NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES

Division of the National Health Laboratory Service

Monkeypox: What do we know now?

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Key messages:

- **A multi-national outbreak of monkeypox has been reported in May 2022. The situation is evolving with cases being recorded in several European countries, the United States of America, Canada, Australia and the United Arab Emirates.**

- **The outbreak is linked to international travel with community-based spread. Index case? 7 May in UK, travel history to Nigeria**

- **No fatalities have yet been reported.**

- **This is the first outbreak of monkeypox to involve cases simultaneously from various non-endemic locations around the globe. It is already the largest outbreak of monkeypox recorded outside of endemic locations.**

- **The goal of surveillance, case investigation and contact tracing in this context is to break chains of human to human transmission and stop the outbreak. Laboratory testing is integral part of containment.**

Features of the current outbreak (at 3 June 2022)

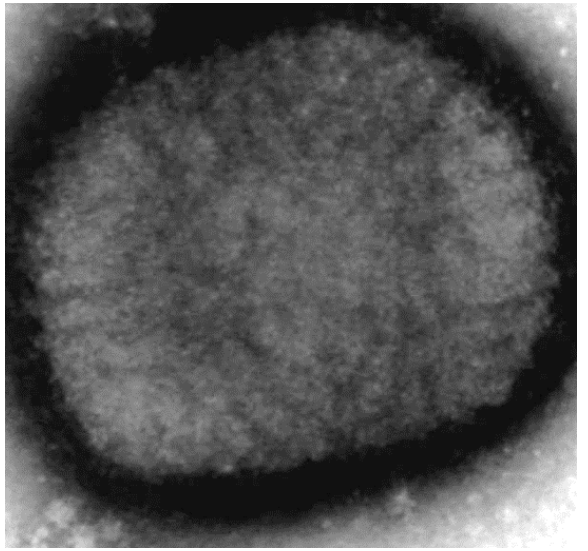
- 27 countries with 377 cases (780 lab confirmed), **no deaths**
- 88% of cases are from European countries
- Most cases male, ages 20-59 yrs
- Links with transmission for some of the cases involved males that self-identify as men having sex with men
- Large gatherings in Antwerp, Madrid and Canary Islands implicated as super spreader events
- Several cases have been characterized and belong to Western African clade
- Confirmed cases:
  Argentina (2); Austria (1); Australia (3); Belgium (12); **Canada (58);** Czechia (6); Denmark (2); Finland (2); **France (33);** Hungary (1); **Germany (57);** Ireland (4); Israel(2); Italy (20); Malta (1); Mexico (1); Morocco (1); **Netherlands (31);** Norway (1); **Portugal (138);** Slovenia (6); **Spain (156);** Sweden (4); Switzerland (4); UAE (8); **UK (207);** US (19)

Combined data from: WHO, US CDC, ECDC, Promed

Natural history of monkeypox

- Monkeypox is caused by **monkeypox virus**, a member of the *Orthopoxvirus* genus in the family *Poxviridae*.

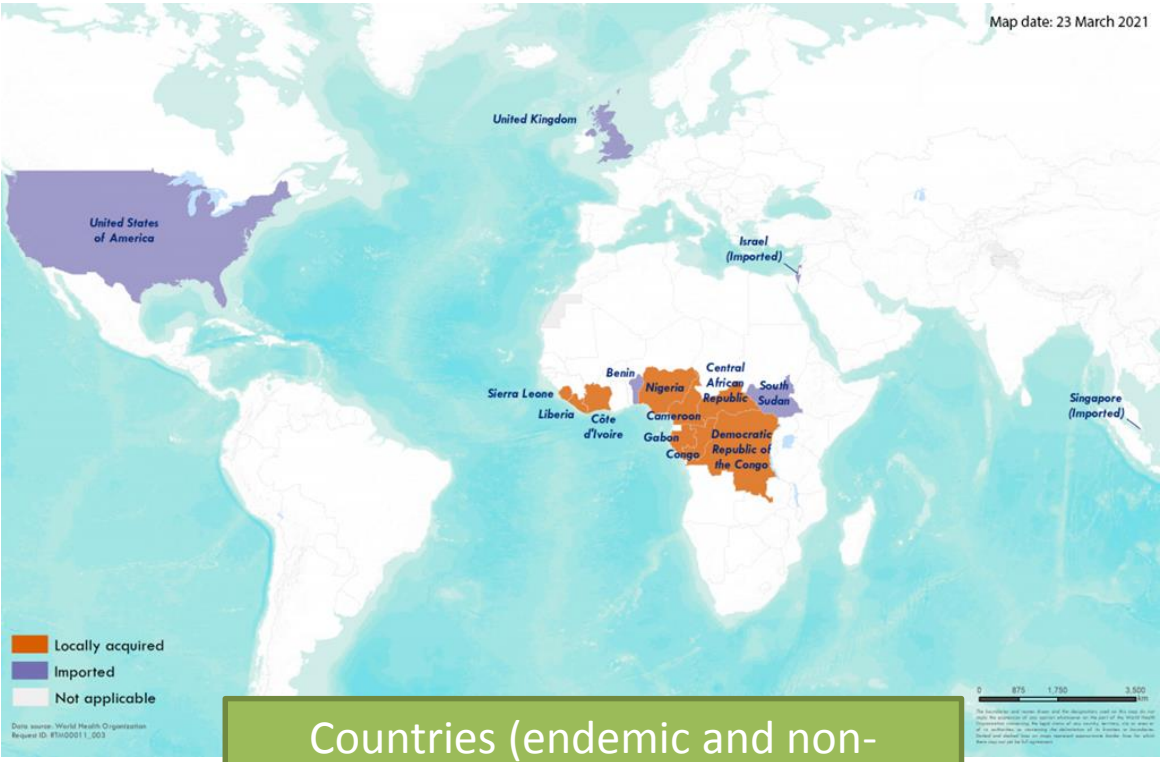
- There are **more than 80 poxviruses** known and they **affect different species** of mammals, birds, reptiles and insects.
- **Two poxviruses known to cause only human disease** – smallpox and molluscum contagiosum. The former has been eradicated through vaccination.
- Human infection from **spillover from animals** (this is zoonotic infections) may be caused by cowpox, buffalopox, orf and monkeypox virus infection.



Electronmicrograph of orthopoxvirus particle
Dr Monica Birkhead, NICD

- Monkeypox is a **viral zoonotic disease** that originates from **tropical rainforest areas of Central and West Africa** and is occasionally exported to other regions.
- <u>Endemic countries include:</u>

  Democratic Republic of Congo, Nigeria, Central African Republic, Cameroon, Ghana, Sierra Leone, Liberia, South Sudan, Ivory Coast
- There are **two distinct genetic clades** of the virus – the Central African (Congo Basin) (more severe, more transmissible?) clade and the West African clade.
- The geographical division between the two clades has so far been in Cameroon - the only country where both virus clades have been found.

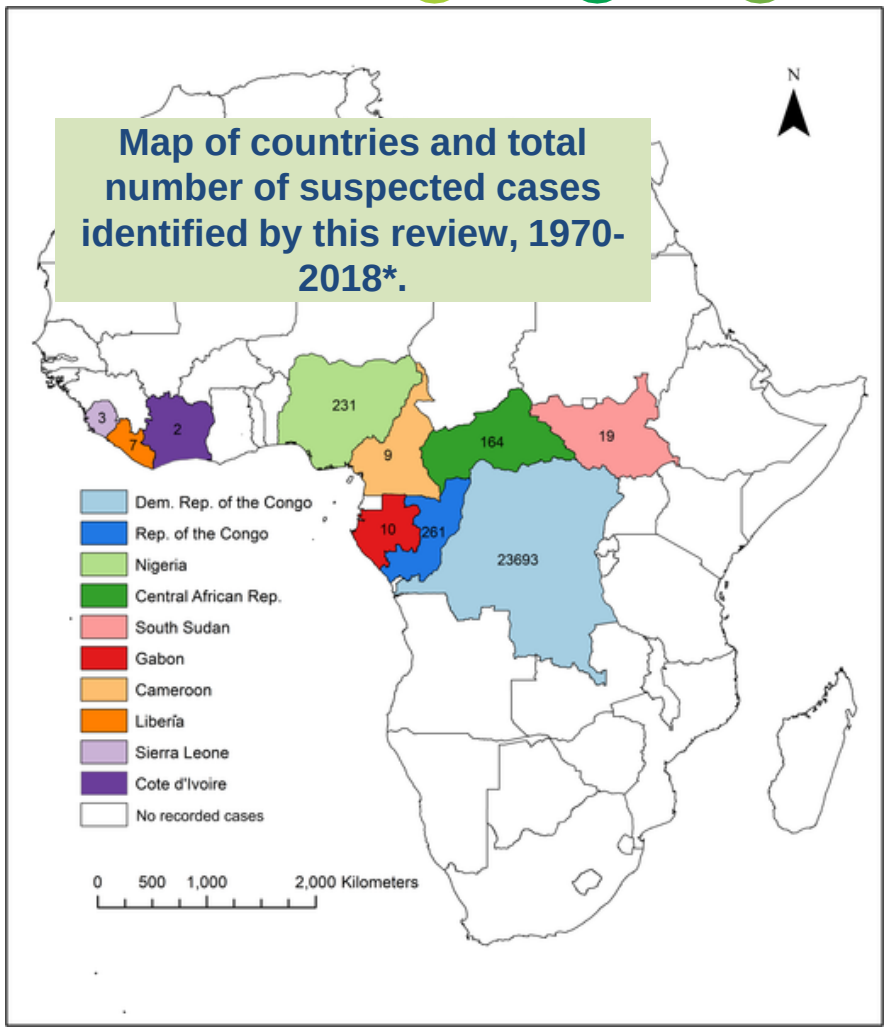


Countries (endemic and non-endemic) reporting human cases of monkeypox, 1970-2021
(Source: WHO)

Recent reporting of monkeypox in endemic countries, Jan 22 – 1 June 2022

Country	Cases (Suspected/Confirmed)	Deaths
Cameroon	28/3	2
Central African Republic	17/8	2
Nigeria	66/21	1
Republic of Congo	7/2	3
Democratic Republic of Congo	1284/10	58
Sierra Leone	2/0	0
Liberia	4/0	0
TOTAL	44 CONFIRMED	

Source: WHO



Beer EM, Rao VB (2019) A systematic review of the epidemiology of human monkeypox outbreaks and implications for outbreak strategy. PLOS Neglected Tropical Diseases 13(10): e0007791. https://doi.org/10.1371/journal.pntd.0007791
https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0007791

Previous monkeypox outbreaks outside of endemic countries

- **Denmark, 1958:** No human cases. Monkeypox discovered for the first time in monkeys exported from Africa and used for research

- **USA, 2003**: 71 cases (35 lab confirmed, 100% recovery) of monkeypox diagnosed from different locations in the US. The first report of monkeypox outside of endemic countries. Linked to exotic pet trade and involved prairie dogs which was co-housed with several other animals that originated from Ghana, these included rodents, including rope squirrels (*Funiscuirus* sp.), tree squirrels (*Heliosciurus* sp.), Gambian giant rats (*Cricetomys* sp.), brushtail porcupines (*Atherurus* sp.), dormice (*Graphiurus* sp.), and striped mice (*Hybomys* sp).

- **Israel, 2018**: Person returning from Nigeria to Israel. Had contact with rodents that he disposed form his lodging in Nigeria before falling ill, no secondary cases. The person recovered.

- **United Kingdom, 2018**: 4 unlinked cases in persons returning from Nigeria to UK. One secondary case in health care worker. One family cluster involving 3 secondary cases. 100% recovery.

- **Singapore, 2019**: Person returning from Nigeria to Singapore. NO secondary cases. 100% recovery.

- **USA, 2021**: Person returning form Nigeria to Maryland. No secondary cases. 100% recovery.

- **USA, 2021:** Person returning from Nigeria to Texas. No secondary cases. 100% recovery.

Transmission

- **Zoonotic transmission**:

  First human case noted in DRC in child / 1970

  1970-1980: only 59 human cases reported, all cases occurred in rain forests of Western/Central Africa in individuals exposed to forest wild life

  Close contact with infected animals / Bites, scratches, bush meat preparation (in adequately cooked meat; slaughtering; animal derived products), contact with contaminated materials

  True host/reservoir still unknown

  Have been isolated from rope squirrel, mangabey. Also other mammals including tree squirrels, Gambian pouched rats, dormice, other non-human primates

- **Person-to-person transmission**:

  Close contact (prolonged face to face contact, kissing, sexual contact)

  Contact with materials contaminated with virus (via scabs, lesion fluid, for example contaminated linen/clothes)

  Large droplet transmission is possible

  HCW and close contacts such as household members/sexual partners are at greatest risk

  Secondary attack rate, approx. 10% in smallpox unvaccinated individuals

Source: Wikipedia

- Virus enters the body through broken skin, respiratory tract, or the mucous membranes (eyes, nose, or mouth).

Clinical aspects

- Incubation period: 6 to 13 days (range: 5 to 21 days)
- The infection can be divided into two periods:

Invasion period (lasts between 0-5 days) fever, intense headache, lymphadenopathy (swollen lymph glands)*, back pain, body aches, intense weakness, chills

*distinctive feature of monkeypox compared to chickenpox, measles etc

Skin eruption (begins within 1-3 days of appearance of fever).

Concentrated on the face and extremities rather than on the trunk.

It affects the face (in 95%), and palms of the hands and soles of the feet (75%).

Also mouth (70%), **genitalia and anogenital** (30%), eyes (20%), cornea (rarely).

Localization of lesions are sometimes reported – for example only on hands or only on genitals. May be indicated of site of exposure and limited spread of the virus systemically .

Rash evolution: macules (lesions with a flat base) to papules (slightly raised firm lesions), vesicles (lesions filled with clear fluid), pustules (lesions filled with yellowish fluid), and crusts which dry up and fall off. See next slide.

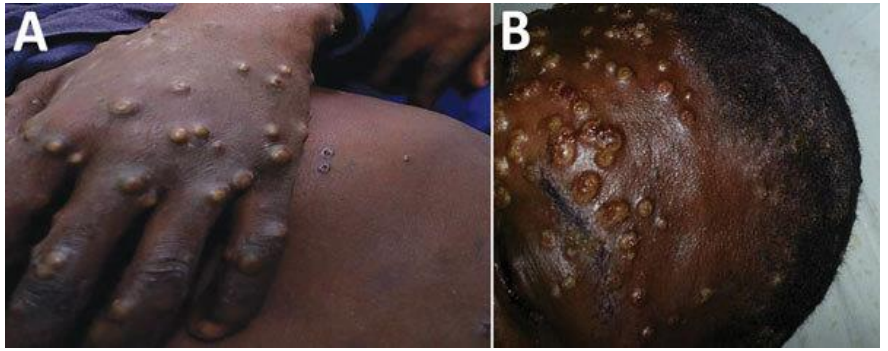
Number of lesions: few to several thousand.

Most lesions appear at the same time, so mostly uniform development

Severe cases: lesions can coalesce until large sections of skin slough off.

Source: CDC, USA

Source: Medscape



Source: Yinka-Ogunleye, A., Aruna, O., Ogoina, D., Aworabhi, N., Eteng, W., Badaru, S., ... & Ihekweazu, C. (2018). Reemergence of human monkeypox in Nigeria, 2017. *Emerging infectious diseases*, *24*(6), 1149.

Source: UK Health Security Agency

Monkeypox lesions

Sources: Mayoclinic and WHO

Clinical aspects (cont.)

- Self-limited disease, lasting 2 to 4 weeks
- Severe cases: Children / Pregnant women / Underlying immune deficiencies

  Since 2017 cases in monkeypox deaths in West Africa have included children/untreated HIV disease

  Complications: Secondary infections, sepsis, encephalitis, pneumonitis, cornea infection with vision loss

  Sequelae: Scarring, vision loss (rare)
- Case fatality ratio, varies, in recent outbreaks involving Western Africa clade approx. 1%
- Differential diagnosis:

  Chickenpox (varicella virus) (typically no lymphadenopathy/lesions at different stages at a given time)

  Measles / Syphilis (primary/secondary) / Herpes simplex / Herpes zoster / Hand-foot and mouth disease / Molluscum contagiosum / Bacterial skin infections / disseminated gonococcus infection /Chancroid, lymphogranuloma venereum, granuloma inguinale/ Non-infectious aetiologies such as allergic reaction

Treatment and vaccines

- Most case do not need any specific treatment and infection resolves on it own without long-term side effect
- Doctors may prescribe medication to alleviate the symptoms of the disease
- Vaccination against smallpox was demonstrated through several observational studies to be about 85% effective in preventing monkeypox. Thus, prior smallpox vaccination may result in milder illness. Smallpox vaccination was ceased in most countries by 1980 with the eradication of smallpox. A newer vaccine based on a modified attenuated vaccinia virus (Ankara strain) was approved for the prevention of monkeypox in 2019. This is a two-dose vaccine for which availability remains limited.
- No specific recommendations from WHO on how vaccination will be used in current outbreak (yet)

LABORATORY INVESTIGATION OF SUSPECTED MONKEYPOX CASES

- First line test: Monkeypox or orthopoxvirus PCR
- Electron microscopy can be useful
- Sequencing of positive cases is important
- Samples:

Specimen type	Collection materials	Comments
Skin lesion material: Swabs of lesion exudate Roofs Lesion crust	Dacron or polyester flocked swabs with VTM or dry swab	Required for all investigations
Throat swab	Dacron or polyester flocked swabs with VTM or dry swab	Optional
Rectal and or genital swabs (if lesions present)	Dacron or polyester flocked swabs with VTM or dry swab	Optional
Semen	Urine specimen jar	Optional
Plasma	EDTA collection tube (purple top)	Optional
Serum	Serum separator tubes or clotted blood	Optional

Ship as cat A (UN2814) (in accordance with IATA regs), preferably on ice (cold chain)

- Biosafety issues:

Risk based (previously categorized as a risk group 3 agent)

For basic processing for diagnostic procedures – universal precautions / preference for staff that are vaccinated for smallpox

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See NICD website: www.nicd.ac.za/monkeypox

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