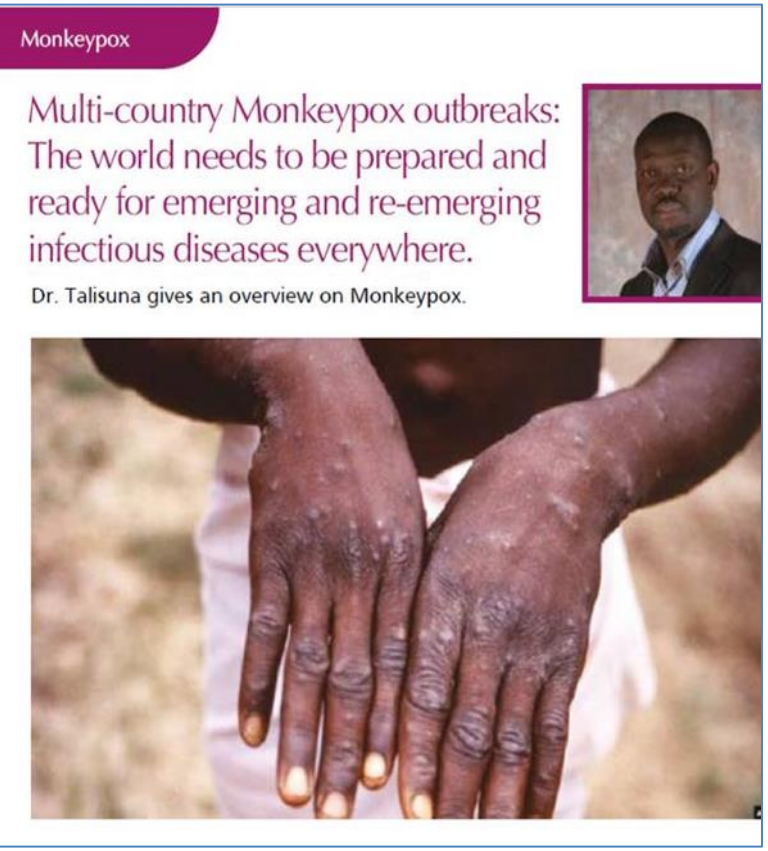
Emerging Viral Infections and Diseases: Focus on Monkeypox

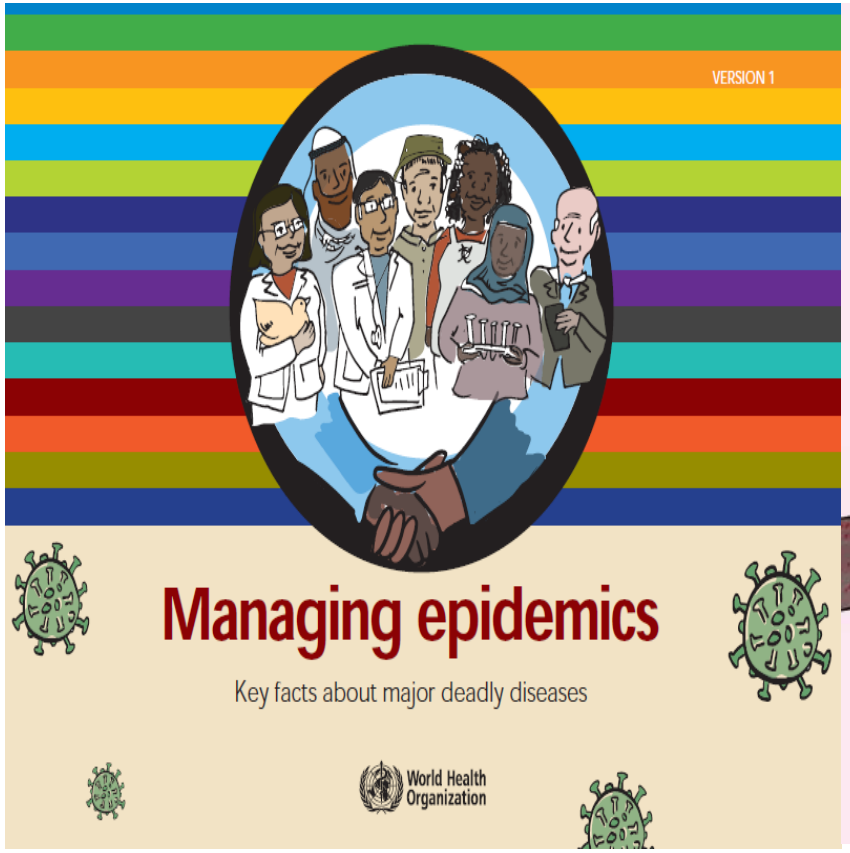
General Overview

- Monkeypox virus
- Disease
- Mode of transmission
- Ecology and geographical distribution
- Need for collaboration and partnership

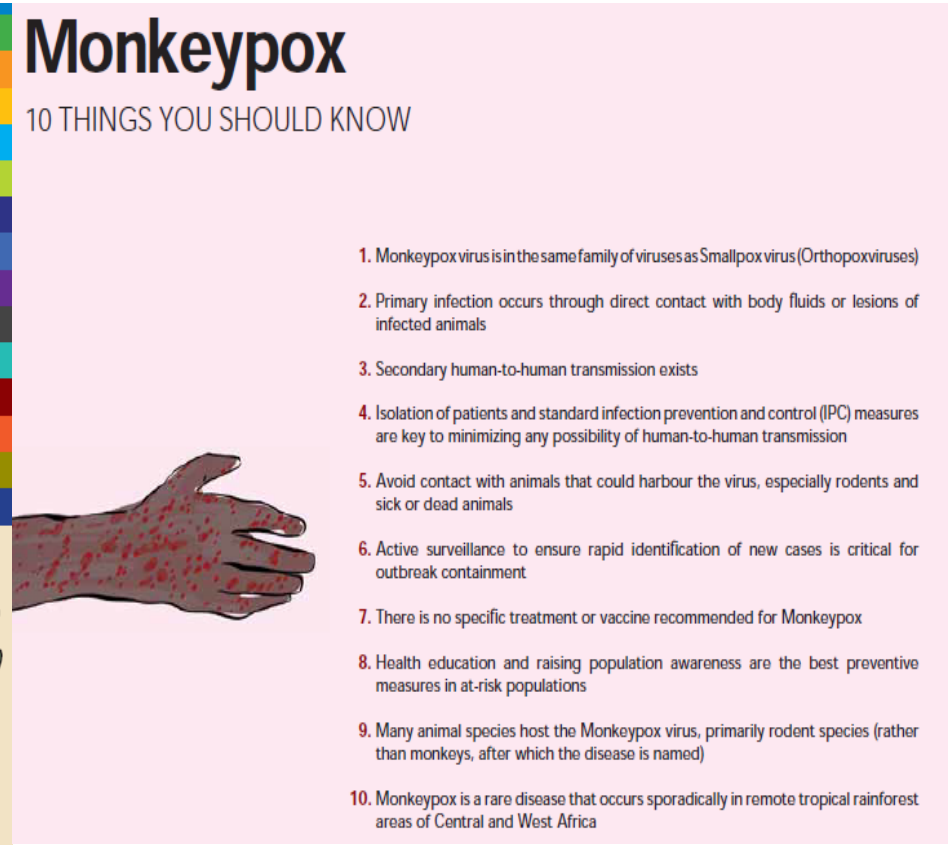
Overview



Africa Health, July 2022

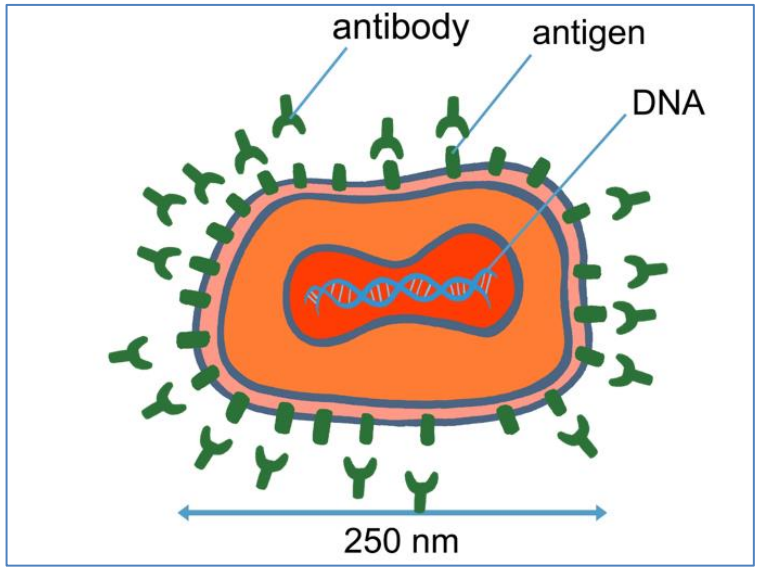


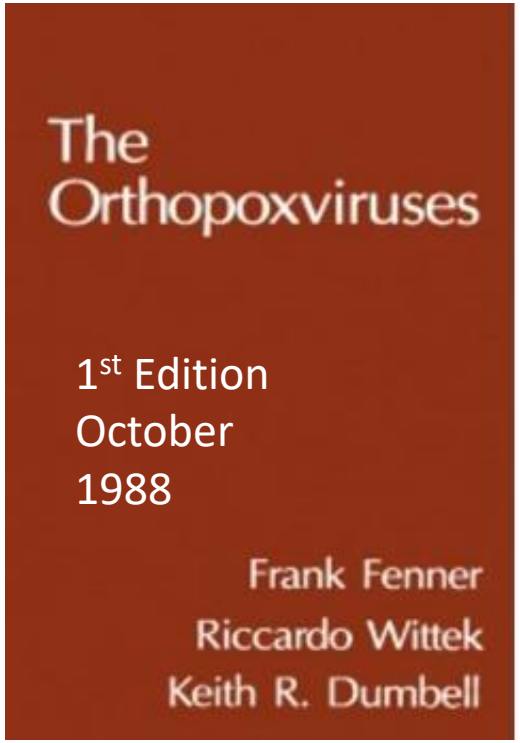
World Health Organization 2018, ISBN 978-92-4-156553-0



Monkeypox virus

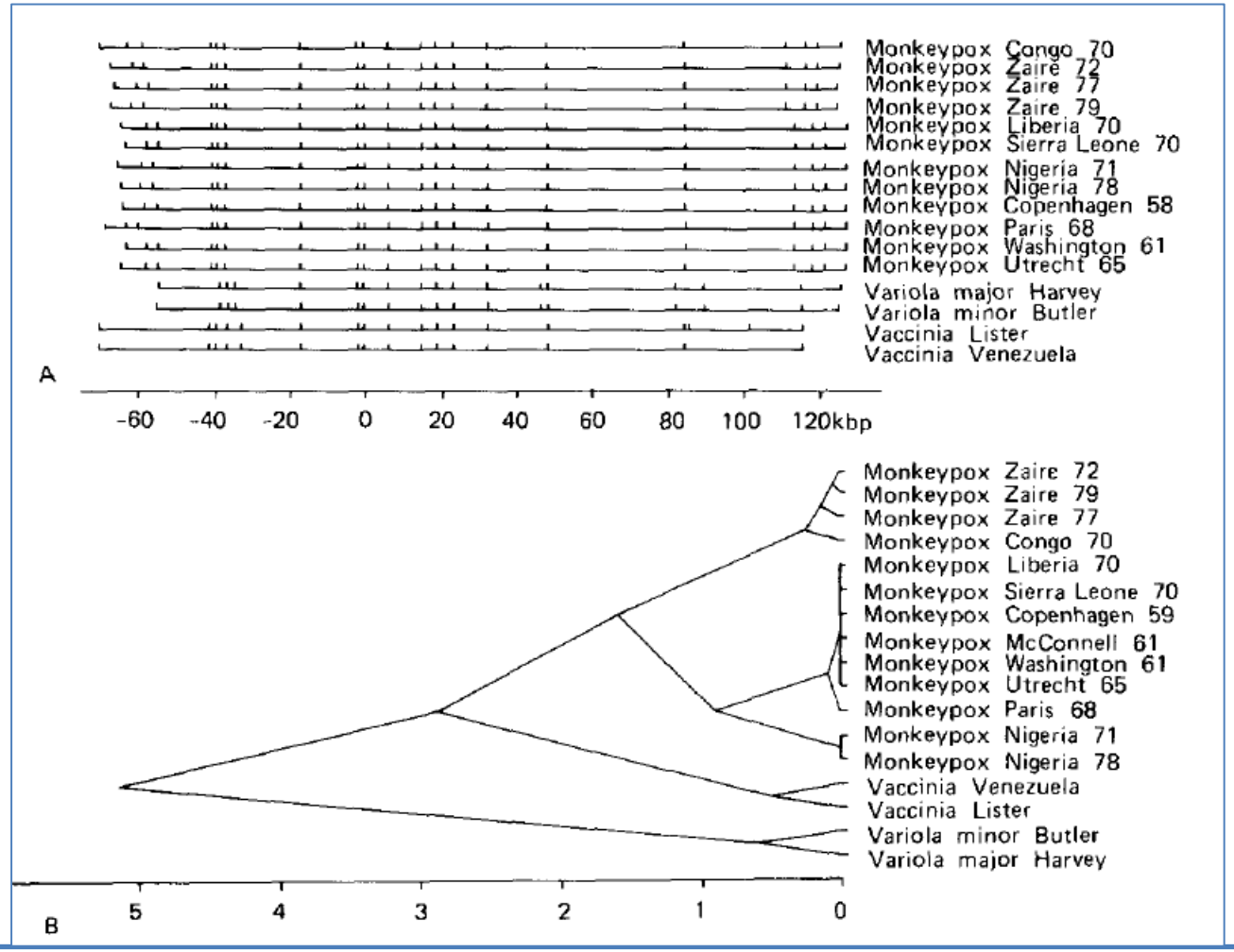
- Monkeypox in captive primates
- Properties of monkeypox virus
- Human monkeypox
- Ecology of monkeypox virus

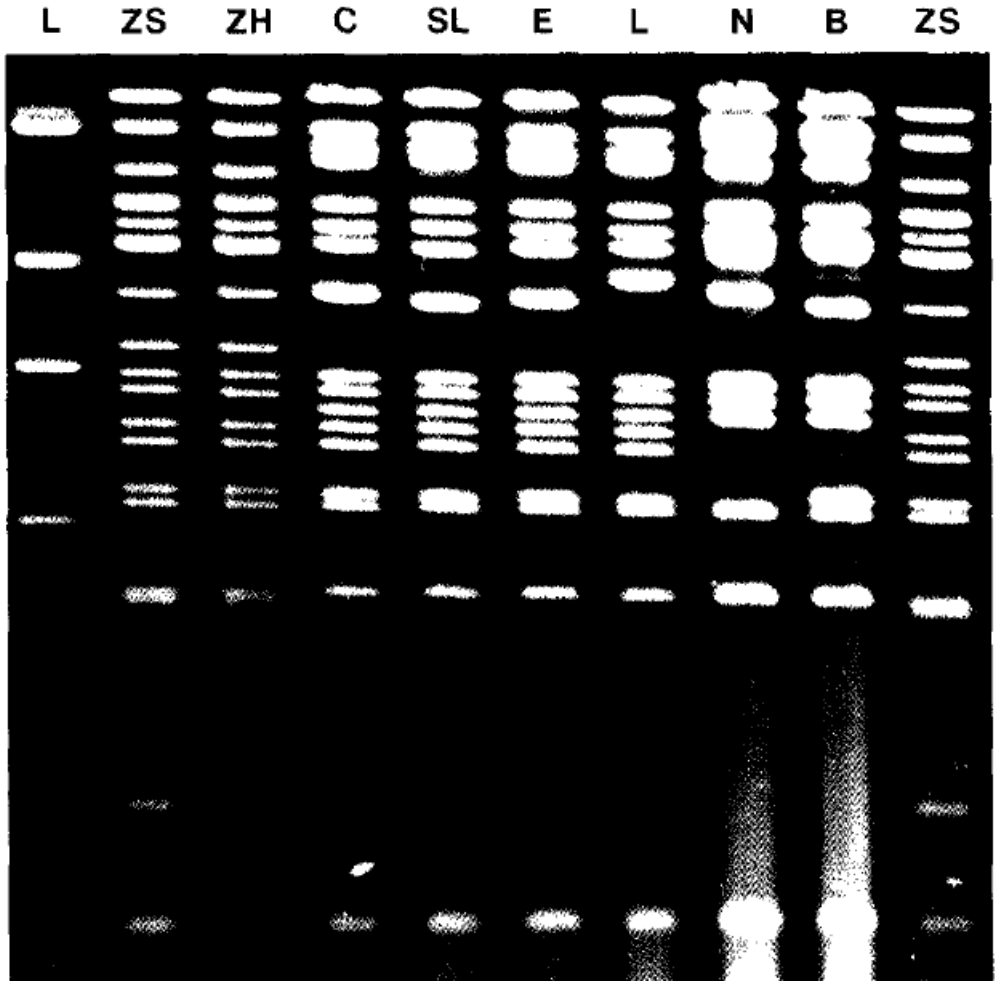




(A) Acute stage; pustules on the leg and sole of the foot.
(B) Convalescent stage; healing pustules and scars. (From von Magnus et al. (1959), courtesy of Dr. K. L. Fennestad.)

Comparison of DNA Maps of Strains of Monkeypox Virus





Fenner, 1988

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HEALTH EMERGENCIES programme

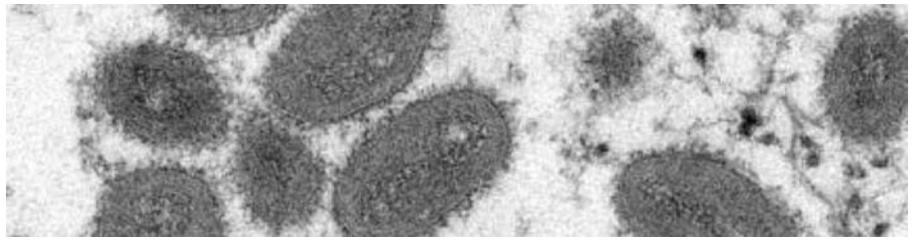
A HUMAN INFECTION CAUSED BY

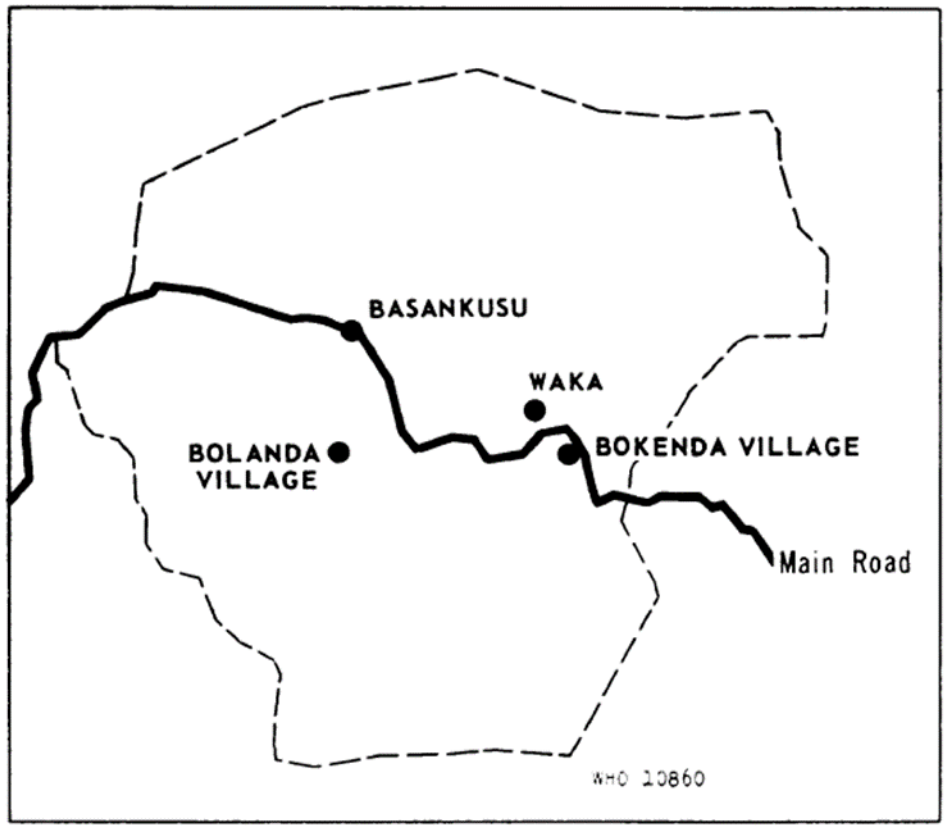
Bull. Org. mond. Santé
Bull. Wld Hlth Org. } 1972, **46**, 593-597

A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo *

I. D. LADNYJ,[1] P. ZIEGLER,[2] & E. KIMA [3]

This paper presents clinical and epidemiological information on a patient with smallpox-like disease, from whom a monkeypox-like virus was isolated. The patient was the first recognized human monkeypox case in medical history.



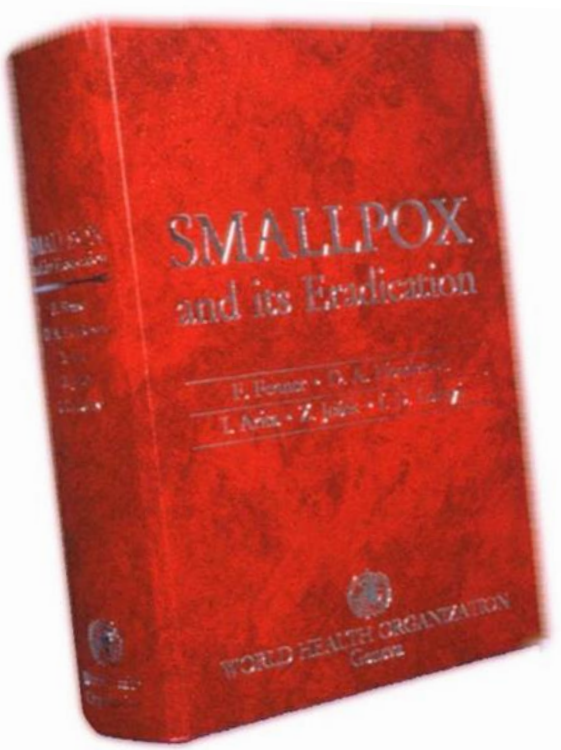


"The patient (A. I.) was a 9-month-old boy who became ill with fever on 22 August 1970 and 2 days later developed a rash. He was admitted to Basankusu Hospital on 1 September".

Cessation of routine smallpox vaccination: emergence of monkeypox disease

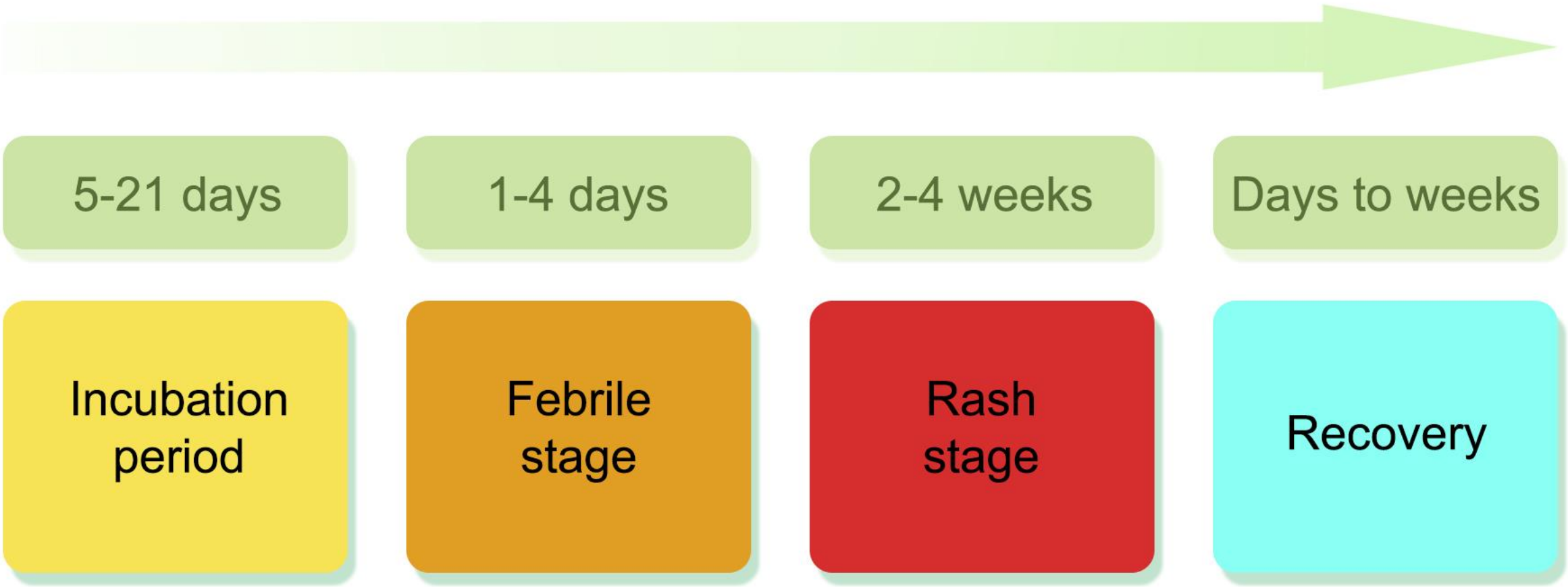
Intensified surveillance for smallpox disease:

- **Surveillance system was based primary upon health-institutions in the epidemic regions**
- **Importance of collaboration of hospital and dispensary staff for accurate and complete reporting of cases (detection of cases)**
- **Examination of monkeypox cases and collection/dispatch of specimens for laboratory testing and thus for confirmation of the clinical diagnosis**
  - **Specimens (lesion material, sera)**
  - **WHO Collaborating Centres: at the Centres for Disease Control, Atlanta, USA, or at the Research Institute for Viral Preparations, Moscow, USSR.**

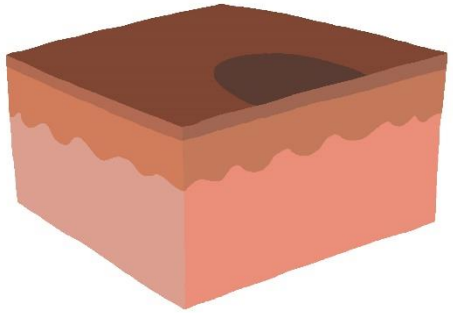
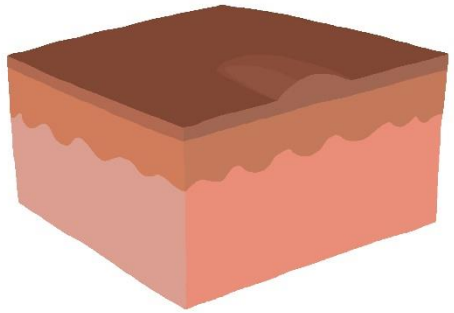
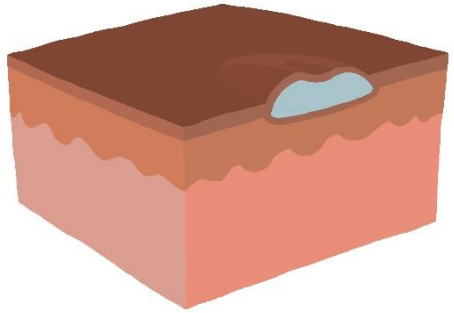
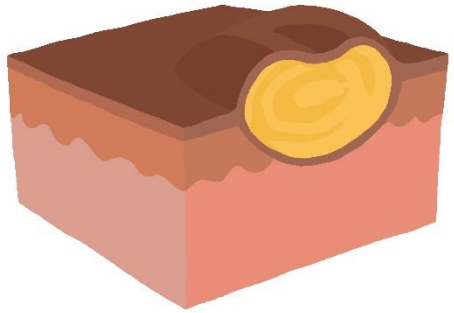
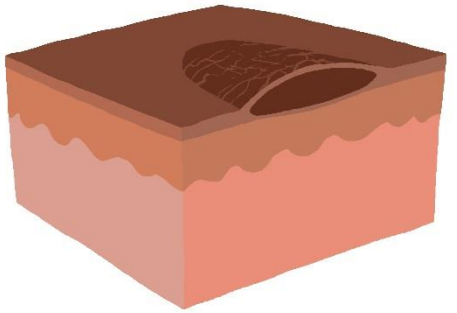


Fine et al. 1988

Overview of disease progression



Disease progression III – Rash stage

Macule	Papule	Vesicle	Pustule	Crust
				
				
Credit: Emerg Infect Dis / N. Erez et al., 2018. Retrived from:https://wwwnc.cdc.gov/eid/article/25/5/19-0076-f1	Credit: NEJM/ D.Kurz et al .2004 Retrived from: https://www.nejm.org/doi/full/10.1056/NEJMoa032299	Credit: Andrea McCollum / CDC	Credit: Toutou Likafi/ Kinshasa School of Public Health	Credit: P. Mbala /Institut Nationale de recherche biomedicale. DRC

World Health Organization

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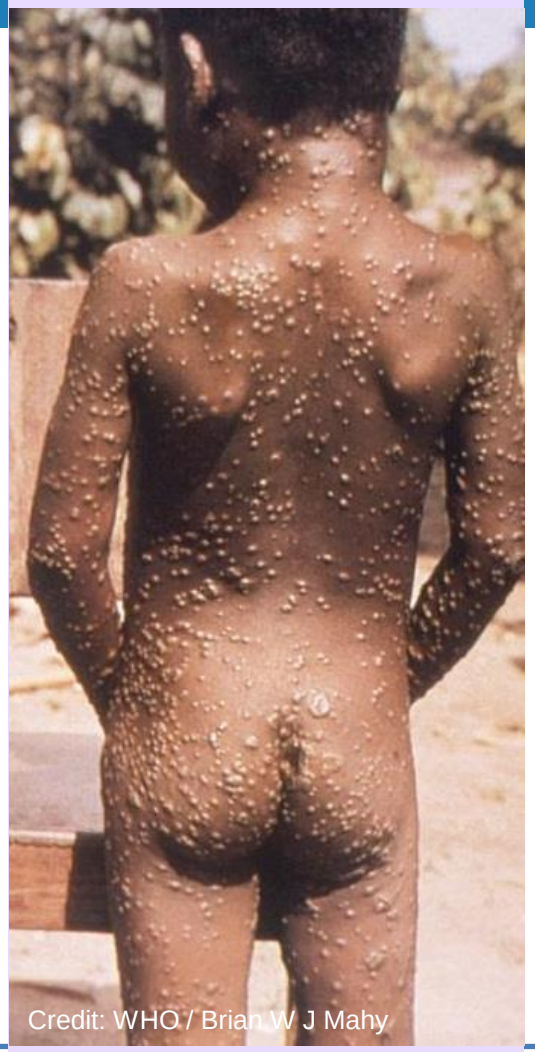
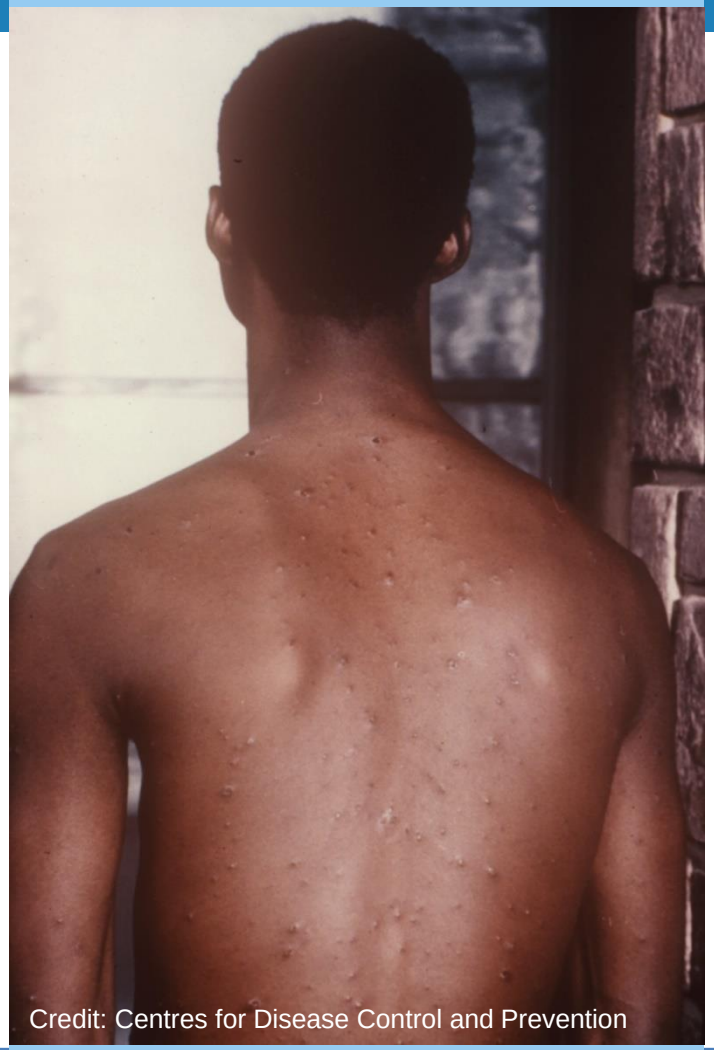
Monkeypox disease , chickenpox and measles



Credit: WHO / Brian W J Mahy

Monkeypox



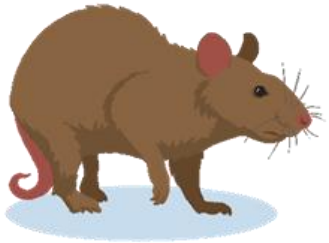
Credit: Centres for Disease Control and Prevention

Chickenpox

Credit: Centres for Disease Control and Prevention

Measles

Monkeypox transmission



Primary infection

Animal ➡ human

Contact with infected animals

Contact with contaminated animal products

Secondary infection

human ➡ human

Contact with infected people

Mother to fetus

World Organization

NCIES programme

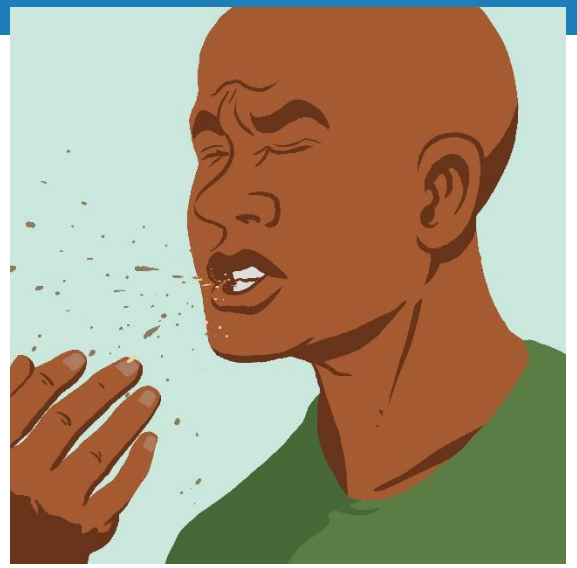
Monkeypox – modes of transmission

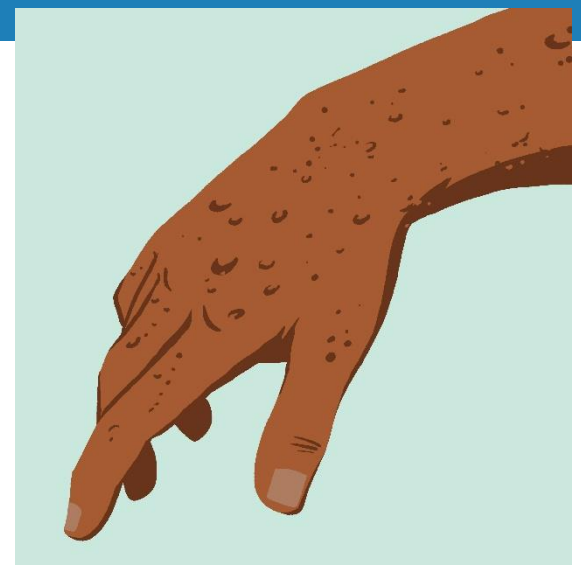
Unprotected contact with:

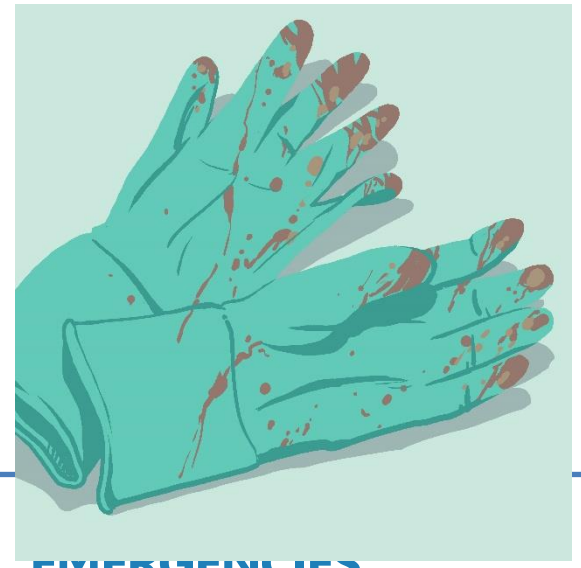
- respiratory droplets
- lesion material
- body fluids
- contaminated materials and surfaces

The virus can enter through:

- respiratory tract
- mucous membranes (eyes and mouth, etc.)
- broken skin (e.g. animal bites, other routes)







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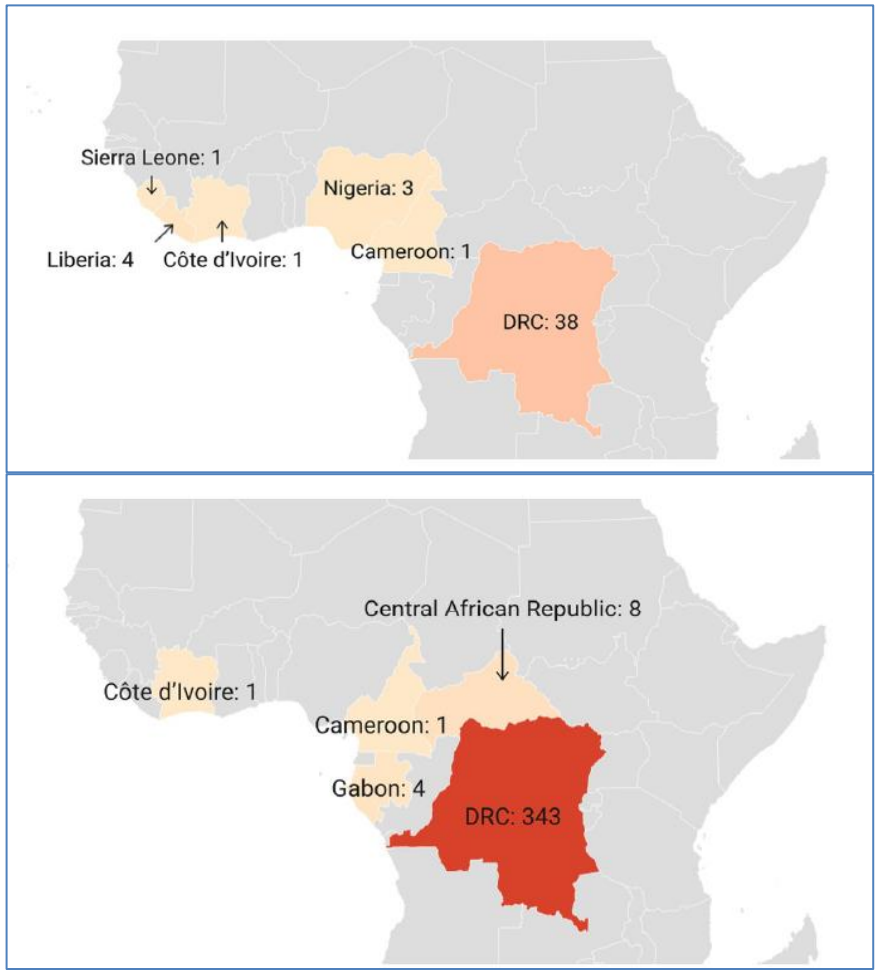
Occurrence of monkeypox virus in widely scattered areas of Africa during 1970 -1979

- **Sporadic zoonotic infection in remote rural villages in Central and West African countries, now declared as Public Health Emergency of International Concern (PHEIC)**
- **Clade names Congo Basin becomes I and West African becomes IIa and IIb (clade most seen in global outbreak)**



Number of confirmed, probable, and/or possible monkeypox cases between 1970–1979

Number of confirmed, probable, and/or possible monkeypox cases between 1980–1989.

Bunge et al., 2022

World Health Organization

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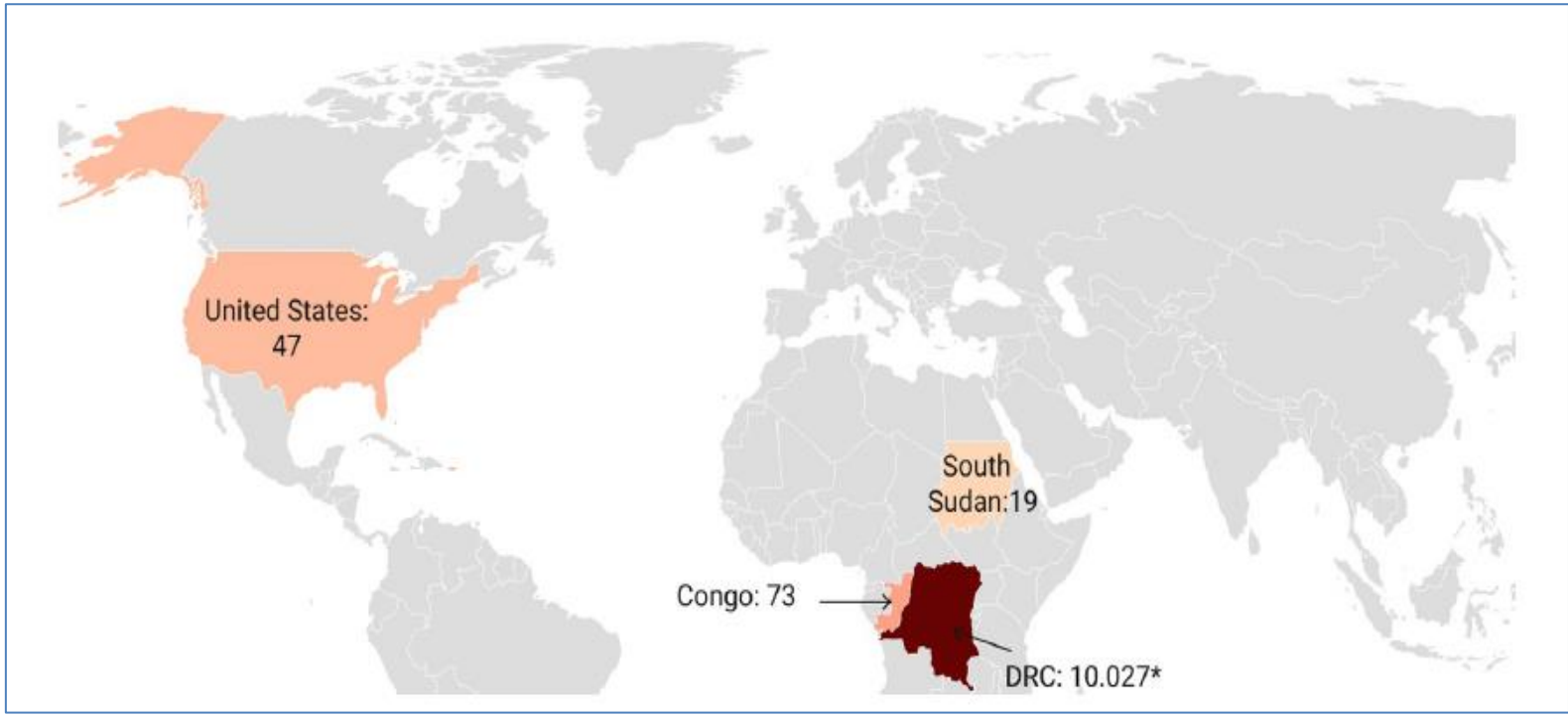
Number of confirmed, probable, and/or possible monkeypox cases between 1990-2009

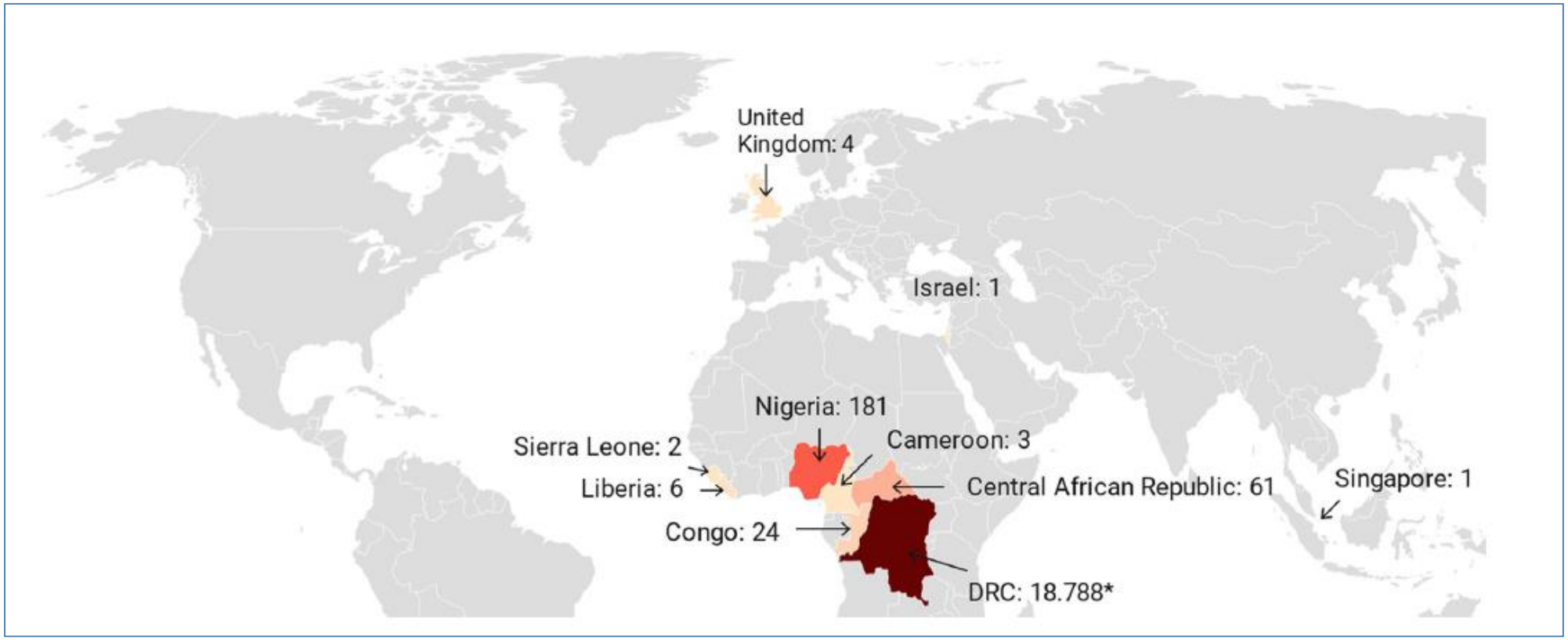
Number of confirmed, probable, and/or possible monkeypox cases between 1990-1999.



Number of confirmed, probable, and/or possible monkeypox cases between 2000-2009.

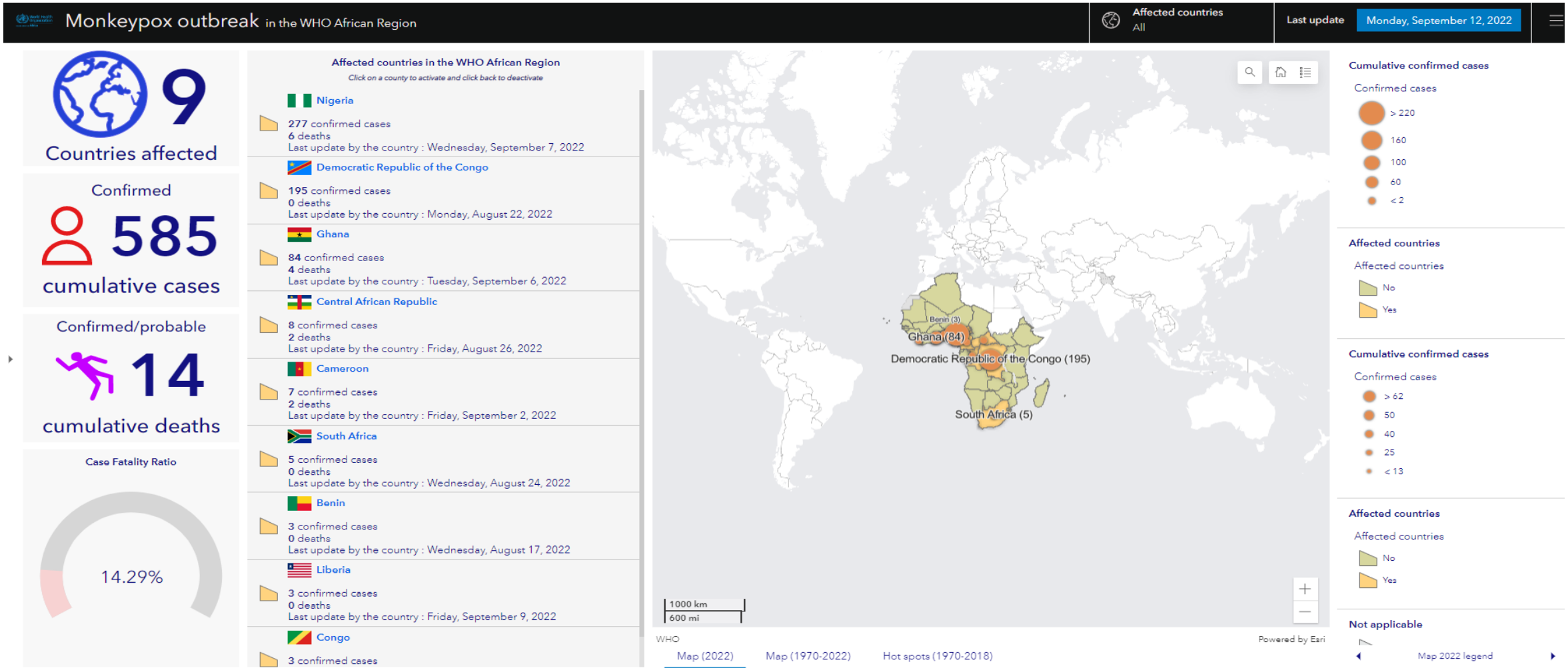
Number of confirmed, probable, and/or possible monkeypox cases between 2010-2019

18 September 2022



Monkeypox outbreak in the WHO African Region

As 12 September 2022



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https://www.arcgis.com/apps/dashboards/8370608ef8c74ad8bb356673bfcc087d

Emerging, re-emerging or adaption of the monkeypox virus

Transmission Potential of Monkeypox Virus in Unvaccinated Human Populations

Transmission Potential of Monkeypox Virus in Human Populations (1980-1984) in DRC

Two pertinent questions were addressed in 1988

- **1) What is the epidemic potential of monkeypox in unvaccinated human population?**
- **2) Is it possible that monkeypox could persist in unvaccinated human populations through continuous-person-to-person transmission?**

Fine et al. 1988, The transmission potential of monkeypox virus in human populations. Intonational Journal of Epidemiology

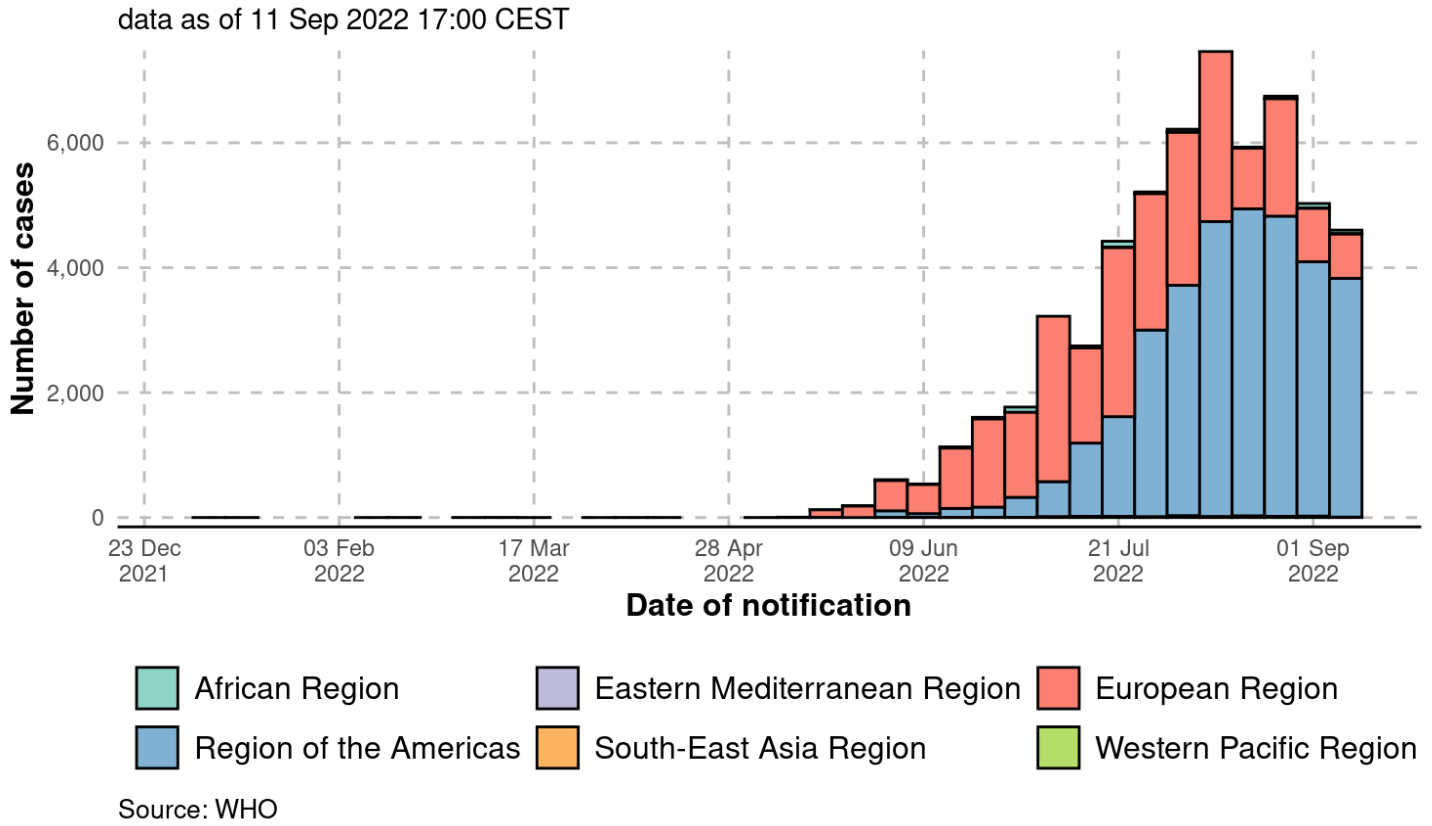
Emerging, re-emerging or adaption of the monkeypox virus

Monkeypox disease outbreak in multiple countries

Global Epidemiological Situation

Confirmed cases by date of notification

- Since 1 Jan 2022, cases reported to WHO from **103 (1 new) Member States /** territories across all **6 WHO regions**
- As of 12 September 2022, at 17h CEST, a total of **57,607 laboratory confirmed cases (4,602 new)** including **22 deaths (4 new)**, have been reported
- Number of new weekly cases has decreased by 8.5% compared to the previous week



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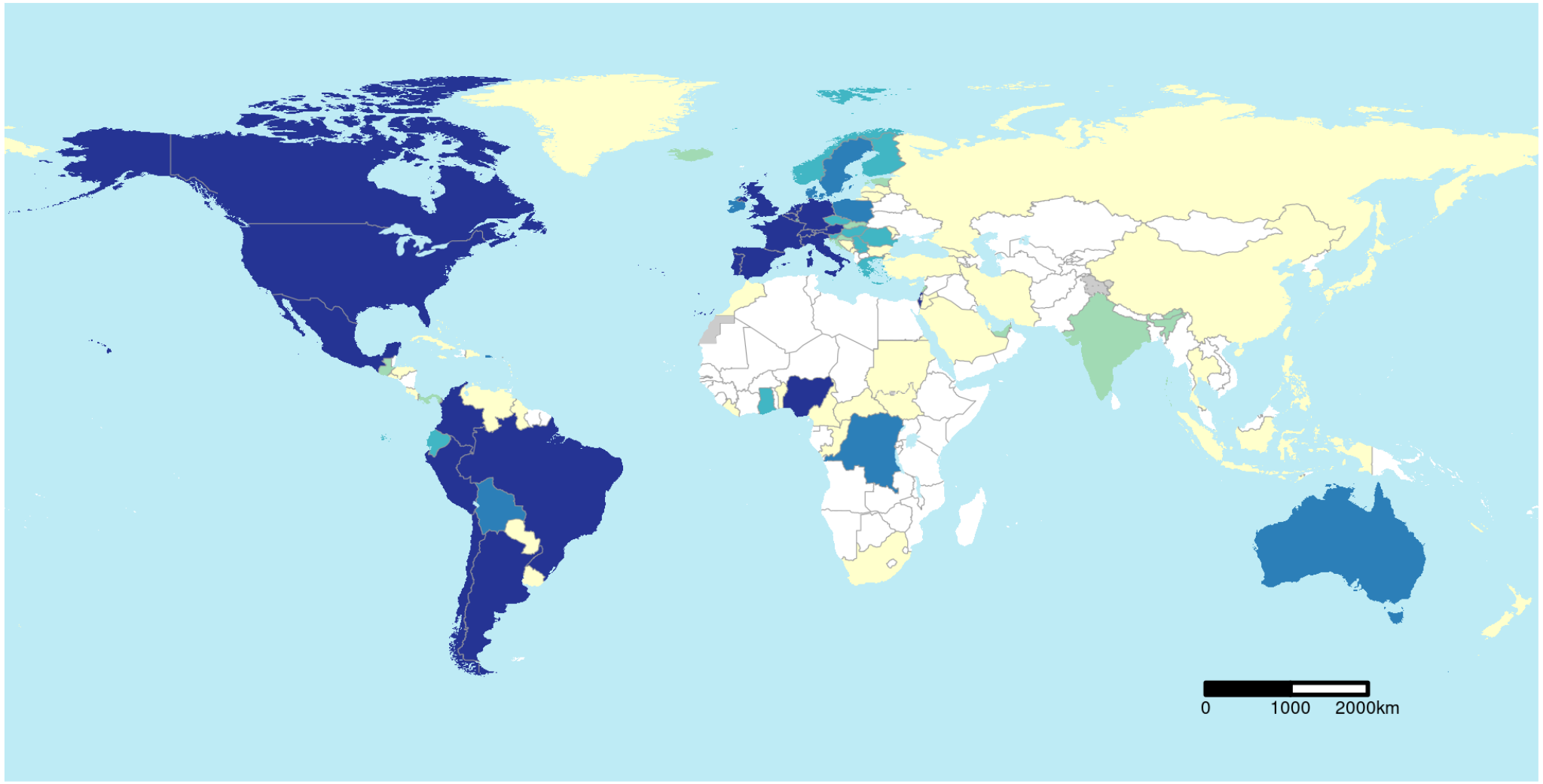
Confirmed cases of Monkeypox

from 1 Jan 2022, as of 12 Sep 22

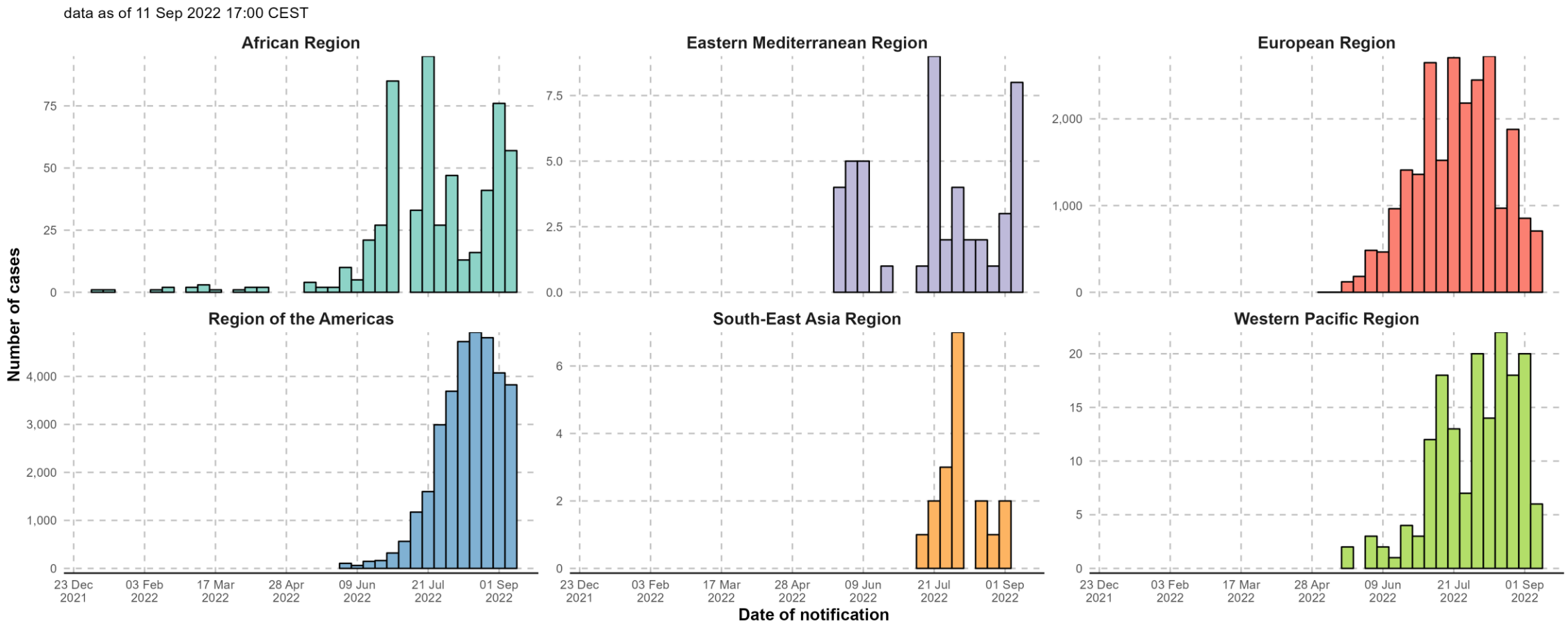
World Health Organization



The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.
Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: WHO Health Emergencies Programme

Regional Epi Curves



Source: WHO

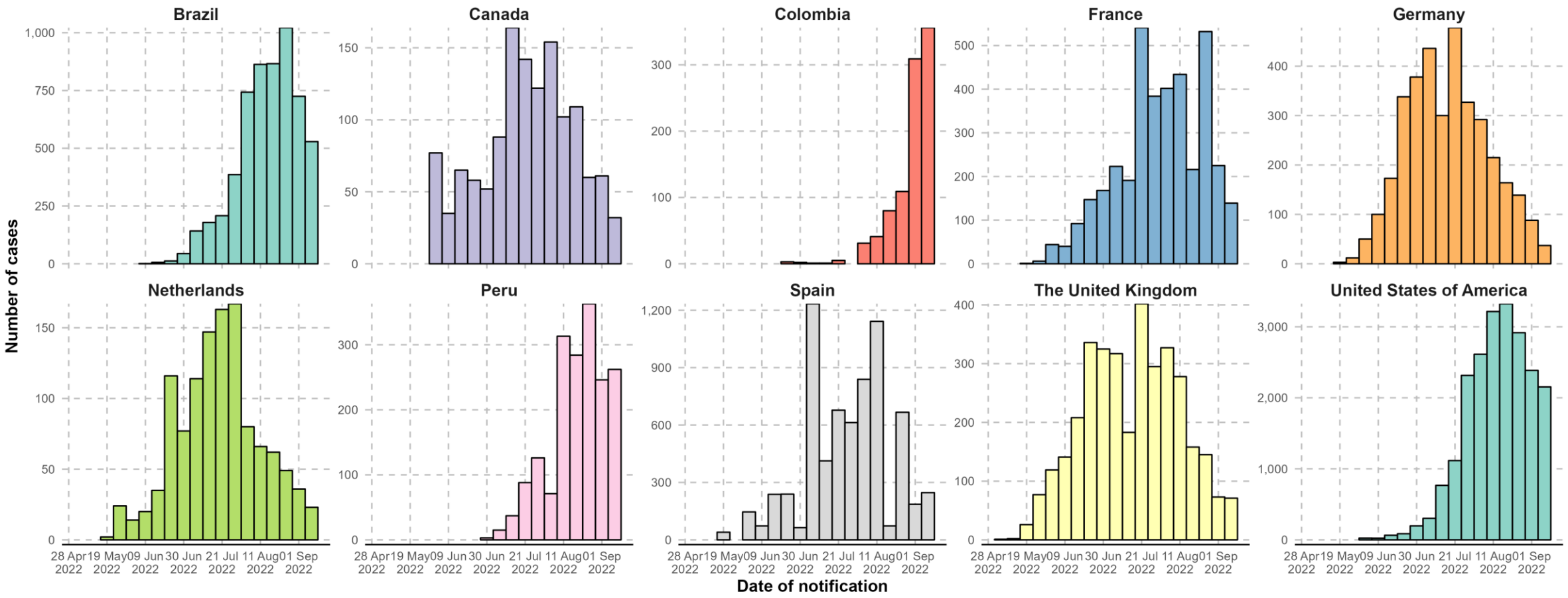
World Health Organization

HEALTH EMERGENCIES programme

Top 10 countries epidemic curves by total reported cases

data as of 11 Sep 2022 17:00 CEST

Note different y-axis scales



Source: WHO

World Health Organization

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Demographics (case report forms)

Case profiles

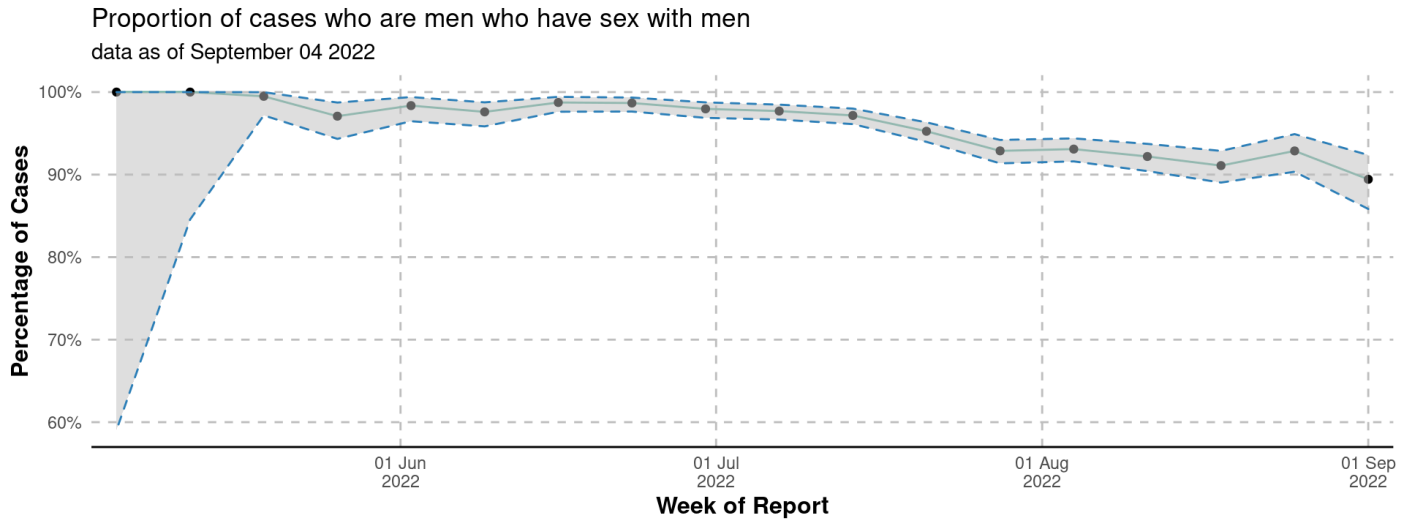
As of September 11 2022

	Reported values[1]		Unknown or Missing Value
	Yes	No	
Men who have sex with men	12661 (95.0%)	663 (5.0%)	36305
HIV-Positive	5971 (45.7%)	7108 (54.3%)	36550
Health worker	322 (4.1%)	7481 (95.9%)	41826
Travel History	1327 (26.5%)	3690 (73.5%)	44612
Sexual Transmission	8430 (90.6%)	878 (9.4%)	40321
Hospitalised[2]	1792 (9.1%)	17968 (90.9%)	29869
ICU	11 (0.1%)	8536 (99.9%)	41082
Died	4 (0.0%)	20898 (100.0%)	28727

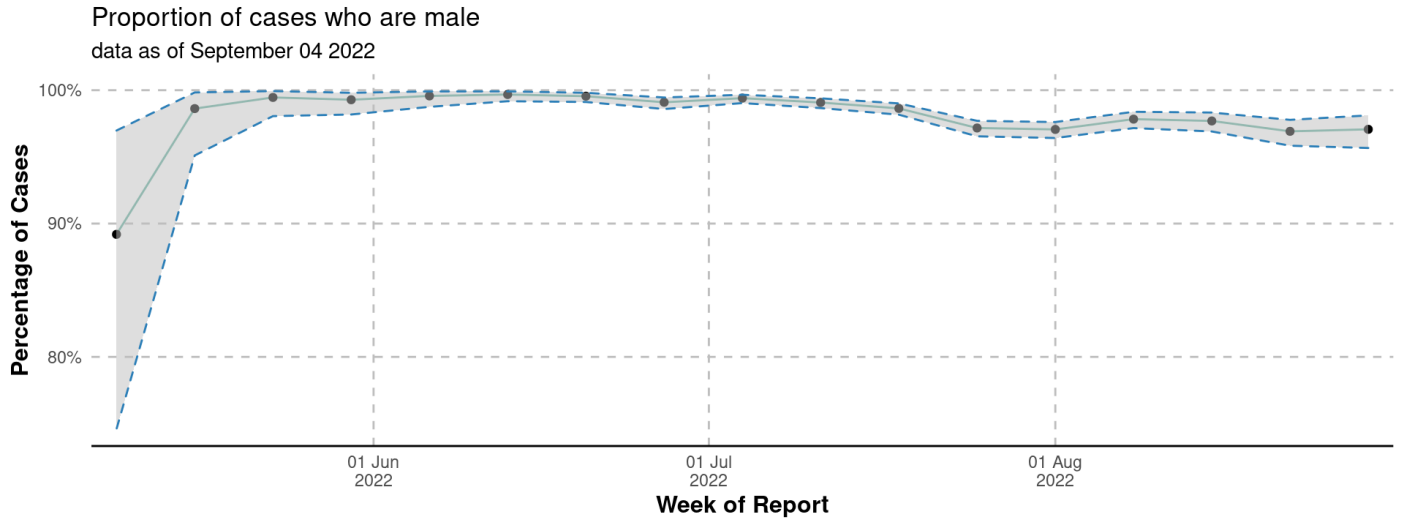
[1] Note given true proportions of variables, yes reporting may be common than no reporting

[2] May be hospitalised for isolation or medical treatment

Proportions of Male Cases and MSM



Source: WHO



Source: WHO

Demographics (case report forms)

Case profiles

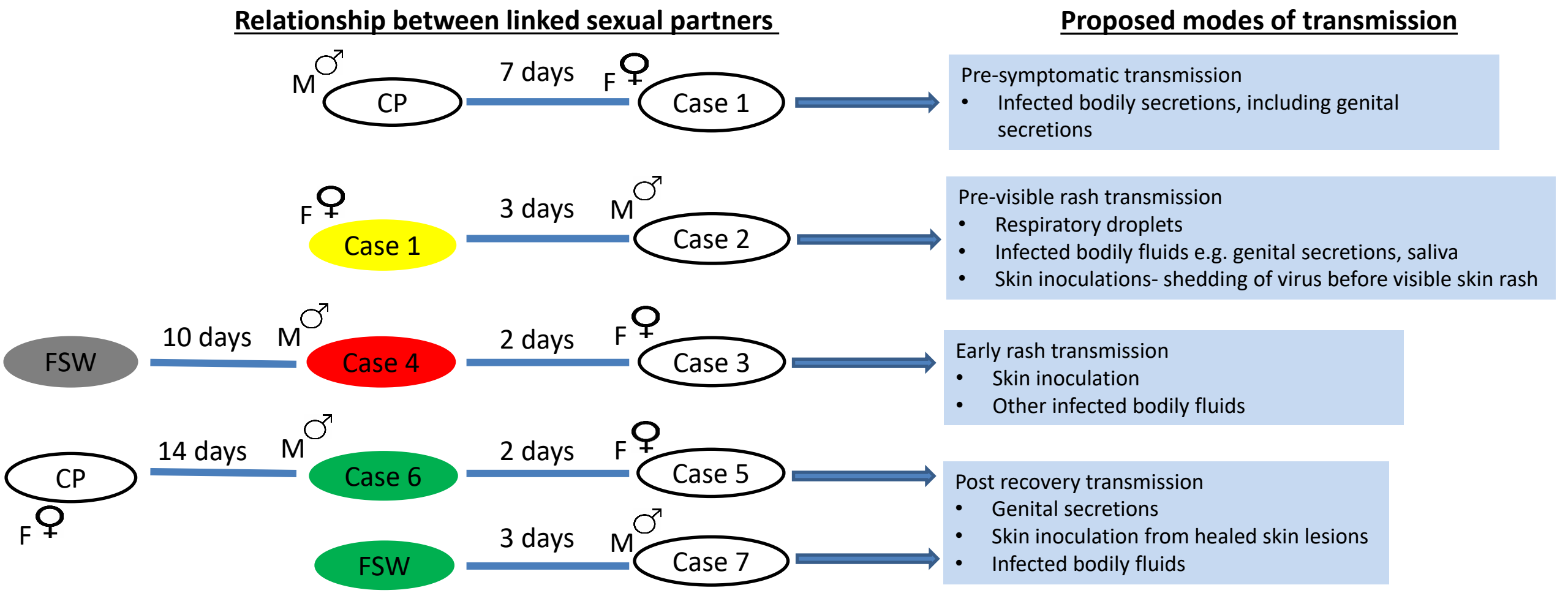
As of September 05 2022

	Reported values[1]		Unknown or Missing Value
	Yes	No	
Men who have sex with men	11923 (95.2%)	607 (4.8%)	33442
HIV-Positive	5576 (44.9%)	6834 (55.1%)	33562
Health worker	313 (4.2%)	7070 (95.8%)	38589
Travel History	1213 (27.9%)	3127 (72.1%)	41632
Sexual Transmission	7822 (91.0%)	777 (9.0%)	37373
Hospitalised[2]	1550 (8.4%)	16928 (91.6%)	27494
ICU	9 (0.1%)	8072 (99.9%)	37891
Died	4 (0.0%)	19681 (100.0%)	26287

[1] Note given true proportions of variables, yes reporting may be common than no reporting

[2] May be hospitalised for isolation or medical treatment

Potential heterosexual transmission of monkeypox among seven linked casual sexual partners in Bayelsa, Nigeria (2022)



Transmission of MPX via sexual contact in some parts of Nigeria

Monkeypox among linked heterosexual casual partners in Bayelsa, Nigeria

Dimie Ogoina[1], Izibewule Hendris James[2]

1 Niger Delta University
2 Niger Delta University Teaching Hospital (NDUTH)

Funding: The author(s) received no specific funding for this work.

Potential competing interests: The author(s) declared that no potential competing interests exist.

Abstract

Introduction

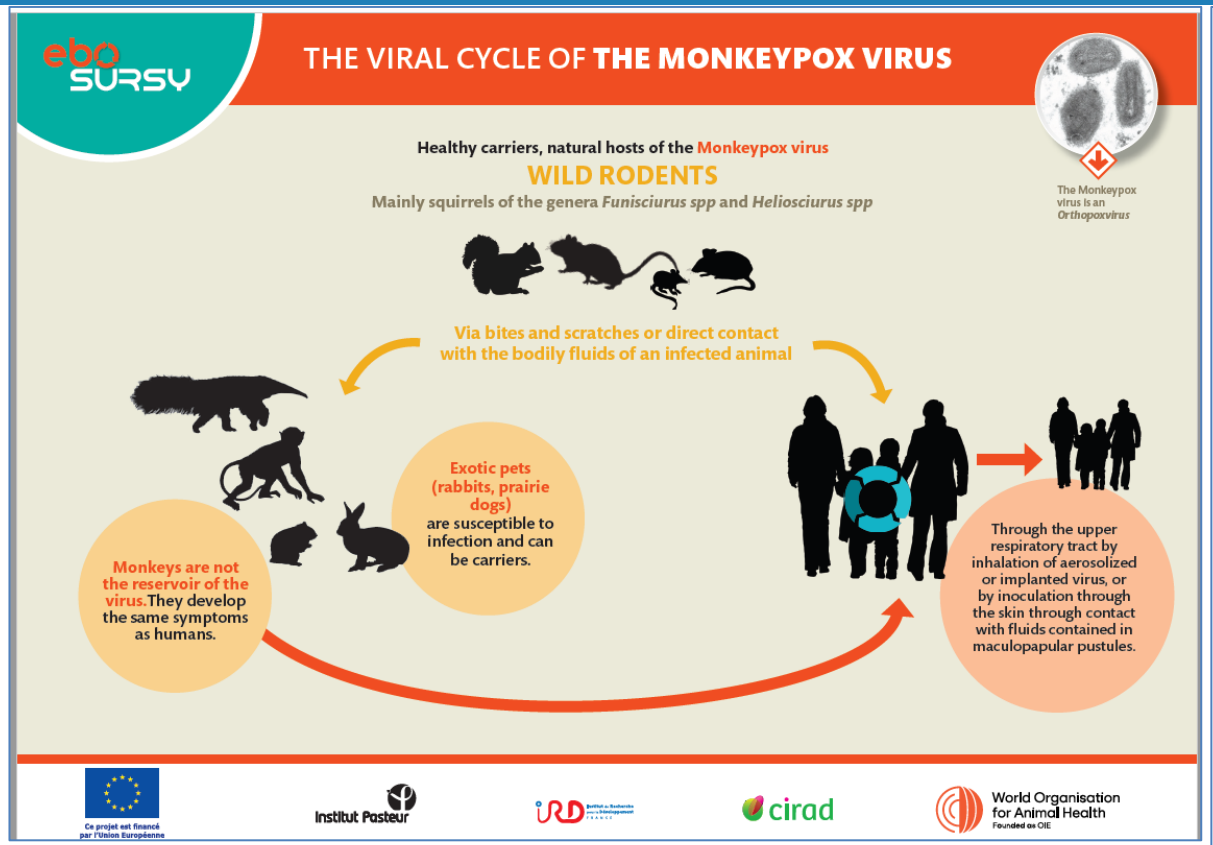
The 2022 outbreak of monkeypox (MPX) in the global north has been linked to sexual networks of gay and bisexual men with high-risk behaviours such as multiple sexual partners (MSP) and condomless casual sex (CCS). Studies describing potential transmissions of the monkeypox virus (MPV) via sexual contact among heterosexuals in MPX-endemic countries are lacking. We report the epidemiological and clinical features of seven cases of MPX in Bayelsa State, Nigeria who were linked heterosexual casual partners.

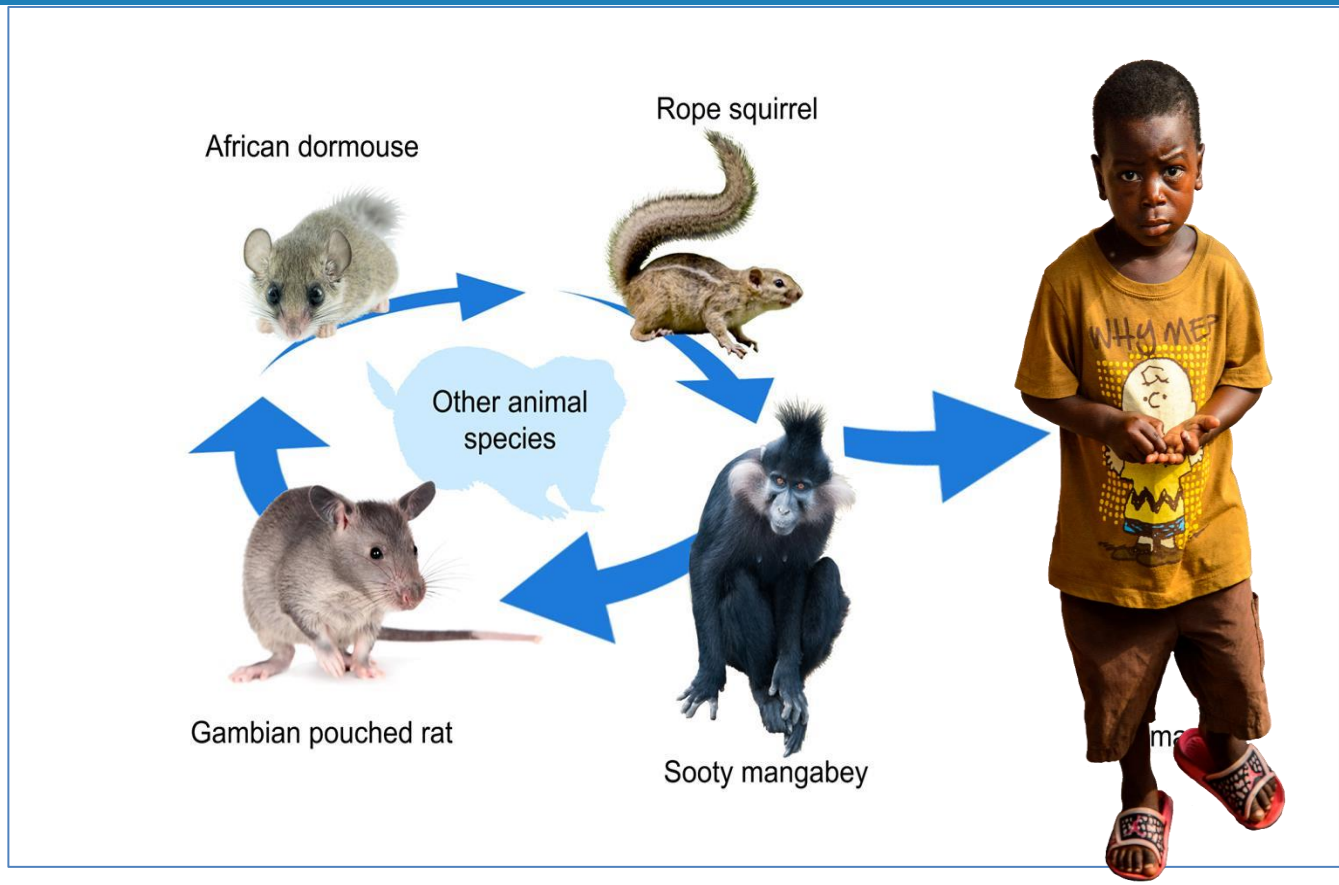
"Overall, our study supports our prior hypothesis in the 2017-2018 outbreak where we proposed transmission of MPX via sexual contact in some parts of Nigeria. Additionally, in this study, we report potential transmission of MPV among linked heterosexual casual partners who report high-risk behaviours. These findings call for more enhanced surveillance to identify and understand the role of sexual activity in the transmission of monkeypox in Nigeria".

Transmission Potential of Monkeypox Virus

Ecology and geographical distribution

Monkeypox virus transmission cycle: need for One Health approach





Animals associated with monkeypox virus

Surveillance for monkeypox, transmissibility in wildlife and human population

Key attributes:

- Accuracy/completeness
- Sensitivity
- Specificity
- Timeliness
- Cost
- Simplicity

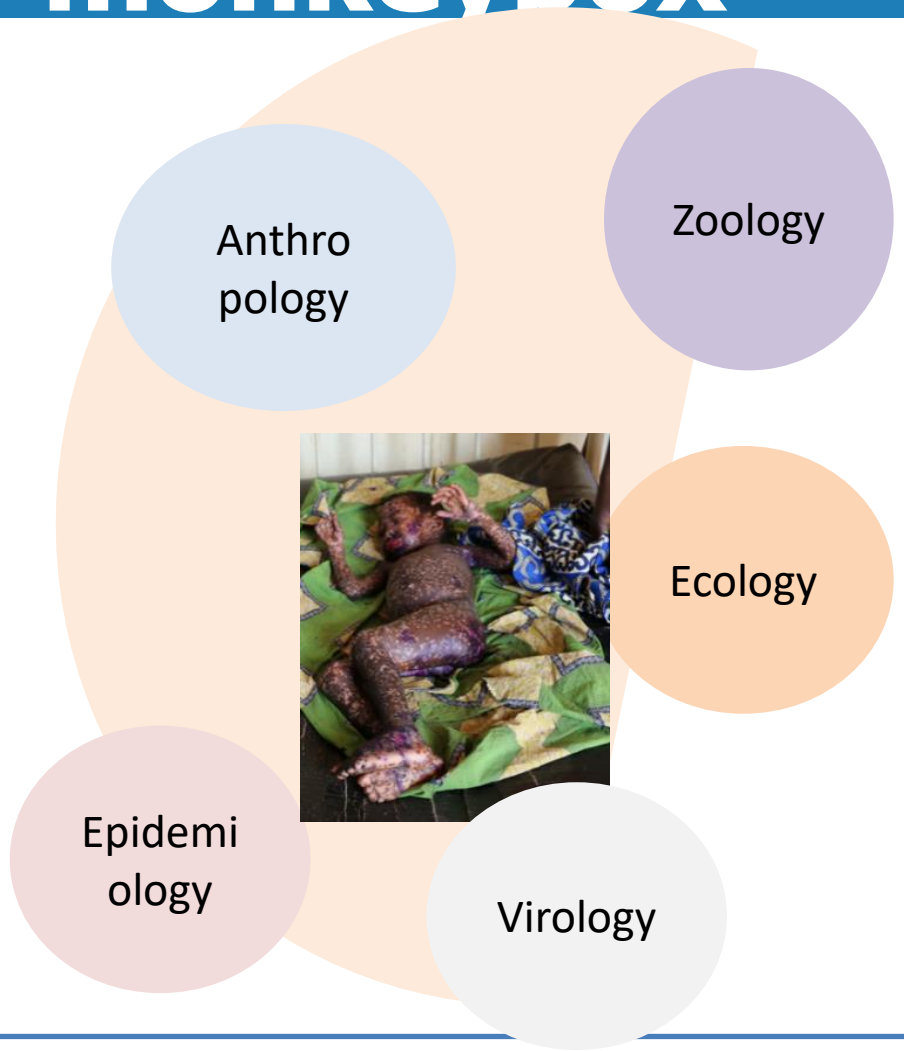
Human population

Animal population

Environment

Extended One Health approach

AFRIPOX : A One Health approach of monkeypox

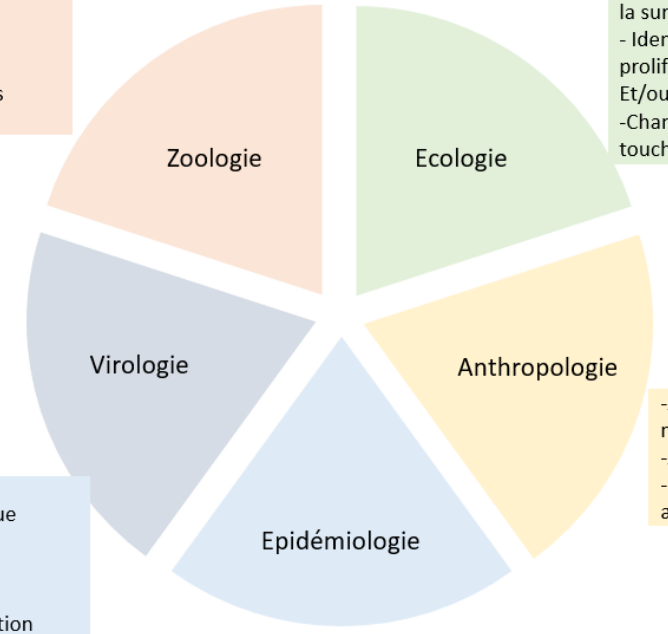


Central African Republic (CAR)

-Identification réservoir animal et hôtes intermédiaires
- Facteurs favorisant la prolifération du réservoir et l'augmentation des contacts réservoir/humains

-Caractérisation des environnements favorables à la survenue d'épidémie
- Identification des écotopes favorables à la prolifération du réservoir animal
Et/ou aux interactions humain/animal
-Changement écologiques récents dans les zones touchées

-Développement d'un nouveau test sérologique plus spécifique
-Développement test diagnostic moléculaire de terrain
-Séquençage, phylogénie, phylogéographie



-Anthropologie de la santé et de la maladie
-Approche Ethnohistorique
- Ethnoécologie-pratiques actuelles avec faune sauvage

-Description des formes cliniques
-Facteurs de risque de transmission zoonotique interhumaine
-Facteurs de risque environnementaux
-Évaluation des tests diagnostics
-Mesure de la réponse sérologique post infection
-Potentiel épidémique et immunité des populations

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Links to more information:

- WHO Regional Office for Europe – One health: link
- CDC – One Health: link
- WHO - Taking a multisectoral, One Health Approach: A Tripartite guide to addressing zoonotic diseases in countries: link
- One Health: Basics of multisectoral collaboration at the Human - Animal - Environment interface (online course): link

Links to more information:

Online introductory training. Monkeypox: Introduction:
https://openwho.org/courses/monkeypox-introduction

Formation de base en ligne: Variole du singe : Introduction :
https://openwho.org/courses/variole-du-singe-introduction

Online extended training. Monkeypox epidemiology, preparedness and response: https://openwho.org/courses/monkeypox-intermediate

Formation avancée en ligne: Épidémiologie de la variole du singe, préparation et réponse : https://openwho.org/courses/variole-du-singe-intermediaire/

THANK YOU
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