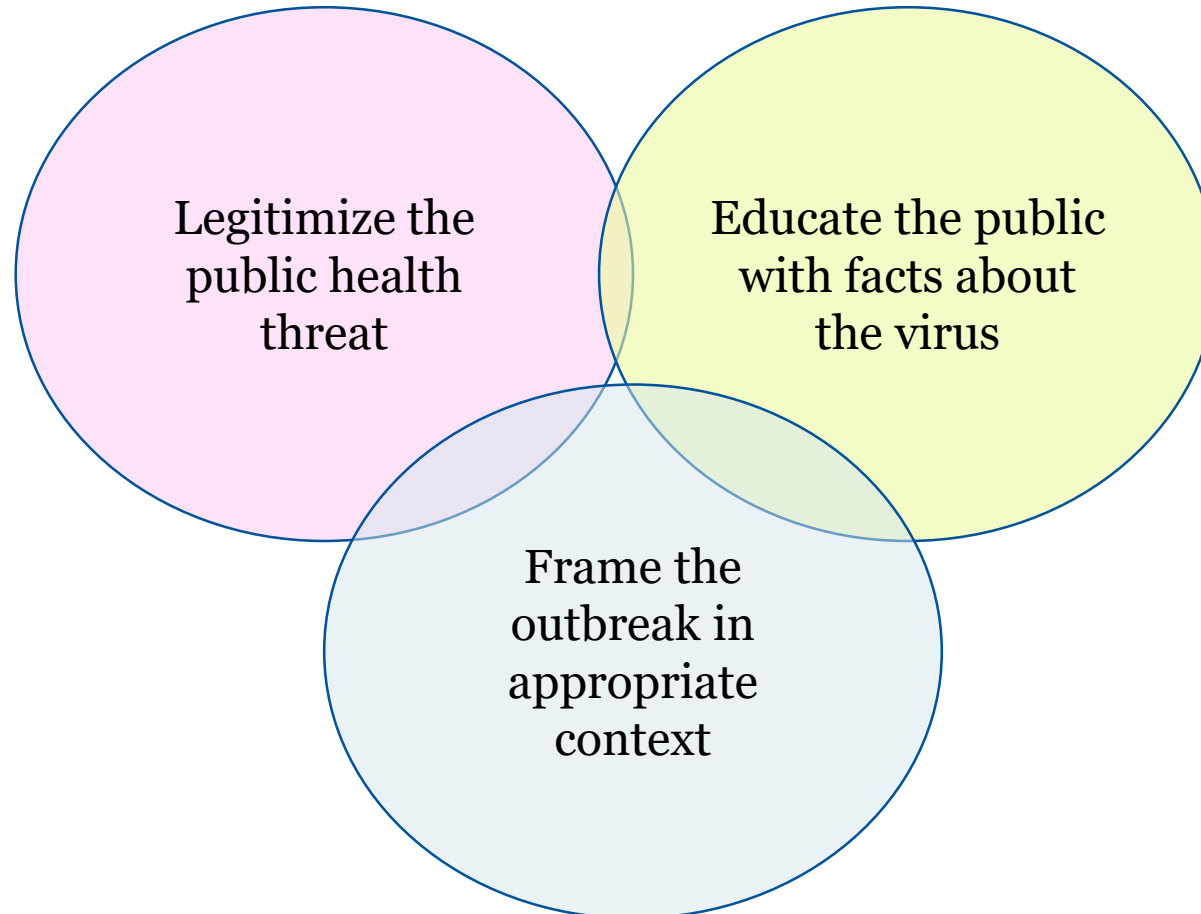


# Special Considerations: HIV and Monkeypox

- Antiretroviral therapy should NOT be discontinued while infected with monkeypox
- There are few drug-drug interactions between Tpoxx and ART
- There are no known drug-drug interactions between ART and monkeypox vaccine
- Jynneos can be used in persons with HIV, regardless of immune status
- **ACAM2000 vaccine should be avoided**

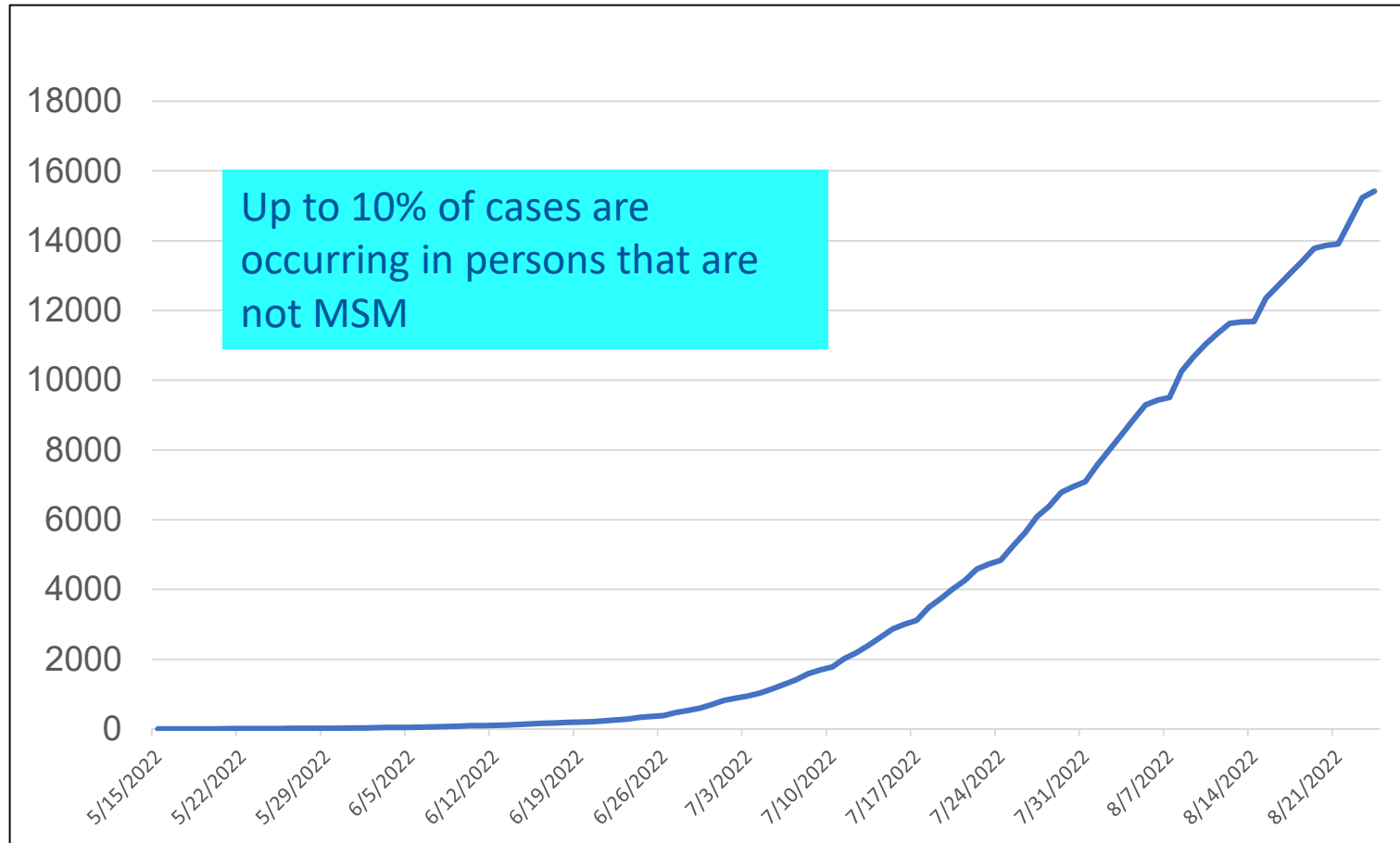


# Combatting stigma in the monkeypox outbreak





Legitimize the public health threat



Confirmed Monkeypox Cases, United States (May 15 – Aug 24, 2022)



# Debunking Common Myths about Monkeypox

Monkeypox is **NOT** a new disease

The monkeypox vaccine is **NOT** new

You **CANNOT** get monkeypox from being in a crowd

Monkeypox is **NOT** deadlier than COVID

Monkeypox is **NOT** more contagious than COVID



## Debunking Common Myths about Monkeypox

Having chickenpox as a child does **NOT** prevent against monkeypox

Monkeypox was **NOT** created in a lab

The Jynneos vaccine and Tpoxx treatment **ARE** safe in persons with HIV

**Anyone** who does not have immunity can get monkeypox

Monkeypox is **NOT** an STI



0

deaths attributable to monkeypox in the  
United States





## If I think I have monkeypox, where should I go?

- Primary care provider
- Local health department
- Local urgent care/emergency department



<https://www.hanc.info/resources/sops-guidelines-resources/monkeypox.html#monkeypoxhiv>