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Global FMD Surveillance Report

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Department
for Environment
Food & Rural Affairs



FMD Reference Laboratory



WRLFMD: Our history....

World Foot-and-Mouth Disease Reference Laboratory

In connection with the action taken by FAO in appointing the Research Institute, Pirbright, United Kingdom as a World Foot-and-Mouth Disease Reference Laboratory, it was decided that the interests of the Commission should be included. Following negotiations, the Government of the United Kingdom accepted a contribution of £250 per annum for the next two years, beginning 1958 from the Commission in recognition of the Commission's interest in the work.

50th Anniversary
May 2008

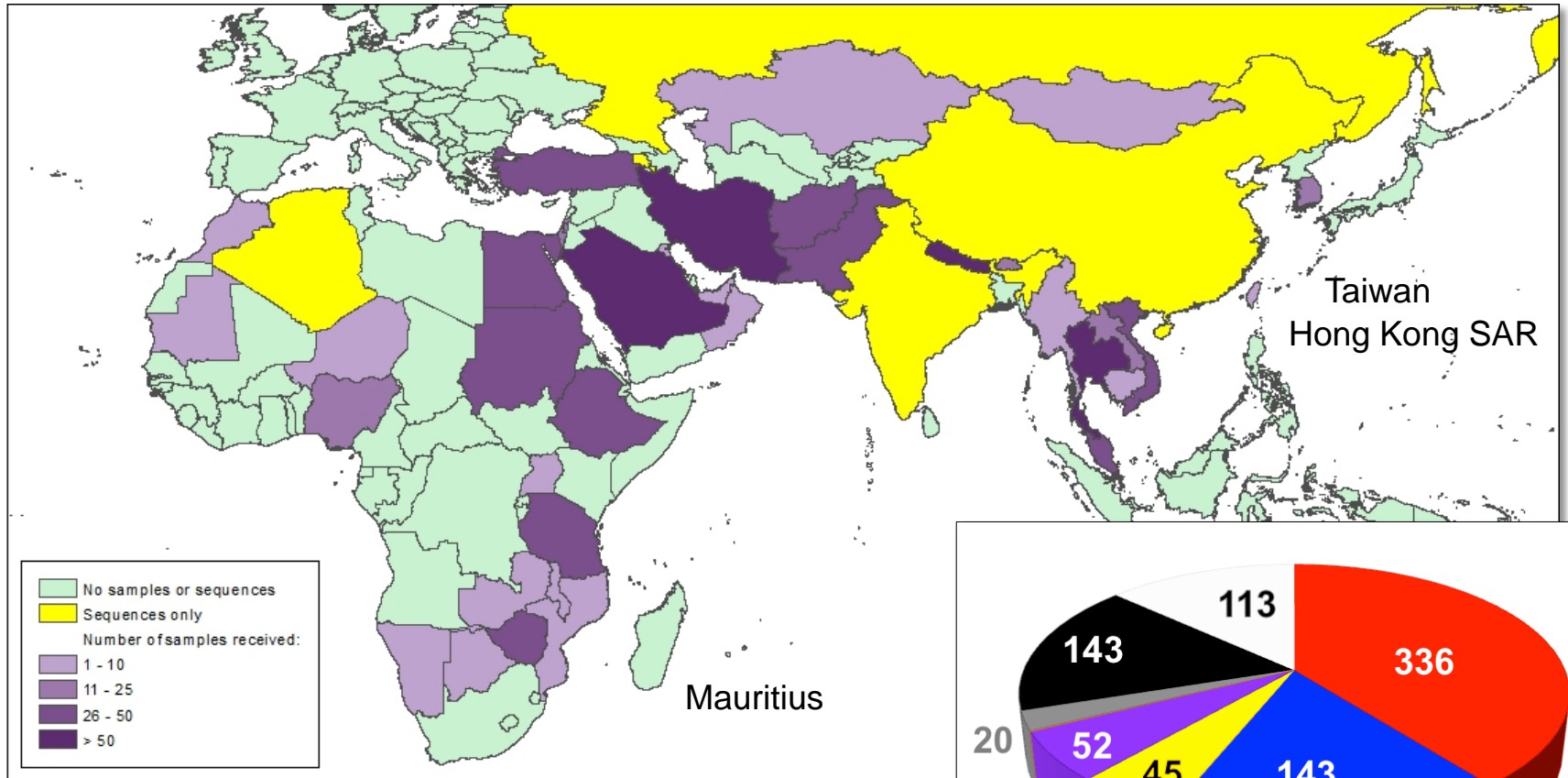


Royal Society, London, 2008

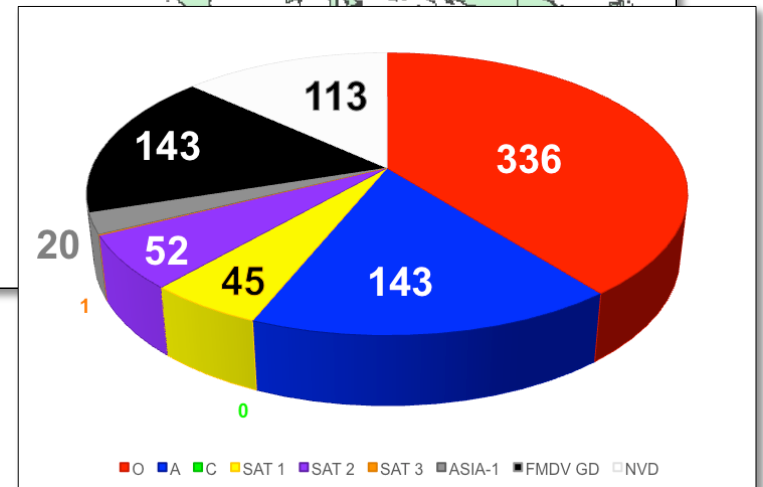
Samples and sequences received at WRLFMD

April 2015 – March 2017

853 samples



Currently processing samples from:
Algeria, Ethiopia and Iran



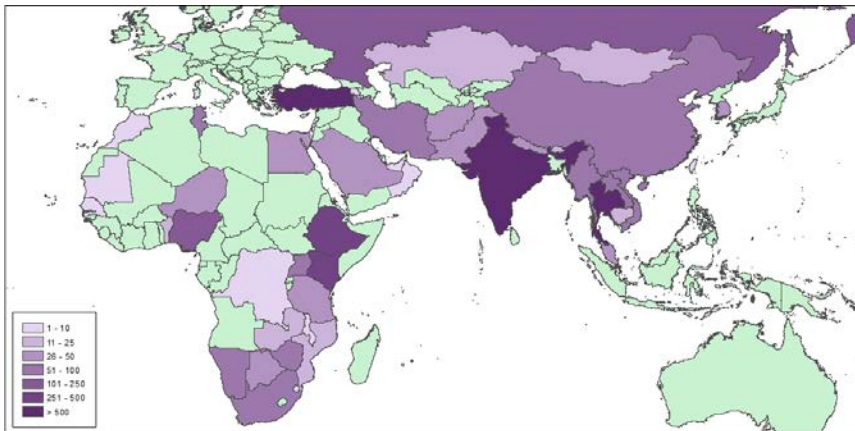
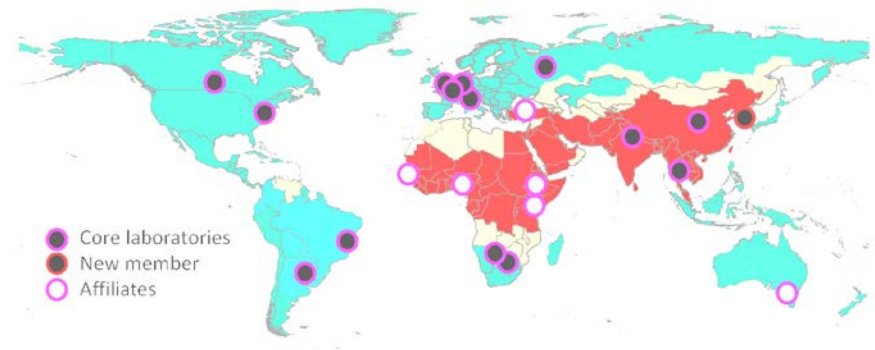
Quarterly reports and phylogenetic trees: www.wrlfmd.org

OIE/FAO FMD Laboratory Network



- **Global surveillance and changing patterns in risk pathways**
 - Priority - gaps in East and West Africa
- **Harmonised and improved lab capacity**
 - Working Groups (nomenclature and PVM)
 - Meeting reports available <http://www.foot-and-mouth.org/>

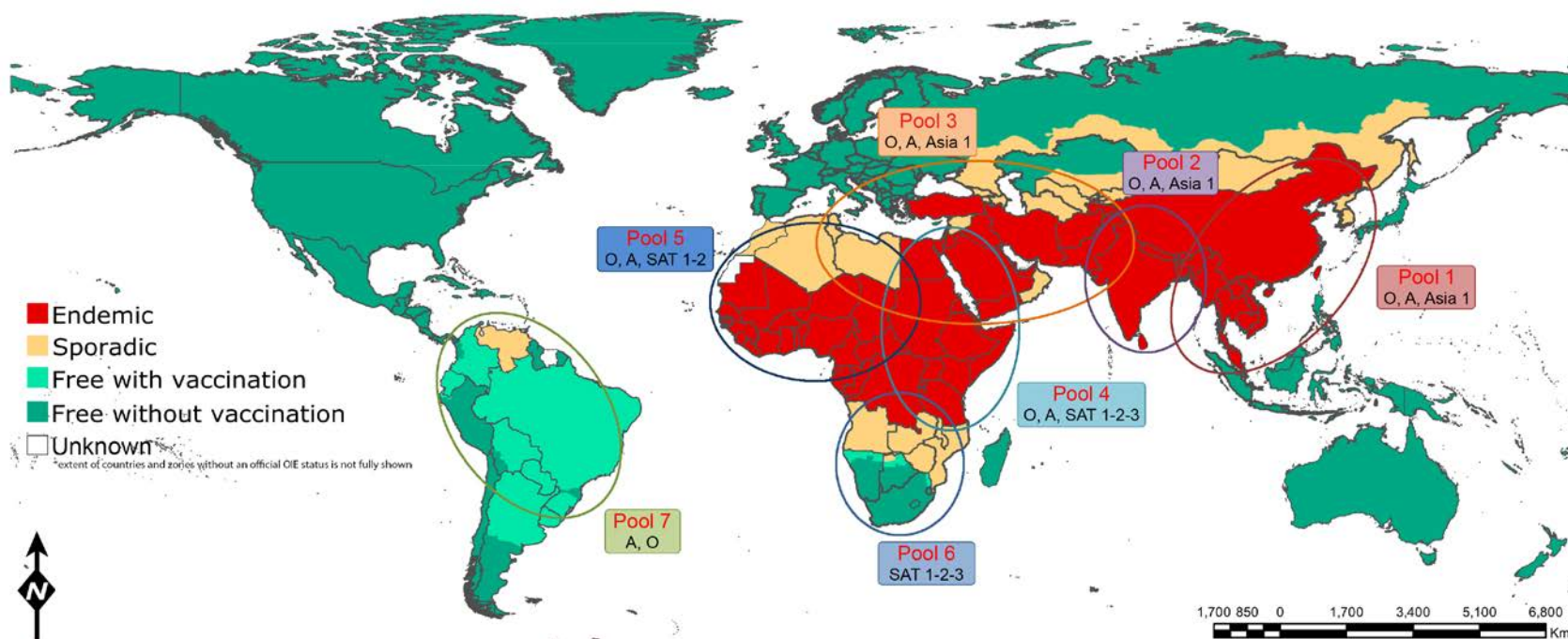
Core Network Members and affiliates:



Paris – November 2016

FMD: Headline summary and conjectured global status

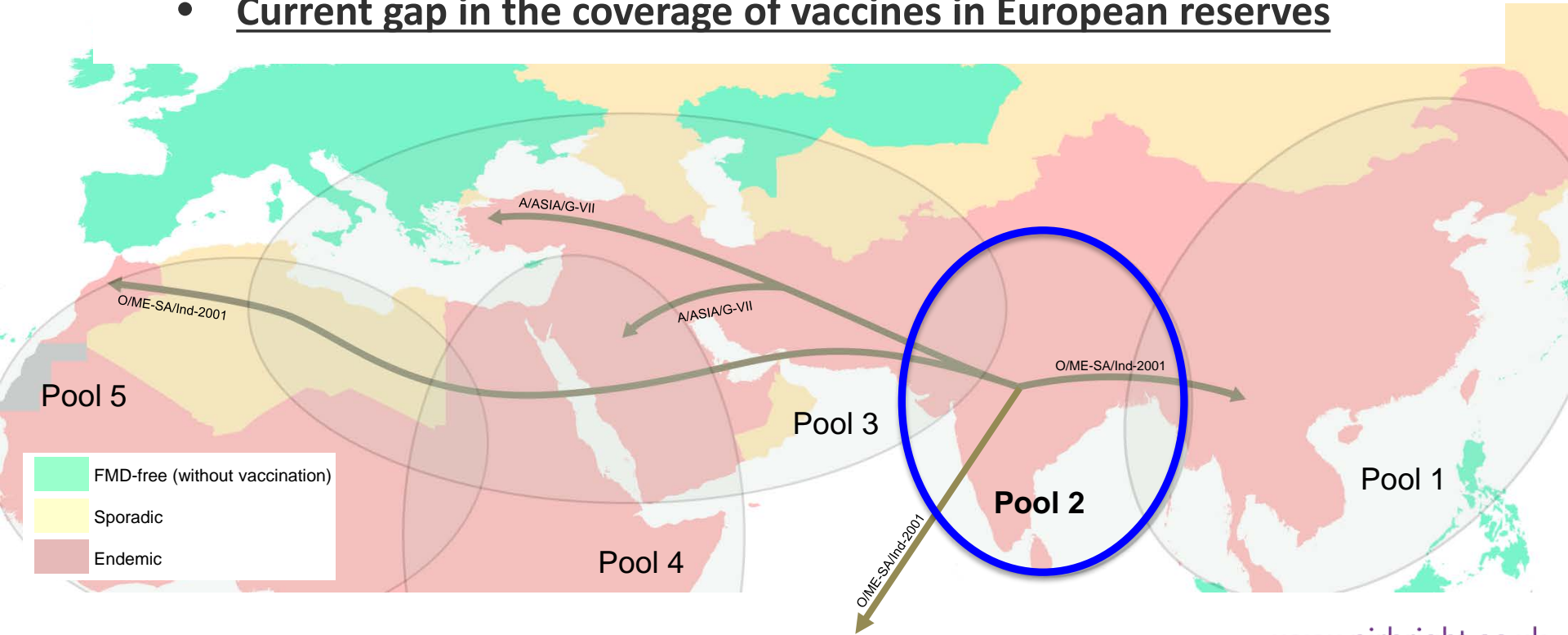
- Seven FMDV serotypes
- **Seven endemic pools** requiring tailored diagnostics and vaccines



- New FMD-free zone (without vaccination) established in northern Kazakhstan and **Russia (except a new containment zone – associated with an outbreak in October 2016)**
- No reported outbreaks in South America since **2013 (Venezuela)**
- No serotype C outbreaks since 2004

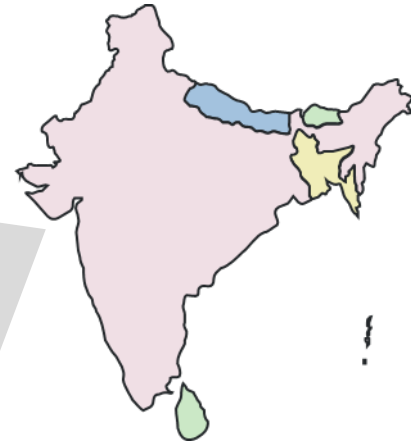
Long-distance “trans-pool” movements from Pool 2

- **O/ME-SA/Ind-2001d**
 - Emerged in 2013
 - Expanding range of this lineage (East Asia and Middle East)
- **A/ASIA/G-VII**
 - Emerged in 2015
 - Rapid spread in parts of West EurAsia
 - Current gap in the coverage of vaccines in European reserves

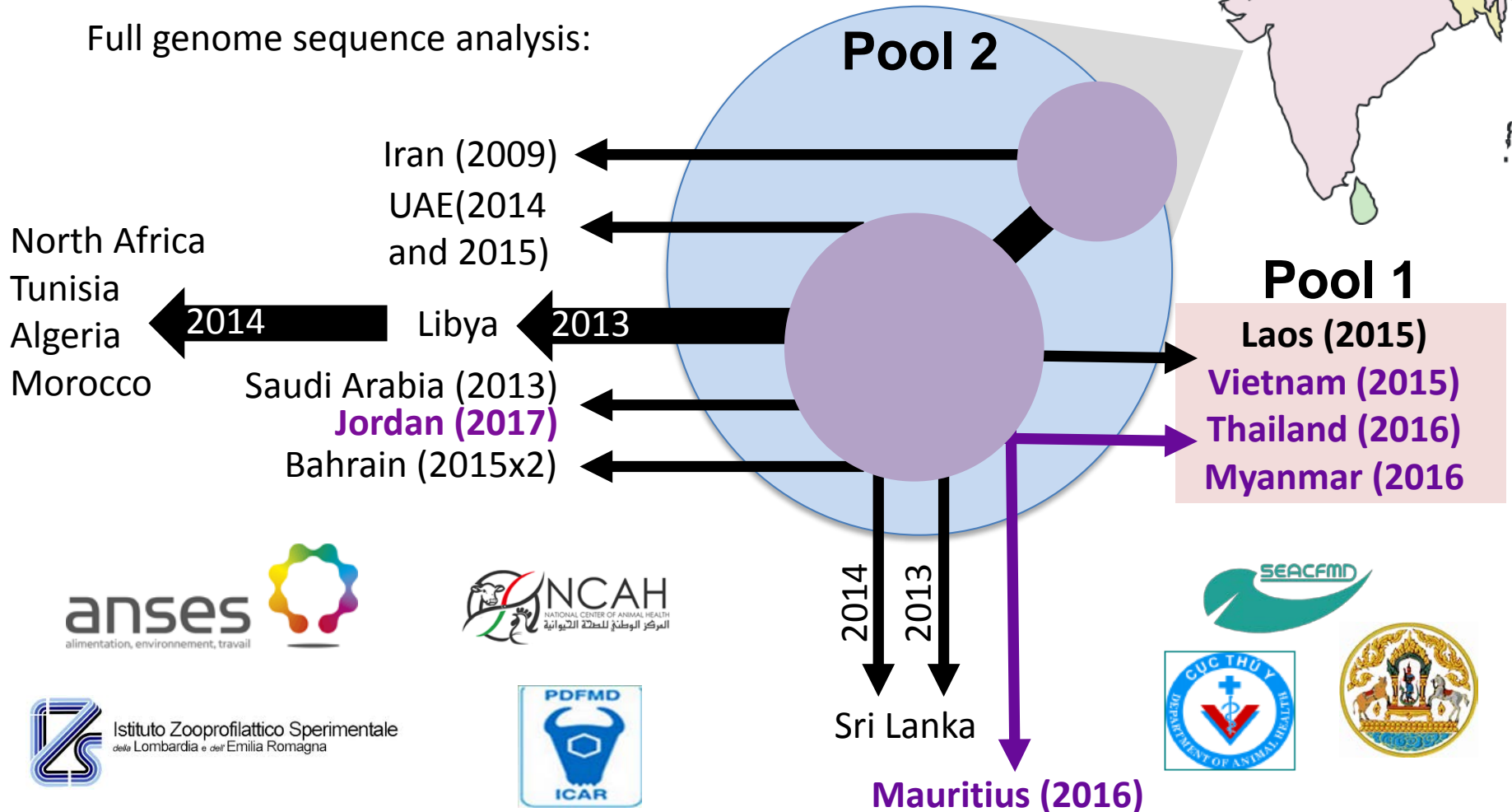


O/ME-SA/Ind-2001d: the new PanAsia?

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



Full genome sequence analysis:



O/ME-SA/Ind-2001d:

Onward transmission from POOL 1?

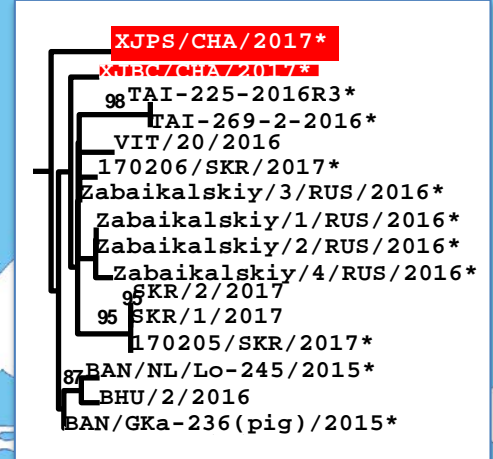
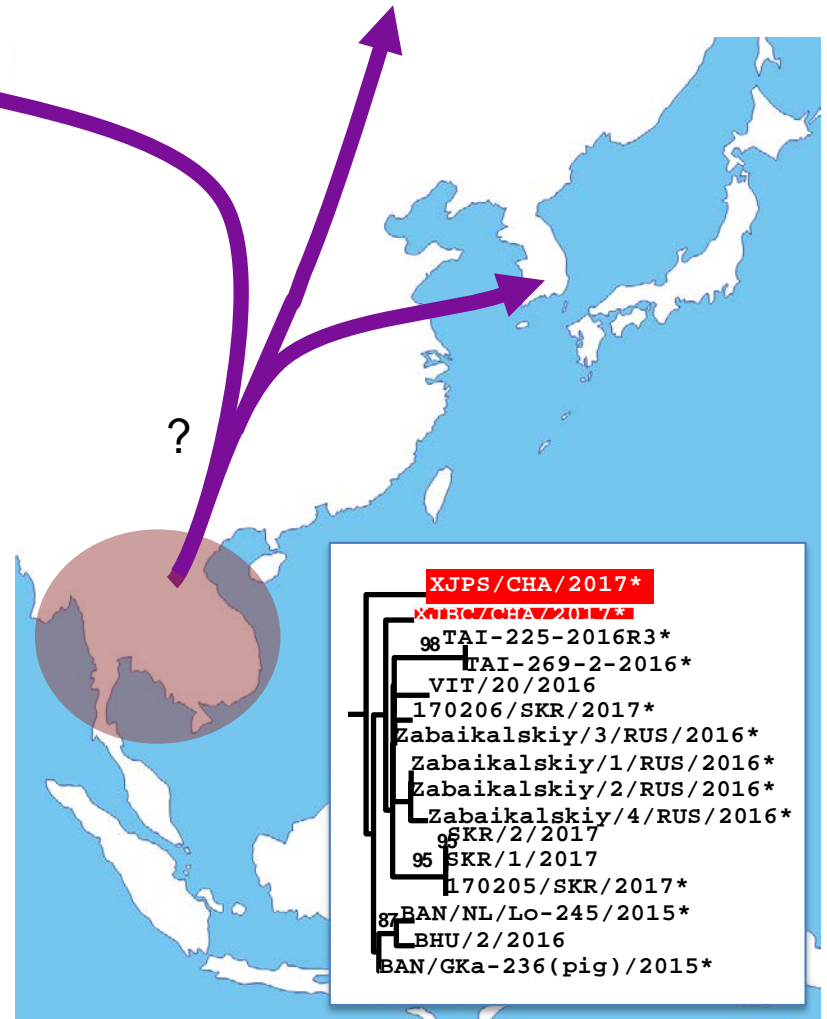
Russian Federation

- November 2016
- Three outbreaks
- Cattle
- Close to the Chinese border



Republic of Korea

- February 2017
- Eight outbreaks
- Cattle
- Other outbreaks in the country due to A/ASIA/Sea-97



Can this lineage now be found elsewhere in the East Asia region?

Reported at SEACFMD: China (Xinjiang Province in western China)

Vaccines for O/ME-SA/Ind-2001

in vitro vaccine matching:

42 field isolates from Africa, Middle East and southeast Asia:

O 3039	O ₁ Manisa	O/TUR/5/2009
Mostly matched 86%	Some Matches 33%	Almost all matched 95%

Potency testing in cattle:

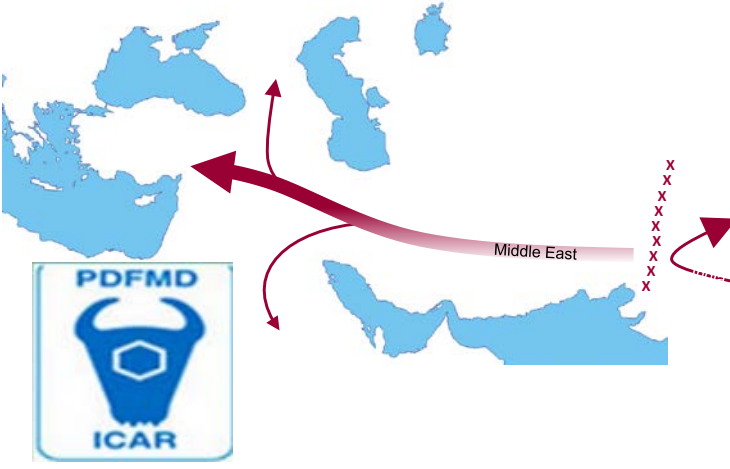
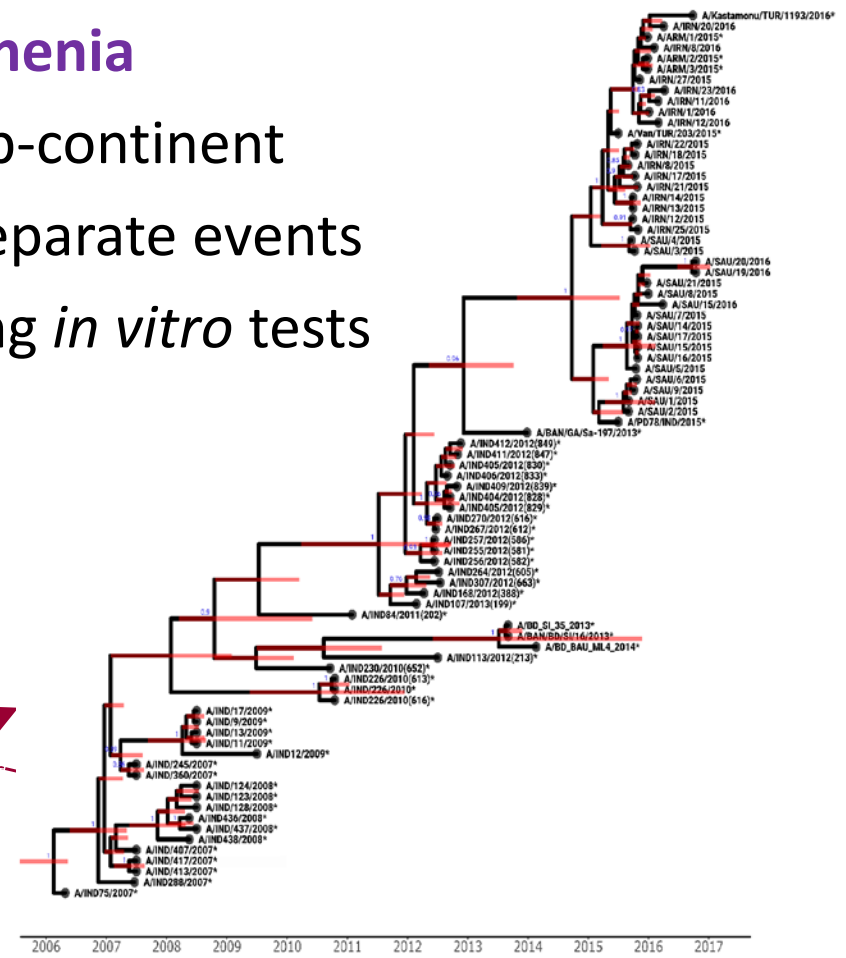
- PD50 study [CVL/WRLFMD/IZSLER]
 - O-Manisa – heterologous protection ~ 3PD₅₀
- Emergency Vaccination [CSIRO]
 - O-Manisa
 - O-3039



Many vaccine supplier use multivalent vaccines

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
 - Evidence for at least two separate events
- Very poor antigenic match using *in vitro* tests



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/IRN/25/2015
A-Iran-05	0	0	0	0	0
A-Tur-20-06	0.03	0.06	0.01	0.15	0.01
A-22	0.11	0.11	0.13	nd	0
A-Iran-87	0	0.04	nd	nd	nd
A-Iran-96	0.04	0.06	nd	nd	nd
A-Iran-99	0.01	0.01	nd	nd	nd
A-Sau-95*	0.20	0.19	0.26	0.16	nd
A-May-97	0.14	0.23	0.15	0.23	nd
A-Tur-11	0.01	nd	0.10	0.04	nd
A-Tur-14	0	nd	0	0	nd
A-IND-40-2000*	0.26	nd	0.03	0.24	nd

* Multiple BVS tested

A/ASIA/G-VII

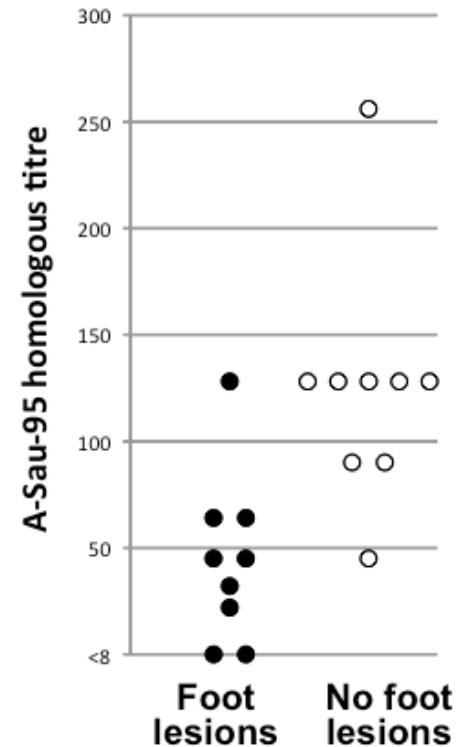
Summary of two *in vivo* vaccine/challenge experiments

April 2016:

- PPG study design
- Multivalent vaccine containing A-Sau-95 and A-Irn-05
- A-Sau-95 titres (measured by VNT) correlated with protection
- 7/16 vaccinates developed foot lesions (only **56% protection***)

December 2016:

- Pilot trial to evaluate two additional monovalent FMDV vaccines (from Merial) – A22 and A/May/97
- A22 (**28% protection**)
- A/May/97 (**72% protection***)



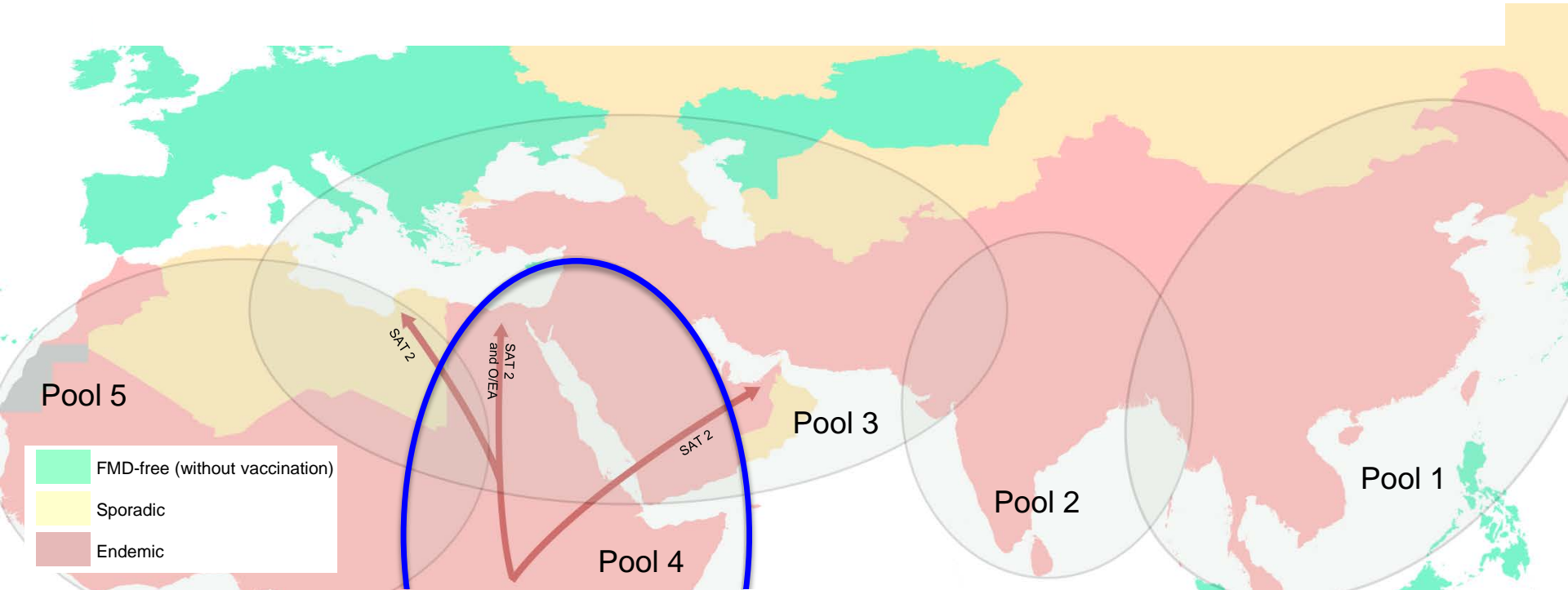
*OIE guidelines 75% is required

Long-distance “trans-pool” movements

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

More recent examples...

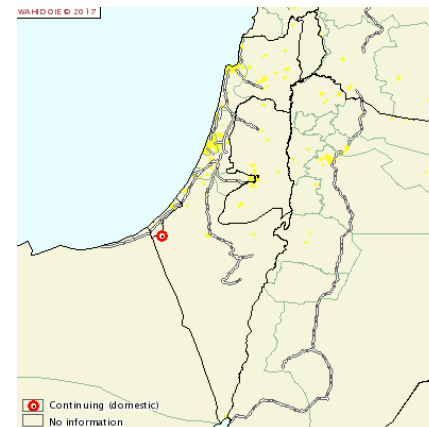
- O/EA-3 (in Egypt [2016], Palestine [2017] and Israel [2017])
- A/AFRICA/G-IV (Algeria – April 2017)



O/EA-3 moving in to the Middle East

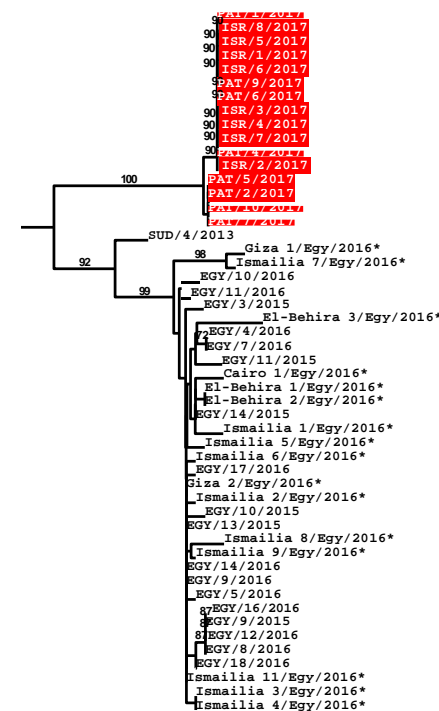
Israel/Palestine

- FMD cases in cattle in during February 2017
- Outbreaks in cattle in/close to the Gaza Strip
- Vaccine matching data:



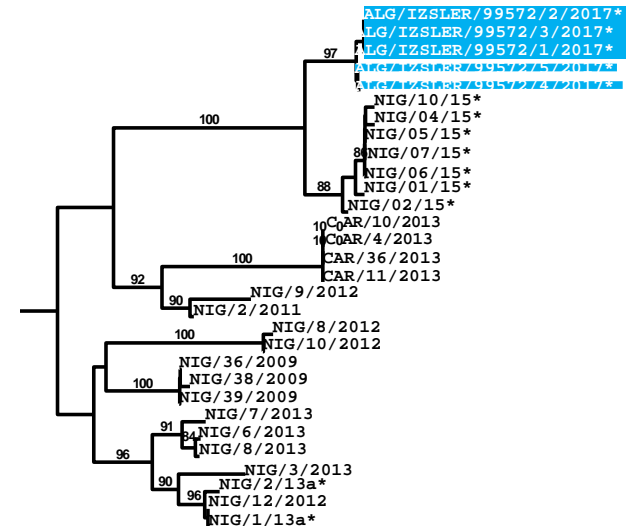
Sample	O-3039	O-Manisa	O/TUR/5/09
ETH/22/2013	0.40	0.18	0.81
ETH/3/2015	0.85	0.25	1.00
EGY/7/2016	0.27	0.35	0.11
NIG/4/2016	0.26	0.23	0.29
NIG/12/2016	0.66	0.60	0.51
NIG/19/2016	0.52	0.79	0.68
SUD/6/2012	0.38	0.22	0.35
SUD/4/2013	0.15	0.21	0.60

*Representative O/EA-3 data from different countries



Recent FMD cases in Algeria (end of March 2017)

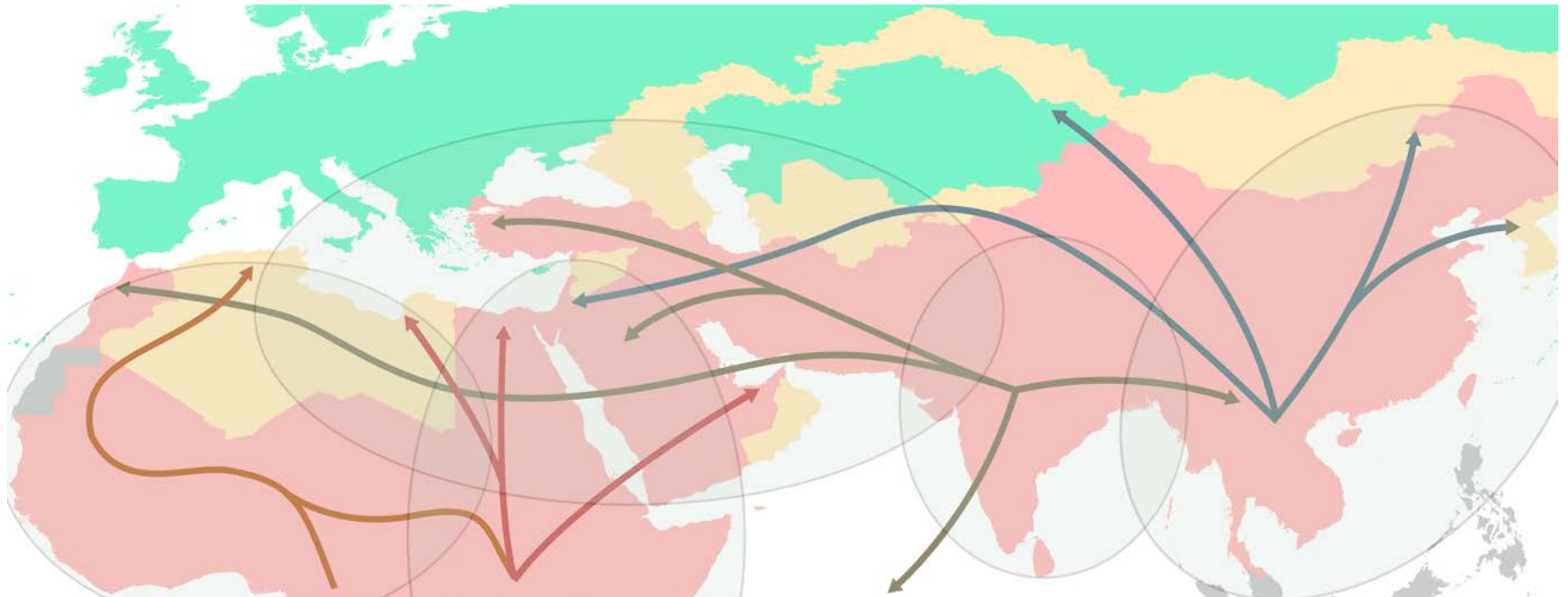
- 4 Outbreaks in cattle
- Due to a new FMD virus strain for the region (A/AFRICA/G-IV)
- Further reports of SAT 1 (not confirmed by the OIE Reference Laboratory in Brescia, Italy)
- *in-vitro* vaccine matching data for representative viruses from this lineage is not encouraging
- Yet another new threat for Europe?



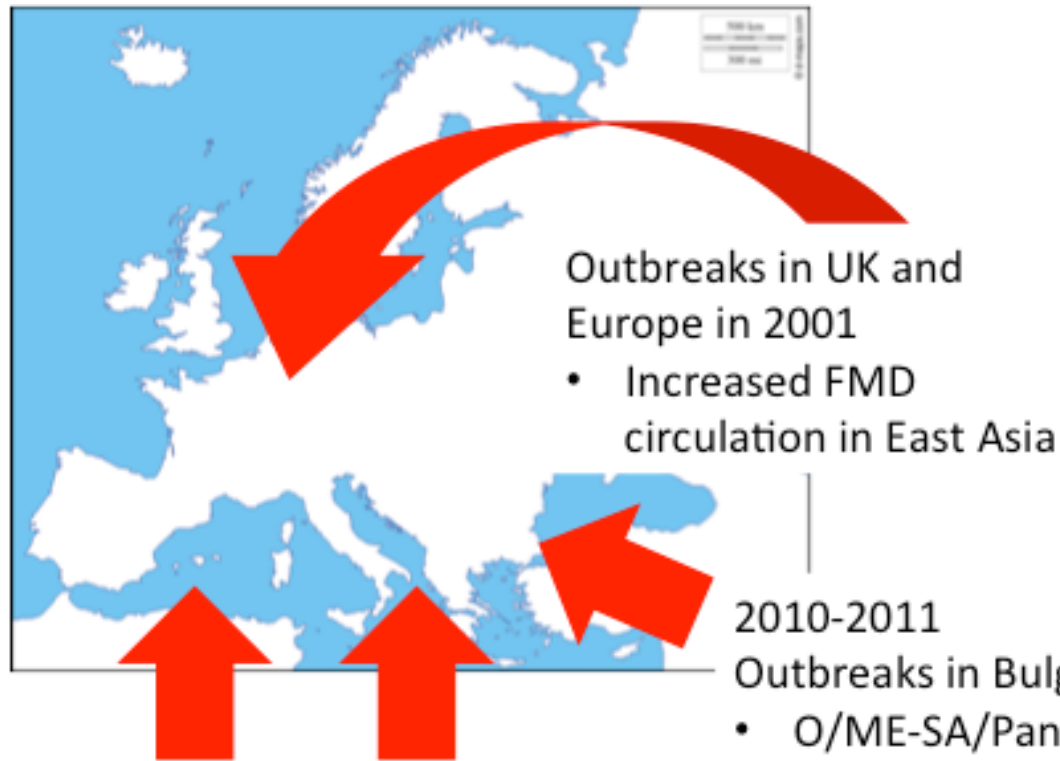
Long-distance “trans-pool” movements

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 and **increased demand for animal products** in East Asia.

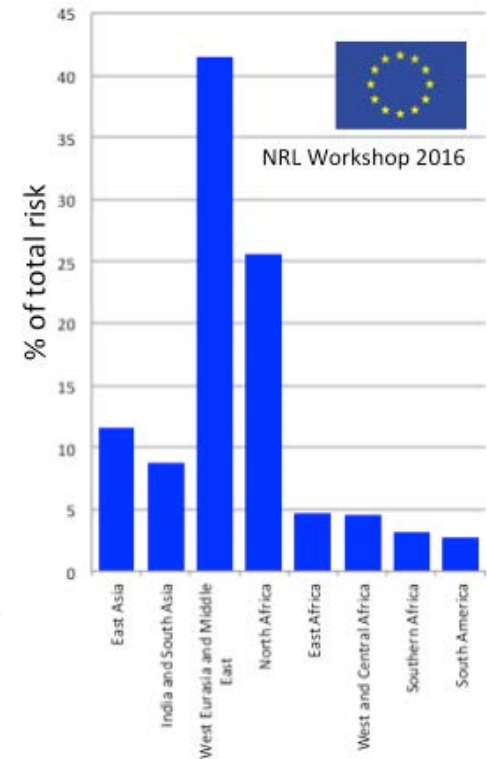


The threats to Europe – a quick summary



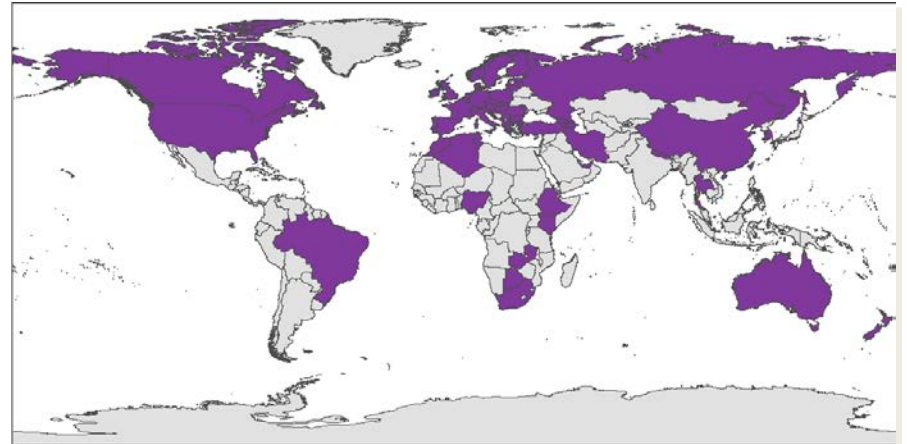
- New FMD lineages in North Africa
- Outbreaks in FMD-free countries
- O/ME-SA/Ind-2001d
- A/AFRICA/G-IV

- O/ME-SA/PanAsia-2
- A/ASIA/Irn-05
- Asia-1
- A/ASIA/G-V-II
- O/EA-3



Annual Proficiency Testing Scheme

- To assist National FMD Laboratories to develop/improve accurate and reproducible FMD diagnostic tests
- QA requirements to support ISO/IEC 17025
- NRLs from all EU member states must participate
- Feedback (reiterative improvements to assays)
- Covers SVDV as well as FMDV
- Phase XXIX - reported in 2016 66 countries worldwide



PTS update

- As part of the LoA – EUFMD supports participation of labs in the PTS

- Global Network
- Non EU - EuFMD members
- Neighborhood states

Algeria, Armenia, Azerbaijan, Egypt, Lebanon, Montenegro, Morocco, Ukraine

- Performance generally good and improving in all laboratories against set criteria (4 categories)

	2015	2016
Total invited laboratories	91	91
Total number of shipments	66	66
Participants from European Union (funded by EURL for FMD)	27	27

EUFMD funded participants

Participants from Global Network Labs	Panaftosa Brazil, Pakchong Thailand, BVI Botswana, OVI South Africa, ARRIAH Russia, NVRI Nigeria, LNERV Senegal, Emabakasi FMD laboratory Kenya, NAHDIC Ethiopia, USDA USA ³	Panaftosa Brazil, Pakchong Thailand, BVI Botswana, OVI South Africa, ARRIAH Russia, NVRI Nigeria, Emabakasi FMD laboratory Kenya, NAHDIC Ethiopia, USDA USA ³
% of labs meeting target performance	Cat-1 0% Cat-2 10% Cat-3 60% Cat-4 30%	Cat-1 0% Cat-2 0% Cat-3 64% Cat-4 36%
Participants from EuFMD Member states (non-EU)	Albania, Georgia, FYRO Macedonia, Israel, Norway, Serbia, Switzerland, Turkey	Albania, Georgia, FYRO Macedonia, Norway, Serbia, Switzerland, Turkey
% of labs meeting target performance	Cat-1 0% Cat-2 0% Cat-3 88% Cat-4 13%	Cat-1 0% Cat-2 0% Cat-3 67% Cat-4 33%
Participants from neighbourhood countries	Algeria, Armenia, Azerbaijan, Egypt, Lebanon, Montenegro, Morocco, Ukraine	Algeria, Armenia, Azerbaijan, Iran, Lebanon, Moldova Montenegro, Morocco, Tunisia
% of labs meeting target performance	Cat-1 0% Cat-2 0% Cat-3 63% Cat-4 38%	Cat-1 0% Cat-2 0% Cat-3 78% Cat-4 22%

Summary of EUFMD funded participants

Invited	36	36
Total number of participants funded by EUFMD	26	26

* Self funded

Talk summary

- Epidemiology of FMD is very dynamic
 - Sampling of field outbreaks is critical
 - New unpredictable patterns in Asia (East and West) and North Africa
 - Established lineages within serotypes O, A, and Asia-1
 - Emerging lineages within serotypes O, A, and SAT 2
 - Threats to FMD-free countries in Europe and Turkish Thrace
 - Impact upon selection and deployment of vaccines
 - Multiple FMDV lineages may have different epidemiological features
- Importance of an active FMD Reference Laboratory Network to facilitate sample collection from FMD outbreaks in the field– to feed real-time lab data back to FMD control programmes

Thanks...

- 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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Vaccine Bank Recommendations (April 2017)

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.