Ophthalmic Manifestations of Mpox:

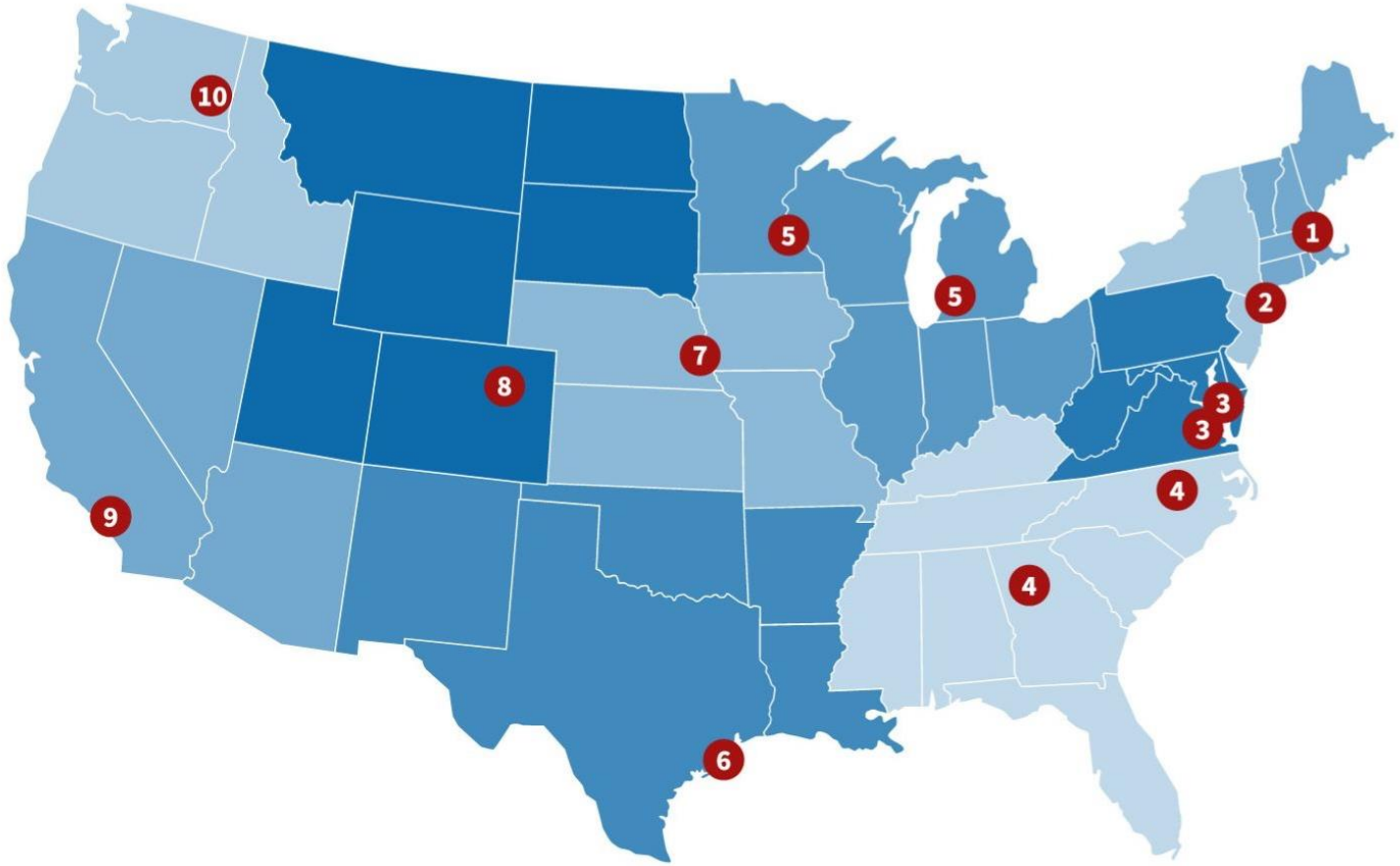
WHAT CLINICIANS NEED TO KNOW

NETEC:
A Partnership for Preparedness

Setting the gold standard for special pathogen preparedness and response across health systems in the U.S. with the goals of driving best practices, closing knowledge gaps, and developing innovative resources.

Regional Emerging Special Pathogens Treatment Centers

NETEC
NATIONAL EMERGING SPECIAL PATHOGENS TRAINING AND EDUCATION CENTER



1. **CT, ME, MA, NH, RI, VT**
   Massachusetts General Hospital
2. **NJ, NY, PR, VI**
   NYC Health + Hospitals / Bellevue
3. **DC, DE, MD, PA, VA, WV**
   Johns Hopkins Hospital
   Medstar Washington Hospital Center / Children's National
4. **AL, FL, GA, KY, MS, NC, SC, TN**
   Emory University / Children's Healthcare of Atlanta
   University of North Carolina at Chapel Hill
5. **IL, IN, MI, MN, OH, WI**
   University of Minnesota Medical Center
   Corewell Health System
6. **AR, LA, NM, OK, TX**
   University of Texas Medical Branch
7. **IA, KS, MO, NE**
   University of Nebraska Medical Center / Nebraska Medicine
8. **CO, MT, ND, SD, UT, WY**
   Denver Health & Hospital Authority
9. **AZ, CA, HI, NV, AS, MP, FM, GU, MH, PW**
   Cedars-Sinai Medical Center
10. **AK, ID, OR, WA**
    Providence Sacred Heart Medical Center & Children's Hospital

Locate your regional contacts, including physician, nursing, pediatric, and operations leadership, as well as local and state health partners.

Areas of Focus

NETEC
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CONSULTATION & ASSESSMENT

Empower hospitals to gauge their readiness using **self-assessment**

Provide direct feedback to hospitals via **on-site assessment**

Provide **on-site and remote guidance**

Provide **emergency on-call mobilization**

EDUCATION & TRAINING

Deliver didactic and hands-on simulation training via **in-person courses**

Provide self-paced education through **online trainings**

Compile an **online repository** of tools and resources

Develop customizable **exercise templates** based on the HSEEP model

RESEARCH NETWORK

Build a **central IRB process** for rapid implementation of clinical research protocols

Develop **policies, procedures, and data capture tools** to facilitate research

Create the infrastructure for a **specimen biorepository**

INTERNATIONAL PARTNERSHIPS

Organize, plan, and implement **strategic international collaborations**

Strengthen **relationships** with global special pathogens programs

Establish mechanisms to **facilitate sharing of best practices** and knowledge among special pathogens programs

Cross cutting, supportive activities

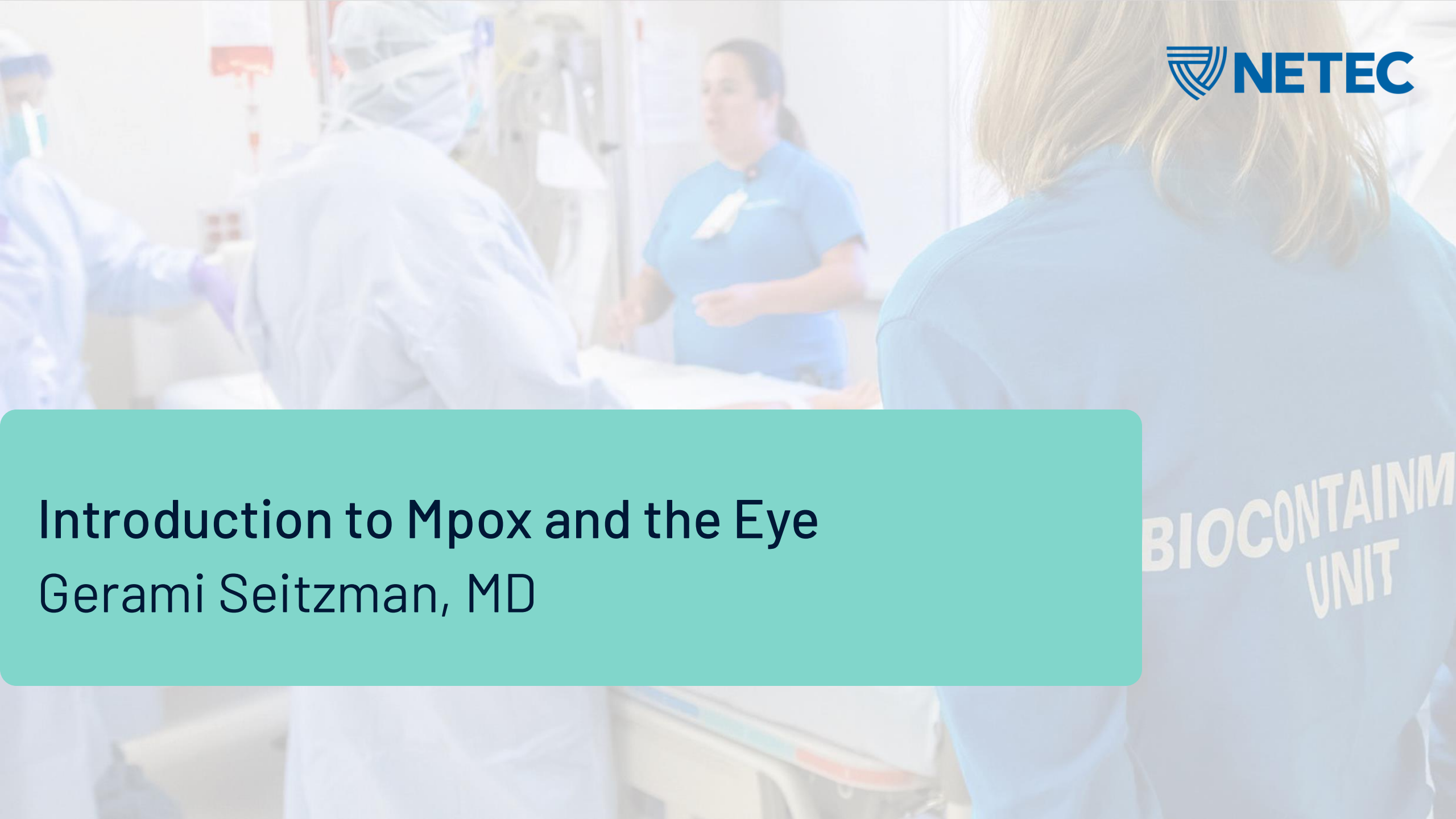
Overview

Welcome: Anna Quay Yaffee, MD

- **Introduction to Mpox and the Eye** Gerami Seitzman, MD
- **Mpox in the Field: DRC** Placide Mbala-Kingebeni, MD, PhD
- **DRC Field Response to Ocular Mpox** Jean-Claude Mwanza, MD, MPH, PhD
- **Infection Prevention & Control Principles** Jessica Carag, DVM, MS
- **Emerging Infectious Diseases of the Eye: Mpox, Ebola, and Emerging Pathogens** Steven Yeh, MD

Questions and Answers

NETEC Resources: Anna Quay Yaffee, MD



Introduction to Mpox and the Eye

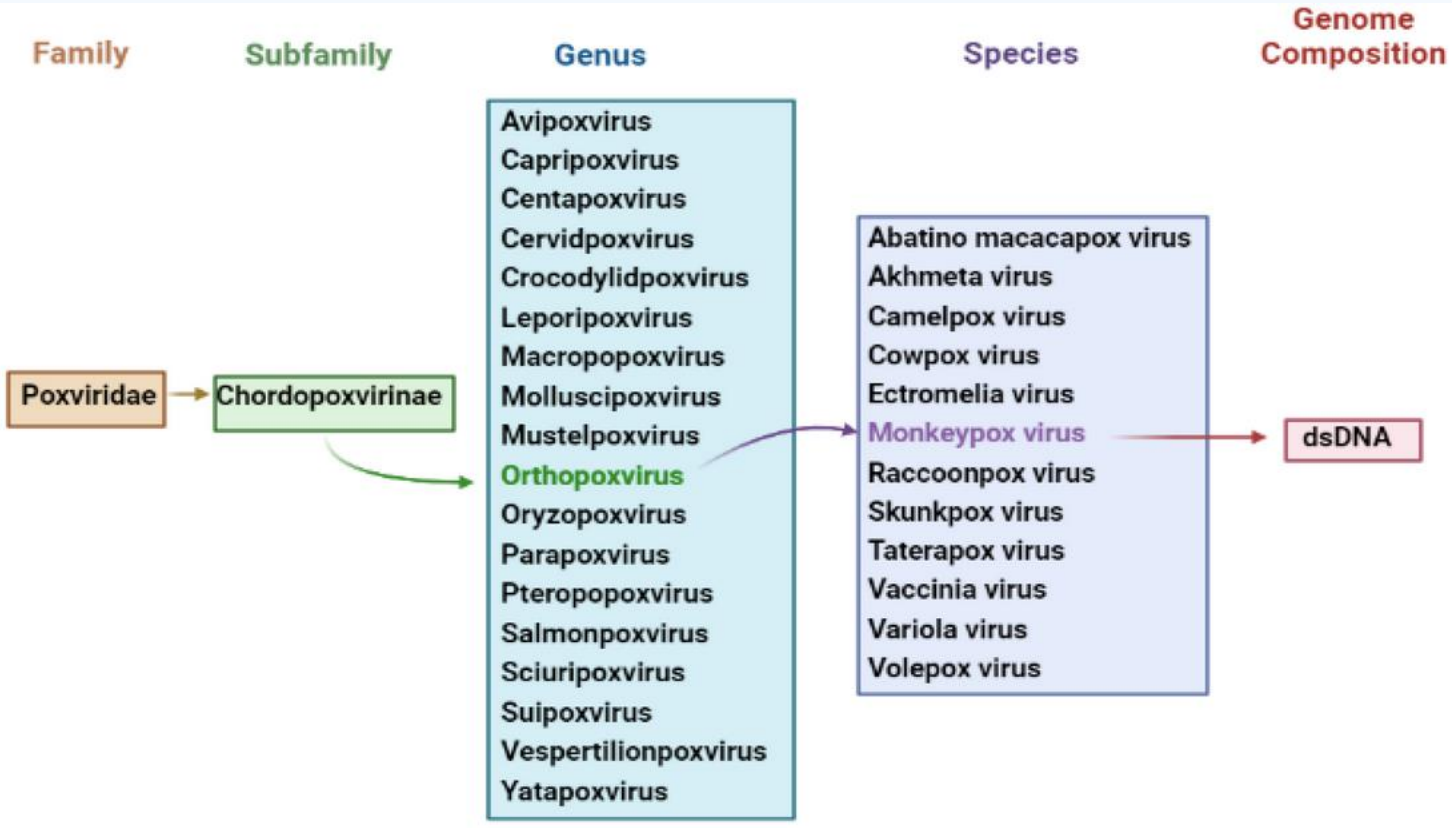
Gerami Seitzman, MD

Overview

- ✓ Brief introduction to Mpox
- ✓ Ocular symptoms of Mpox-common
- ✓ Ocular symptoms of Mpox-less common
- ✓ Brief review of treatment options
- ✓ Brief review of Ocular Mpox diagnostics

Mpox

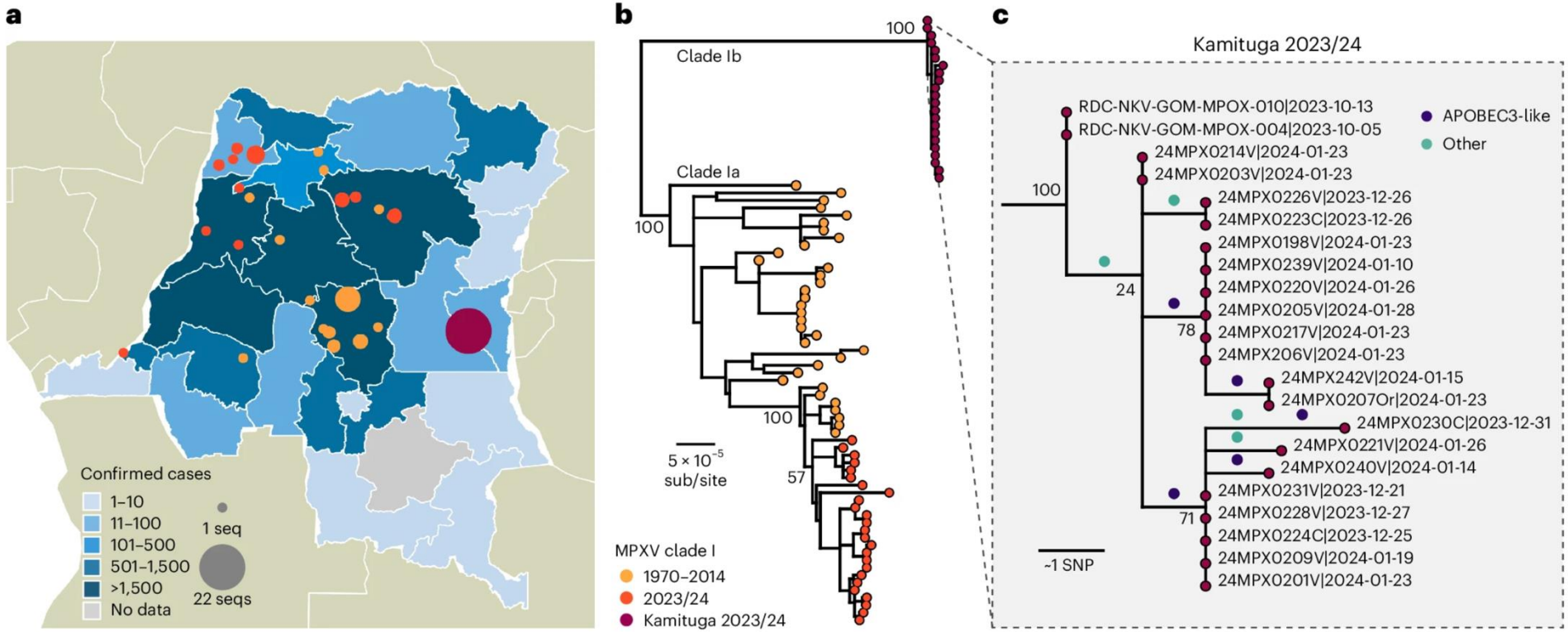
- Double-stranded DNA virus
- FAMILY: poxviridae
- GENUS: orthopoxvirus



Anwar F, Haider F, Khan S, Ahmad I, Ahmed N, Imran M, Rashid S, Ren Z-G, Khattak S, Ji X-Y. Clinical Manifestation, Transmission, Pathogenesis, and Diagnosis of Monkeypox Virus: A Comprehensive Review. Life. 2023; 13(2):522

Clades

- Mpox genetic sequences are classified into **clades**.
- Clade = organisms that include a common ancestor.



Vakaniaki EH, Kacita C, Kinganda-Lusamaki E, et al. Sustained human outbreak of a new MPXV clade I lineage in eastern Democratic Republic of the Congo. *Nat Med*. 2024;30(10):2791-2795.

- Clade I - Central Africa/Congo Basin (1970-2014)
- Clade II describes the virus initially transmitted in West Africa (2010, 2023-24)
- Most recent outbreak is being classified - often referred to as clade IIb and/or clade III

Ocular Mpox

External

- Eyelids

Ocular

- Eyeball
  - Cornea
  - Conjunctiva
  - Inside of the eye
    - Anterior uveitis
    - Vitritis

External (Eyelid) Mpox

40 cases from Nigeria (2020, clade II)

97.5% Face

25% Eyelids

Clinical Infectious Diseases, Volume 71, Issue 8, 15 October 2020, Pages e210–e214
Cornea 2023; 42:751–754.

Ocular Mpox

- Conjunctivitis
  - Before 2022→ 17%
  - After 2022 → 1%

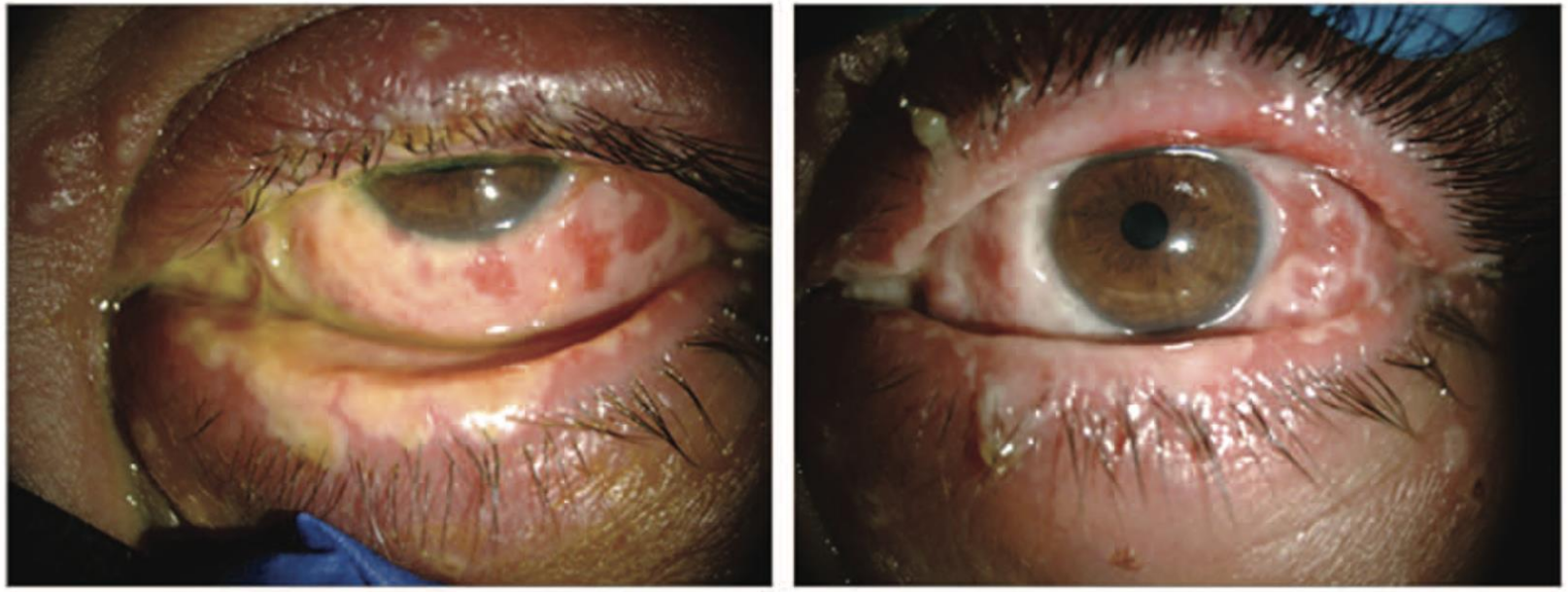
Incidence of ocular mpox post 2022 Clade IIb still emerging

Abdelaal A, Reda A, Hassan AR, et al. Monkeypox-Associated Manifestations and Complications Involving the Eye: A Systematic Review and Meta-Analysis of Previous and Current Outbreaks. *Asia Pac J Ophthalmol (Phila).* 2023;12(3):326-337.

Ocular Mpox

Eyeball

- Conjunctiva
- Cornea
- Inside of the eye
  - Anterior uveitis
  - Vitritis



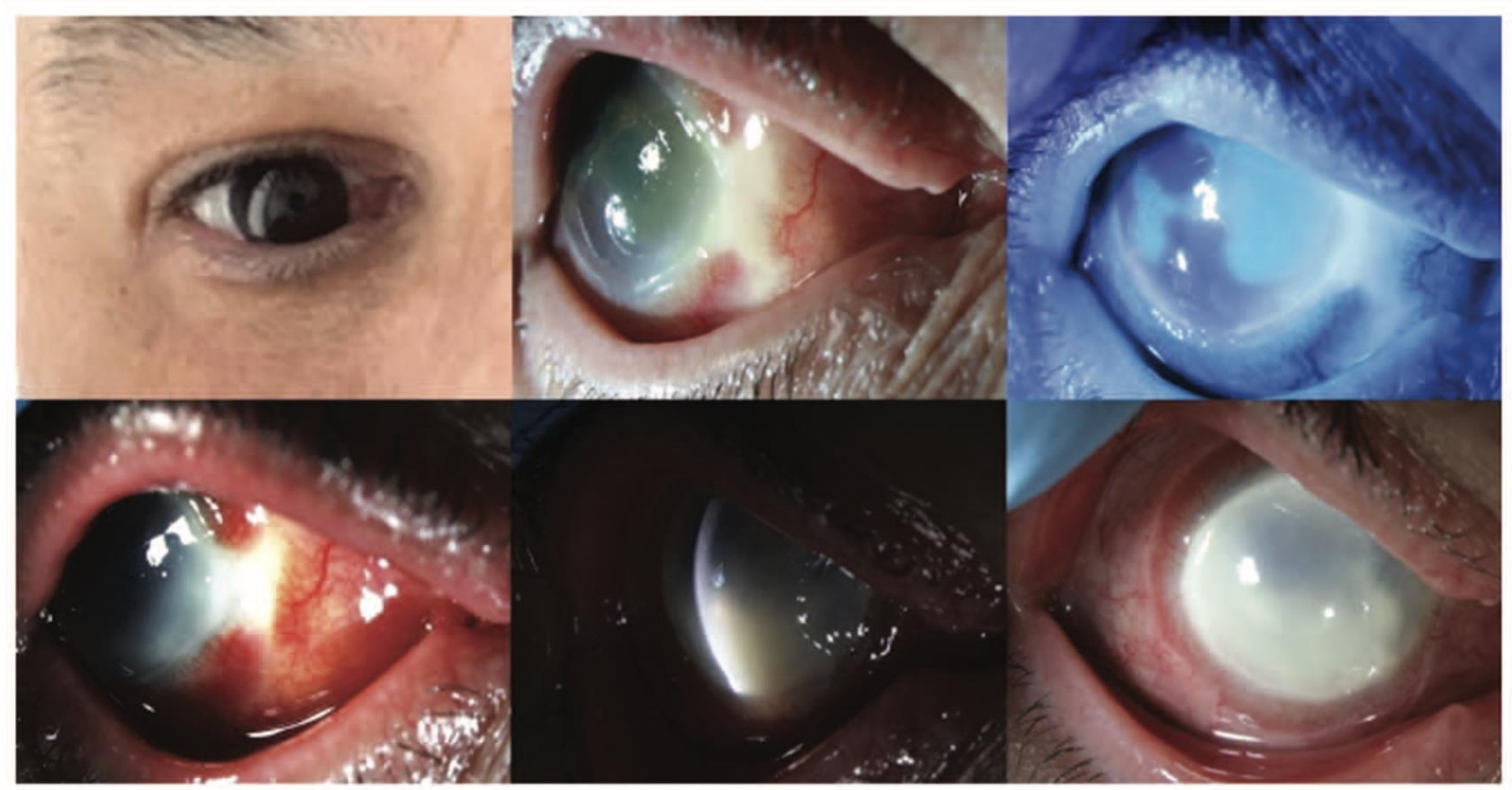
JAMA Ophthalmol 2022; 140:1022–1024

If you have a red eye with eyelid lesions → straightforward

But…!

Isolated ocular Mpox without skin lesions can also happen

Eyeball Only Mpox (No Eyelid Lesions)



Nguyen MT,….Seitzman GD. Isolated Ocular Mpox without Skin Lesions, United States. Emerg Infect Dis. 2023 Jun;29(6):1285-1288

Eyeball Only Mpox (No Eyelid Lesions)

- Conjunctivitis
- Episcleritis
- Scleritis
- Uveitis
  - (anterior, endotheliitis, vitritis)
- Corneal ulcer
  - (neurotrophic)

- More common:
  - Vesiculopapular umbilicated eyelid lesions
  - Conjunctivitis
- Less common
  - Corneal involvement
  - Uveitis
  - Vision loss in the setting of Mpox should warrant emergent referral

Pazos M, Riera J, Moll-Udina A, et al. Characteristics and Management of Ocular Involvement in Individuals with Monkeypox Disease. *Ophthalmology*. 2023;130(6):655-658

Treatment

- No definitively established anti-viral regimens for the treatment of ocular Mpox
- Topical
  - Trifluridine (preferred tx for ocular vaccinia)
  - Ganciclovir gel
  - Betadine
- Systemic
  - Tecovirimat
  - Cidofovir
  - Brincidofovir

Ocular Mpox Diagnosis

- Real-time PCR is the gold standard

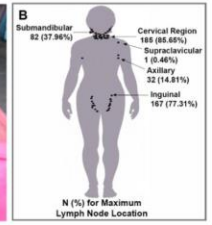
- Possible but less used:
  - Viral culture
  - Serology (antibody detection)
  - LAMP
  - CRISPR/based test
  - Whole genome sequencing

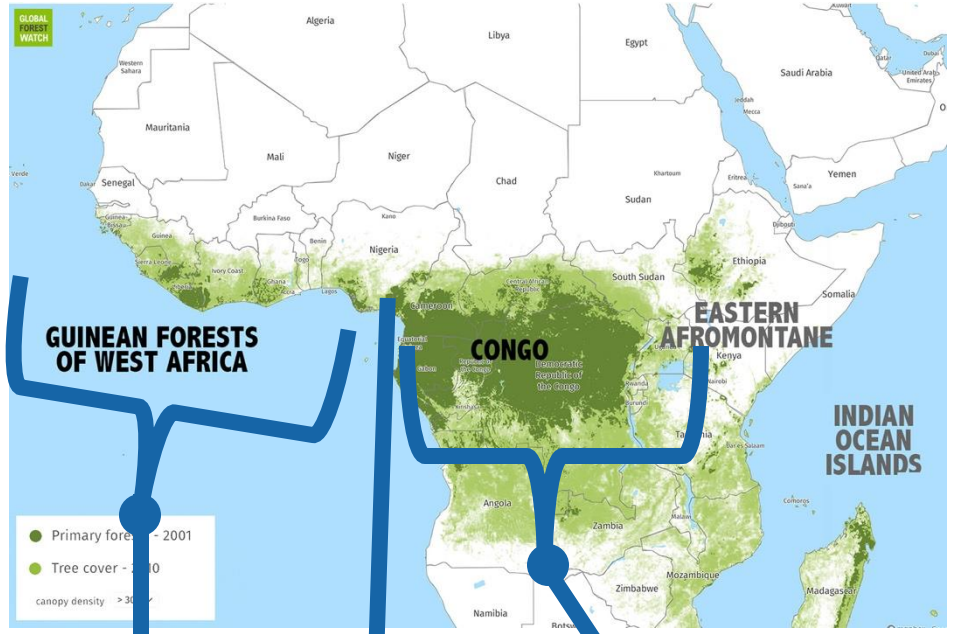
Mpox In the Field: DRC

Placide Mbala-Kingebeni, MD, PhD

Mpox: Epidemiology (1970–2016)

- **Geographical distribution:**
  - Tropical rainforest areas of West and Central Africa
- **Settings:**
  - Rural settlements, small villages
- **Demographics:**
  - Mostly children < 15 years
  - Fairly equal sex distribution
- **Transmission dynamics and risk factors:**
  - > 70% zoonotic source
  - Limited human-to-human household transmissions
  - † incidence among smallpox unvaccinated
- **Clinical features and outcome:**
  - Generalised febrile rash illness
  - More severe illness among smallpox unvaccinated
  - CFR- 0.2-10.1% (Clade I > Clade II)





Cameron
Clade I & II

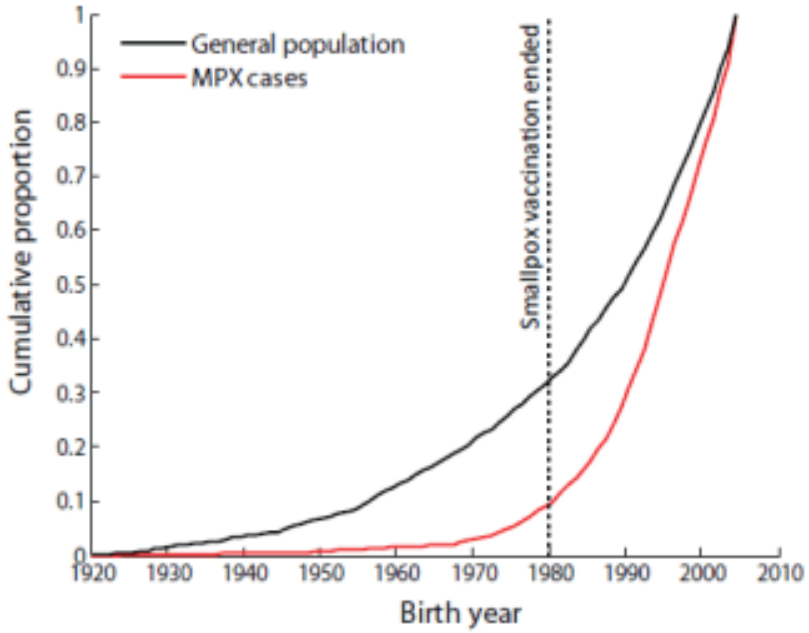
West African Clade
Clade II

Congo Basin Clade
Clade I

The Role of Smallpox Vaccination

Data from the 1980s suggested that smallpox vaccination conferred 85% (95% CI: 74-92) protection against clinical infection with monkeypox.

Distribution by age of recent infections suggests that vaccination is protective.



Analysis of data from 2005 to 2007 shows that smallpox vaccine provides 80.7% (70 to 89%) protection against clinical MPXV infection.

→ **no significant decline over time**.

2017-2019 Nigeria Mpox Outbreak

Emergence of the new Mpox

September 2017:

- Mpox reappears after 38 years (last case in 1978).

Index Case:

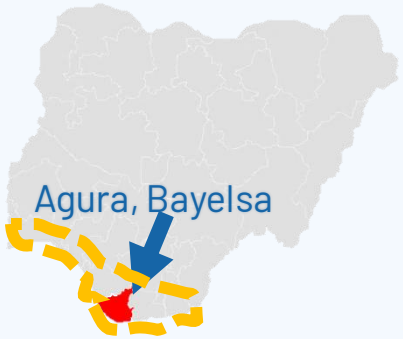
- 11-year-old boy from a rural settlement in Bayelsa (within rainforest area)

Subsequent Cases:

- Mostly young adults (20-40yrs), 75% male
- > 80% in urban areas
- No established zoonotic source
- Some had genital ulcers, STIs, including HIV

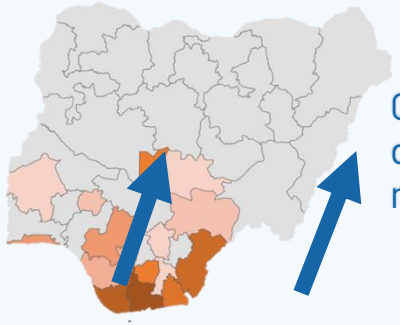
Geographical Spread:

- 88 cases reported in 17 of 37 states within three months
- Spread to cities outside traditional rainforest regions



Index case: 11yr old with skin eruptions

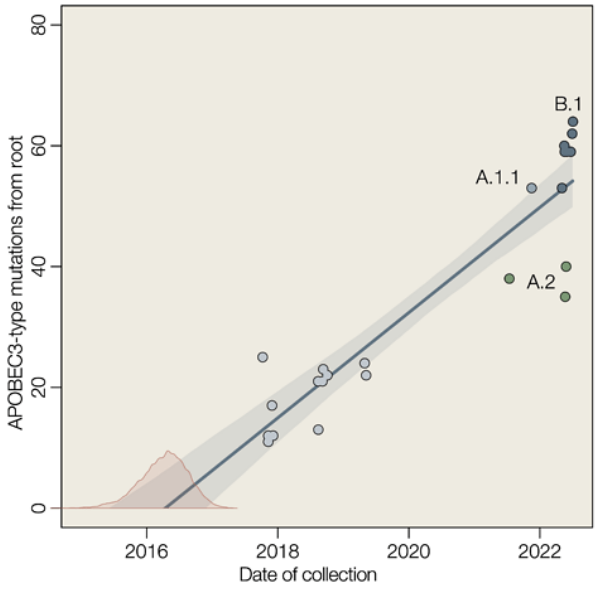
Young adults with genital ulcers + HIV, syphilis



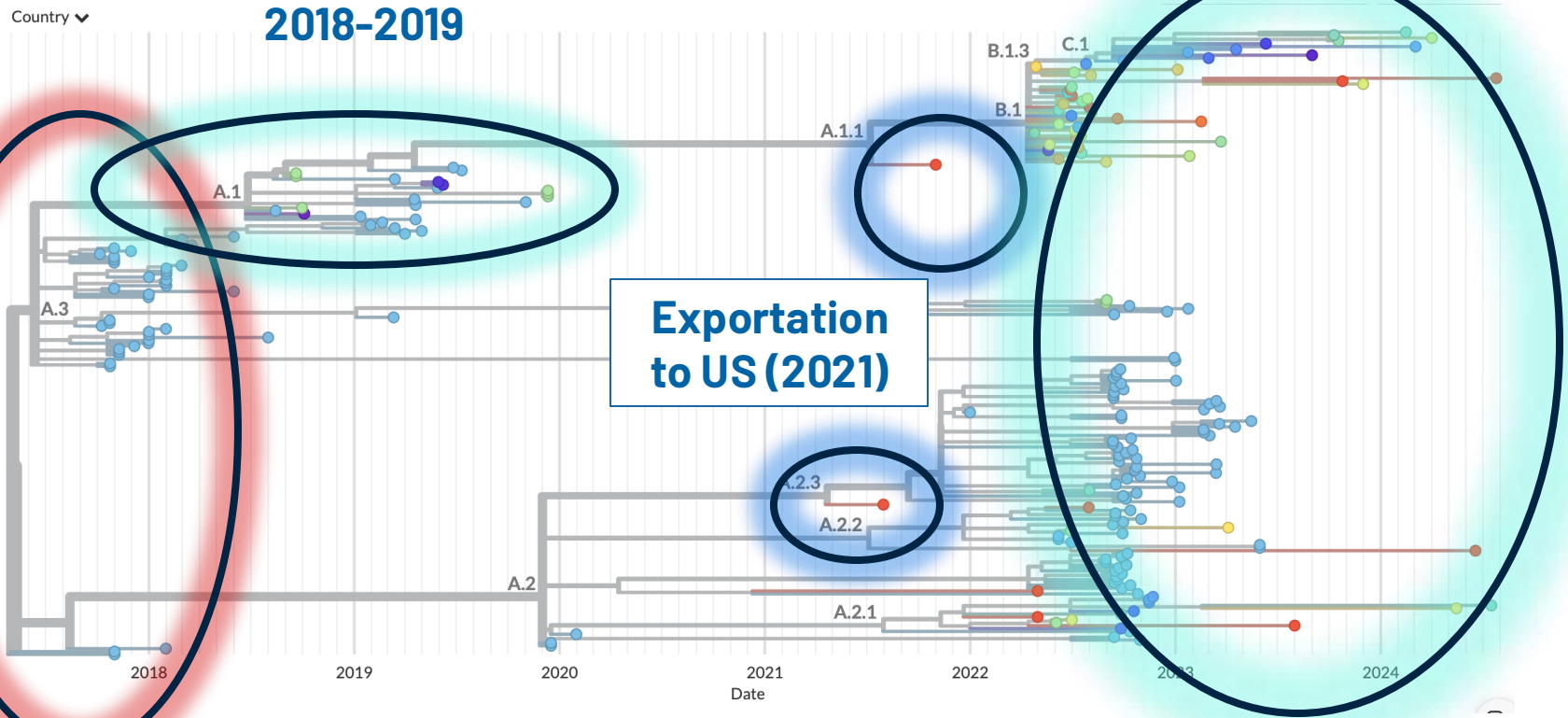
Geographical distribution of mpox Nigeria 2017

Ogoina D, *PLoS One*. 2019;14(4):e0214229.

Link Between Nigeria Outbreak and Global Outbreak



Exportation to Singapore, Isreal & UK 2018-2019



Exportation to US (2021)

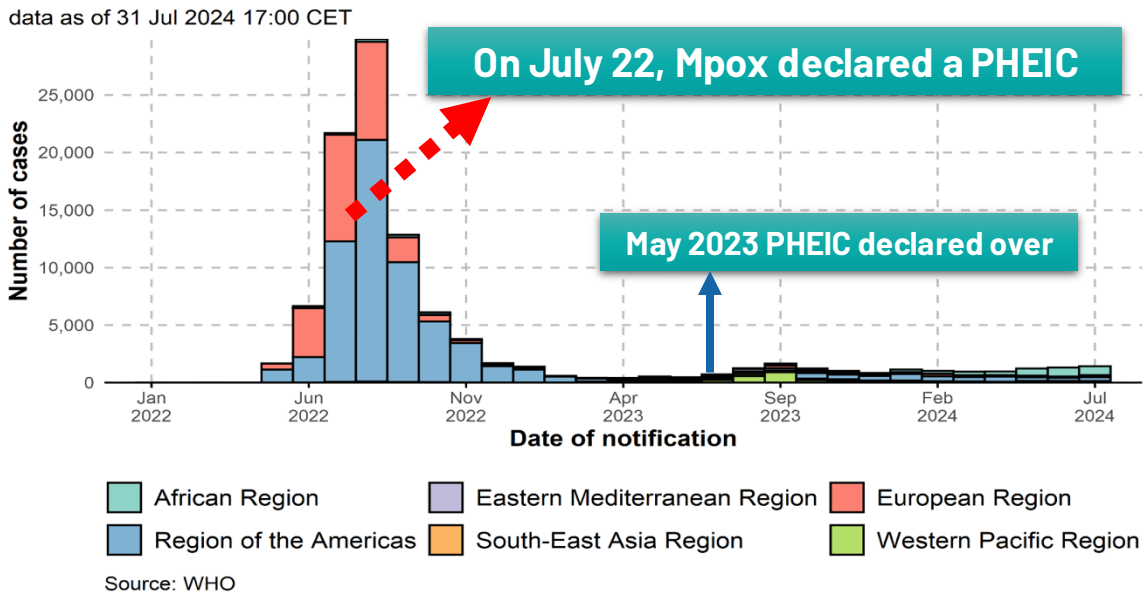
Nigeria Mpox outbreak 2017-2018

Global outbreak 2022-2024

Sources: O'Toole Á. et al. Science 382, 595–600 (2023), https://nextstrain.org/mpox/clade-IIb?c=country&p=full&tl=clade_membership&transmissions=show

Global Spread of Human Mpox (2022-2024)

Source: WHO



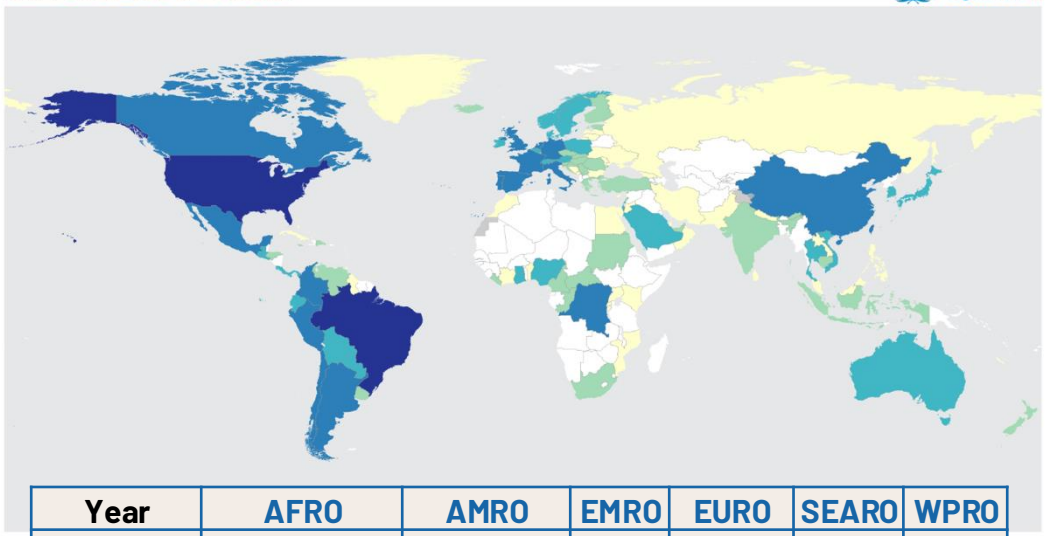
Source: WHO

Country	2022	2023
Nigeria	756	105
DRC	279	966
Ghana	121	6
Central African Rep	30	17
Cameroon	18	27
Liberia	6	12
Congo	5	21
South Africa	5	0
Benin	3	0
Mozambique	1	0
Total	1224	1154

Total cases	Total deaths	Countries reporting cases
102 997	223	121

Total cases in July 2024	Total deaths in July 2024	Countries reporting cases in July 2024
1 425	6	35

Total mpox cases
from 1 Jan 2022, as of 31 Jul 2024



Year	AFRO	AMRO	EMRO	EURO	SEARO	WPRO
2022	1224	57122	80	25705	35	229
2023	1154	4262	685	998	755	2690

85.8% were gay and bisexual men
51.9% were PLHIV

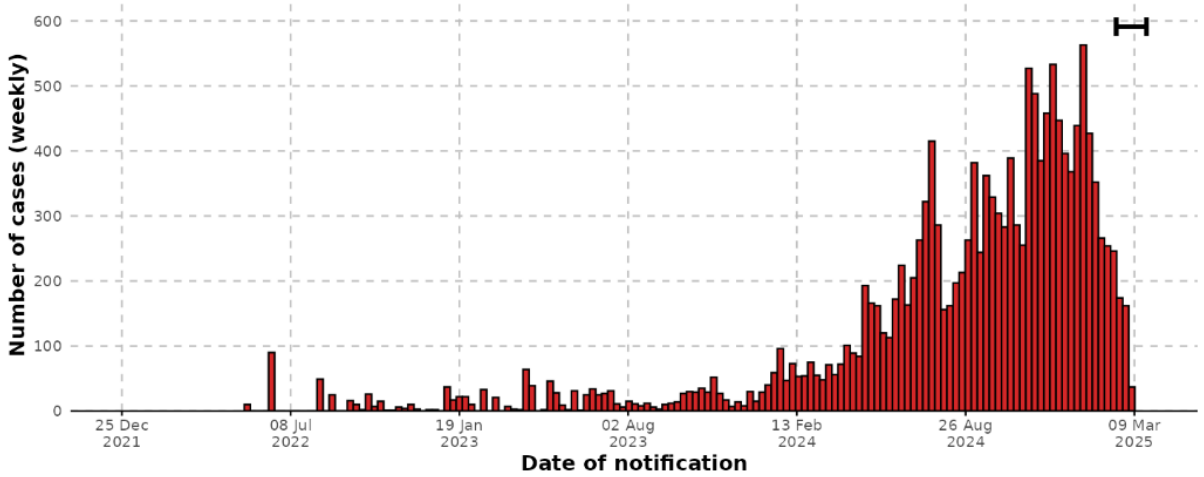
Evidence of Mpox transmission via sexual contact

Trends in Mpox Cases in DRC

Country with the highest number of reported Mpox cases worldwide

- 2022: 5,600 suspected cases
- 2023: 14,626 suspected cases
- 2024:
  - > 63,500 suspected cases (1,341 deaths)
  - 14,608 PCR confirmed cases

    ~75% of all confirmed cases in Africa
- From 01 Jan to 23 Feb 2025
  - 19,872 suspected cases (226 deaths)
  - 2648 PCR confirmed cases (~1/5 of 2024)



https://worldhealthorg.shinyapps.io/mpx_global/

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ISSN: 1080-6059
EID Journal > Volume 30 > Early Release > Main Article
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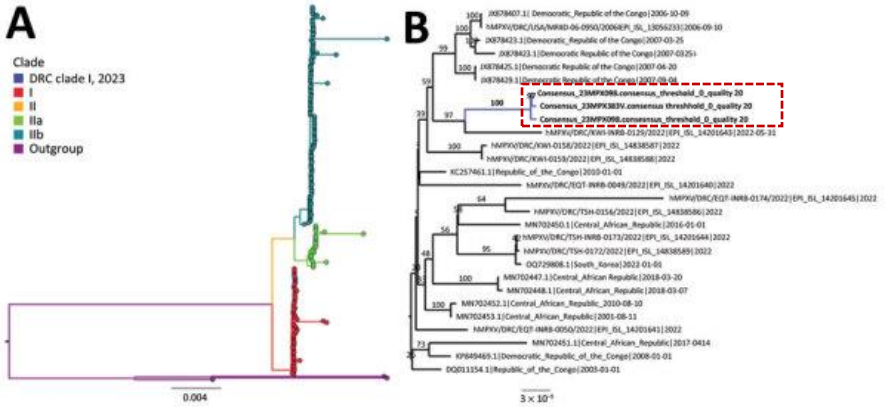
Volume 30, Number 1—January 2024
Dispatch

Clade I–Associated Mpox Cases Associated with Sexual Contact, the Democratic Republic of the Congo

In March 2023, **five Mpox confirmed cases among MSM in Kwango province**; genome sequencing suggest they belonged to the same transmission chain



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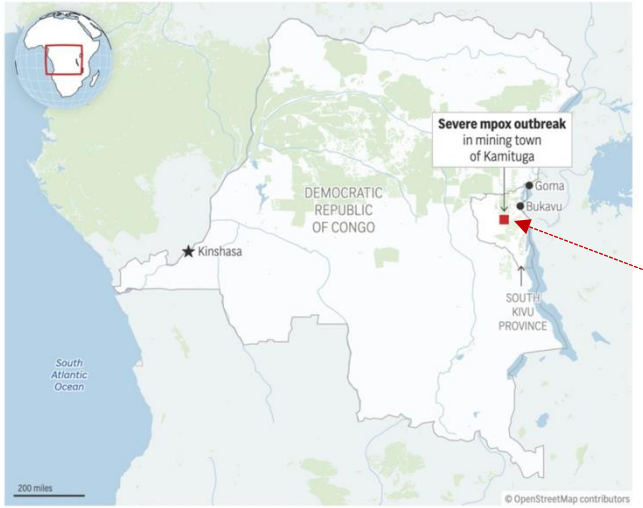
Disease Outbreak News

Mpox (monkeypox)- Democratic Republic of the Congo

New mpox strain spreads infection and fear

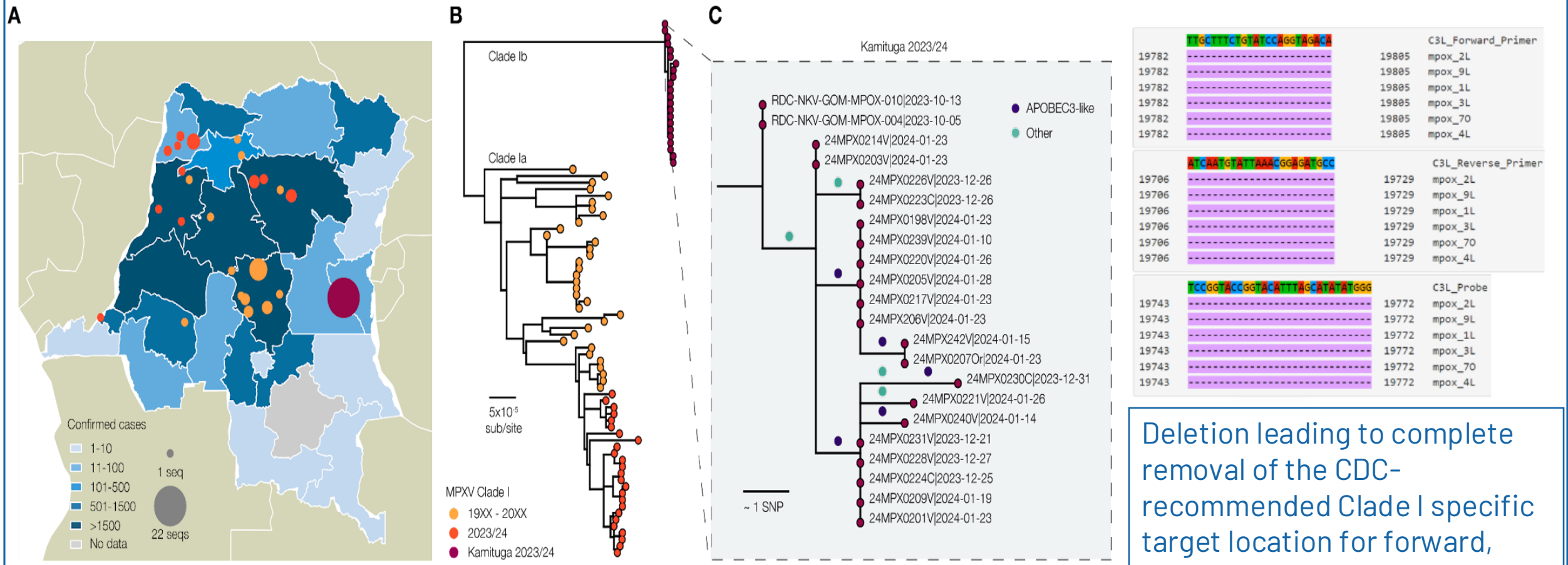
In Congo's province of South Kivu, the town of Kamituga has become the epicenter of the latest mpox outbreak as a new variant of the virus is infecting people faster and more easily than previous epidemics.



Source: AP reports

As of November 22, 2023, **34 confirmed cases** (including **20 sex workers**) of Mpox have been reported in **South Kivu**, mainly in the **Kamituga health zone**, with no deaths.

Genomic Surveillance of Mpox in the DRC showing a sustained H2H transmission in Kamituga, South Kivu



	TTGCTTTCTGTATCCAGGTAGACA		C3L_Forward_Primer
19782	----------	19805	mpox_2L
19782	----------	19805	mpox_9L
19782	----------	19805	mpox_1L
19782	----------	19805	mpox_3L
19782	----------	19805	mpox_70
19782	----------	19805	mpox_4L

	ATCAATGTATTAAACGGAGATGCC		C3L_Reverse_Primer
19706	----------	19729	mpox_2L
19706	----------	19729	mpox_9L
19706	----------	19729	mpox_1L
19706	----------	19729	mpox_3L
19706	----------	19729	mpox_70
19706	----------	19729	mpox_4L

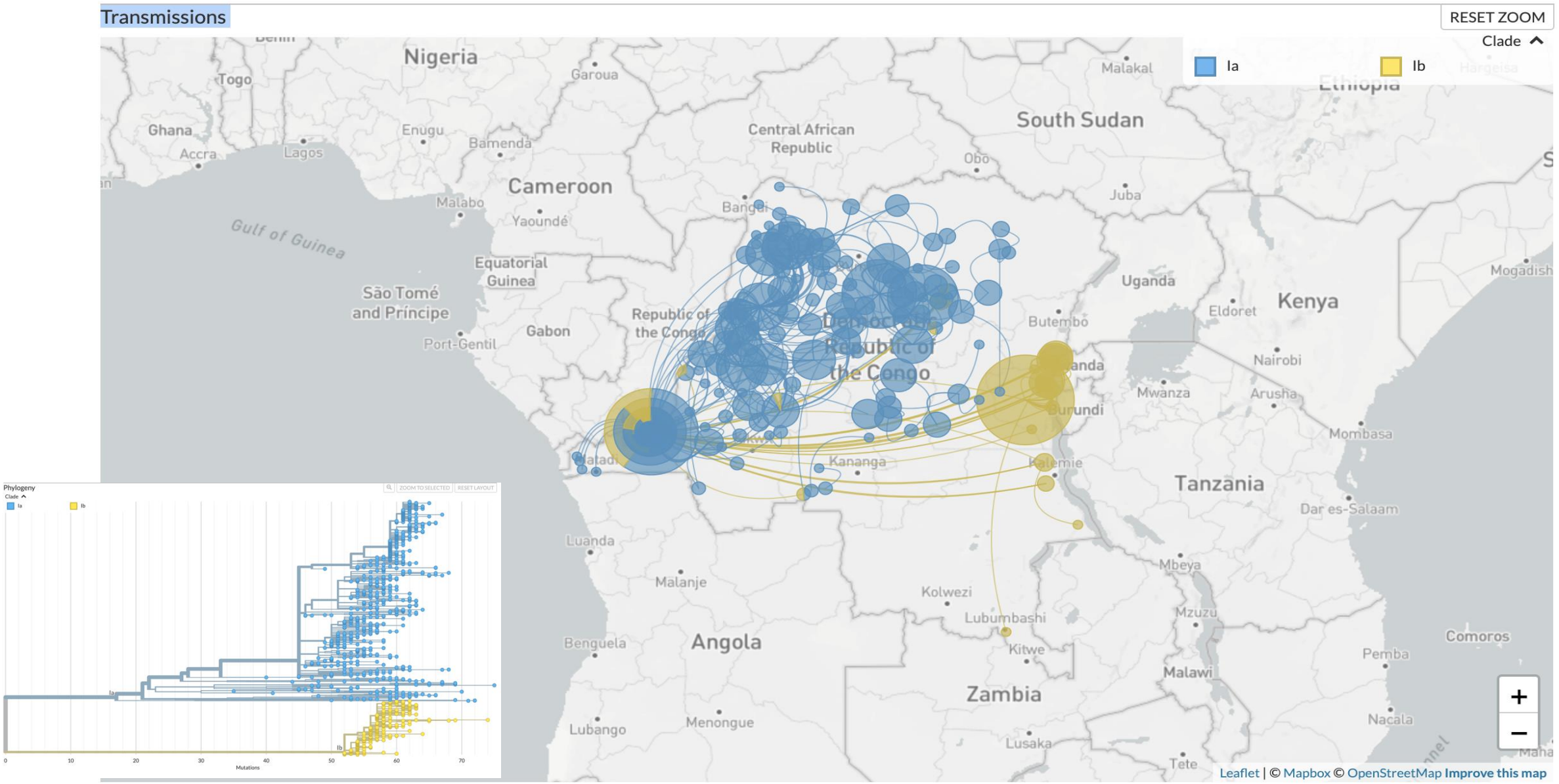
	TCCGGTACCGGTACATTTAGCATATATGGG		C3L_Probe
19743	----------	19772	mpox_2L
19743	----------	19772	mpox_9L
19743	----------	19772	mpox_1L
19743	----------	19772	mpox_3L
19743	----------	19772	mpox_70
19743	----------	19772	mpox_4L

Deletion leading to complete removal of the CDC-recommended Clade I specific target location for forward, backward, and probe (C3L).

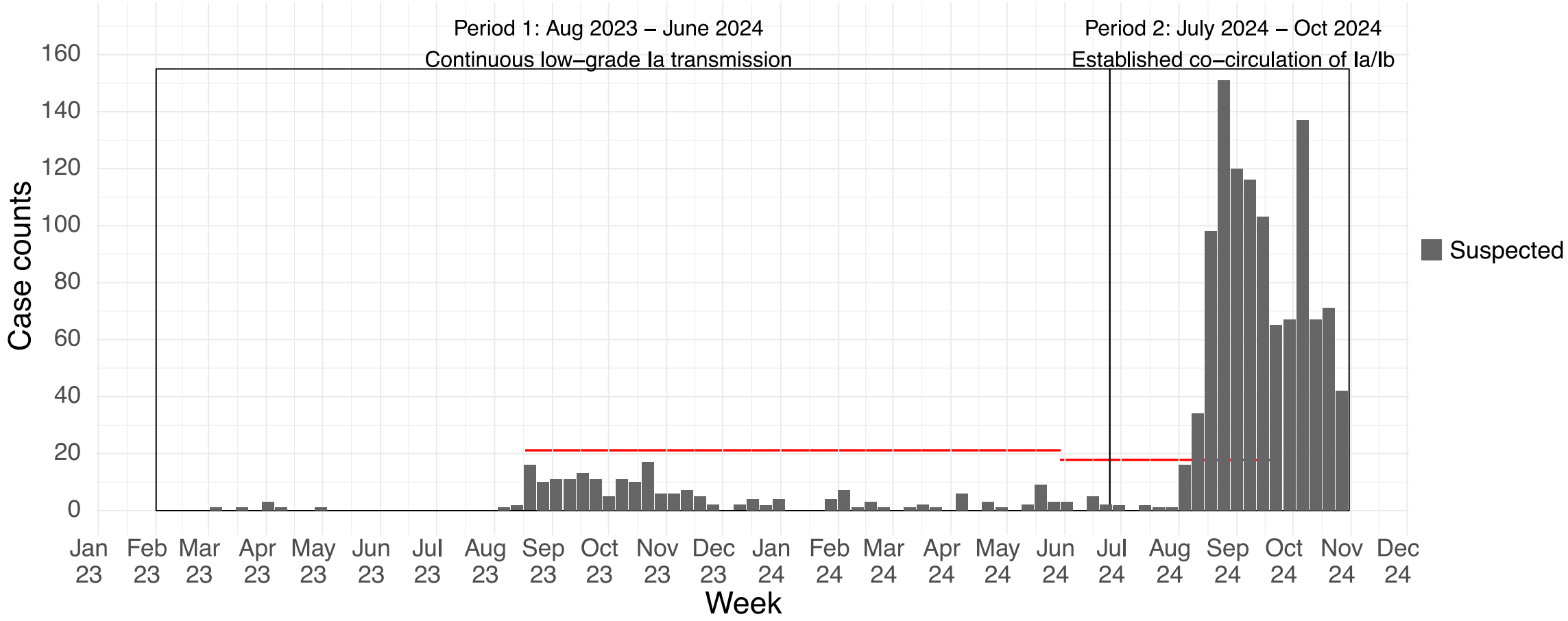
Emmanuel Vakaniaki, Cris Kacita, Eddy Kinganda-Lusamaki et al., Nature Medicine 2024

Novel Clade I genome sequences from the ongoing mpox virus outbreak of Kamituga in South Kivu province, Democratic Republic of Congo - Monkeypox - Virological

Co-Circulation of Mpox Clade Ia and Clade Ib in DR Congo

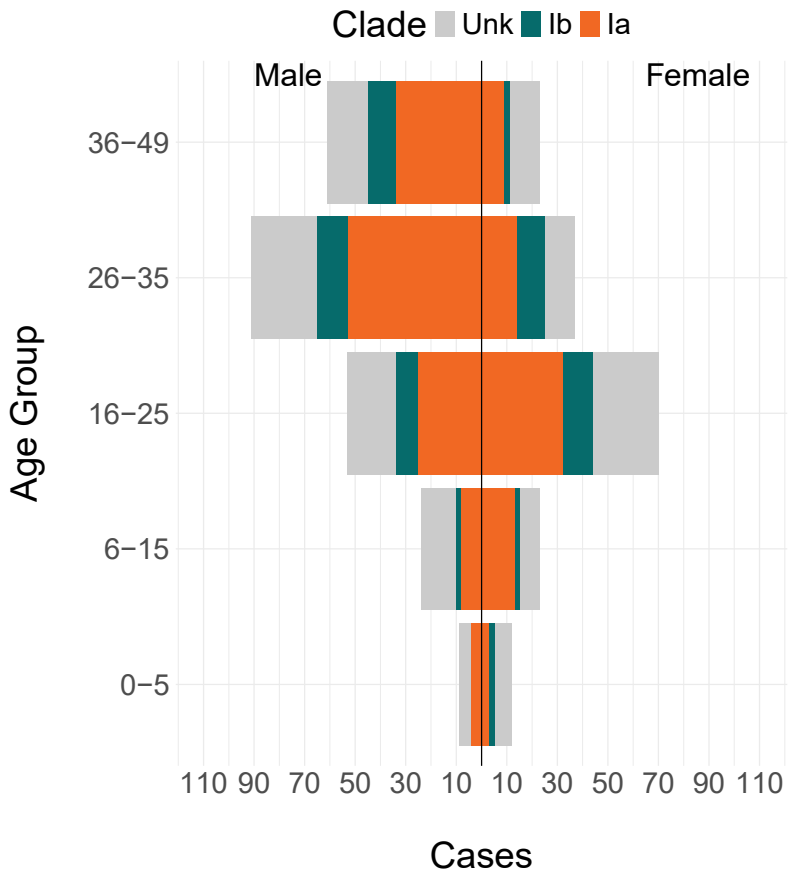


Epidemiology and phylogenomic characterisation of two distinct Mpox outbreaks in Kinshasa, Democratic Republic of the Congo involving a new subclade Ia lineage: a retrospective observational study



Wawina et al. 2025 The Lancet

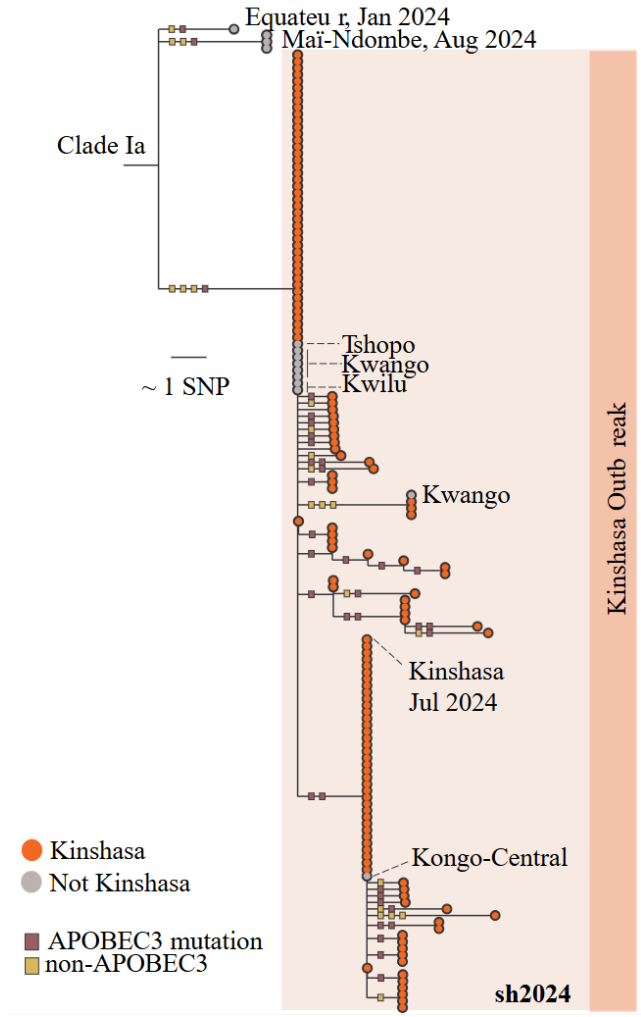
Epidemiology and phylogenomic characterisation of two distinct Mpox outbreaks in Kinshasa, Democratic Republic of the Congo involving a new subclade Ia lineage: a retrospective observational study

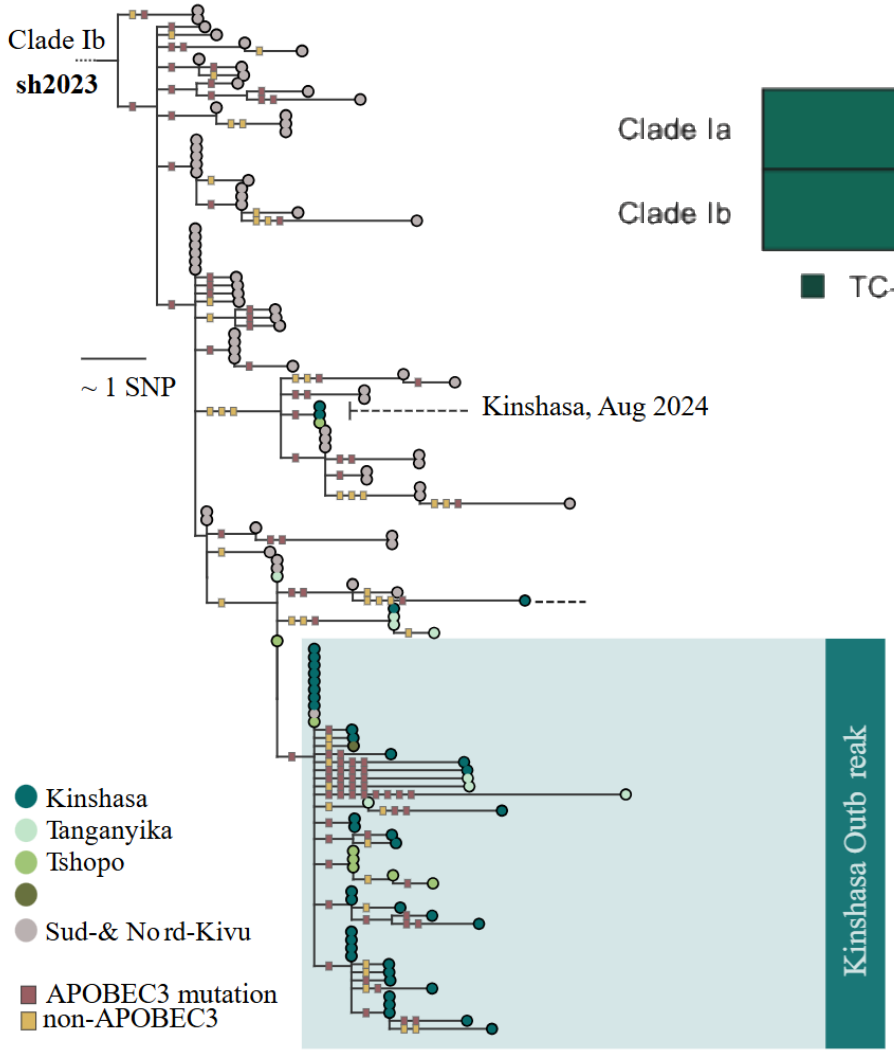


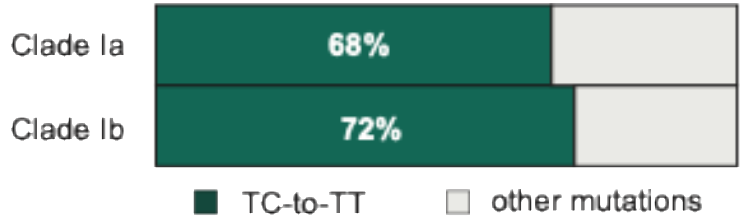
	Clade Ia		Clade Ib		Total	
	n	%	n	%	n	%
Clinical Symptoms	**61**	**100**	**32**	**100**	**93**	**100**
Fever	49	80.3	12	37.5	61	65.6
Rash	48	78.7	18	56.3	66	71.0
Sore throat	36	59.0	11	34.4	47	50.5
Joint/muscle pain	35	57.4	8	25.0	43	46.2
Headache	32	52.5	5	15.6	37	39.8
Lymphadenopathy	28	45.9	11	34.4	39	41.9
Fatigue	26	42.6	5	15.6	31	33.3
Lesion Location	**55**	**100**	**19**	**100**	**74**	**100**
(ano-)genital	35	63.6	13	68.4	48	64.9
Limbs/extremities	35	63.6	11	57.9	46	62.2
Face	32	58.2	12	63.2	44	59.5
Trunk	20	36.4	11	57.9	31	41.9
Oral	12	21.8	2	10.5	14	18.9
Hospitalization Status	**46**	**100**	**15**	**100**	**61**	**100**
Yes	4	8.7	3	20.0	7	11.5
No	42	91.3	12	80.0	54	88.5

Wawina et al. 2025 The Lancet

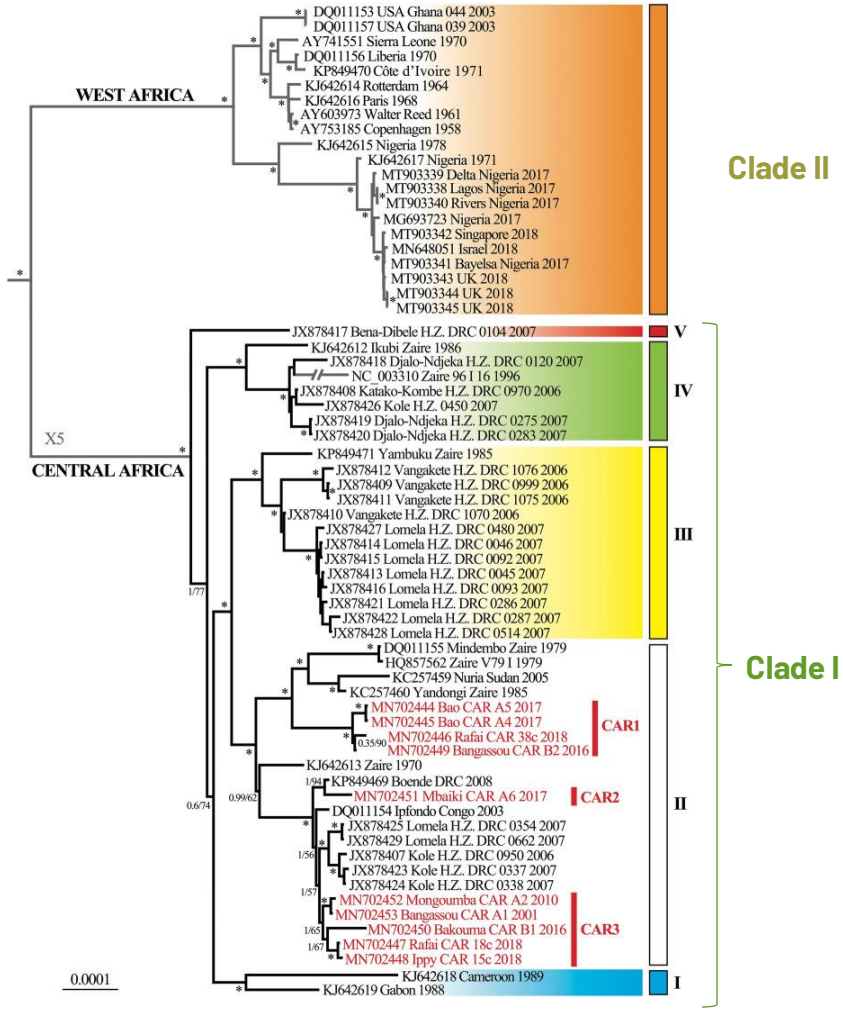
Epidemiology and phylogenomic characterisation of two distinct Mpox outbreaks in Kinshasa, Democratic Republic of the Congo involving a new subclade Ia lineage: a retrospective observational study







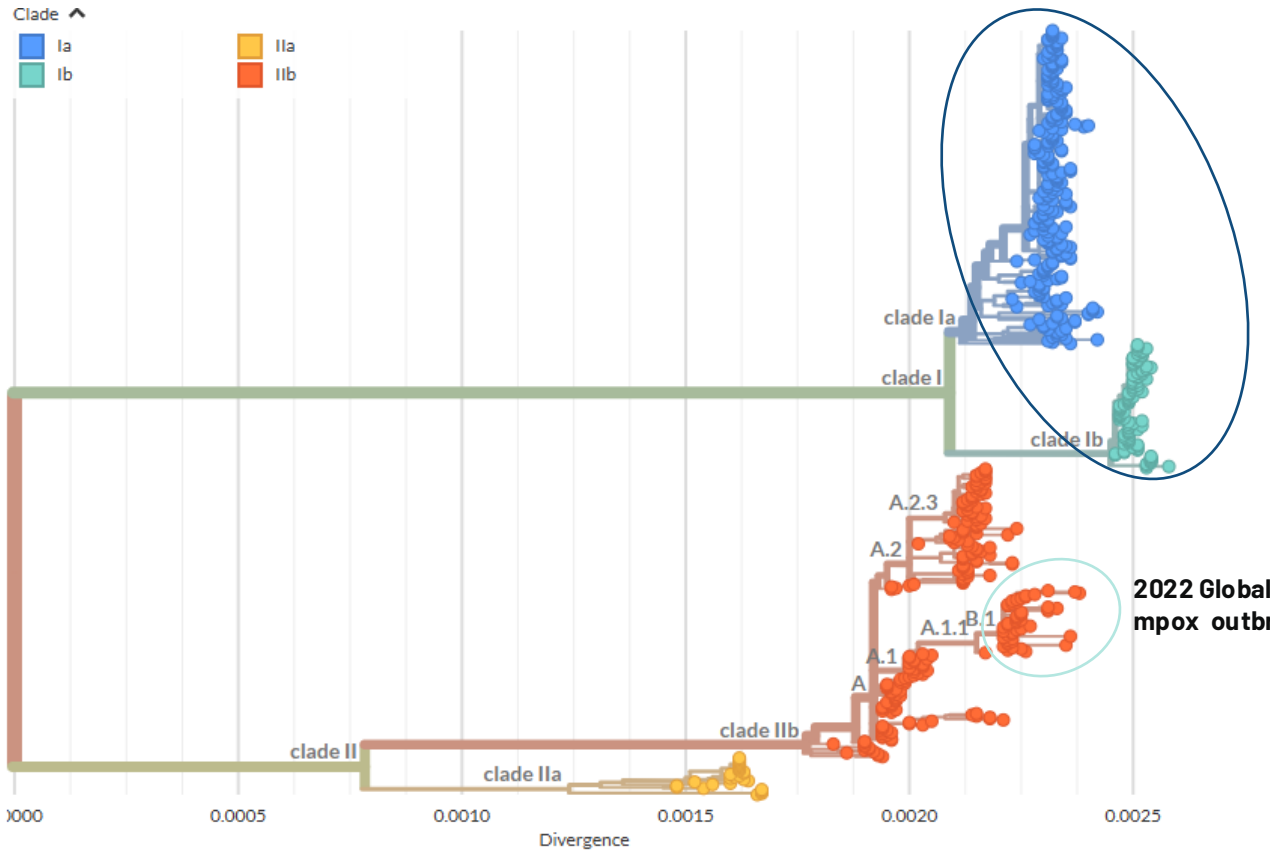
Epidemics of Four MPVX Clades



Berthet et al. Scientific Reports 2021

Nat Med. 2024 Oct;30(10):2791-2795. doi: 10.1038/s41591-024-03130-3. Epub 2024 Jun 13.

Sustained human outbreak of a new MPXV clade I lineage in eastern Democratic Republic of the Congo



2022 Global Clade IIb mpox outbreak

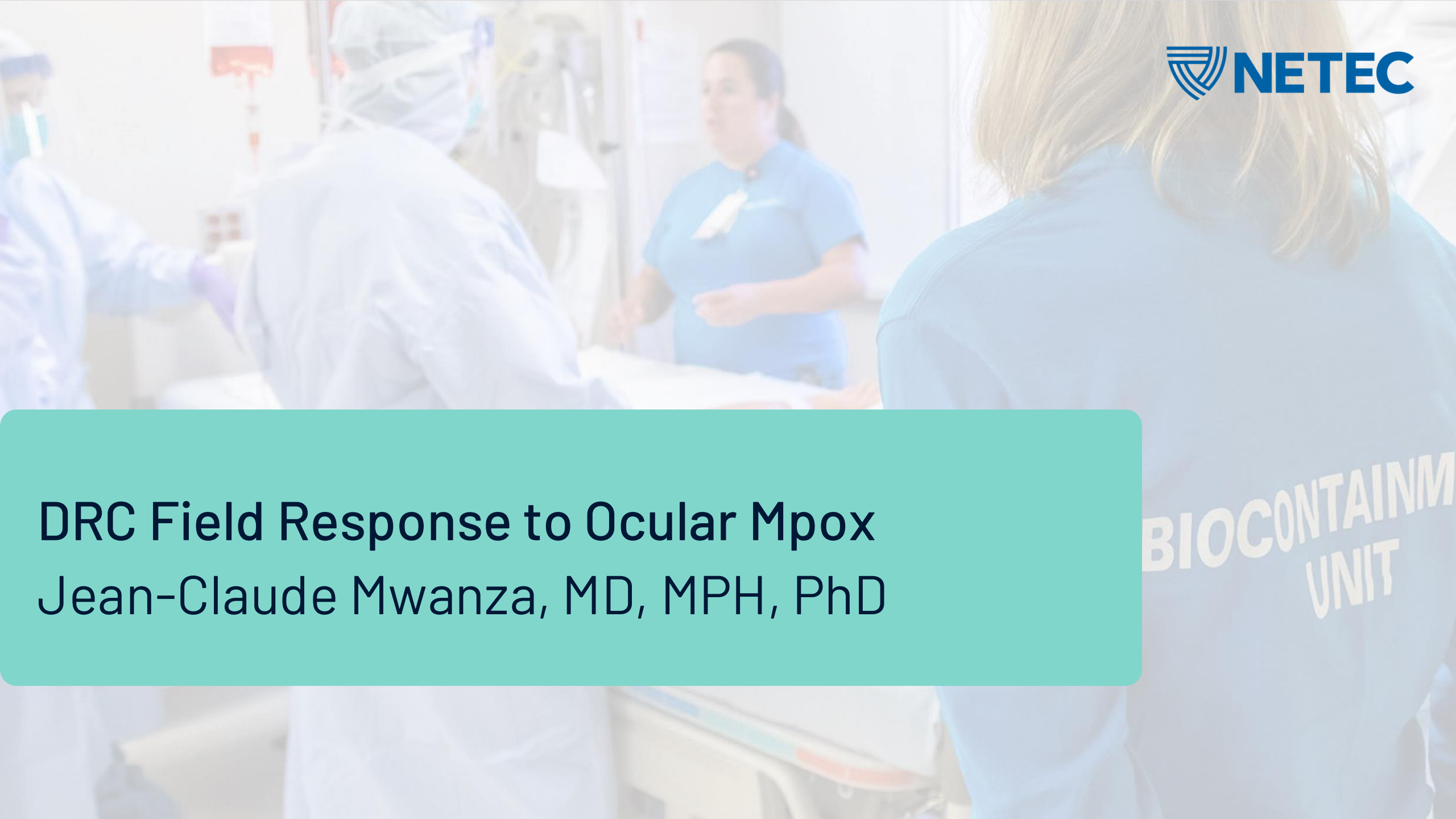
https://nextstrain.org/mpox/all-clades?p=grid

Summary

- A shift in the epidemiology of Mpox outbreaks
  - Previously known as zoonotic with limited secondary human-to-human transmission
- Clade IIb, clade Ib, and clade Ia can spread through sexual networks
- A new clade Ia lineage associated with sustained h2h transmission “APOBEC3”
- All MPXV lineages can cause sustained human outbreaks if the right conditions are met

Pakadjuma, Kinshasa, December 2024

Wawina et al. 2025 The Lancet



NETEC

DRC Field Response to Ocular Mpox

Jean-Claude Mwanza, MD, MPH, PhD

Objectives

- ✓ Describe response efforts to ocular Mpox during the current outbreak in DRC
- ✓ Discuss ongoing challenges and sustained actions to mitigate the ocular complications as the outbreak expands

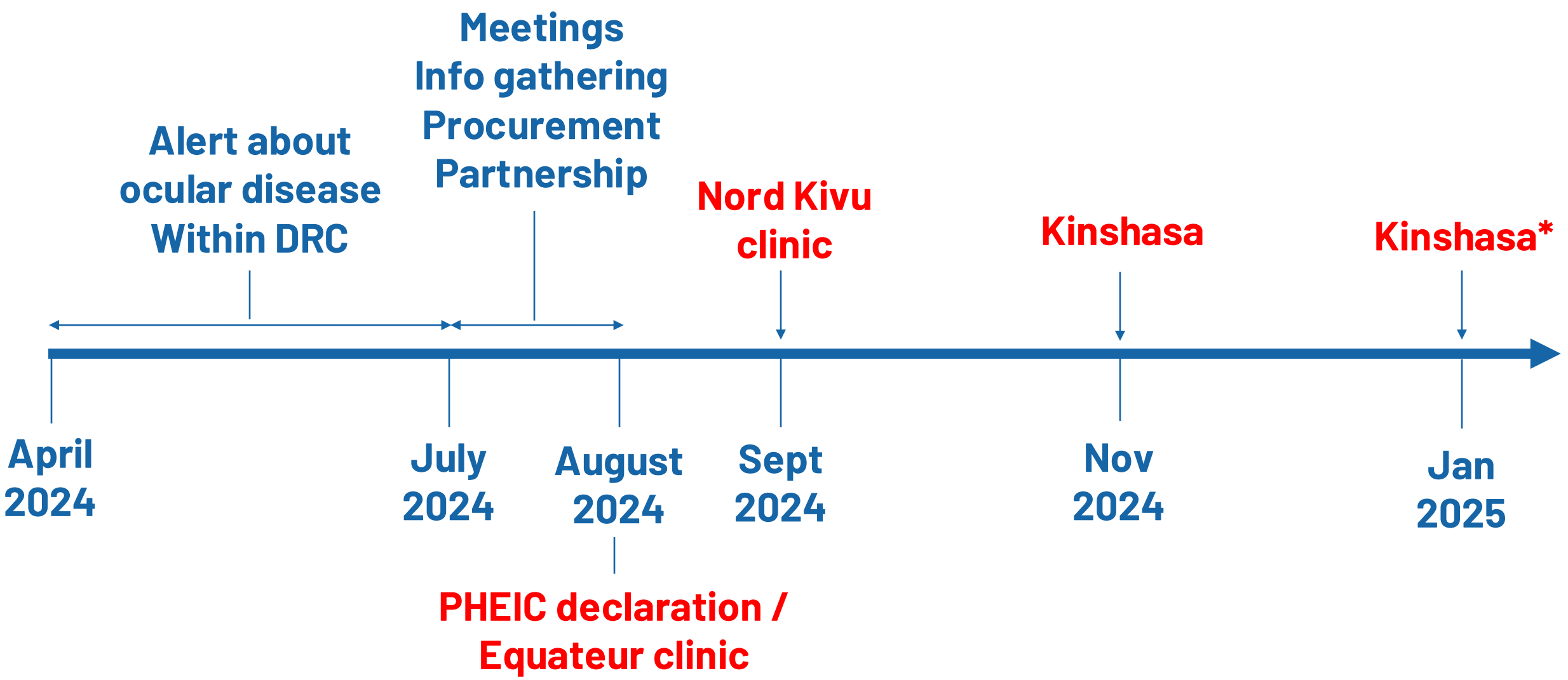
Prevalence of MPXROD

Clade II Studies	N	MPXROD
Pazos et al, 2023, Spain	880	1%
Patel et al, 2022, UK	197	1%
Thornhill et al, 2022, multination	528	1%
Catala et al, 2022, Spain	185	1%
Pascom et al, 2022, Brazil	8617	1%
Rodriguez-Badillo et al, 2024, Mexico	100	1.1%
Fink et al, 2022, UK	156	3.8%
Mailhe et al, 2022, France	264	3.8%
Mitja et al, 2023, multination	382	5.2%
Kyaw et al, 2022, US	614	6.2%

West Afr. Clade	N	MPXROD
Yinka-Ogunleye et al, 2019, Nigeria	122	23%
Ogoina et al, 2023, Nigeria	160	15%

Clade I Studies	N	MPXROD
Jezek et al, 1987, DRC	282	13.4%
Jezek et al, 1987, DRC	338	25%
Hughes et al, 2014, DRC	294	23.1%
Osadebe et al, 2017, DRC	739	17.1%
Pitman et al, 2022, DRC	216	18%
Whitehouse et al, 2021, DRC	1057	51%

Timeline and Ongoing Work



Challenges from the Field

Information gathering

- Eyecare personnel typically not involved in rural settings
- No estimates on the magnitude and types of eye complications

Multiple parties and chains of communication needed

- MoH National Emergency Program
- INRB
- Health officials (province, district)
- WHO offices

Operational challenges

- Eye care equipment malfunctioning or unavailable
- Consistent source of electricity (slit lamp microscope use)

Challenges from the Field

- Security issues due to escalating conflict
  - Elevation of U.S. Department of State from Level 3 to Level 4 “Do Not Travel” Advisory, Ordered departure of U.S. government employees and families
  - Recent fighting in eastern DRC cities (Goma, Bukavu) and political unrest in Kinshasa
  - Clinical operations paused in late January 2025

Travel Advisory
January 29, 2025

Democratic Republic of the Congo - Level 4: Do Not Travel

Kinshasa, DRC (Nytimes.com)

Goma, DRC (Peacekeeping.un.org)

Information from Mpox Affected Areas in the DRC

Nord Kivu

Nord Kivu

Nord Kivu

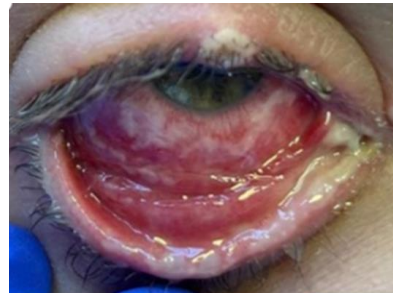
Equateur

Kole

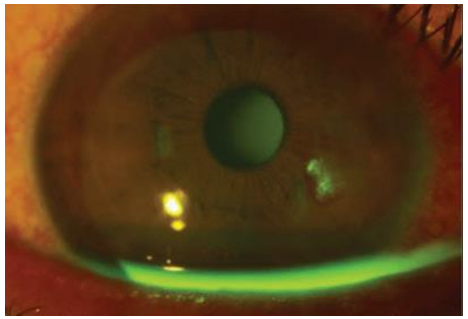
Reports Parallel Our Experience: Precise Scale To Be Determined

Ogoina et al, 2023

Yi-Ting et al, 2024



Pazos et al



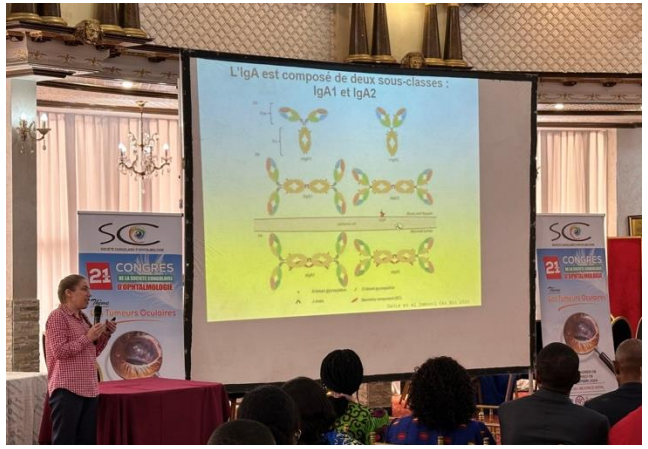
Yi-Ting et al, 2024

Nguyen et al, 2023

Congolese Ophthalmological Society Training

Didactics in Ebola, Mpox, PPE and IPC Measures for Congolese Ophthalmologists

Emerging Infectious Disease of the Eye



Ocular Immunology

Panel Discussions

Conclusions/Future Directions

- ✓Mpox is associated with an array of ocular manifestations (e.g. conjunctivitis, keratitis) within the DRC, over many years
- ✓Given the rising number of cases, threat to vision and difficult access, concerted efforts are required among all stakeholders (e.g., MOH, CC Africa, Ophthalmologists, non-government stakeholders)
- ✓Need for increased awareness among HCWs and patients (ocular symptoms, preventive measures)

Infection Prevention & Control Principles

Jessica Carag, DVM, MS

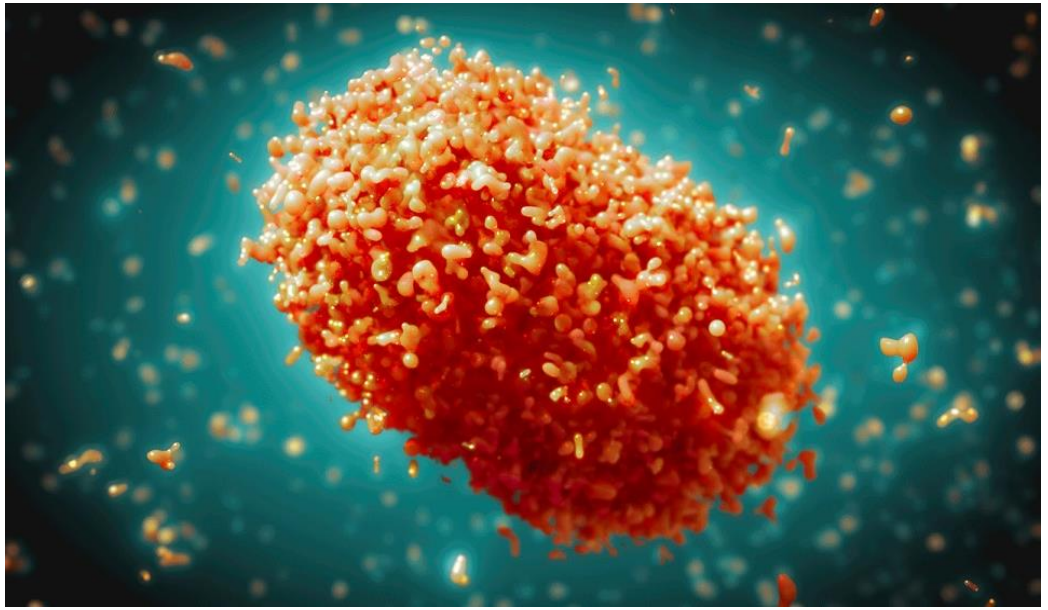
MPXV: Long to linger | Easy to inactivate

- Poxviruses known to be resistant to desiccation and **persist for long periods** in the environment
  - Variola and vaccinia viruses viable for months to years under controlled environmental conditions

Household environmental sampling by CDC for MPXV yielded viable virus **15 days** after infected patient had vacated

Enveloped virus

- Inactivated by disrupting lipid envelope



World Health Organization (WHO)

Routes of Transmission

Direct or indirect contact with:
Rash, scabs
Fluid, pus, blood from **skin lesions**
Respiratory **droplets**
Virus has been detected in saliva, semen, vaginal fluid, urine, feces, **tears/ocular secretions** • Transmissibility via these fluids unclear
Contaminated **fomites** – clothing, bedding, towels, nonporous surfaces or equipment

Airborne
Transmission likely less efficient
Evidence of occurrence in both humans and animals

Other
Vertical
Exposure to infected animals

Source: Dr. Steve Yeh, taken with permission of patient

Protect Yourself: Healthcare Worker Safety

Utilize Standard Precautions
Hand hygiene
PPE
Respiratory hygiene
Environmental and equipment cleaning & disinfection
Safe handling of linens
Appropriate waste management

Additional Mpox-Specific Precautions

- Immediately **notify IPC personnel** if patient suspected to have mpox
- Place patient in **single-person room** with door closed, if possible, and a dedicated bathroom
  - Intubation, extubation, **aerosol generating procedures** should be performed in a negative pressure/airborne infection isolation room (AIIR)

Refer to CDC's Mpox Infection Prevention and Control site for more detail.

https://www.cdc.gov/mpox/hcp/infection-control/healthcare-settings.html

Protect Yourself: Healthcare Worker Safety

Source Control

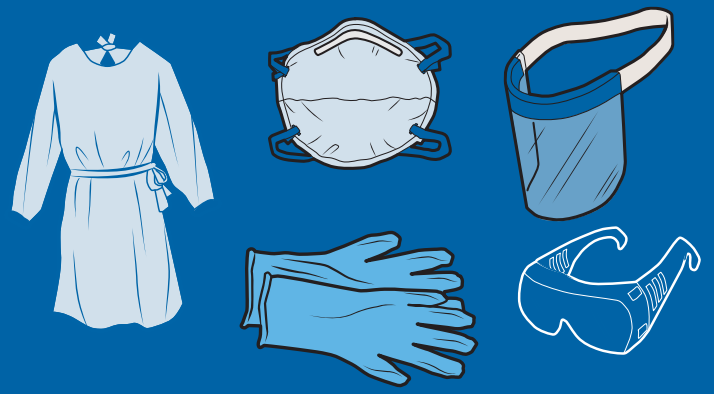
Important for ocular exams!

- Medical mask
- Exposed lesions covered with sheet or gown (when feasible)

Source: Dr. Steve Yeh, taken with permission of patient

Personal Protective Equipment

- Gown
- Gloves
- NIOSH-approved particulate respirator, N95 or higher
- Eye protection – goggles or face shield



*Vaccination

Hand Hygiene

- Frequent washing and use of alcohol-based handrub

Awareness

- Stay aware of **what you and the patient have touched**
- Remember that gloves protect you, but not your surroundings – can **spread contamination**!

Protect Others: Environmental Disinfection

Clean and disinfect with **EPA-registered, hospital-grade disinfectant with emerging viral pathogen (EVP) claim**

- Use per manufacturer's instructions

Avoid activities that could **resuspend** dried material from lesions (portable fans, dry dusting, sweeping, vacuuming, shaking linens)

Clade I or II MPXV

Category B waste

- Dispose as standard regulated medical waste
- Exception: lab cultures of Clade I MPXV are Cat A

Protect the *Patient*: Considerations for Ocular Exam

Infectivity and transmission potential of tears and ocular secretions is unclear

Infectious lesions can present around eyes

Source: Dr. Steve Yeh, taken with permission of patient

Protect patients from **cross-contamination or autoinoculation** of eyes

- ✓ Clean instruments between uses on individual eyes, work from **clean eye to dirty eye** when possible
- ✓ **Avoid touching lesions** when manipulating the periocular area, or use a **clean barrier** such as sterile gauze
- ✓ Advise patients to **avoid eye rubbing**, practice frequent hand hygiene, and avoid use of contact lenses
- ✓ Be careful about **multi-use eyedrop bottle contamination**
  - Evidence that air exhaled through **superior mask gap** can contact bottle during drop administration - occlude with **gloved** fingers to reduce risk
  - Consider alternatives to multiuse eye drop bottles. Example: Sterile syringe, single-use droppers

Depiction of superior mask gap occlusion technique – use GLOVES with mpox patients

Journal of Cataract & Refractive Surgery47(9):1167-1174, September 2021.

Have a Plan

- What tasks will you need to perform?
- How close will you be to the patient?
  How much direct contact will be required?
- Where are the lesions?
- What supplies/equipment will you need?
- Will you have assistance?

Planning your interaction prior to entering the room will help minimize risk to the HCW, patient, and others

Emerging Infectious Diseases of the Eye: Mpox, Ebola, and Emerging Pathogens

Steven Yeh, MD

Objectives

- ✓ Provide an overview of the vision-threatening consequences of Ebola virus disease, Mpox, and implications for emerging infectious diseases
- ✓ Discuss the context of recent and ongoing outbreaks that have informed our approaches to vision-threatening sequelae of Ebola and emerging pathogens

Global Impact: Emerging Infectious Disease

CNN Health » Food | Fitness | Wellness | Parenting | Live Longer — Live TV — U.S. Edition +

A UCLA employee infected with measles ate at a campus food court while contagious

By Cheri Mossburg and Hollie Silverman, CNN
Updated 3:35 AM ET, Wed July 10, 2019

More from CNN

Grandfather didn't dangle baby from cruise ship window. This is...

A blackbird hopped on the

How measles was eliminated and then came back 00:55

9:43 a.m. ET, May 6, 2021

India reports highest-ever 24-hour surge in Covid-19 cases and a record-high daily death toll

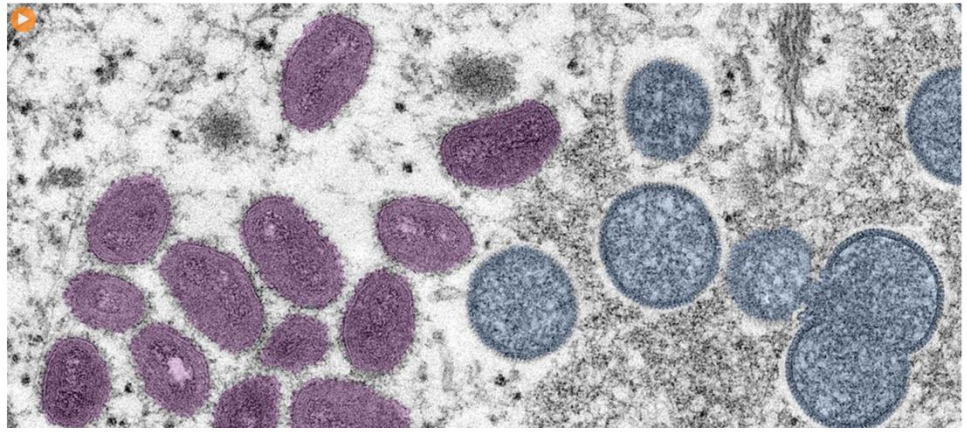
From CNN's Swati Gupta in Delhi

Time Is Running Out to Stop an Ebola Epidemic

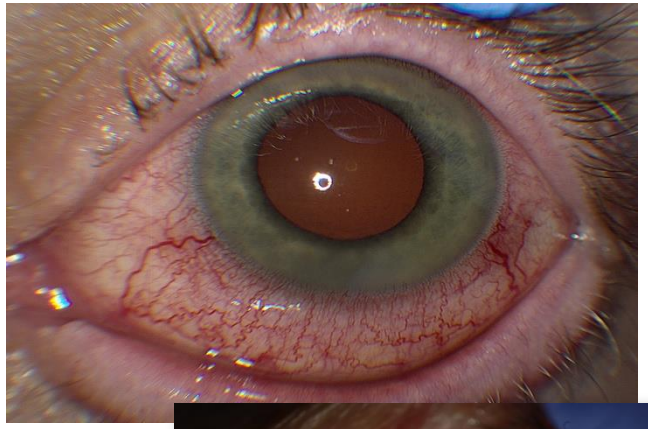
A mass exodus from the Democratic Republic of Congo could be catastrophic.

United Nations | UN News
Global perspective Human stories

Monkeypox declared a global health emergency by the World Health Organization

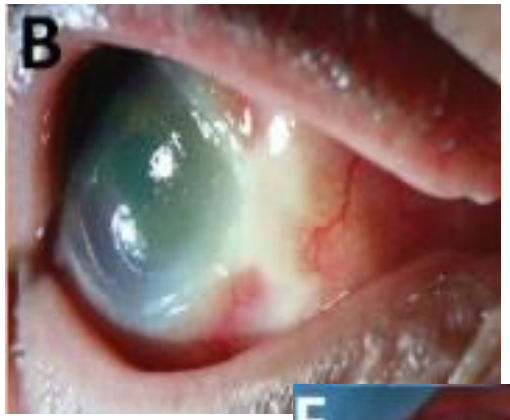


The Eye as a Window to Emerging Infectious Diseases



Varkey et al *NEJM* 2015
Shantha et al *Ophthalmol 2016*

Ebola



Nguyen, Seitzman, *Emerg Infect Dis 2023*

Mpox

Uyeki et al NEJM 2024

Landmann 2021

Highly Pathogenic Avian Influenza H5N1

Ebola's Legacy: Children with Cataract

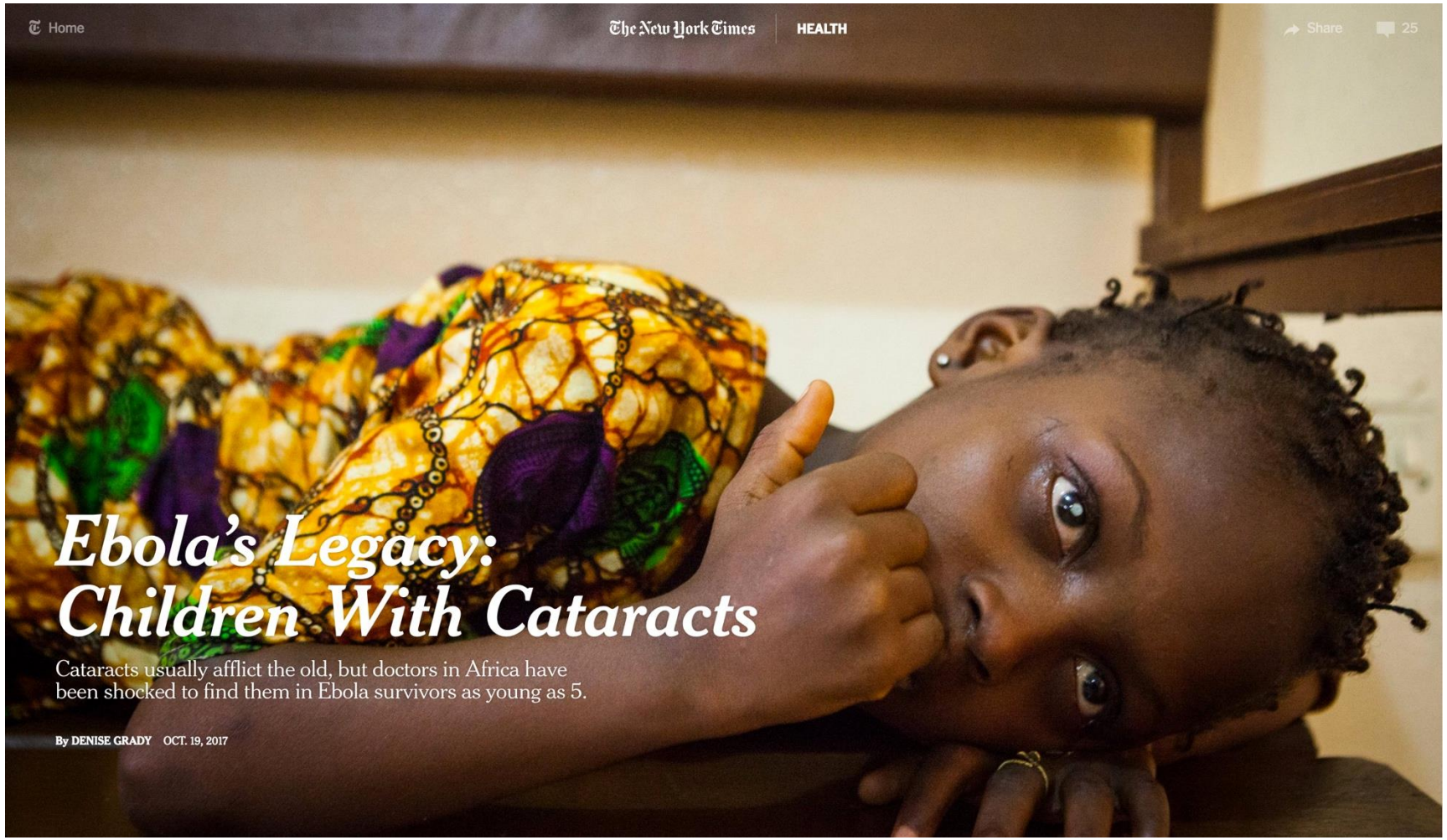


Photo Credit Jane Hahn *NY Times 2017*

Ebola Becomes a Global Concern

Dr. Kent Brantly
Atlanta, GA

Ms. Nancy Writebol
Monrovia, Liberia

Dr. Rick Sacra
Omaha, NE

Dr. Ian Crozier
Freetown, Sierra Leone

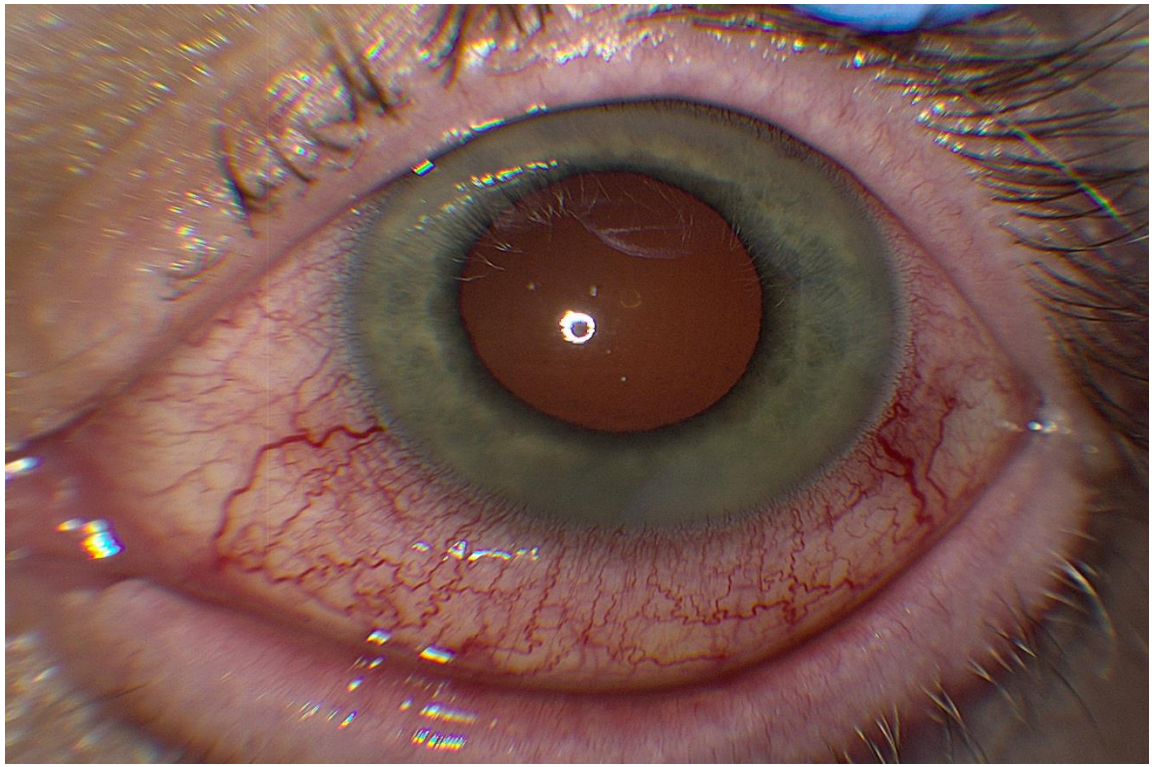
The New York Times

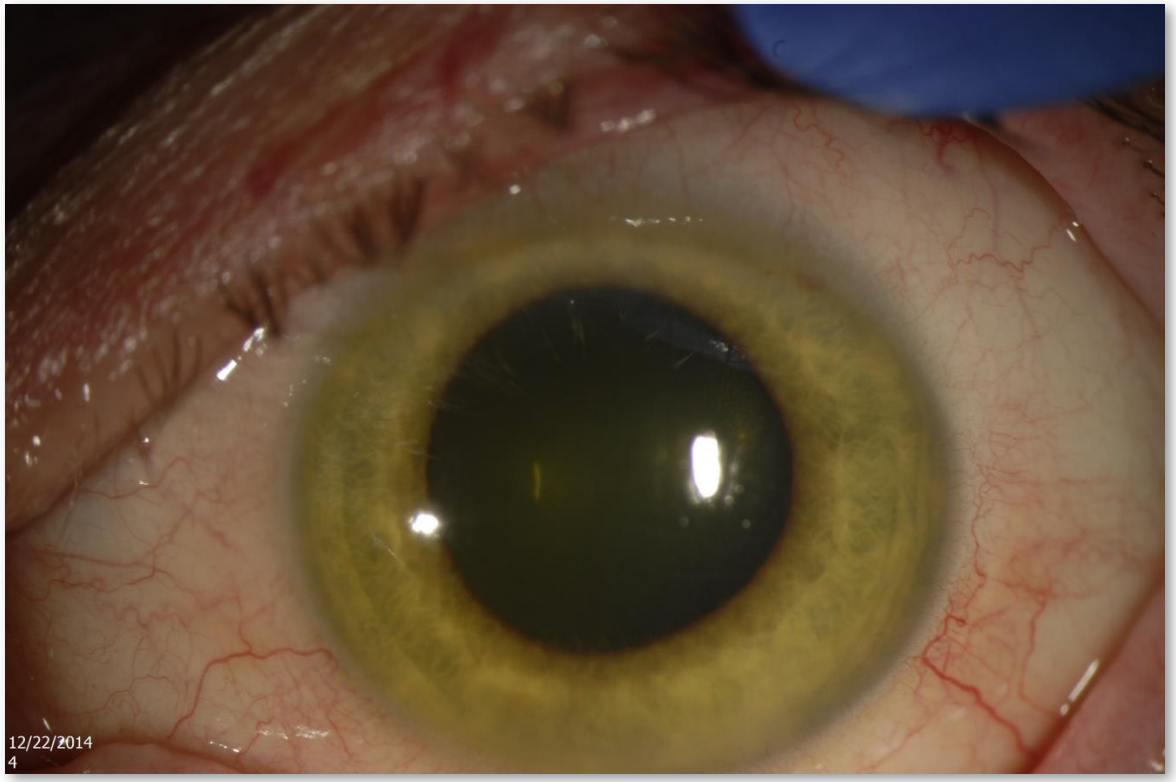
An Ebola Doctor's Return From the Edge of Death

By **DENISE GRADY** DEC. 7, 2014

December 7, 2014

Aggressive, Vision-Threatening Eye Inflammation





Anterior Uveitis Scleritis Hypopyon Intermediate uveitis Heterochromia Panuveitis

U.S. Health Care Worker during Ebola Convalescence

Persistence of Ebola Virus in Ocular Fluid

The NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

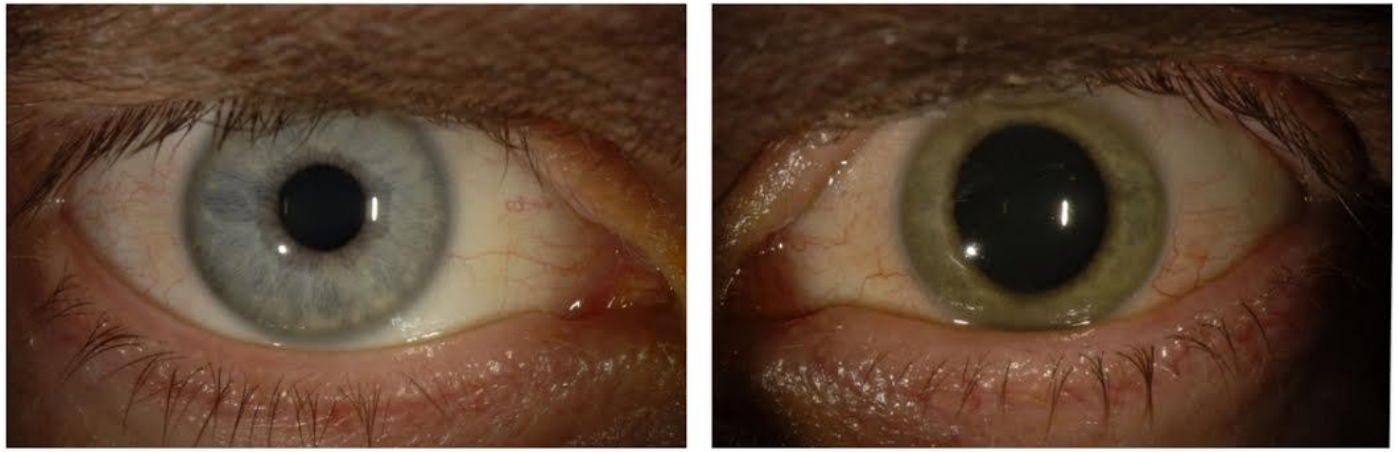
Persistence of Ebola Virus in Ocular Fluid during Convalescence

Jay B. Varkey, M.D., Jessica G. Shantha, M.D., Ian Crozier, M.D., Colleen S. Kraft, M.D., G. Marshall Lyon, M.D., Aneesh K. Mehta, M.D., Gokul Kumar, M.D., Justine R. Smith, M.B., B.S., Ph.D., Markus H. Kainulainen, Ph.D., Shannon Whitmer, Ph.D., Ute Ströher, Ph.D., Timothy M. Uyeki, M.D., M.P.H., M.P.P., Bruce S. Ribner, M.D., M.P.H., and Steven Yeh, M.D.

The New York Times

After Nearly Claiming His Life, Ebola Lurked in a Doctor's Eye

By DENISE GRADY MAY 7, 2015



Before he contracted Ebola, Dr. Ian Crozier had two blue eyes. After he was told he was cured of the disease, his left eye turned green. Emory Eye Center

West Africa Experience: Ebola and Eye Disease

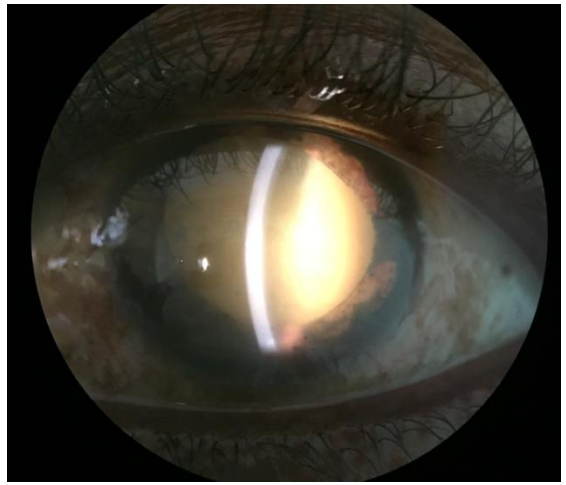
ORIGINAL ARTICLE

A Longitudinal Study of Ebola Sequelae in Liberia

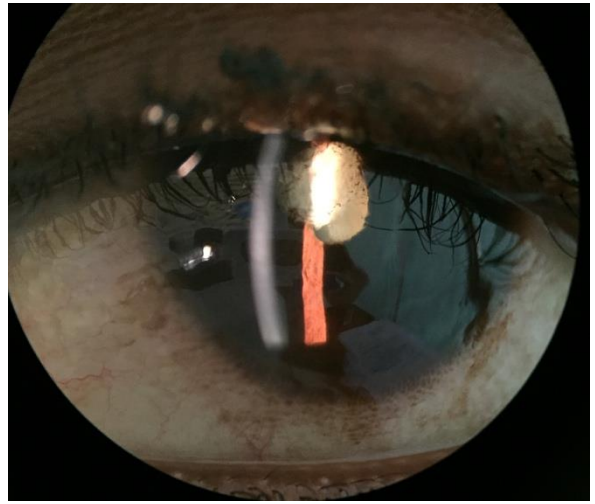
The PREVAIL III Study Group*

- 966 Ebola survivors, 2350 close-contacts
- 26.4% survivors with uveitis at enrollment vs. 12.1% controls
- 33.3% uveitis at 1 year vs. 15.4% controls

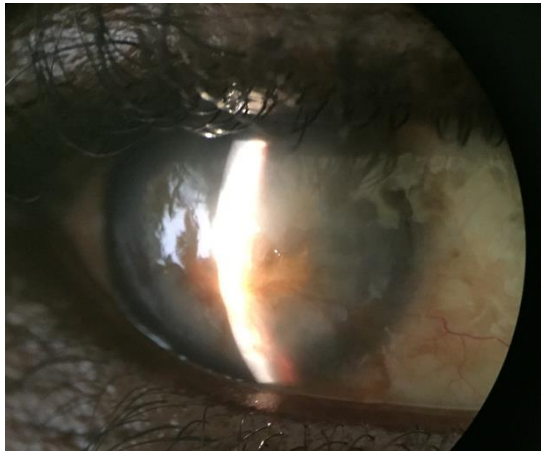
PREVAIL III Study Group, *NEJM 2019*



Neovascular Glaucoma



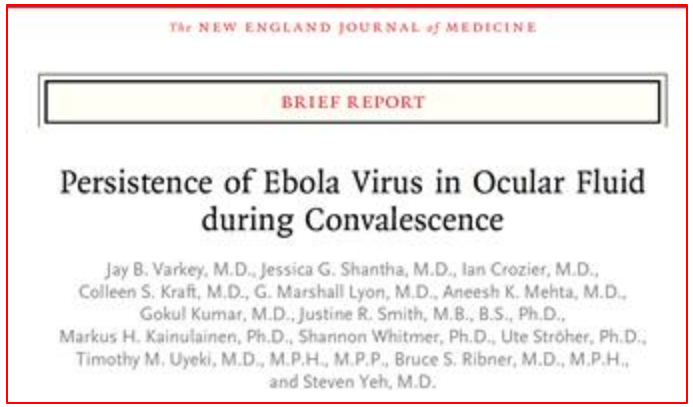
Uveitic Cataract, Hypotony



Phthisis Bulbi, Corneal Scar (Leukoma)

Shantha et al, *Ophthalmol 2017*

Ebola Virus Persistence in Immune Privileged Organs



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Aqueous humor

Uveitis / Vision Health

Ebola RNA Persistence in Semen of Ebola Virus Disease Survivors — Preliminary Report

G.F. Deen, B. Knust, N. Broutet, F.R. Sesay, P. Formenty, C. Ross, A.E. Thorson, T.A. Massaquoi, J.E. Marrinan, E. Ervin, A. Jambai, S.L.R. McDonald, K. Bernstein, A.H. Wurie, M.S. Dumbuya, N. Abad, B. Idriss, T. Wi, S.D. Bennett, T. Davies, F.K. Ebrahim, E. Meites, D. Naidoo, S. Smith, A. Banerjee, B.R. Erickson, A. Brault, K.N. Durski, J. Winter, T. Sealy, S.T. Nichol, M. Lamunu, U. Ströher, O. Morgan, and F. Sahr

Seminal fluid

Sexual transmission

Late Ebola virus relapse causing meningoencephalitis: a case report

Michael Jacobs, Alison Rodger, David J Bell, Sanjay Bhagani, Ian Cropley, Ana Filipe, Robert J Gifford, Susan Hopkins, Joseph Hughes, Farrah Jabeen, Ingolfur Johannessen, Drosos Karageorgopoulos, Angie Lackenby, Rebecca Lester, Rebecca S N Liu, Alisdair MacConnachie, Tabitha Mahungu, Daniel Martin, Neal Marshall, Stephen Mepham, Richard Orton, Massimo Palmarini, Monika Patel, Colin Perry, S Erica Peters, Duncan Porter, David Ritchie, Neil D Ritchie, R Andrew Seaton, Vattipally B Sreenu, Kate Templeton, Simon Warren, Gavin S Wilkie, Maria Zambon, Robin Gopal, Emma C Thomson

Central nervous system

Meningitis / Seizures / CNS Sequelae

Ebola Hemorrhagic Fever and Pregnancy

Kibadi Mupapa, Woliere Mukundu, Mpia Ado Bwaka, Mungala Kipasa, Ann De Roo, Kivudi Kuvula, Kapay Kibadi, Matondo Massamba, Djuma Ndaberey, Robert Colebunders, and J. J. Muyembe-Tamfum

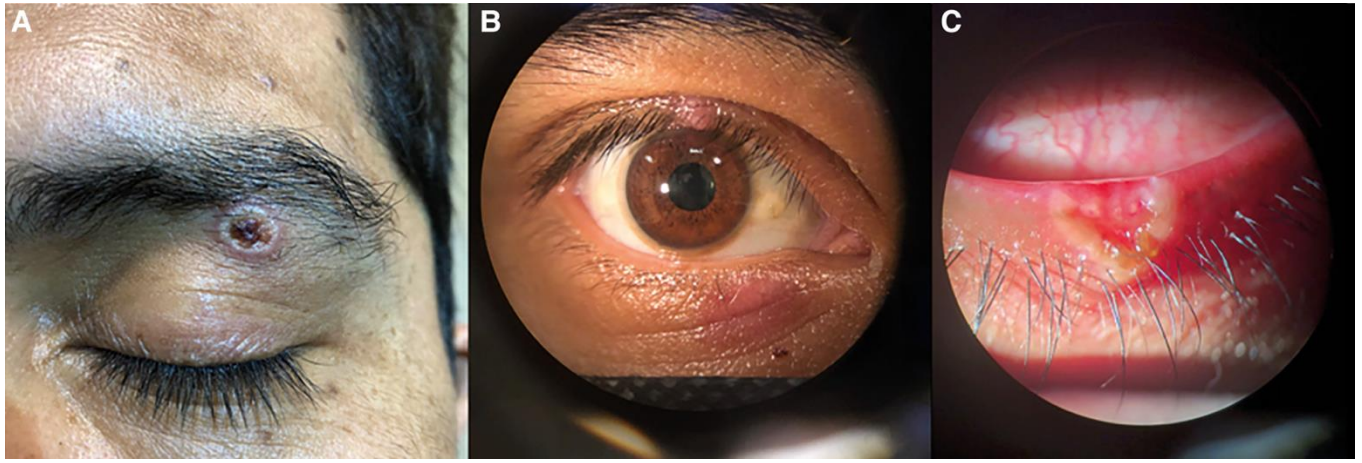
Placenta

Stillborn infants / Maternal death

Ophthalmic Implications of Mpox

Clinical Features

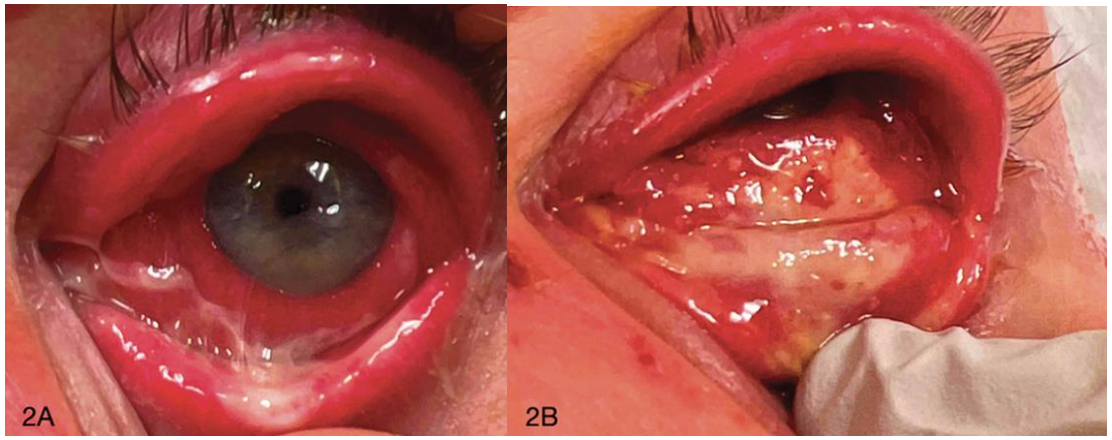
- Periocular, umbilicated lesions
- Conjunctivitis
- Keratitis (Epithelial and stromal)
- Uveitis, Hypopyon



Rodriguz et al *J Infect Dis* 2024

Molecular detection

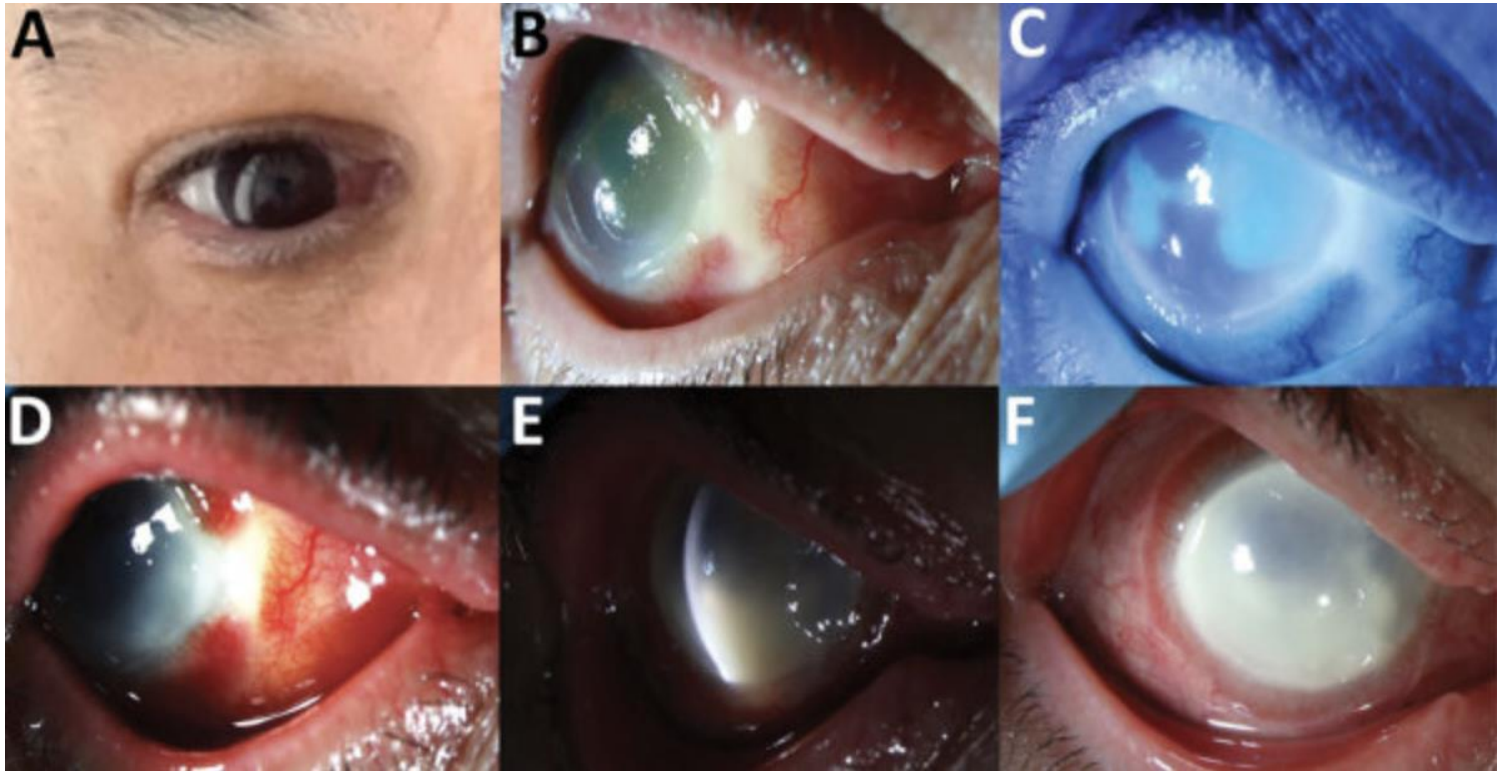
- PCR, sequencing
- Late recurrence of positive PCR reported



Uner et al *Cornea 2023*

Combining Clinical Management with Diagnostics and Molecular Detection

Isolated Ocular Mpox without Skin Lesions, United States



- HIV-negative patient with scleritis, keratitis, and uveitis
- Mpox virus confirmed in sclera and cornea by PCR
- Deep sequencing showed Mpox RNA in aqueous humor

Nguyen et al *Emerg Infect Dis 2023*

Ocular Manifestations of Mpox with Viral Persistence

- Replicating MPXV identified in at least one sample in all patients, ranging from 31 – 145 days after first skin lesion
- Twenty-one samples: Conjunctiva (16), Aqueous humor (2), corneal surface (2), eyelid margin lesion (1)
- HIV (CD5: 500 cells/mm^3 showed the latest positive results (145 days)
- CT values: Ranged from 24.2 - 35.8

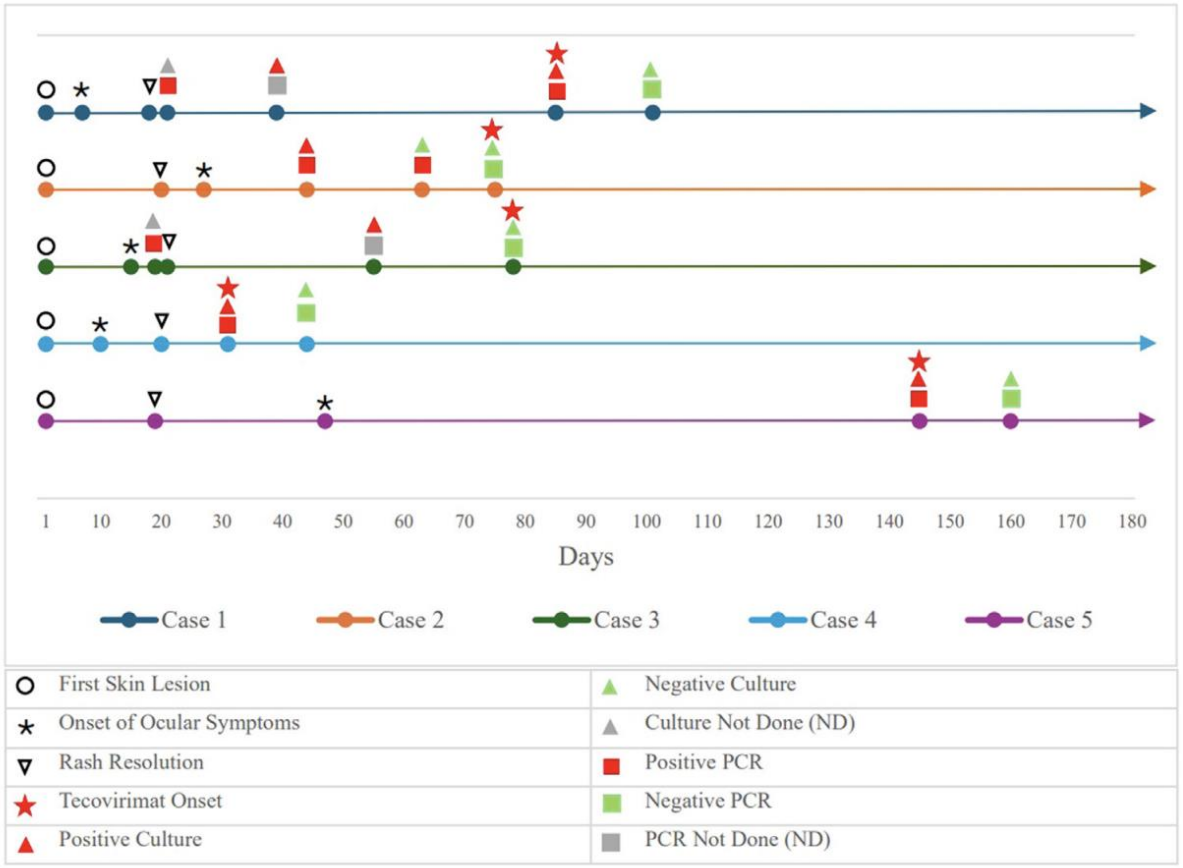


Figure 2. Main PCR and viral culture results, onset of ocular symptoms, rash resolution, and initiation of tecovirimat treatment.

Finamor et al *Int J Inf Dis* 2024

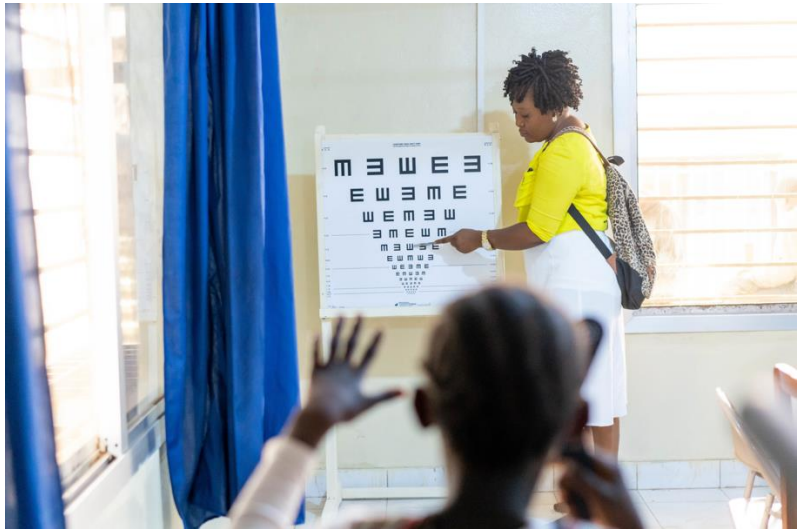
Addressing Ocular Mpox within the DRC

Principles Illustrated

- Source control
- Appropriate PPE
- Equipment handling precautions and disinfection
- Active monitoring with expert assistance for disinfection

Photos obtained with consent from patient / guardian

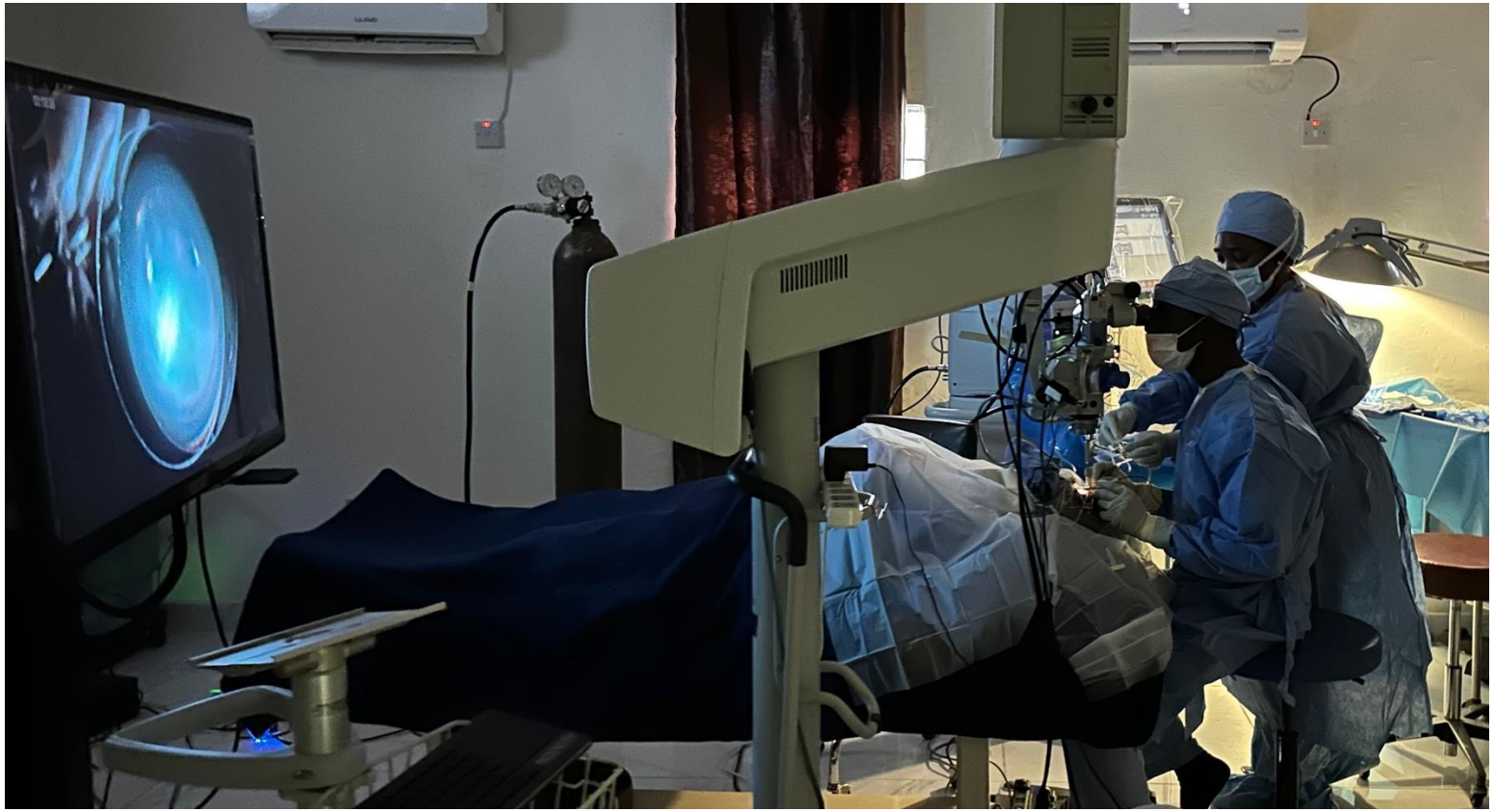
Long-Term Study of Ocular Complications in Ebola Survivors
Freetown, Sierra Leone (2020-2025)

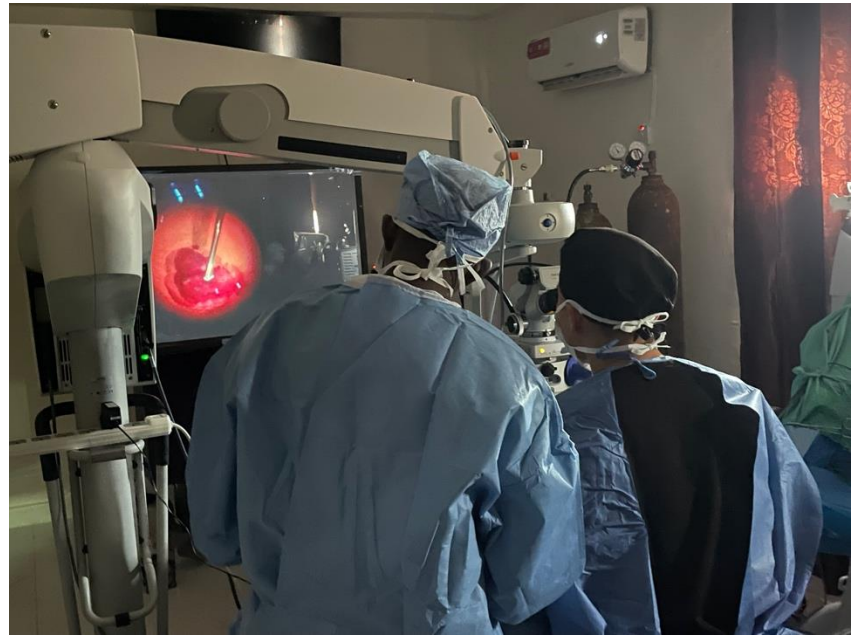


Freetown, Sierra Leone

Photo Credit: Andrew Gess Photography

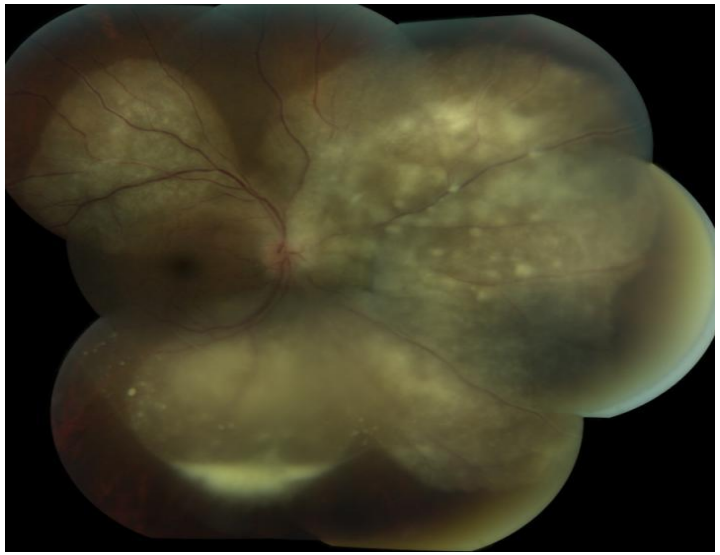
Development of Ophthalmic Surgical Capacity: Collaboration, Infrastructure, and Investment



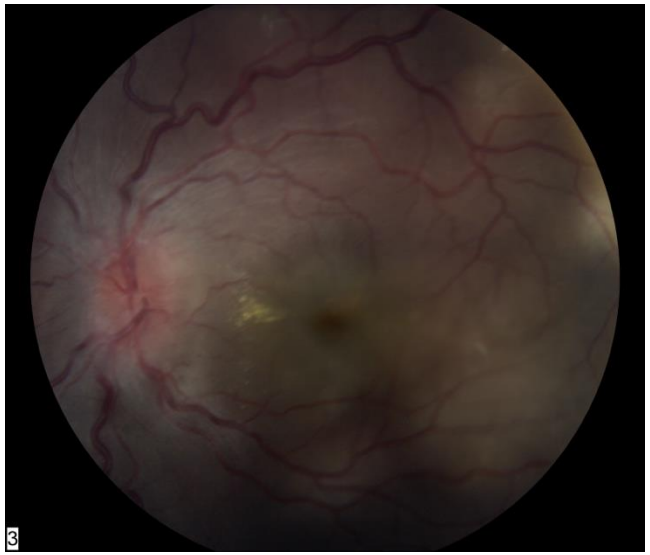


"The impediment to action advances action. What stands in the way becomes the way" -Marcus Aurelius, *Meditations*

Infectious Eye Disease

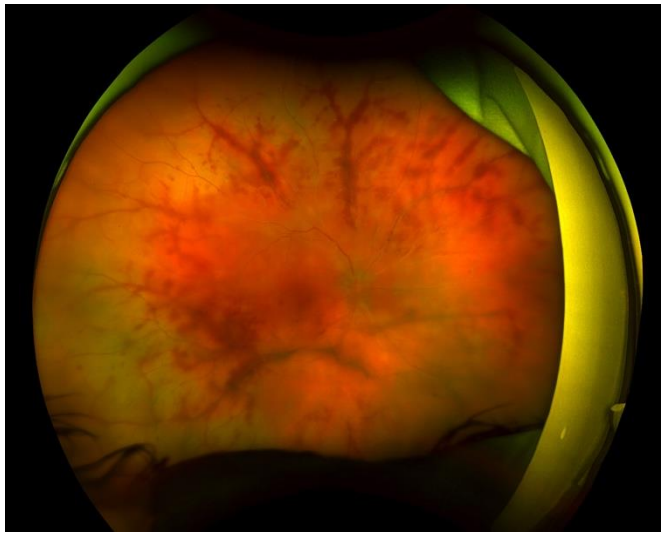


Syphilis



Tuberculosis

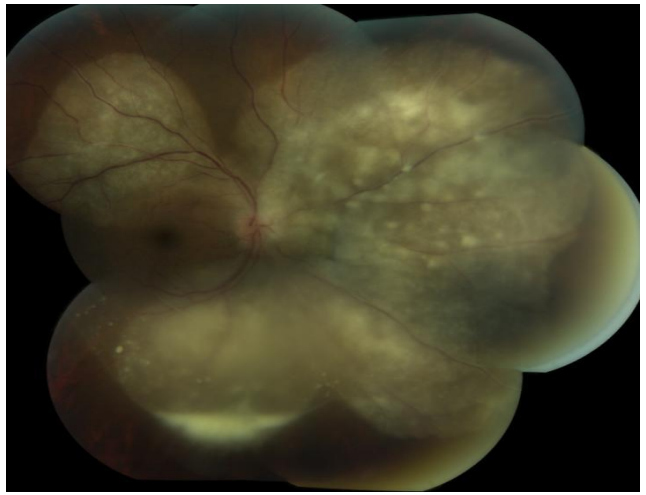
Toxoplasmosis



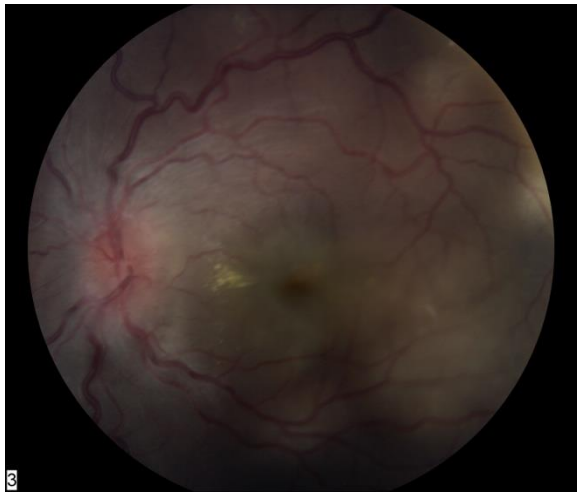
Acute retinal necrosis (HSV, VZV, CMV)

Infectious Eye Disease

Ebola

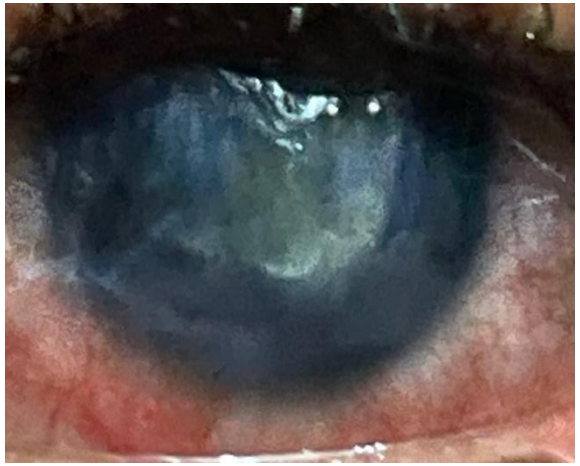


Syphilis



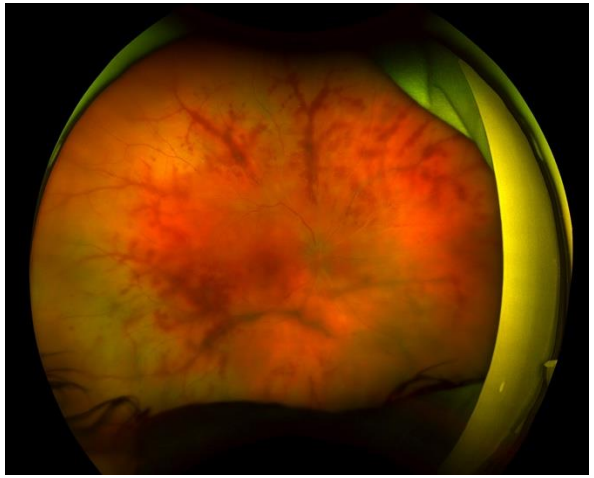
Tuberculosis

Chikungunya



Mpox

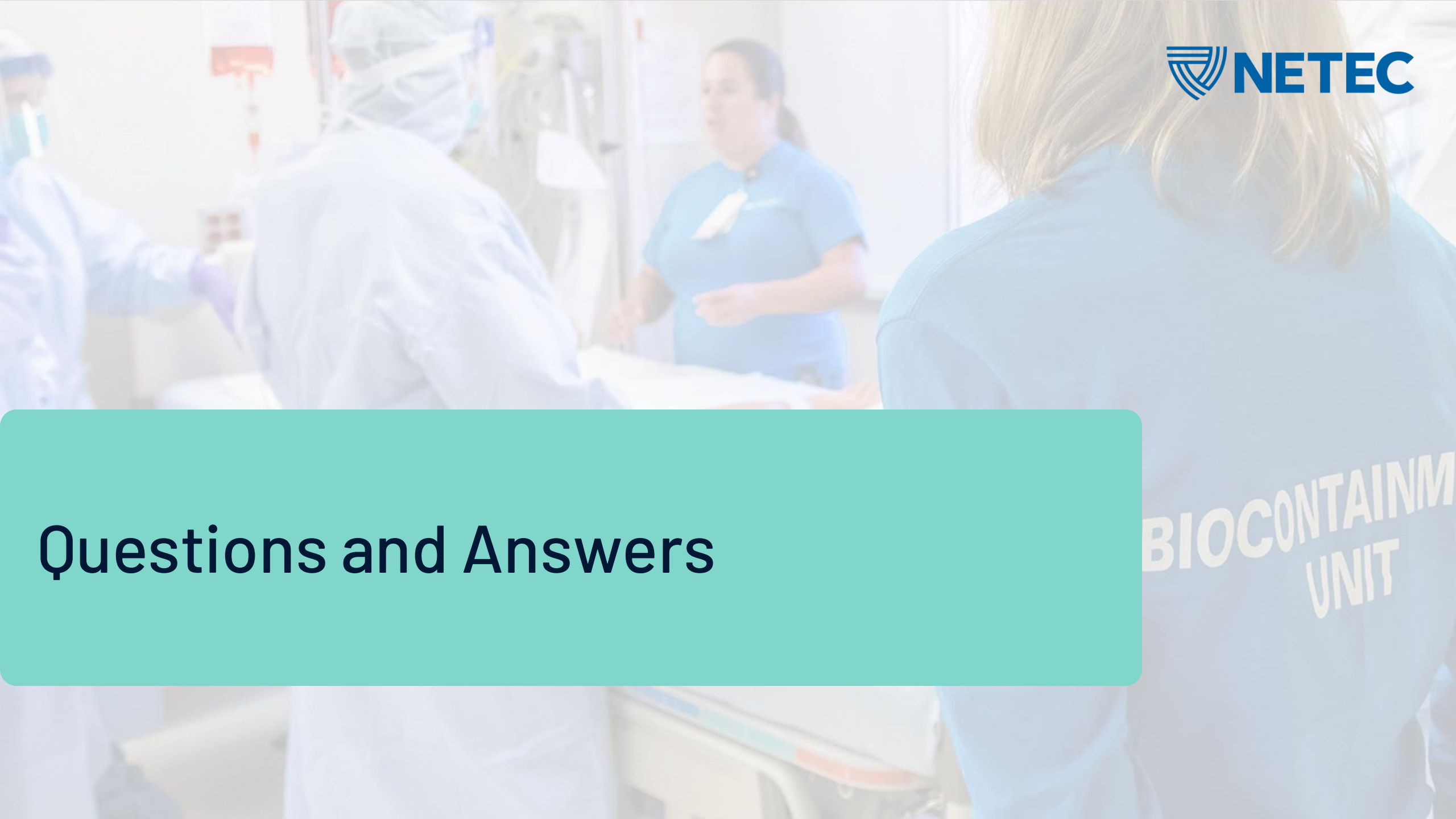
Toxoplasmosis



Acute retinal necrosis

Rift Valley Fever


Asante Sana!!



Questions and Answers

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