HENRY FORD HEALTH®

Monkeypox

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Poxviruses

- Large viruses, double stranded DNA
- With eradication of smallpox in 1977, all poxviruses are zoonoses except for molluscum contagiosum
- DNA alone not infectious – requires core enzymes
  - DNA-dependent RNA polymerase
- Replicate at site of infection
  - Dermal hyperplasia
  - Leukocyte infiltration
  - Produce epidermal growth factor
- Some cause lymphadenopathy

TABLE 69-3 Poxviruses of Vertebrates

Genus[a]	Species and Members
Orthopoxvirus[b]	Smallpox, monkeypox, vaccinia, cowpox, camelpox, mousepox, raccoonpox viruses
Molluscipoxvirus	Molluscum contagiosum virus
Parapoxvirus[c]	Orf [contagious pustular dermatitis], milker's nodes [pseudocowpox], bovine papular stomatitis viruses
Capripoxvirus	Sheeppox, goatpox, lumpy skin disease viruses
Avipoxvirus	Fowlpox, canarypox, pigeonpox, sparrowpox viruses, etc.
Leporipoxvirus	Myxoma, hare fibroma, rabbit fibroma, squirrel fibroma viruses
Suipoxvirus	Swinepox virus
Yatapoxvirus	Tanapox, Yabapox viruses

[a] Unclassified poxviruses have been isolated from e.g. seals, dolphins, crocodiles.

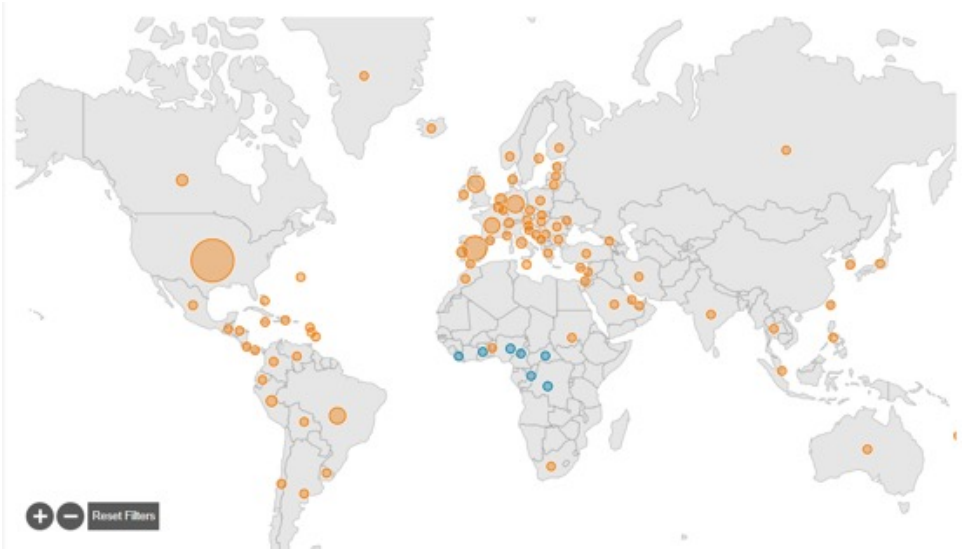
[b] Whitepox viruses, indistinguishable from smallpox virus and apparently isolated from wild animals, are considered to represent laboratory contamination with smallpox virus. Strains previously referred to as rabbitpox and buffalopox are regarded as variants of vaccinia virus.

[c] Unclassified parapoxviruses have been isolated from camels and squirrels.

From https://www.ncbi.nlm.nih.gov/books/NBK8364/

Outbreak data from 17 Aug 2022

- 38,019 cases
  - 37,632 cases in areas without monkeypox transmission previously (98.98% cases)
  - 387 cases in areas with history of monkeypox transmission (1.02% cases)
  - 12 deaths worldwide
- 12,688 cases in United States
  - 33.4% of all cases
  - 0 deaths



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

Jurisdiction	Total
Bay	1
Detroit City	29
Ingham	5
Ionia	1
Jackson	1
Kent	9
Livingston	1
Macomb	13
Montcalm	1
Muskegon	1
Oakland	18
Ottawa	4
St Clair	1
Washtenaw	6
Wayne	13
Total	**104**

Michigan monkeypox

- 104 cases
- 70.2% cases reside in:
  - **Detroit**
  - Macomb County
  - Oakland County
  - Wayne County

https://www.michigan.gov/mdhhs/keep-mi-healthy/communicablediseases/diseasesandimmunization/mpv#USReports

Monkeypox

- 1958: identified in laboratory primates
  - Animal reservoir: likely rodents, non-human primates
- 1970: identified in humans, occasional cases in Africa
- WHO renaming virus: name to be determined
  - Congo Basin / Central Africa → Clade 1
    - More virulent, requires special handling of medical waste
  - West African → Clade 2
- Current outbreak is Clade 2

Monkeypox continued

- Incubation 3-17 days
- Illness lasts 2-4 weeks
- Contagious until all scabs fall off AND fresh layer of skin forms
  - May be contagious up to 28 days

Transmission

Virus must contact non-intact skin or mucous membranes

- Close contact:
  - Direct contact with rash / body fluids from patient
  - Contact with respiratory secretions
  - Touching objects/fabrics contaminated by rash or body fluids
  - Dancing in crowded setting??? https://wwwnc.cdc.gov/eid/article/28/10/22-1191_article
- Intimate contact
  - Prolonged face to face contact
  - Hugging / kissing
  - Sexual activities & 'toys'
- Vertical transmission from mother to fetus
- Animal contact (bite, scratch, eating)

Symptoms

Not all patients develop a rash

- Usually prodrome precedes rash by 1 – 4 days (sometimes vice versa)
  - Fever, chills, lymphadenopathy, fatigue, myalgia, HA, pharyngitis, cough
- Proctitis may be only symptom (may not have typical lesions)
- May present as pharyngitis / tonsillitis
- Rash described as painful / pruritis
  - Lesions umbilicated
  - Lesions evolve together
  - May be in mouth / GU region / rectum

Progression of rash

- Macule → Papule → vesicle → pustule → scabbing/desquamation
- Pictures at https://www.cdc.gov/poxvirus/monkeypox/clinicians/clinical-recognition.html

Stage	Stage Duration	Characteristics
Enanthem		• Sometimes, lesions first form on the tongue and in the mouth.
Macules	1–2 days	• Macular lesions appear.
Papules	1–2 days	• Lesions typically progress from macular (flat) to papular (raised).
Vesicles	1–2 days	• Lesions then typically become vesicular (raised and filled with clear fluid).
Pustules	5–7 days	• Lesions then typically become pustular (filled with opaque fluid) – sharply raised, usually round, and firm to the touch (deep seated). • Finally, lesions typically develop a depression in the center (umbilication). • The pustules will remain for approximately 5 to 7 days before beginning to crust.
Scabs	7–14 days	• By the end of the second week, pustules have crusted and scabbed over. • Scabs will remain for about a week before beginning to fall off.

Testing: Orthopoxvirus PCR

- Testing offered by Michigan Dept. of Health & Human Services Bureau of Laboratories
  - Must complete form DCH-1396 if using state lab
    - https://www.michigan.gov/mdhhs/-/media/Project/Websites/mdhhs/Folder1/Folder3/DCH-1053TEST_REQUEST.pdf?rev=2226385d765f4345b03f01d43691fe7e&hash=90DC7B11EEDBA68588D93C808ADBC9AD
- Offered by commercial labs as well
- Important to check lab requirements for specimens
  - Dry swab versus swab in viral transport media
- "vigorously swab rash" but do not need to open lesions
- CDC recommends swabbing multiple lesions, but each swab will need an individual order

Treatment

- Usually manage at home
  - Hospitalization may be required for trouble eating / drinking, voiding, defecating
- Supportive care – see guidance from NY State Health Department
  - Treat STI coinfections
  - Treat bacterial superinfections
  - Keep lesions dry and covered
  - Pruritis: oral antihistamines, oatmeal baths
  - Oral lesions: salt water, 'magic mouthwash'
  - GU / anorectal lesions: sitz baths
  - Proctitis: stool softeners, OTC meds, topical anesthetic agents, gabapentin
    - Caution with opioids but may be necessary

https://www1.nyc.gov/assets/doh/downloads/pdf/cd/monkeypox-treatment-guidance-interim.pdf

Patients that may benefit from specific therapy

- People with severe disease (e.g., hemorrhagic disease, confluent lesions, sepsis, encephalitis, or other conditions requiring hospitalization)
- People who may be at high risk of severe disease:
  - People with immunocompromise (e.g., human immunodeficiency virus/acquired immune deficiency syndrome infection, leukemia, lymphoma, generalized malignancy, solid organ transplantation, therapy with alkylating agents, antimetabolites, radiation, tumor necrosis factor inhibitors, high-dose corticosteroids, being a recipient with hematopoietic stem cell transplant <24 months post-transplant or ≥24 months but with graft-versus-host disease or disease relapse, or having autoimmune disease with immunodeficiency as a clinical component)[1]
  - Pediatric populations, particularly patients younger than 8 years of age[2]
  - People with a history or presence of atopic dermatitis, persons with other active exfoliative skin conditions (e.g., eczema, burns, impetigo, varicella zoster virus infection, herpes simplex virus infection, severe acne, severe diaper dermatitis with extensive areas of denuded skin, psoriasis, or Darier disease [keratosis follicularis])
  - Pregnant or breastfeeding women[3]
  - People with one or more complications (e.g., secondary bacterial skin infection; gastroenteritis with severe nausea/vomiting, diarrhea, or dehydration; bronchopneumonia; concurrent disease or other comorbidities)[4]
- People with monkeypox virus aberrant infections that include accidental implantation in eyes, mouth, or other anatomical areas where monkeypox virus infection might constitute a special hazard (e.g., the genitals or anus)

https://www.cdc.gov/poxvirus/monkeypox/clinicians/treatment.html

Consult with CDC & health department to obtain medication

- Tecovirimat (TPOXX): currently available under expanded access investigational new drug protocol (EA IND) from CDC
  - FDA approved drug to treat smallpox
  - Inhibits VP37 envelope wrapping protein
  - PO & IV formulations
- Vaccinia immune globulin
  - Role for prophylaxis in severe T-cell immunodeficiency patients
- Cidofovir: significant toxicities / adverse events
  - FDA approved to treat CMV in HIV patients
  - Nucleotide analog to inhibit viral DNA synthesis
- Brincidofovir: lipid bound prodrug with higher bioavailability and decreased toxicity
  - CDC is working on EU IND
  - PO and IV

Smallpox vaccine

- Jynneos is attenuated, live virus that will not replicate unlike the 'traditional' smallpox vaccines
- FDA approved to prevent smallpox
  - Emergency Use Approval for monkeypox 8/9/22
- New dosing regimen is 1/5 dose administered via intradermal route
- Primarily offered to household contacts and individuals at high risk because of sexual activities
  - Not available for healthcare / lab workers at this time
- Pre-exposure prophylaxis
  - Prevent disease if administered < 96 hours after exposure
  - Less severe disease if administered 4-14 days after exposure