



Global Update

EuFMD Exec. Committee

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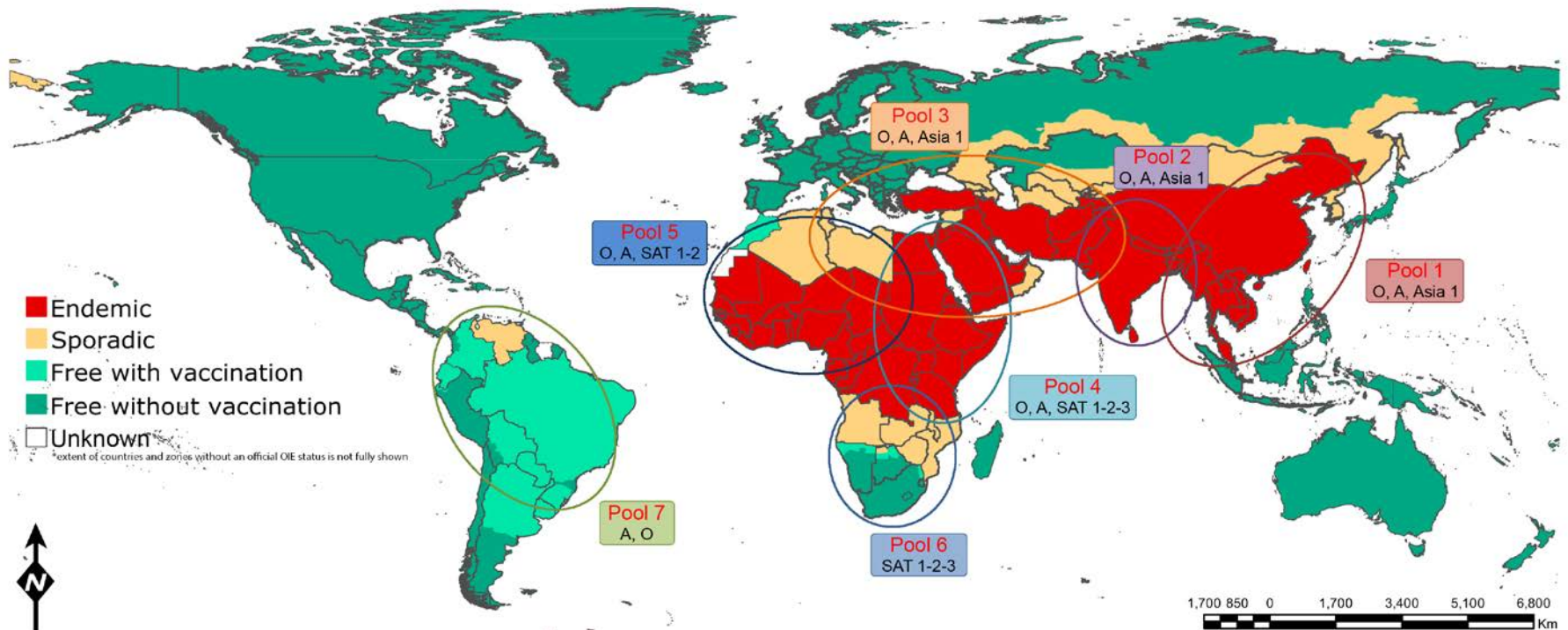


Department
for Environment
Food & Rural Affairs



FMD: Summary and conjectured global status

- Seven FMDV serotypes
- Seven endemic pools requiring tailored diagnostics and vaccines



- No reported FMD outbreaks in South America (> 4 years)
- No outbreaks due to serotype C (>10 years)
- New FMD-free zone (without vaccination) established in northern Kazakhstan and **Russian Federation**

Recent submissions to WRLFMD Pirbright

Since last EuFMD Exec. Comm. (Hague, March 2016)

Reports for:

Botswana, Cambodia, Egypt, Ethiopia, Hong Kong SAR, Iran, Israel, Kuwait, Laos, Malawi, Mauritius*, Mozambique, Myanmar*, Namibia, Nepal, Palestine, Pakistan, Saudi Arabia, South Korea, Sudan, Thailand, Turkey, UAE, Zambia, Zimbabwe
(25 countries)

**via sequence exchange*

Results pending for:

Afghanistan, Malaysia, Mauritius

Arranging shipments:

Guinea Bissau, Nigeria (?), Vietnam (and increased efforts elsewhere in West Africa)

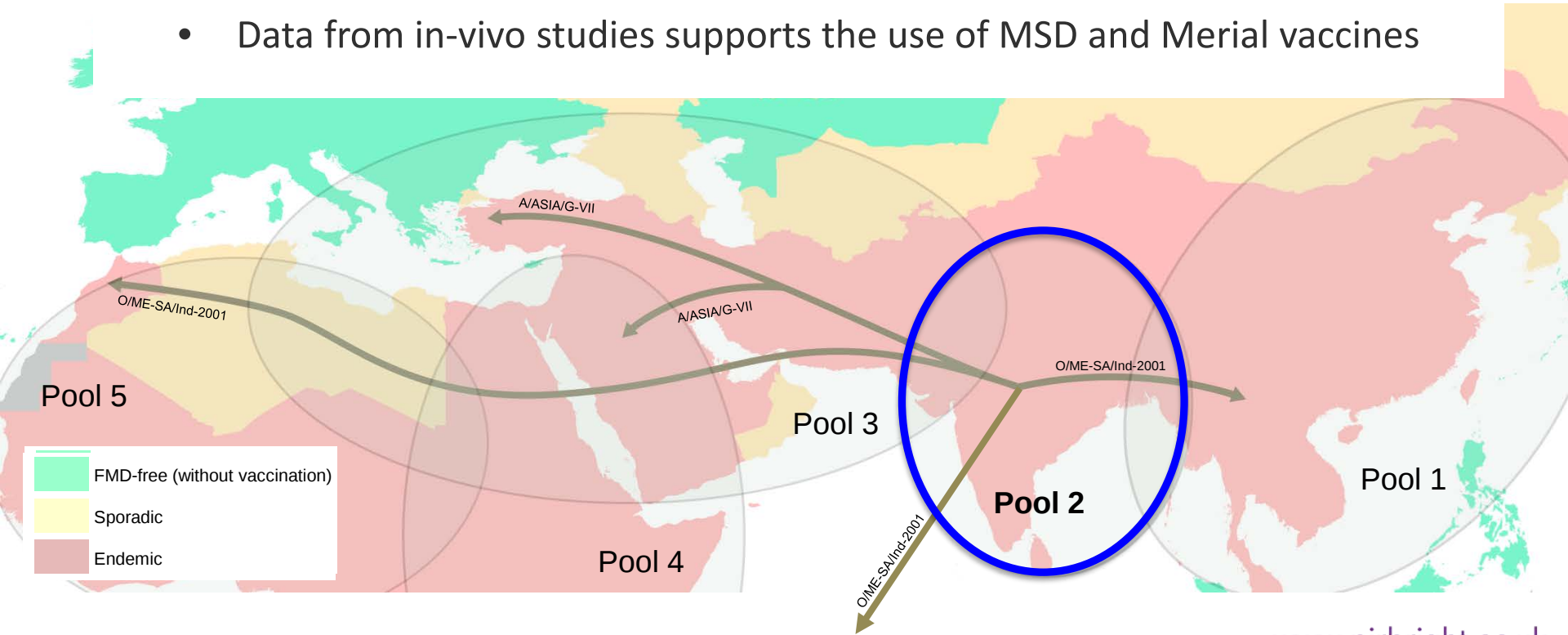
Long-distance “trans-pool” movements

- **A/ASIA/G-VII**

- Maintenance of FMD-free buffer-zone in Thrace dependent upon locally produced vaccine in Turkey (previous incursions in 2006 and 2010)
- Current gap in the availability of vaccines from Merial or MSD

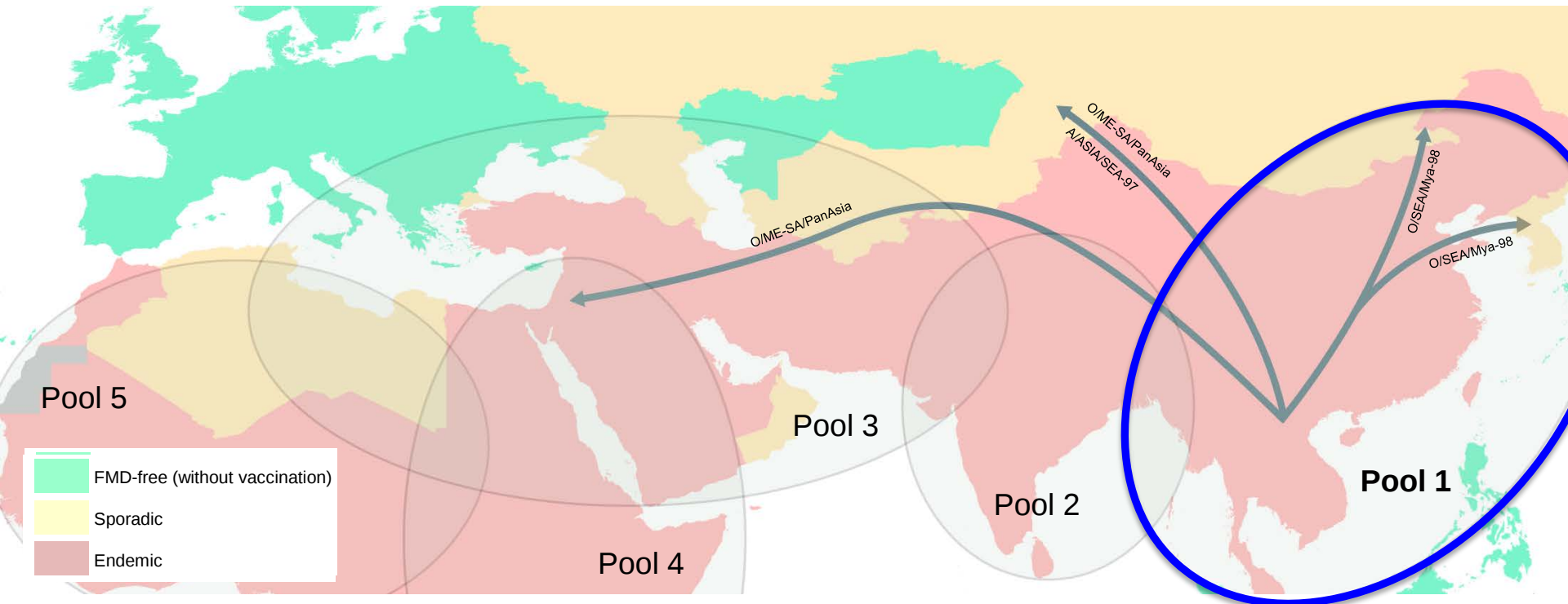
- **O/ME-SA/Ind-2001**

- Multiple “escapes” from the Indian subcontinent
- Expanding range of this lineage
- Data from in-vivo studies supports the use of MSD and Merial vaccines



Long-distance “trans-pool” movements

- **O/SEA/Mya-98** outbreaks in East Asia
 - continued “events” in Korea
- **O/ME-SA/PanAsia** reported in Israel and PAT
 - Sequence data shows close relationship to FMD viruses found in East Asia (Vietnam and China)

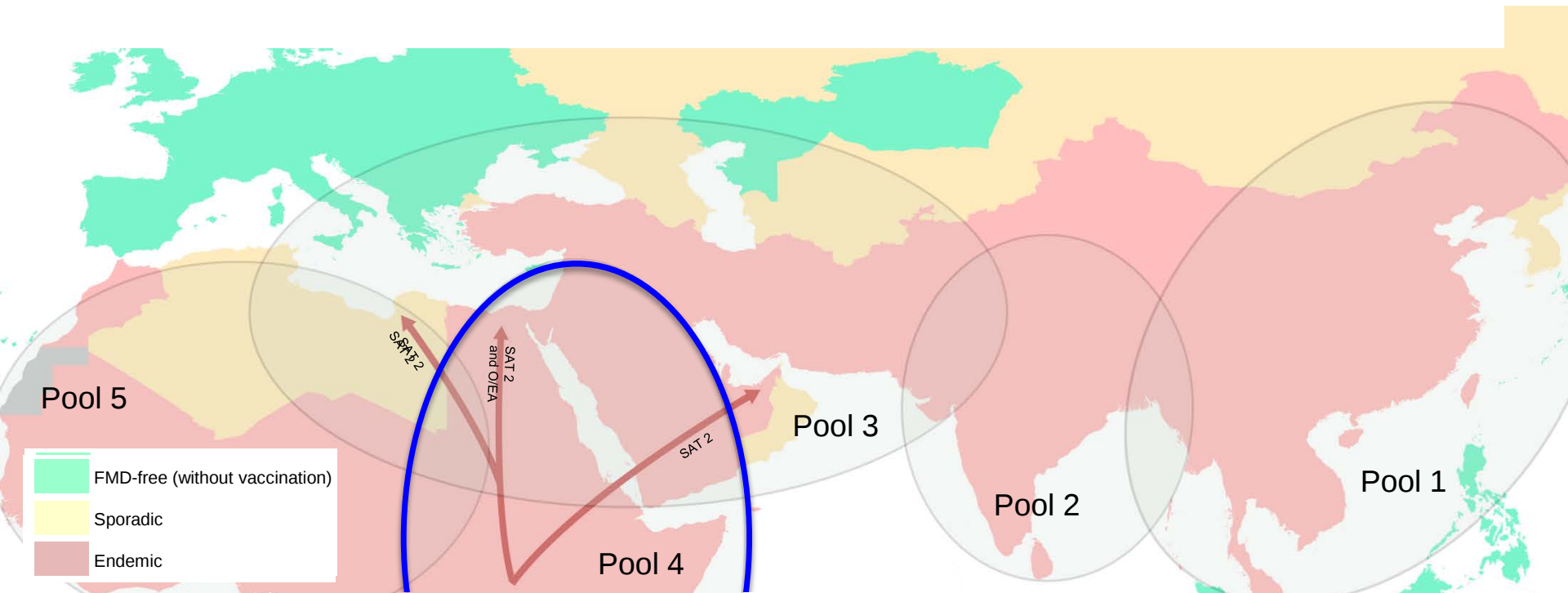


Long-distance “trans-pool” movements

- **SAT 2 (topotype VII)**
 - 2015 – outbreaks in Oman
 - Continued cases in Egypt

Other recent samples (2015/16) in Egypt...

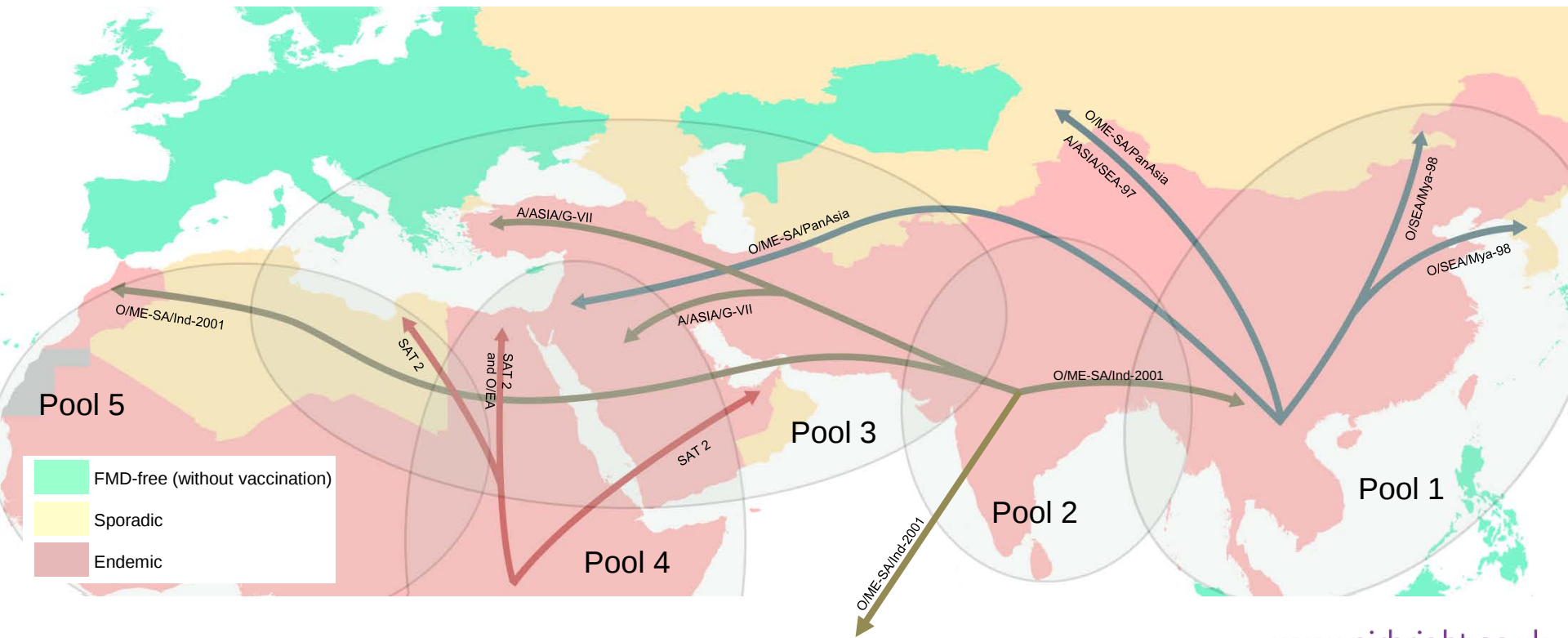
- **A/AFRICA/G-IV** (most related to FMD virus from Ethiopia in 2015)
- **O/EA-3** (most closely related to FMD virus from Sudan in 2013)



Long-distance “trans-pool” movements

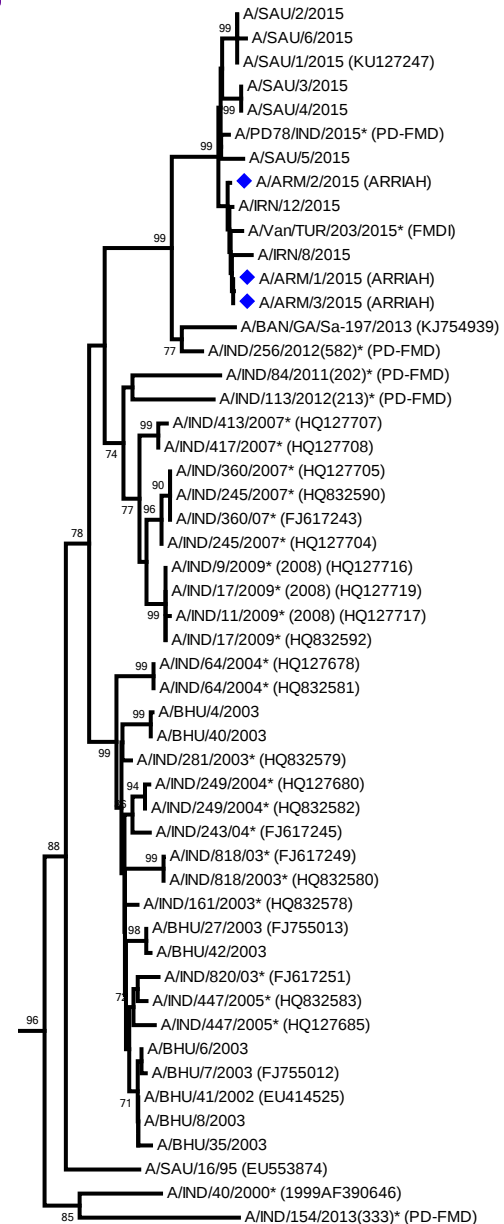
Why now?

- Probably no single factor that underpins these dynamic transboundary patterns;
- although these long distance and rapid movements of FMDV are probably exacerbated by the **escalation of regional political crises**, and **migration of people** in North Africa and the Middle East.

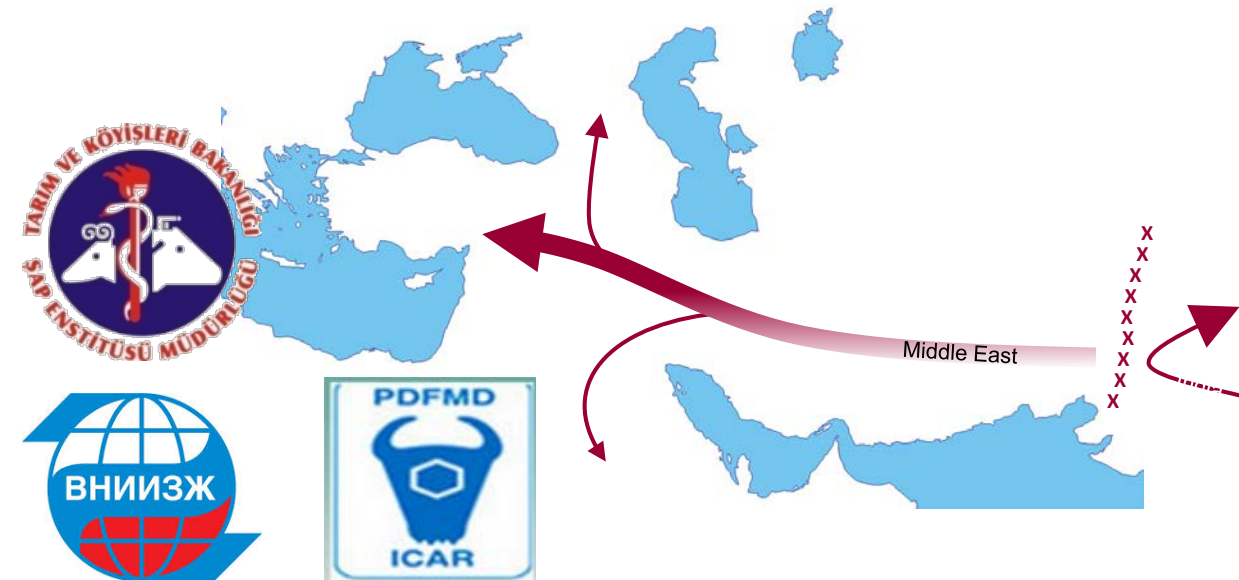


New serotype A outbreaks in West EurAsia (A/ASIA/G-VII)

- Initial reports September 2015
- **Saudi Arabia, Turkey, Iran, Armenia**
- Originating from the Indian sub-continent
- Impact upon vaccination?



G-VII (G-18)



A/ASIA/G-VII

Poor in-vitro match to many commercial vaccines

Vaccines

Recent r-values:	A/SAU/1/2015	A/SAU/2/2015	A/IRN/8/2015	A/IRN/12/2015
A-Iran-05	0	0	0	0
A-Iran-87	0	0.04	nd	nd
A-Iran-96	0.04	0.06	nd	nd
A-Iran-99	0.01	0.01	nd	nd
A-Sau-95*	0.20	0.19	0.26	0.16
A-22	0.11	0.11	0.13	nd
A-Tur-20-06	0.03	0.06	0.01	0.15
A-May-97	0.14	0.23	0.15	0.23
A-Tur-11	0.01	nd	0.10	0.04
A-Tur-14	0	nd	0	0
A-IND-40-2000*	0.26	nd	0.03	0.24

* Multiple BVS tested

A/ASIA/G-VII (G18) – vaccine trial

- Monovalent vaccines not available from Merial
- Polyvalent vaccine
 - O-3039, O-Manisa, O-PanAsia-2, A-Iran-05, **A-Sau-95**, Asia-1, SAT 2
- PPG format
- Challenge at 21 dpv with A/IRN/2015
- Serological and clinical data analysed in context of detailed information obtained from field cases in Saudi Arabia

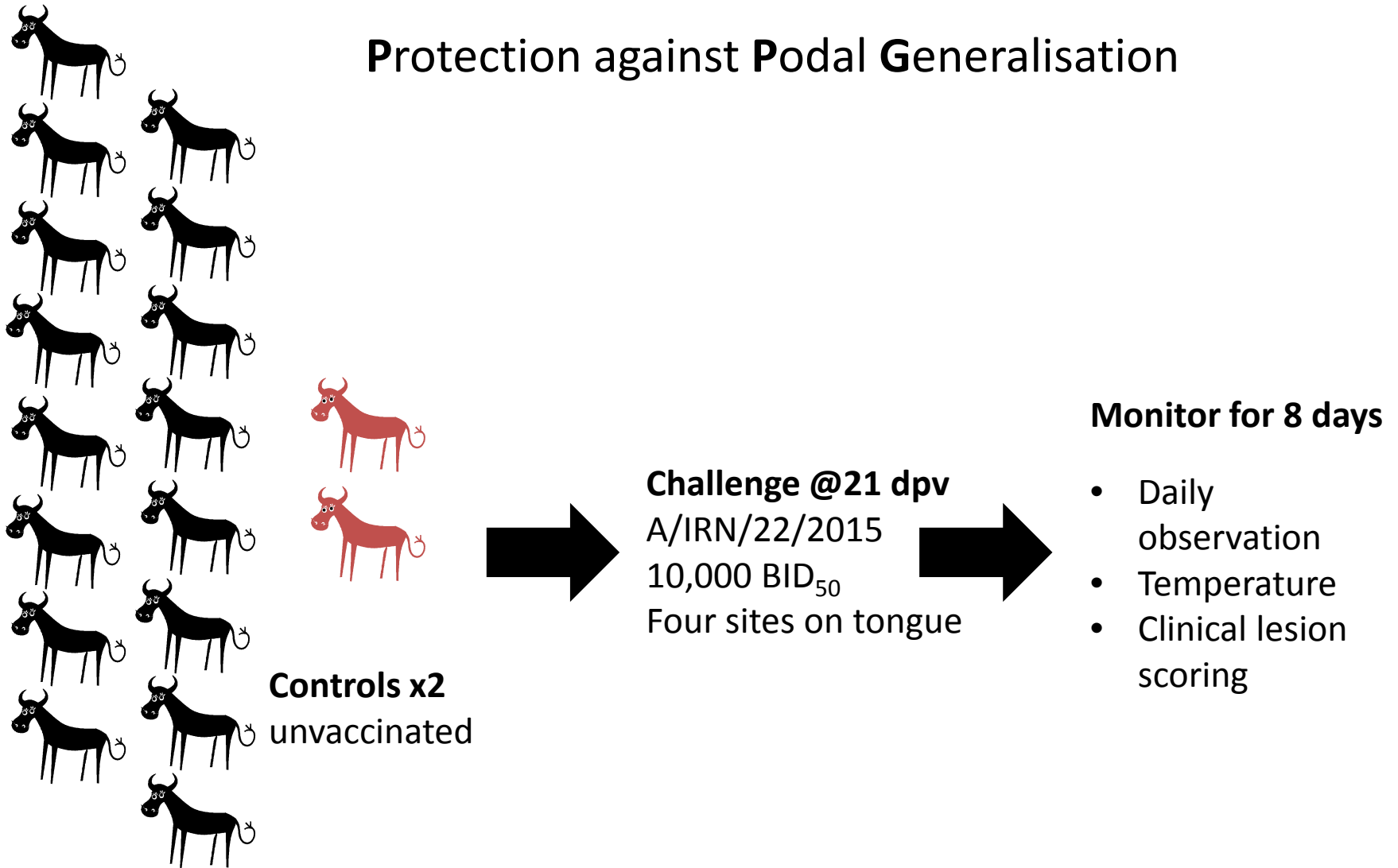


Funded by:



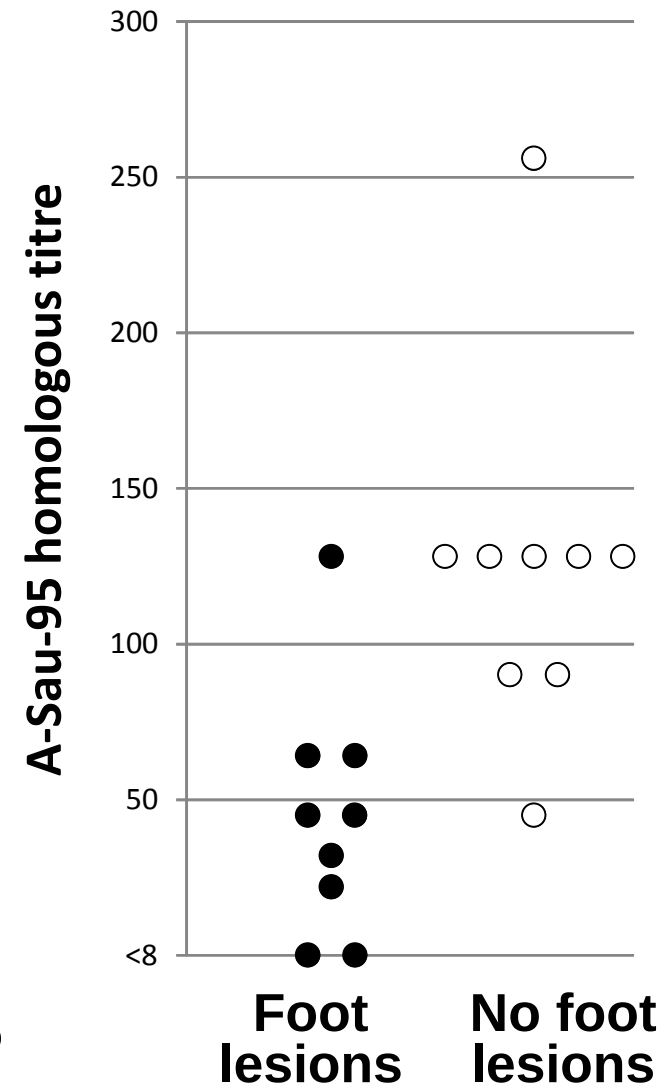
PPG Study Design

Protection against Podal Generalisation



TPI Vaccine trial (summary of results)

- Both control animals developed foot lesions
- 7/16 vaccinates developed foot lesions
- Only 56% protection from generalisation
- A-Sau-95 titres (measured by VNT) correlated with protection
- Use of vaccine in endemic settings where animals are multiply-vaccinated
- Despite satisfactory heterologous titres, cases still occurred in up to 20% of animals in affected groups



Planned pilot vaccine trial and other priorities

(with CSIRO (Australia) and CVI (Lelystad))

- Current gap and vulnerability for emergency vaccination in FMD-free countries (until 2017?)
- Keep EU funding until new vaccine becomes available?
- Using available funds - plan to evaluate two vaccines
 - A22 and A/May/97
 - Pilot study design (n=5) for each vaccine and control group
- **Post-vaccination monitoring of animals in Turkish Thrace?**

Vaccines	Recent r-values:	A/SAU/1/2015	A/SAU/2/2015	A/IRN/8/2015	A/IRN/12/2015
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O/ME-SA/Ind-2001



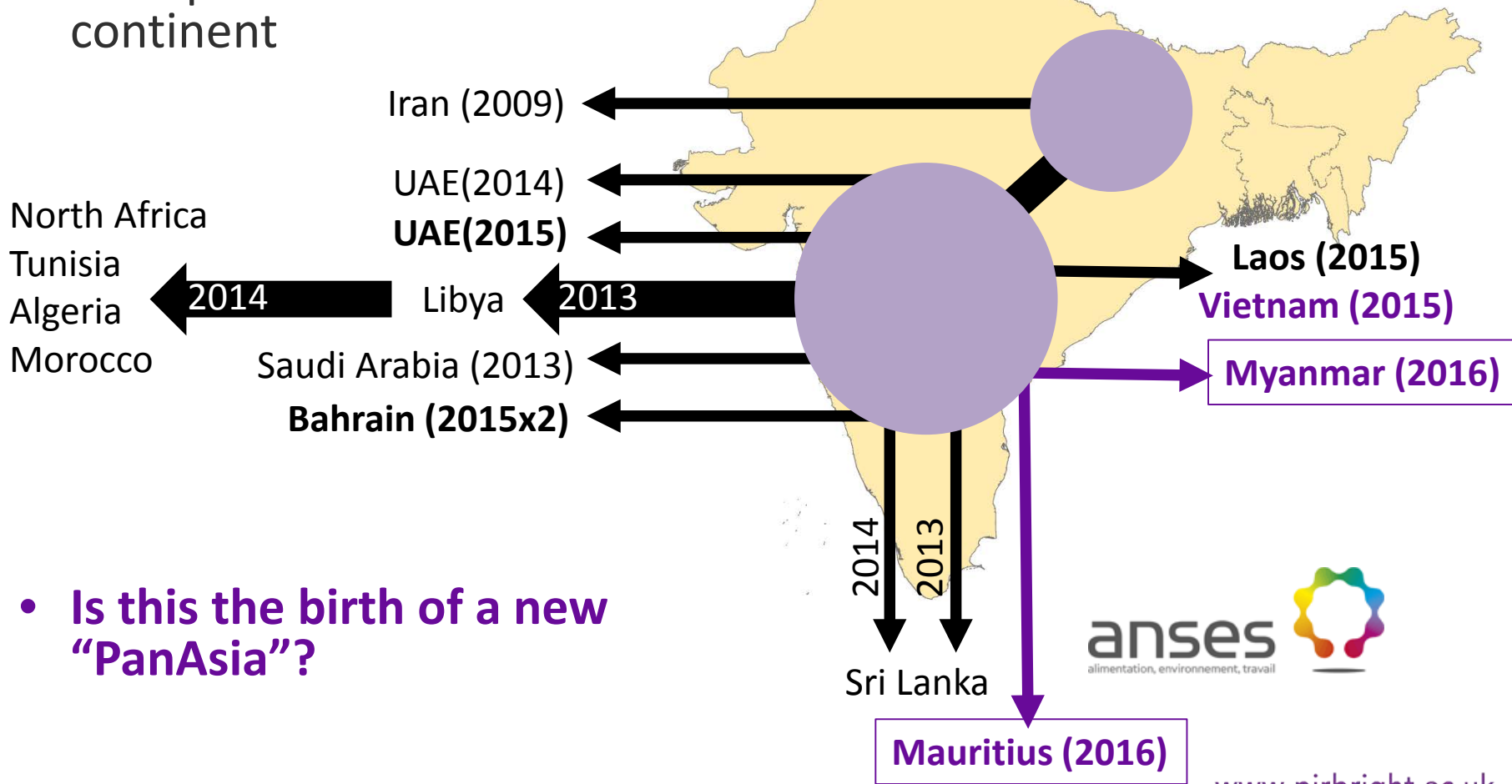
परियोजना निदेशालय खुर पका मुँह पका रोग
Project Directorate on Foot and Mouth Disease



Istituto Zooprofilattico Sperimentale
della Lombardia e dell'Emilia Romagna



- Sequence data indicates that there have been multiple “escapes” from the Indian sub-continent

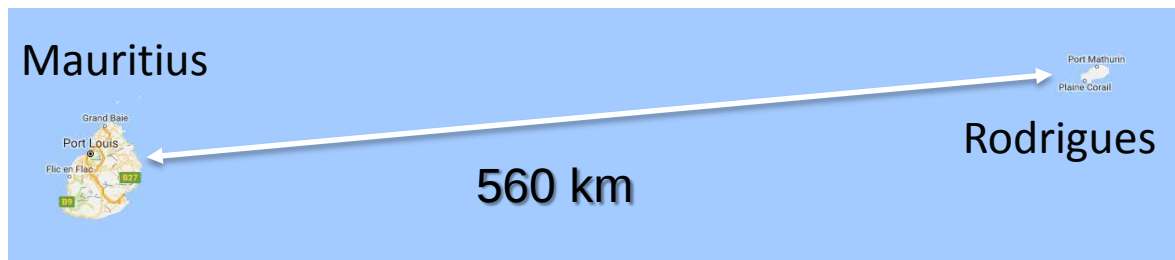


- Is this the birth of a new “PanAsia”?



O/ME-SA/Ind-2001 in Mauritius

- Started in 7th July 2016
- Initial cases on the Island of Rodrigues
- Cases on the Island of Mauritius
 - via importation of cattle
- >150 reported outbreaks
- Reports of delayed local diagnosis
- Appears to be genetically distinct to cases elsewhere in the Gulf States, North Africa or SEA
- Data from PD-FMD indicates that these sequences are most closely related to samples from Nepal (2015/16), rather than India (2012)



Vaccine Bank Recommendations (September 2016)

High Priority

A/ASIA/G-VII(G-18)*

O Manisa

O PanAsia-2 (or equivalent)

O BFS or Campos

A24 Cruzeiro

Asia 1 Shamir

A Iran-05 (or A TUR 06)

A22 Iraq

SAT 2 Saudi Arabia (or equivalent i.e. SAT 2 Eritrea)

Medium Priority

A Eritrea

SAT 2 Zimbabwe

SAT 1 South Africa

A Malaysia 97 (or Thai equivalent such as A/Sakolnakorn/97)

A Argentina 2001

O Taiwan 97 (pig-adapted strain or Philippine equivalent)

Low Priority

A Iran '96

A Iran '99

A Iran 87 or A Saudi Arabia 23/86 (or equivalent)

A15 Bangkok related strain

A87 Argentina related strain

C Noville

SAT 2 Kenya

SAT 1 Kenya

SAT 3 Zimbabwe

*Recent in-vitro data from WRLFMD for serotype A viruses from Saudi Arabia and Iran highlights an apparent gap in vaccine coverage. Work is urgently required to evaluate whether there is adequate in-vitro match with Indian vaccine strains (A/IND/40/2000) or whether in-vivo protection may be provided by high potency international vaccines.

Training and Missions

In-country training/missions:

- Kenya (PCR diagnosis) - funded by EuFMD
- Thailand (Ag-ELISA) – funded by OIE
- Saudi Arabia (Milk PCR) – funded by TPI
- Tanzania (Sequencing) – funded by Wellcome Trust
- Tanzania (pen-side tests) – Funded by Japanese Gov.
- Ethiopia (case investigation) – OIE Twinning Project



Tanzania– September 2016

Lab training at Pirbright

- Botswana – PCR and sequencing – May 2016
- FMD Laboratory Diagnostics - November 2016 and May 2017

E-Learning courses (Available modules)

- Module 1_Clinical Diagnosis of FMD
- Module 2_Pathogenesis and Spread of FMD
- Module 3_Ageing of FMD lesions

Meetings

NRL Workshop

- Feedback on PTS
- Participatory exercise to evaluate risks to Europe

EuFMD Open Session

OIE/FAO FMD Laboratory Network

- MoU drafted and agreed by partners
 - awaiting feedback from OIE and FAO
- Next meeting ANSES, Paris in Nov-Dec 2016
 - WRLFMD/EuFMD funded participants from Turkey, Kenya, Nigeria and Senegal



Sunningdale, UK – May 2016



Brussels, Belgium – November 2015

Acknowledgements

- Support for the WRLFMD and research projects
- Collaborating FMD Reference Laboratories and field teams
- Partners within the OIE/FAO FMD Lab Network



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Batch: WRLMEG/2016/00016
(supplementary)

Software: MEGA 6.08

Analysis

Analysis ————— Phylogeny Reconstruction

Scope All Selected Taxes

Statistical Method ——— Neighbor-joining

Phylogeny Test

Test of Phylogeny ——— Bootstrap method

No. of Bootstrap Replications — 1000

Substitution Model

Substitutions Type ——— Nucleotide

Model/Method ————— Kimura 2-parameter model

Substitutions to include ——— d: Transitions + Transversions

Rates and Patterns

Rates among Sites ————— Uniform rates

Pattern among Lineages ——— Same (Homogeneous)

Data Subset to Use

Gaps/Missing Data Treatment — Pairwise deletion

Codons Included _____

No. of Sites : 642

No Of Bootstrap Reps = 1000

Only bootstrap values of 70%

*, not a WRLFMD Ref. No.

N.J. Knowles, J. Wadsworth & K. Bachanek-Bankowska,
28 August 2018

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