Global situation of FMD

David Paton, on behalf of WRLFMD

Acknowledgements: Don King, Valerie Mioulet, Nick Knowles, Anna Ludi, Britta Wood, Ginette Wilsden, Krupali Parekh, Andrew Shaw, Antonello Di Nardo, Jemma Wadsworth, Clare Browning, Mark Henstock, Hayley Hicks, Dexter Wiseman, Jozhel Baguisi, Harry Bull, Amy McCarron, Bryony Armson, Sarah Belgrave, Sarah Belton

INTERNATIONAL SEMINAR – PRE-COSALFA 50
Getting Close to Regional Eradication: Half a Century of Progress
22- 23 April 2024
Global Overview

FMD is Endemic in Asia and Africa (and parts of South America)

7 endemic pools of specific viral lineages
6 circulating serotypes with unequal / dynamic distributions
Serotypes O and then A most prevalent; in Africa, SAT 1 & 2 more common than SAT 3
Serotype C undetected since 2004

Countries with endorsed official control programmes for FMD:
Botswana, India, Kyrgyzstan, Morocco, Namibia, Thailand

Suspensions of Official Disease Status

Suspension of an “FMD-free country where vaccination is not practised” status

Guyana

Following the failure to submit the annual reconfirmation and the adequate documentation evidence by the end of January 2024, according to Articles 1.6.2. and 8.8.2. of the Territorial Animal Health Code, the FMD-free country where vaccination is not practised” status of Guyana as recognised by the WOAH World Assembly of Delegates in May 2023 is suspended with effect from 20 February 2024.

Withdrawal of WOAH endorsement of ‘official control programme for FMD’

China (People’s Rep. of)

Following the assessment of China’s annual reconfirmation for its official control programme for FMD endorsed by WOAH, the Scientific Commission for Animal Diseases concluded that China no longer fulfils the requirements in Articles 1.6.2. and 8.8.39. of the Territorial Animal Health Code for a country having an endorsed official control programme for FMD. As a result, the endorsement of the “official control programme for FMD” for China, as recognised by the World Assembly of Delegates in terms of Resolution No. 12 in May 2023, was withdrawn with effect from 20 February 2024.
Suspensions of Official Disease Status

China (People’s Rep. of): The Commission acknowledged the information submitted by China regarding the progress made in implementing its official FMD control programme. The Commission noted that, as per recommendations by the Commission, China had followed up on FMD outbreaks by investigating the vaccination status and the herd immunity level of the farms where clinically positive animals had been detected and performed PVM data analysis stratified by age.

However, the Commission noted that FMDV-positive animals detected through pathogenic surveillance were not classified as FMD cases or outbreaks. The Commission considered that this is a critical component of an endorsed programme, and whilst noting that some of the recommendations had been addressed, this remained pending. In addition, the Commission noted that the revision of the prevention and control targets and performance indicators of the FMD official control plan initiated three years ago had not been finalised. Therefore, the Commission concluded that China no longer fulfils the requirements in Articles 1.6.2. and 8.8.39. of the Terrestrial Code for a country having an endorsed official control programme for FMD and recommended the withdrawal of the endorsement. The Commission stressed that should China wish to apply for the endorsement of an FMD official control programme, an updated plan must be submitted including a revised case definition aligned with Article 8.8.8.
FMD Regions: Regional FMD Roadmap approaches aligned to FMD virus pools

- Middle East
- W Eurasia
- S Asia
- W Africa
- C Africa
- E Africa
- Southern Africa

Source: OIE/FAO Reference Laboratory Network for Foot-and-Mouth Disease
PCP-FMD Status

Evolution of progress along the PCP-FMD and WOAH official FMD status between 2012 and 2023.
Vaccines must already have a marketing authorisation (i.e. licensed/registered by at least one national competent authority)

A risk-based evaluation of evidence provided by the applicant in the prequalification evidence file (PEF) to demonstrate that the vaccine meets at least the minimum standards in the WOAH Terrestrial Manual with respect to the key properties of the vaccine that are essential for its safe and effective use.

The level of assurance is rated from ‘Full’, through ‘Partial’ to ‘Incomplete’ to recognize that the level of assurance depends on the amount and quality of data provided.

In the case of vaccines rated ‘Partial’ or ‘Incomplete’, the outcome of PQv does not call into question the evaluation performed by a national competent authority in qualifying the vaccine but only reflects that data has not been provided to EuFMD to demonstrate compliance with the minimum standards of the WOAH Manual.
WOAH/FAO FMD Laboratory Network

https://www.foot-and-mouth.org/Ref-Lab-Network

Core activities:

• FMDV detection and characterisation
• Collation, exchange and release of data
• Test improvement and harmonization

• Evaluating vaccine performance
• Review of FMD risks
• Support to GF-TADs regional RoadMaps
Headline global events (2021/23)

**Tunisia, Algeria, Libya**
- 2022 and 2023
- O/EA-3
- SAT2/V

**Namibia, Zambia, Malawi, Mozambique**
- 2021-2022
- O/EA-2

**South Africa**
- FMD outbreaks due to SAT 2 and SAT 3 in provinces that were previously FMD-free
- 2021+
- O/ME-SA/SA-2018

**Egypt (2022)**
- O/EURO-SA
- A/EURO-SA

**Eastern Mediterranean**
- Dec 2021 – on-going
- O/ME-SA/PanAsia-2^ANT-10

**Russia / Kazakhstan**
- Dec 21 - Jan 2022
- South Korea
- May 2023
- O/ME-SA/Ind-2001e

**Indonesia**
- May 2022
- O/ME-SA/Ind-2001e

WOAH Map – March 2023
• Full genome data supports at least two independent introductions of SAT2/XIV into the Middle East from East Africa
• New samples tested from Türkiye linked to cases in Iraq
• Vaccine trial (SAT2-Eri-98 and SAT2-Zim-83) in cattle conducted recently at Pirbright (funded by UK Defra and BI)
North Africa: Unexpected emergence of SAT2/V in Algeria

- Sequences/samples shared by ANSES
- Associated with FMD outbreaks in cattle (December 2023)
- Characterised as SAT2/V
- Last detected in West Africa in 1991

### SAT2/V real-time RT-PCR is under development

<table>
<thead>
<tr>
<th>Field virus</th>
<th>SAT 2 Eri-98 (BI)</th>
<th>SAT2 ZIM-83 (BI)</th>
<th>SAT2 Oman 2015 (BB)</th>
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<td>Heterologous titre ($\log_{10}$)</td>
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<td>Heterologous titre ($\log_{10}$)</td>
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<td>ALG/4/2023</td>
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<td>0.70</td>
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<td>ALG/6/2023</td>
<td>1.59</td>
<td>0.72</td>
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Emergence of foot and mouth disease virus, serotype O, Europe–South America topotype in Egypt, 2022

Mohamed A. Soltan, Mohamed M. Mahmoud, Yamen Hegazy, Mohamed M. Abd-Eldiam

First published: 09 June 2022 | https://doi.org/10.1111/tbed.14612 | Citations: 1

From where and how introduced?

Will they persist and cause problems?

Vaccines used in Europe and Asia not often tested for efficacy against S American field viruses. Thanks to PANAFTOSA for sending viruses to WRLFMD for matching tests.

Molecular detection and phylogenetic analysis of newly emerging foot-and-mouth disease virus type A, Lineage EURO-SA in Egypt in 2022


Batch: WRLFMD/2022/00090
Long distance spread of FMD

Cattle density map, Robinson et al., 2007

Long distance (trans-pool) FMDV movements (since 2015)

- Related to strain prevalence/emergence at source and transmission opportunities, new and old
- Impact/change regional FMD risks for FMD free and endemic countries and vaccine selection
Risks for Transboundary Spread

Readiness for an exotic incursion?
- Vaccine supply (banks)
- Decision to vaccinate
- Diagnostic coverage

Animal products: especially illegal movements

Probability = risk x frequency

Millions of passengers travel between FMD-endemic and free countries every year

Figure A-1: Livestock trade and disease outbreaks

Note: Data on the annual number of livestock heads traded sourced from FAOSTAT. Data on livestock disease outbreaks calculated from FAO’s EMPERS-I database. The EMPERS-I database records animal disease data from 2004 onwards.

People: farm workers, tourists, military

Wild animals: wild pigs and deer

Bioterrorism:
Current and future trade in livestock products

D. Enahoro (1)*, S. Bahta (2), C. Mensah (1), S. Ololo (2) & K.M. Rich (2)

Fig. 3

Exports of major livestock products by region (2009-2019), million tonnes. Data source: (16)

Fig. 5

Imports of major livestock products by region (2009–2019). Data source: (16)
The PRAGMATIST tool for regional/national vaccine prioritisation and vaccine bank managers

Vaccine Antigen Prioritisation: Europe
July 2021

PRAGMATIST: A tool to prioritize foot-and-mouth disease virus antigens held in vaccine banks

1. Define source risks
2. Review source viruses
3. Review vaccine matching
4. Select vaccines

NB: Analyses uses best available data, however there are gaps in surveillance and vaccine coverage data

Viral lineages:
- 40%
- 0%

Risk Profile:
- Vaccine Coverage:
  - O-TUR/5/2009 [HIGH]
  - O-3039 [HIGH]
  - O1-Manisa [HIGH]
  - O1-Campos [HIGH]
  - O-SFR/1863 [LOW]
  - O-SKR/7/2010 [LOW]
  - O-TAW/98 [LOW]

- A22 Iraq [HIGH]
- A-Iran-05 [HIGH]
- A-G-VII [HIGH]
- A-Entereia 98 [MEDIUM]
- A-Malaysia 97 [HIGH]
- A-SAU 95 [LOW]
- A-TUR/2006 [HIGH]

- Asia1-Shamir [HIGH]
- SAT 1 Rho/78 [MEDIUM]
- SAT2-ZIM [MEDIUM]
- SAT 2 Entereia 3218 [HIGH]

Insufficient Data:
- A24 Cruzeiro [LOW]
- C1 Oberbayern [LOW]
- SAT2 SAU [HIGH]
- SAT3 ZIM 2/83 [LOW]

Annual Lab Network Task
Trade and risk experts
WRLFMD
Bank Managers
Vaccination regime
Vaccination potency
Antigenic match
Vaccination coverage

www.pirbright.ac.uk
Table 1: Proposed changes to the conjectured relative prevalence of circulating FMD viral lineages in each Pool.

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</table>

\(^1\) Includes cases due to the emerging O/ME-SA/SA-18 lineage that has been recently detected in Pools 2 and 3.
Estimating cross-protection

Heterologous VNT can predict protection in a potency test

But multiple variables can affect this association
Broad immunogenic spectrum of monovalent and trivalent foot-and-mouth disease virus vaccines containing O1 campos, A24 cruzeiro and A Argentina 2001 strains against circulating viral lineages in cattle and pigs

Viviana Melirat, Cecilia Caldevilla, Sabrina Cardillo, Ana María Espinoza, Sabrina Galdo Novo, Ana Taffarel, Melanie Barrios Benito, Ingrid E. Bergmann
Opinion piece co-authored by:

- FAO
- EuFMD
- WOAH
- Network Laboratories (free and endemic)
- Vaccine companies
Further information......

- FMD reports and lab testing ([https://www.wrlfmd.org/ref-lab-reports](https://www.wrlfmd.org/ref-lab-reports))
  - Genotyping reports, Vaccine matching and Serotyping reports

- Other data sources:
  - Quarterly WRLFMD/EuFMD report ([https://www.wrlfmd.org/ref-lab-reports](https://www.wrlfmd.org/ref-lab-reports))
Acknowledgements

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- Support for the WRLFMD and research projects