Introduction to monkeypox

Prevention and control

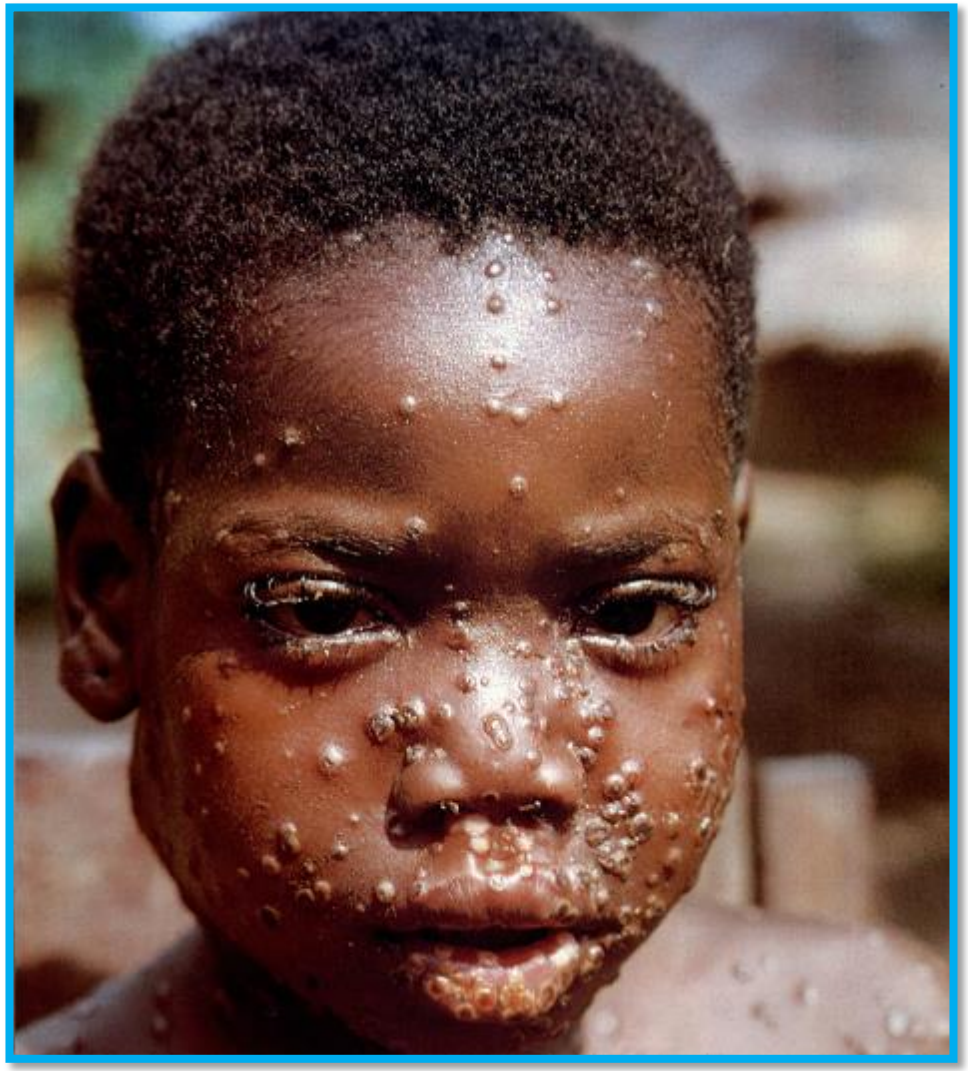
World Health Organization

Monkeypox: Learning objectives

- Understand the emergence of monkeypox
- Describe routes of transmission
- List signs and symptoms
- Identify monkeypox, chickenpox, measles
- Describe laboratory specimens and tests
- Discuss prevention and control strategies

Credit: Am J Trop Med Hyg./ Reynolds et al., 2013

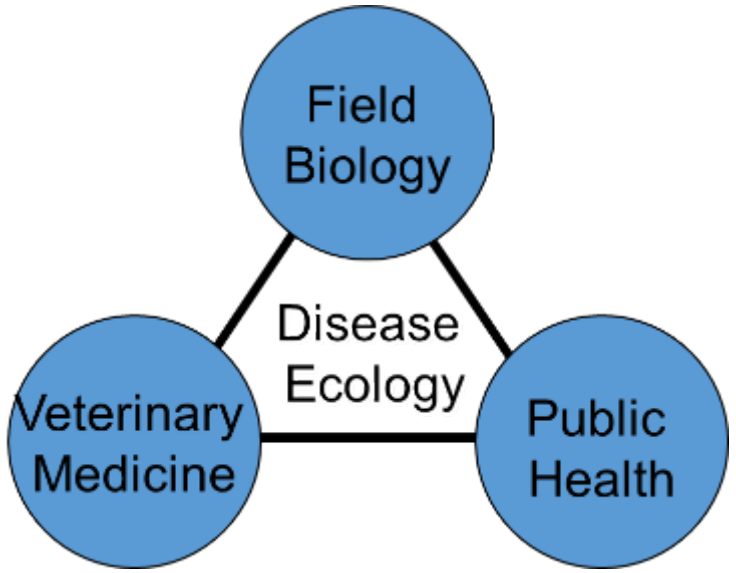
Monkeypox: Illness



Credit: WHO/ M. V. Szczeniowski

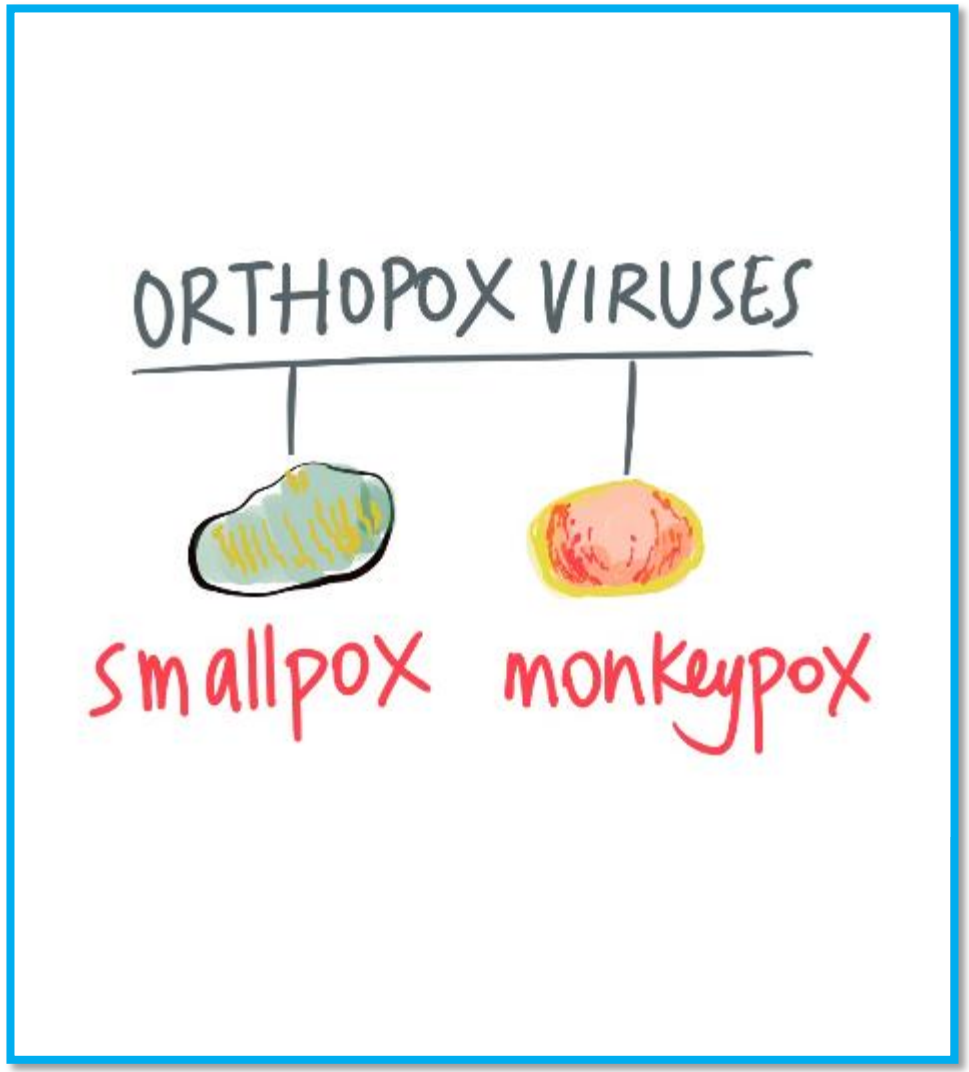
- infectious disease caused by monkeypox virus and characterized by a severe rash
- typically self-limiting, but can lead to severe illness or death
- death occurs in up to 11% of cases, most often in younger age groups

Monkeypox: Zoonotic transmission



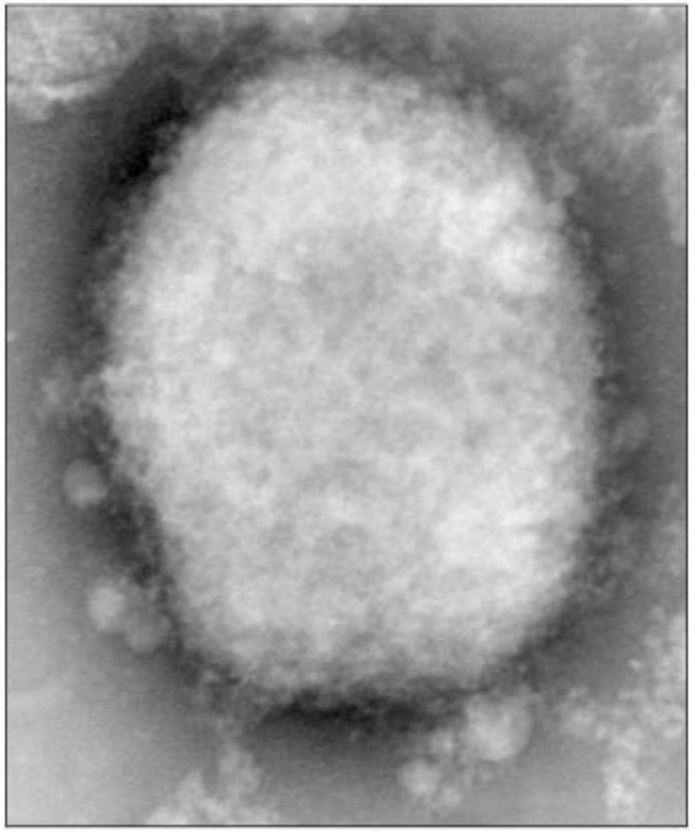
- Monkeypox occurs primarily around rainforests of West and Central Africa.
- The natural host of monkeypox is not known.
- Many species of small rodents and non-human primates are susceptible to monkeypox virus.
- Following the eradication of smallpox, monkeypox virus emerged as the most significant orthopoxvirus in humans.

Monkeypox: The orthopoxviruses



- Like cowpox virus and variola virus (which causes smallpox), the monkeypox virus is a species of the genus *Orthopoxvirus* in the family *Poxviridae.*
- Monkeypox is a zoonosis (transmitted to humans from animals) with symptoms similar to smallpox, although less severe.
- Smallpox was eradicated in 1980 and vaccination ceased.
- Waning immunity may be a factor in the emergence of monkeypox.

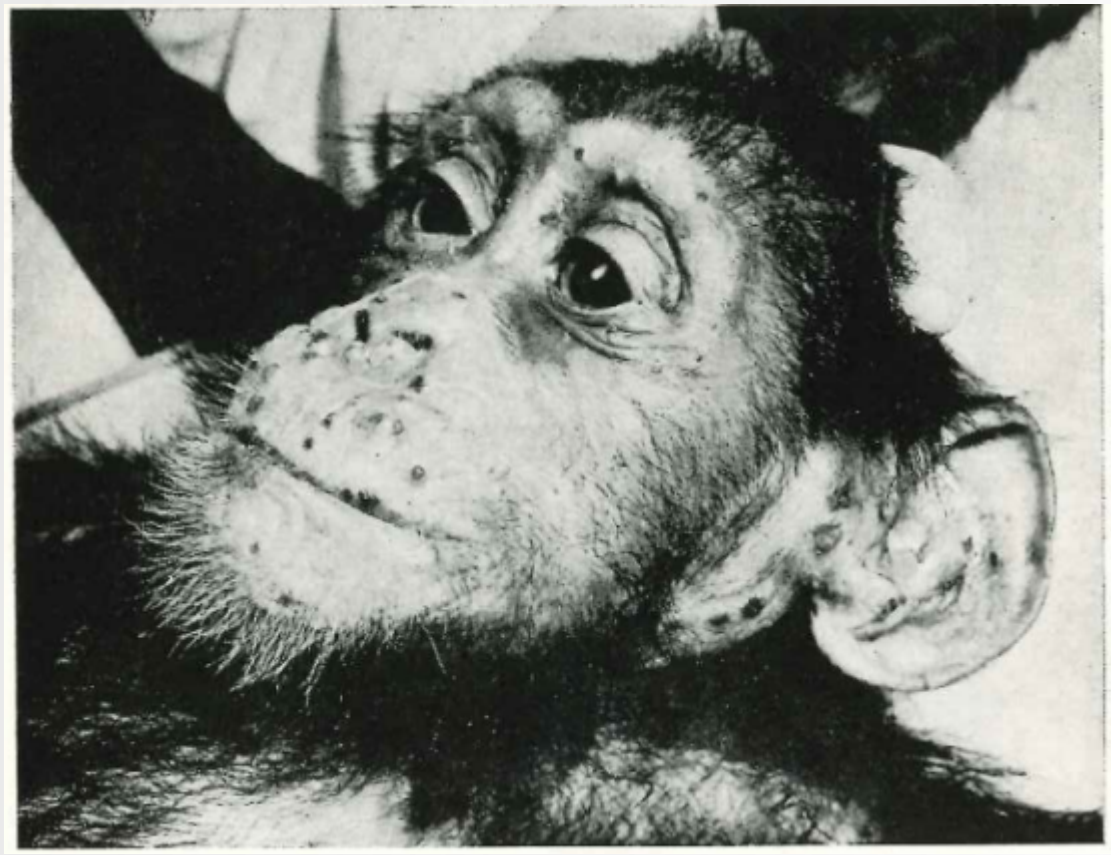
Monkeypox: Virus characteristics



Credit: The Centers for Disease Control and Prevention (CDC), USA

- Distinct virus subtypes group in two clades:
- The **Central African** clade, prevalent in the Central African Republic, the Democratic Republic of the Congo and other countries.
  - Clinically, virus in this clade causes more severe illness and case fatality up to 11%
- The **West African** clade, found in Nigeria, Côte d'Ivoire, Liberia and Sierra Leone.
  - This monkeypox virus causes less human-to-human transmission, less severe illness, and death in up to 6% of cases.

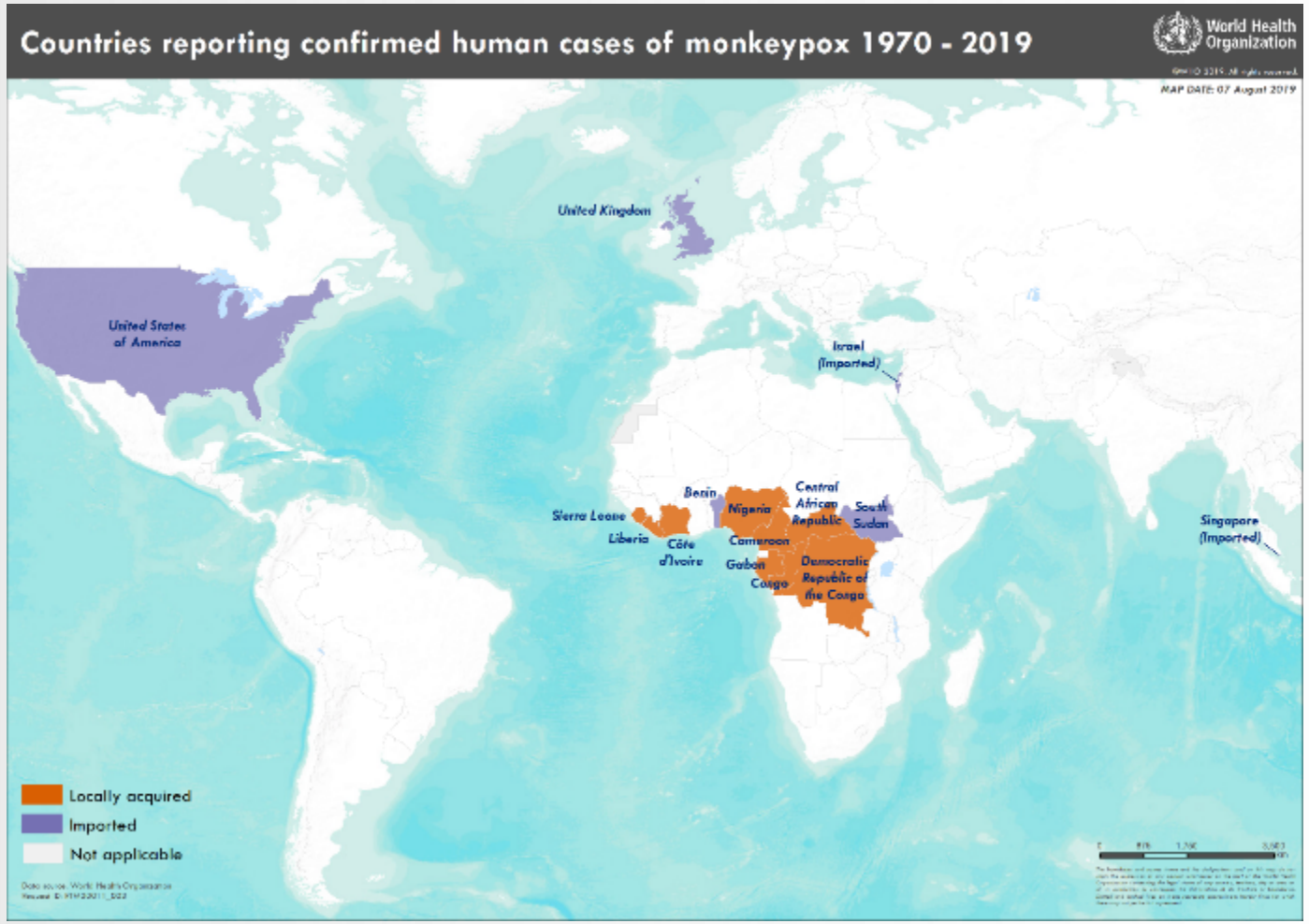
History of monkeypox



Credit: Exp Anim / C. Milhaud, et al., 1969

- Monkeypox was first identified as an illness of non-human primates. The virus is also found in rodents.
- Monkeypox in humans was first identified in 1970 in the Democratic Republic of Congo.
- Democratic Republic of the Congo routinely reports a high number of cases: more than 1,000 suspected cases per year since 2005.

Monkeypox: Geographic distribution



- Since 2016, human monkeypox has been confirmed in
  - the Central African Republic,
  - the Democratic Republic of the Congo
  - Liberia
  - Nigeria
  - the Republic of the Congo
  - Sierra Leone.
- In 2018-19, cases were confirmed among travelers from Nigeria in
  - Israel
  - Singapore
  - the United Kingdom

Monkeypox : Animal-to-human transmission

Credit: 123rf

- Human infection has occurred from handling infected animals: giant poached rats, rope squirrels, and monkeys.
- Infection results from direct contact with the blood, bodily fluids, or external lesions of infected animals.
- Eating inadequately cooked meat of infected animals is a possible risk factor.
- For most human infections, the source is not known.

Animal species in Africa found to host monkeypox virus

Gambian pouched rat
Cricetomys gambianus *

Dwarf dormouse
Graphiurus murinus *

Sun squirrel
Heliosciurus* sp.

Rope squirrel
Funisciurus* sp.

Colobus monkey
Colobus sp. **

Sooty mangabey
Cercocebus atys **

* Credit: The Centers for Disease Control and Prevention (CDC), USA
** Credit: 123rf

Monkeypox transmission: Human-to-human

- Human-to-human transmission results from close contact with infected respiratory droplets, skin lesions, or contaminated objects.
- Health care workers and household members of active cases are at higher risk of infection.
- As human-to-human transmission is limited, most outbreaks consist of only a few cases within families.

Monkeypox: Incubation period

- The interval from infection to onset of symptoms is usually 6 to 13 days, but can range from 5 to 21 days.

WHO/ M. V. Szczeniowski

Monkeypox: Disease course

- The infection progresses in two phases:
  - the **invasion** period (0-5 days) characterized by fever, headache, lymphadenopathy (swelling of the lymph nodes), back pain, myalgia (muscle aches), and fatigue; and
  - A characteristic **rash** appearing in stages 1-3 days after the onset of fever, beginning on the face and spreading to the trunk and limbs.

Credit: Nigeria Centre for Disease Control

Monkeypox: An evolving rash

- The rash lesions evolve from macules (lesions with a flat base) to papules (raised firm lesions) to vesicles (filled with clear fluid) to pustules (filled with yellowish fluid), followed by crusts
- The rash affects
  - the face in 95% of cases,
  - the palms and soles of the feet (75%),
  - oral mucous membranes (70%),
  - genitalia (30%),
  - the conjunctivae and cornea (20%).
- It may take three weeks for crusts to disappear.

Credit: CDC/ B. W. J. Mahy

Monkeypox: Extent and duration of illness

- Lesions range from a few to several thousand and are often painful.
- Severe lymphadenopathy (swollen lymph nodes) is a distinctive feature of monkeypox and generally develops before the rash.
- Monkeypox usually lasts 3 to 4 weeks.
- Severe illness occurs more commonly in children.

Swollen lymph nodes

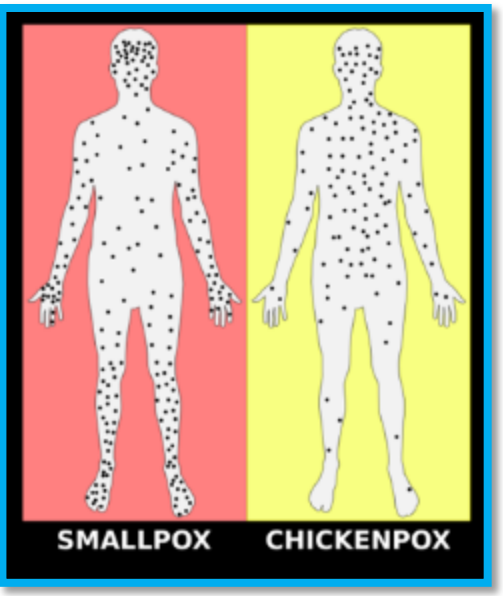
Credit: CDC/ B. W. J. Mahy

Monkeypox: Differential diagnosis

WHO/ M. V. Szczeniowski

- Monkeypox can resemble other infectious illnesses with fever and rash, such as:
  - varicella (chickenpox)
  - measles
  - smallpox (now eradicated).
- Other conditions to ruled out:
  - bacterial skin infections, scabies, syphilis and medication allergies
- Early considerations include other febrile illnesses
- Laboratory confirmation is necessary to make a definitive diagnosis.

Monkeypox: Clinical features



Symptoms	Monkeypox	Chickenpox	Measles
Fever	Fever > 38 °C Rash after 1-3 days	Fever to 39 °C Rash after 0-2 days	High fever to 40.5 °C, Rash after 2-4 days
Rash appearance	Macules, papules, vesicles, pustules present at the same stage on any area	Macules, papules, vesicles, present in several stages	Non-vesicular rash in different stages
Rash development	Slow, 3-4 weeks	Rapid, appear in crops over several days	Rapid, 5-7 days
Rash distribution	Starts on head; more dense on face and limbs; appears on palms and soles	Starts on head; more dense on body; absent on palms and soles	Starts on head and spreads; may reach hands and feet
Classic feature	Lymphadenopathy	Itchy rash	Koplik spots
Death	Up to 11%	Rare	Varies widely

Note: Smallpox was eradicated in 1980. Clinically, smallpox was very similar to monkeypox. However, lymphadenopathy was not present in smallpox. Smallpox was more contagious and more often fatal.

Monkeypox: Laboratory diagnosis

Credit: Am. J. Trop. Med. Hyg. / McCollum, 2017

- Monkeypox can be confirmed in the laboratory.
- The best specimens are from lesions (fluid, roof and crust).
- The virus can be best identified with nucleic acid tests by PCR. Antigen and antibody detection methods are not specific
- Specimens from persons and animals should be handled by trained staff, wearing personal protective equipment and working in suitably equipped laboratories.
- Procedures for safe storage and transport of samples must be followed.

Monkeypox: Infection prevention and control

- Health care workers caring for patients or handling specimens must take standard, contact and droplet precautions:
  - wash hands before and after caring for a patient, touching surroundings or handling specimens
  - wear appropriate personal protective equipment including gowns, gloves, masks, goggles and boots
  - ensure isolation of the patient in hospital or at home
  - ensure proper waste disposal and environmental decontamination
  - ensure safe and dignified burial.

Monkeypox: Reducing human-to-human transmission

- Any person in contact with or taking care of a person with monkeypox should:
  - avoid close contact
  - wear gloves and other protective equipment
  - always wash hands before and after caring for or visiting sick persons.

Monkeypox: Prevention and treatment

WHO/ M. V. Szczeniowski

- Case management is based on symptom-specific, supportive care.
- First generation vaccinia vaccines used to prevent smallpox also largely protected vaccinees from monkeypox.
- In 2019, a newer vaccinia vaccine for smallpox was also approved for prevention of monkeypox in adults.
- Further vaccination and treatment studies are underway.

Monkeypox: Surveillance

- Countries at risk should include monkeypox in their integrated disease surveillance and response system
- The goal is to detect and immediately respond to any suspected case of monkeypox
- Develop case definitions: e.g. a suspected case may be
  - an acute illness with fever > 38 °C, intense headache, lymphadenopathy, back pain, myalgia, and intense fatigue followed one to three days later by a progressively developing rash on the face and spreading to the body, palms of hands and soles of feet.
- Safely collect patient information and lesion samples from every suspected case for laboratory testing.

Monkeypox: Outbreak response

- Each suspected or confirmed case of monkeypox requires immediate response.
- Report all case information to health authorities.
- Initiate outbreak coordination.
- Put in place laboratory confirmation, contact tracing, active search, rumour tracking, and enhance surveillance.
- Initiate community education and risk communication.
- Institute infection prevention and control measures in all situations.

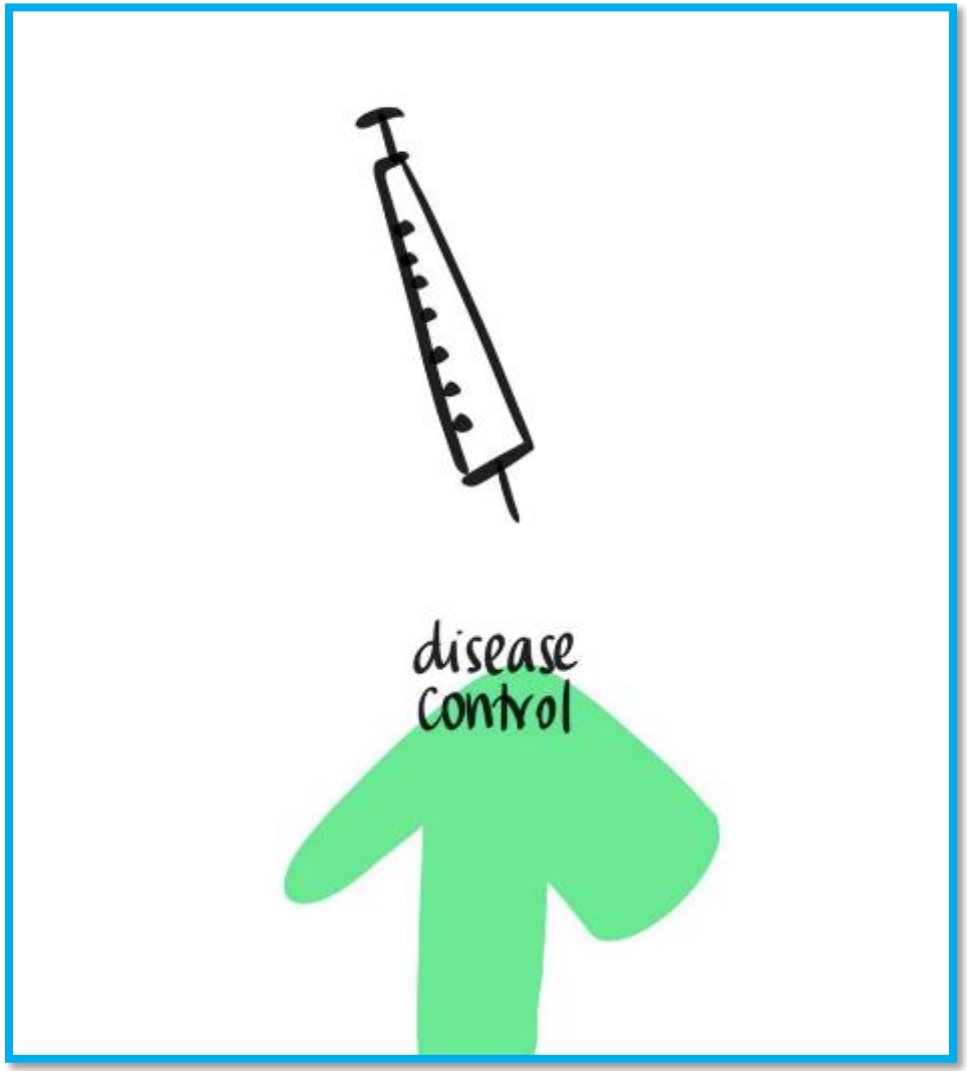
Monkeypox: Prevention

Focus health education on measures to reduce exposure:

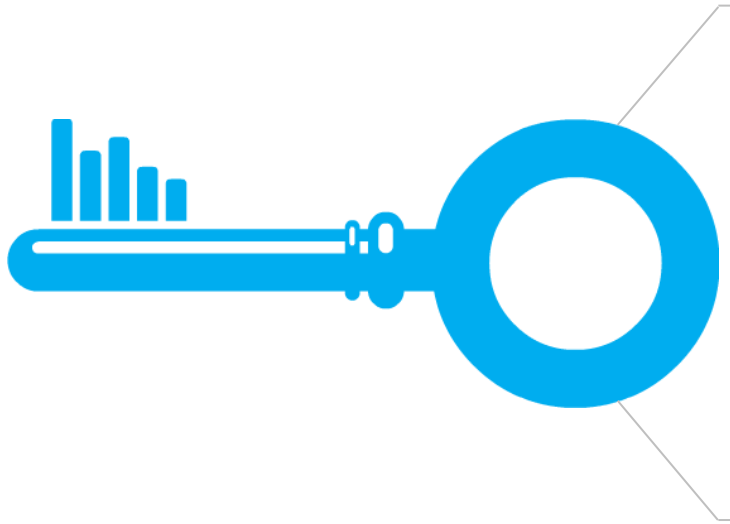
- understand the risk of handling or consuming wild animals and avoid contact.
- wear gloves and other protective clothing to handle or slaughter animals.
- avoid close contact with patients during human monkeypox outbreaks.

Monkeypox: Implications for global preparedness and disease control

- WHO and partners are working to improve understanding and control of monkeypox
  - One Health approach
- Early detection and diagnostics:
  - clinical knowledge;
  - laboratory capacity.
- Better capacity for disease control:
  - coordinating global expertise
  - vaccines and treatments.



Monkeypox: Key messages



- Monkeypox is an emerging disease
- Monkeypox can be seen in endemic countries or anywhere in the world
- Report any suspected case
- Take all precautions to prevent spread

Monkeypox: Key contact

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Cover photo credits (from left to right): WHO/ M. V. Szczeniowski; CDC/ Brian W.J. Mahy