

MPOX: THE VIRUS FORMERLY KNOWN AS MONKEYPOX





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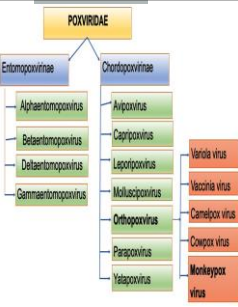
OBJECTIVES

1. DESCRIBE THE MONKEYPOX (MPOX) VIRUS AND ASSOCIATED ILLNESSES.
2. DISCUSS THE EPIDEMIOLOGY, TREATMENT, AND PREVENTION OF MPOX.
3. OUTLINE BASIC BIOSAFETY PRECAUTIONS FOR MPOX SPECIMEN COLLECTION, TESTING, RETENTION, AND DISPOSAL.

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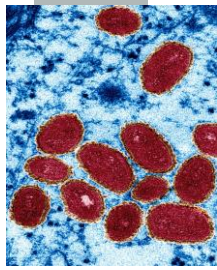
WHAT IS MPOX?



- *Monkeypox virus* (MPXV) is the etiological agent
 - dsDNA virus
 - *Poxviridae* family
 - *Chordopoxvirinae* subfamily
 - *Orthopoxvirus* genus
- mpx is the zoonotic disease caused by MPXV

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WHAT IS MPOX?



- There are 2 types of MPXV:
 - Clade I
 - Clade II
 - Clade IIa
 - Clade IIb – current outbreaks
- MPXV has been endemic in West and Central Africa since 1970
- Natural host reservoir still unknown

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HISTORY OF MPXV



- No human cases before 1970
- First identified in captive monkeys in Denmark in 1958
- August 1970: first human mpx case in 9-month-old boy in Democratic Republic of the Congo (DRC)
- Sept 1970 – April 1971: Six additional human cases in Liberia, Sierra Leone, and Nigeria
- Endemic in West and Central Africa ever since

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HISTORICAL OUTBREAKS



- DRC reports yearly cases since 1970
- Nigeria sporadic cases until re-emergence in 2017
- 2003: outbreak in USA
- 2018 – 2021: Eleven travel-related cases in Singapore, UK, Israel, and USA
 - All originated in Nigeria
 - All were confirmed as Clade II

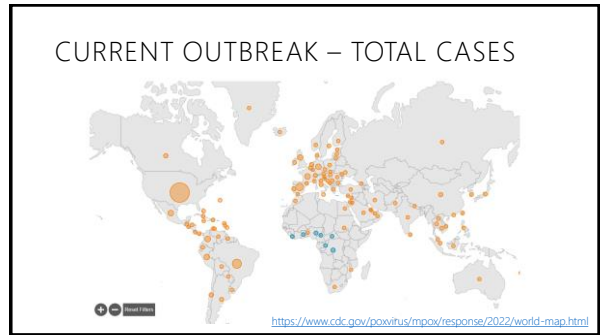
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2003 OUTBREAK IN USA

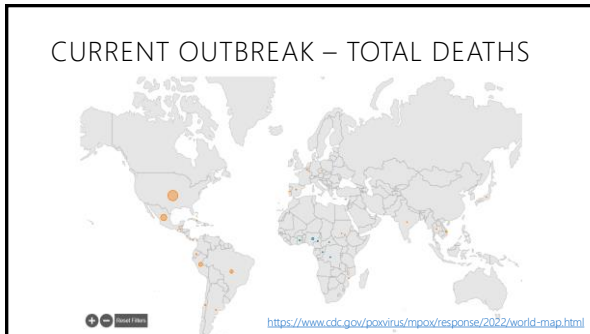
- First time human mpox reported outside of Africa
- 800 animals imported from Ghana in April 2003
- Housed next to prairie dogs being sold as pets
- 47 confirmed/probable cases in 6 states (*Illinois, Indiana, Kansas, Missouri, Ohio, Wisconsin*)
- Contact with infected prairie dogs and/or bedding
- No person-to-person transmission




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CURRENT OUTBREAK – DRC (AFRICA)


- Democratic Republic of Congo (DRC)
- Largest mpox outbreak ever recorded
- **12,569 cases and 581 deaths since Jan 1, 2023**
- Some infections transmitted via sexual contact
- CDC: Risk to general public of USA is low; get vaxxed
- Travel Notice: Level 2 – Practice enhanced precautions



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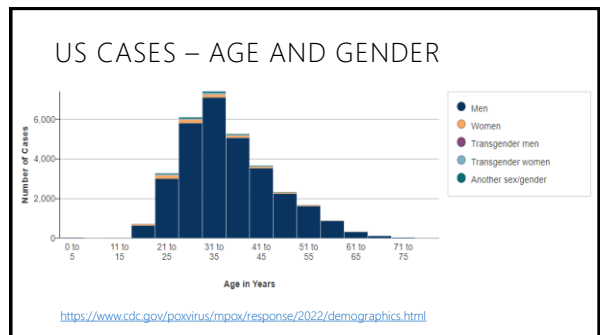
CURRENT OUTBREAK – USA

- Began May 2022
- Declared a public health emergency July 23, 2022
- **32,063 cases**
- **58 deaths**

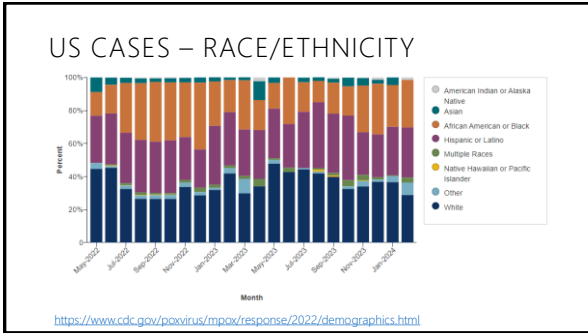


<https://www.cdc.gov/poxvirus/mpox/response/2022/us-map.html>

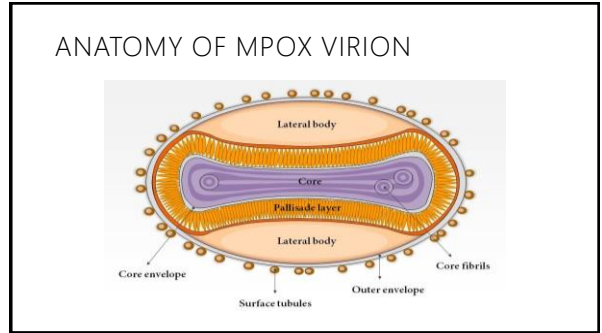
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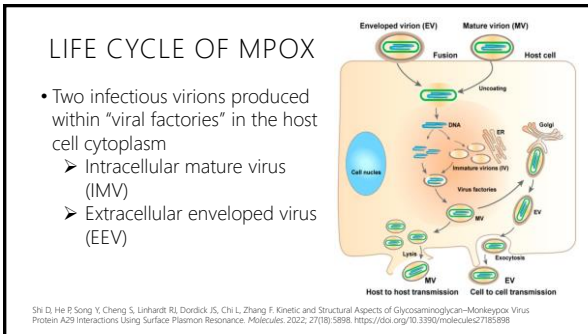
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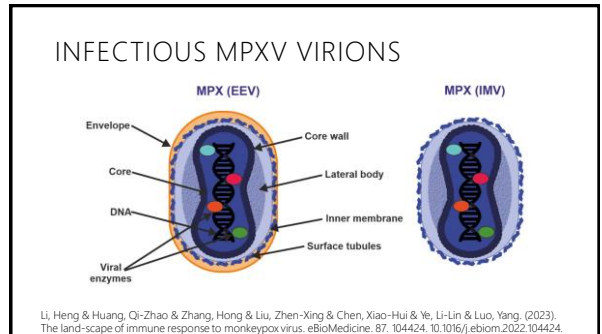
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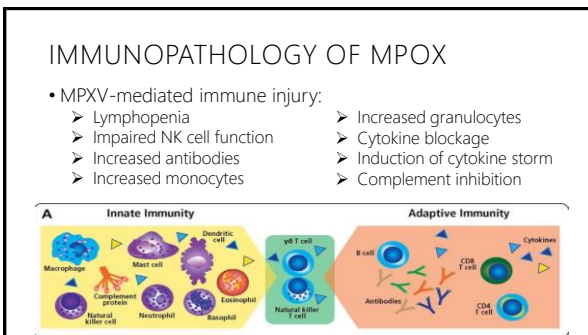
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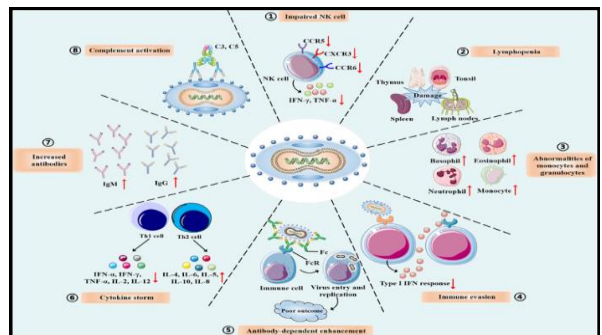
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MPOX DISEASE STAGES

- **Incubation period:**
 - No symptoms, not contagious
 - About 1 – 2 weeks
- **Prodromal period (prodrome):**
 - Early set of symptoms, usually cold/flu-like
 - May be contagious here
- **Rash:**
 - May appear without a recognized prodrome
 - Synchronous progression through multiple stages

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CHARACTERISTIC SYMPTOMS

- Typically manifest within 21 days of exposure
- Prodromal phase: flu-like symptoms
 - Fever, chills, exhaustion, muscle aches, sore throat, congestion
- **Lymphadenopathy (swollen lymph nodes)**
- Rash appears 1-4 days after the onset of prodrome
 - Hands, feet, chest, face, mouth, genitals, anus
 - Will begin as pimple/blister and may be painful or itchy
 - Lesions go through several stages before scabbing
- Patients may experience all or only a few symptoms
- Person is infectious until the last scab falls off

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MPOX RASH PROGRESSION

| STAGE | DURATION | CHARACTERISTIC(S) |
|----------|-------------|---|
| Enanthem | | Lesions may first appear in the mouth |
| Macules | 1 – 2 days | Flat lesions |
| Papules | 1 – 2 days | Raised lesions |
| Vesicles | 1 – 2 days | Raised and filled with clear fluid |
| Pustules | 5 – 7 days | Filled with opaque fluid, sharply raised, usually round and firm (deep seated); will eventually develop depression in the center (umbilication) |
| Scabs | 7 – 14 days | Pustules crust and scab over; will remain for about 1 week and then begin to fall off |

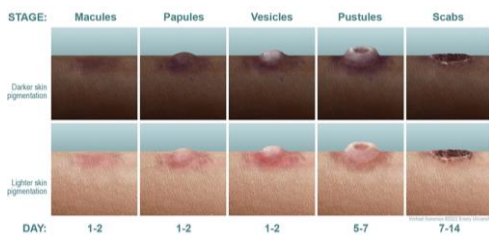
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MPOX RASH PROGRESSION



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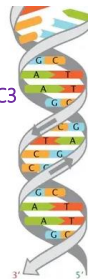
MPOX RASH PROGRESSION



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MOLECULAR ANALYSIS OF MPXV

- Interesting gene mutations, deletions, insertions
- **Most peculiar mutations concerning human APOBEC3**
 - Apolipoprotein B Editing Complex
 - Family of enzymes that deaminase cytosine
 - Generation of stop codons and missense mutations during viral replication
- Prior to 2017, evolutionary rate of MPXV was ~ 1 nucleotide substitution every 3 years
- Genome from 2022 MPXV ~42 substitutions



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SPECIFIC RISK FACTORS

- Majority of cases in current outbreak involved homosexual or bisexual males
- Unsafe, anonymous, and/or multiple sexual contact puts individuals at higher risk, regardless of sexual identity
- Those at risk for severe mpox illness:
 - Immunocompromised
 - Children younger than 1 year
 - People with history of eczema
 - Women who are pregnant

**MPOX DOES NOT
PICK AND CHOOSE.**
ANYBODY CAN GET.
EVERYBODY CAN HELP STOP IT.

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ACTIVITY RISK RATING

| | |
|---------------------|--|
| HIGHEST RISK | <ul style="list-style-type: none"> • Direct contact with the infectious rash, scabs, or body fluids • Sexual or intimate contact (please note that condoms do not protect against Monkeypox transmission) |
| SOME RISK | <ul style="list-style-type: none"> • Kissing • Cuddling • Sharing items: toothbrushes, drinks, cigarettes, etc. • Sharing a bed, towels, or other personal items • Dancing at a crowded party <i>inside</i> with non-fully clothed people |
| UNLIKELY | <ul style="list-style-type: none"> • Touching a doorknob • In public restrooms or on public transit • Traveling in an airport or on a plane • In a swimming pool, hot tub, or body of water • At a grocery store or coffee shop or a gym (via equipment) • Trying on clothing at a store • Coworker-to-coworker transmission • Dancing at a crowded party <i>outside</i> with fully clothed people |

<https://michigansealing.org/monkeypox-risk/>

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DIAGNOSIS



- Important to distinguish mpox from chickenpox, measles, bacterial skin infections, scabies, herpes, syphilis, other STIs, and medication-associated allergies
- **Preferred method is detection of viral DNA by PCR**
- **Best specimens are taken directly from rash**
- Serology is not recommended – antibody detection will not distinguish between different orthopoxviruses

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TREATMENT

- Goal is to take care of rash, manage pain, and prevent complications
- Antiviral medications available:
 - **Tecovirimat (ST-246 or TPOXX®)**
 - Brincidofovir (CMX001)
 - Cidofovir (CDV or Vistide®)



<https://www.cdc.gov/poxvirus/mpox/clinicians/Tecovirimat.html#print>

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VACCINATION = PREVENTION

- JYNNEOS (Imvamune or Imvanex)
 - Approved by FDA in September 2019
 - Prevention of smallpox and mpox in adults >18 years
 - Modified, 3rd generation attenuated *Vaccinia* virus
 - 2-dose series
- ACAM2000™
 - Approved by FDA in August 2007
 - Recommended as post-exposure prophylaxis
 - Modified, 2nd generation attenuated *Vaccinia* virus
 - Not as safe



<https://www.cdc.gov/poxvirus/mpox/vaccines/vaccine-recommendations.html>

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LABORATORY BIOSAFETY MEASURES

- Laboratorians who work directly with viral cultures or infected/contaminated animals should be vaccinated
 - Booster every 2 years
- Routine specimen processing in BSL-2 laboratory under hood
- Follow all other Standard Precautions and biosafety protocols
 - PPE, eye protection, double gloves, limit number of staff manipulating specimen, avoid creating aerosols




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LABORATORY BIOSAFETY MEASURES

- Culture-based testing should not be performed in clinical or diagnostic laboratory
- Quantity of orthopoxvirus in blood and body fluids is low
- Lesion specimen (swabs, aspirates, crusts) will have very high quantity of active virus
 - Once viral DNA is extracted, it is not infectious
- Additional guidelines for surgical pathology, cytology, autopsy, and veterinary practices

https://www.cdc.gov/poxvirus/mpox/lab-personnel/lab-procedures.html#anchor_1663782209854



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CASE REPORTING RECOMMENDATIONS

- Any lab performing diagnostic testing for mpox
- Report test results to state, tribal, local, or territorial (SLTL) health departments

<https://www.cdc.gov/poxvirus/mpox/lab-personnel/report-results.html>



<https://dh.la.gov/page/infectious-disease-epidemiology-opening-page>

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THANK YOU!

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