DYNAMICS OF FMDV STRAINS EMERGENCE AND SPREAD WITHIN REGIONS; PROGRESS AND GAPS TO ACHIEVE RAPID THREAT DETECTION

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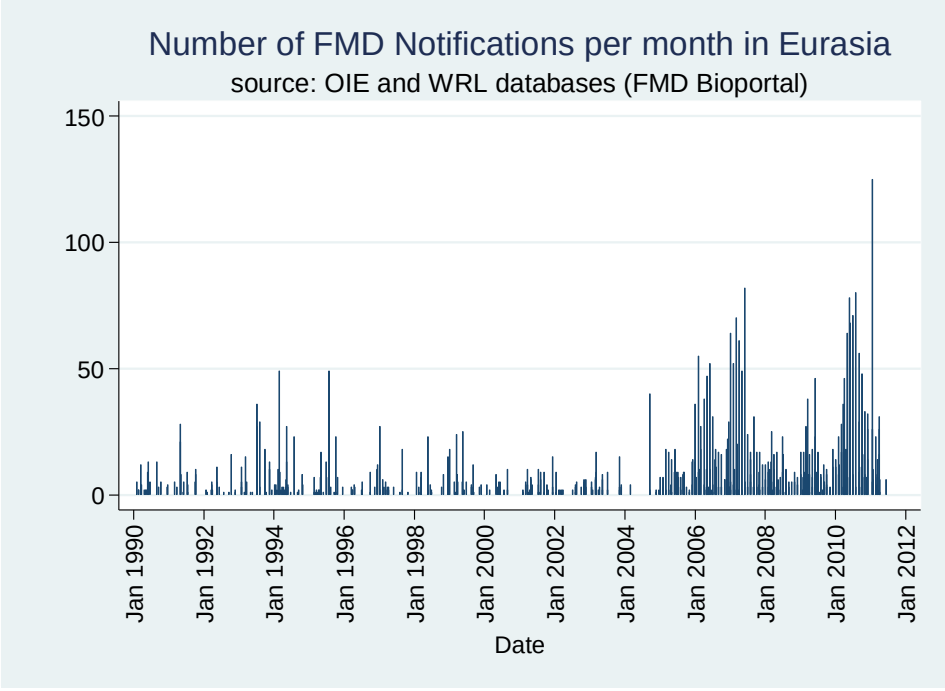
Pool 3: FMD Endemic – or multiple Epidemics?

- Epidemic: higher FMD incidence than usual, unpredicted
- New epidemic waves emerge every 1-2 years in Eurasia

FMD notifications in Pool 3: 1990-2011

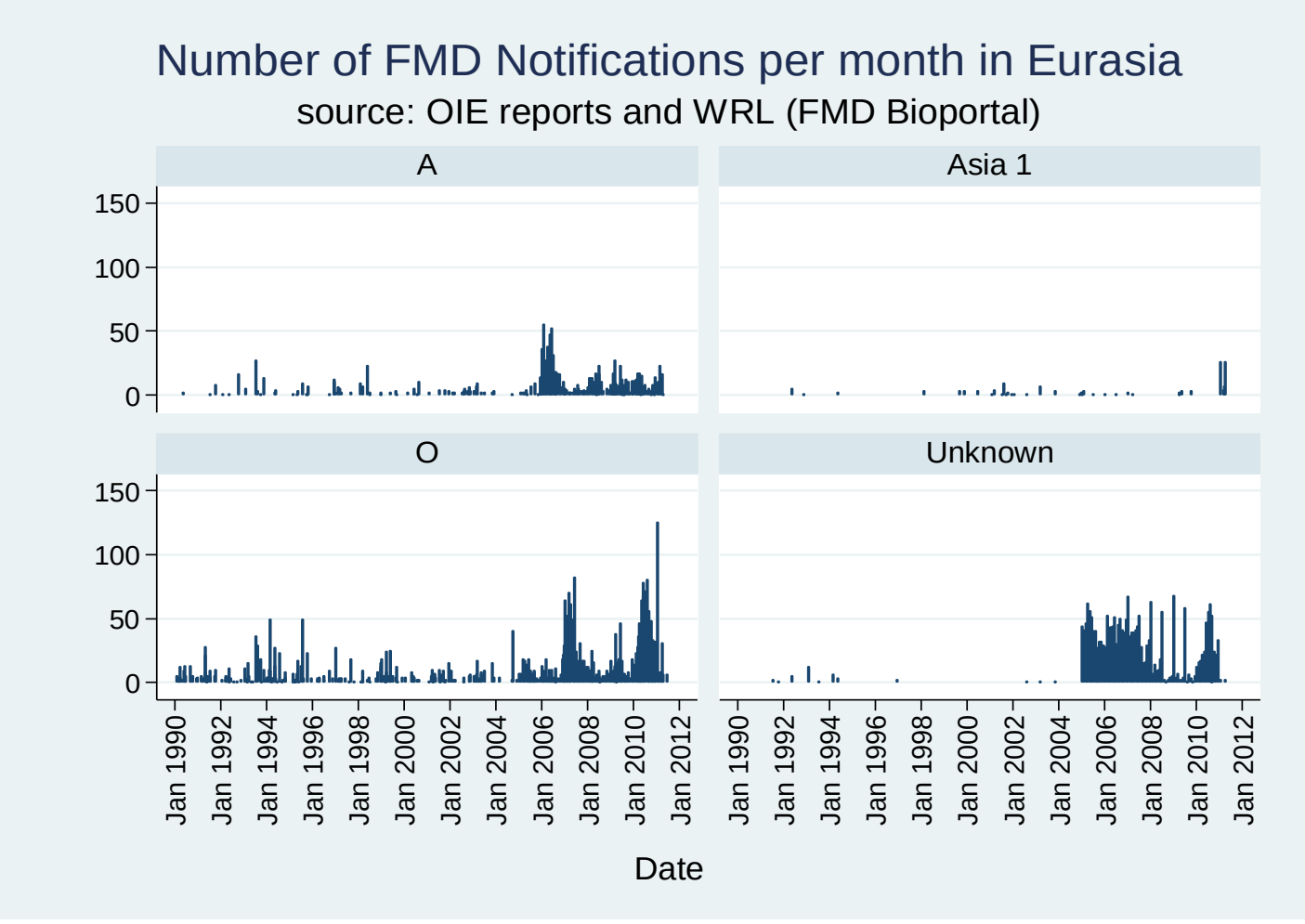


FMD notifications in Pool 3: 1990-2011

Can we Predict these epidemic events?? and so...

- Prepare
- Prevent

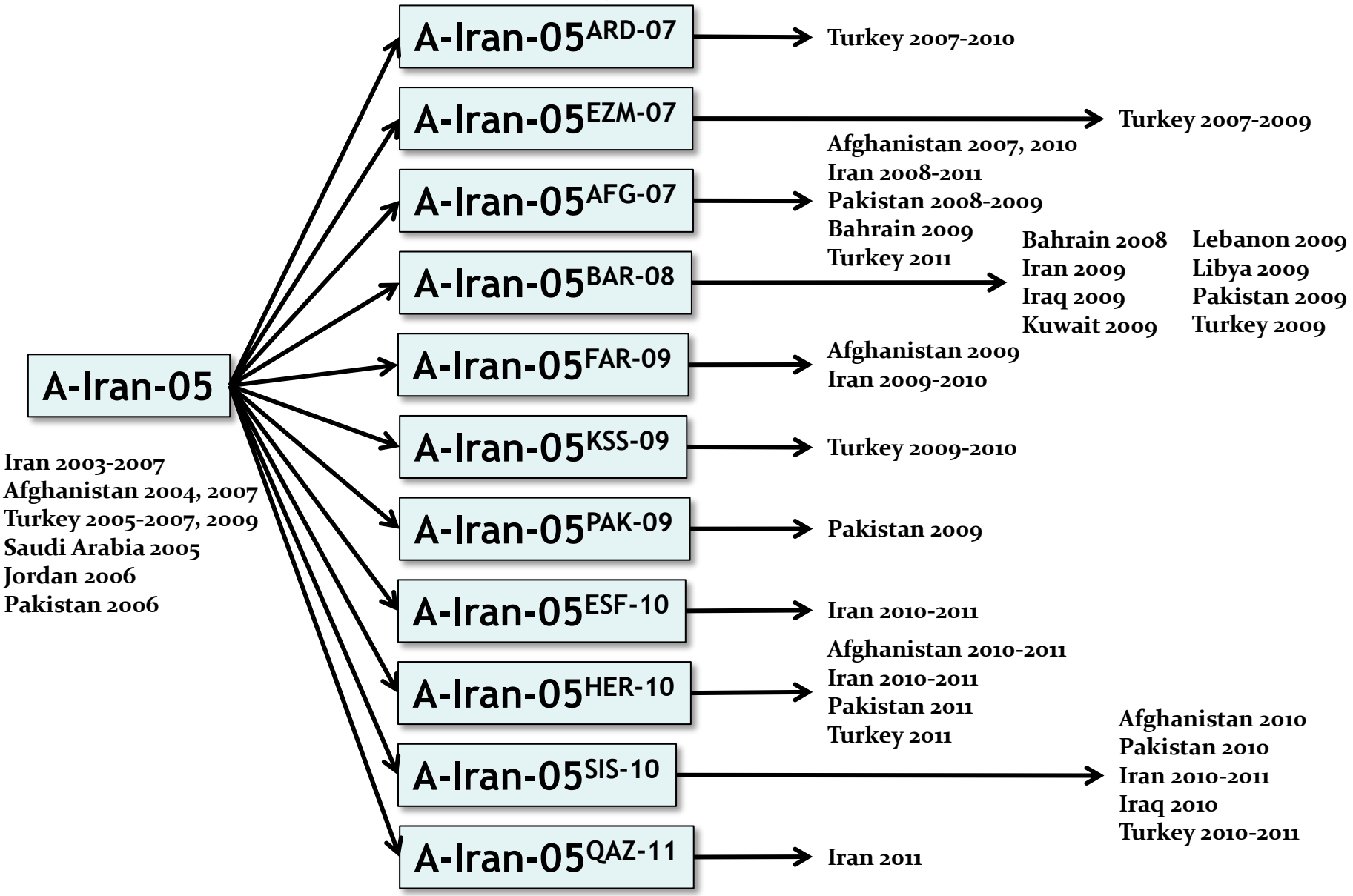
3P's



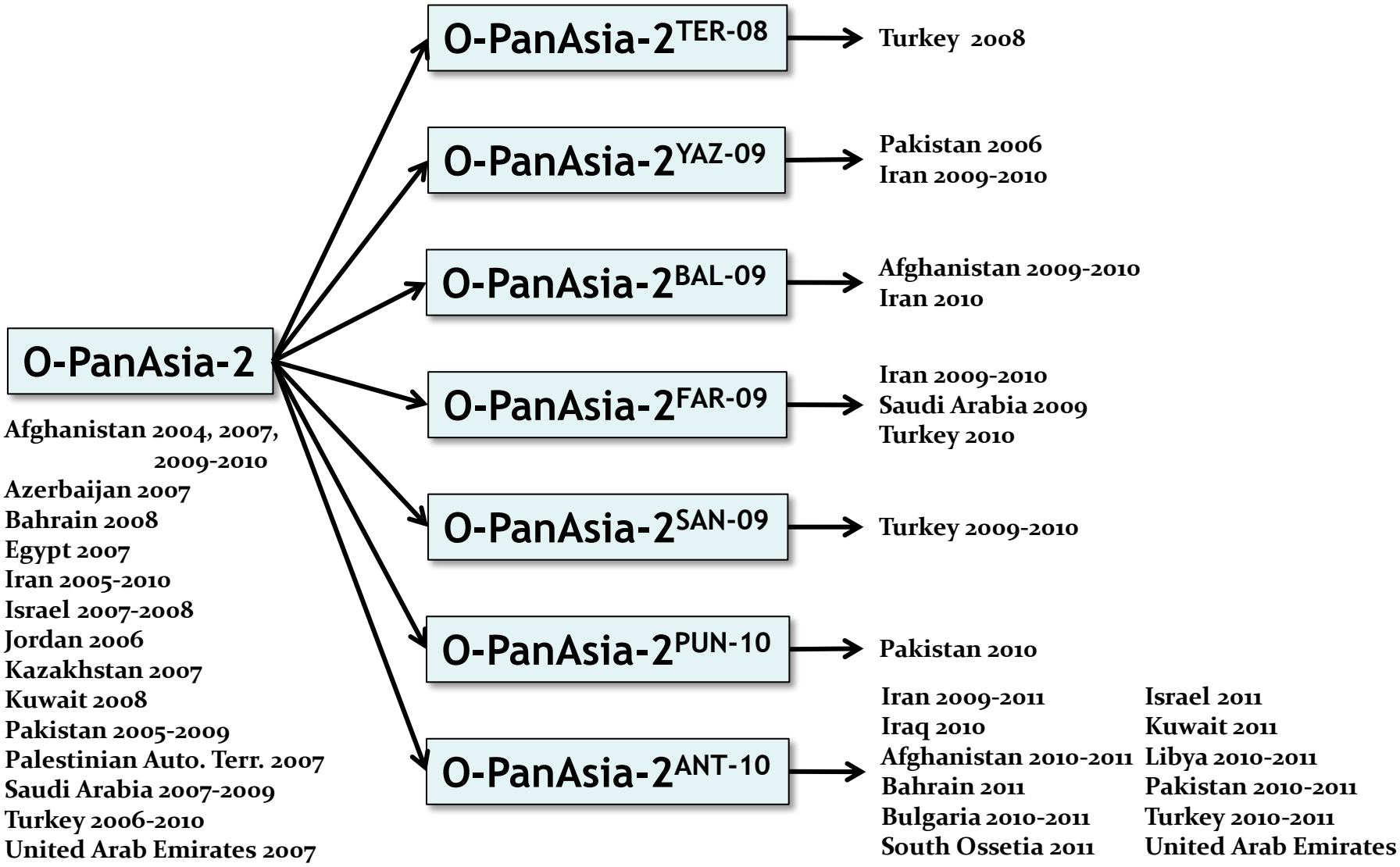
Recent FMD Events in W. Eurasia

Serotype-strain	First detected	Epidemics	Associated Factors
A-Iran-05 (11 sublineages)	2003: Iran	2006--? Iran, Turkey	Vaccines not protective (A-Iran-96, then A22)
O-PanAsia-2 (7 sublineages)	India 2001 (Iran 2005)	2007, 2010 Iran, Turkey	-increased animal movement (meat prices) -waning immunity from last O epidemic -decreased protection from vaccine
Asia 1	Late 2008: Pakistan	2011--ongoing Iran, Turkey	-Shamir vaccine not protective --no natural immunity (previous incursion in 2004)

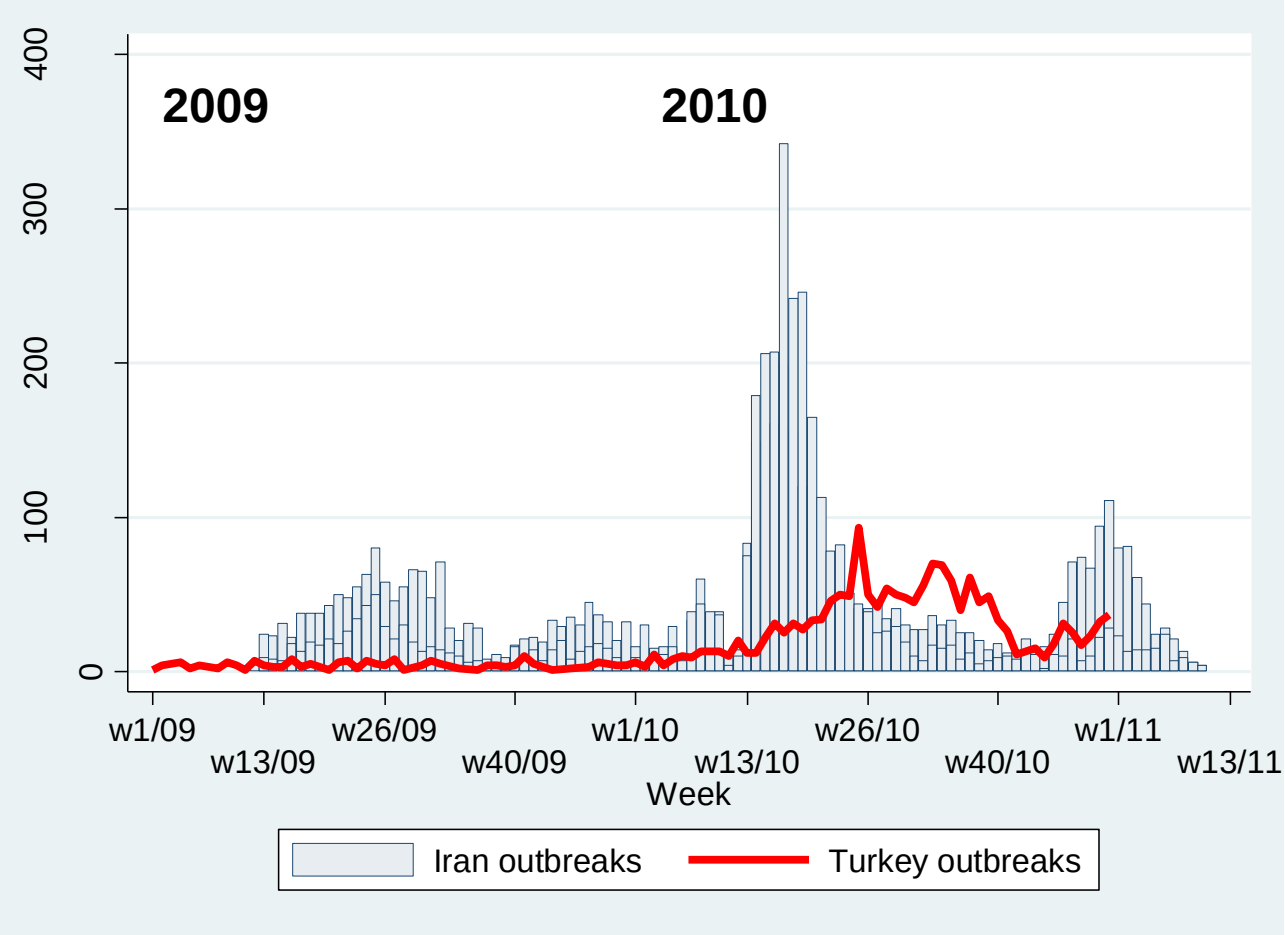
Sub-lineages of A-Iran-05



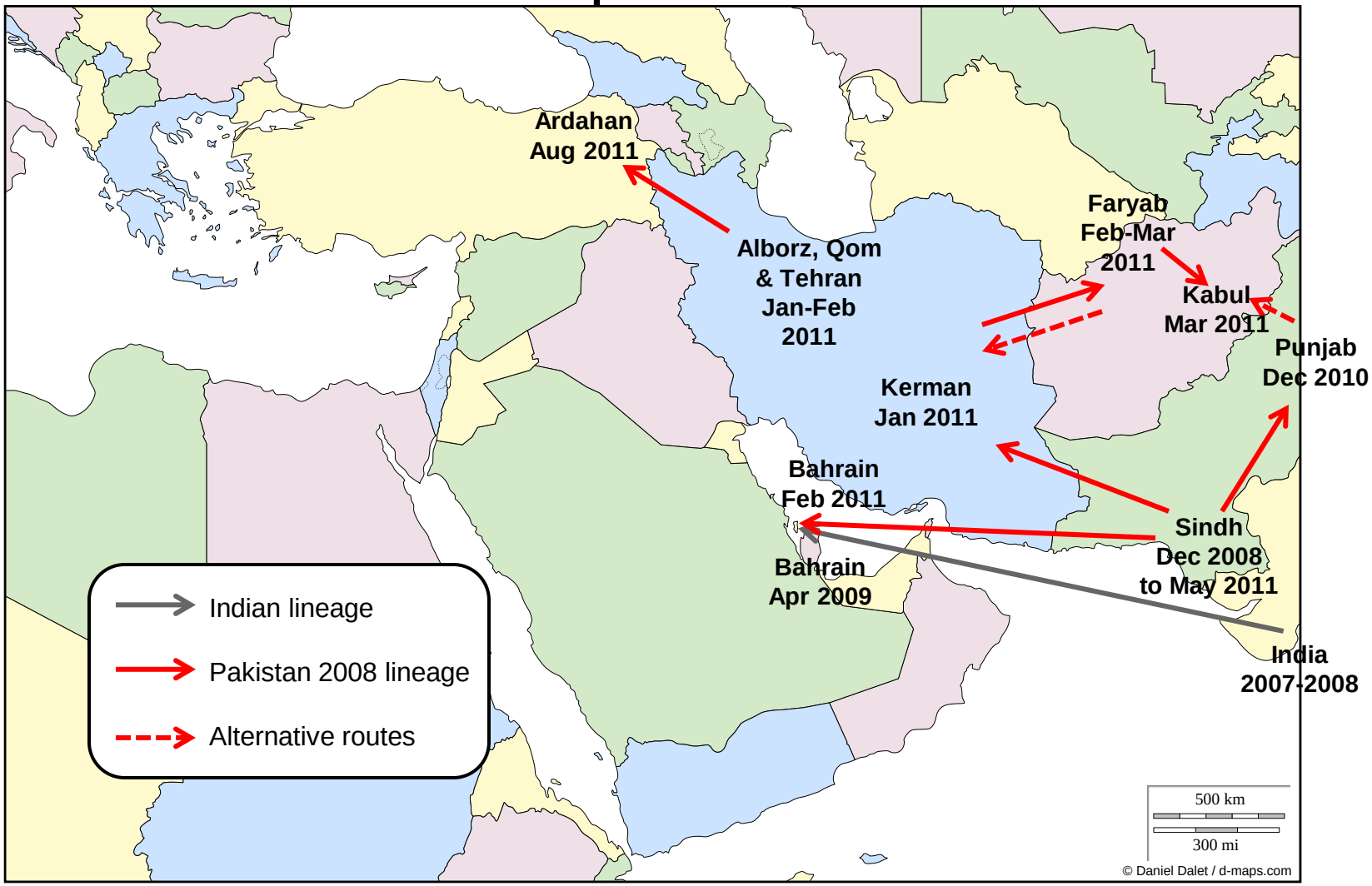
Sub-lineages of O-PanAsia-2



O PanAsia 2: Large surge in outbreaks in Turkey and Iran in 2010



FMDV Asia 1
Postulated Spread 2009-2011*



* Based on samples and information submitted to the FAO World Reference Laboratory for Foot-and-Mouth Disease

How can we reduce the impact of these epidemics?

- Detection and monitoring of threats
- Early recognition of events/epidemics
- Effective and feasible mitigation options
  - Prevention and control

Threat

Threat (Merriam-Webster):

1 : an expression of an intent to do harm

2 : something that threatens

3 : an indication of something impending

In this case, the threat is a situation that increases the chance of an event (in this case, an epidemic)

...but the event hasn't happened YET

Threat detection

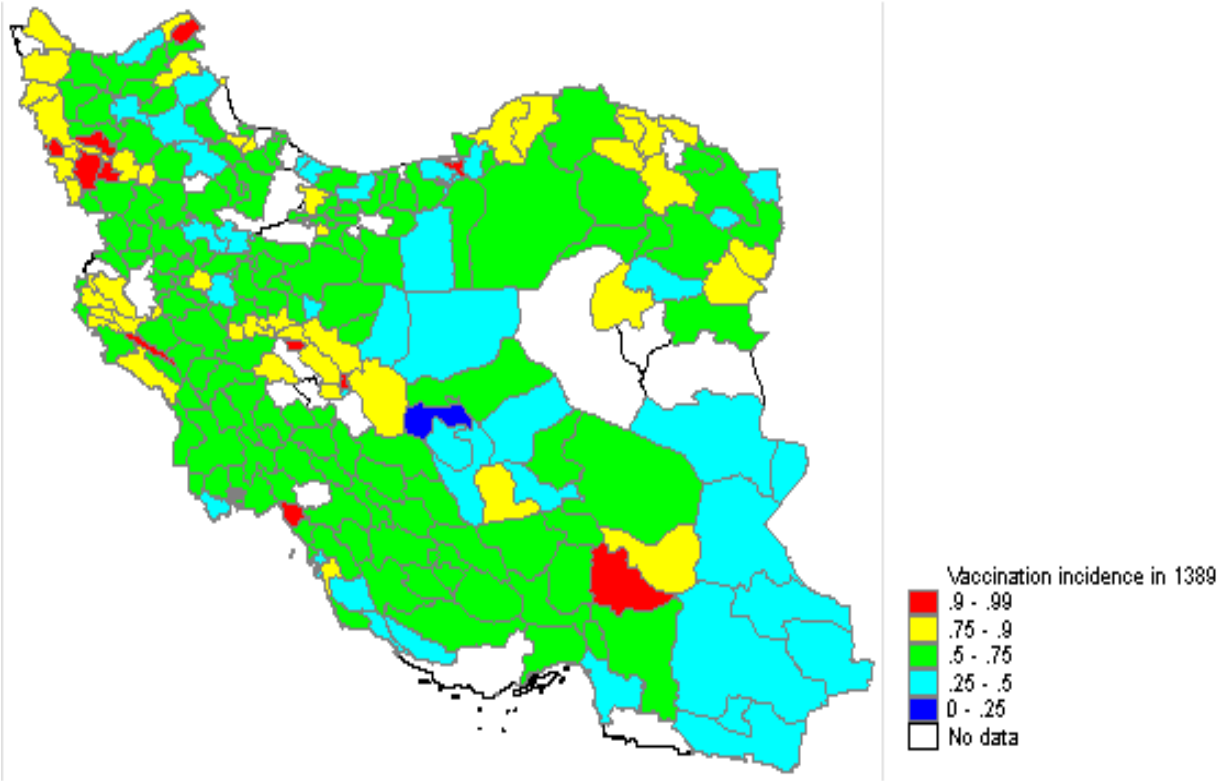
Routine monitoring of indicators:

- Host:
  - Level of immunity
    - Vaccination-generated
    - Previous infection
- Agent:
  - New strains – how know which will cause greatest impact?
    - Increased virulence, infectiousneess
    - Low vaccine matching
- Environment:
  - Animal movement patterns: related to price differentials, festivals
  - Regional FMD situation...events in neighbouring countries

Monitoring: the Host

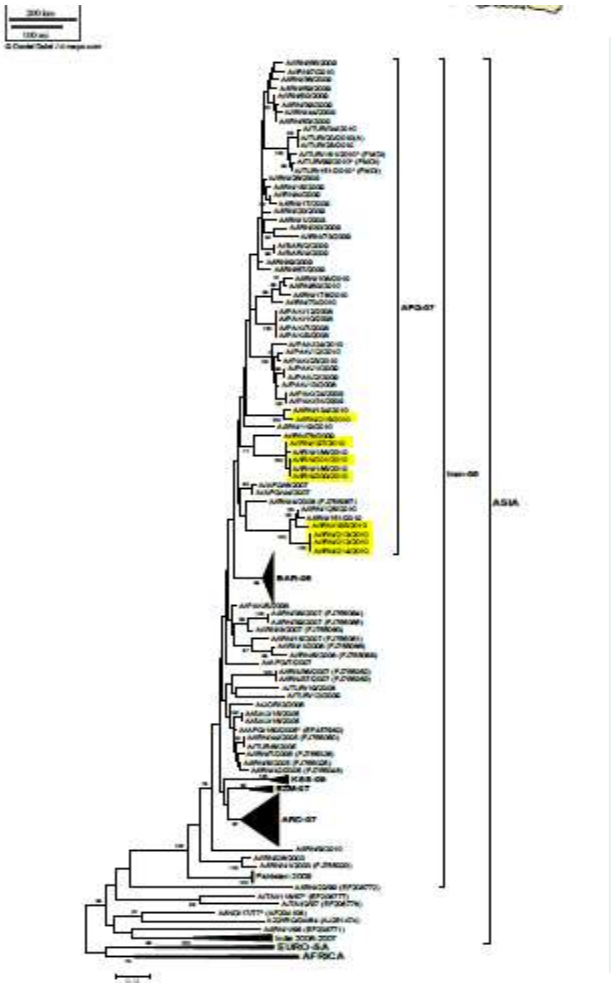
Iran 2010: Proportion of epi-units vaccinated per district

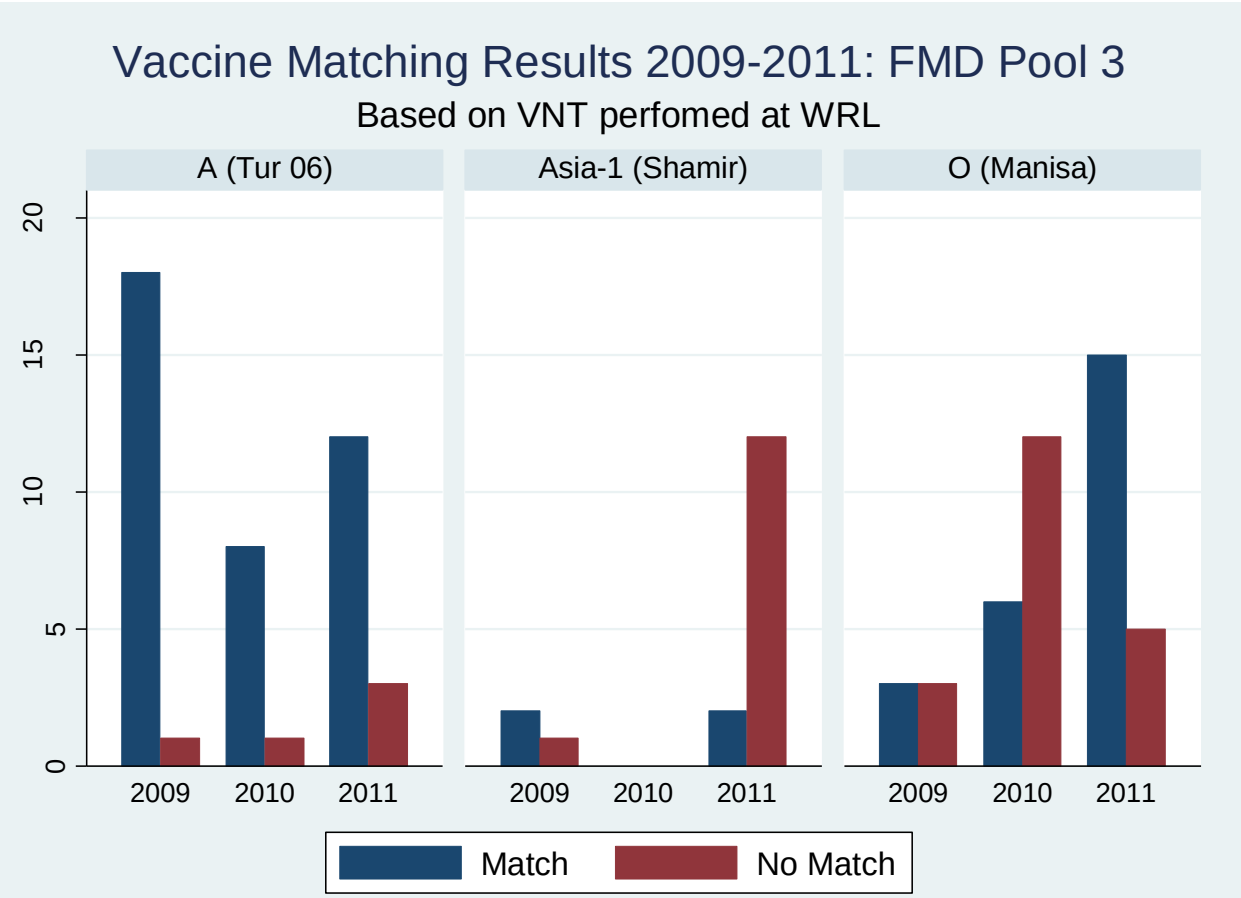
- Naive animals
  - Waning immunity
  - Population turnover
- Need to follow over time
- Correlation of vaccination coverage with immunity ?



Monitoring: the Agent

- How identify *a priori* which strains pose greatest threat?
  - Prone to spread, high virulence





Monitoring: the Environment

- Large scale animal movements
  - price differentials could be indicator
- Events in neighbouring countries:
  - Regional communication, networks (lab & epi)

Prices (in USD per kilo) for live cattle and beef (young male animals)

Country	**Live**		**Meat**	
	2009	*2010*	*2009*	*2010*
Turkey	3.7	6.7	6.2	10.5
Iran	2.3		7	
Georgia	1.5	2.0	4.2	4.3
Armenia	1.6	2.7	3.9	5,4
Azerbaijan	4	4,5	6,2	6,5

Threat detection in practice: 2010 WRL Report

"**Notably,** an Asia 1 epidemic may be due in EurAsia, **since cases are occurring in Pakistan**, whilst other countries including Iran and Turkey with high levels of circulating O and A viruses will by now have a **low population immunity** to this serotype (last seen in 2004). **Increased imports and movements** of live cattle and small ruminants into and through the Middle East from Africa and through new trade routes may also increase the risk of African strains being introduced. "

What should the response to threats be??

Will depend on:

- Sensitivity, specificity and predictive value of alert system...how likely is an event and
- How serious would that event be ??

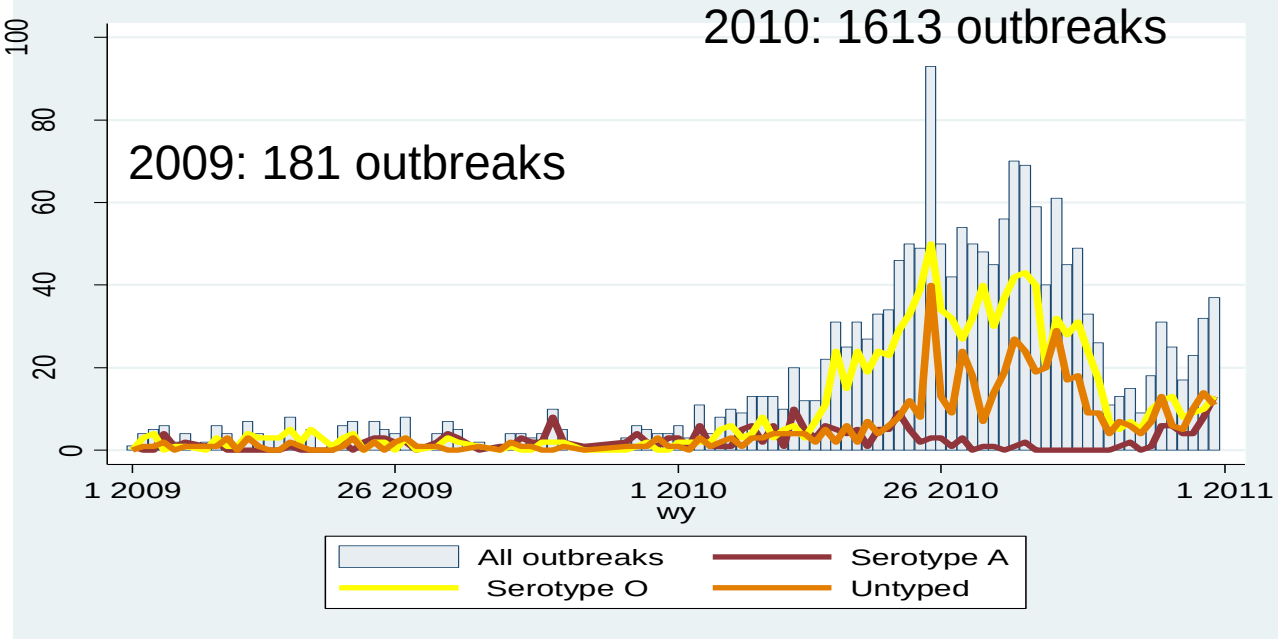
May include:

- Vaccine development
  - Expensive, takes time
- Increased biosecurity –
  - Especially effective when 'threat' is time-limited (eg festivals)
- Enhanced surveillance...facilitate early event detection
- Communication, enhance awareness: locally & regionally

Event recognition

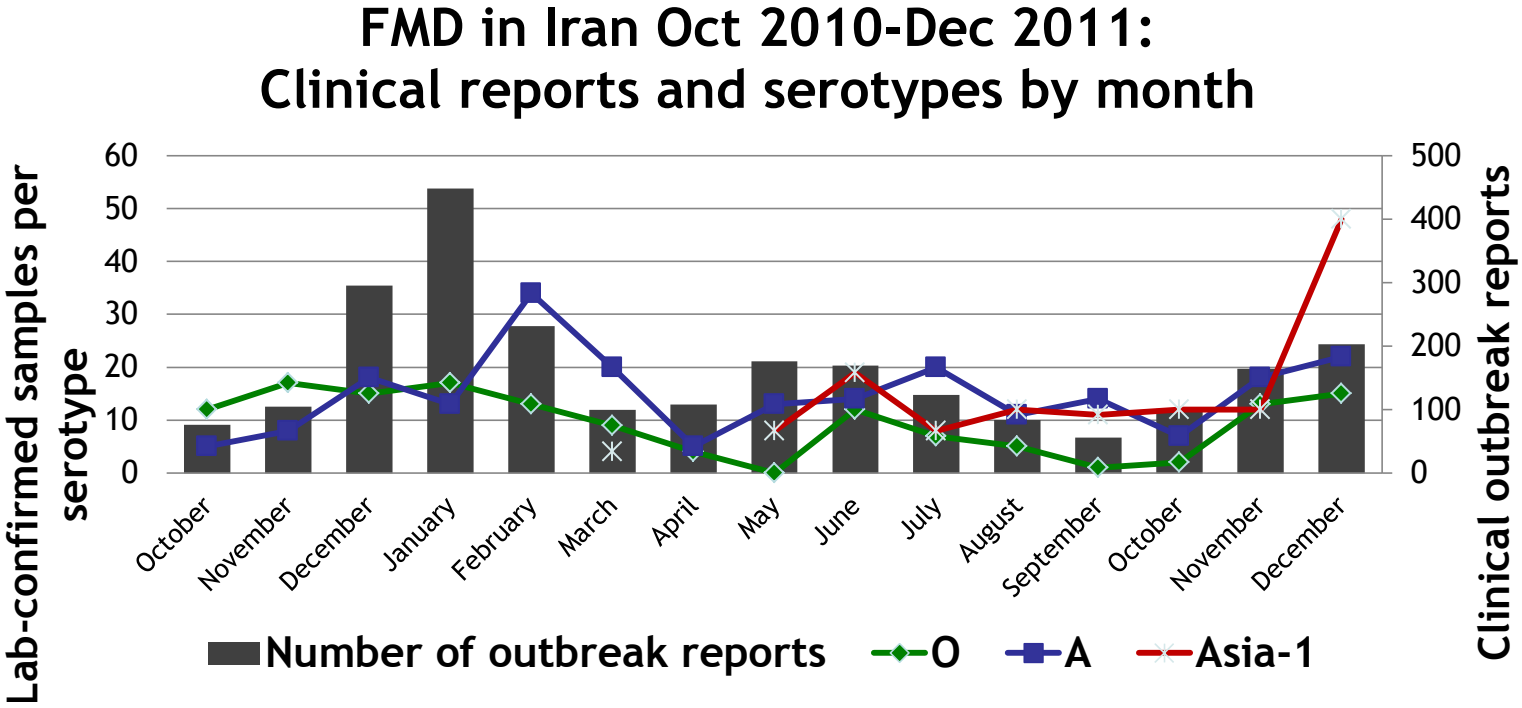
- Early detection to facilitate early response
  - Detection is National responsibility
- Routine monitoring & surveillance essential..."Real-time"
  - Must define what is 'normal' to recognize what is not normal
  - Need high quality data over time

Turkey: 2009-2010



Event recognition: Define criteria to 'trigger' further investigation

- Increased number of cases reported
  - Could be automatic algorithm
  - Requires good reporting system for suspect cases



Event recognition: Define criteria to 'trigger' further investigation

- Unusual clinical presentation
  - Higher mortality
  - Age of affected animals
- FMD in vaccinated animals

Event recognition: Define criteria to 'trigger' further investigation

Criteria: are a "screening" test:

- High sensitivity (detect all events),
- There will be false alarms
- Therefore they are signal for further investigation

Response to Event:

- Minimize spread/impact: biosecurity, movement controls, vaccination

Progress & Gaps

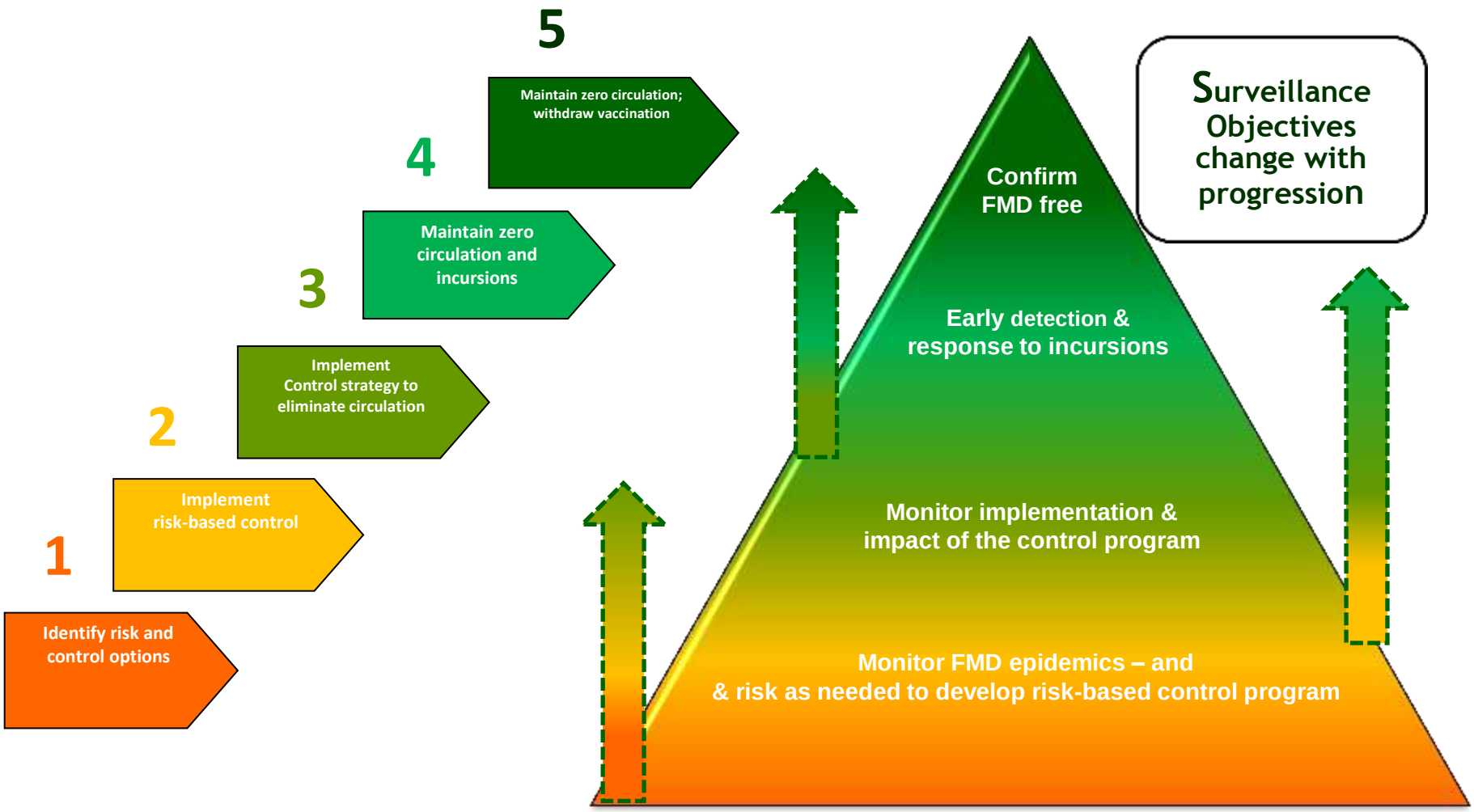
Progress:

- Regional coordination & communication:
  - lab networks: getting more results, faster
  - Regional Roadmaps
  - FMD remains sensitive issue
- Data for surveillance (TurkVet, Iran Gis-vet)

Gaps:

- A lot of data is collected...but analysis and applying information to improve strategies is not yet routine
- More coordination between field, lab, epidemiologists
  - Need to improve information flow about samples (so lab knows clinical picture, and field knows results in timely manner)

Monitoring - is a key principle of the PCP



Summary 1

- FMD in 'endemic' areas is actually characterized by epidemic waves that sweep across regions
- Precipitated by certain conditions ("threat") related to host-agent-environment
- These conditions should be monitored to detect when threat-level is increased...(colour coded alert?)
  - Multiple Indicators should be developed and should consider host, agent and environment factors
- When threat detected: an appropriate response must be implemented...contingency plan

Summary 2

- “Event” detection is different from ‘threat detection’ because indicates early stages of epidemic already started
- Constant monitoring and surveillance, data analysis is critical...need to combine lab and field data
- Sensitivity, specificity & predictive value key attributes for both ‘threat’ and ‘event’ detection
- Early detection for early response...contingency planning, practical & effective mitigation options urgently needed

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Thank you!