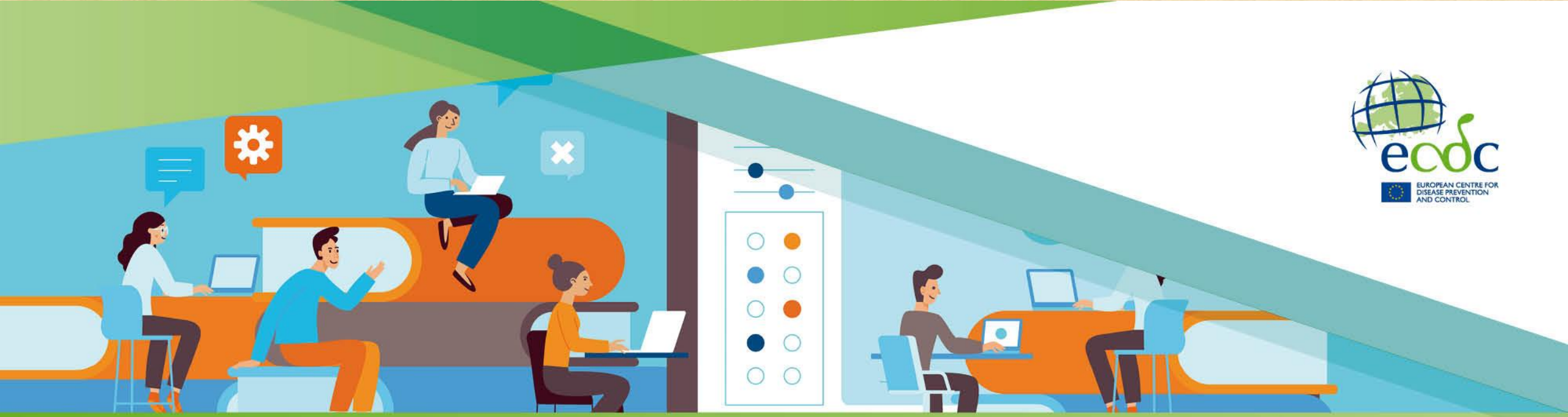


GenEpi-BioTrain Virtual Training 29 - Genomic epidemiology of mpox

Reflections

12-10-2026

David Nieuwenhuijse and Bas Oude Munnink

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Can you think of examples of impact on public health response?

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SARS-CoV-2 examples

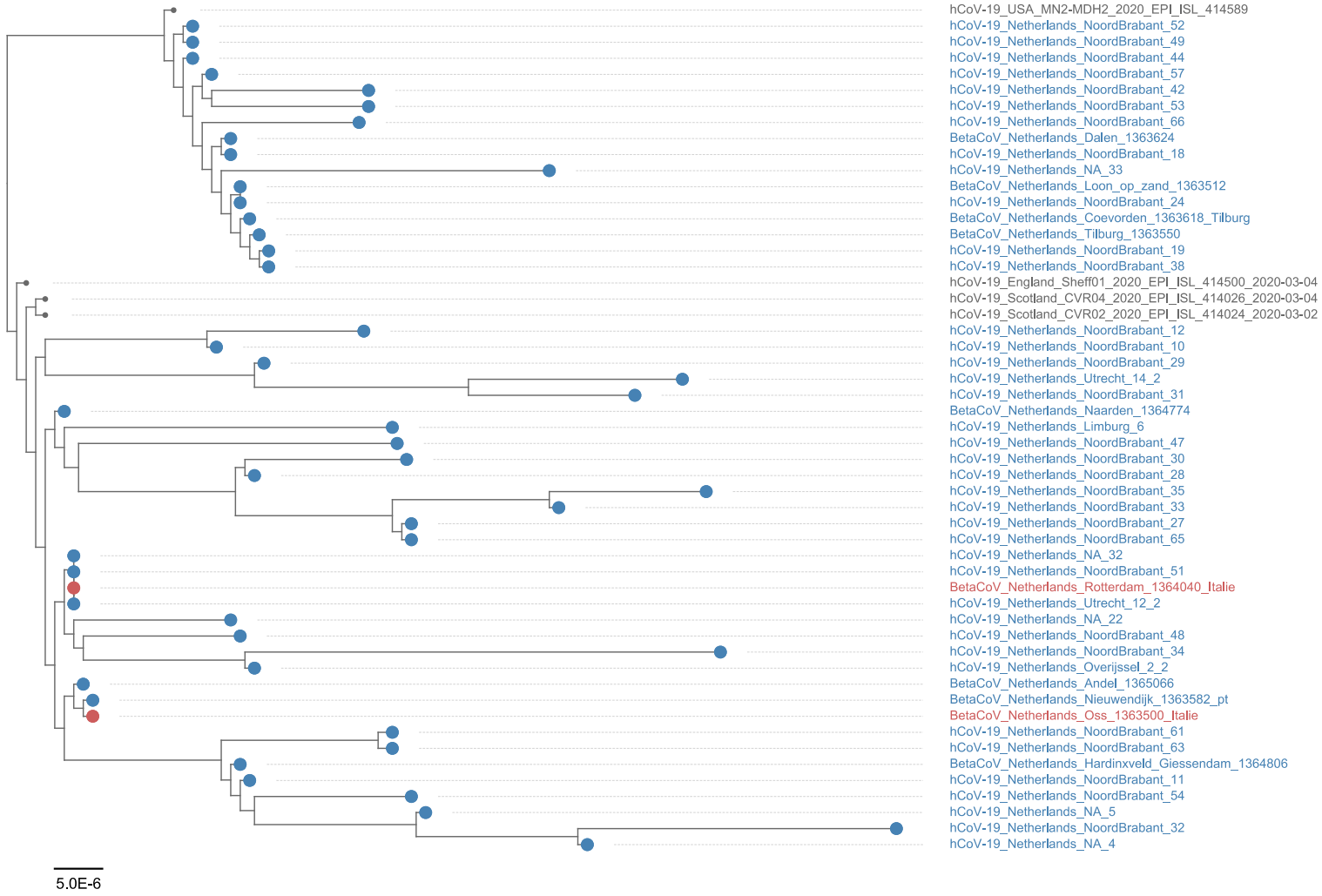
The first SARS-CoV-2 infection in the Netherlands was confirmed on February 27th and an additional case one day later. The genomes of these first two positive samples were generated and analyzed by the February 29th.



Not from one recent source, e.g. unlikely connected

Oude Munnink et al, Nature Med, 2020

SARS-CoV-2 examples



The sequences detected in the Netherlands were diverse and revealed the presence of multiple co-circulating sequence types, found in several different clusters in the phylogenetic tree.

The increase in COVID-19 patients as well as increasing affected geographic areas and occurrence of local clusters provided further support for the increased movement restrictions.

Oude Munnink et al, Nature Med, 2020

SARS-CoV-2 examples

Determine the geographical signature (if any)

Monitor significant changes in the genome

Outbreak investigations

- Hospitals
- Nursing homes
- Slaughterhouses
- Gyms
- Schools
- Fruit industry
- **Mink farms**



US coronavirus hotspots linked to meat processing plants

- Analysis shows factories a source of virus transmission
- Workers and unions urge health and safety overhaul

A billboard advertises job hiring at Agri Beef's plant in Toppenish, Washington. Donald Trump last month declared such plants to be critical to the US economy. Photograph: Ted S Warren/AP



COVID-19 in health-care workers in three hospitals in the south of the Netherlands: a cross-sectional study

Reina S Sikkema*, Suzan D Pas*, David F Nieuwenhuijse, Áine O'Toole, Jaco J Verweij, Anne van der Linden, Irina Chestakova, Claudia Schapendonk, Mark Pronk, Pascal Lexmond, Theo Bestebroer, Ronald J Overmars, Stefan van Nieuwkoop, Wouter van den Bijllaardt, Robbert G Bentvelsen, Miranda M L van Rijen, Anton G M Buiting, Anne J G van Oudheusden, Bram M Diederen, Anneke M C Bergmans, Annemiek van der Eijk, Richard Molenkamp, Andrew Rambaut, Aura Timen, Jan A J W Kluytmans, Bas B Oude Munnink, Marjolein F Q Kluytmans van den Bergh*, Marion P G Koopmans*

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REPORT

Transmission of SARS-CoV-2 on mink farms between humans and mink and back to humans

Bas B. Oude Munnink[1,*], Reina S. Sikkema[1], David F. Nieuwenhuijse[1], Robert Jan Molenaar[2], Emmanu…

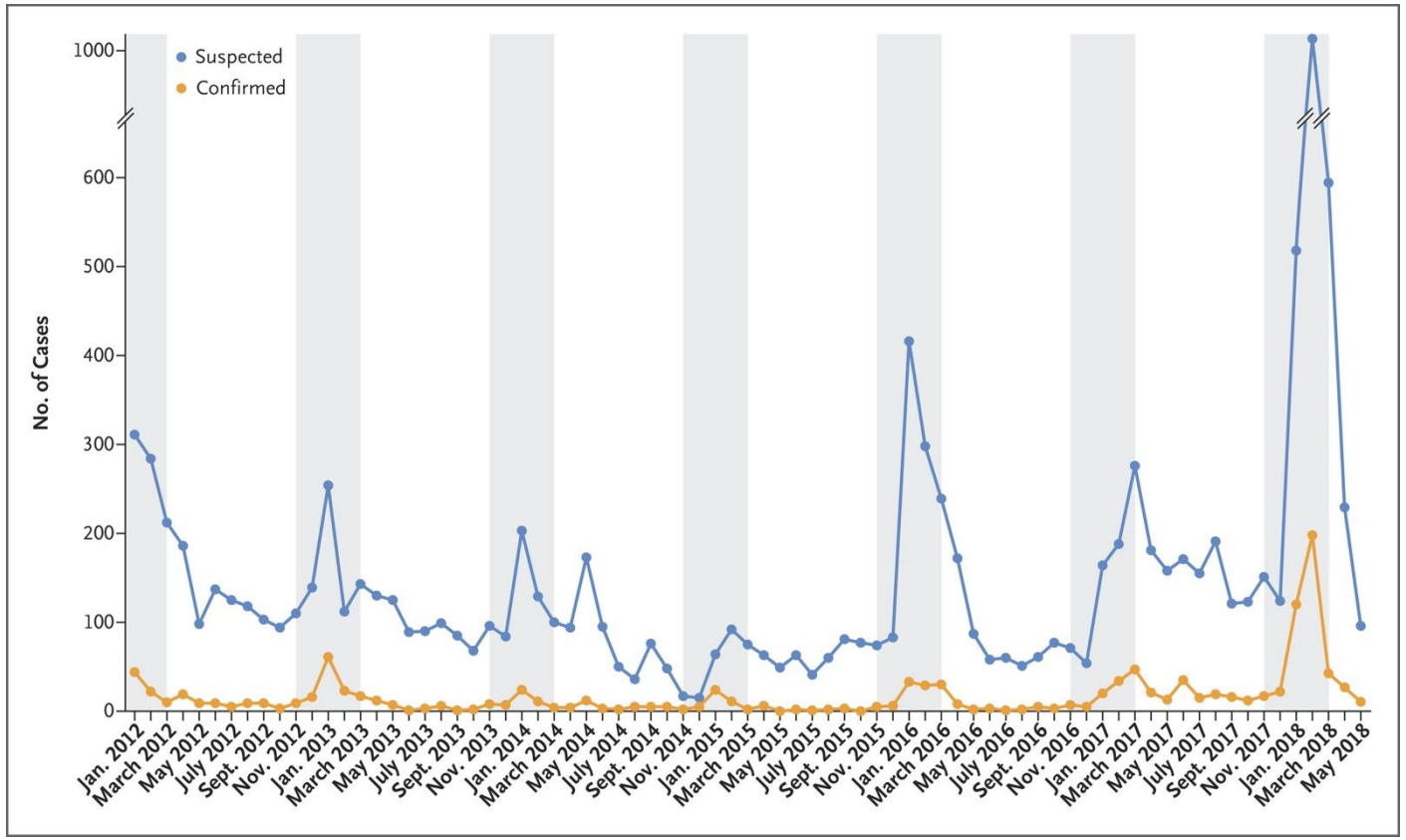
+ See all authors and affiliations

Science 10 Nov 2020:
eabe5901
DOI: 10.1126/science.abe5901

Article | Figures & Data | Info & Metrics | eLetters | PDF

Lassa virus example

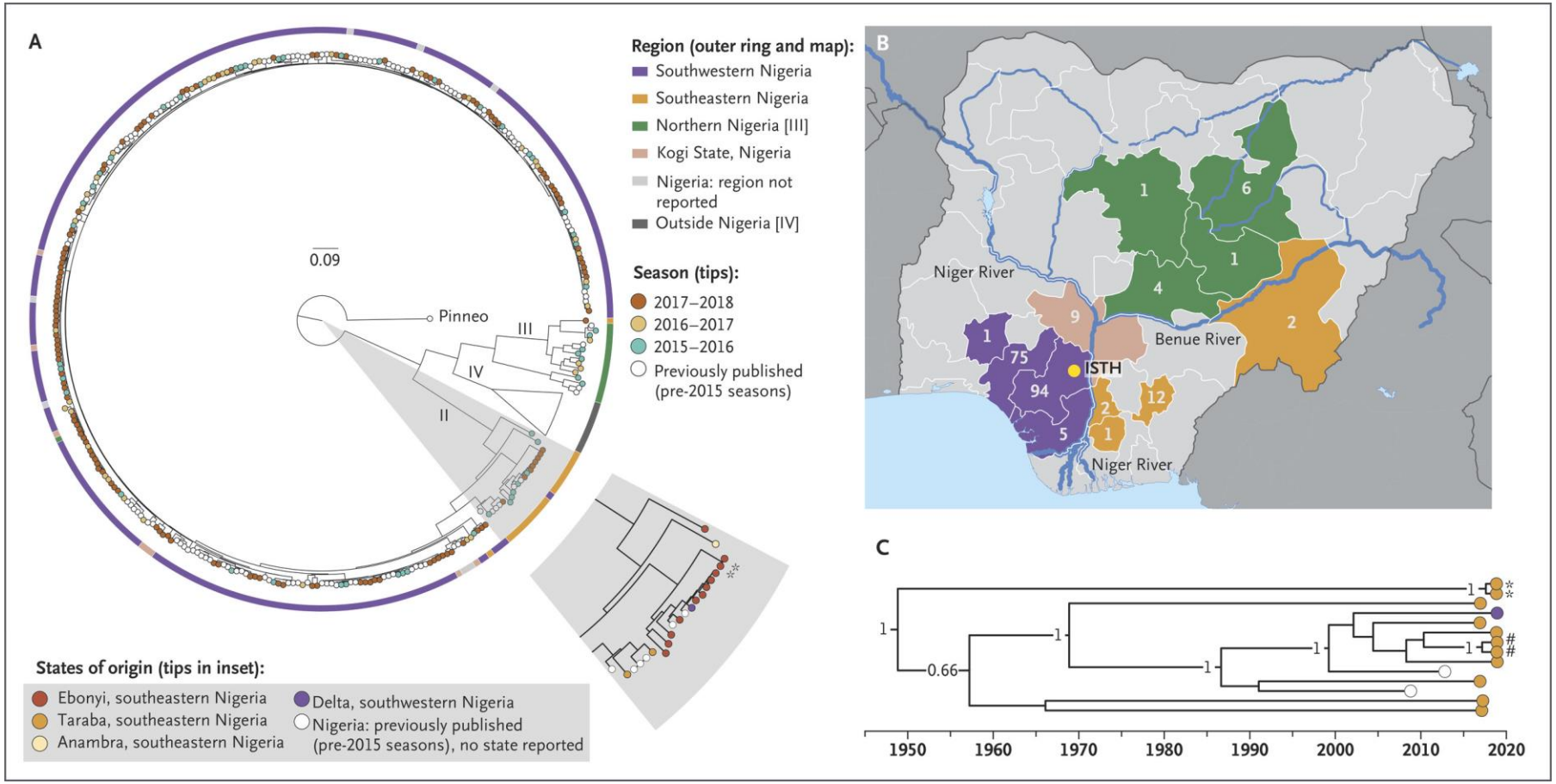
- Zoonotic virus transmitted from rat to humans
- Unusual increase of cases in Nigeria in 2018
- Change in the transmission dynamics of this virus?



Siddle et al, NEJM, 2018

Lassa virus example

- Whole genome sequencing of 220 genomes



- No evidence of a particular strain circulating

Mpox Clade Ib example

WHO Director-General declares mpox outbreak a public health emergency of international concern

14 August 2024 | News release |Reading time: 3 min (788 words)

WHO Director-General Dr Tedros Adhanom Ghebreyesus has determined that the upsurge of mpox in the Democratic Republic of the Congo (DRC) and a growing number of countries in Africa constitutes a public health emergency of international concern (PHEIC) under the International Health Regulations (2005) (IHR).

Dr Tedros's declaration came on the advice of an IHR Emergency Committee of independent experts who met earlier in the day to review data presented by experts from WHO and affected countries. The Committee informed the Director-General that it considers the upsurge of mpox to be a PHEIC, with potential to spread further across countries in Africa and possibly outside the continent.

The Director-General will share the report of the Committee's meeting and, based on the advice of the Committee, issue temporary recommendations to countries.

In declaring the PHEIC, Dr Tedros said, "The emergence of a new clade of mpox, its rapid spread in eastern DRC, and the reporting of cases in several neighbouring countries are very worrying. On top of outbreaks of other mpox clades in DRC and other countries in Africa, it's clear that a coordinated international response is needed to stop these outbreaks and save lives."

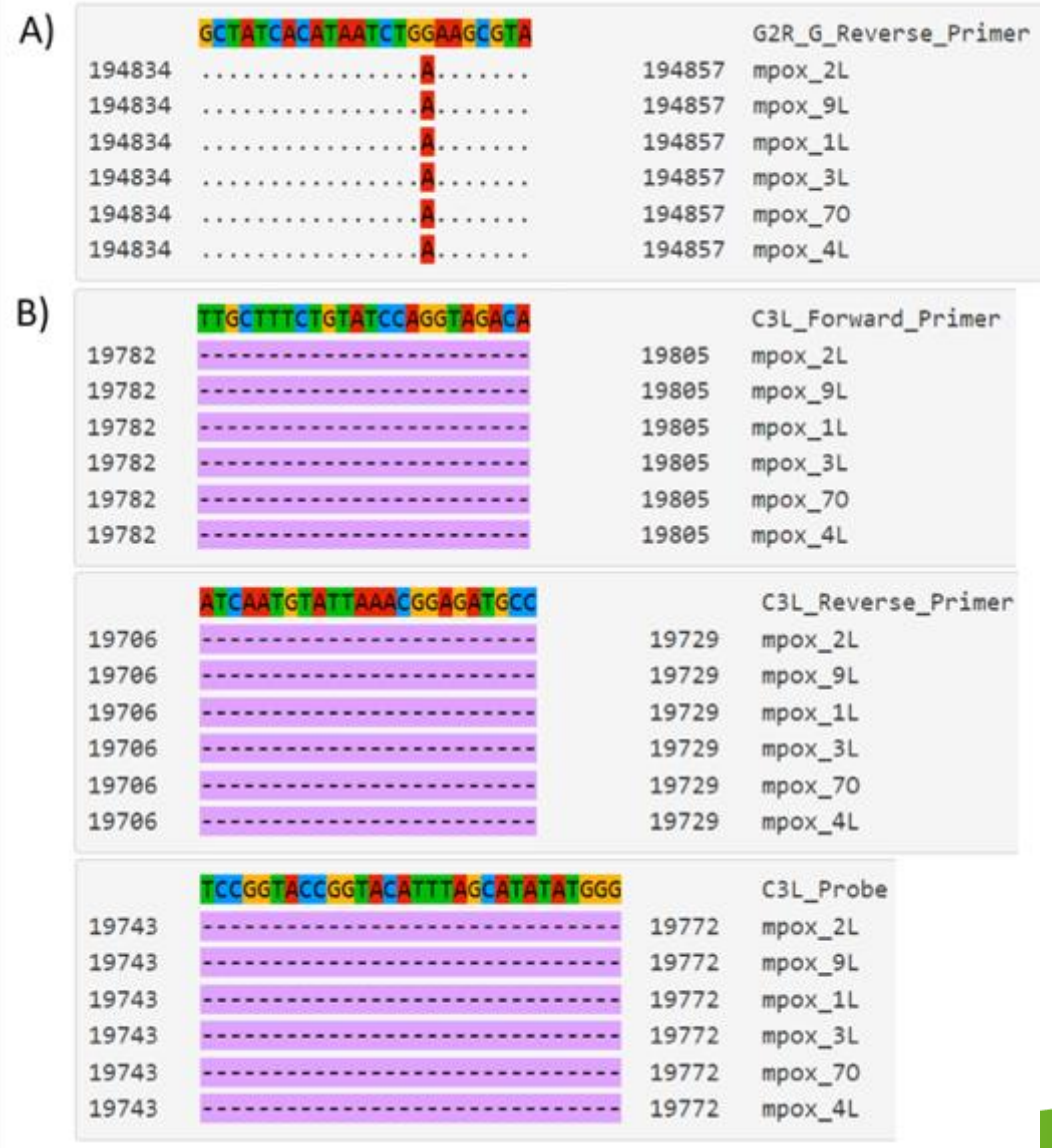
- Extra attention
- Extra resources
- Extra funding

Diagnostic primer performance

- OPG032/D14L is the target recommended by the CDC to differentially diagnose Clade I versus Clade II mpox virus --> **Not working anymore**

CDC recommended primers

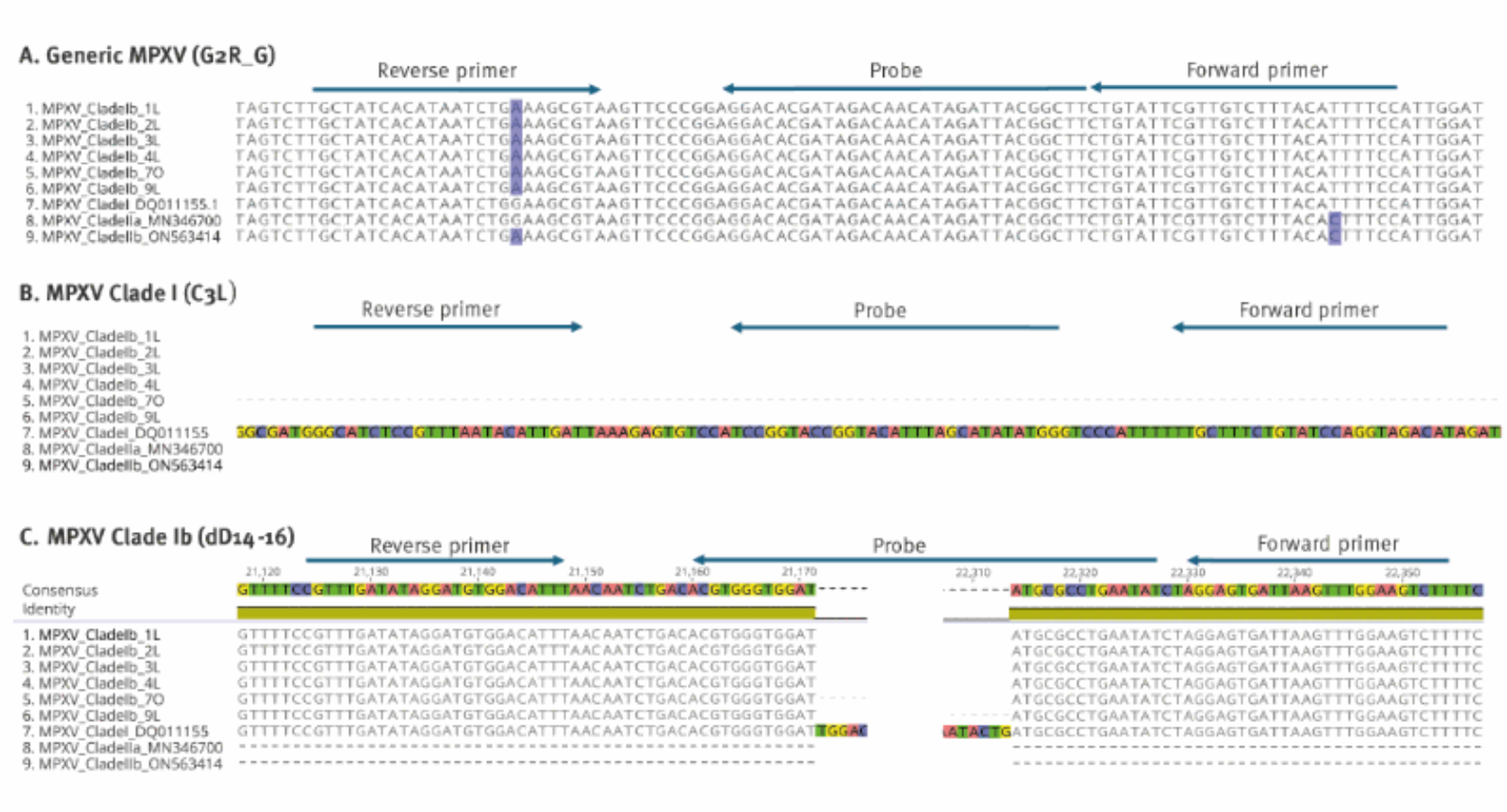
	Primers/Probe	Sequence (5' > 3')	Length
Generic	G2R_G Forward Primer	GGAAAATGTAAAGACAACGAATACAG	26
	G2R_G Reverse Primer	GCTATCACATAATCTGGAAGCGTA	24
	G2R_G Probe	FAM-AAGCCGTAATCTATGTTGTCTATCGTGTCC-BHQ1	30
Clade I	C3L Forward Primer	TGTCTACCTGGATACAGAAAGCAA	26
	C3L Reverse Primer	GGCATCTCCGTTTAATACATTGAT	24
	C3L Probe	FAM-CCCATATATGCTAAATGTACCGGTACCGGA-BHQ1	30



https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2024.29.32.2400486

Development of new clade Ib specific RT-PCR

- We developed a novel real-time PCR assay (dD14-16) to detect the new MPXV Clade Ib.
- The assay can be performed alongside other TaqMan-based real-time targets to detect MPXV and distinguish between Clade I and Clade II.
- We designed a specific probe sequence to anneal directly upstream and downstream of the deletion in Clade Ib



https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2024.29.32.2400486

Zoonotic transmission versus ongoing human-to-human transmission

- APOBEC-3 mutations in the mpox example
- Outbreak of Andes hantavirus on a cruiseship
- Lassa virus outbreak in Nigeria
- **Essential for public health responses (but why)**

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What kind of public health response actions would you recommend in case of zoonotic transmission events?

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Zoonotic transmission of mpox versus human-to-human transmission

Actions in case of zoonotic transmission

- Investigate the animal reservoirs
- Reducing exposure to infected animals
- Strenghening veterinary and wildlife surveillance
- Community education on hunting, handling, or consumption of animals

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What kind of public health response actions would you recommend in case of human-to-human transmission?

ⓘ The Slido app must be installed on every computer you're presenting from

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Zoonotic transmission of mpox versus human-to-human transmission

Actions in case of human-to-human transmission:

- Vaccination of target groups
- Contact tracing
- Isolation
- Risk communication

Open Q&A

- How to use WGS in future outbreak investigations?

- Anything else which you find important which was not covered yet?

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