

Emerging Infections 2022

Shireesha Dhanireddy, MD

Professor, Department of Medicine

Division of Infectious Diseases, University of Washington

What's New In Medicine

9 September 2022

Disclosures

Dr. Shireesha Dhanireddy has no relevant financial relationships with ineligible companies to disclose.

Objectives

- Discuss epidemiology, presentation, diagnosis and management of emerging infectious diseases in 2022
- Discuss pathogens with potential to give rise to future epidemics



Environmental changes	Example diseases	Pathway of effect
Dams, canals, irrigation	Schistosomiasis	▲ Snail host habitat, human contact
	Malaria	▲ Breeding sites for mosquitoes
	Helminthiasis	▲ Larval contact due to moist soil
	River blindness	▼ Blackfly breeding, ▼ disease
Agricultural intensification	Malaria	Crop insecticides and ▲ vector resistance
	Venezuelan haemorrhagic fever	▲ rodent abundance, contact
Urbanization, urban crowding	Cholera	▼ sanitation, hygiene; ▲ water contamination
	Dengue	Water-collecting trash, ▲ <i>Aedes aegypti</i> mosquito breeding sites
	Cutaneous leishmaniasis	▲ proximity, sandfly vectors
Deforestation and new habitation	Malaria	▲ Breeding sites and vectors, immigration of susceptible people
	Oropouche	▲ contact, breeding of vectors
	Visceral leishmaniasis	▲ contact with sandfly vectors
Reforestation	Lyme disease	▲ tick hosts, outdoor exposure
Ocean warming	Red tide	▲ Toxic algal blooms
Elevated precipitation	Rift valley fever	▲ Pools for mosquito breeding
	Hantavirus pulmonary syndrome	▲ Rodent food, habitat, abundance

Will 'Centaurus' be the next global coronavirus variant? Indian cases offers clues

The BA.2.75 variant is rising fast in the country, but hospitalization rates are low so far.

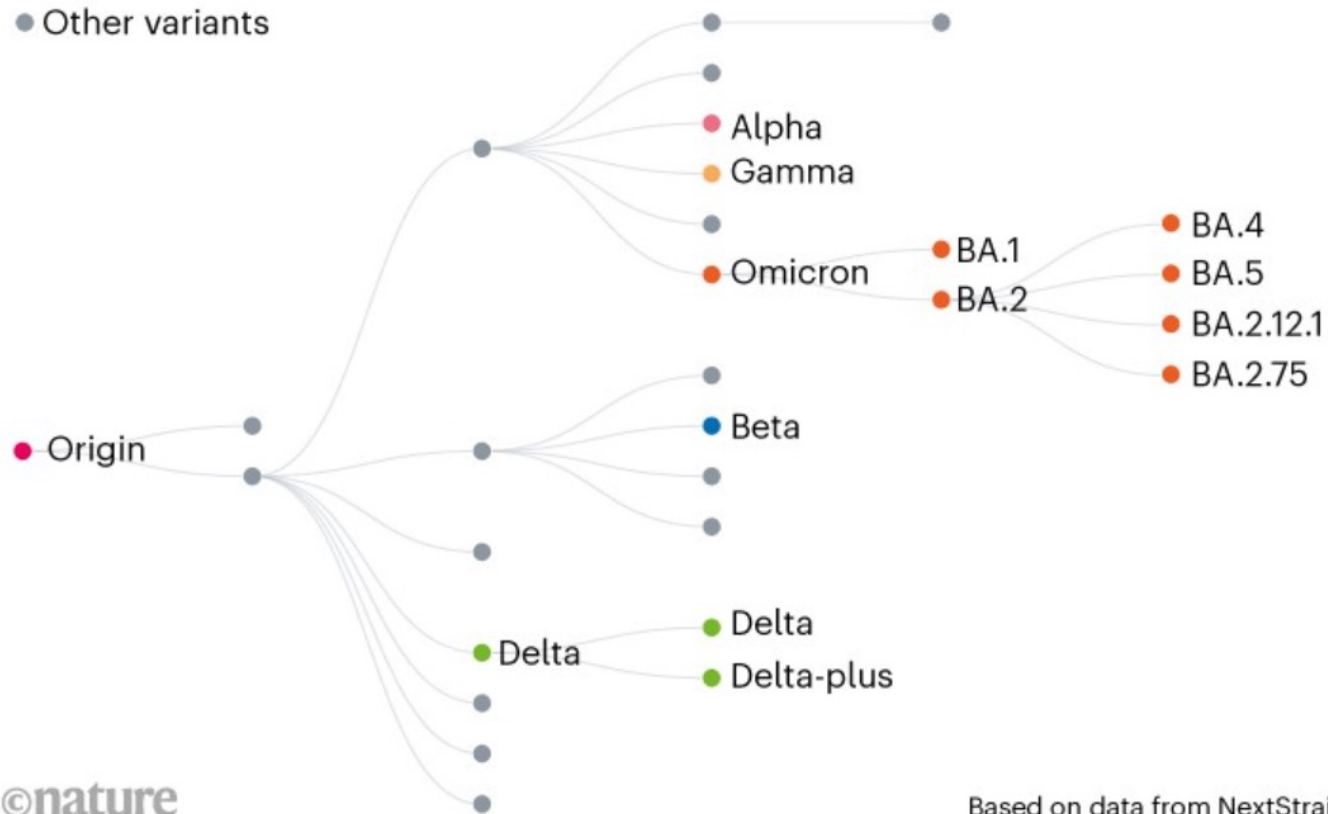
[Ewen Callaway](#)



COVID-19 Update

PATHOGEN PROGRESSION

This diagram shows how the coronavirus SARS-CoV-2 has evolved to spawn several related variants. One of the latest is BA.2.75, an Omicron lineage that is on the rise in countries including India.



©nature

Based on data from NextStrain.

COVID-19 Update

New reported cases

All time

Last 90 days

800,000 cases

600,000

400,000

200,000

JUNE 28, 2020

Daily average: 38,252

New cases: 39,508

7-day average

Feb. 2020

Jul.

Dec.

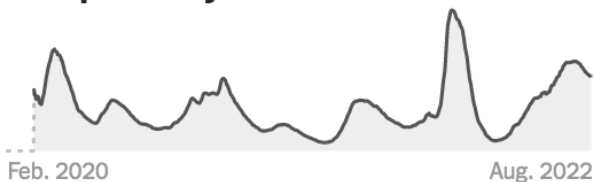
May 2021

Oct.

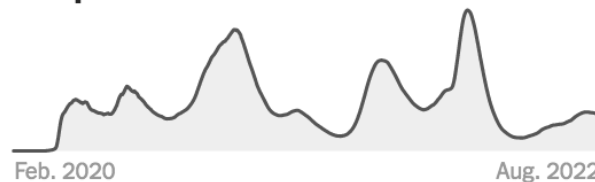
Mar. 2022

Aug.

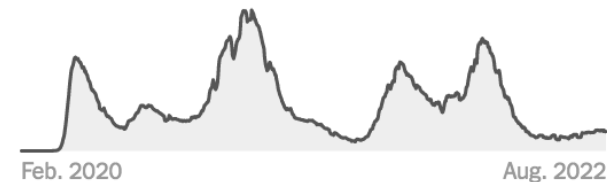
Test positivity rate



Hospitalized



Deaths



Update on COVID-19 Vaccines

Currently available vaccines in the US:

- Pfizer (Cominarty)
- Moderna (Spikevax)
- J&J
- Novavax

Update on COVID-19 Vaccines

U.K. Approves Covid Booster Vaccine That Targets Two Variants

Britain is the first country to approve the Moderna-made vaccine, which generated a strong immune response against both the original virus and the Omicron variant.

Give this article    89



A clinician preparing doses of a Moderna vaccine at a vaccination center in London in December. Daniel Leal/Agence France-Presse — Getty Images



By **Jenny Gross**

Aug. 15, 2022

Each dose of the booster contains half original variant from 2020 and the other half BA.1 (first omicron strain)

Update on COVID-19 Vaccines

VACCINES

Omicron-Specific COVID Boosters Are Coming



Case

- 35 year old man presented to clinic with penile lesions
- He went to visit a friend in London in early May. He had anal insertive intercourse with this friend.
- He returned to US in mid May and developed penile lesions, not painful initially.
- Went to urgent care and diagnosed with herpes – swabbed and treated. HSV
- HSV testing negative
- Went to a sexual health clinic ...

Monkeypox

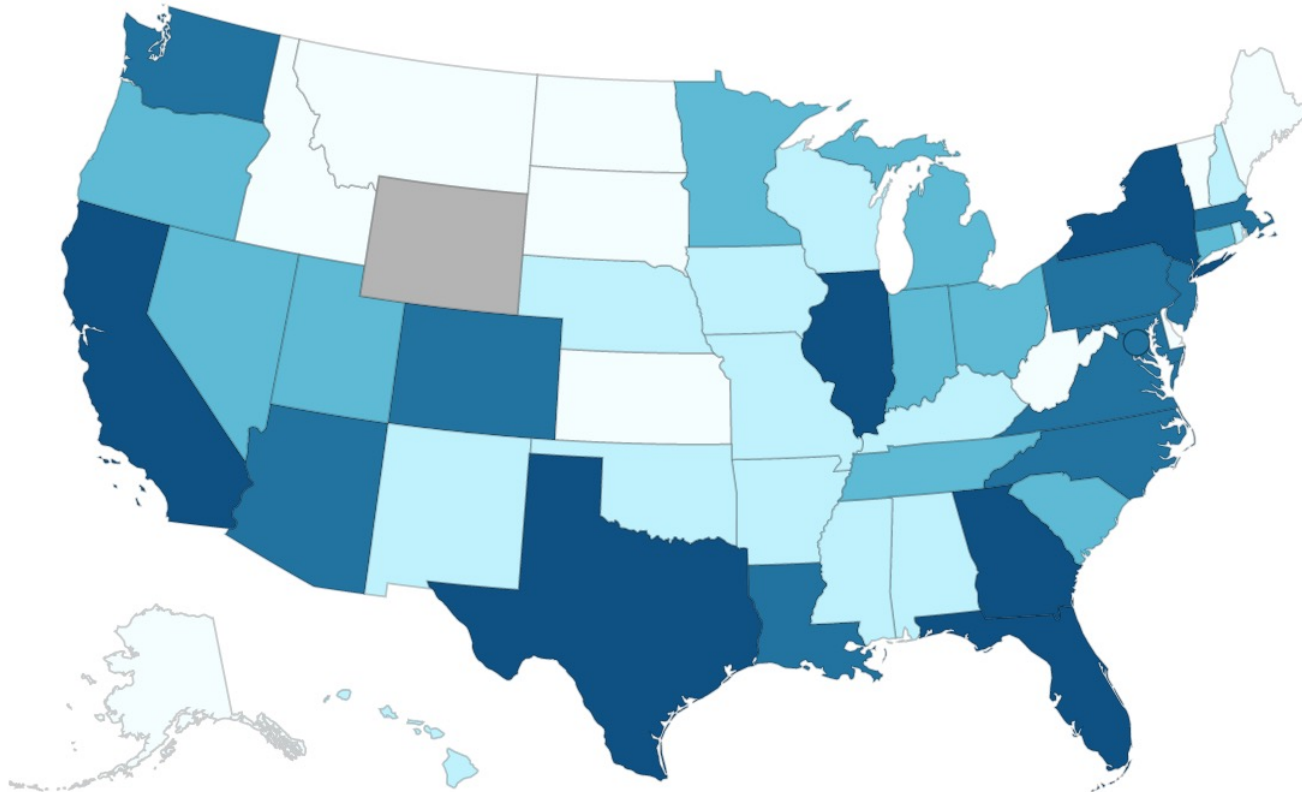
- Provider called public health and coordinated testing for monkeypox, which was positive



Monkeypox (as of 8/12/2022)

11,177 Total confirmed monkeypox/orthopoxvirus cases

*One Florida case is listed here but included in the United Kingdom case counts because the individual was tested while in the UK.



Territories PR

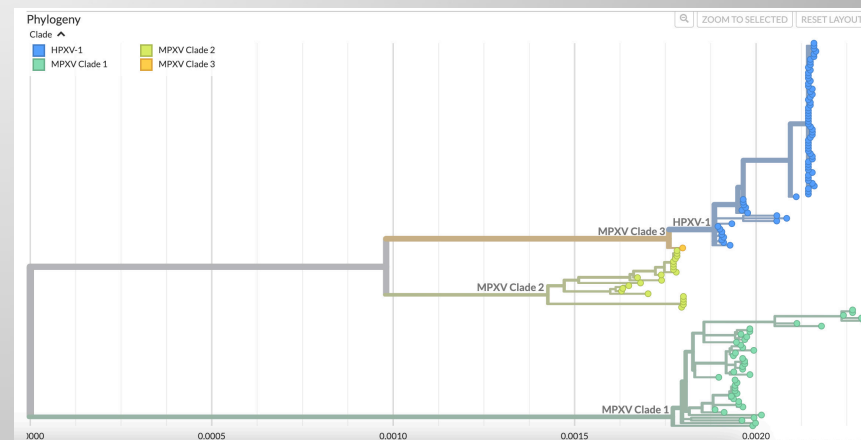


Monkeypox: History

- First isolated 1958: monkeys shipped from Singapore to Denmark became ill
- 1970: 1st confirmed human case Democratic Republic Congo(DRC)
- 2003: Sustained human to human transmission documented in DRC
- 2003: US Outbreak - Gambian giant rats imported to US – co-habitant prairie dogs sold as pets in Midwest -> 53 cases
 - Small, sporadic outbreaks outside of Africa since that time
- 2017: Nigeria outbreak – 183 cases in 18 states (Clade II)
 - Thought to reflect declining smallpox immunity & ↑ interaction forest animals
- May 2022: First cases reported from current outbreak – concentrated in men who have sex with men (MSM)

Monkeypox: Virology

- Orthopoxvirus – same genus as variola (smallpox) & vaccinia (smallpox vaccine)
 - Large number of viruses of variable pathogenicity and host range
 - Hypothesis: Gene loss driven by selective pressure leads to change in host range and pathogenicity
 - Cowpox – largest virus, wide host range, low pathogenicity
 - Smallpox – smallest virus, only infects humans, high pathogenicity
- Linear double stranded DNA virus
- Three clades
 - CI (Central Africa)
 - CII (West Africa) – less virulent
 - CIII – current outbreak (like C2)

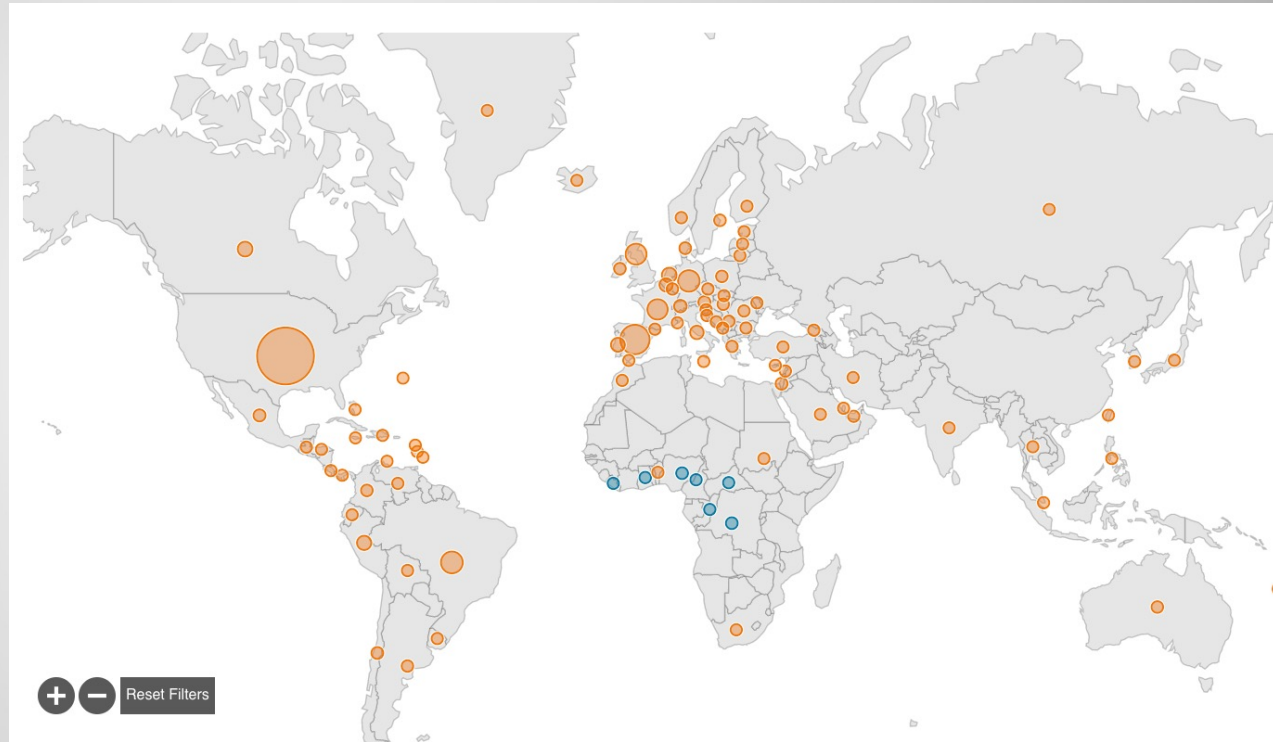


Monkeypox: Transmission

- Zoonotic disease
 - Rodents thought to be natural reservoir
- Animal-human transmission
 - Contact with bodily fluids or mucosal lesions
- Human-human transmission
 - Direct contact with infected lesions or fluid
 - Spreads during intimate contact
 - Contact with contaminated materials such as bedding or clothing
 - In utero
 - RARE: respiratory droplets

Monkeypox: Epidemiology

- First cases identified in the UK May 7, 2022
- ~ 41,000 confirmed cases in 70 countries that do not historically had MPX
- USA – 14,000 (as of 8.19.22)



Monkeypox: Clinical Course

Prodrome

1-3 Days

Rash

2-4 Weeks

Healing

- Prodrome – fever, chills, headache, myalgias, back pain, fatigue
- Rash
 - Often starts on mucosal surfaces (e.g., oropharynx) and then appear on skin
 - Centrifugal - more lesions on face and torso - > extremities (maybe)
 - Synchronous crops
 - Number or lesions highly variable

Monkeypox: Clinical Course

- Many (? Most) cases are not displaying a typical course
- Many have lesions at the presumed site of inoculation with variable subsequent development of disseminated lesions
 - Lesions on the genitals, perianal area, and mouth/pharynx are common
 - Proctitis, which is often painful, is common
 - Some patients' predominant complaint is pharyngitis – mononucleosis-like syndrome
- Not everyone has a prodrome, some have a mild prodrome, and others have it concurrent or after their initial lesions

Monkeypox: Prognosis & Complications

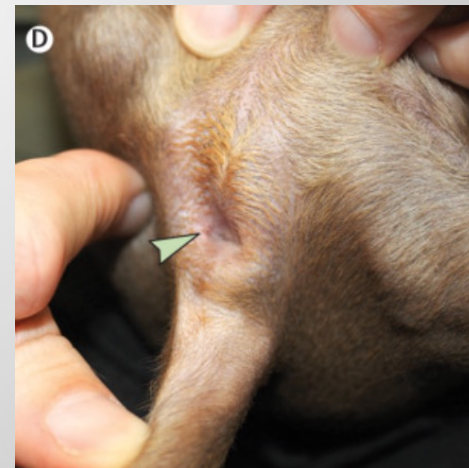
- Overwhelming majority of patients will do well
 - Case-fatality up to 10% in some older C1 series
 - Low case-fatality in more recent, C2/3 disease
- More severe disease associated with immunosuppression, children
- Complications
 - Bacterial superinfection
 - Permanent skin scarring
 - Hyper/hypopigmentation
 - Corneal scarring – vision loss
 - Pneumonia
 - Dehydration
 - Sepsis
 - Encephalitis/neuropysch

Monkeypox: transmission to pets

THE LANCET

Evidence of human-to-dog transmission of monkeypox virus

Published: August 10, 2022



Monkeypox: Shedding

Background: Anatomic sites, frequency, and duration of MPX viral shedding unknown

Methods: 12 Spanish patients with MPX has specimens collected for saliva, rectal, and pharyngeal testing. **4/7 patients with a vaccine history had received smallpox vaccine**

Outcome: PCR positivity

PCR Positivity of Different Specimen Types in Men with MPX

Specimen	Pos/Total (%)
Saliva	12/12 (100)
Rectal	11/12 (92)
Nasopharyngeal	10/12 (83)
Semen	7/9 (78)
Urine	9/12 (75)
Feces	8/12 (66)

- Shedding up to 16 days following symptom onset

- Viral shedding is widespread from different anatomic sites during MPX infection

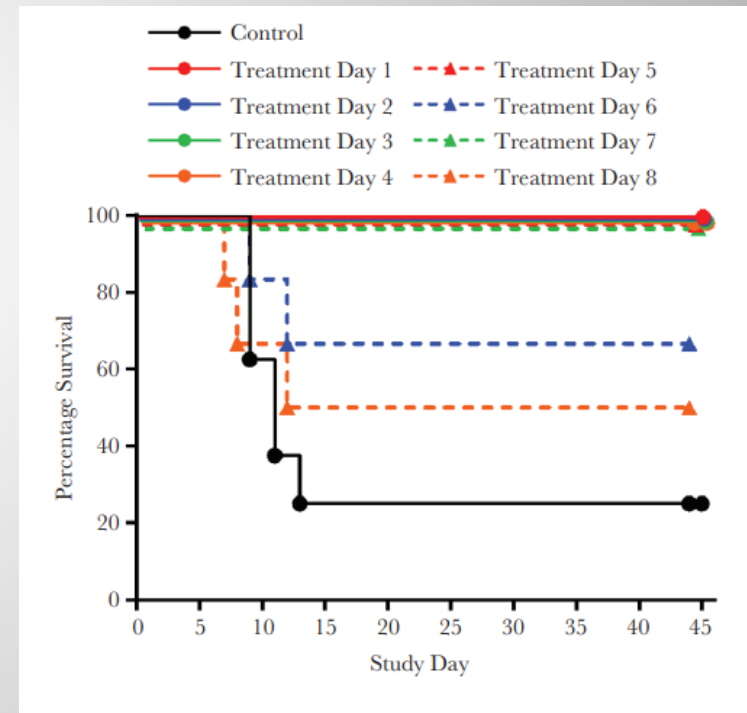
Testing

- Definitive diagnosis requires PCR testing
- Testing initially all done at State Public Health lab
 - Each test had to be approved individually – helps with surveillance, not good for clinical care and discourages testing
- UW and large commercial labs now offering
 - Improved access to testing
 - Turn around time for some tests not clear
- Testing is still way too limited
 - Need to educate providers about when to test and that the test is available

Treatment: Tecovirimat (TPOXX)

- Inhibits p37-protein in all orthopoxviruses
- Safety data in 449 volunteers
- Efficacy
 - Macaque model¹
 - Single case report suggested shorter duration shedding & illness²
- Administration
 - 600 mg PO BID x 14 days – 1200mg bid if pt >260lb
 - Requires high calories, high-fat food
- Available through expanded access protocol

TPOXX Efficacy in Macaque Model



CDC: When to Consider Treatment

- Severe disease - hemorrhagic disease, confluent lesions, sepsis, encephalitis, or other conditions requiring hospitalization
- High risk of severe disease:
 - Immunocompromised - HIV/AIDS, cancer, bone marrow and solid organ transplant, immunosuppressive drugs, autoimmunity
 - Pediatric populations - particularly age <8 years
 - Pregnant or breastfeeding women
 - Skin disease - atopic dermatitis, active exfoliative skin conditions (e.g., eczema, burns, impetigo, VZV, HSV, severe acne, severe diaper dermatitis, psoriasis, keratosis follicularis)
 - Complicated MPOX - secondary bacterial skin infection; severe nausea/vomiting, diarrhea; bronchopneumonia; concurrent disease or other comorbidities
- Aberrant infections - eyes, mouth, or other anatomic areas where *Monkeypox virus* infection might constitute a special hazard (e.g., the genitals or anus)

Treatment: Initial Challenge in Implementation

- Investigational drug process
 - 124 pages protocol
 - 5 visits with blood draws and lots of documentation – must be submitted to CDC and local IRB (this is NOT a study)
 - Each prescribing provider needs clearance
 - Not designed for a large global outbreak
- Requires response at the public health and healthcare organizational level
 - Negotiate with CDC to change protocol
 - Build local capacity HCO by HCO – expand number of providers and build referral networks
 - Can we get data on efficacy?

Treatment: Initial Challenge in Implementation

Investigational drug process

As of August 18, 2022:

CDC Regulatory Affairs simplified requirements

- Informed consent still required, doesn't need to be sent to CDC
- Intake form simplified
- Follow up forms optional

organizational level

- Negotiate with CDC to change protocol
- Build local capacity HCO by HCO – expand number of providers and build referral networks
- Can we get data on efficacy?

Monkeypox: Vaccines

- ACAM2000 – not currently being used
 - Live, replication competent *Vaccinia* virus
 - Administered by pricking the skin to cause a local infection
 - Wound needs care for 28 days
 - Virus can spread other parts of the body or to other people
 - Myocarditis/pericarditis risk ~0.6/1000
 - Contraindicated in: pregnant women, heart disease, immunocompromised, chronic skin conditions
- JYNNEOS – Currently used vaccine
 - Live non-replicating virus
 - Thought to be effective 2 weeks after initial immunization
 - Mostly local side effects – pain at injection site
 - OK in pregnancy, immunosuppressed persons

Monkeypox: Vaccines

FDA NEWS RELEASE

Monkeypox Update: FDA Authorizes Emergency Use of JYNNEOS Vaccine to Increase Vaccine Supply

[Share](#)

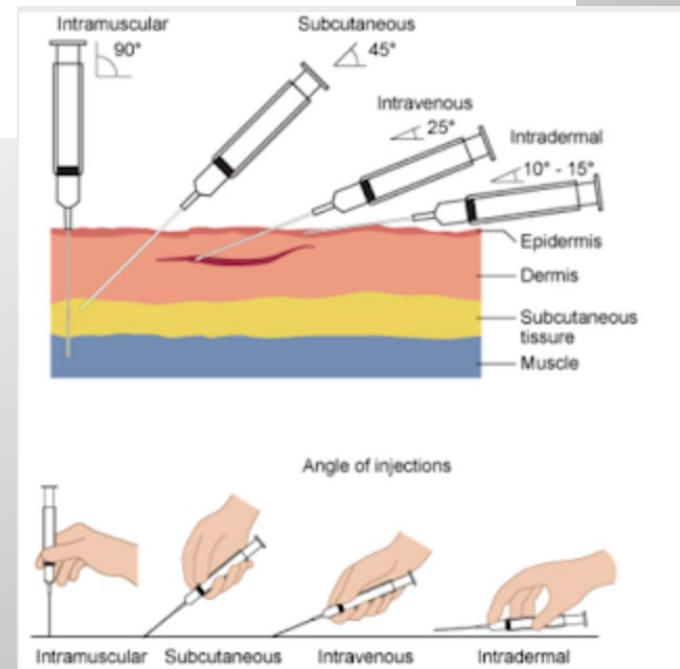
[Tweet](#)

[LinkedIn](#)

[Email](#)

[Print](#)

For Immediate Release: August 09, 2022



Monkeypox: Immunization

- Post-exposure prophylaxis
 - Focus on high-risk contacts – intimate contact
 - Best given within 4 days of exposure – up to day 14
 - Initially required confirmed exposure -> patient reported now sufficient
- PrEP
 - Not enough vaccine
 - ~60,000 GBMSM - ~1/3 at higher risk for STI and presumably MPX

Monkeypox

- Pandemic of MPX continues to grow
- Highly concentrated in GBMSM with characteristics of a sexually transmitted infection
- Will this be an outbreak or an endemic STI?
- What will be the scope? – Scale of the problem and populations affected



Case

- 5 year old child presents with vomiting dark urine, light-colored stool and jaundice.

Pediatric Hepatitis

10/2021-11/2021

- 5 pediatric patients presented to a hospital in Alabama with severe hepatitis/liver failure
- All found to have adenovirus viremia
- All previously healthy
- 4 additional cases reported through 2/2022

Pediatric Hepatitis

1/2022 – 4/2022 in UK

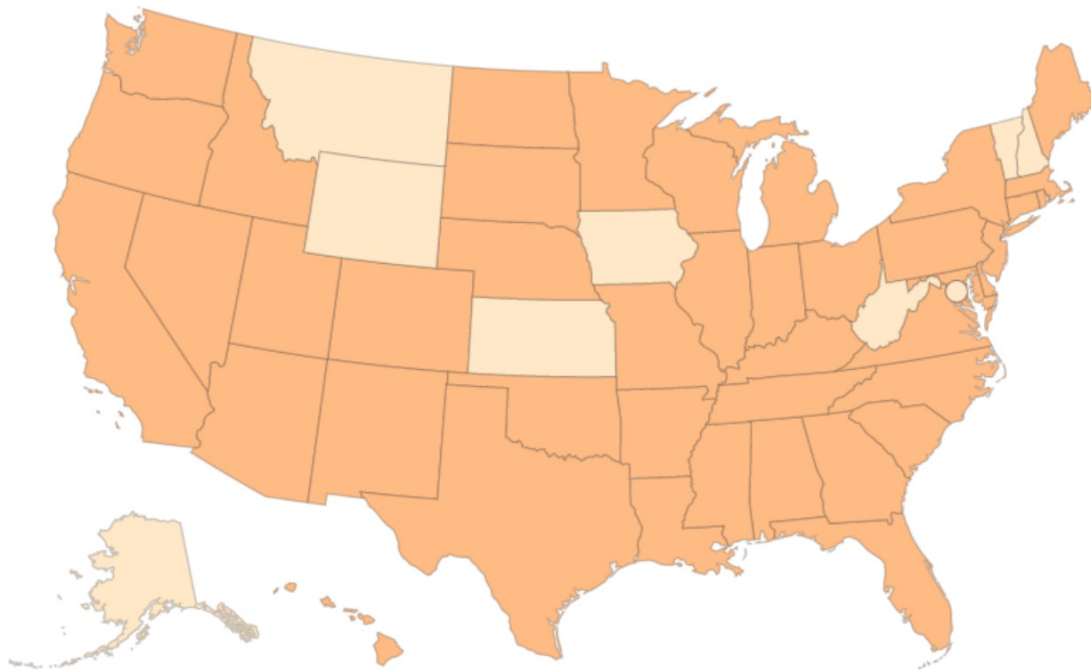
- 111 cases of hepatitis in children age < 16 years (most < 5 years old)
- Gastroenteritis prodrome, followed by jaundice, and marked AST/ALT elevations
- Adenovirus detected in 75% of cases

Pediatric Hepatitis

- 169 cases of hepatitis in children reported in 11 countries (most in UK)
- 10% required liver transplant
- 1 death
- Adenovirus detected in 74 cases (unknown how many tested)
- **Alert issued to test children with hepatitis (ALT > 500) of unknown etiology for adenovirus**

Pediatric Hepatitis

357 cases under investigation from 43 states/jurisdictions (as of 8/3/2022)



Legend

○ No PUI

● PUI

Territories

AS

GU

PR

VI

MP

FM

PW

MH



Adenovirus

- Existing virus – new clinical presentation
- **What is adenovirus?**
- **Transmission**
- **Clinical manifestations**
- **Treatment**
- **Outcomes**

Pediatric Hepatitis

- Adenovirus most frequently detected pathogen in these cases
- Pathology does not show findings consistent with adenovirus associated hepatitis so likely another co-factor involved
- Incidence of cases decreased by June



Case

- 52 year old man presents with acute onset headache, nausea, vomiting, fever and muscle pain. He develops LE weakness with absent reflexes. Sensory exam normal.

Polio – August 2022

Polio Has Been Detected in New York City Wastewater, Officials Say

The detection of the virus in sewage suggests it is circulating in the city, Health Department officials said.



Give this article



358

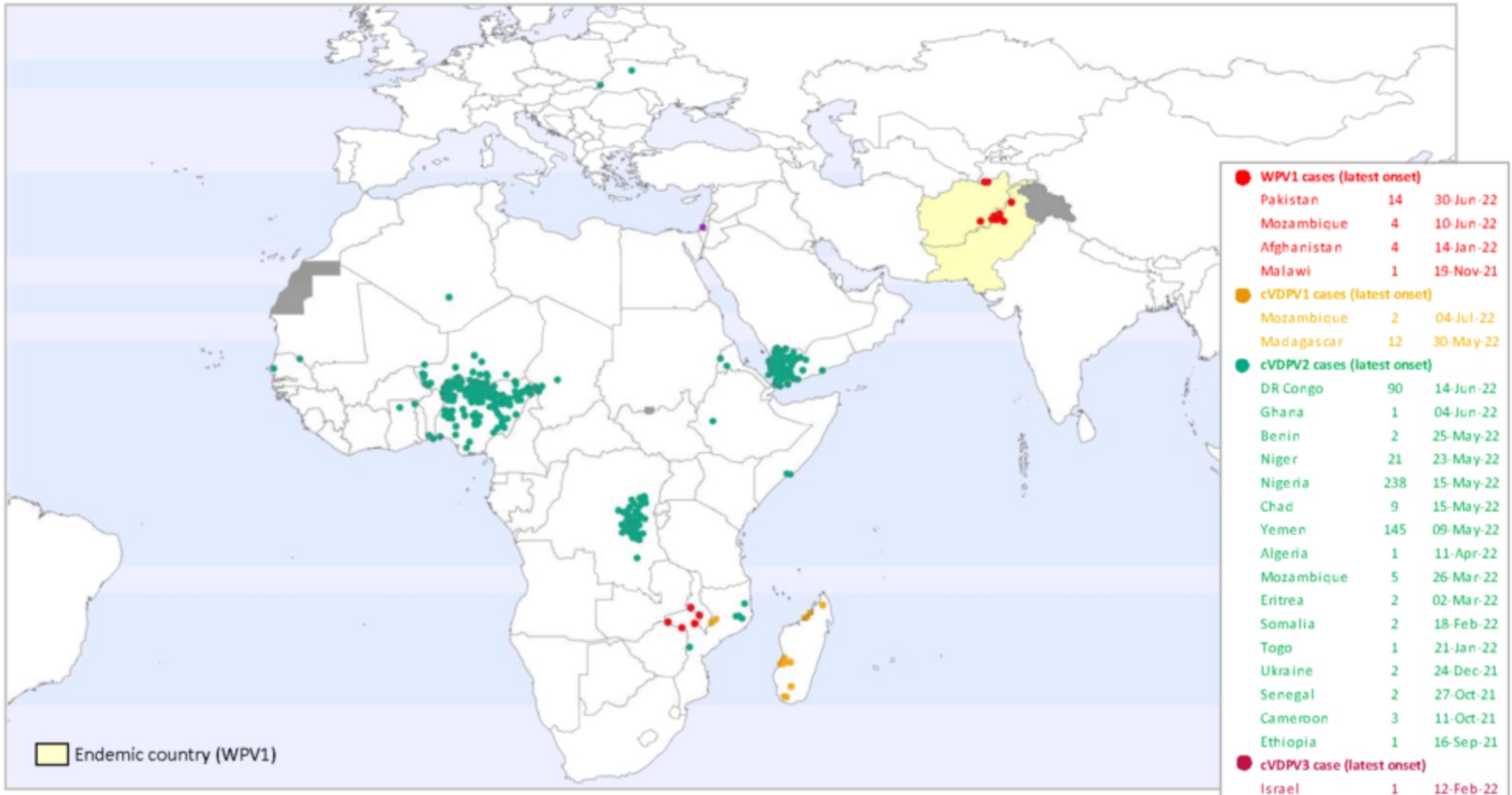


Poliomyelitis

- Polio virus – human enterovirus caused RNA virus
- Disease of acute poliomyelitis can be caused by wild type virus or from oral polio vaccine virus

Polio in Africa

Global WPV1 & cVDPV Cases¹, Previous 12 Months²



¹Excludes viruses detected from environmental surveillance; ²Onset of paralysis 10 Aug. 2021 to 09 Aug. 2022

Poliomyelitis: Clinical Manifestations

- Acute flaccid weakness due to anterior horn cell injury
- Can be associated with symptoms of meningitis
- Weakness can progress

Polio



The Fight Against Polio

The highly contagious virus was one of the most feared diseases until the 1950s, when the first vaccine was developed.

- **New York Case:** Officials in a [New York suburb](#) reported a case of polio in an unvaccinated adult man in July — [the first U.S. case in nearly a decade](#).
- **A Multibillion-Dollar Effort:** A partnership of national governments and health organizations has [a plan to rid the world of polio by 2026](#), which is now endemic in just two countries.
- **Major Obstacles:** Two of the three strains of polio have been eliminated from the Earth. [But new barriers to full eradication keep cropping up](#).
- **Childhood Vaccinations Drop:** A sharp decline in childhood vaccinations around the world during the coronavirus pandemic — including those for polio — [could threaten the lives of millions of children](#).

Take Home Points

- Be mindful of current outbreaks both domestically and globally
- Vaccinate for what we can – COVID, monkeypox, measles, polio

THANK YOU
sdhanir@uw.edu

