Mpox Vaccines

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Sentara®

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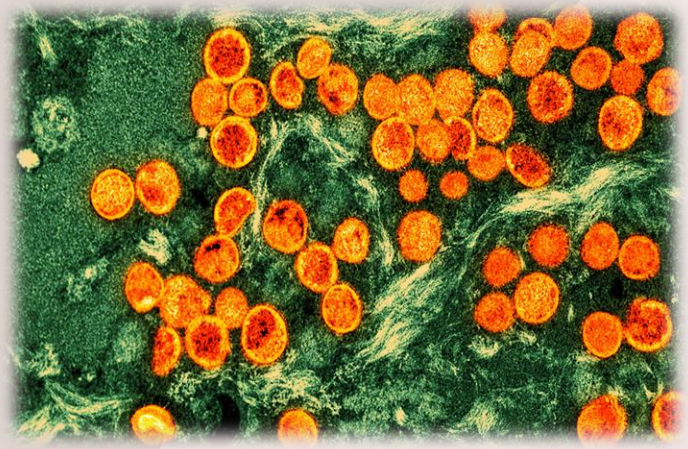
Learning Objectives

- Describe mpox virus outbreak evolution
- Describe prevention and control strategies for mpox, including vaccination
- Identify strategies to increase vaccination in eligible people
- Describe strategies to incorporate mpox vaccination into routine HIV/STI testing and care

Mpox Vaccines



1. Mpox Virus
2. Vaccination History
3. Jynneos Vaccine and Strategies
4. Biological Security
5. Resources

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Mpox Virus

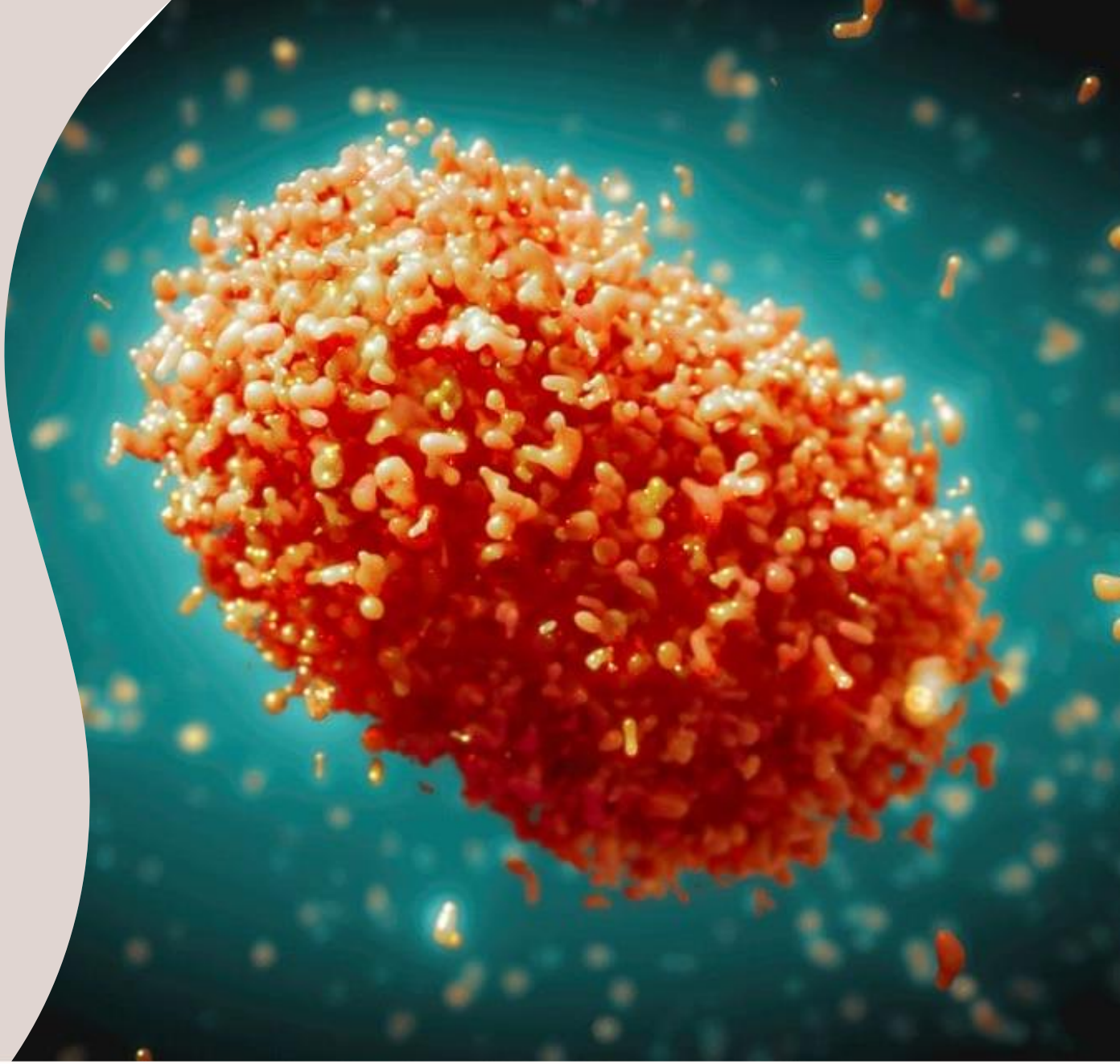
MPXV

Family: *Poxviridae*

Subfamily: *chordopoxvirus*

Genus*: orthopoxvirus*

Clade: *II b (West Africa)*



Monkeypox Name Origin

Rhesus Macaque

- 1958: Monkeypox virus MPXV was isolated and identified in laboratory primates (transported from Singapore) in Copenhagen, Denmark before it was recognized as a zoonosis in August 1970 in Congo (DRC).
- On November 28, 2022, the World Health Organization (WHO) announced that it would begin to use the preferred term "**mpox**" as a synonym for monkeypox.

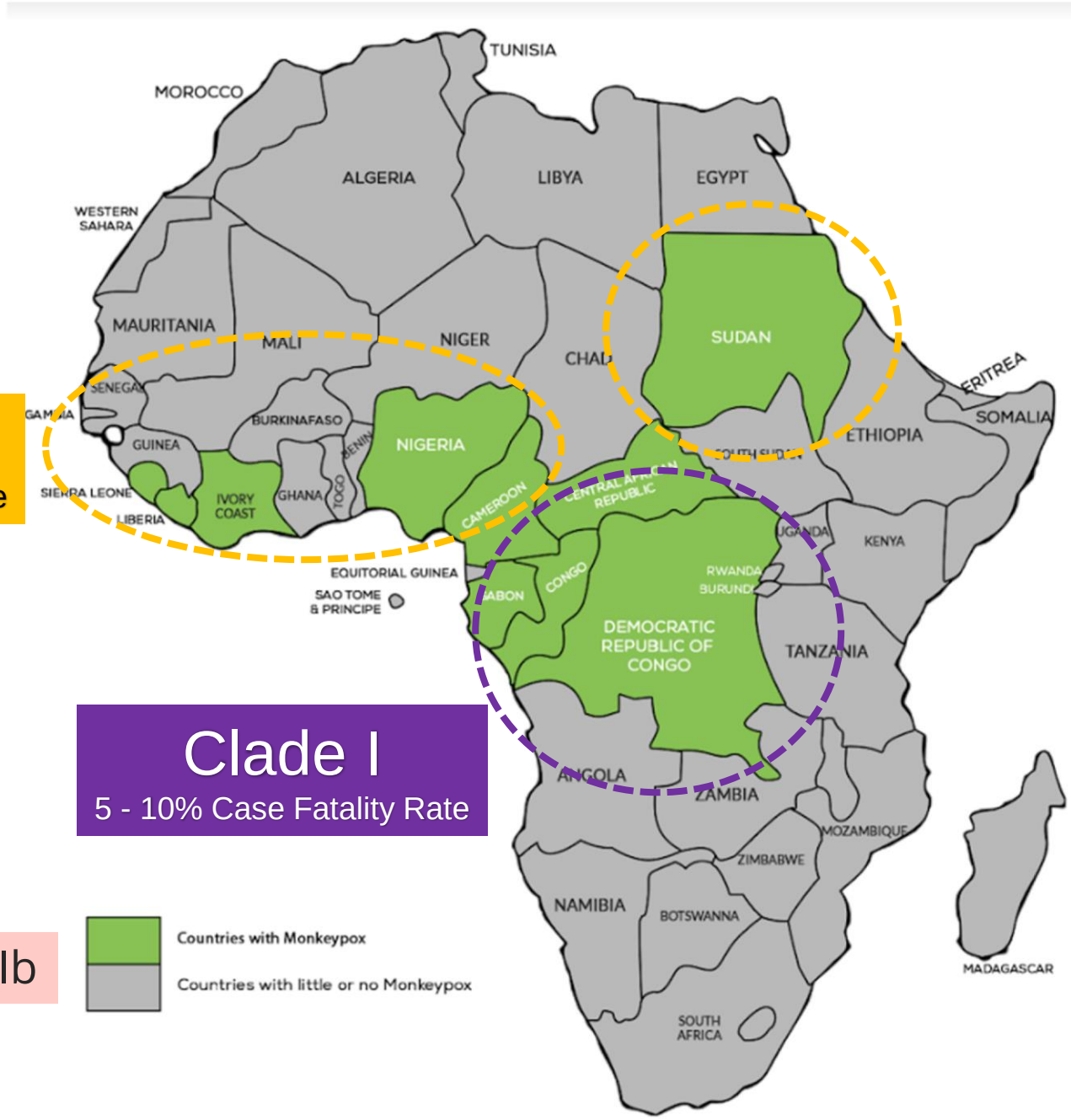

African Dormouse


Prairie Dog

Mpox Endemic Countries

Clade II
<1% Case Fatality Rate

Clade I
5 - 10% Case Fatality Rate



Virulence: Clade I > Clade IIa > Clade IIb

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Mpox

- Mpox (MPX) is a zoonotic disease caused by the Monkeypox virus (MPXV) (Poxviridae: Orthopoxvirus), which is endemic to Central and Western African countries
- While smallpox was eradicated in 1980, Mpox continues to occur in countries of Central and West Africa.
- Clade I (Congo Basin/Central Africa) 
- Clade II (West Africa) 

MPOX outbreaks

 1970 Democratic Republic Of Congo (DRC) and 5 African nations (47 cases) Increased incidence in Children < 8 years

 1996–97 Democratic Republic Of Congo (511 cases) *Clade I*

 2003 USA (IL, IN, KS, MO, OH, WI) Pet Prairie Dogs (47 cases) *Clade IIa*

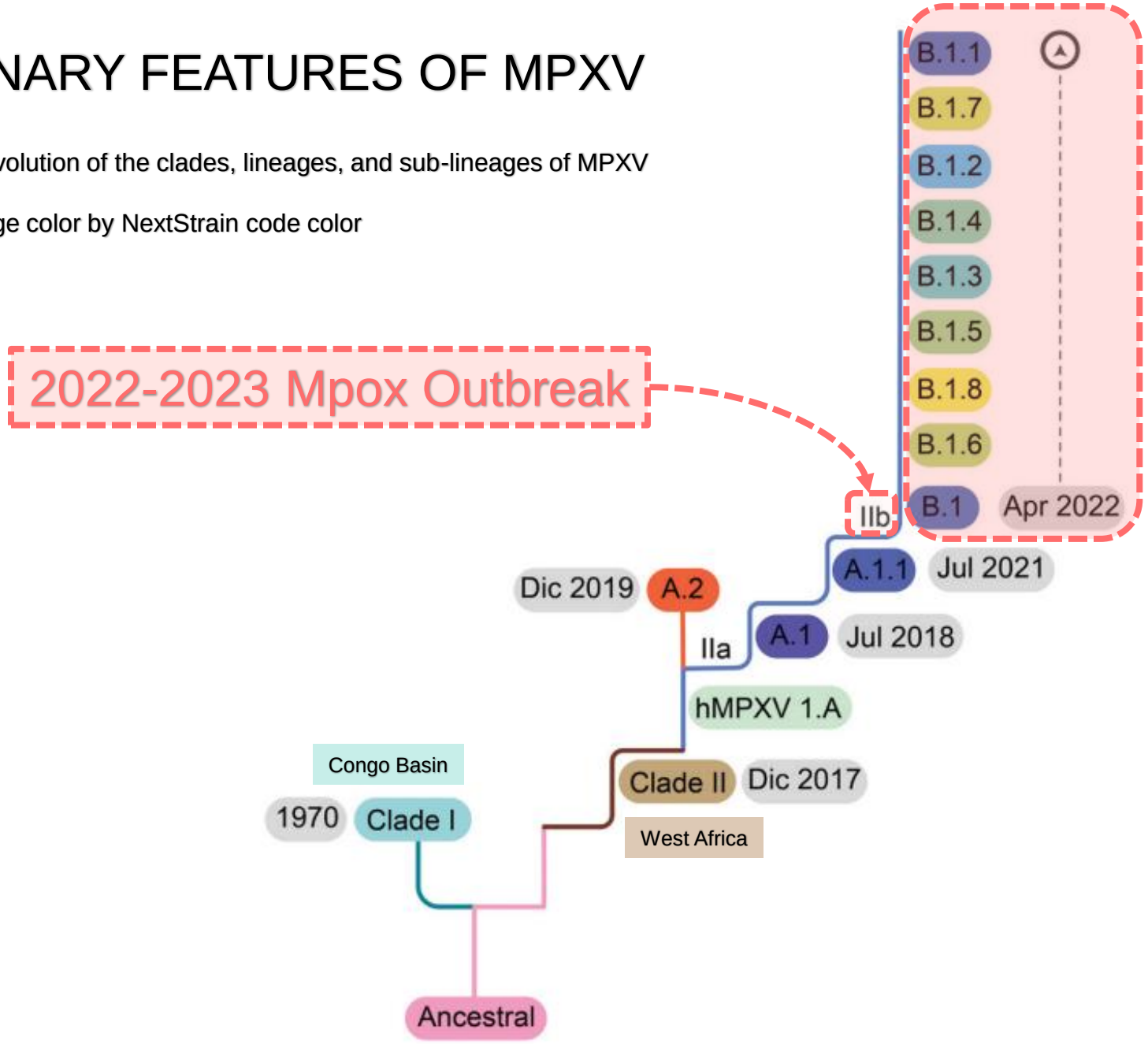
 2018 Nigeria (122 cases) *Clade IIa*

 2022-23 Ongoing 116 nations (92,000 cases) *Clade IIb*

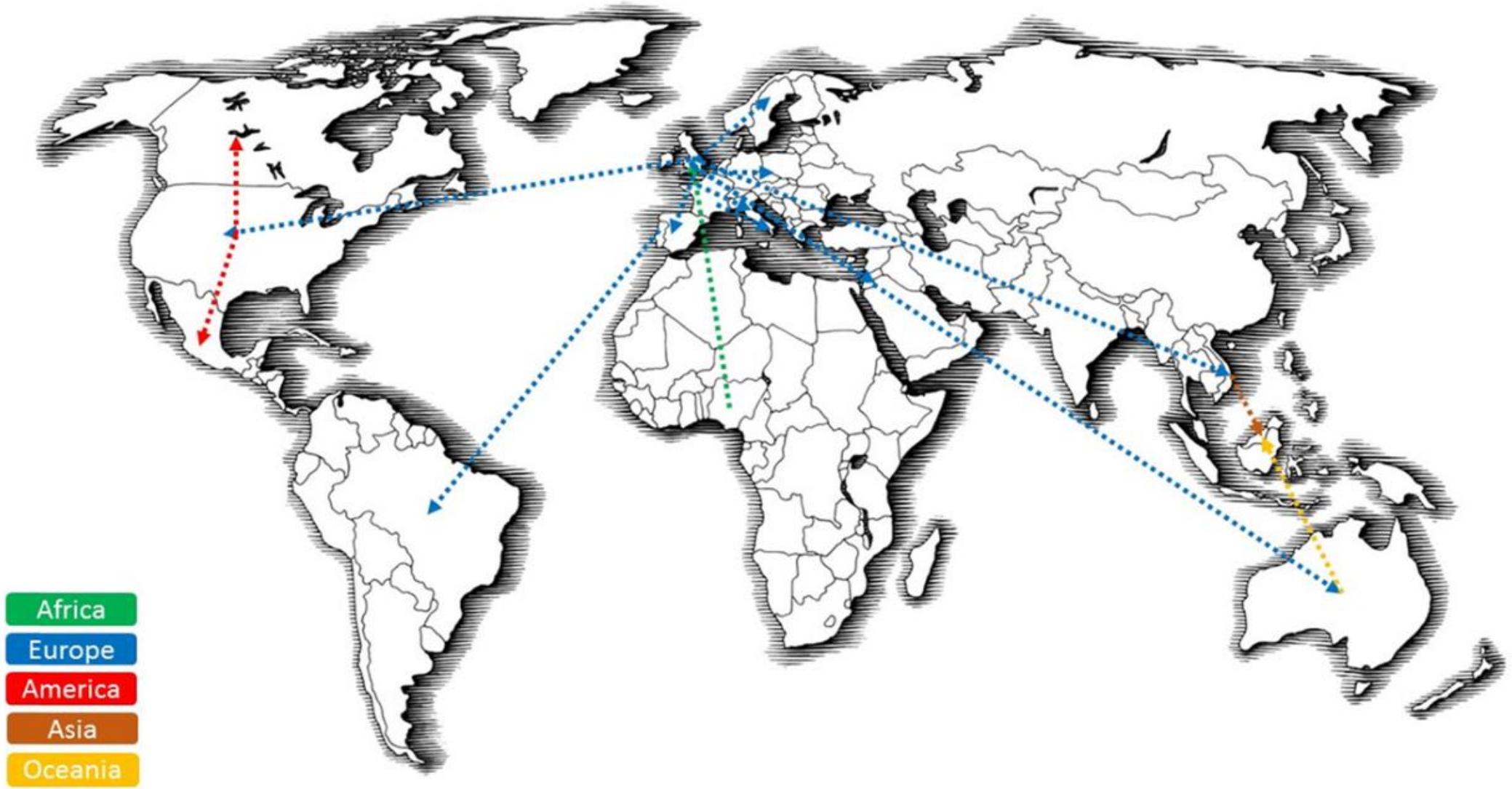
EVOLUTIONARY FEATURES OF MPXV

Representation of the evolution of the clades, lineages, and sub-lineages of MPXV

Lineages and sub-lineage color by NextStrain code color



Spatial dissemination of hMPXV across the world



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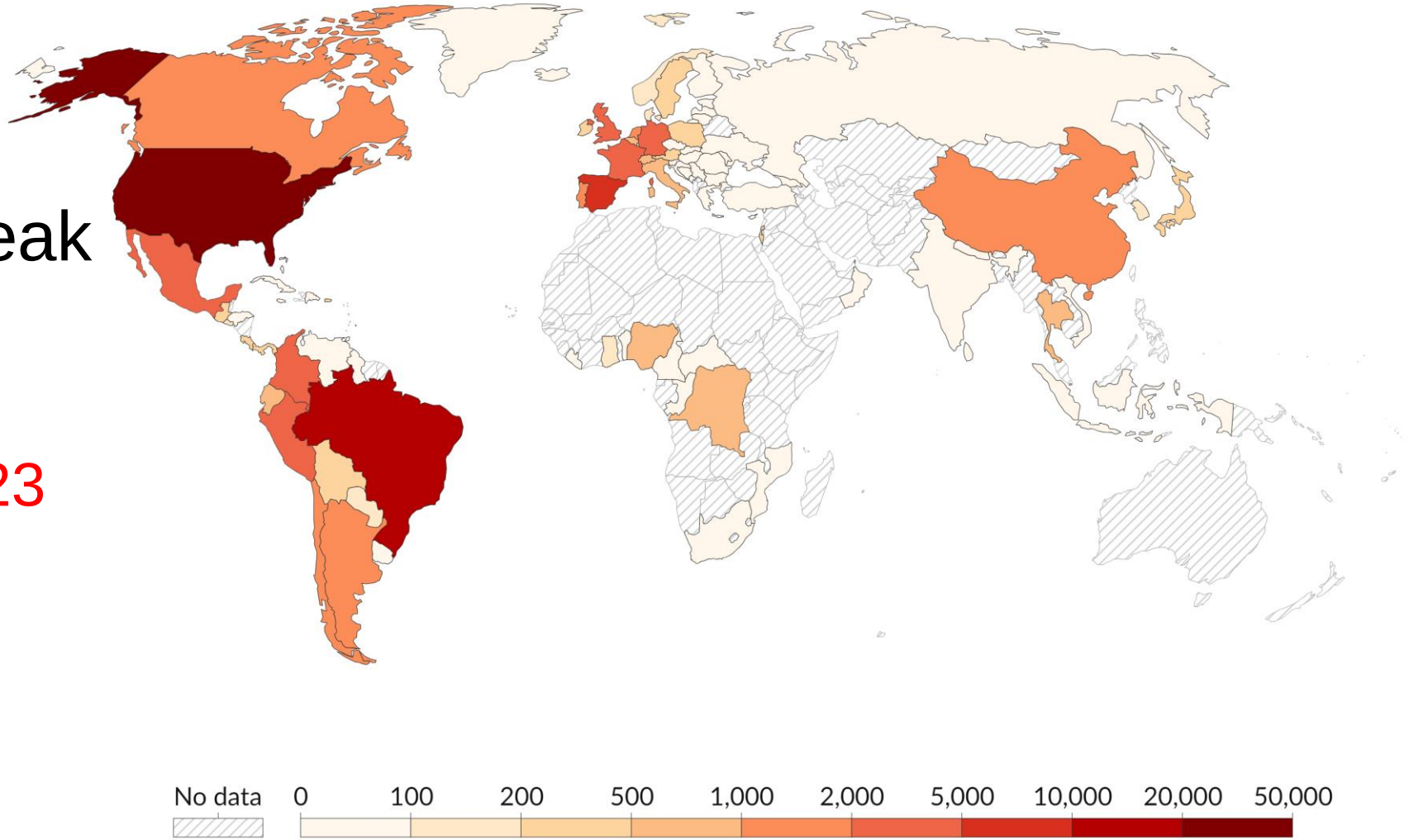
Mpox: Cumulative confirmed cases, Nov 17, 2023

Our World in Data

MPXV Clade IIb
Global Outbreak
2022-2023



As of 12/08/2023
Total Countries: 116
Total Cases: 92,167
Total Deaths: 170

Data source: World Health Organization

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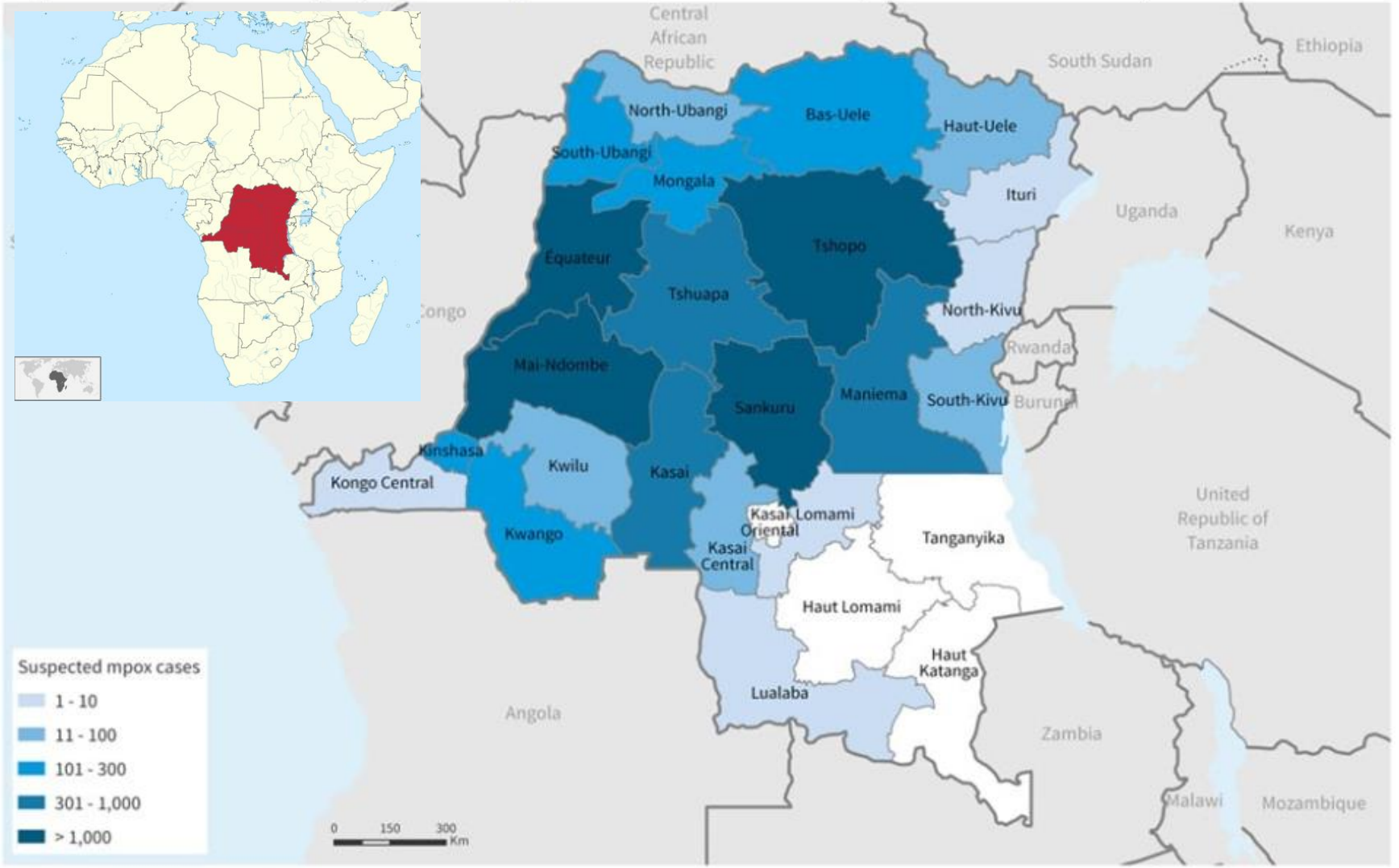
MPXV Clade I Outbreak 2023 DRC

As of 11/04/2023

Total provinces: 22/26 (85%)
Total Cases: 12,569
Total Deaths: 581

Figure 1: Geographic distribution of suspected mpox cases by province, Democratic Republic of the Congo, 1 January – 4 November 2023 (Epi weeks 1 to 44)



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, The Ministry of Public Health of the Democratic Republic of the Congo
Map Production: WHO Health Emergencies Programme
Map Date: 20 November 2023

World Health Organization

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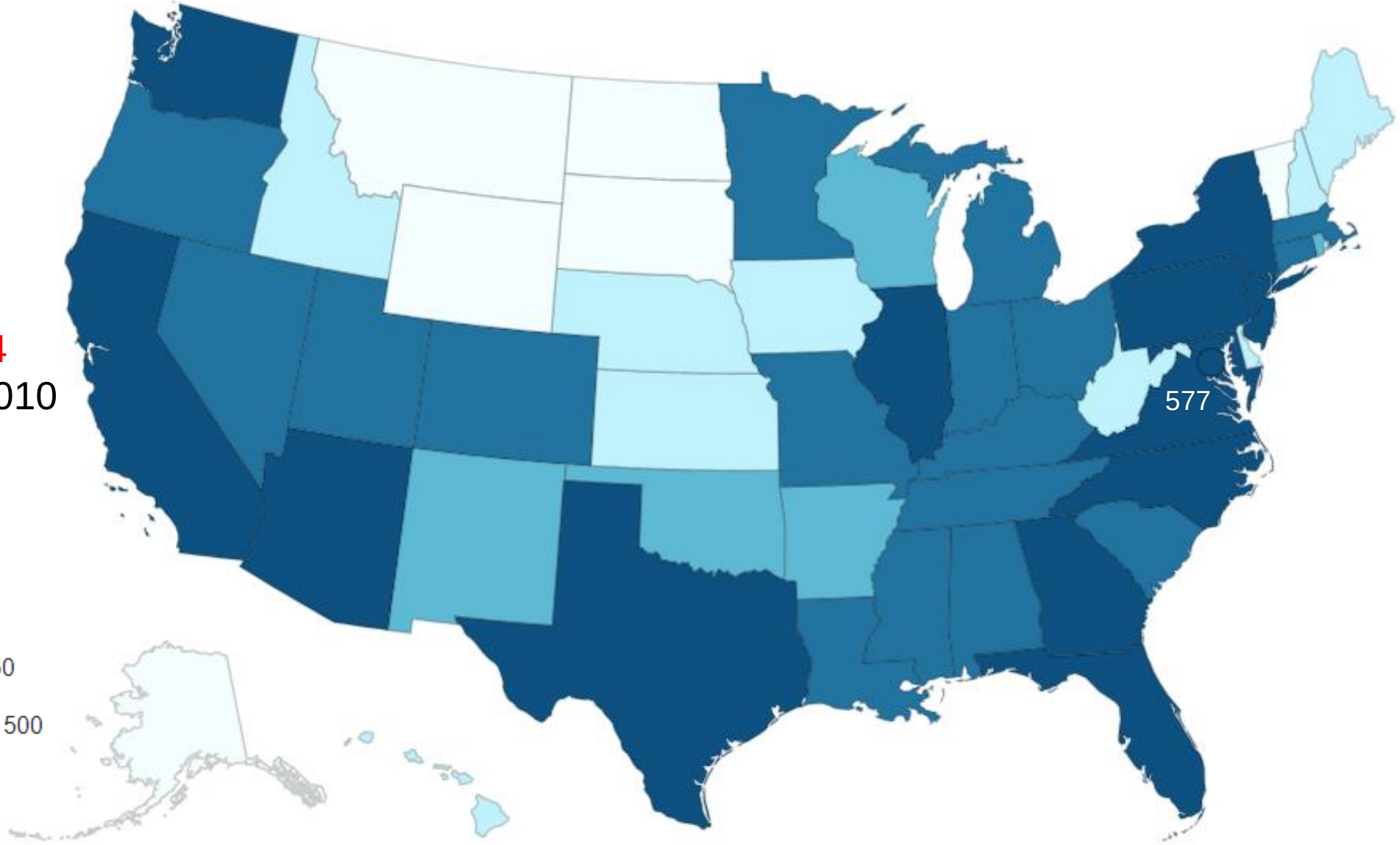
US MPXV

Clade IIb

Outbreak

As of 01/18/2024
Total Cases: 31,010
Total Deaths: 55



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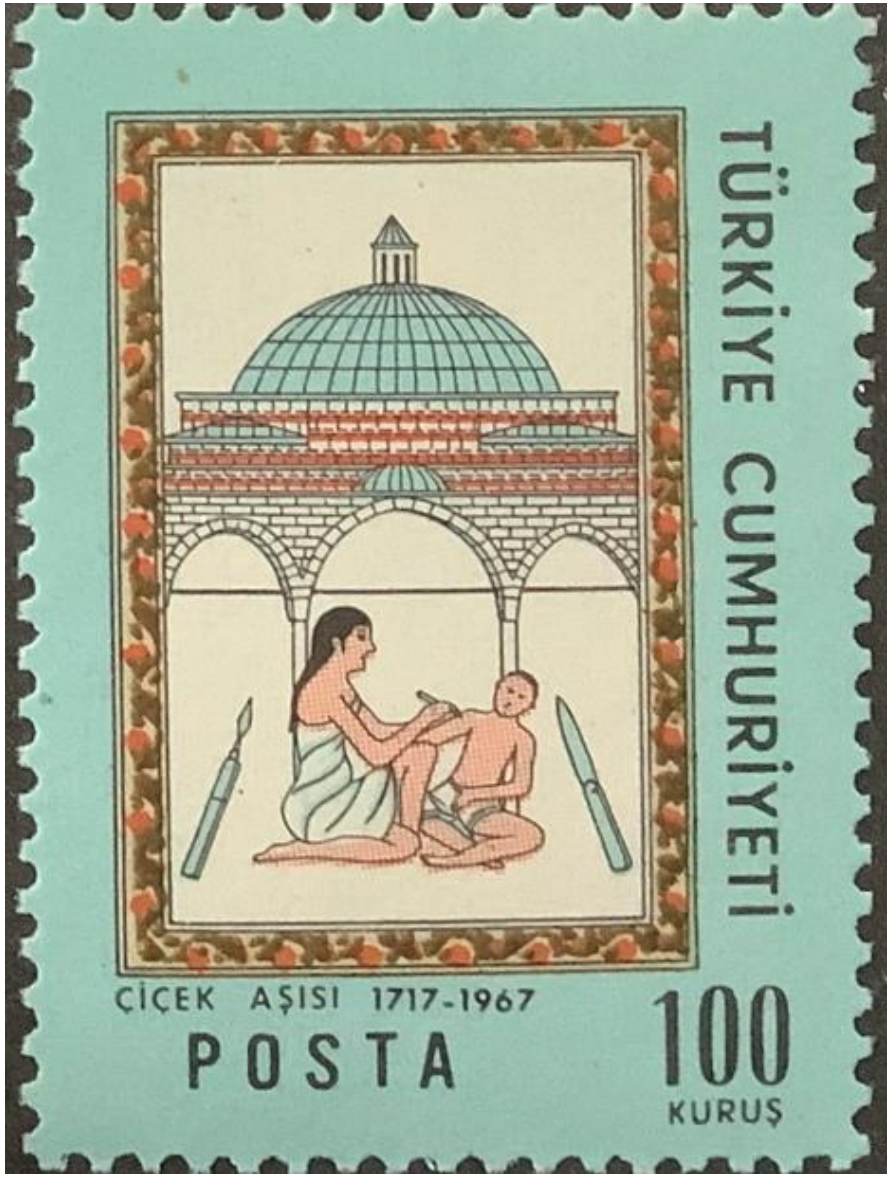
Vaccination History



Lady Mary Wortley Montagu with her son, Edward
by Jean Baptiste Vanmour

Smallpox Variolation History

10,000 BCE

Emergence od smallpox virus

1350 BCE

Mummified remains of Pharaoh Ramses V

200 BCE

Variolation practices in Asia, parts of Africa

1500 AD

Insufflation of dried Smallpox scabs in China

1600 AD

Inoculation with needle of scab in India

1716 AD

West Africans had long practiced the technique, and after his slave, Onesimus told him how it worked in 1716, Cotton Mather publicized it and argued for its use in response to a 1721 outbreak of smallpox in Massachusetts.

1721 AD

Lady Mary Wortley Montagu introduced inoculation after she had observed the practice in the Ottoman Empire, where her husband was stationed as ambassador to Turkey.

300 million smallpox deaths in the 20th Century

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World’s First Vaccine

1802 caricature By James Gillray depicting the controversy around Jenner's vaccination

May 1796 AD

The world’s first vaccine was demonstrated, using the same principle as variolation but with a less dangerous viral source, cowpox.

Having heard of local beliefs and practices in rural communities that cowpox protected against smallpox, Dr Edward Jenner inoculated 8-year-old James Phipps with matter from a cowpox sore on the hand of Sarah Nelmes, a local milkmaid.

Phipps reacted to the cowpox matter and felt unwell for several days but made a full recovery.

Two months later, in July 1796, Jenner took matter from a human smallpox sore and inoculated Phipps to test his resistance.

Phipps remained in perfect health, the first person vaccinated against smallpox.

Smallpox Is Dead

- By the 1950s, advances in vaccination led to smallpox elimination in Western Europe, North America, and Japan.
- Thanks to the combined efforts of national health agencies, WHO and scientists around the world, smallpox was eliminated from South America in 1971, Asia in 1975 and Africa in 1977 (Somalia).
- 1978 Last death Janet Parker, Birmingham, UK (Lab)
- In 1980, WHO declared smallpox officially eradicated.
- 1984 Official repositories (CDC and VECTOR)
- After 3000 years of suffering and death from the disease, there hasn’t been a recorded case of smallpox in almost half a century.

Mpox Vaccines

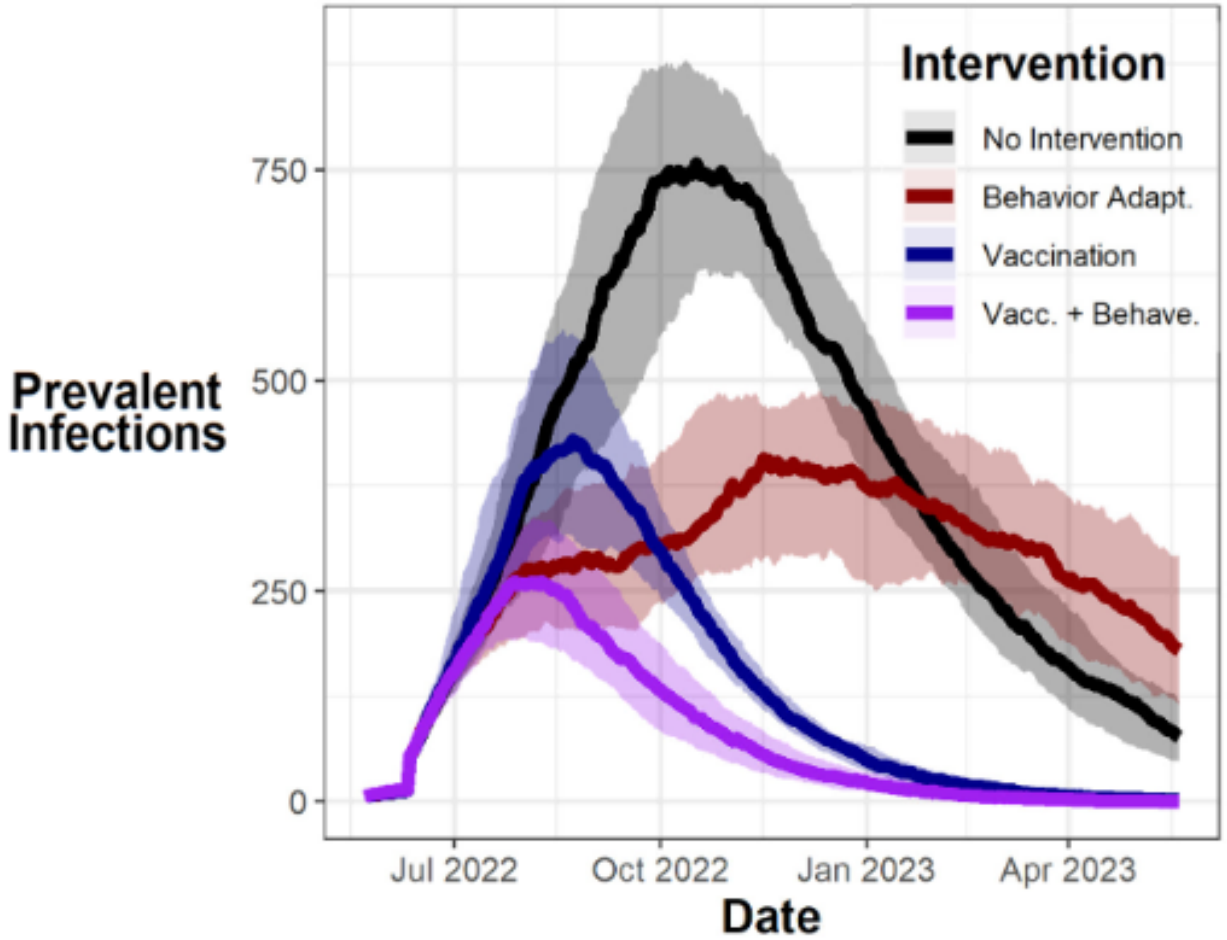
- Populations have become more susceptible to Mpox due to the termination of routine smallpox vaccination, which offered some cross-protection in the past.
- In the United States few people have been vaccinated in 34 years.
- Many years of research have led to the development of newer and safer vaccines for smallpox, which may also be helpful for Mpox.

Generation	Type	Examples
FIRST	Live virus Replication-competent	Dryvax® Wyeth Labs (Calf-skin grown NYCBH VACV) Wetvax® Aventis Pasteur (NYCBH VACV)
SECOND	Live virus Replication-competent	ACAM2000® Acambis (Vero-cell NYCBH VACV) Aventis Pasteur Smallpox Vaccine® [APSV] (NCYBH VACV)
THIRD	Live virus Replication-deficient	Jynneos® [Imvanex®, Imvamune®] (CEF cell MVA-BN virus) Manufactured by Bavarian Nordic

The **Why** Of Mpox Vaccination

- Prevent or minimize life-threatening manifestations of Mpox.
- Protect the immunocompromised population.
- Prevent the emergence of a Mpox Pandemic.
- Need to improve overall vaccine coverage; <25% of the eligible population is fully vaccinated with two doses
- Modeling suggests that without vaccination, the transmission of Mpox will continue with sporadic outbreaks.
- Protect Healthcare Personnel (HCP) at high risk for Mpox.
- Prevent loss of pregnancy.
- Prevent neonatal Mpox.
- High secondary Mpox rate of 9.28% in unvaccinated persons.
- The safety profile of third-generation vaccines outweighs the risks.
- Severe Mpox disease and deaths continue to occur.

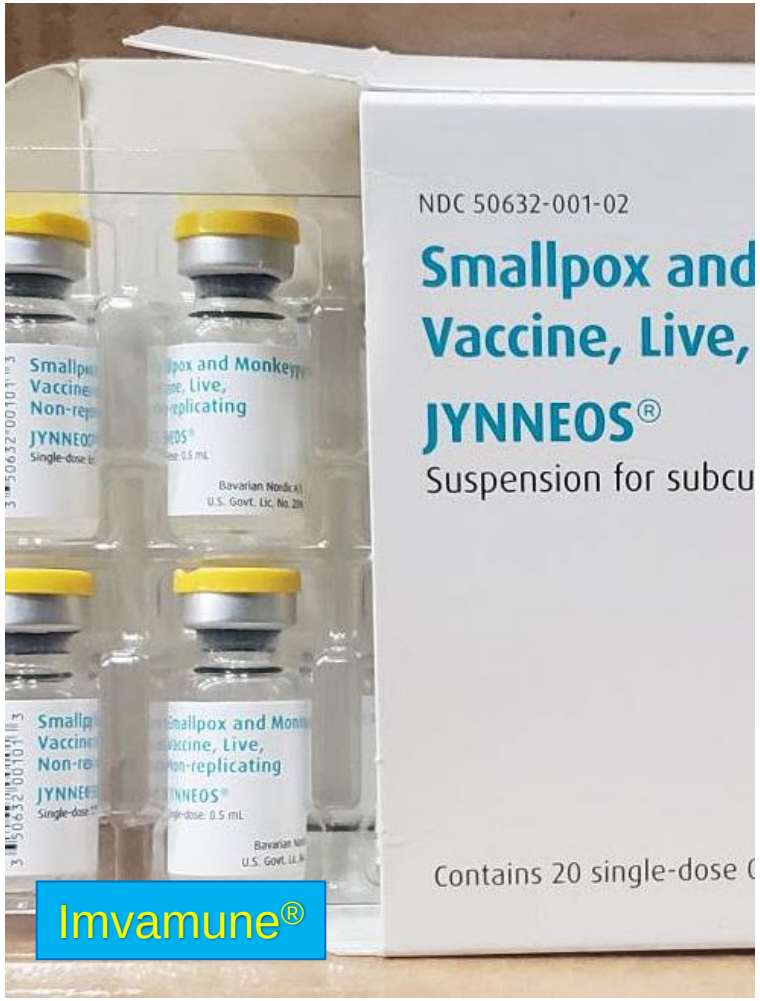
Estimating Averted Cases from Vaccination and Behavioral Adaptation in DC



Lines and shaded regions reflect median and interquartile range from 120 simulations
https://www.medrxiv.org/content/10.1101/2023.02.10.23285772v1.full.pdf

- Behavioral adaptation alone would have had early impact on the curve and flattened it
- Vaccination alone would have had a later impact, but would have ended the outbreak within 1 year
- Combined, behavioral adaptation and vaccination averted 80% of cases 1 year into the outbreak

US MPX Vaccines



Three vaccines are available to reduce the risk and severity of Mpox infection in the United States.

1. JYNNEOS® (Imvamune®)
2. ACAM2000®
3. APSV®

- JYNNEOS® is the preferred vaccine for the current outbreak of Mpox
- APSV ® may be used under IND or EUA.

3

Jynneos
Imvamune® Vaccine

Jynneos Imvamune® Smallpox/Mpox Vaccine

Bavarian Nordic A/S headquarters and commercial scale vaccine production facility in Kvistgaard, Denmark.

- The JYNNEOS **(Imvamune®)** vaccine, made by Bavarian Nordic A/S, is approved in Canada, Europe, and the United States to prevent Smallpox and Mpox.
- It was codeveloped with the US government **(BARDA Project BioShield)**
- The JYNNEOS vaccine features an attenuated (weakened) form of **live vaccinia virus*** incapable of replicating.
- The **third-generation** Imvamune® vaccine is 85% effective in protecting against MPX.

***Modified Vaccinia Ankara-Bavarian Nordic** (MVA-BN) – a highly attenuated strain of Chorioallantois Vaccinia virus Ankara (CVA)

Origins of MVA-BN

BAVARIAN NORDIC

Vaccinia virus Ankara (VA)

1948: Propagated on the skin of calves and donkeys in Ankara, Turkey

TURKISH VACCINE INSTITUTE

Used in vaccination campaigns against smallpox

Cytopathic effects "Take" present

Chorioallantois Vaccinia virus Ankara (CVA) 208kb

1953: VA brought to Munich cultivated on chicken eggs renamed CVA

UNIVERSITY OF MUNICH

Anton Mayr, A. Herrlich
INSTITUTE FOR INFECTIOUS DISEASES AND TROPICAL MEDICINE

Used in vaccination campaigns against smallpox

Cytopathic effects "Take" present

Modified Vaccinia virus Ankara (MVA) 177kb

1968: After 516th passage in Chicken Embryo Fibroblasts (CEF) virus renamed MVA

Anton Mayr, Eberhard Munz
BAVARIAN STATE INSTITUTE FOR VACCINES

MVA-516 strain (first MVA version) Smallpox vaccine

No cytopathic effects "Take" absent

MVA-BN (Bavarian Nordic)

1977: After the 572nd serial passage in CEF virus was renamed MVA-BN*

>120,000 Germans Vaccinated (smallpox)

H. Stickl, V. Hochstein-Mintzel
BAVARIAN STATE INSTITUTE FOR VACCINES

**MVA-BN 584 strain (approved for mpox) Jynneos® vaccine*

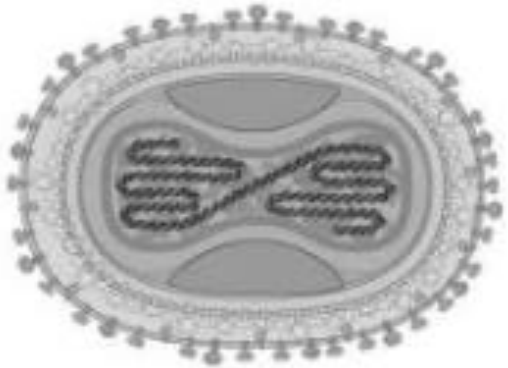
No cytopathic effects "Take" absent

Imvamune® Third-Generation Smallpox/Mpox Vaccine

- Live non-replicating virus MVA-BN **(Modified vaccinia Ankara-Bavarian Nordic)***
- MVA-BN can enter host cells, express its genes, and replicate its genome, but it fails to assemble virus particles.
- The block of the MVA life cycle occurs late at the step of virion assembly, resulting in the assembly of immature virus particles that are not released from the infected cell.
- MVA can be handled under biosafety level 1 (BSL-1) conditions.

Attractive properties of MVA-BN:

- High safety profile (No virulence)
- High Immunogenicity (robust humoral and cytotoxic T-cell responses)
- No immunogenic adjuvants needed
- Abortive infection of human cells (non-replicating)
- Non-pathogenic in immunodeficient hosts
- Large package size (25kb) of transgenes (exogenous DNA sequences)
- Lack of virus persistence in humans
- Strict virus-specific control of recombinant gene expression
- Low production costs
- Absence of special requirements for storage and transportation.



**MVA-584 strain*

Imvamune® Mpox Vaccine Composition

One dose (0.5 ml) contains:

- **Modified Vaccinia Ankara-Bavarian Nordic® Live virus** (non-replicating) no less than 5 x 10^7 Infectious Units
- **Traces of:**
  - Residual Chicken Embryo Fibroblast (CEF) cell DNA and proteins
  - Tromethamine (trometamol, tris) maintains the pH, extending shelf life at warmer temperatures.
  - Benzonase Nuclease is a genetically engineered endonuclease from Serratia marcescens. It degrades all forms of DNA and RNA (single-stranded, double-stranded, linear, and circular) while having no proteolytic activity.
  - Gentamicin
  - Ciprofloxacin
- **No Adjuvants / Preservatives**
- **Sodium Chloride, Water**

SHELF LIFE
Three years at -20°C +/-5°C
Five years at -50°C +/-10°C
Nine years at -80°C +/-10°C

Store frozen at -20°C ± 5°C or -50°C ±10°C or -80°C ±10°C.
After thawing, the vaccine should be used immediately or stored at 2°C –8°C for up to 2 weeks before use.
Do not refreeze a vial once it has been thawed. Protect from light.

Jynneos Imvamune® Vaccine FDA Approval

- **September 24, 2019**: JYNNEOS™ Imvamune® is approved* by the Food and Drug Administration (FDA) to prevent smallpox and monkeypox disease in adults 18.
- **August 9, 2022**: The CDC and FDA released an EUA (Emergency Use Authorization) allowing an alternative dose vaccination regimen in people 18 years and over and allowing the use of the JYNNEOS Imvamune® vaccine in individuals younger than 18.
- The original JYNNEOS Imvamune® approval included two **0.5 mL** doses administered subcutaneously (under the skin).
- The alternative regimen allows two lower doses, **0.1 mL** of vaccine administered intradermally (into the skin).
- **>1.25 million** doses of JYNNEOS Imvamune® have been administered in the United States

*Earl, P.L. et al. Immunogenicity of a highly attenuated MVA smallpox vaccine and protection against monkeypox. Nature 2004

By Sakurai Midori - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=1368270

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Jynneos Imvamune® Vaccine Administration

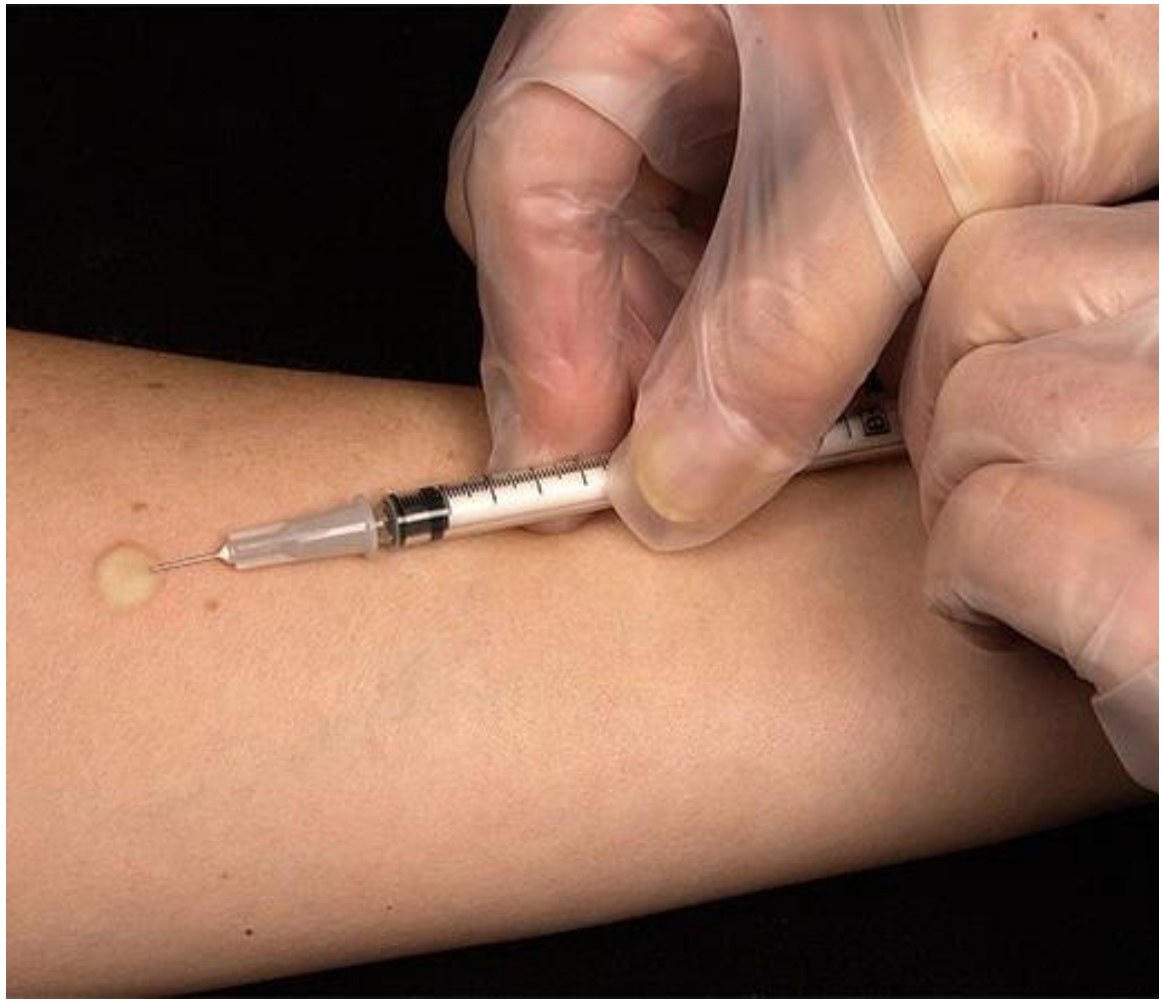
- SQ and ID dosing regimens are interchangeable
- People of any age with a history of developing keloid scars and individuals <18 years of age should receive vaccine via the SQ route
- Patients with concerns about ID administration due to potential stigma or other personal reasons should be offered SQ doses
- CDC recommends that providers have both SQ and ID vaccine administration options available on-site
- Providers should discuss which route of administration each patient prefers (for patients ≥18 years)

Jynneos Imvamune® Vaccine Administration

- CDC recommends Mpox vaccination within four days of exposure.
- If administered between 4 and 14 days of exposure, vaccination may lessen symptoms but will not prevent the disease
- Imvamune® vaccine is administered as a series of 2 injections, four weeks apart.
- The second dose may be given up to 7 days later than the minimum interval of 28 days (i.e., up to 35 days after the first dose).
- Imvamune® vaccine does not cause lesions at the immunization site and does not pose a danger of autoinoculation, unintentional transmission, or systemic dissemination.
- Booster doses are recommended every 2 or 10 years if a person remains at continued risk for exposure to smallpox, monkeypox, or other Orthopoxviruses.
- Unlike the ACAM2000 ® and APSV ® vaccines, Imvamune® was found to be safe for use in people having HIV infection, AIDS patients, or those with atopic dermatitis.

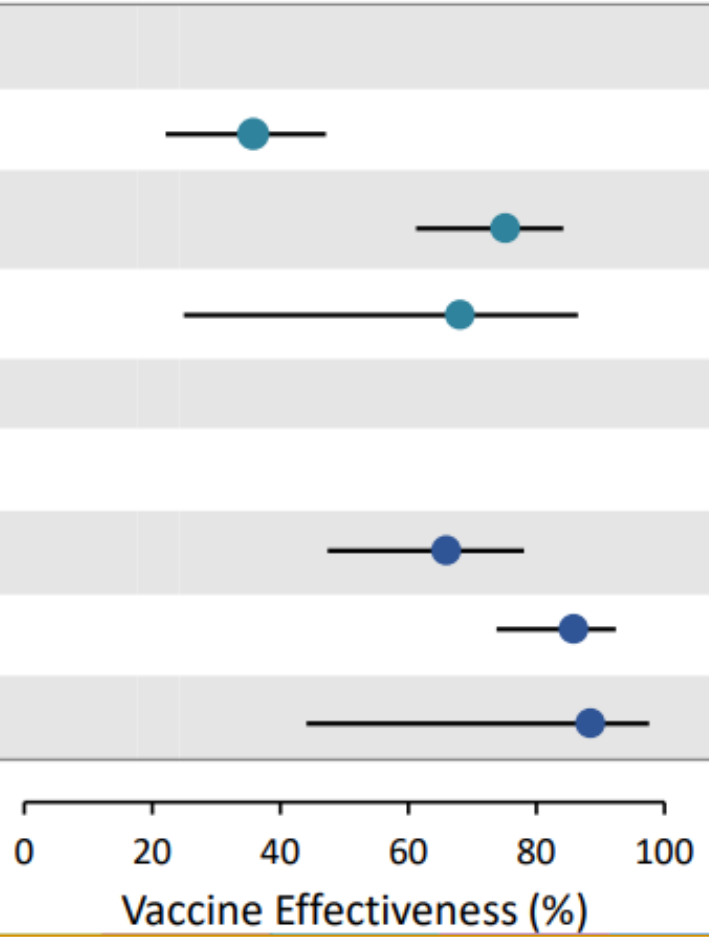
Jynneos Imvamune® Vaccine Route Of Administration

- Results from a clinical study showed that the lower intradermal dose was immunologically non-inferior to the standard subcutaneous dose [Frey SE et al., Vaccine, 2015; 33(39):5225-5234].
- Recently published studies show similar vaccine effectiveness for subcutaneous or intradermal routes.
- No cytopathic effects or “take” with vaccine via either route (SQ or ID)



Vaccine effectiveness of JYNNEOS against mpox ranges from 36%–75% for 1-dose vaccination and 66%–89% for 2-dose vaccination

	Cases	Controls	Adjusted* VE (95% CI)
1-dose JYNNEOS			
Epic Cosmos case-control study	146	1000	36% (22–47)
Multi-jurisdictional case-control study	58	237	75% (61–84)
New York State case-control study	10	23	68% (25–86)
2-dose JYNNEOS			
Epic Cosmos case-control study	25	335	66% (47–78)
Multi-jurisdictional case-control study	14	122	86% (74–89)
New York State case-control study	2	19	89% (44–98)



JYNNEOS (MVA-BN) Mpox Vaccine Efficacy

CDC MMWR May 19, 2023

Characteristic	Case-patients*	Control patients*	VE (95% CI)	
			Unadjusted	Adjusted†
Overall, full vaccination§	28	178	87.4 (78.6 to 92.6)	85.9 (73.8 to 92.4)
Overall, partial vaccination¶	58	237	75.7 (64.5 to 83.3)	75.2 (61.2 to 84.2)

The real-world effectiveness of a single dose of JYNNEOS (in males) adjusted VE was estimated at 86% (95% confidence interval, 59–95%). (Nature: January 31, 2023)

The U.K. Health Security Agency (UKHSA) announced on November 22, 2022, its estimate of Mpox vaccine effectiveness for a dose of 78% fourteen or more days after vaccination.

Eligibility For Vaccination In Virginia

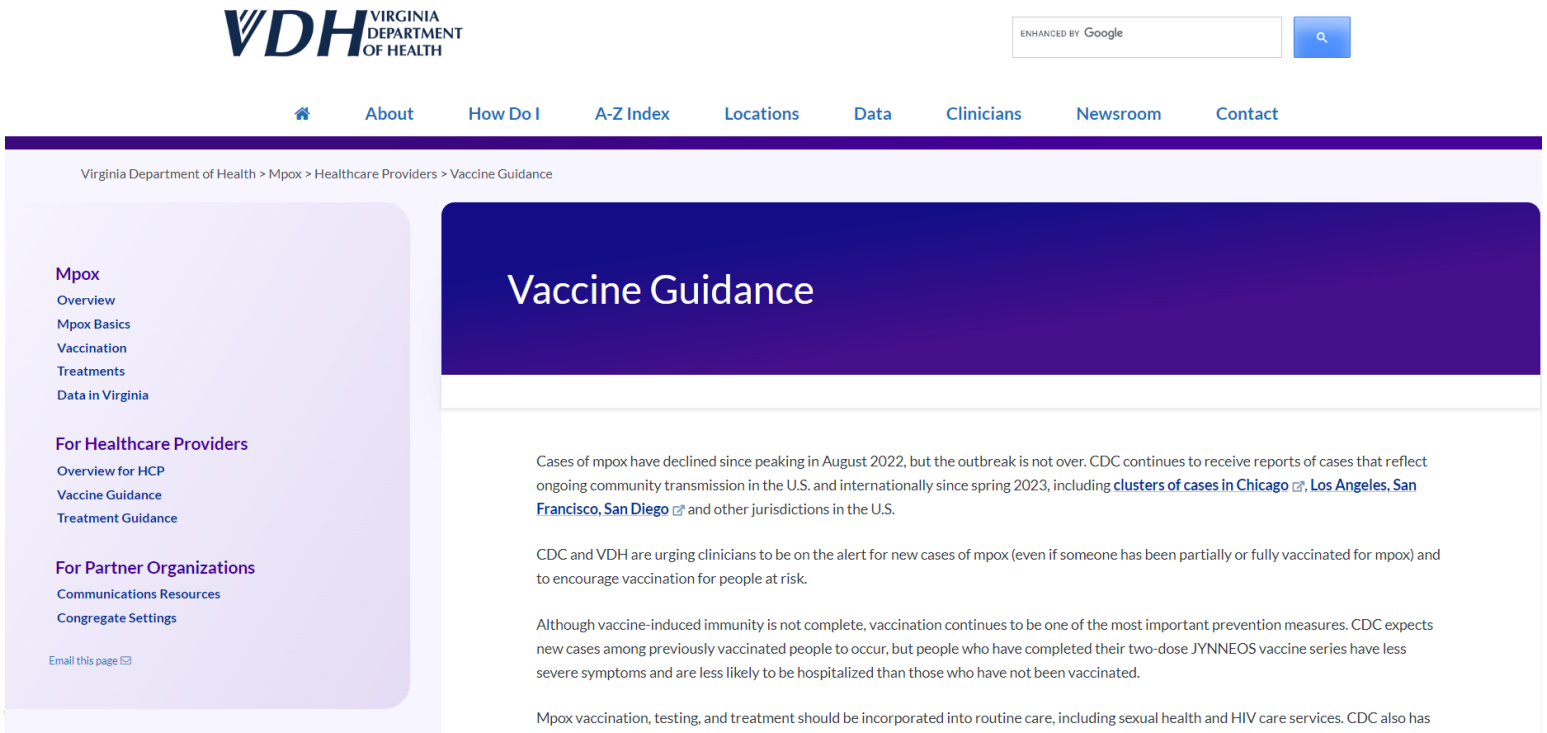
VDH and CDC recommend vaccinating against mpox if:

- ✓ You had known or suspected exposure to someone with mpox
- ✓ You had a sex partner in the past two weeks that was diagnosed with mpox
- ✓ You are a gay, bisexual, or other man who has sex with men or a transgender, nonbinary, or gender-diverse person who in the past 6 months has had:
  - A new diagnosis of 1 or more sexually transmitted diseases (e.g., chlamydia, gonorrhea, or syphilis) OR
  - More than one sex partner
- ✓ You have had any of the following in the past six months:
  - Sex at a commercial sex venue (like a sex club or bath house)
  - Sex related to a large commercial event or in a geographic area (like a city or county, for example) where mpox transmission is occurring
- ✓ You have a sex partner with any of the above risks
- ✓ You anticipate experiencing any of the above scenarios

Eligibility For Vaccination In Virginia

Individuals may attest to meeting one or more eligibility criteria for vaccination, but should not be required to attest to a specific criterion nor should they be asked for details about their eligibility

Refer to the VDH Healthcare Providers Vaccine Guidance webpage for the latest guidance



Occupational Exposure Vaccination Guidance

ACIP Recommendations:

You work in settings where you may be exposed to mpox:

You work with orthopoxviruses in a laboratory

You are part of an orthopoxvirus and health care worker response team

- Persons (typically laboratorians) at occupational risk for variola virus and MPXV exposures should receive JYNNEOS Imvamune® booster doses every two years
- JYNNEOS Imvamune® is not recommended as a routine vaccination for Healthcare Personnel (HCP) unless sexual risk factors are present

Pre-Exposure (PrEP) Vaccination

VDH and CDC recommend getting the Mpox Imvamune® vaccine if you:

- Are a gay, bisexual, or other same-gender loving man who has sex with men or a transgender, gender non-binary, or gender-diverse
- Have had sexual or intimate contact with someone who may have Mpox

AND if you, in the last six months, have had or expect to have:

- One or more sexually transmitted infections
- A weakened immune system because of another illness, like HIV
- Sexual or intimate contact with a person who is at risk of Mpox
- Anonymous sexual or intimate contact or more than one sexual partner

Mpox Post-Exposure (PEP) Vaccination

Persons eligible for post-exposure Imvamune® vaccination (PEP):

- People who had known or suspected exposure to someone with Mpox
- People who had a sex partner in the past two weeks who was diagnosed with Mpox

1965
Benjamin Rubin
Inventor
Wyeth Labs

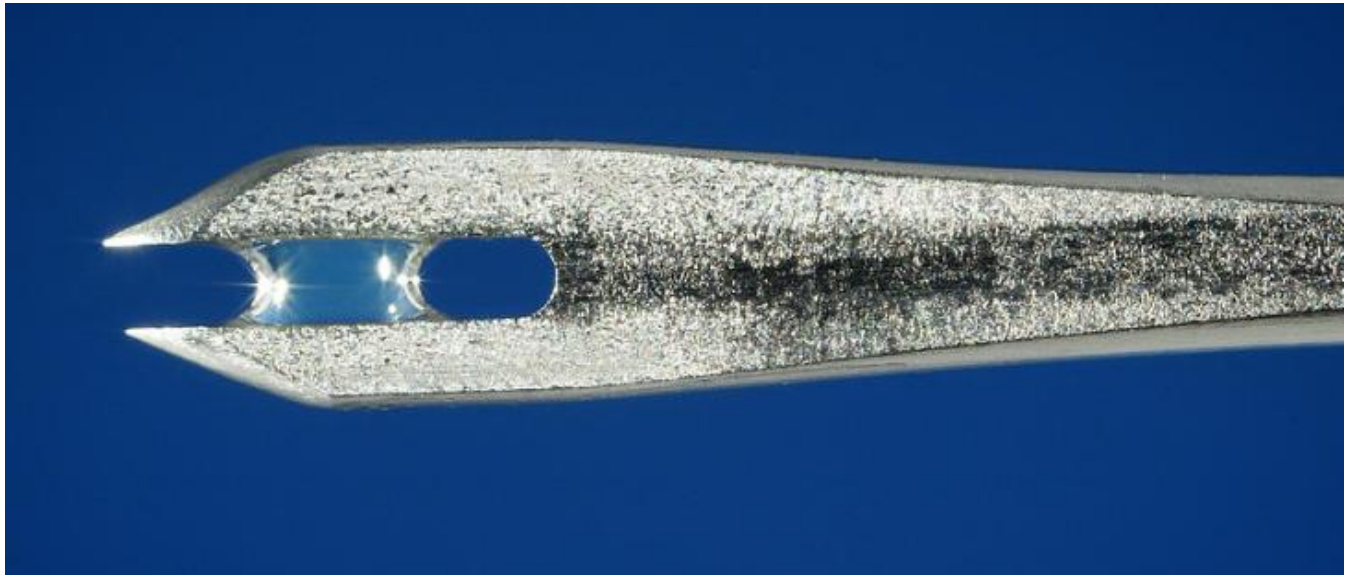


Table 2. Vaccination Schedule and Dosing Regimens for JYNNEOS Vaccine

JYNNEOS vaccine regimen	Route of administration	Injection volume	Recommended number of doses	Recommended interval between 1st and 2nd dose
Standard regimen[1]				
People age ≥18 years	Subcut	0.5 mL	2	28 days (4 weeks)
People age <18 years[2]	Subcut	0.5 mL	2	28 days (4 weeks)
Alternative regimen				
People age ≥18 years	ID	0.1 mL	2	28 days (4 weeks)

[1]People of any age who have a history of developing keloid scars are recommended to receive the standard regimen of JYNNEOS.

CDC Guidance: Imvamune® And COVID-19 vaccines

- No required minimum interval between any COVID-19 vaccine and Imvamune® vaccine regardless of which vaccine is administered first
- Adolescent and young adult males might consider waiting four weeks between vaccines. This is because of the observed risk of myocarditis and pericarditis after receipt of ACAM2000 ® orthopoxvirus vaccine and COVID-19 vaccines and the hypothetical risk for myocarditis and pericarditis after JYNNEOS ® vaccine.
- However, if a patient's risk for Mpox or severe disease due to COVID-19 is increased, administration of JYNNEOS ® and COVID-19 vaccines should not be delayed

https://www.cdc.gov/vaccines/covid-19/clinical-considerations/interim-considerations-us.html

Side Effects Of Imvamune®

VAERS Vaccine Adverse Event Reporting System
VSD Vaccine Safety Datalink

The most common side effects are pain, redness, and itching at the injection site.

The following symptoms may occur, which indicates the immune system is responding to the vaccine:

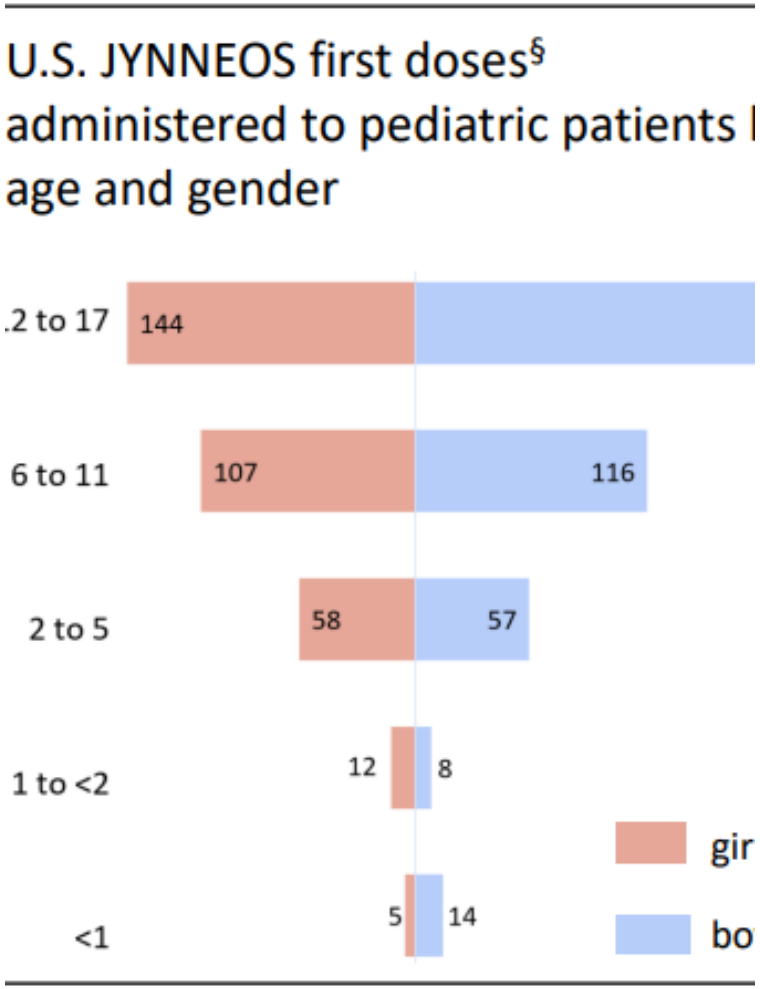
- Fever
- Headache
- Tiredness
- Nausea
- Chills
- Muscle Aches

Safe in immunocompromised: Transplant recipients, HIV, and Atopic Dermatitis.

Uncommon adverse events:

- Syncope: 49 reports per million doses administered
- Anaphylaxis: 2 reports per million doses administered
- Myocarditis and pericarditis are of particular interest - Observed rates are consistent with expected background rates

Jynneos Imvamune® In Children



SAFETY IN PEDIATRICS

12-17 years of age, n=349

- No safety signals identified via CDC surveillance systems
- NIH clinical trial underway to evaluate safety and efficacy

0-11 years of age, n=377

- No safety signals identified via CDC surveillance systems
- No clinical trials or other studies are planned at this time

GUIDANCE FOR PEDIATRICS

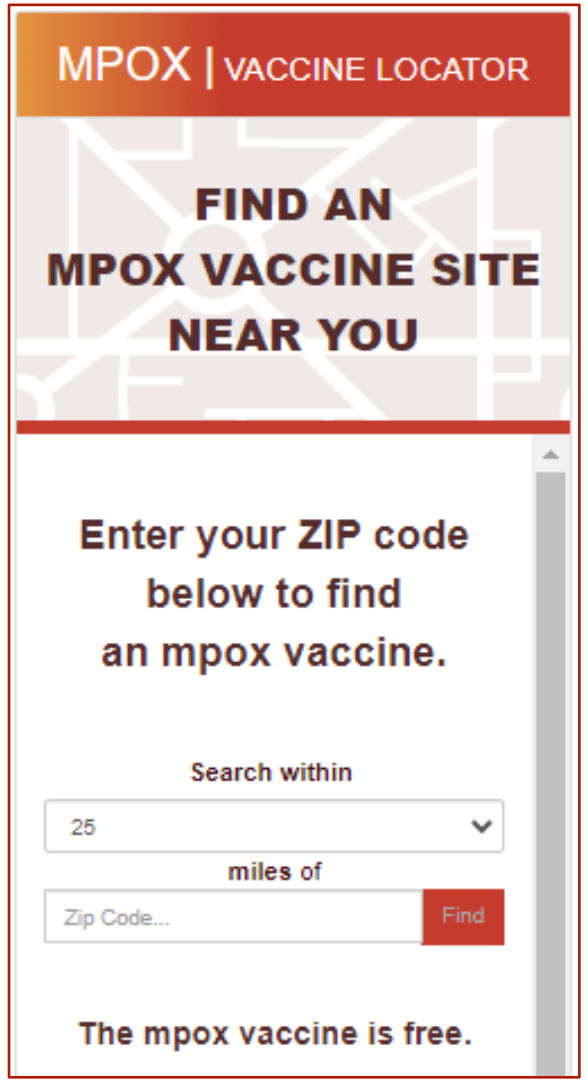
For persons **6 months to 17 years**, JYNNEOS® should be administered as PrEP or PEP if a high-risk exposure has occurred.

For children < 6 months of age, VIGIV should be administered instead of JYNNEOS® if PEP is indicated.

Data from recent publications is encouraging. (Ladhani et al. Lancet Infectious Disease 2023)

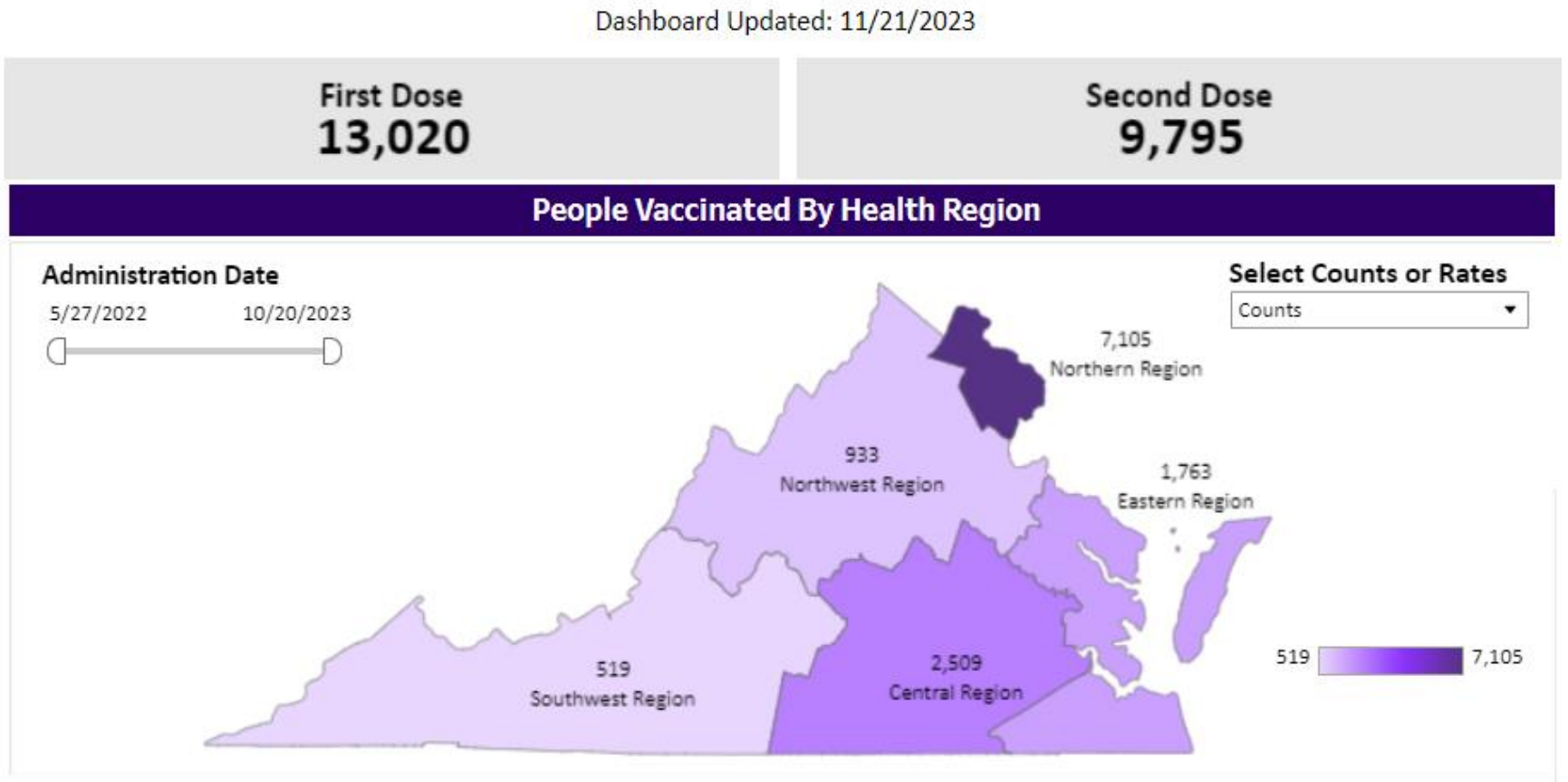
Where Can You Get The Mpox Imvamune® Vaccine

- CDC has developed a Mpox vaccine locator tool to help people find a location closest to them.
- Mpox Imvamune® vaccines may be available at your local health department, public health clinics, hospitals, or large social gatherings or venues in some large cities.
- Contact your local health department to find a vaccine in your community.
- Mpox Imvamune® vaccines are free at this time.
- Providers must give you the vaccine regardless of your ability to pay the administration fee.
- Providers may bill a plan or program that covers the Mpox vaccine administration fee (such as your private insurance or Medicare/Medicaid).



VDH Vaccines Administrated Dashboard

- Launched August 2022
- 13,020 first doses and 9,795 second doses given as of 11/21/2023



Vaccine Equity

Mpox outbreak has disproportionately affected gay, bisexual, and other men who have sex with men, people of color, people with HIV, transgender and gender-diverse adults

- Critical to ensuring equity in treatment and vaccination
- Recent publications and data report racial and ethnic disparities in vaccination rates, especially among Black and Latino men

CDC MMWR published in April 2023

- JYNNEOS vaccination rates are higher in Black and Hispanic males than White males, but not high enough to offset the disproportionate incidence of Mpox
- Sustained equity-based strategies, such as tailored messaging and expanding vaccination services to reach racial and ethnic minority groups, are needed to prevent disparities in future mpox outbreaks

Vaccine Strategies

Sexually transmitted infections (STIs) have been rising steadily, and access to pre-exposure prophylaxis (PrEP) among Black and Hispanic MSM—one of the highest-risk groups for new HIV acquisition—has declined.

Rapid and high-volume deployment of mpox vaccines to the highest-risk populations, combined with behavior change among at-risk individuals, has undoubtedly contributed to the current decline in cases nationally

Among individuals presenting for monkeypox vaccination, transition from an opt-out protocol for sexually transmitted infection (STI) and HIV risk assessment and testing to an opt-in protocol was associated with a substantial increase in missed opportunities for HIV pre-exposure prophylaxis and STI testing at an ambulatory sexual health clinic.

Vaccine Barriers

- It is unlikely, that domestic mpox transmission will be eradicated soon.
- It emphasizes the importance of integrating vaccination into existing routine services that are trusted and utilized by the most impacted populations.
- For MSM with sexual risk factors, vaccination represents a point in time during which personal and collective health benefits—through earlier disease detection and treatment and STI and HIV prevention—might be achieved with a comprehensive sexual health approach.
- One limitation in assessing the true uptake of comprehensive sexual care during the presentation for mpox vaccination is that unknown-status patients may opt out of screening because of current engagement in sexual health care with outside providers.
- Another limitation, the inability to retrieve external medical records, impedes accurate assessment of the proportion of PrEP users or PWH.
- Finally, reliance on patient self-identification for vaccine eligibility may result in a greater proportion of patients with low sexual risk.

Vaccine Barriers

Designing, staffing, and funding alternative strategies for vaccine deployment within sexual health clinics may intensify public health impact by simultaneously addressing critical HIV and STI healthcare issues of the at-risk population.

The world’s largest multi-country outbreak of mpoxv was sustained in the social and sexual networks of Gay, Bisexual, and other Men who have Sex with Men (GBMSM).

Mpox can be described as sexually transmissible, meaning that transmission can occur during a sexual encounter, with or without penetrative sexual intercourse. (sexually associated)

Stewart, J., Bartkus, M., Sperring, H., Ruiz-Mercado, G., Johnson, S., & Pierre, C. (2023). Monkeypox Vaccination Strategy and Missed Opportunities in STI and HIV Prevention: An Urban Sexual Health Clinic's Experience During a Public Health Emergency. Open Forum Infectious Diseases, 10(1). https://doi.org/10.1093/ofid/ofad006

4

Biological Security

Smallpox A Biological Weapon?

- 1343: The Mongol army catapulted plague-infested corpses of warriors over the fortified walls of the besieged Genoese port city of Caffa.
- 1767: Smallpox was used as a biological weapon (French and Indian Wars) by British General Jeffery Amherst, the commander of Fort Pitt, in what is today the city of Pittsburgh, Pennsylvania. Soldiers distributed blankets used by smallpox patients, initiating outbreaks among American Indians and leading to 50% mortality in the tribes.
- 1949: The last natural smallpox outbreak in the United States.
- 1972: Smallpox vaccine is no longer given routinely in the United States.
- 1977: The last naturally spread case in the entire world happened.
- 1980: The World Health Assembly declared smallpox eradicated.
- The last repositories of smallpox virus are at
  - **CDC** the Centers for Disease Control and Prevention in Atlanta, Georgia, USA
  - **VECTOR** the State Research Centre of Virology and Biotechnology in Koltsovo, Novosibirsk Oblast, Russia
- Even a single confirmed case of smallpox today would be considered an emergency.

Ottawa Indian Chief Pontiac 1764 Peace talks

CDC Classification Of Potential Bioterrorism Agents/Diseases

Biological Weapons Convention (**BWC**) is a United Nations disarmament treaty ratified by 185 states effective March 26, 1975.

It bans biological and toxin weapons by prohibiting their development, production, acquisition, transfer, stockpiling, and use.

Bioterrorism agents/diseases as classified by the Centers for Disease Control and Prevention

Category	Organism/disease
A	Smallpox
	Anthrax
	Tularemia
	Plague
	Botulism
	Viral hemorrhagic fevers
B	Brucellosis
	Glanders
	Ricin toxin
	Typhus fever
	Q fever
	Staphylococcal enterotoxin B
	Viral encephalitis (alphavirus: VEE, EEE, WEE)
	Water safety threats (e.g., *Vibrio cholerae*, *Cryptosporidium parvum*)
C	Emerging infectious diseases such as Nipah virus and Hantavirus

Strategic National Stockpile Vaccines

1. ACAM2000® (Live, Replication-competent) Smallpox
2. Jynneos Imvamune® (Live, Non-replicating) Smallpox/Mpox
3. Aventis Pasteur Smallpox Vaccine (Live, Replication-competent) Smallpox

Strategic National Stockpile (SNS) is the nation's largest supply of potentially life-saving pharmaceuticals and medical supplies for use in a public health emergency that is severe enough to cause local supplies to be depleted.

SNS was established in 1999

VDH Resources

- VDH Mpox Website
- VDH Mpox Information for Healthcare Professionals
- VDH Trainings for Healthcare Providers
  - An overview of Mpox
  - Prevention and Containment
  - Testing
  - Vaccination
  - Mpox Treatment and Patient Management
- VDH Case and Vaccine Dashboards
- VDH Communications Resources
- Assessing and Managing Exposed Healthcare Personnel
- Mpox Preparedness Checklist for Healthcare Facilities
- DCLS Mpox Testing and Shipping Instructions

CDC Resources

- CDC Mpox Homepage
  - Clinical consultation service (email eocevent482@cdc.gov) or call CDC Emergency Operations Center at 770-488-7100
  - Information for healthcare providers
  - Infection control in healthcare settings
- CDC Health Alert Network health advisory 5/20/2022, 6/14/22, 7/28/22, 7/30/22, 9/29/22, 11/17/22, 5/15/23
- COCA calls 5/24/2022, 6/29/22, 7/26/22, 8/11/22, 10/6/22, 10/27/22, 5/18/22
- Technical Report 4: Multi-National Mpox Outbreak, United States, 2022 (archived)
- Technical Report 4 Supplementary Analysis: Multi-National Mpox Outbreak, United States, 2022 (archived)
- CDC Science Brief: Detection and Transmission of Mpox Virus (archived)

Resources For Special Populations

- Children
  - CDC MMWR Epidemiologic and Clinical Features of Children and Adolescents Aged <18 Years with Monkeypox — United States, May 17-September 24, 2022
  - CDC Clinical Considerations for Mpox in Children and Adolescents
- People who are pregnant or breastfeeding
  - CDC Clinical Considerations for Mpox in People Who are Pregnant or Breastfeeding
  - Mpox Cases Among Cisgender Women and Pregnant Persons — United States, May 11-November 7, 2022
- People with HIV
  - CDC Clinical Considerations for Treatment and Prophylaxis of Mpox Virus Infection in People Who are Immunocompromised
  - HIV and Sexually Transmitted Infections Among Persons with Monkeypox — Eight U.S. Jurisdictions, May 17-July 22, 2022
  - Severe Monkeypox in Hospitalized Patients — United States, August 10-October 10, 2022

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Thank you

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