Evaluation of routine vaccination against serotype A G-VII among large-scale dairy farms In Saudi Arabia

Nick Lyons

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The Pirbright Institute receives strategic funding from BBSRC.

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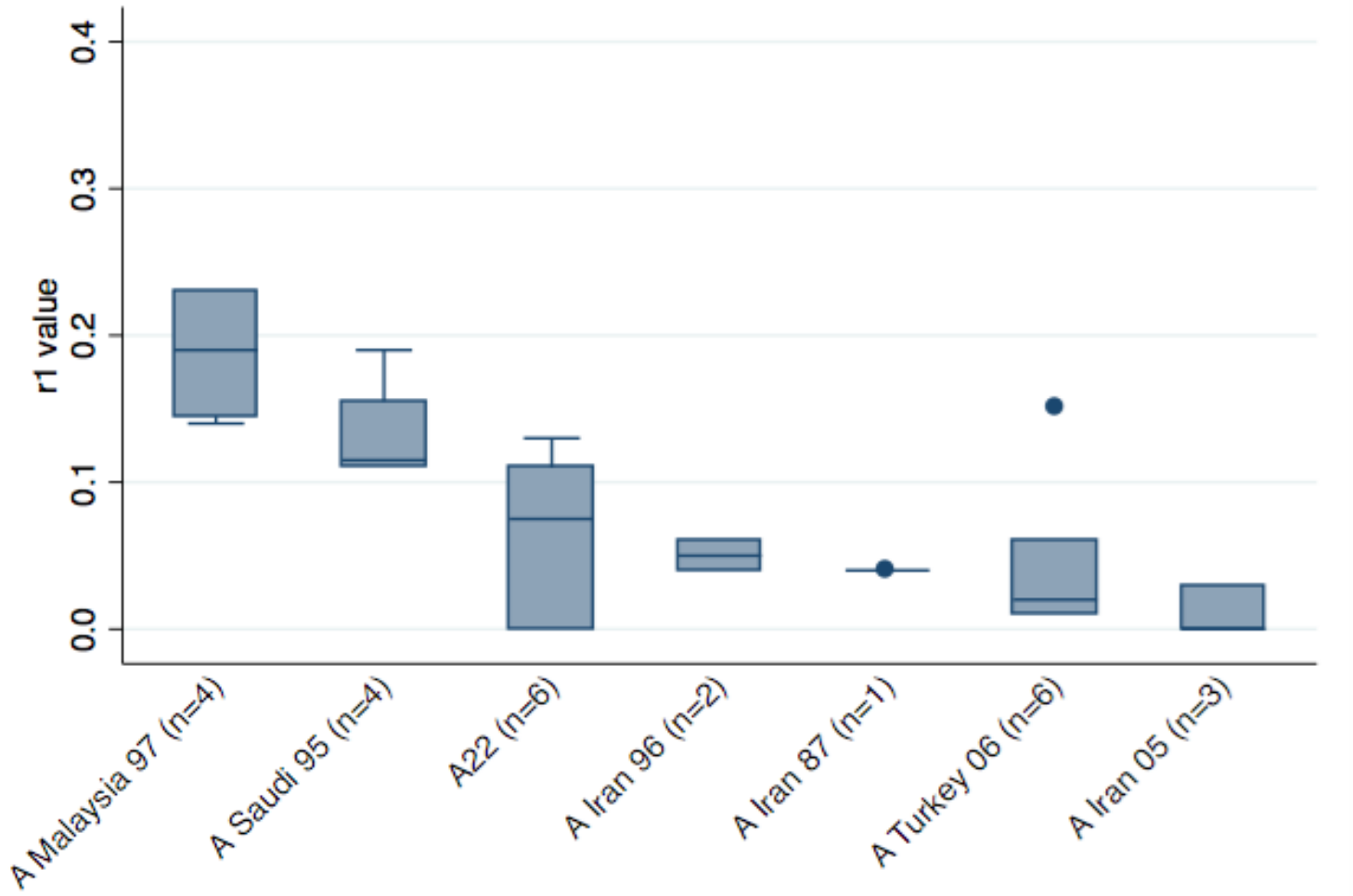
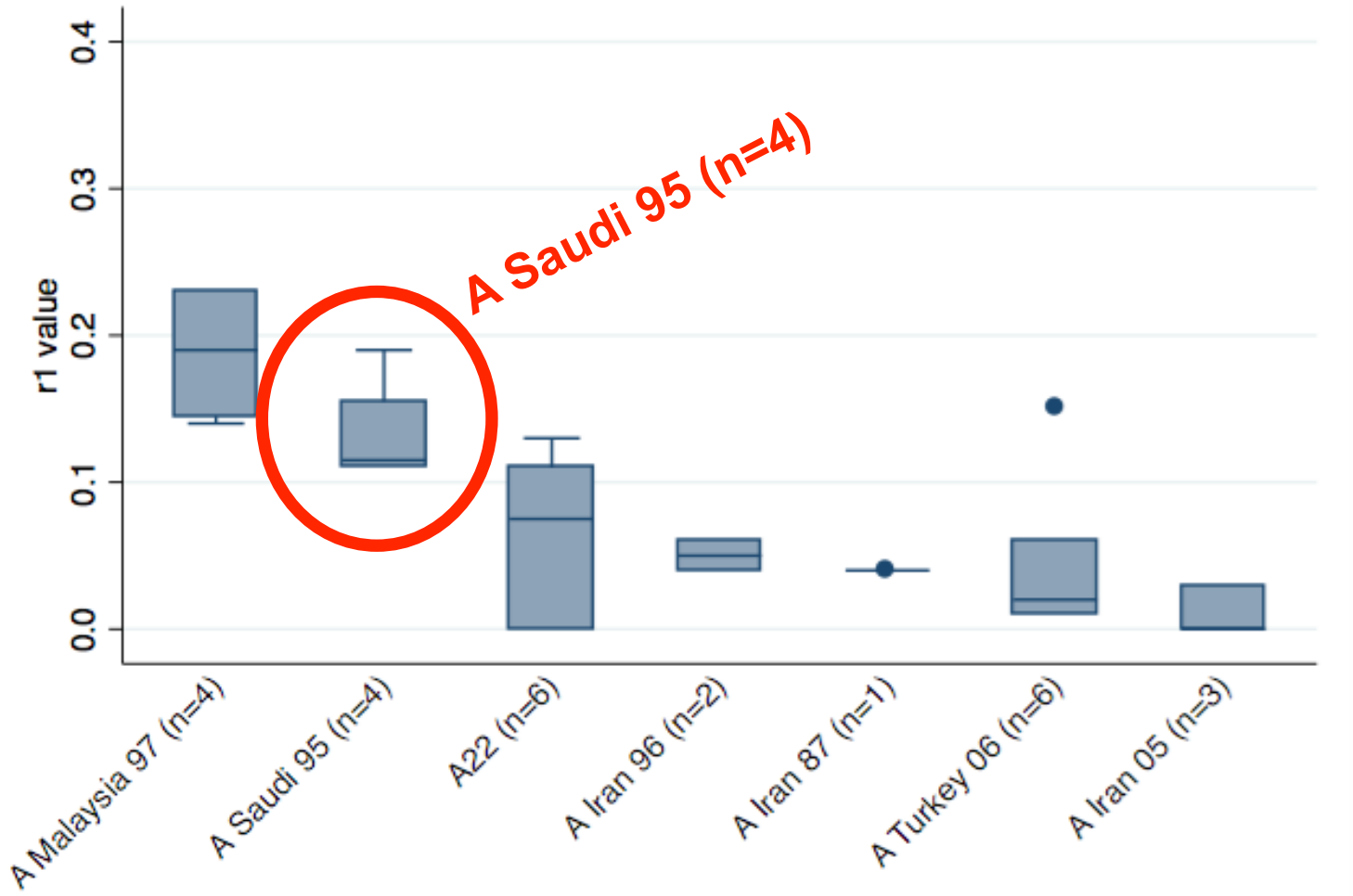
Background – Lineage A/ASIA/G-VII

- During 2015, a new serotype A lineage previously restricted to the Indian sub-continent emerged in Saudi Arabia, Iran, Armenia and Turkey
- Known as genotype A G-VII (or 18)
- Rapidly spread to the borders of FMD free zone of Turkish Thrace

Vaccine matching



Vaccine matching



Background –Saudi Arabia and FMD

- Saudi Arabia has some of the largest dairy farms in the world

- In Saudi Arabia, **serotype A G-VII** outbreaks have occurred on large-scale farms despite regular vaccination (using A Saudi 95)

Objective of this presentation

- To use field data to **briefly describe outbreaks** of confirmed FMDV lineage A-GVII on four large scale dairy farms in Saudi Arabia….

  ….and **evaluate the performance of a vaccine** containing A Saudi 95 strain…..
- Use a combination of:
  - Individual animal data
  - Serological data from a related farm that had no clinical disease
- These are preliminary results (analysis is ongoing)

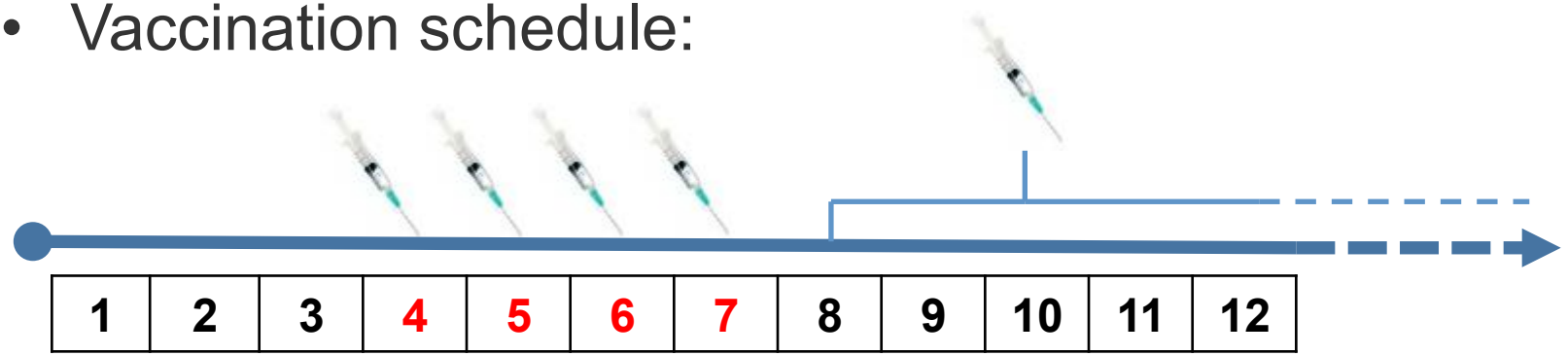
Farm backgrounds

- Four large-scale dairy farms (100% Holstein)
- All farms were in a similar area using same vaccination schedules (and often batches) but are separate epidemiological units

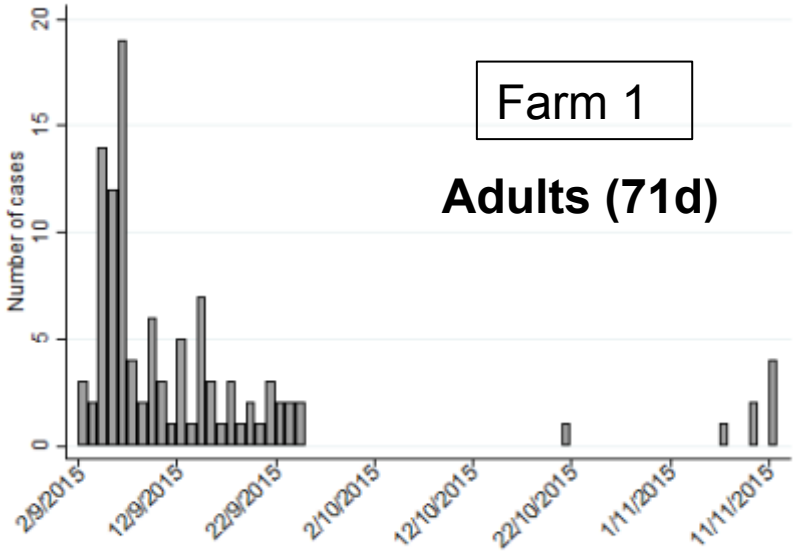
Vaccination policy

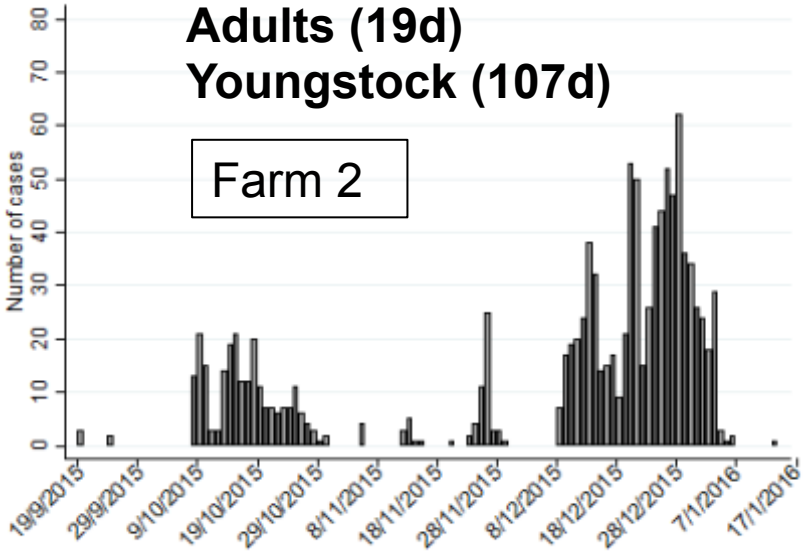
- Farms all use an aqueous based, NSP purified, ≥6.0PD_{50} vaccine
- Contains **A Iran 05** and **A Saudi 95** strains as part of a hexavalent vaccine (Aftovaxpur, Merial)

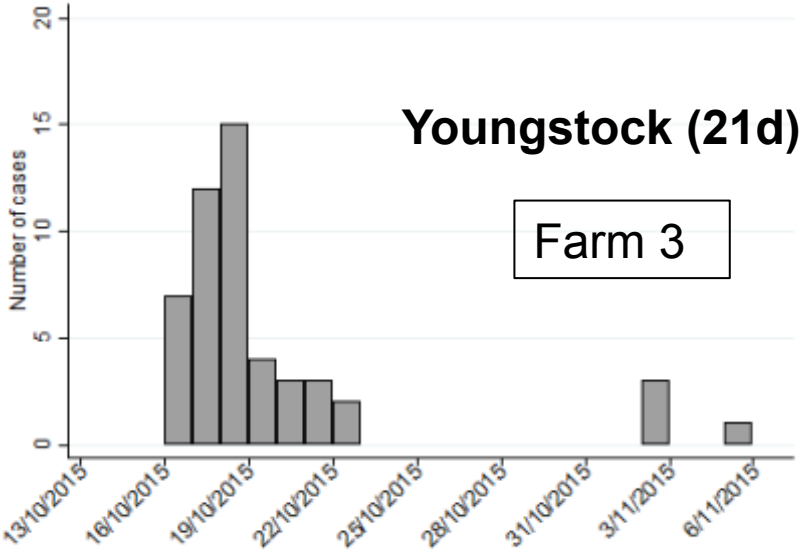
- Vaccination schedule:

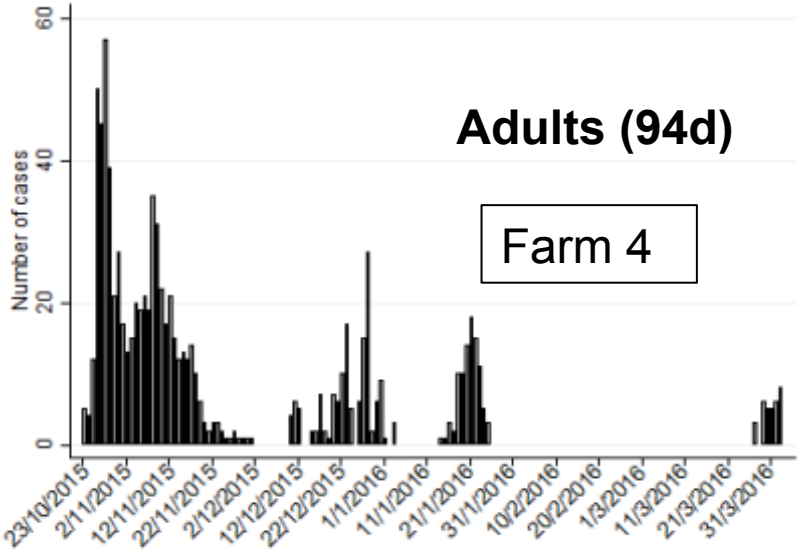


Epidemic curves

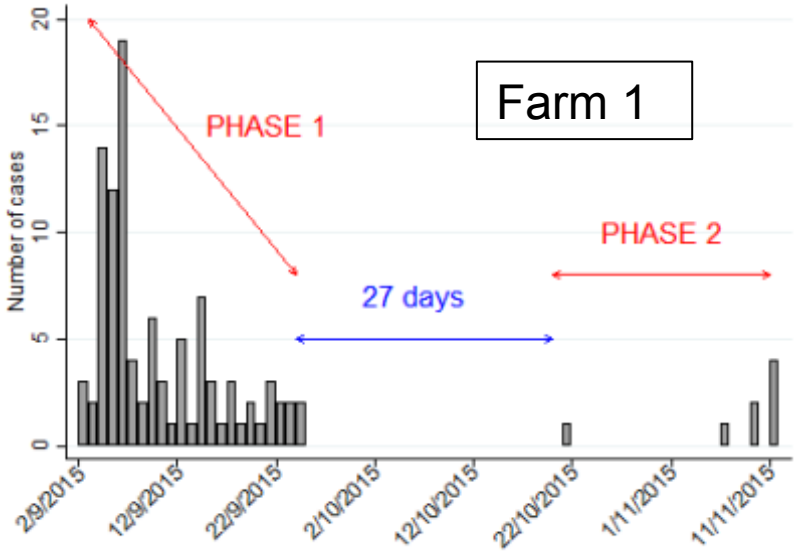


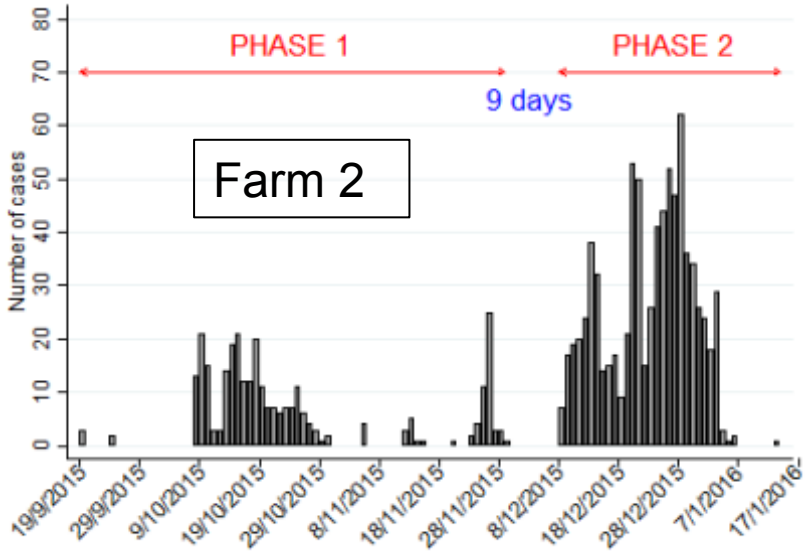


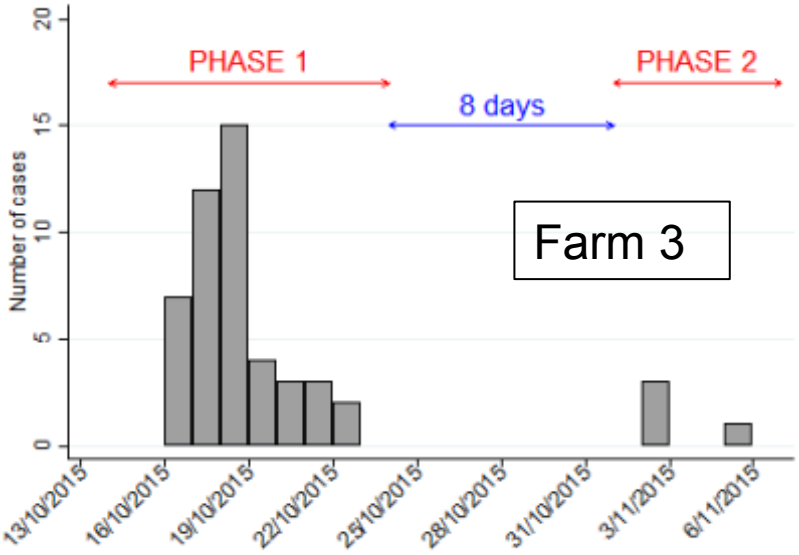


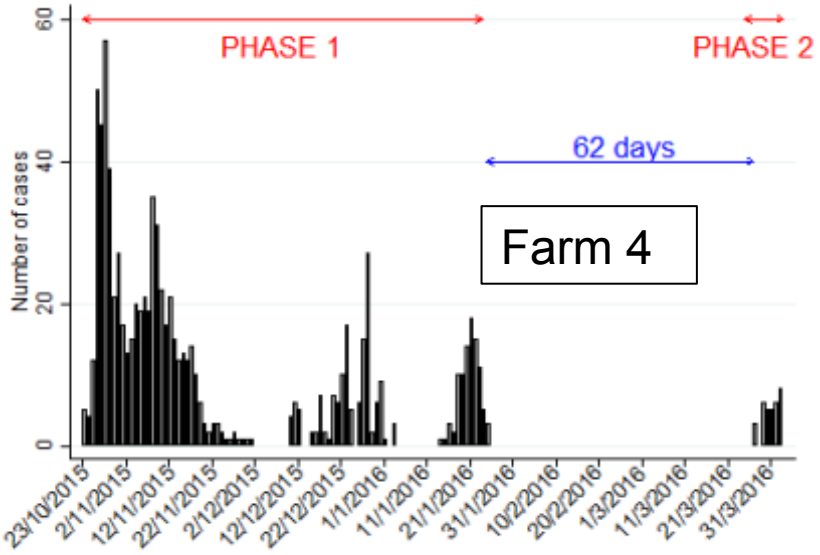


Epidemic curves - Phases

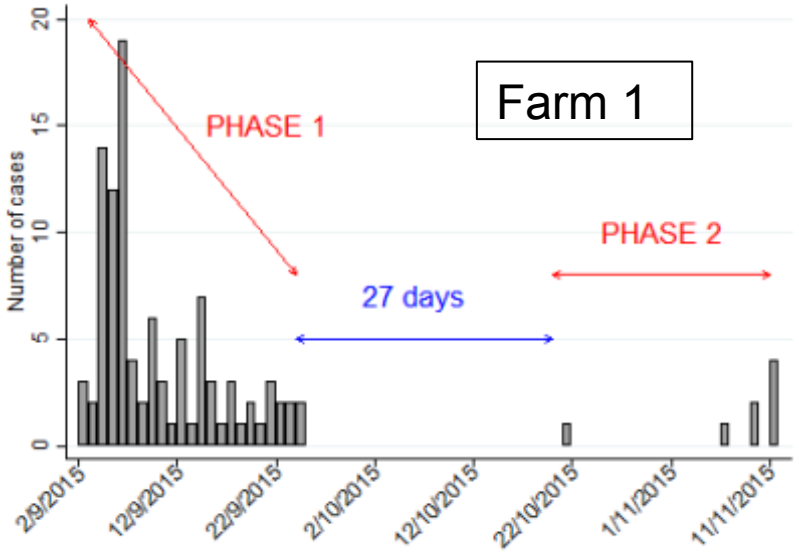






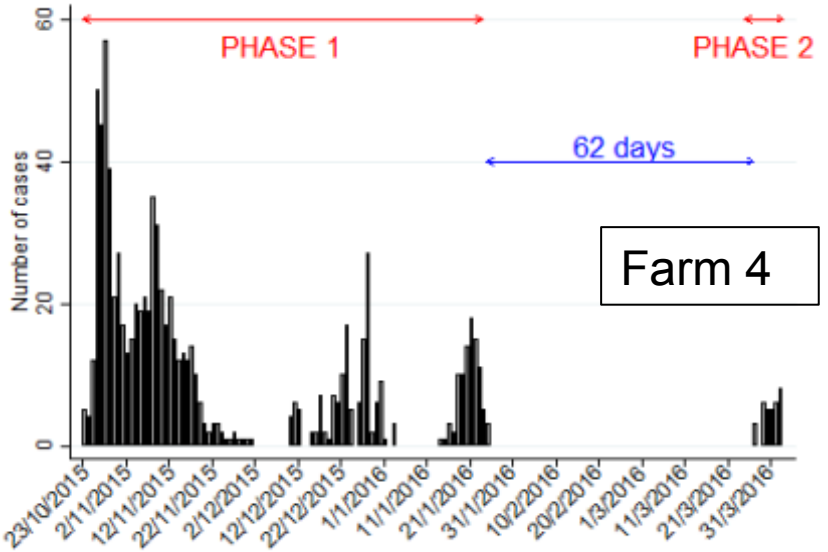


Epidemic curves - Phases

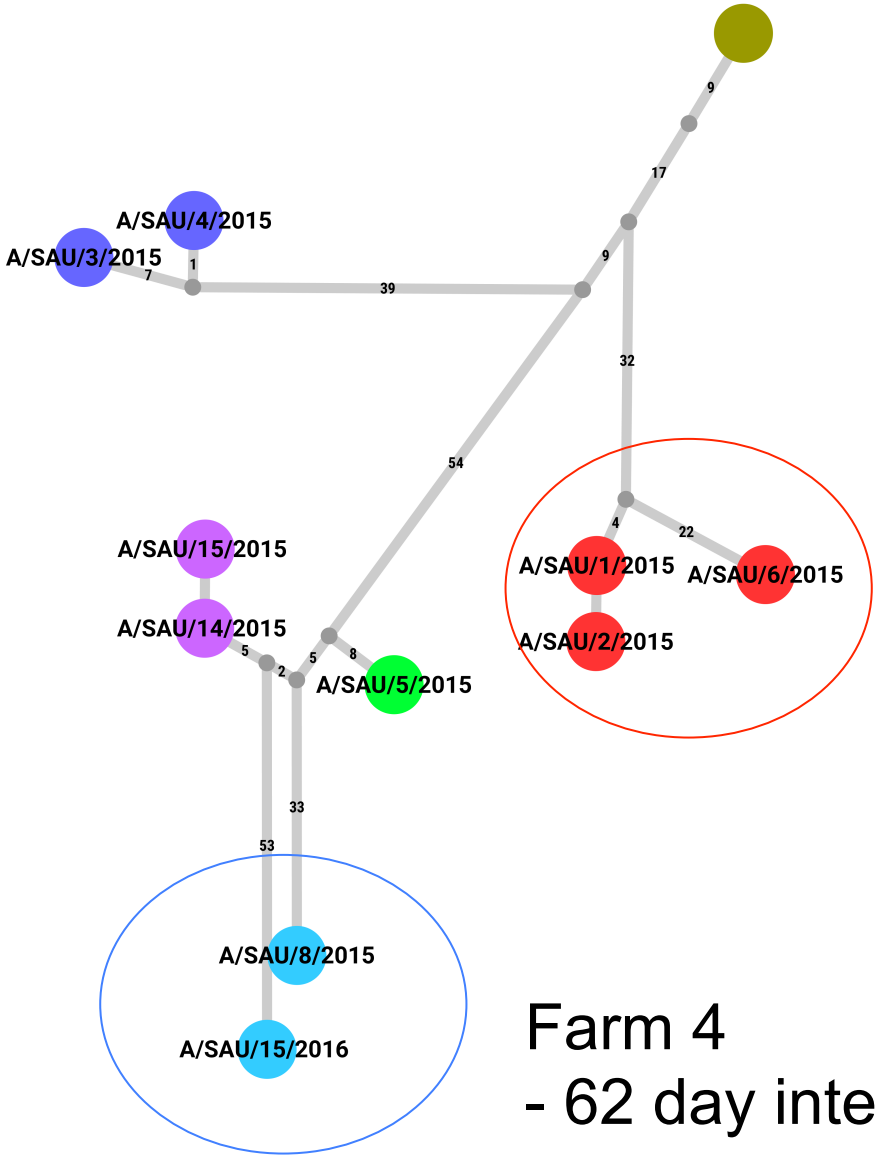


- More protracted periods of no cases

- New introductions?
- or….subclinical/undetected infection



New introductions?

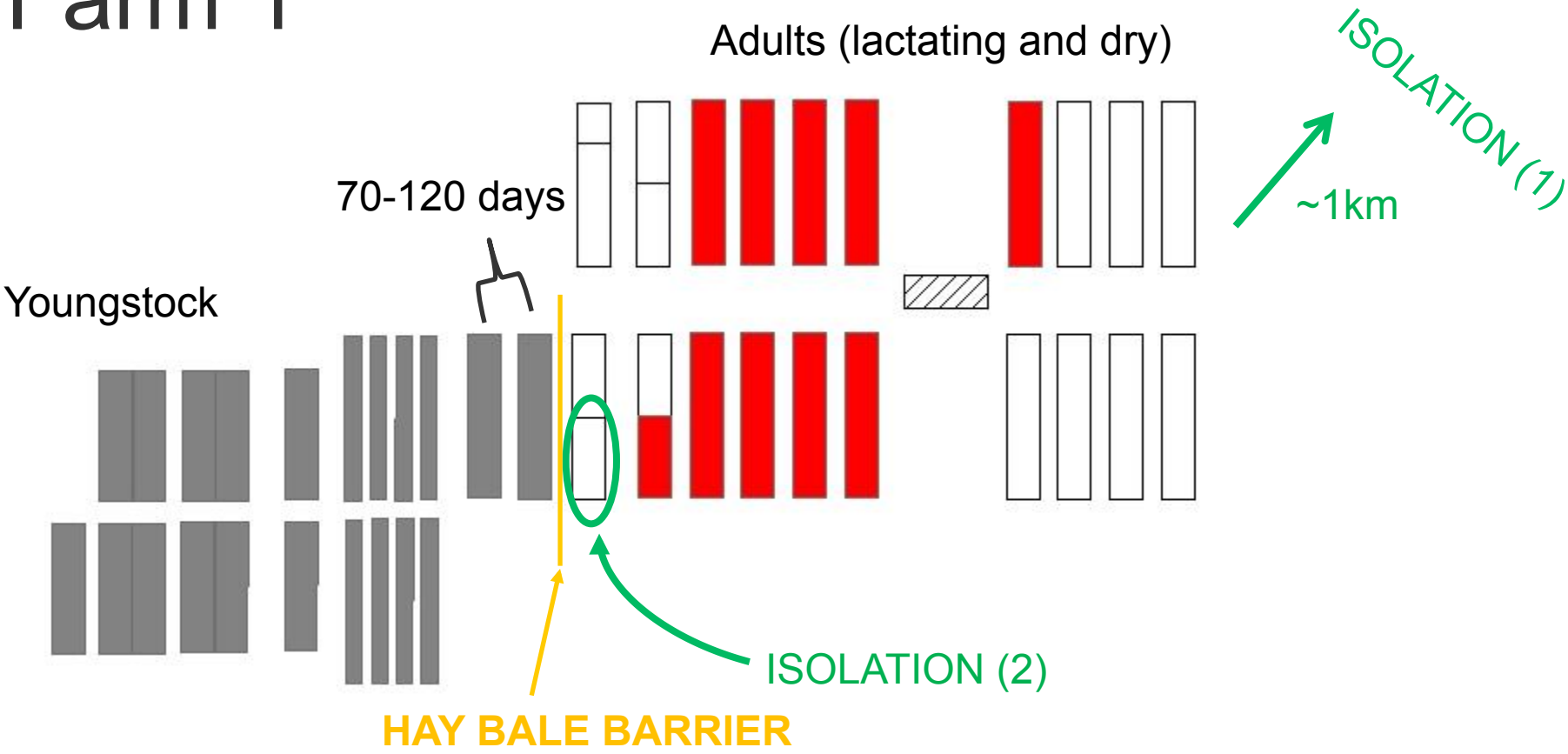


Farm 1
- 27 day interval

Farm 4
- 62 day interval

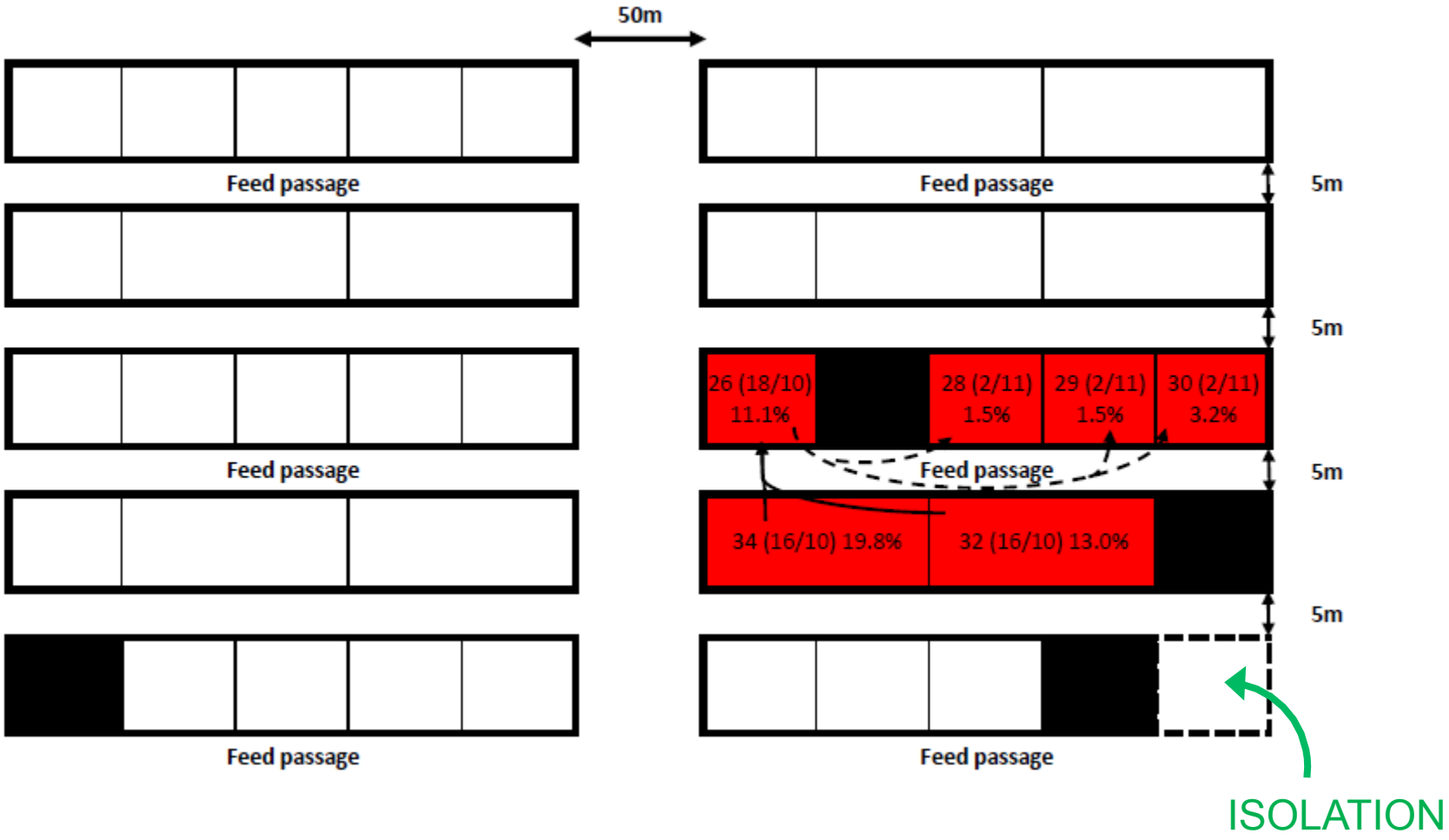
Acknowledgement:
Dr Antonello Di Nardo
Dr Kasia Bankowska
Dr Nick Knowles

Farm 1



- Just affected adult groups despite relative close proximity of younger animals
- Individual cases isolated on other part of farm initially then in separate pen (until full...then left in original house)

Farm 3



- Just youngstock ~11-21 months old

FMD outbreaks – incidence

	FARM NUMBER				
	1	2		3	4
	Adults	Adults	Youngstock	Youngstock	Adults
Overall farm incidence risk (%)	107/3,800 2.8%	144/20,750 0.7%	947/14,800 6.4%	50/4,030 1.2%	882/23,200 3.8%
% groups affected	10/24 (41.7)	12/82 (15.0)	64/218 (29.4)	6/50 (12.0)	34/99 (34%)
Incidence risk % (95% CI)*	4.7 (0-9.7)	2.6 (0.05-4.6)	20.1 (14.3-25.9)	9.9 (4.2-15.7)	9.7 (7.0-12.5)

*robust standard errors, adjusted for intragroup correlation

OVERALL INCIDENCE RISK:

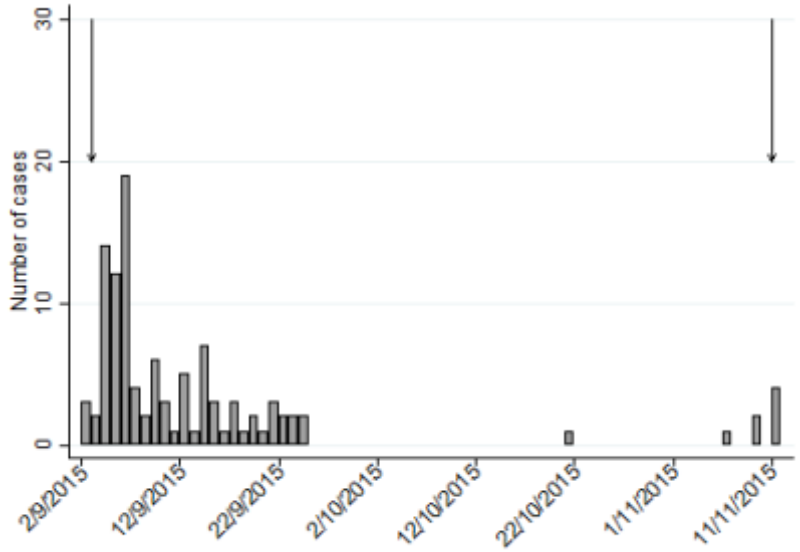
- **Youngstock 18.7% (95%CI 13.6-23.9)**
- **Adults 8.0% (95%CI 5.6-10.4)**

FMD outbreaks – Vaccination

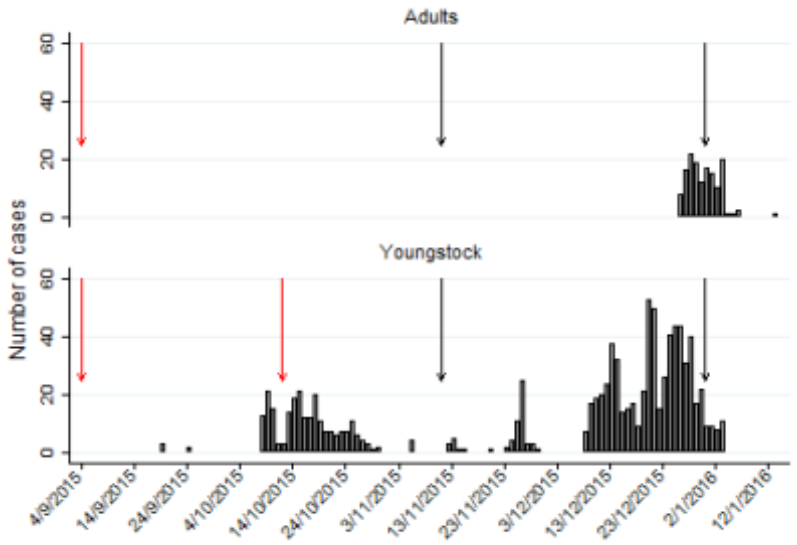
	FARM NUMBER				
	1	2		3	4
	Adults	Adults	Youngstock	Youngstock	Adults
Time since vaccination (days)	65	45	15	43	50

Aftovaxpur (A Saudi 95/A Iran 05)

Aftovaxpur and Decivac (just A Iran 05, DOE)



FARM 1



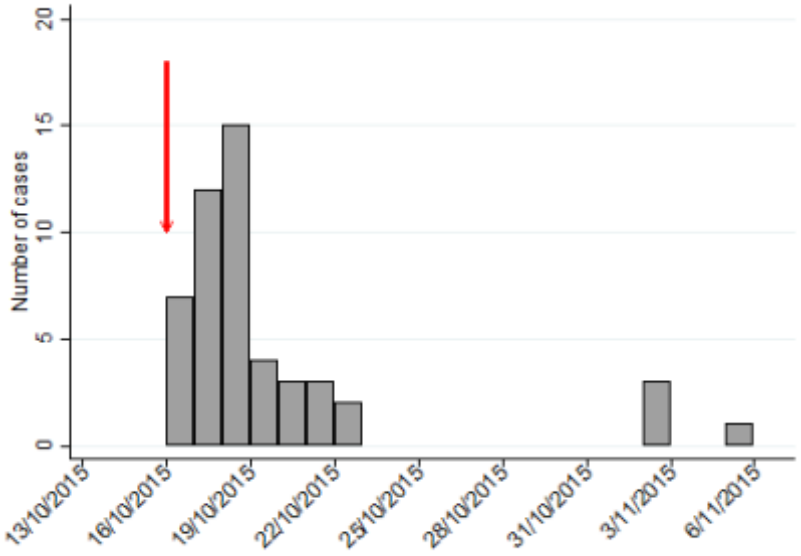
FARM 2

FMD outbreaks – Vaccination

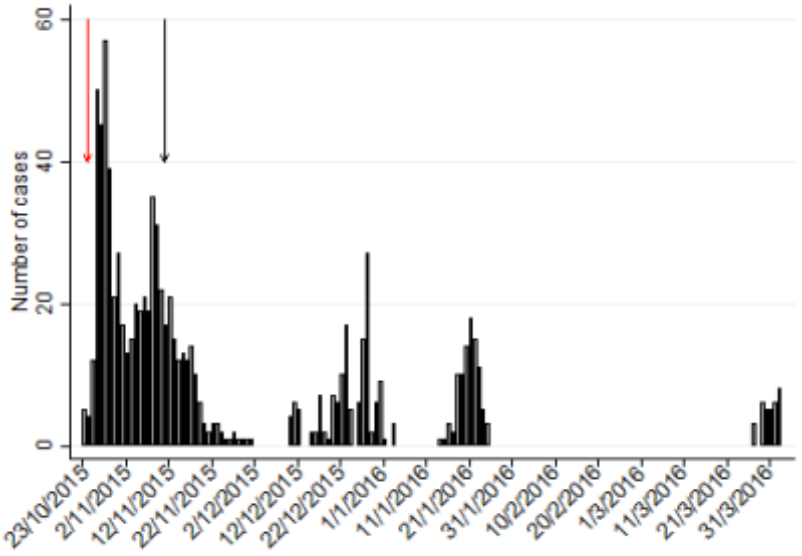
	FARM NUMBER				
	1	2		3	4
	Adults	Adults	Youngstock	Youngstock	Adults
Time since vaccination (days)	65	45	15	43	50

Aftovaxpur (A Saudi 95/A Iran 05)

Aftovaxpur and Decivac (just A Iran 05)



FARM 3

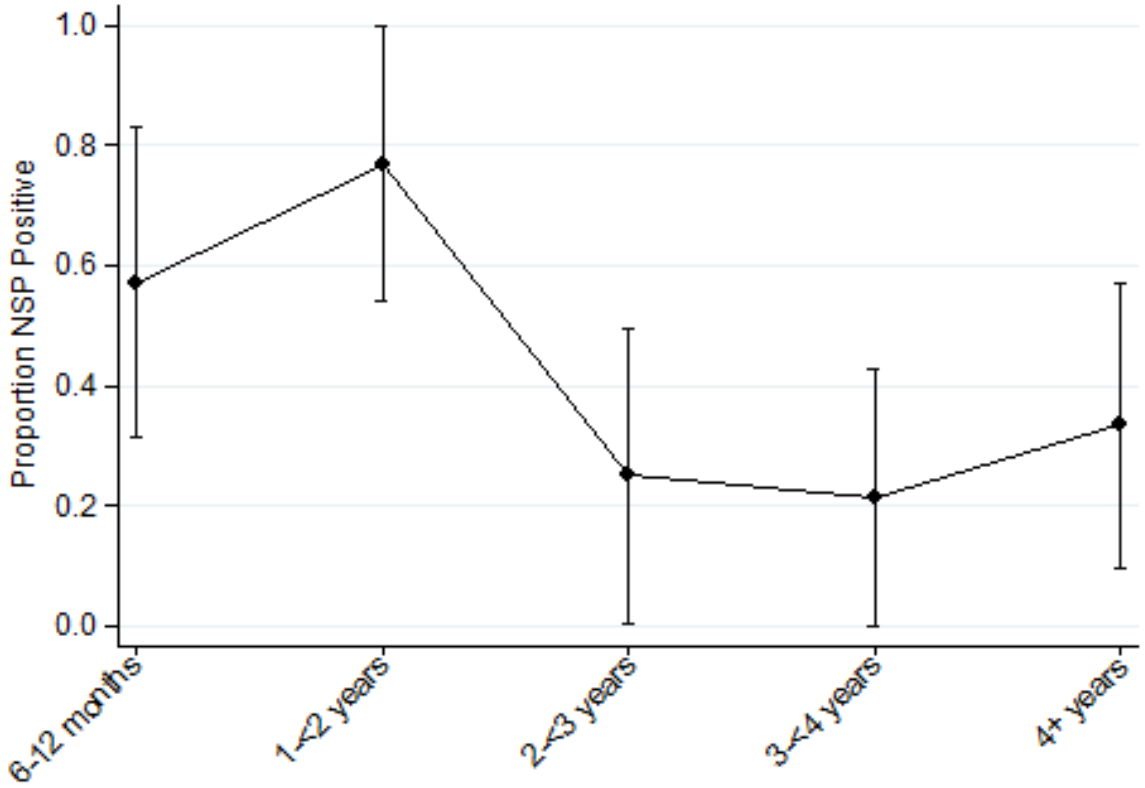


FARM 4

Serological assessment

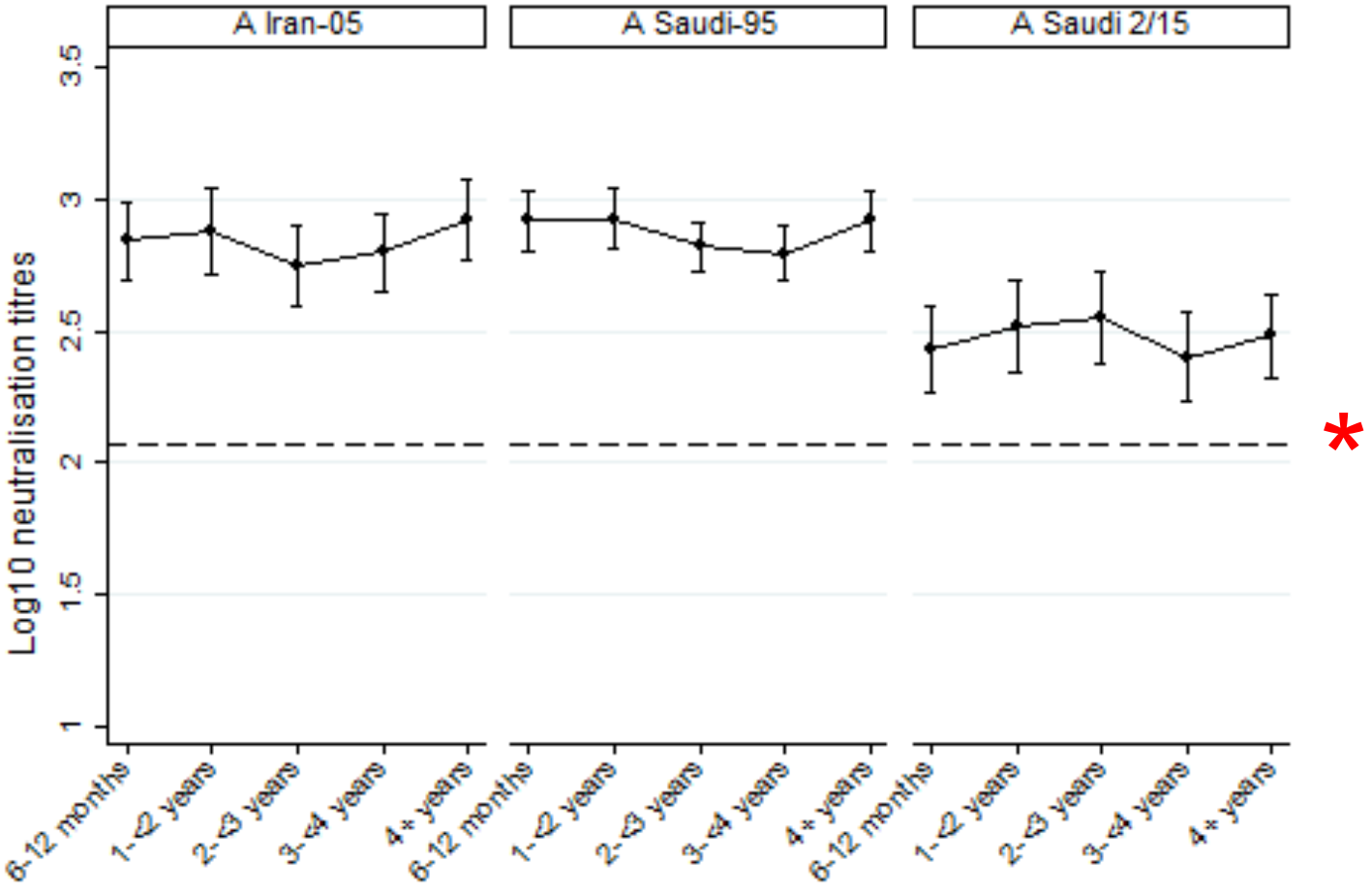
- Performed a serological evaluation of the vaccine on an ***unaffected*** farm using same vaccines and schedules
- This farm had not reported any clinical FMD since 2008 (before any animals present were born)
- Age stratified sampling approach
- All sampled animals were born and reared on this farm
- At Pirbright, tested for NSP antibodies and neutralising antibodies to homologous (i.e. vaccine) and a field strain

Serological assessment - NSP



- **NSP +VE ANIMALS** DID NOT HAVE DIFFERENT SEROTYPE A TITRES
- EXPOSURE WAS LIKELY TO A DIFFERENT SEROTYPE

Serological assessment - VNT



*Protective cut-off for 95% of animals as reported by Barnett et al (2003) based on challenge studies done at the Pirbright Institute for serotype A strains

Serological assessment

- This is a different farm, but titres are likely to be similar in all farms
- Despite probable **satisfactory heterologous titres**, incidence in adults and youngstock was ~8.0 and 18.7% respectively
- Is the 2.0 cut-off from Barnett et al (2003) valid in this setting?
- For other diseases, **correlates of protection can vary in different populations and age groups** (probably related to differing exposures)
    - Pneumococcus (Siber et al, 2007)
    - Influenza (Black et al, 2011)
    - An important but understudied area for FMD

Summary

- This analysis gives an idea of the **levels of disease one can expect in the field** with this vaccine match using a ≥6.0 PD_{50} vaccine
- Infection can **persist** for long periods on epi-units
- Infection may occur **subclinically** on farms in endemic settings
- It may be possible to **contain** outbreaks on large-scale farms (more lessons need to be learned how to best do this)
- Antibody titres were “acceptable”? – implications for ***correlates of protection***

Acknowledgments

- Dr Ibrahim Al Qassim and colleagues in the Ministry of Agriculture, Kingdom of Saudi Arabia
- The farm owners, workers and veterinary surgeons on the study farms
- WRLFMD and the Vesicular Disease Reference Laboratory Group
- BBSRC
- Lawrence Livermore National Laboratory (LLNL)
- Institute of Infectious Animal Diseases (IIAD)