



OIE/FAO  
Foot-and-Mouth Disease  
Reference Laboratories  
Network



# Global Update –2018/19

*on behalf of the OIE/FAO FMD Lab Network*

**Acknowledgements:** Don King, Valerie Mioulet, Nick Knowles, Anna Ludi, Ginette Wilsden, Alison Morris, David Paton, Abid Bin-Tarif, Mehreen Azhar, Hannah Baker, Lissie Henry, Jemma Wadsworth, Clare Browning, Antonello Di Nardo, Bob Statham, Britta Wood, Ashley Gray, Beth Johns, Mark Henstock, Nick Lyons, Dexter Wiseman, Julie Maryan, Sarah Belgrave



Department  
for Environment  
Food & Rural Affairs



FMD Reference Laboratory



# Enhanced surveillance via the OIE/FAO FMD Laboratory Network

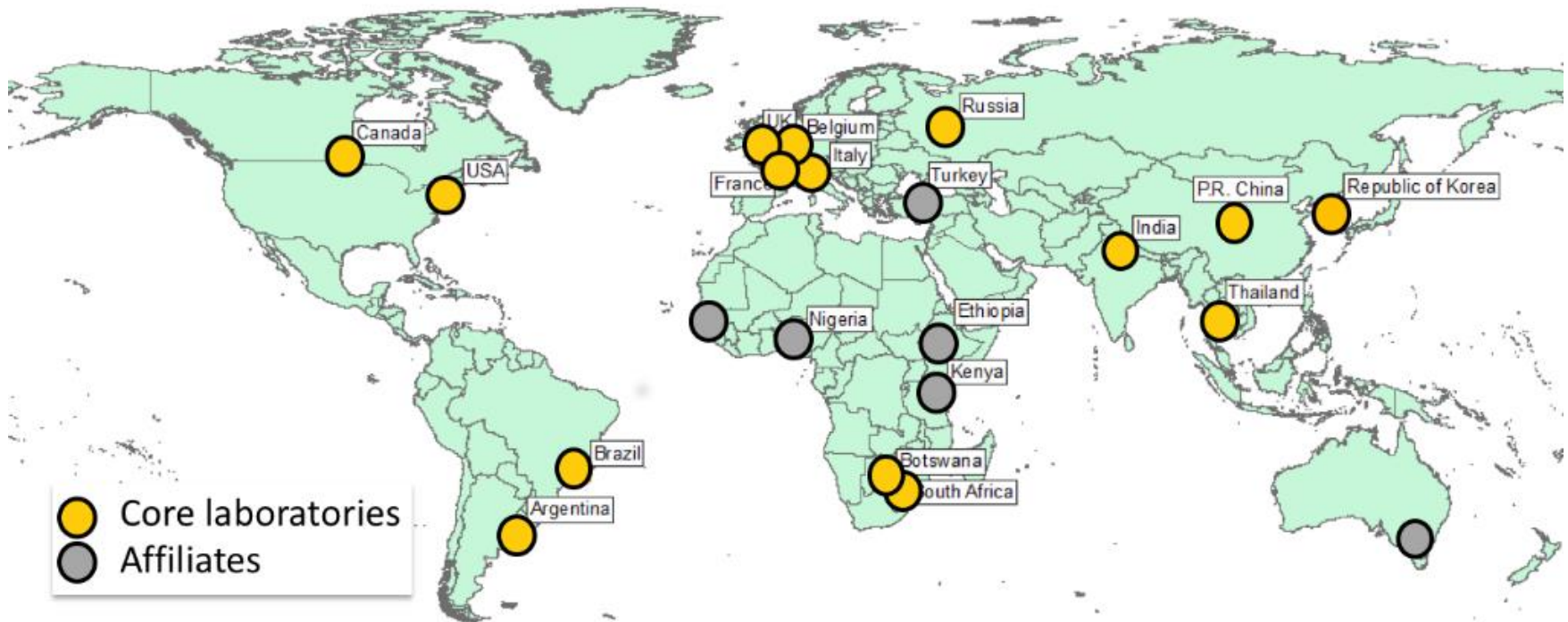


- Able to rapidly respond to changing events
- **Global surveillance and changing patterns in risk**
- **Harmonised and improved lab capacity**
- Established in 2004
- 15 Core OIE and FAO FMD Reference Laboratories
- New EU ref labs: Maisons-Alfort Laboratory for Animal Health, ANSES, France and Sciensano, Belgium
- Meeting and annual reports available: <http://www.foot-and-mouth.org/>



# OIE/FAO FMD Laboratory Network - MoU

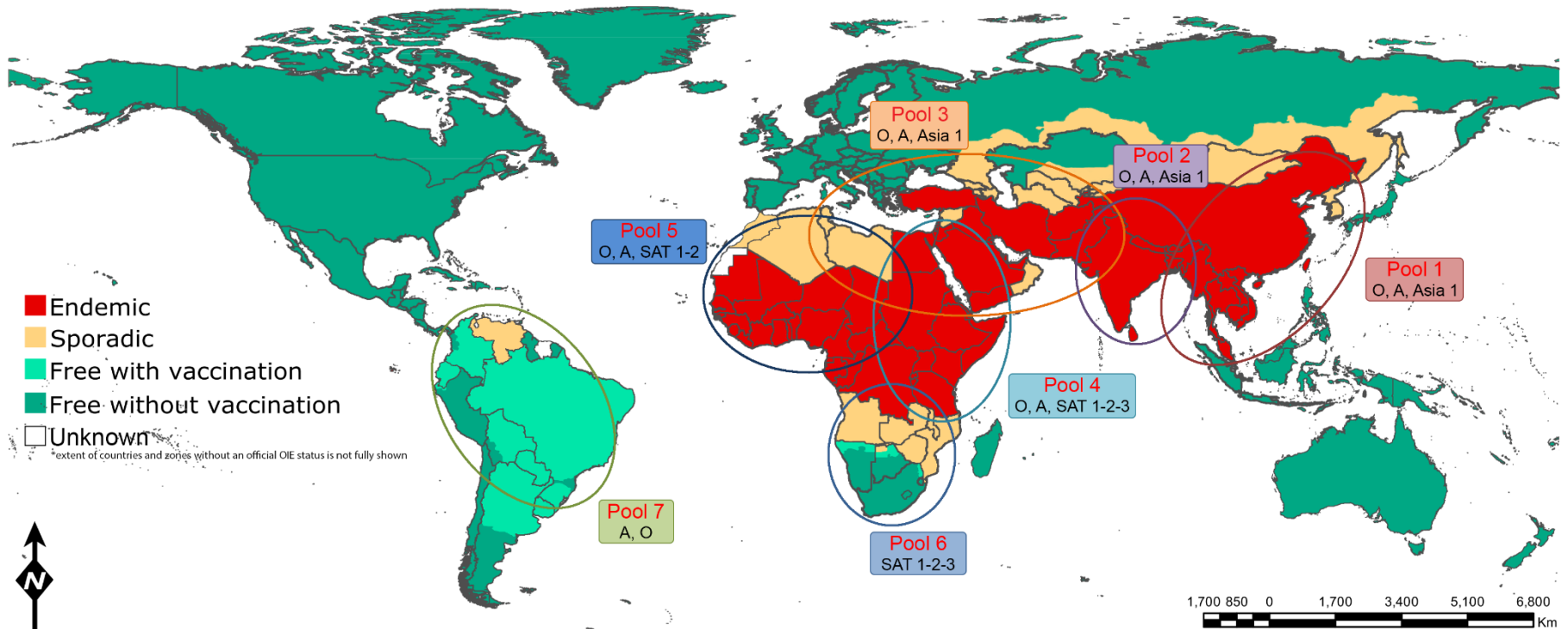
- Work collectively to freely share real-time unpublished data
- Confident of relationship between the “core” partners
- Acknowledge data sources in communications and reports



# Conjectured global status

## Seven endemic pools

- Ecological niches that maintain specific FMD virus strains
- Control via (tailored) vaccination and supporting diagnostics



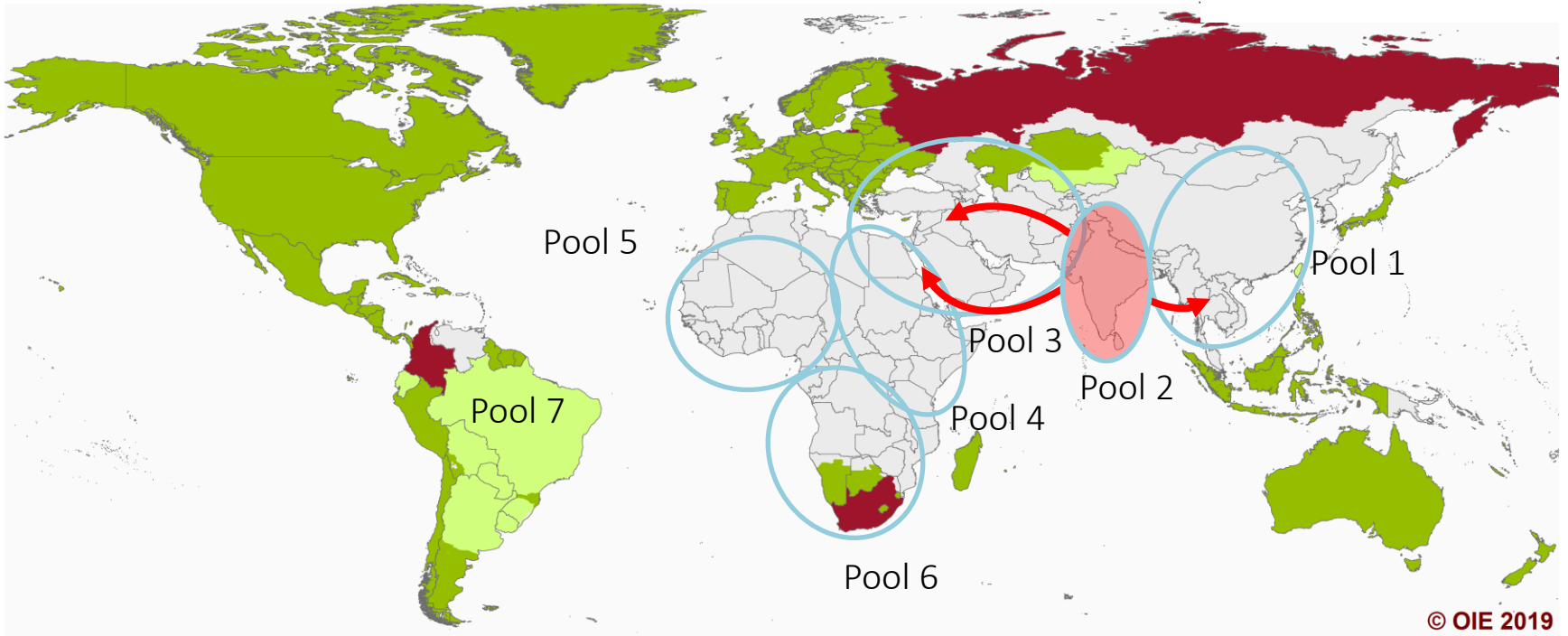
- No reported serotype C outbreaks since 2004 (Kenya and Brazil)







# OIE Global status

## OIE Members' official FMD status map

Last update January 2019



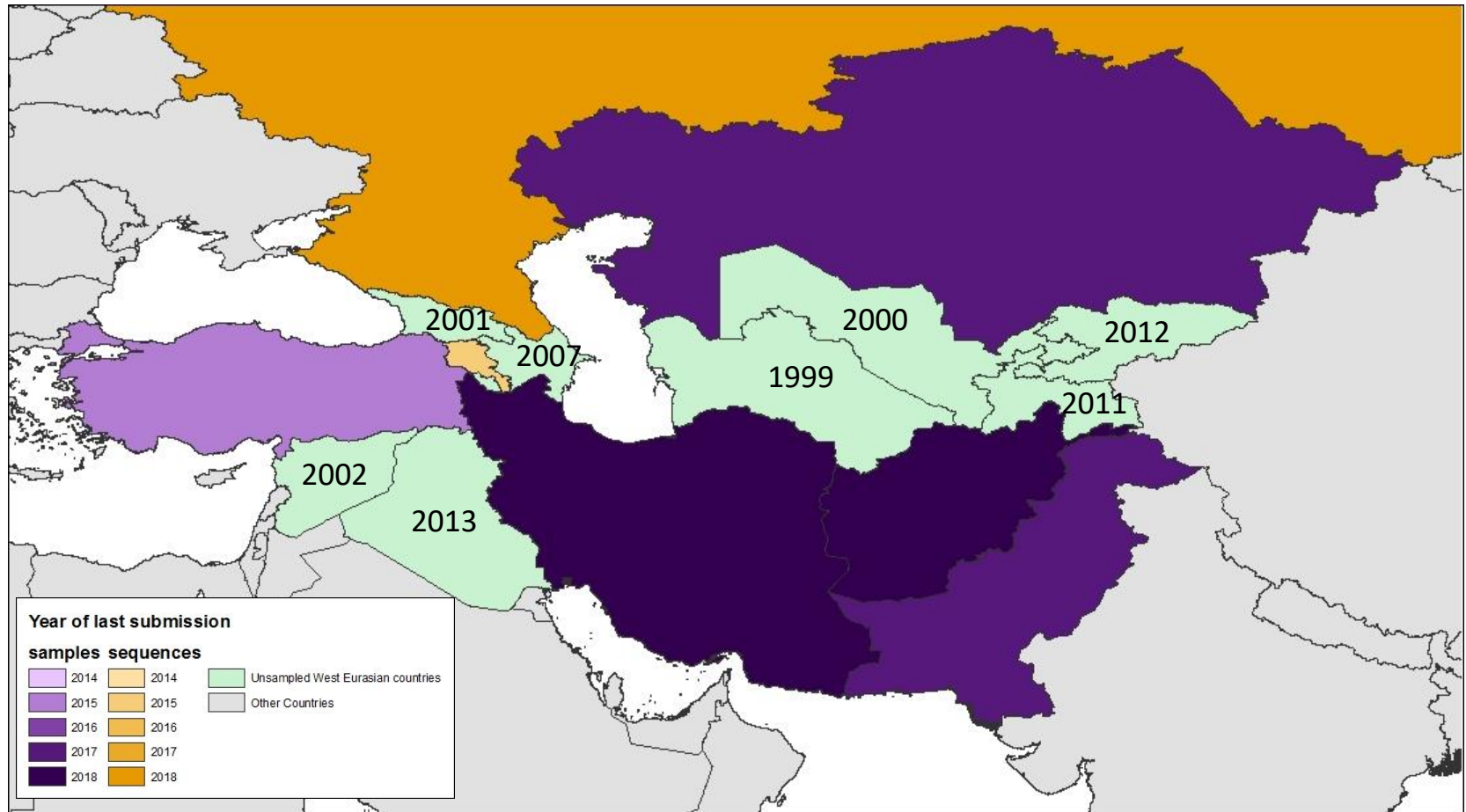
-  Members and zones recognised as free from FMD without vaccination
-  Members and zones recognised as free from FMD with vaccination

-  Suspension of FMD free status
-  Countries and zones without an OIE official status for FMD



# FMD surveillance within West Eurasia

## WRLFMD sample/sequence submissions (2014-2018)

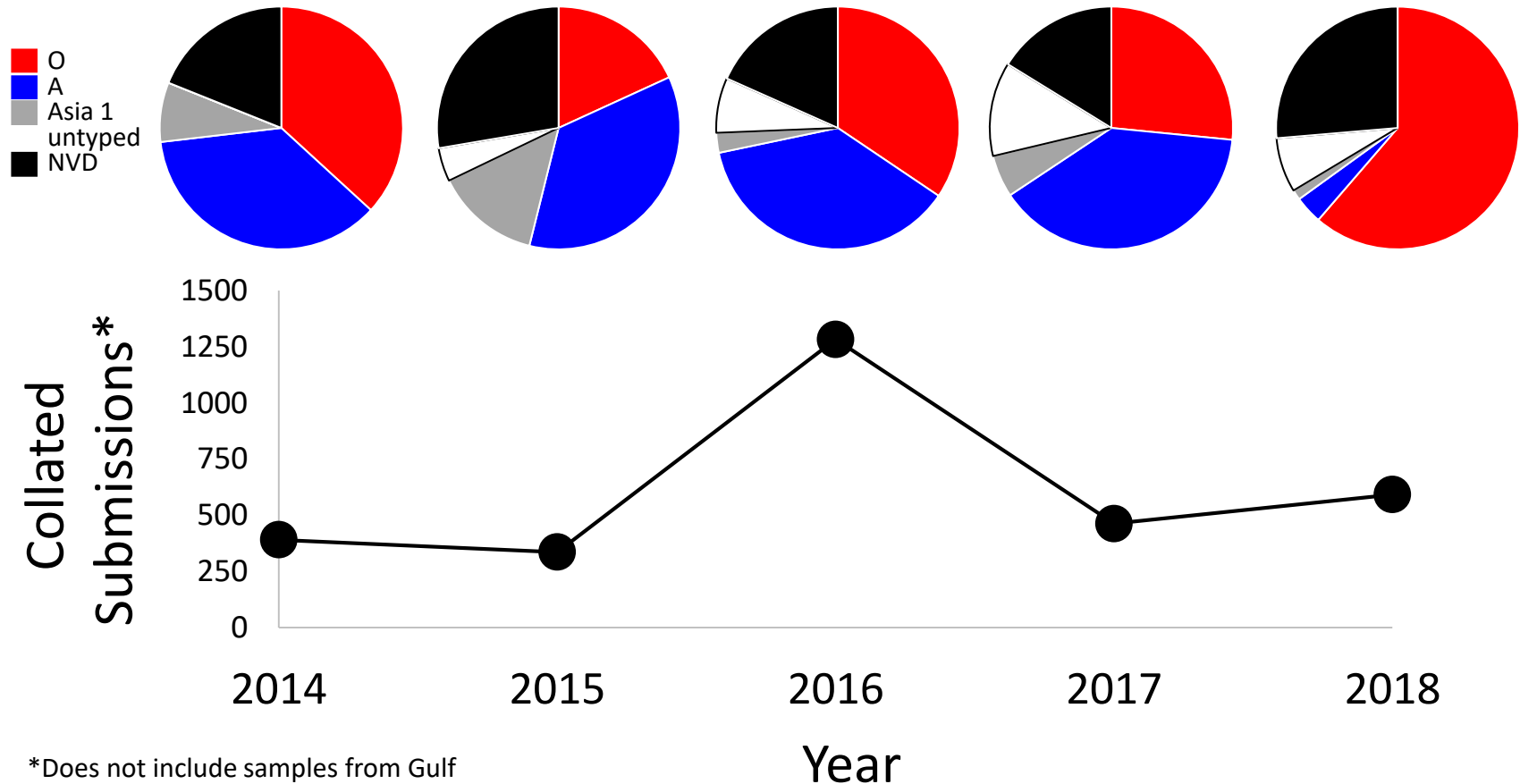


- All submissions shown (positive and negative samples)
- Detailed reports for all samples can be found at: [www.wrlfmd.org](http://www.wrlfmd.org)

# Collated data for West Eurasia Roadmap countries (2014-18)\*



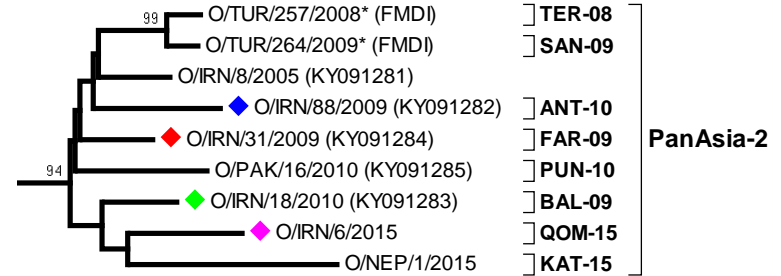
- Data from ARRIAH (Russia), ŞAP Institute (Turkey) and WRLFMD
- 2018 increased dominance of serotype O in the region



\*Does not include samples from Gulf States or countries in the Near East

# O/ME-SA/PanAsia-2

- Sub-lineage nomenclature used to define different viral genotypes
- Some of these sub-lineages appear to co-circulate
- Sequence data provide evidence for east-west movements of these viruses
- **Two active sub-lineages**
- An additional O/ME-SA genotype in Pakistan, Iran and Russia (Bashkortostan – 2017)



ANT-10	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran					
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan					
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

FAR-09	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran					
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan					
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

BAL-09	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran		*			
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan		*			
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

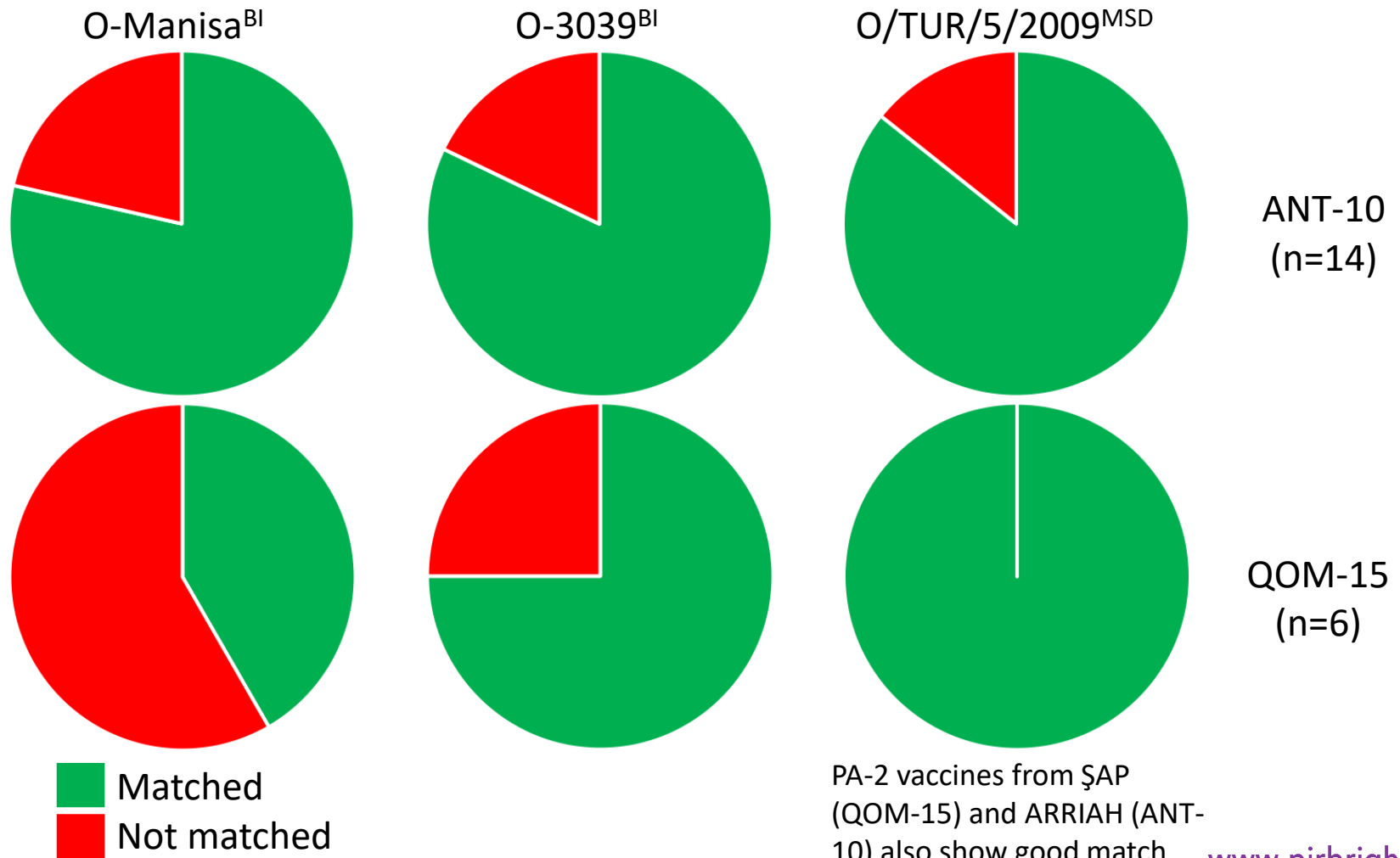
QOM-15	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran					
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan					
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

\* These isolates were subsequently re-classified as QOM-15



# O/ME-SA/PanAsia-2 : vaccine matching (2014-18)

- Quick and cost-effective laboratory assessment of the antigenic relationship between **field** and **vaccine** viruses



# A new (emerging) antigenic variant for serotype O?

- Two isolates in a new discrete genetic clade within O/ME-SA/PanAsia-2<sup>ANT-10</sup>
- Collected in Punjab, Pakistan (2016/17) from cattle and water buffalo
- No neutralization in VNT with BVS for O-Manisa, O-3039 or O-TUR-5-09

Vaccine-matching:  $r_1$ -values

	O 3039	O Manisa	O TUR/5/2009
O/PAK/14/2017	0.62	0.32	0.48
O/PAK/10/2016	0	0	0
O/PAK/4/2017	0	0.10	0

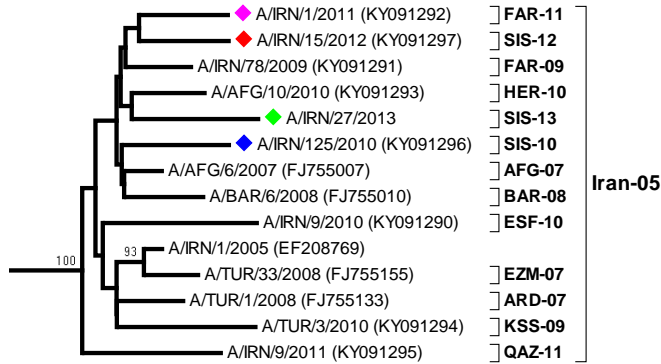


# What other FMDV lineages are circulating in the region?

<b>Viral lineage:</b>		<b>West EurAsia</b>	<b>Gulf States</b>	
	<b>O/ME-SA/PanAsia-2</b>	✓	✓	
	<b>A/ASIA/Iran-05</b>	✓	✓	
	<b>Asia-1</b>	✓	✓ 2011 Bahrain	Vaccines: Asia-1 Shamir Asia-1 Sindh-08 Asia-1 TUR 14
From Indian sub- continent	<b>A/ASIA/G-VII</b>	✓	✓	
	<b>O/ME-SA/Ind-2001d/e</b>		✓	
From Africa	<b>O/EA-3</b>		✓	
	<b>SAT 2 topotype VII</b>		✓ 2015	Oman
	<b>SAT 2 topotype IV</b>		✓ 2012	Bahrain

- Spectrum of vaccines required to cover these different threats

# A/ASIA/Iran-05



- **Two active sub-lineages in 2018;**

- SIS-13
- FAR-11

SIS-10	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran					
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan					
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

SIS-12	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran					
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan					
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

- SIS-12 sub-lineage appears to have become extinct

- In many respects, east-to-west regional movements parallel

O/ME-SA/PanAsia-2

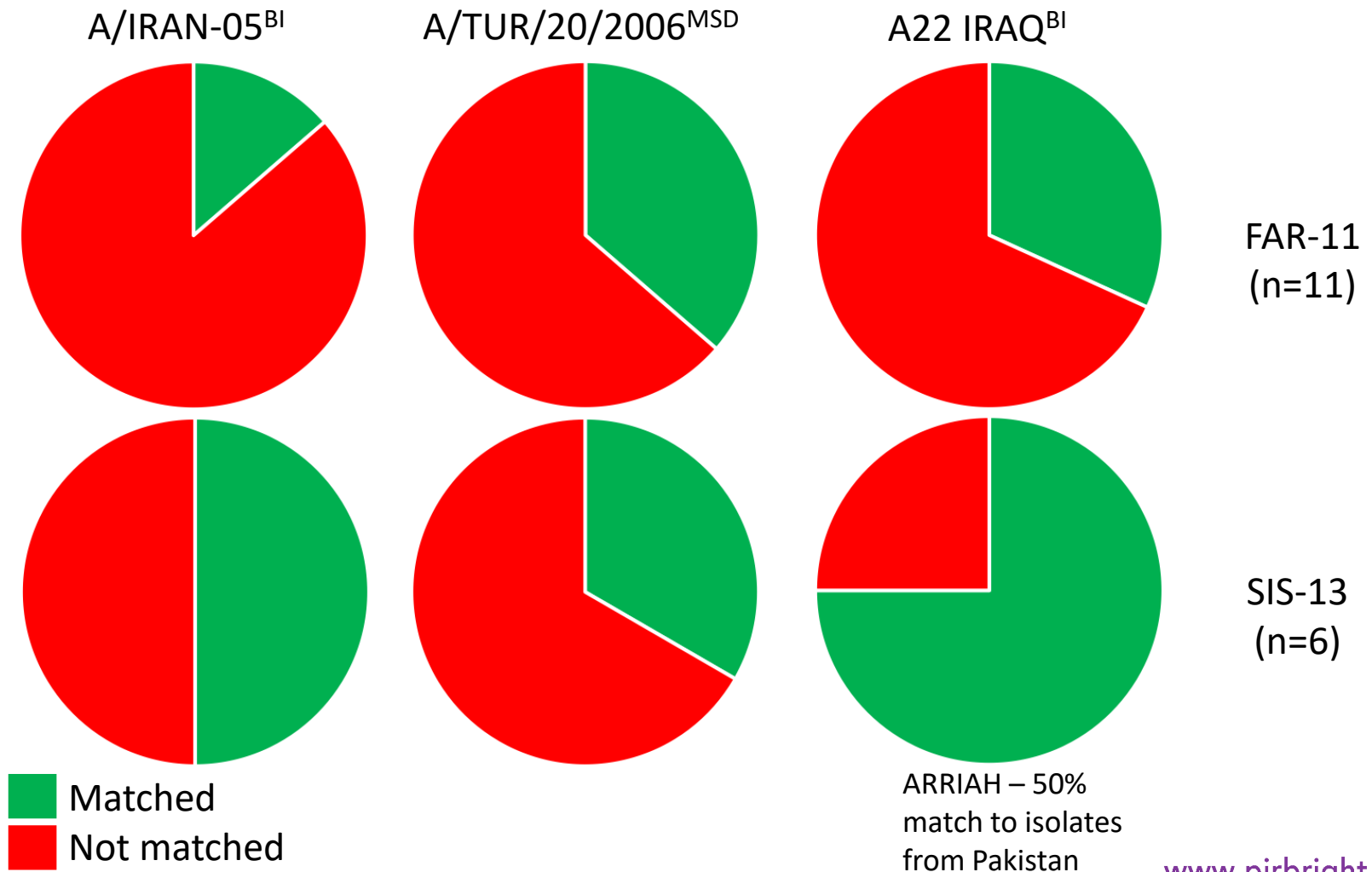
- Since 2015, A/ASIA/G-VII has replaced A/ASIA/Iran-05 in Turkey

SIS-13	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran					
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan					
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

FAR-11	Country	2014	2015	2016	2017	2018
◆	Afghanistan					
	Armenia					
	Azerbaijan					
	Georgia					
	Iran					
	Iraq					
	Kazakhstan					
	Kyrgyzstan					
	Pakistan					
	Russia					
	Syria					
	Tajikistan					
	Turkey					
	Turkmenistan					
	Uzbekistan					

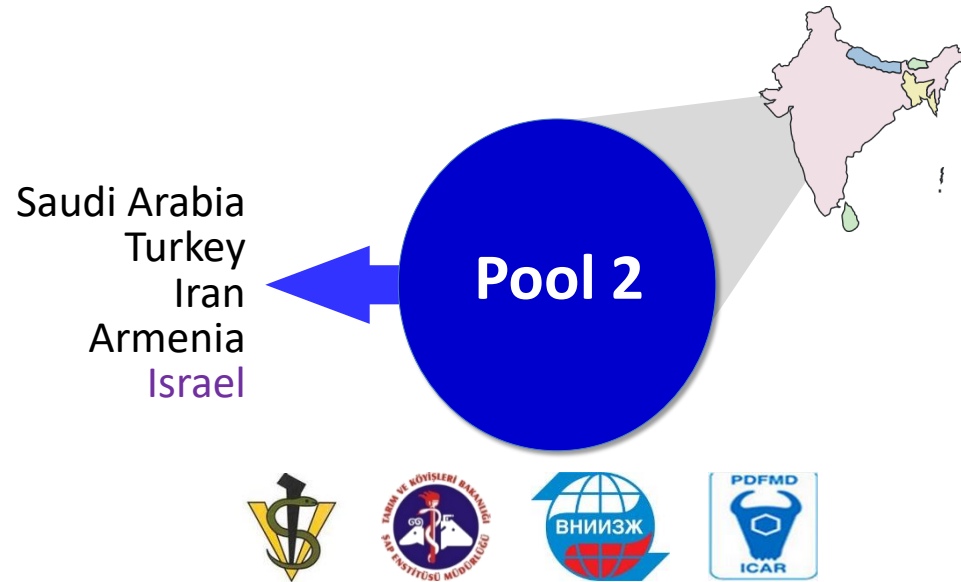
# A/ASIA/Iran-05: vaccine matching (2014-18)

- Reinforces the importance of good quality vaccines, booster regime with good coverage in target host populations



# Spread of A/ASIA/G-VII:

- Emerged in 2015 from Pool 2
- Rapid spread in a number of countries (Israel in 2017)
- Poor *in vitro* and *in vivo* responses for vaccines that are used in West Eurasia
- New tailored vaccine strains have been produced
- Are cases due to this lineage decreasing in the region?
- Is A/ASIA/Iran-05 now the most important serotype A lineage in the region?



r-values:

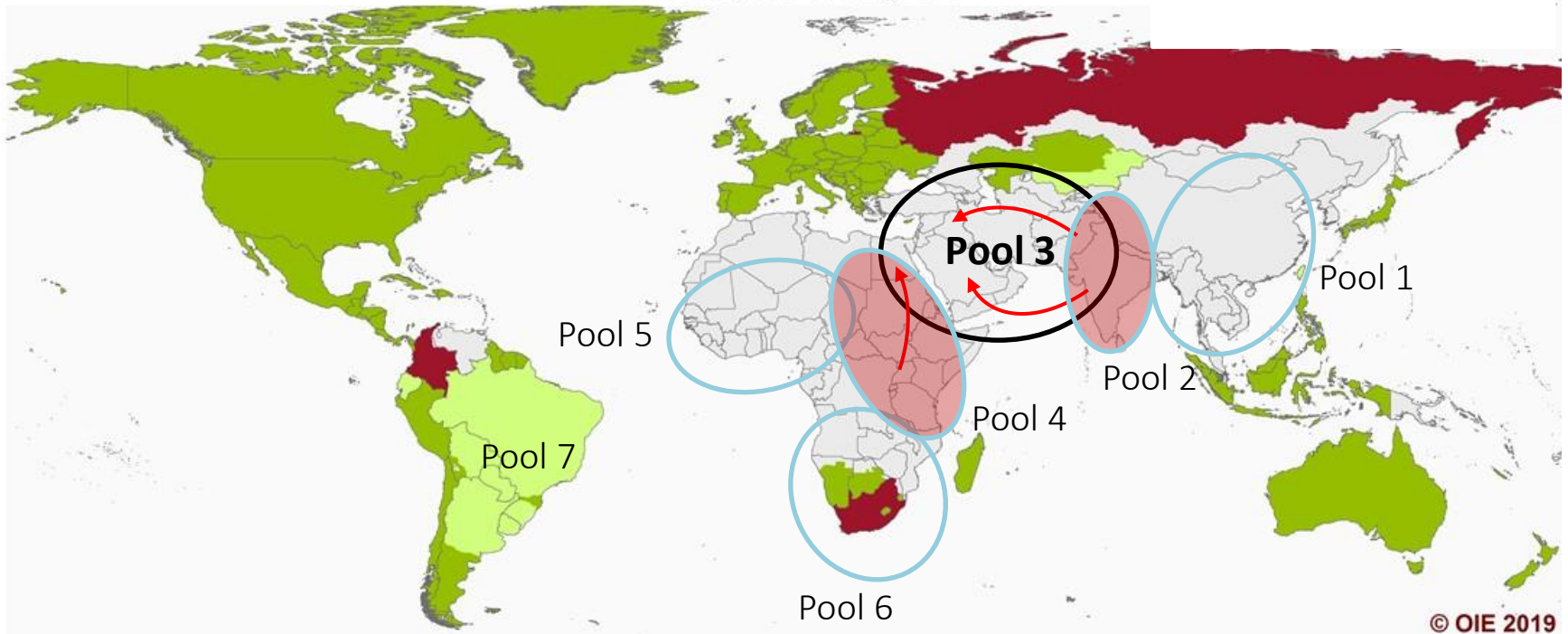
	A/SAU/1/2015	A/SAU/2/2015	A/IRN/8/2015	A/IRN/12/2015	A/IRN/25/2015
A-Iran-05	0	0	0	0	0
A-Tur-20-06	0.03	0.06	0.01	0.15	0.01
A-22	0.11	0.11	0.13	nd	0
A-Iran-87	0	0.04	nd	nd	nd
A-Iran-96	0.04	0.06	nd	nd	nd
A-Iran-99	0.01	0.01	nd	nd	nd
A-Sau-95*	0.20	0.19	0.26	0.16	nd
A-May-97	0.14	0.23	0.15	0.23	nd
A-Tur-11	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

Vaccines





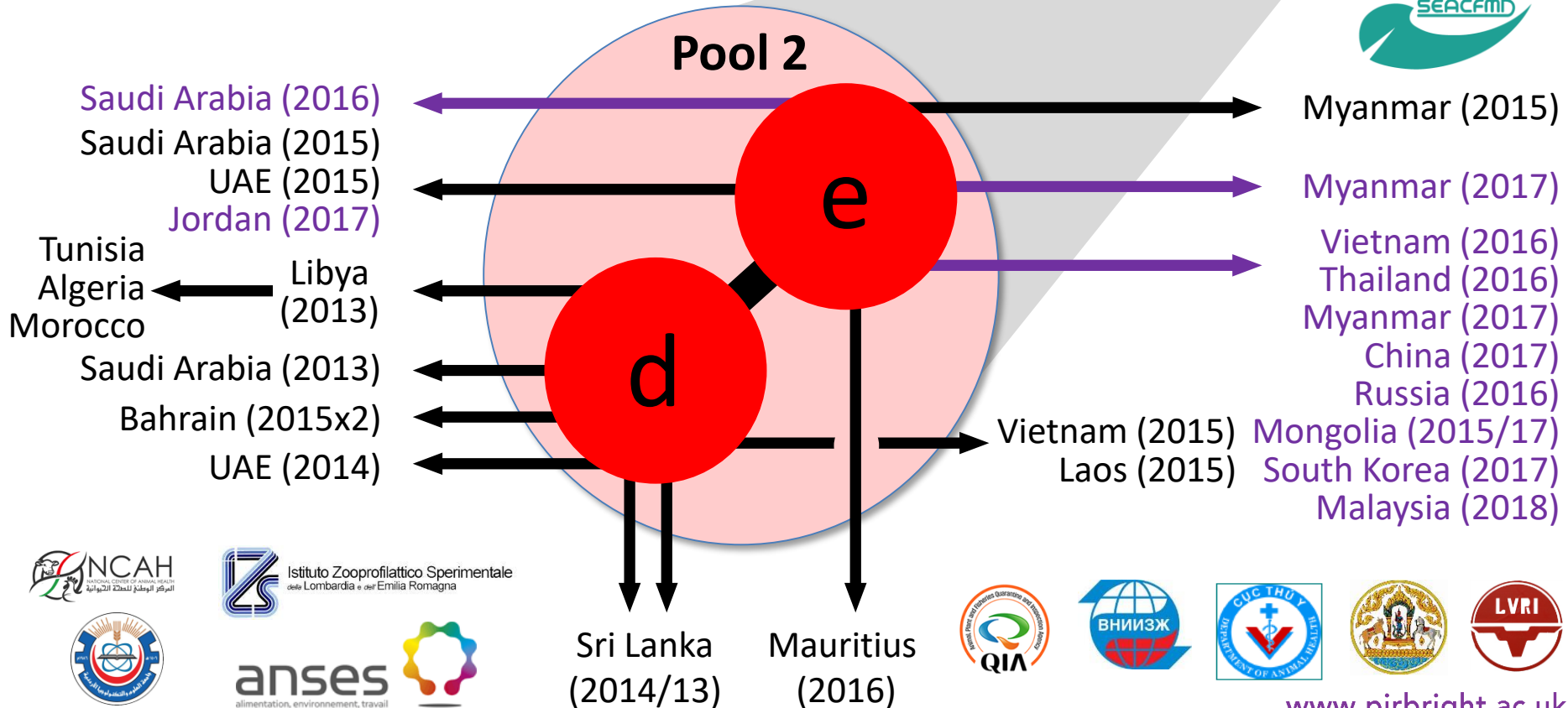
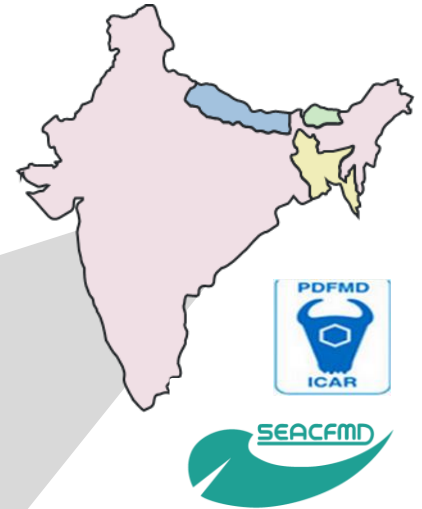
# Threats to the region: Via trans-pool viral movements



- Viruses from neighboring pools (Pool 2 [South Asia] and Pool 4 [East Africa])

# O/ME-SA/Ind-2001: a risk for the region?

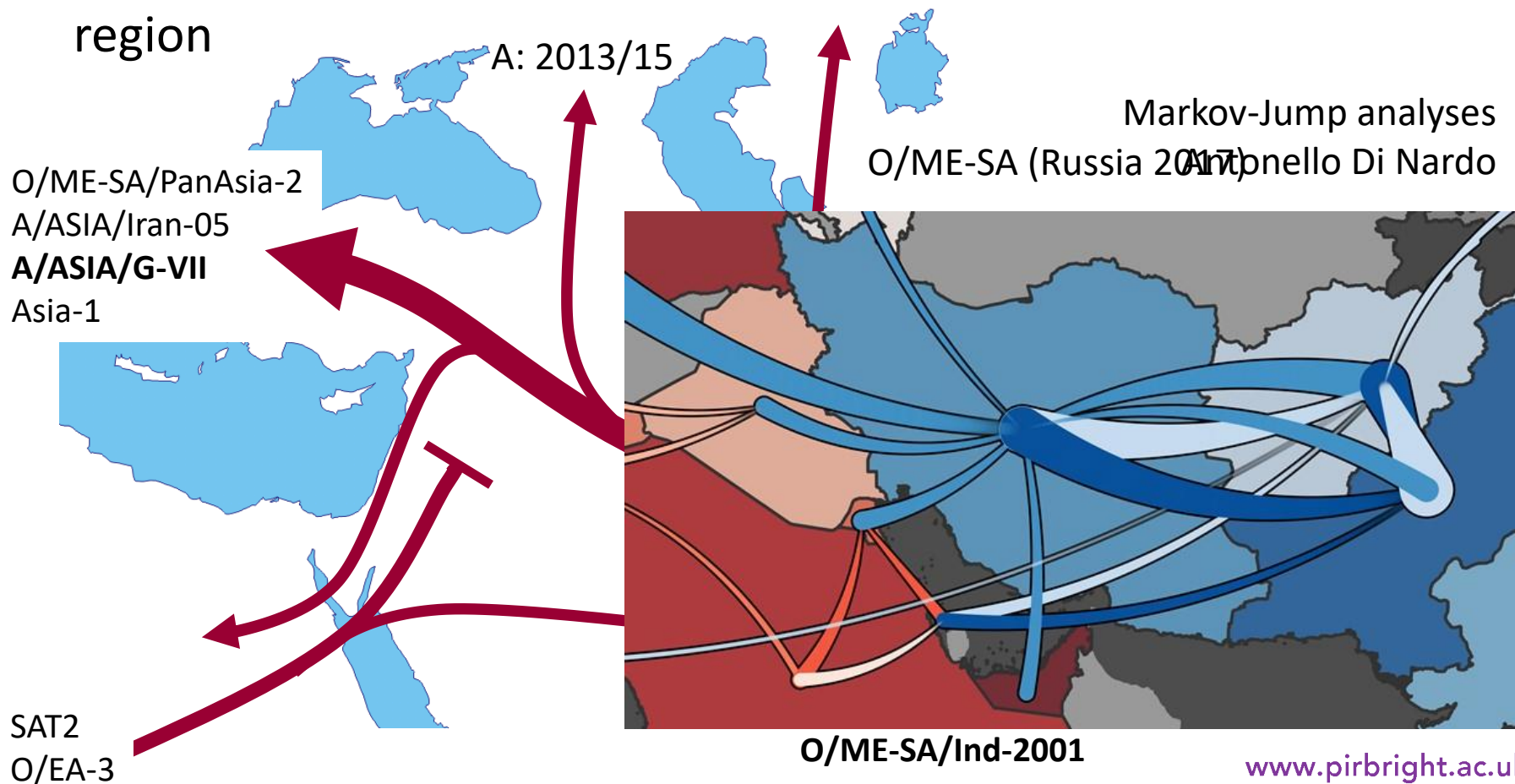
- Two sub-lineages (d and e)
- Since 2013, full genomic sequence data indicates that there have been multiple “escapes” from Pool 2  
(Bachanek-Bankowska et al., 2018)



# West Eurasia

Simplified summary and conjectured routes by which FMD spreads

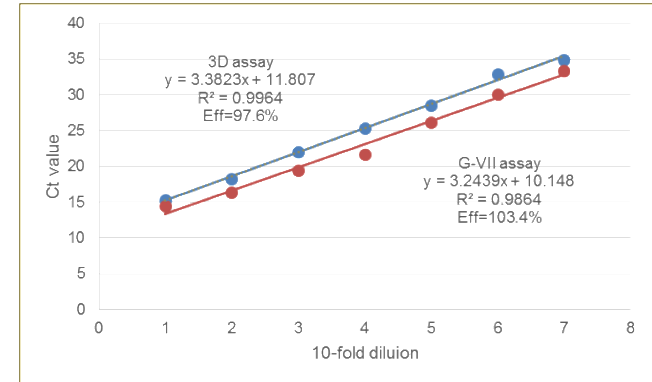
- Understanding transmission pathways helps identify future FMDV lineages that threaten the region



# Development of tailored lineage-specific real-time RT-PCR assays for FMDVs circulating in Asia

- Real-time RT-PCRs designed to detect:
  - A/ASIA/Iran-05, A/ASIA/Sea-97,
  - O/ME-SA/Ind-2001, O/ME-SA/PanAsia and PanAsia-2, O/SEA/Mya-98 , O/EA-3
  - Serotype Asia 1
  - SAT 2/VII
- Single protocol used for all assays – identical to pan-serotype rRT-PCR
- Validated with recent samples sent to WRLFMD from Pool 1, Pool 2 and Pool 3
- Represent a comprehensive panel of assays (**molecular toolbox**) for rapid characterisation of the FMDV lineages circulating in Asia at relatively low cost

Saduakassova et al. (2018) JVM  
Saduakassova et al., EuFMD OS-18



Analytical sensitivity comparison to 3D rRT-PCR



Mika Saduakassova and Kasia Bankowska

# Proficiency Testing Scheme (PTS)

- To assist FMD Reference Laboratories to develop/improve accurate and reproducible FMD diagnostic tests
- QA requirements to support ISO/IEC 17025
- Phase XXX
  - 71 FMD laboratories participated
- Phase XXXI (self-funded or supported by EU and EuFMD)
  - 15 Network lab participants
- Proposal for Phase XXXII (post-BREXIT):
  - Global PTS to complement PTS organised by EURL
  - Focus on endemic diagnostic challenges
  - Scenarios tailored PCP expectations for the participating labs

# Talk summary



- Epidemiology of FMD is very dynamic
  - New unpredictable patterns in Asia (East and West) and North Africa
  - Threats to FMD-free countries in Europe and Turkish Thrace
- Sampling of field outbreaks is critical
- 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
- **Impact upon selection and deployment of vaccines**



# Reports and information

- New website ([wrlfmd.org](http://wrlfmd.org)) launched in November 2018
- In addition to *Genotyping reports*, now contains *Vaccine matching* and *Serotyping reports*
- Other data sources:
  - EuFMD Monthly report
  - Quarterly WRLFMD report

## Tools for FMDV sequences

- Priority for the FMD community
- FMDVTools:  
<https://mallorn.pirbright.ac.uk>

The image shows a screenshot of the WRLFMD website. At the top, there is a navigation menu with links for WRLFMD, REPORTS, LABORATORY PROTOCOLS, NEWS, EVENTS, and RELATED SITES. Below the menu is a large, colorful world map with a text box labeled 'FOOT-AND-MOUTH DISEASE'. Underneath the map, there is a 'Welcome' section with the WRLFMD logo and a paragraph stating that the Pirbright Institute is designated as the World Reference Laboratory for Foot-and-Mouth Disease by the Food and Agriculture Organization (FAO) and as a reference laboratory for FMD by the Office International des Epizooties (OIE). To the right of the welcome message is a 'Country FMD Reports' section with a world map and a link to 'Country Reports'. Below these sections are two overlapping document covers. The left cover is the 'WRLFMD Quarterly Report April to June 2018' and the right cover is the 'OIE/FAO Foot-and-Mouth Disease Reference Laboratory Network Annual Report 2017'. The right cover lists the editors: Dr Donald King, Dr Antonello Di Nardo, and Dr Mark Henstock, The Pirbright Institute, UK. At the bottom of the page, there are logos for BBSRC, the Department for Environment, Food & Rural Affairs, and eofmd.

# Acknowledgements

- Donald King for sharing slides
- 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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