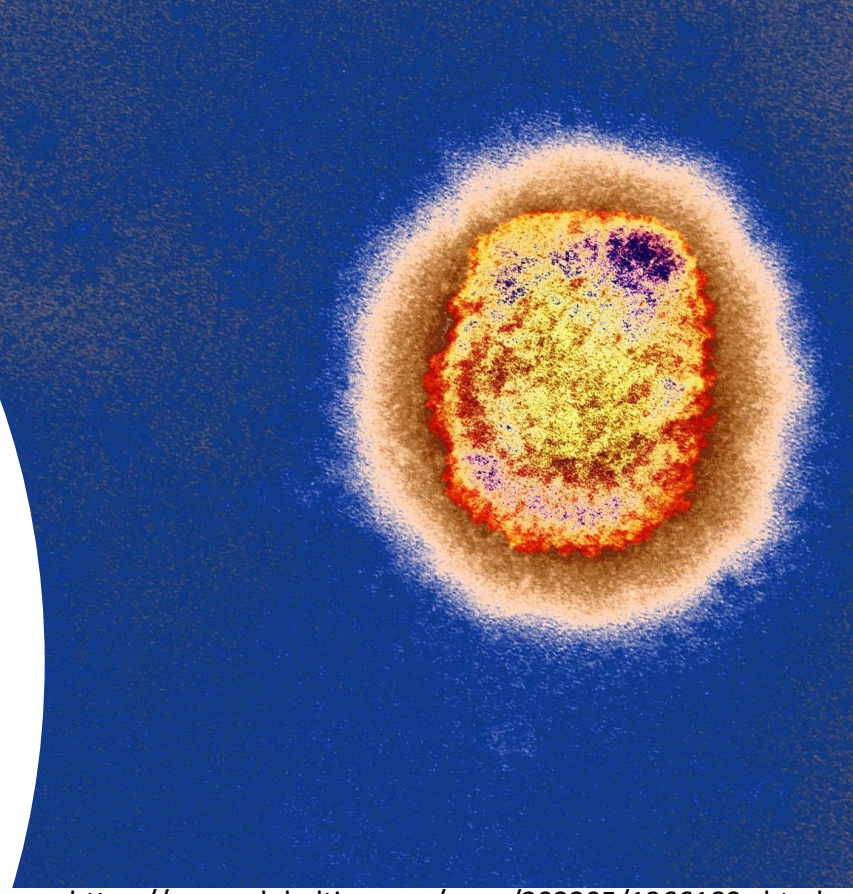
Diagnostic Tests for Monkeypox



https://www.globaltimes.cn/page/202205/1266183.shtml

Yuka Manabe, MD, FIDSA, FRCP
Division of ID, Department of Medicine
Johns Hopkins University School of Medicine

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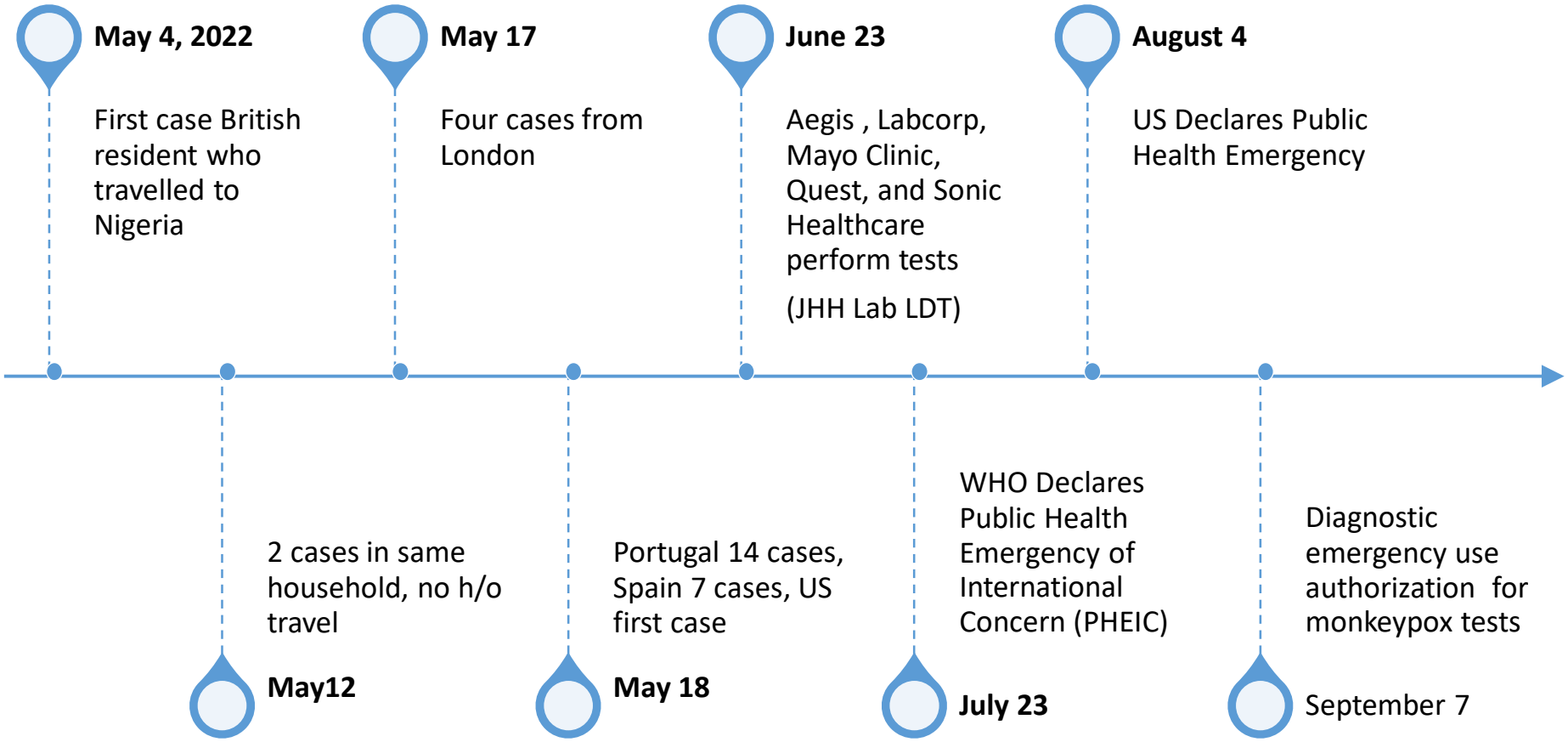
Monkeypox Testing in the US

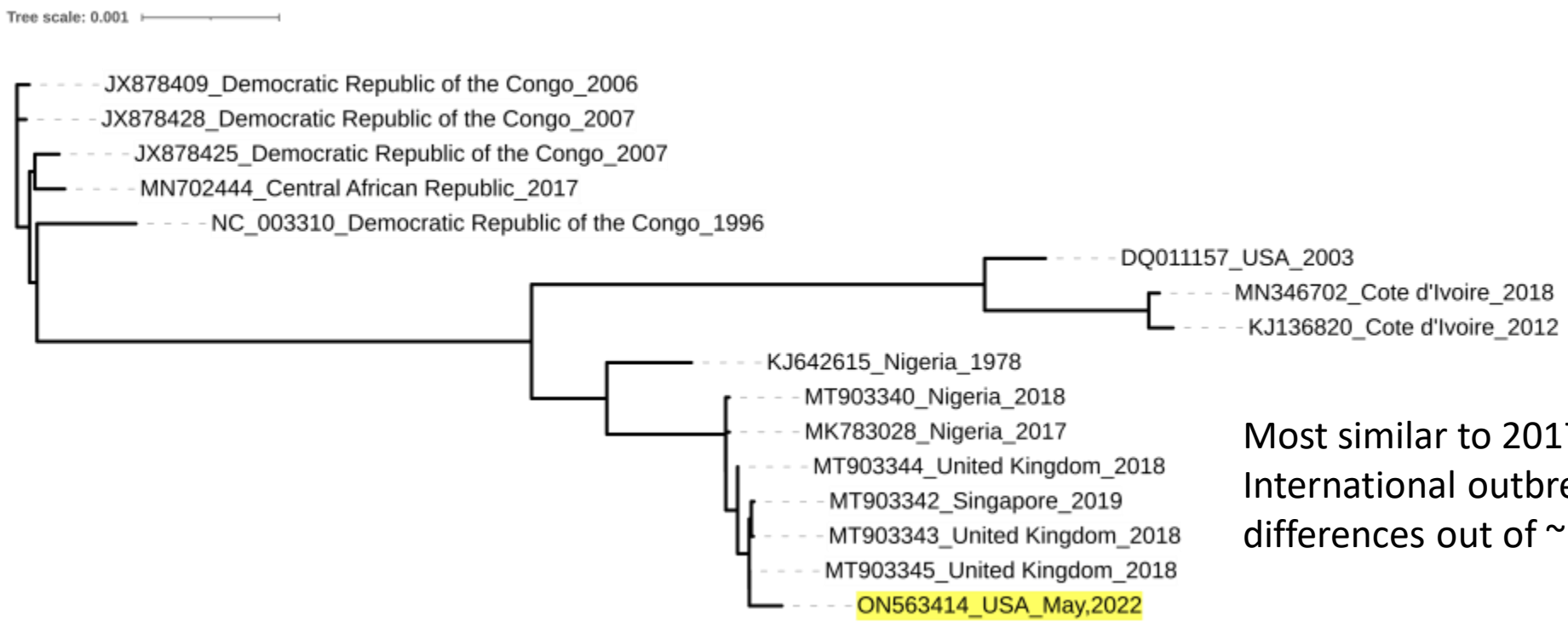


Poxviridae family, DNA virus

- Species
  - Variola virus- (wild) smallpox, eradicated in 1977 with vaccinia virus
  - Abatino macacapox, Akhmeta, Camelpox, Cowpox, Ectromelia, Monkeypox, Raccoonpox, Skunkpox, Taterapox, Vaccina, Volepox
- Monkeypox virus – increasing virulence to humans with evolution[1,2]
  - 196,858 bp genome
  - 6379 bp inverted terminal repetition (tandem repeats, terminal hairpins) with 4 ORFs
  - 190 open reading frames
  - ORFs are essential (C10L to A25R; 56,000-120,000) – 90% sequence identity with other OPV
  - Majority of species and strain-specific different are in the left and right terminal regions
- 1-2 substitutions per genome per year[3]

1. Shchelkunov SN et al. Virology 2002; 297: p172-194
2. Babkin IV et al. Viruses 2022 14:p388
3. Firth C Mol. Biol Evol 2010; 27:2038-2051

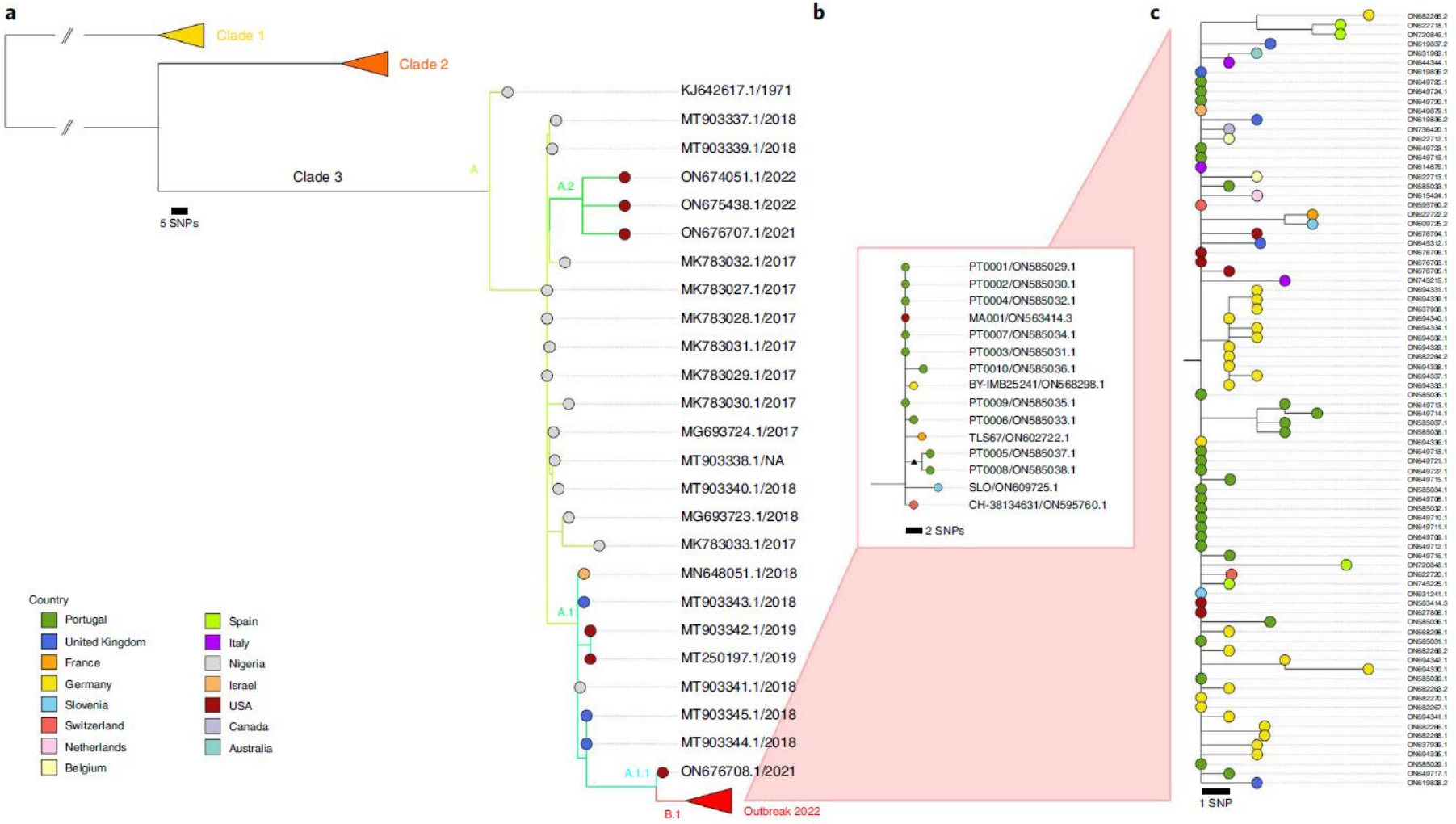
Phylogenetic Tree of Monkeypox Virus Genomes



Most similar to 2017-8 International outbreak: <100 base differences out of ~197,000

https://ncbiinsights.ncbi.nlm.nih.gov/2022/05/26/monkeypox-virus-genome/

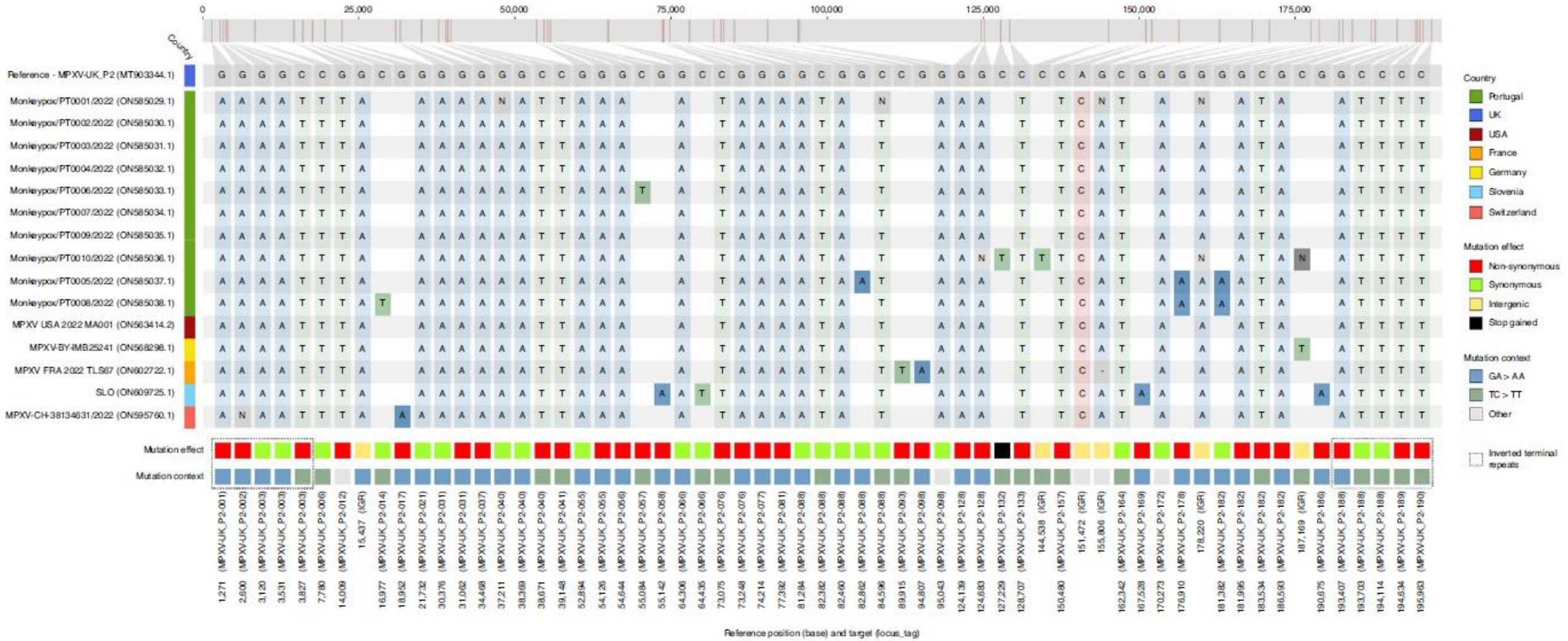
Phylogenetic Analysis of 2022 Outbreak



- Clade III (lineage B.1)
- 40-50 SNP difference from 2018-2019 viruses
- Evidence of accelerated evolution

Isidro J et al. Nature 2022; 28:p1569-1572

SNPs Characterizing the 2022 MPXV Outbreak



Isidro J et al. Nature 2022; 28:p1569-1572

CDC Centers for Disease Control and Prevention
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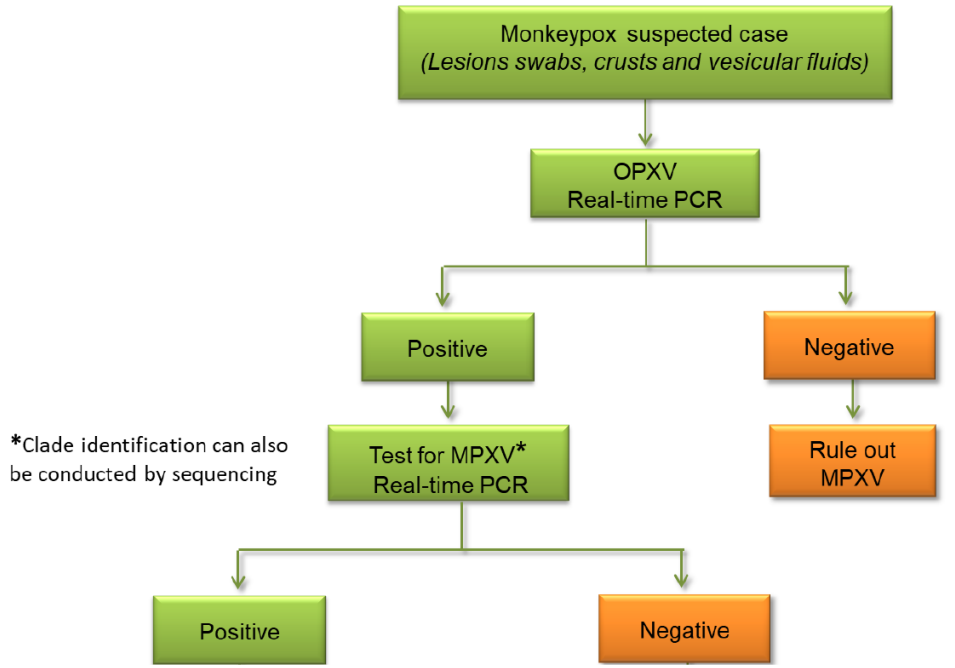
Morbidity and Mortality Weekly Report (*MMWR*)

CDC

Rapid Diagnostic Testing for Response to the Monkeypox Outbreak — Laboratory Response Network, United States, May 17–June 30, 2022

Early Release / July 8, 2022 / 71

- May 17-June 30, 2022 – Laboratory response network tested 2,009 specimens
- June 10→68 US LRN labs in 47 states and DC implemented the NVO (non-variola orthopox) assay
- 730 specimens from 395 patients were positive
- 159 cases confirmed to be monkeypox, 236 confirmatory tests pending



Lab Guidelines for the Detection and Diagnosis of Monkeypox, May 2022 PAHO/WHO

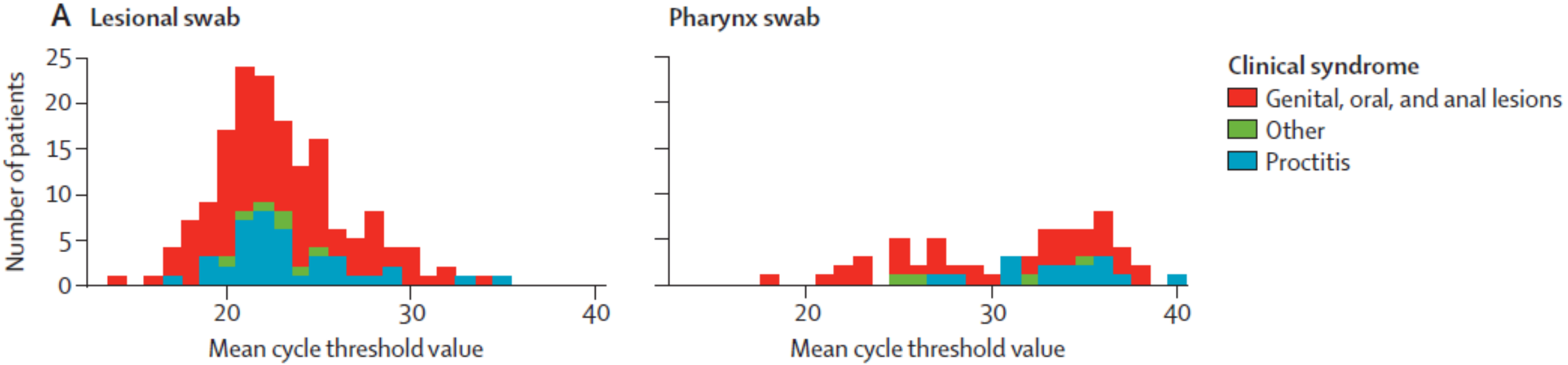
What to sample?

Disease Stage	Specimens to Collect
Prodrome	Tonsillar tissue swab Nasopharyngeal swab Acute serum and whole blood
Rash*	
Macules or Papules	Tonsillar tissue swab Lesion biopsy Acute serum and whole blood
Vesicles or Pustules	Lesion fluid, roof, or biopsy Electron microscopy grid (if supplies available) Acute serum and whole blood
Scabs or Crusts	Lesion scab or crust Acute serum and whole blood
Post-Rash	Convalescent serum

* More than one lesion should be sampled, preferably from different locations on the body and/or from different looking lesions.

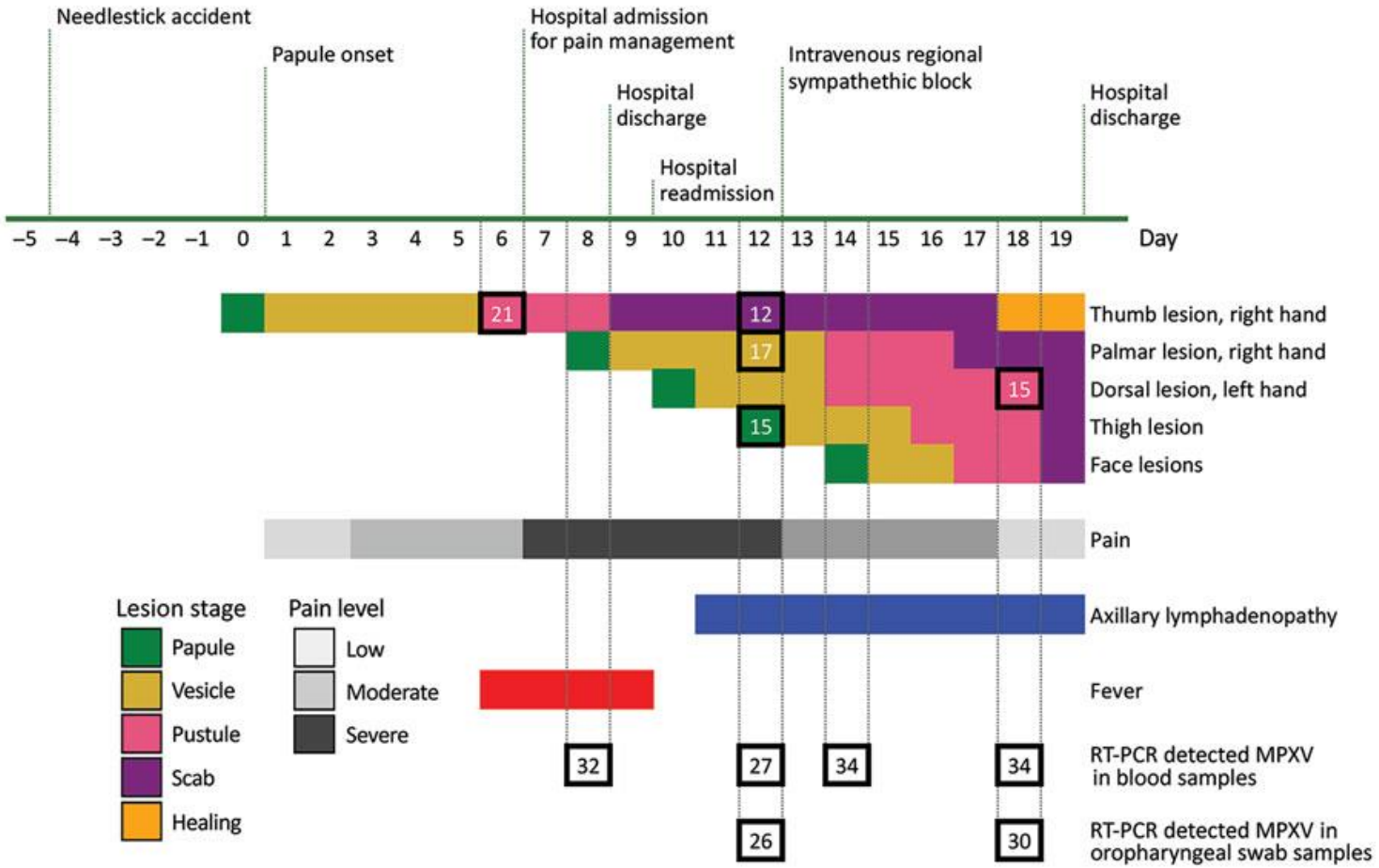
What to sample?

- 181 patients with confirmed MPX, all with skin lesions
- VL higher in lesions than in pharyngeal specimens;
- **Lesions are the highest yield**
- May 11-June 29, 2022



Tarin-Vicente EJ et al. Lancet 2022; 400:661-69

What about other sample types?



- July 9, 2022 – nurse sustained needlestick injury to her thumb from supplies used to sample skin lesion
- 5 days, nodule at the site→ painful vesicle
- Source patient (MSM) had 2 weeks of sore throat cervical lymphadenopathy, few torso lesions

Carvalho LB et al. Emerg Inf Dis 2022:28:

Sample Stability

- DNA virus and very stable in UTM (up to 7 days with no change in cycle threshold) – (internal evaluation)

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Morbidity and Mortality Weekly Report (*MMWR*)

CDC

High–Contact Object and Surface Contamination in a Household of Persons with *Monkeypox Virus* Infection — Utah, June 2022

Weekly / August 26, 2022 / 71(34);1092-1094

On August 19, 2022, this report was posted online as an MMWR *Early Release.*

Jack A. Pfeiffer[1,2]; Abigail Collingwood[2]; Linda E. Rider[2]; Faisal S. Minhaj[1,3]; Audrey M. Matheny[3]; Chantal Kling[3]; Andrea M. McCollum[3]; Leisha D. Nolen[2]; Clint N. Morgan[3]
(View author affiliations)

- 2 patients in one home, 20 days after isolation (12 days after 2nd person became infected), 30 sites swabbed; 21 PCR positive, all culture negative

POC Tests Available

- BioFire Defense Filmarray Sentinel panel, Biothreat panel
- GeneXpert in development BioGX MPX/OPX assay
- Tetracore, Inc Orthopox Biothreat alert – antigen immunoassay – RDT
- NG Biotech (France) NG-Test Monkeypox virus – “ – RDT

FDA EUA (September 27, 2022)

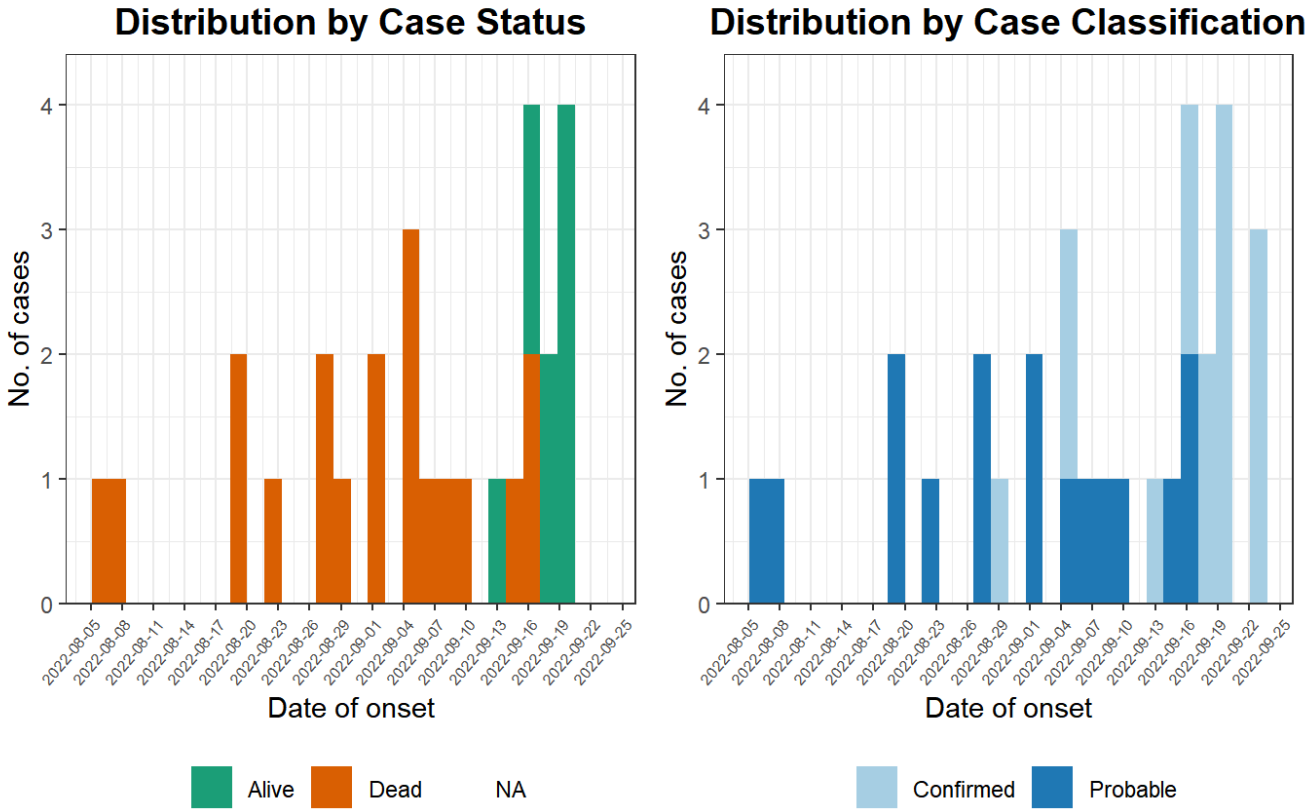
- 9/15/22 – Quest Diagnostics RT-PCR – lesion swab in UTM
  - E9L (Monkeypox, Vaccinia, ectromelia viruses)
  - Monkeypox virus clade II TNF receptor gene
  - Internal processing control – exogenous DNA
  - Human Rnase P gene – specimen adequacy
    - Important to show that specimen quality is high

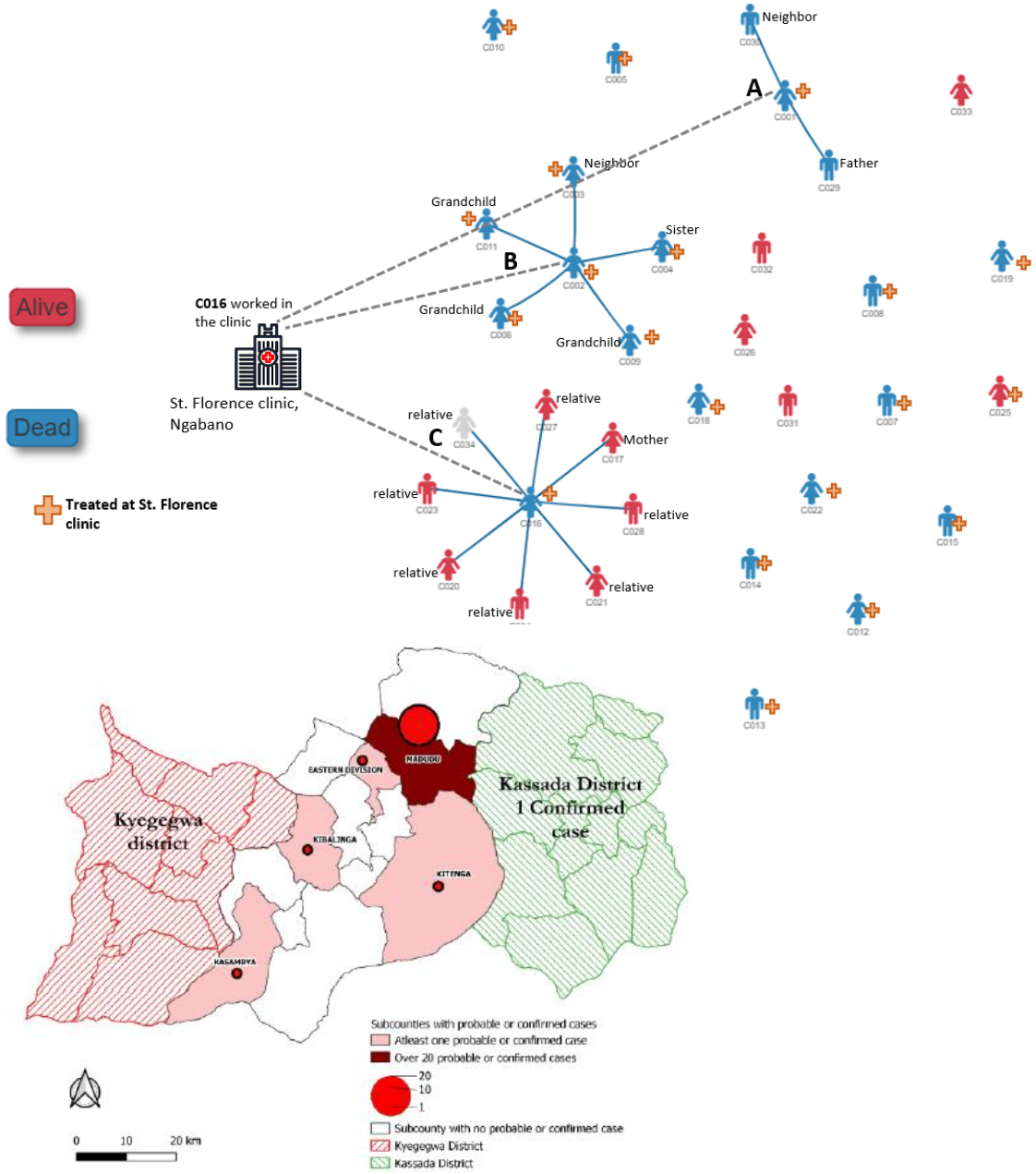
Missed Opportunity?

- Leveraging COVID-19 capacity for molecular testing
  - Still need reagents – extraction, PCR
  - Biosafety training
  - Need careful isolation of pre-amplification from post-amplification
  - No rapid tests, yet
- Some resource
  - Monkeypox Test Directory – FIND working to validate these 111 tests
- Wasted time and did not take advantage of Nigerian situation
- True diagnostic capacity will require a leveling of the playing field

Lancet Microbe Sept 2022: https://doi.org/10.1016/S2666-5247(22)00233-6

Cautionary Tale: Ebola
Madudu, Uganda, Sept 2022





34 cases (16 confirmed, 18 probable)
21 deaths (4 confirmed, 17 probable)

Ugandan Ministry of Health SitRep#5, September 24, 2022

Summary

- Relatively rapid move from public health lab testing to private lab for monkeypox compared to COVID-19 (..and RADx ITAP)
- Monkeypox Clade III (lineage B.1) -Orthopox genome relatively conserved in the middle (monkeypox specific sequences) at the ends of the genome
- Lesions have the highest diagnostic yield
- DNA virus is very stable, (but easy to kill)
- Need to develop a rapid preparedness system for diagnostics for zoonotic infections of pandemic potential and leverage the capacity built during COVID-19 globally

Declare the past, diagnose the present, foretell the future

-Hippocrates

Monkeypox: 2022 Update

Matthew Hamill, MBChB, PhD
Yuka Manabe, MD, FRCP

Johns Hopkins School of Medicine
September 27, 2022

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MEDICINE

Disclosures/Acknowledgements

Matthew Hamill:

- Honorarium: Roche diagnostics. Royalties: UpToDate, British Medical Journal best practice, Clinical Care Options. Consulting fees: GSK

Acknowledgements:

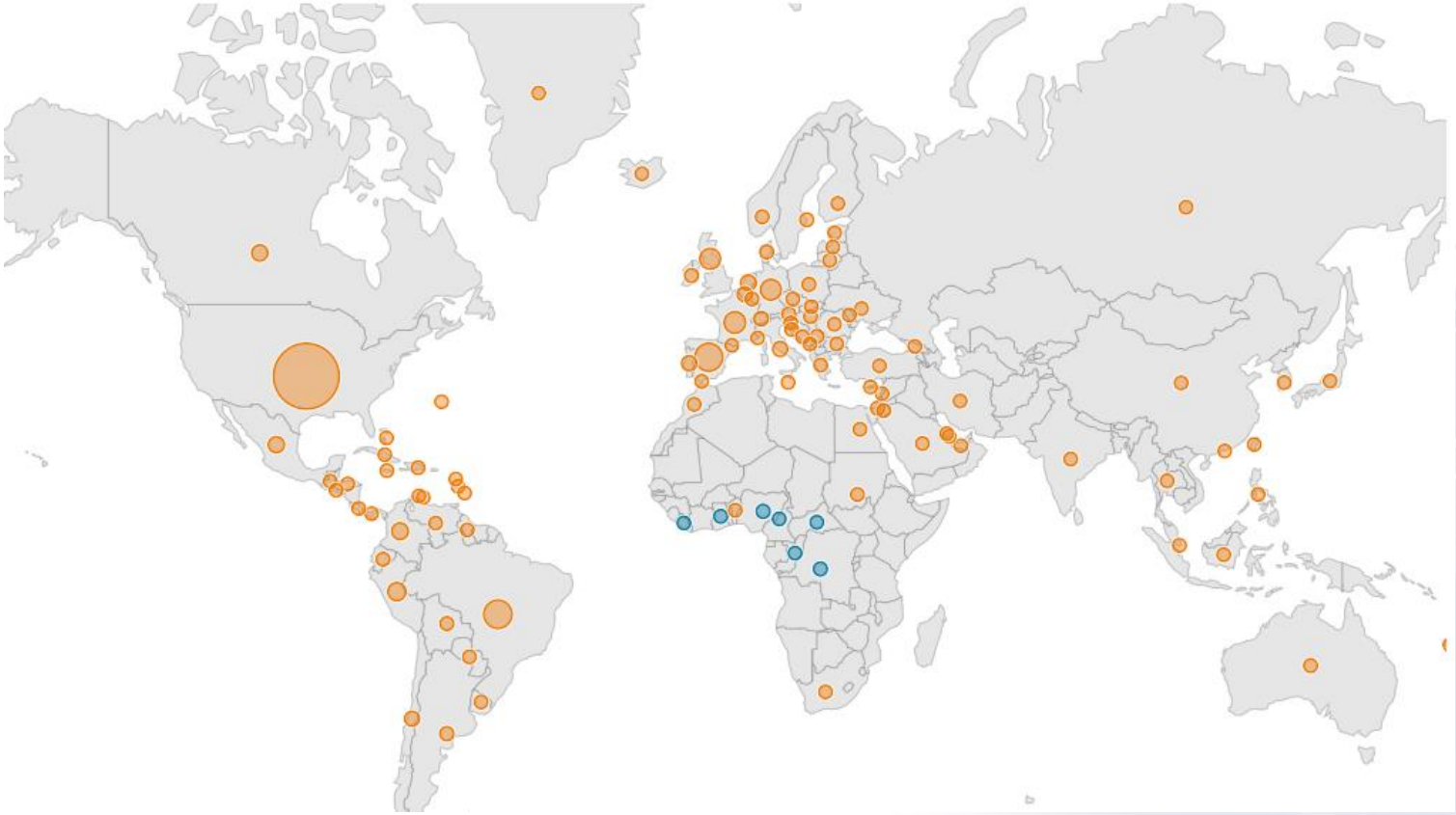
- Drs. Liz Gilliams, Heba Mostafa, Joyce Jones, David Blythe, Jason Farley, Jason Zucker, Kelly Gebo

Monkey pox

- With the eradication of smallpox in **1980 and subsequent cessation of smallpox vaccination**, monkeypox has emerged as the most important orthopoxvirus for public health
- Monkeypox primarily occurs in **central and west Africa**, often in proximity to tropical rainforests, increasingly appearing in urban areas
- Animal hosts include: squirrels, Gambian pouched rats, dormice, non-human primates and other species
- **Fatality**
  - 3.6% CLADE II [west African clade]
  - 10% CLADE I [central African (Congo Basin) clade]
- Clade IIB global clade in 2022

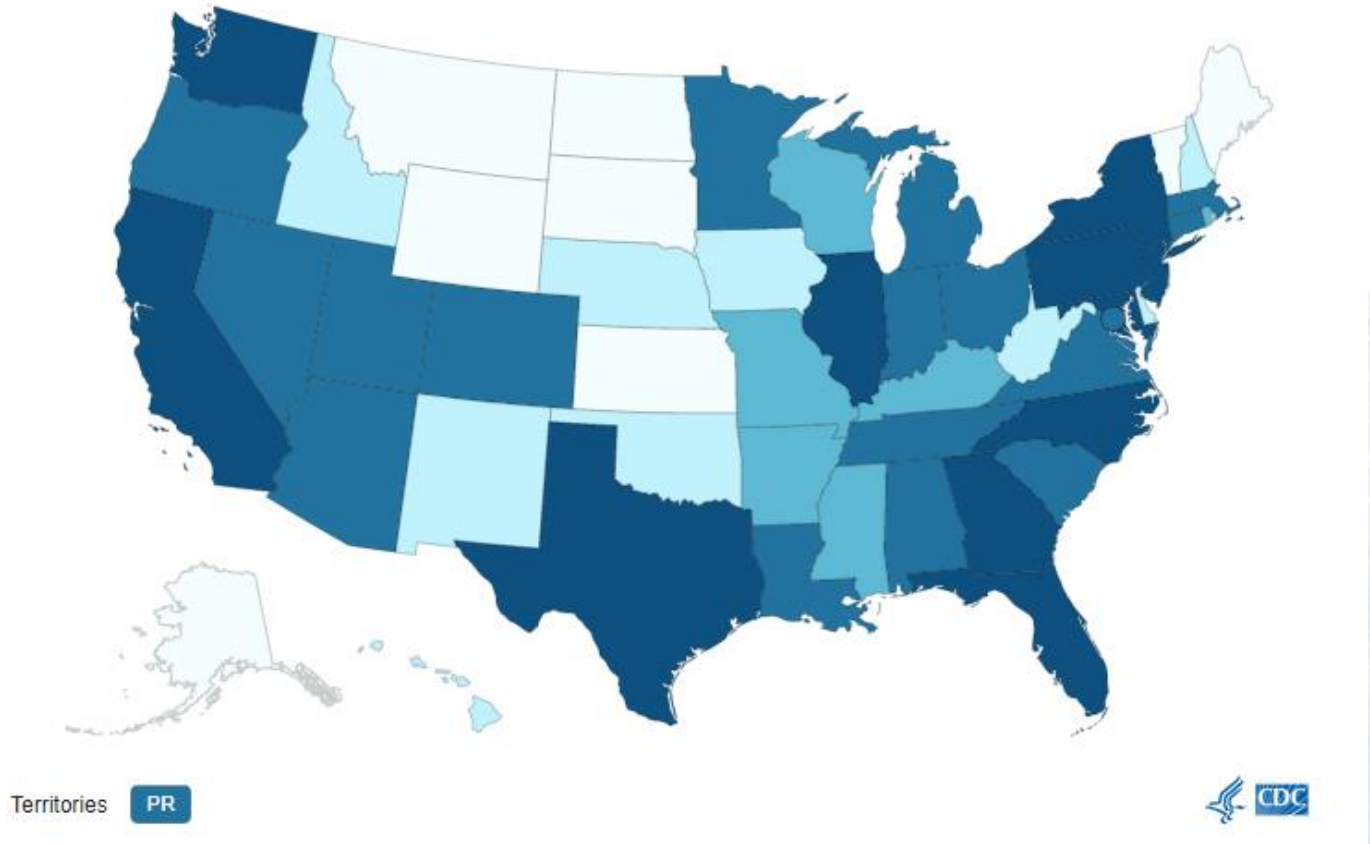
https://www.who.int/news-room/fact-sheets/detail/monkeypox

Where do we stand, globally?



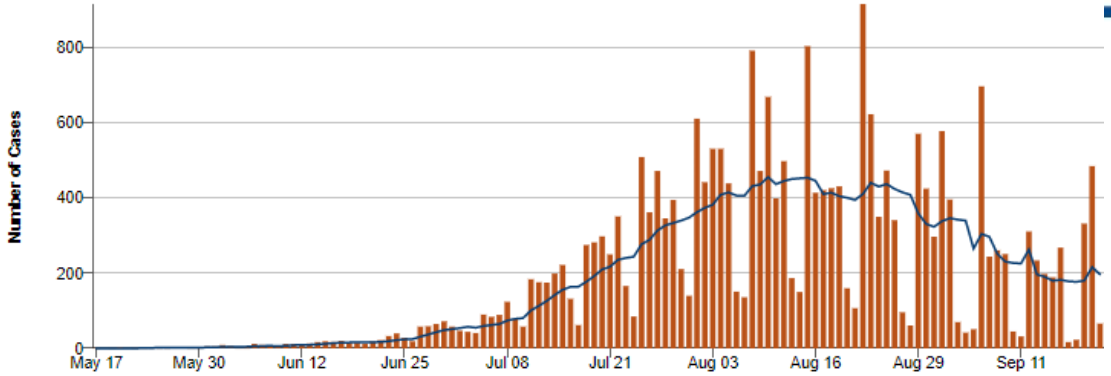
As of 9/26/22: **65,933** cases globally. 13 deaths

United States



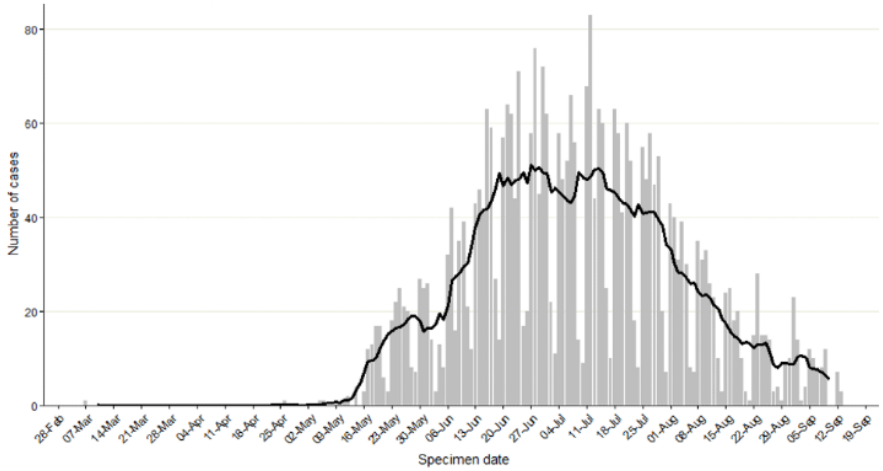
As of 9/26/22: **25,962** cases. 1 death

Trajectory of New Infections



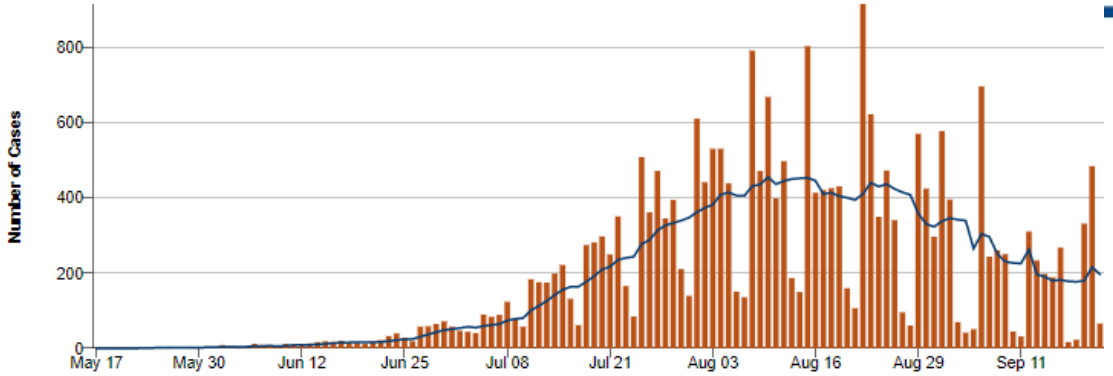
https://www.cdc.gov/poxvirus/monkeypox/response/2022/mpx-trends.html

Figure 1. Confirmed and highly probable monkeypox cases by specimen date* in England as of 16 September 2022



https://www.gov.uk/government/publications/monkeypox-outbreak-technical-briefings/investigation-into-monkeypox-outbreak-in-england-technical-briefing-8

Trajectory of New Infections



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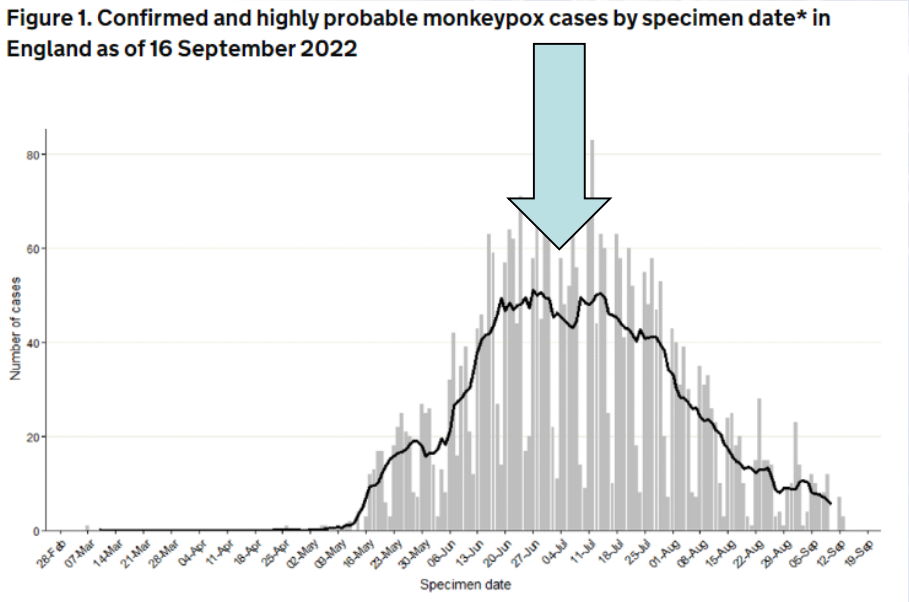

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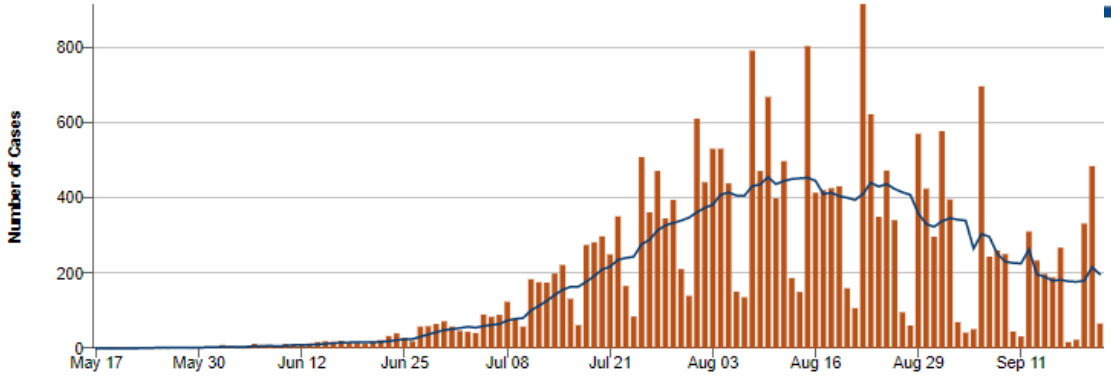
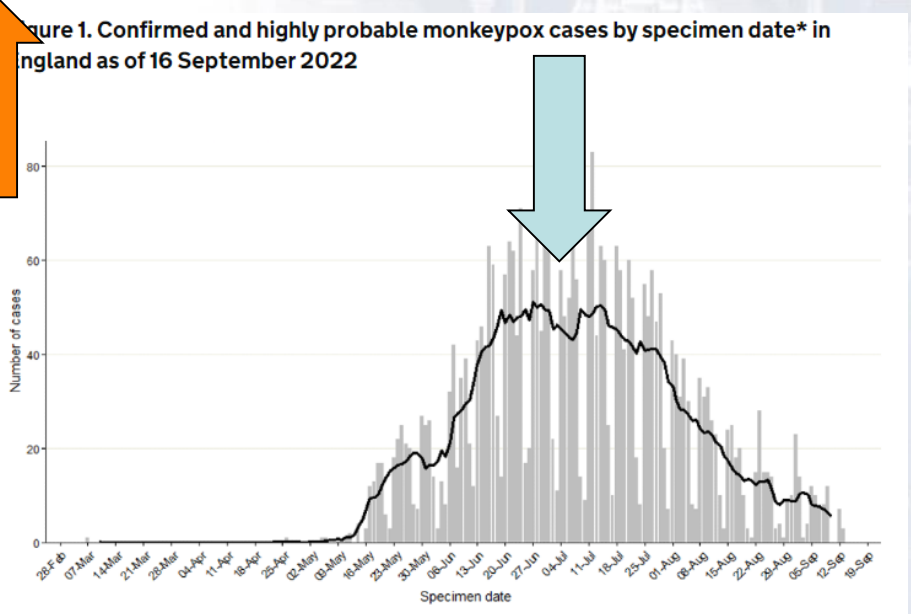
Trajectory of New Infections



https://www.cdc.gov/poxvirus/monkeypox/response/2022/mpx-trends.html



https://www.gov.uk/government/publications/monkeypox-outbreak-technical-briefings/investigation-into-monkeypox-outbreak-in-england-technical-briefing-8

Clinical Presentation (outside of Africa)

DIAGNÓSTICO DIFERENCIAL DE LAS LESIONES CUTÁNEAS DE VIRUELA DEL MONO Federacion de Asociaciones Científico Medicas Españolas
https://seimc.org/contenidos/documentoscientificos/seimc-dc-2022-Viruela-mono-Diagnostico_diferencial-lesiones-cutaneas.pdf

- Skin lesions:
  - Fluid filled (vesicular, pustular)
  - Deep seated
  - Umbilicated
  - Painful
  - Itching during crust phase
- Lesions resolve 2-4 weeks after initial appearance of symptoms

Photo Credit: NHS England High Consequence Infectious Diseases Network

Clinical Presentation (outside of Africa)

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  - Painful
  - Itching during crust phase
- Lesions resolve 2-4 weeks after initial appearance of symptoms

Photo Credit: NHS England High Consequence Infectious Diseases Network

Clinical Presentation

Figure 4: **Multiple ulcerative lesions on perianal skin (A) progressing into a large coalescing ulcerative lesion (B)**
Pictures taken 10 days apart.

Figure 2: **Multiple coalescing lesions on penile sulcus and multiple non-coalescing lesions on penile shaft**

› Lancet Infect Dis. 2022 Jul 1;S1473-3099(22)00411-X. doi: 10.1016/S1473-3099(22)00411-X. Online ahead of print.

Demographic and clinical characteristics of confirmed human monkeypox virus cases in individuals attending a sexual health centre in London, UK: an observational analysis

Nicolò Girometti [1], Ruth Byrne [2], Margherita Bracchi [2], Joseph Heskin [2], Alan McOwan [2], Victoria Tittle [2], Keerti Gedela [2], Christopher Scott [2], Sheel Patel [2], Jesal Gohil [2], Diarmuid Nugent [2], Tara Suchak [2], Molly Dickinson [2], Margaret Feeney [2], Borja Mora-Peris [3], Katrina Stegmann [4], Komal Plaha [4], Gary Davies [2], Luke S P Moore [5], Nabeela Mughal [5], David Asboe [2], Marta Boffito [6], Rachael Jones [2], Gary Whitlock [2]

Differential Diagnosis







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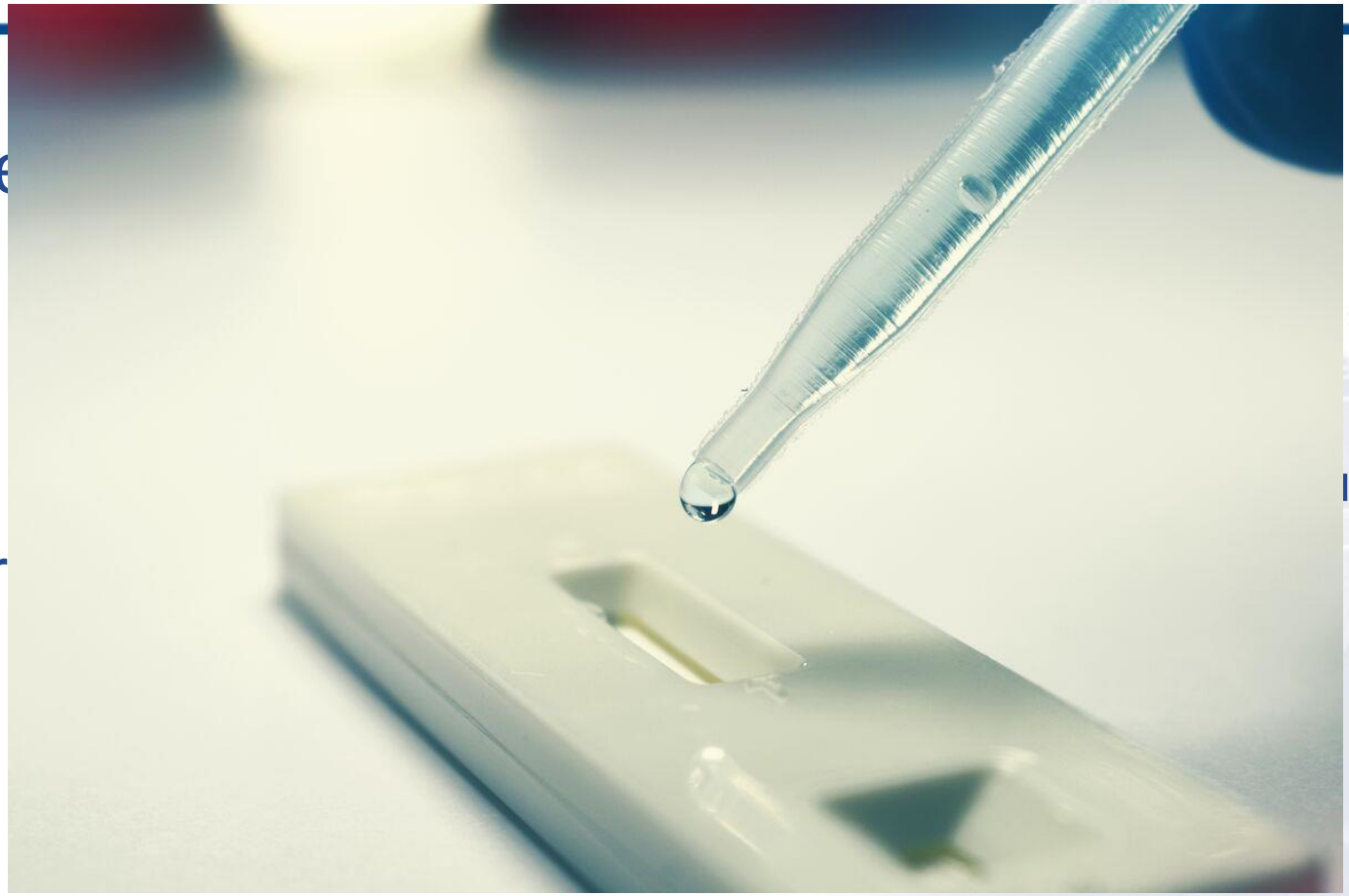
Diagnostic dilemmas

- Genital Ulcers
  - HSV
  - Syphilis
  - Chancroid
  - LGV
- Proctitis
  - GC, Chlamydia
  - HSV
- Rash
  - Disseminated HSV
  - VZV
  - Syphilis
  - Molluscum Contagiosum
  - Disseminated GC
  - Hand Foot and Mouth

Diagnostic dilemmas

- Ge
  - –
  - –
  - –
  - –
- Pr
  - –
  - –



MPV Recent Case Series

Epidemiologic and Clinical Characteristics of Monkeypox Cases — United States, May 17–July 22, 2022

Weekly / August 12, 2022 / 71(32);1018-1022

On August 5, 2022, this report was posted online as an MMWR *Early Release.*

David Philpott, MD[1,2]; Christine M. Hughes, MPH[2]; Karen A. Alroy, DVM[3]; Janna L. Kerins, VMD[4]; Jessica Pavlick, DrPH[5]; Lenore Asbel, MD[6]; Addie Crawley, MPH[3]; Alexand P. Newman, DVM[7]; Hillary Spencer, MD[1,4]; Amanda Feldpausch, DVM[5]; Kelly Cogswell, MPH[8]; Kenneth R. Davis, MPH[9]; Jinlene Chen, MD[10]; Tiffany Henderson, MPH[11]; Katherine Murphy, MPH[12]; Meghan Barnes, MSPH[13]; Brandi Hopkins, MPH[14]; Mary-Margaret A. Fill, MD[15]; Anil T. Mangla, PhD[16]; Dana Perella, MPH[6]; Arti Barnes, MD[17]; S Hughes, PhD[3]; Jayne Griffith, MPH[18]; Abby L. Berns, MPH[19]; Lauren Milroy, MPH[20]; Haley Blake, MPH[21]; Maria M. Sievers, MPH[22]; Melissa Marzan-Rodriguez, DrPH[23]; Mar Tori, MD[1,24]; Stephanie R. Black, MD[4]; Erik Kopping, PhD[3,25]; Irene Ruberto, PhD[26]; Angela Maxted, DVM, PhD[27]; Anuj Sharma, MPH[5]; Kara Tarter, MPH[28]; Sydney A. Jones PhD[29,30]; Brooklyn White, MPH[31]; Ryan Chatelain, MPH[32]; Mia Russo; Sarah Gillani, MPH[16]; Ethan Bornstein, MD[1,8]; Stephen L. White, PhD[9]; Shannon A. Johnson, MPH[11]; Emma Ortega, MPHTM[12]; Lori Saathoff-Huber, MPH[17]; Anam Syed, MPH[5]; Aprielle Wills, MPH[3]; Bridget J. Anderson, PhD[7]; Alexandra M. Oster, MD[2]; Athalia Christie, DrP Jennifer McQuiston, DVM[2]; Andrea M. McCollum, PhD[2]; Agam K. Rao, MD[2,*]; María E. Negrón, DVM, PhD[2,*]; CDC Multinational Monkeypox Response Team (View auth affiliations)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Monkeypox Virus Infection in Humans across 16 Countries — April–June 2022

J.P. Thornhill, S. Barkati, S. Walmsley, J. Rockstroh, A. Antinori, L.B. Harrison, R. Palich, A. Nori, I. Reeves, M.S. Habibi, V. Apea, C. Boesecke, L. Vandekerckhove, M. Yakubovsky, E. Sendagorta, J.L. Blanco, E. Florence, D. Moschese, F.M. Maltez, A. Goorhuis, V. Pourcher, P. Migaud, S. Noe, C. Pintado, F. Maggi, A.-B.E. Hansen, C. Hoffmann, J.I. Lezama, C. Mussini, A.M. Cattelan, K. Makofane, D. Tan, S. Nozza, J. Nemeth, M.B. Klein, and C.M. Orkin, for the SHARE-net Clinical Group*

This article was published on July 21, 2022, at NEJM.org. DOI: 10.1056/NEJMoa2207323

Research

Clinical features and novel presentations of human monkeypox in a central London centre during the 2022 outbreak: descriptive case series

BMJ 2022 ; 378 doi: https://doi.org/10.1136/bmj-2022-072410 (Published 28 July 2022)
Cite this as: *BMJ* 2022;378:e072410

Articles

Clinical presentation and virological assessment of confirmed human monkeypox virus cases in Spain: a prospective observational cohort study

Eloy José Tarín-Vicente MD [a], Andrea Alemany MD [c, e], Manuel Agud-Dios MD [a], Maria Ubals MD [c, e], Clara Suñer PhD [c, e], Andrés Antón PhD [g], Maider Arando PhD [h], Jorge Arroyo-Andrés MD [a], Lorena Calderón-Lozano MD [a], Cristina Casañ PhD [i], José Miguel Cabrera MD [d, e, j], Pep Coll MD [d, e, j], Vicente Descalzo MD [h], María Dolores Folgueira PhD [b, k, l], Jorge N García-Pérez MD [h], Elena Gil-Cruz MD [a], Borja González-Rodríguez MD [a], Christian Gutiérrez-Collar MD [a] ... Oriol Mitjà PhD [c, e, t, u, †]

JOHNS HOPKINS MEDICINE

MPV Case Presentations: 2022 Data

	Spain Lancet N=181	London BMJ N=197	16 Countries NEJM N=528	US MMWR N=1195
Demographics M:F:T	**97% Male 3%Female 0% Trans**	**100% Male 0% Female 0% Trans**	**>99% Male <1% T**	**99% M 0.4% F 0.7% T**
Lesions	100%	100%	95%	100%
Fever	72%	62%	62%	63%
Chills				59%
LAN	85%	58%	56%	59%
Malaise		23%	41%	58%
Myalgia		32%	31%	55%
Headache	53%	25%	27%	51%
Rectal Pain	25%	36%	14%	22%
Sore Throat	36%	17%		

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Myalgia		32%	31%	55%
Headache	53%	25%	27%	51%
Rectal Pain	**25%**	**36%**	**14%**	**22%**
Sore Throat	36%	17%		

Distribution of Lesions

	Spain Lancet N=181	London BMJ N=197	16 Countries NEJM N=528	US MMWR N=1195
Genitals	**55%***	**56%**	**73%**	**46%**
Anal/perianal	**35%**	**42%**		**31%**
Face		36%	25%	38%
Trunk	57%**	36%	55%**	21%
Hands/feet	60%	28%	10%	22%
Perioral	28%			25%***
Oropharyngeal	25%	14%		

*anogenital
** trunk or limbs
*** mouth, lips or oral mucosa

Asymptomatic infection

› Nat Med. 2022 Aug 12. doi: 10.1038/s41591-022-02004-w. Online ahead of print.

Retrospective detection of asymptomatic monkeypox virus infections among male sexual health clinic attendees in Belgium

Irith De Baetselier [# 1], Christophe Van Dijck [# 2 3], Chris Kenyon [4 5], Jasmine Coppens [4], Johan Michiels [6], Tessa de Block [4], Hilde Smet [4], Sandra Coppens [6], Fien Vanroye [4], Joachim Jakob Bugert [7], Philipp Girl [7], Sabine Zange [7], Laurens Liesenborghs [4], Isabel Brosius [4], Johan van Griensven [4], Philippe Selhorst [6], Eric Florence [4], Dorien Van den Bossche [4], Kevin K Ariën [6], Antonio Mauro Rezende [4 8], Koen Vercauteren [9 10], Marjan Van Esbroeck [11], ITM Monkeypox study group

Collaborators, Affiliations + expand

PMID: 35961373 DOI: 10.1038/s41591-022-02004-w

3/224 (1.3%)

› Ann Intern Med. 2022 Aug 16. doi: 10.7326/M22-2183. Online ahead of print.

Detection of Monkeypox Virus in Anorectal Swabs From Asymptomatic Men Who Have Sex With Men in a Sexually Transmitted Infection Screening Program in Paris, France

Valentine Marie Ferré [1], Antoine Bachelard [2], Meryem Zaidi [1], Laurence Armand-Lefevre [3], Diane Descamps [1], Charlotte Charpentier [1], Jade Ghosn [2]

Affiliations + expand

PMID: 35969863 DOI: 10.7326/M22-2183

Free article

No abstract available

13/200 (6.5%)

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Diagnostic dilemmas

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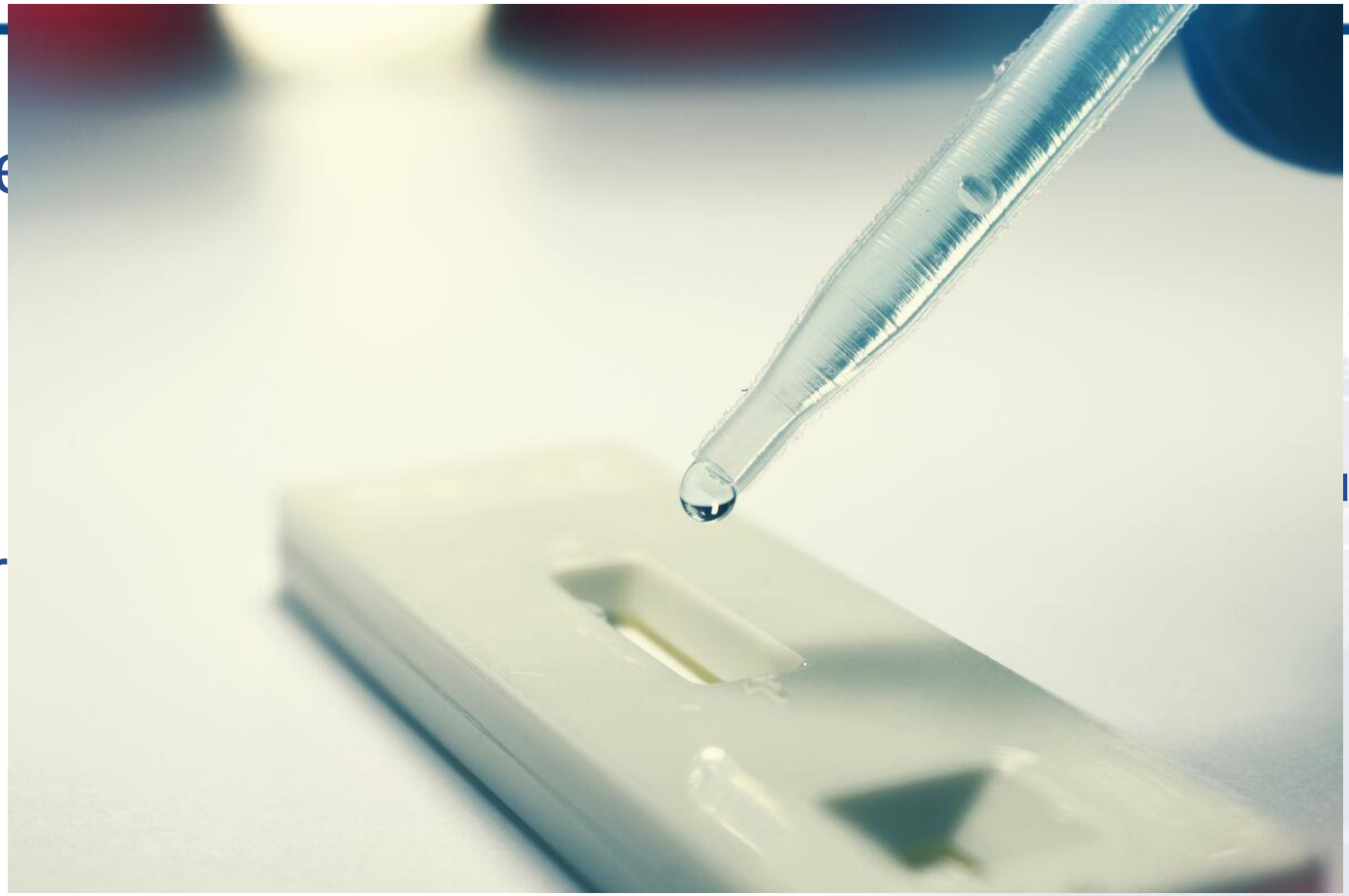

How to obtain specimen

- Provider wears PPE
- Patient wears mask—no need for airborne precautions
- Vigorous rubbing of lesion
- No need to unroof
- 2-3 samples in VTM (depending on lab requirements)

MONKEYPOX

Tips for Adequate Collection of a Lesion Specimen from a Suspect Monkeypox Virus Case

Vigorous swabbing of lesion specimens maximizes the probability of achieving accurate diagnostic results. **Specimens that do not contain enough human DNA may lead to inconclusive PCR test results, with no positive or negative result.** Inconclusive results necessitate patients being sampled again which can delay diagnosis. Follow the instructions below to make sure your specimens are adequate for testing. While vigorous swabbing on the surface of a lesion should collect enough viral DNA, more viral DNA can be found in crusts when present. Recommended infection prevention and control practices, including the use of personal protective equipment (PPE), for caring for a patient with suspected or confirmed monkeypox infection should be used during specimen collection: What Healthcare Professionals Should Know. Unroofing or aspiration of lesions (or otherwise using sharp instruments for monkeypox testing) is **not necessary, nor recommended due to the risk for sharps injury.**

Swabbing of Lesion Surface:

1. Use sterile, synthetic swabs. Do not use cotton swabs.
2. More information on specimen collection can be found here: Preparation and Collection of Specimens.
3. Do not clean the lesion with ethanol or any other disinfectant prior to swabbing.
4. Hold the swab with a firm grasp. Avoid touching the swab shaft at least an inch before the tip if collecting a dry swab and the length of the swab shaft that will be submerged in liquid if using a swab to be stored in viral transport media.

5. Apply firm pressure (generally firm enough so that the swab shaft, if plastic, may bend slightly). This may result in discomfort or slight pain, but it is necessary to obtain adequate DNA.
   a. If lesion ruptures while swabbing, ensure that swab collects lesion fluid.
   b. If possible, avoid using swabs that bend too easily which may make applying firm pressure difficult.
6. Swipe the swab back and forth on the lesion surface at least 2-3 times then rotate and repeat on the other side of the swab at least 2-3 times.

   a. If material is visible on the swab surface (such as skin material or from lesion fluid that is leaking from the lesion), this is indicative of an adequate collection. Although please note that material may not always be visible on swabs.
7. Place swab within appropriate container.
   a. Ensure container, storage and shipping conditions are approved by laboratory that specimen is being sent to for testing.

Collection of crusts from healing lesions:

Crusts are not accepted by all laboratories as an approved specimen type. Ensure the laboratory that will be receiving the specimen for testing is able to test crusts before collecting or sending.

1. Use a forceps or other blunt-tipped sterile instrument to remove all or a piece of the crust at least 4mm x 4mm – about the size of this dot: ●

2. Separate each crust into a dry, sterile container.

   a. Ensure container, storage, and shipping conditions are approved for laboratory that specimen is being sent to for testing.

3. Cover lesion with band aid.

While waiting for test result

- While waiting for the initial test results, the patient should:
  - **Isolate at home**. If living with others, isolate in separate room/area

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  - **Rash persists -** cover lesions, wear mask

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  - **Wear a mask** when around household members
  - **Avoid contact with pets/animals**
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  - Household members **hand hygiene** when touching contaminated items

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  - Household members **hand hygiene** when touching contaminated items
  - Avoid shared **bedding, towels, clothing**
    - standard washing machine, does not require bleach
  - Do not share **dishes or utensils**.

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  - Clean **contaminated shared surfaces** with household cleaners/disinfectants

Positive Test, now what?

Most recover without complications

Symptomatic Treatment

Supportive Care, isolation

Health Department - contact tracing

Antivirals

Hospitalization

Multi-disciplinary care

Complications

- Proctitis
- Urethritis
- Genital swelling and deformation
- Pharyngitis
- Lymphadenopathy
- Bacterial superinfection
- Encephalitis
- Scarring

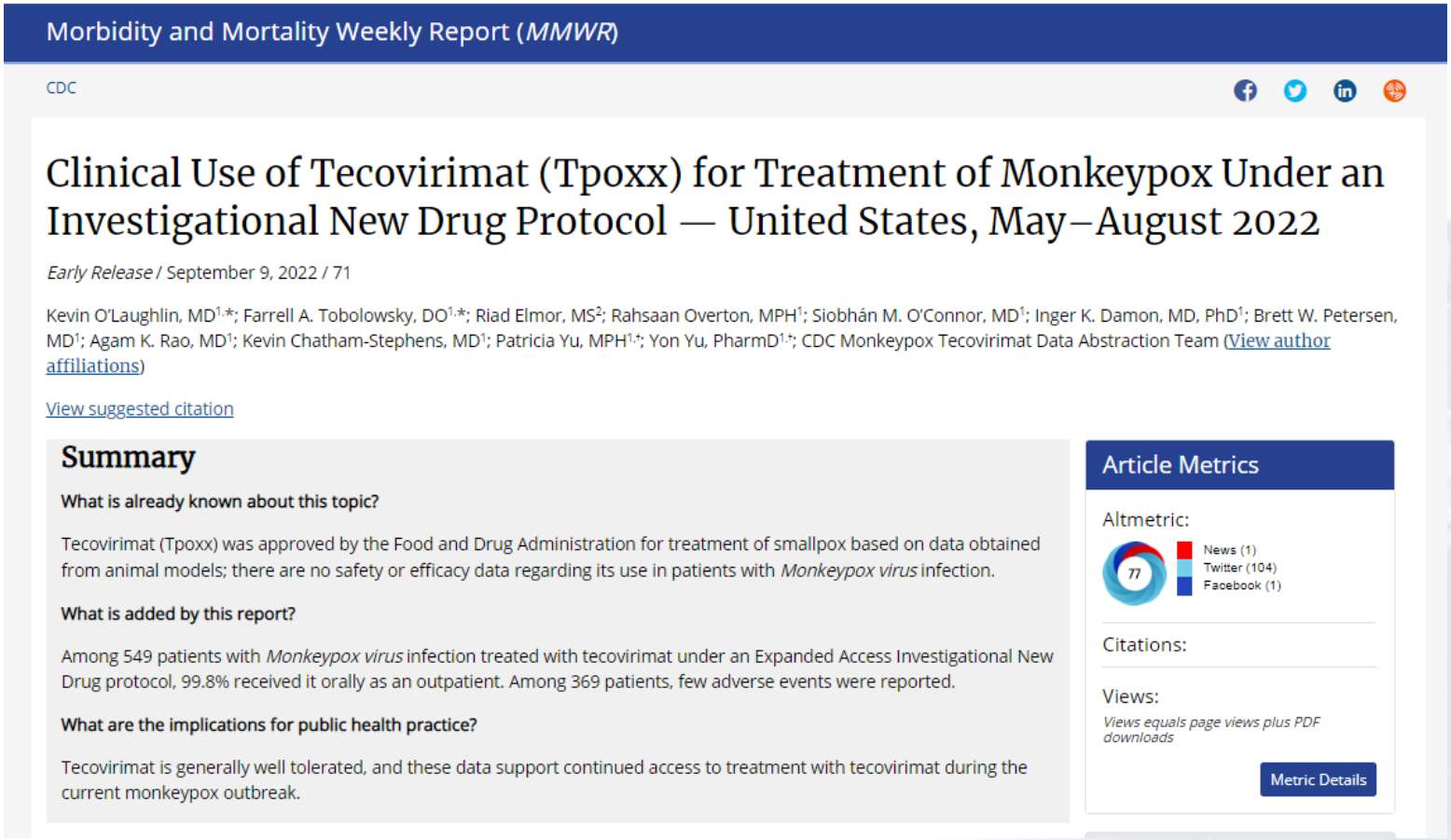
Supportive Care

- Assess pain
  - Mucosal lesions may not be visible on exam
- Supportive care:
  - Oral lesions: Magic mouthwash, salt water gargle, viscous lidocaine
  - Rectal: stool softeners, sitz baths, topical lidocaine, avoid opioids
- Stay in contact with patients
- NSAID's with caution
- Tecovirimat may be indicated for pain

Antivirals

- Tecovirimat (TPOXX) p37 envelope protein inhibitor
  - Available through the CDC under Expanded Access- Investigational New Drug (EA-IND) protocol
  - Oral or IV course x 14 days
  - Taken 30 min after a full meal with moderate fat
  - Limited efficacy data
- Trifluridine (ocular complications)
- Other options (with downsides): Vaccinia IGIV, cidofovir, brincidofovir

Tecovirimat tolerability



Morbidity and Mortality Weekly Report (*MMWR*)

CDC

Clinical Use of Tecovirimat (Tpoxx) for Treatment of Monkeypox Under an Investigational New Drug Protocol — United States, May–August 2022

Early Release / September 9, 2022 / 71

Kevin O'Laughlin, MD[1,*]; Farrell A. Tobolowsky, DO[1,*]; Riad Elmor, MS[2]; Rahsaan Overton, MPH[1]; Siobhán M. O'Connor, MD[1]; Inger K. Damon, MD, PhD[1]; Brett W. Petersen, MD[1]; Agam K. Rao, MD[1]; Kevin Chatham-Stephens, MD[1]; Patricia Yu, MPH[1,†]; Yon Yu, PharmD[1,†]; CDC Monkeypox Tecovirimat Data Abstraction Team (View author affiliations)

View suggested citation

Summary

What is already known about this topic?

Tecovirimat (Tpoxx) was approved by the Food and Drug Administration for treatment of smallpox based on data obtained from animal models; there are no safety or efficacy data regarding its use in patients with *Monkeypox virus* infection.

What is added by this report?

Among 549 patients with *Monkeypox virus* infection treated with tecovirimat under an Expanded Access Investigational New Drug protocol, 99.8% received it orally as an outpatient. Among 369 patients, few adverse events were reported.

What are the implications for public health practice?

Tecovirimat is generally well tolerated, and these data support continued access to treatment with tecovirimat during the current monkeypox outbreak.

Article Metrics

Altmetric:

77

News (1)
Twitter (104)
Facebook (1)

Citations:

Views:

Views equals page views plus PDF downloads

Metric Details

Indications for Antiviral Therapy

- **<u>Antiviral treatment considered for:</u>**
  - People with severe illness
  - People with risk for severe disease
    - Severe immunocompromise (HIV*, leukemia, lymphoma, generalized malignancy, organ/BMT recipient, cancer treatment, TNF inhibitor tx, antimetabolites tx, high dose steroid tx)
    - People with exfoliative skin diseases, atopic dermatitis
    - Pediatric (<8 yo), pregnant, breastfeeding patients
  - People with complications (secondary infections)
  - People with lesions in anatomical areas that might constitute a special hazard (e.g., the genitals or anus) or complication

Vaccines

JYNNEOS

- Live, non-replicating Vaccinia virus
- 2 doses, 4 weeks apart
- FDA approved age 18+ (<18- EA IND)
- No data on efficacy in current outbreak
- Contraindicated: MPX symptoms, severe allergy to egg, ciprofloxacin, gentamicin
- Safe to administer to PLWH, atopic dermatitis

ACAM 2000

- Live, replication competent Vaccinia virus
- 1 dose, bifurcated needle multiple puncture technique
- EA-IND for MPX
- Contraindications
  - Immune deficiency eye disease
  - Atopic dermatitis/ eczema
- Risk of household contact Vaccinia transmission

Lessons learnt

- Monkeypox not new
  - Endemic since 1970s
  - Previous outbreaks in US
- What we did well
  - Planning response
  - communications
  - consistent messaging
  - Stigma reduction

Past U.S. Cases and Outbreaks

Updated June 6, 2022 Print

November 2021 Travel-Associated Case

The Centers for Disease Control and Prevention (CDC) and the Maryland Department of Health confirmed on November 16, 2021 a case of monkeypox in a U.S. resident who recently returned from Nigeria to the United States. CDC is supporting state and local health officials, airline and travel industry partners, and other stakeholders to identify people who had possible contact with the patient. Because it can take up to 21 days for symptoms to develop after infection, contacts are being asked to monitor their health for that amount of time. CDC will continue to collaborate with partners to ensure the success of this investigation to help prevent additional cases of monkeypox in the United States.

July 2021 Travel-Associated Case

CDC and the Texas Department of State Health Services confirmed on July 15, 2021 a case of human monkeypox in a U.S. citizen who traveled from Nigeria to the United States on two commercial flights. CDC supported state and local health officials to identify more than 200 people who had possible contact with the patient. Contacts were asked to monitor their health for 21 days. In early September, 21 days had passed without additional cases identified, and the monitoring period for the remaining contacts ended. Strong collaboration between CDC, state and local health departments, airline and airport partners, and other stakeholders involved in this investigation helped to prevent additional cases of monkeypox in the U.S. related to this case.

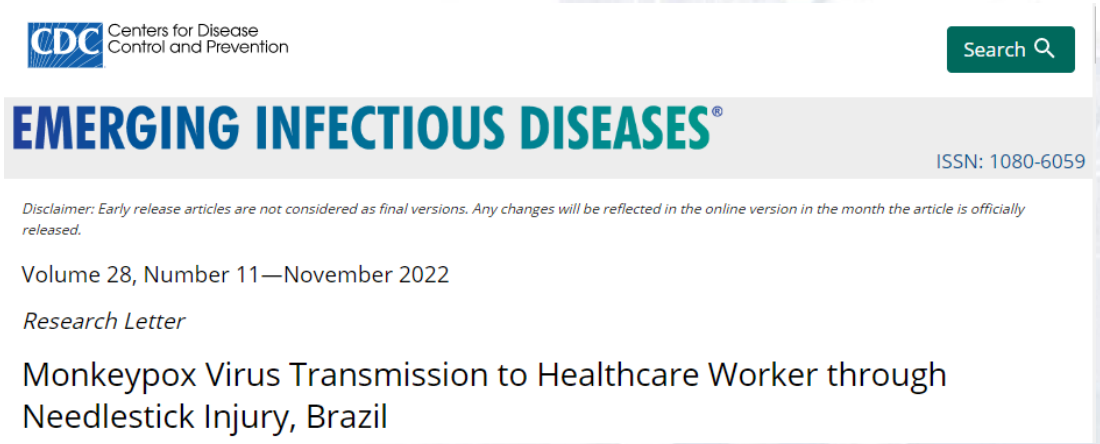
2003 Outbreak from Imported Mammals

In 2003, forty-seven confirmed and probable cases of monkeypox were reported from six states—Illinois, Indiana, Kansas, Missouri, Ohio, and Wisconsin. All people infected with monkeypox in this outbreak became ill after having contact with pet prairie dogs. The pets were infected after being housed near imported small mammals from Ghana. This was the first time that human monkeypox was reported outside of Africa.

https://www.cdc.gov/poxvirus/monkeypox/outbreak/us-outbreaks.html

What we need – a clinician's view

- More data to fill knowledge gaps
- More readily available rapid diagnostics
- Self testing
- Rapid Ag
  - Sharps injury
- Multiplex PCR
  - Skin
  - Genital / Extragenital sites



CDC Centers for Disease Control and Prevention

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Volume 28, Number 11—November 2022

Research Letter

Monkeypox Virus Transmission to Healthcare Worker through Needlestick Injury, Brazil

Conclusions

- Current MPX is not presenting classically but is presenting at STI clinics, HIV providers and EDs
- Looks like other STI's
  - History and physical are important in differential
  - Concomitant STI, HIV testing
- Supportive care is important for most, antivirals are available and should be used
- More rapid diagnostics essential for diagnostic certainty (GUD), facilitate early treatment, isolation advice, delineate new outbreaks

Questions?

Email: mhamill6@jhu.edu

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