Requirements of the Terrestrial Code for FMD surveillance

WORLD ORGANISATION FOR ANIMAL HEALTH

Protecting animals, preserving our future

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Surveillance

Close observation

Origin of the word:

Early 19th century: from French, from sur- ‘over’ + veiller ‘watch’ (from Latin vigilare ‘keep watch’).

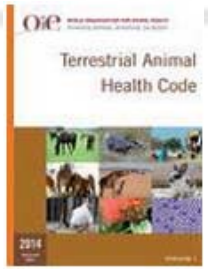
Outline

Principal requirements

- *Demonstrating freedom from FMD, FMDV infection and/or FMDV transmission*
- *Early detection and investigation of cases*
- *Demonstrating the effectiveness of vaccination, if practised*

OIE Standards for FMD surveillance

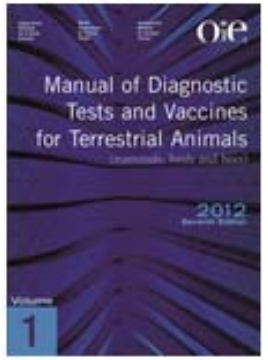
FMD Code Chapter

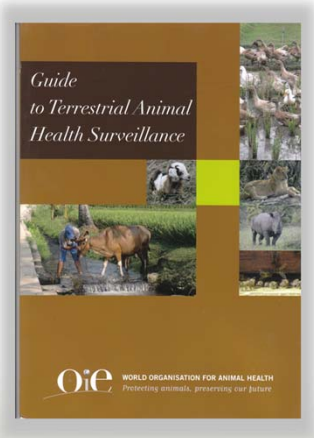


Article 8.8.40.	General principles of surveillance
Articles 8.8.41.	Methods of surveillance
Articles 8.8.42.	The use and interpretation of serological tests

Other standards relevant, not only FMD Code Chapter

Surveillance chapter (1.4.) in Code
Manual of diagnostic tests and vaccines
New guide on post vaccination monitoring





Guideline on Animal Health Surveillance

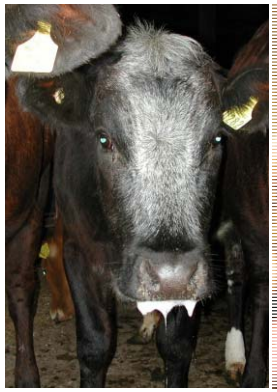
Article 8.8.40.
General Principles of Surveillance

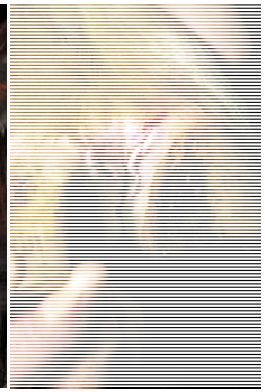
- Early detection
- Demonstration of freedom
- OIE endorsed official control programme
- Surveillance strategies
- Interpreting results and follow-up of suspicious findings
- Demonstration of vaccination effectiveness

Article 8.8.41.
Methods of surveillance (1)

Clinical surveillance

- Across whole livestock chain
- Legal basis of notification
- Awareness and compensation
- Inspect enough animals often enough
- Document investigations
- Corroborate lab/epidemiological findings
- Limitations
  - Lack of opportunity for inspection
  - Livestock species showing mild signs of disease
  - Vaccination masks disease
  - Insufficient time for disease to be disclosed

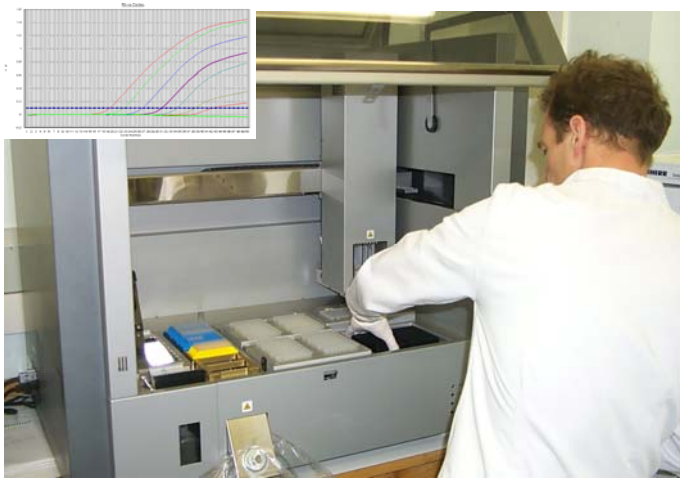




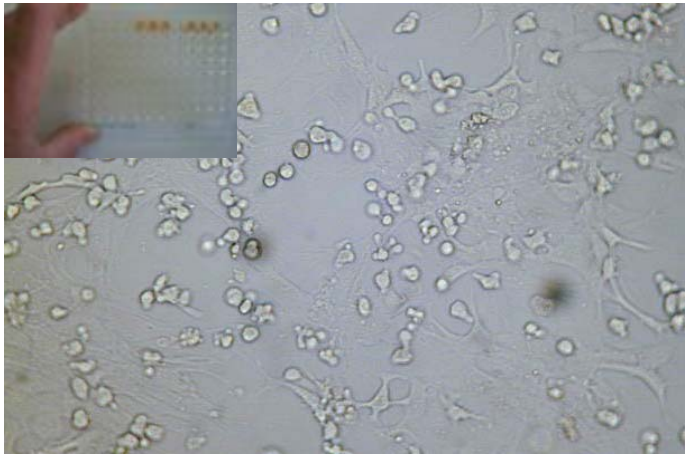
Article 8.8.41.
Methods of surveillance (2)

Virological surveillance

- Confirm clinically and serologically identified suspect cases
- Characterise isolates for epidemiological studies, vaccine matching and other biological properties
- Monitor populations at risk for the presence and transmission of the virus



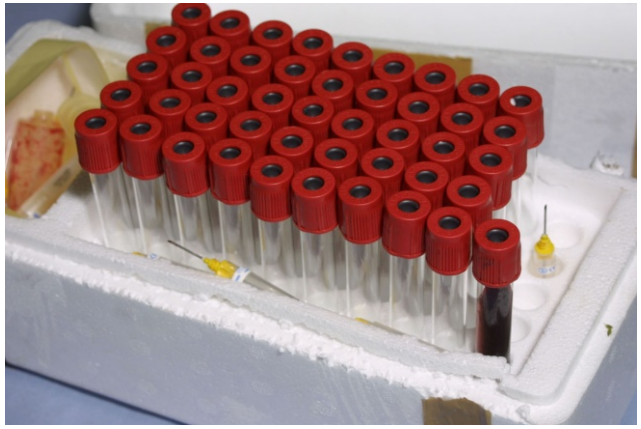
Robotic sample preparation for rRT-PCR



Virus isolation confirmed by Ag ELISA

Article 8.8.41.
Methods of surveillance (3)

Serological surveillance



- Estimate prevalence or substantiate freedom from infection / transmission
- Substantiating freedom should be risk-based
  - When clinical surveillance is unreliable
  - Target high risk populations
    - ✓ Close to borders with infected zones or countries
    - ✓ Enterprises that buy in animals from many/distant sources
    - ✓ Enterprises with shared grazing or transhumance
- Monitor population immunity after vaccination

The pillars of surveillance

The pillars of the surveillance system of a country wishing to be confident of being and be recognized free from FMD

- Targeted (risk based) ongoing surveillance
- Early detection system
- Disease reporting/notification system
- Monitoring of vaccination

Early Detection

- Surveillance system under official veterinary control
- Reporting of suspected *cases*
- Expertise in FMD diagnosis and control
- Sampling, submission and testing procedure

Demonstration of freedom

- Continuing programme required
- Approach tailored to local circumstances
- Risk-based and proportionate

To substantiate FMD freedom:

Where vaccination is not practised	Demonstrate absence of infection
Where vaccination is practised	Demonstrate absence of transmission
For a compartment	Identify the prevalence, distribution and characteristics of FMD outside the compartment

OIE endorsed official control programme

- Surveillance should demonstrate the effectiveness of any *vaccination* and of the ability to rapidly detect all FMD *outbreaks*

- Need to establish that the whole territory or part of it is free from FMDV *infection* and transmission and to understand the epidemiology of FMD

Surveillance strategies

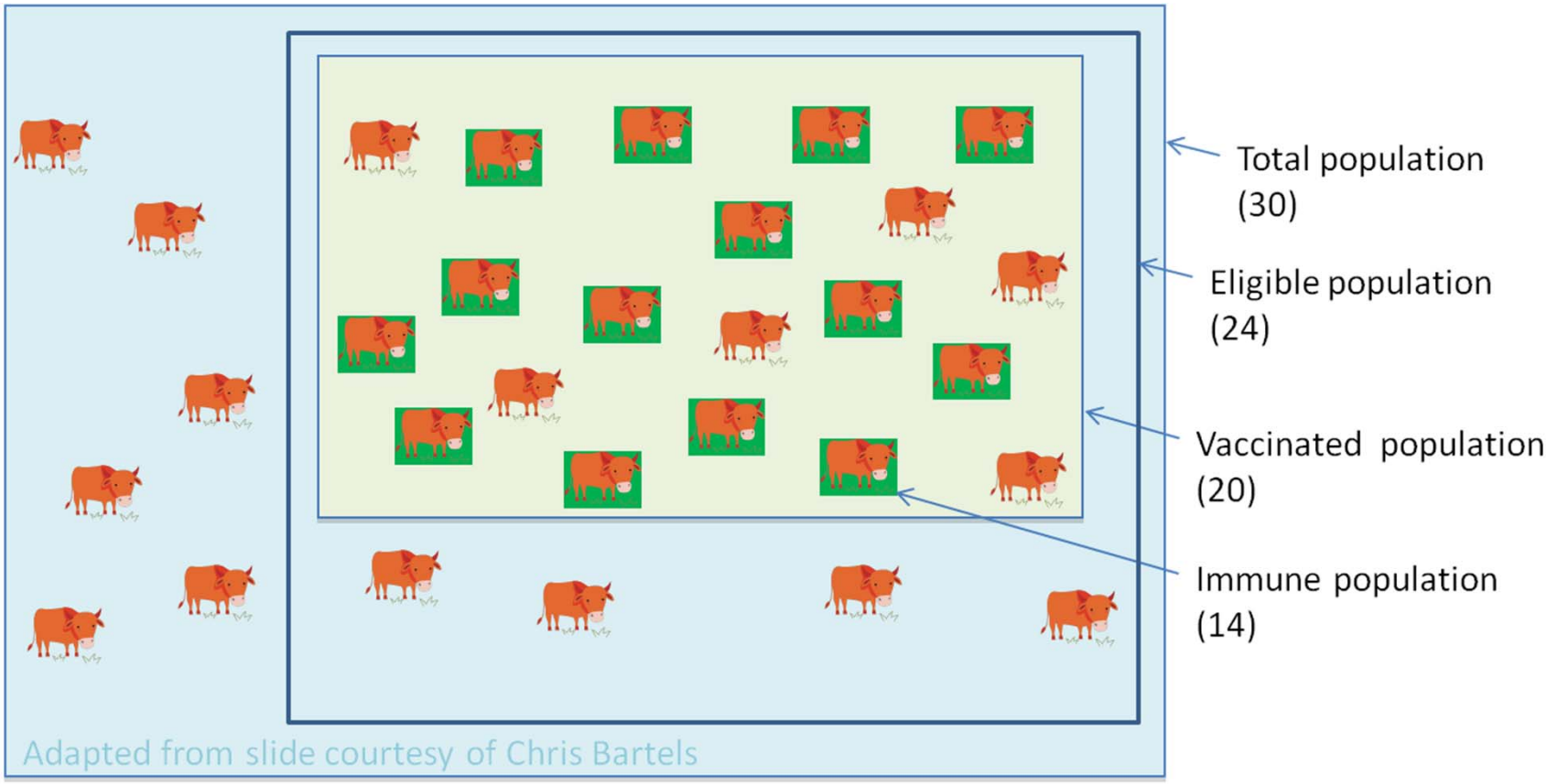
- Randomised / targeted clinical investigation or sampling
- Risk-based approaches
  - Appropriate design prevalence and frequency
  - High versus low risk sub-populations
  - Clinical versus serological surveillance
  - Justification

Interpreting results and follow-up of suspicious findings

- Timely and documented
- Take account of field and laboratory findings
- Take account of test performance characteristics
- Repeat testing and follow-up visits and investigations

Demonstration of vaccination effectiveness

Vaccination coverage and population immunity



Vaccine coverage is 20 out of 24 = **83%**

Vaccinated population is 20 out of 30 = **67%**

Population immunity amongst vaccinated is 14 out of 20 = **70%**

Population immunity overall is 14 out of 30 = 47%*

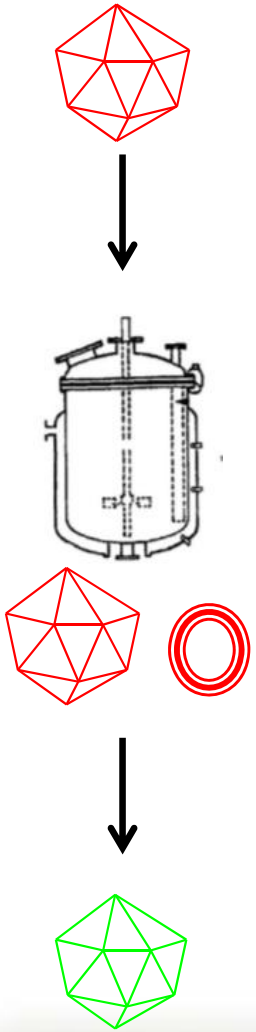
*** Ignoring impact of immunity from colostrum, past vaccination or infection**

Article 8.8.42.
Use & interpretation of serological tests

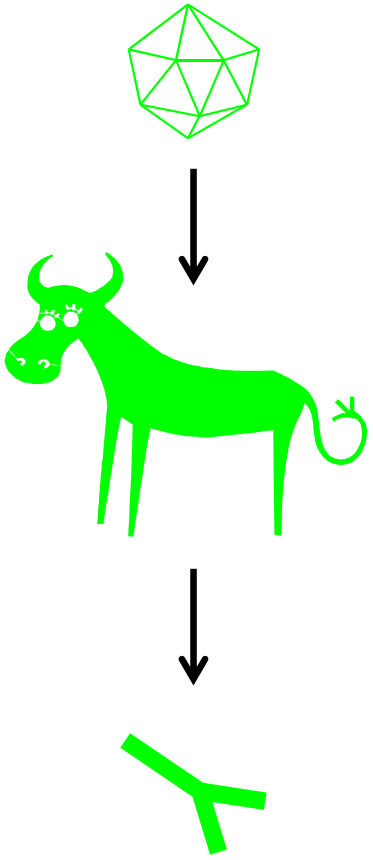
- Tests for antibodies to FMDV structural proteins
- Tests for antibodies to FMDV non-structural proteins
- Causes of positive results
  - Infection
  - Vaccination
  - Maternal antibody
  - Non-specific reactivity
- Follow-up procedures

NSP / SP Serology

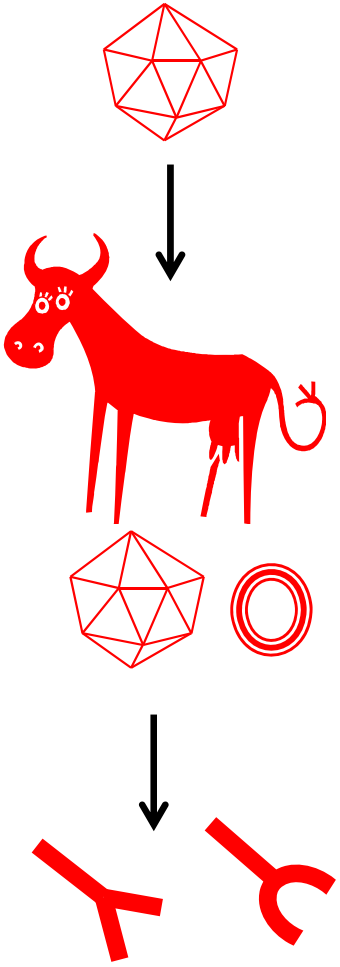
Growth of vaccine virus



Vaccination with purified vaccine



Infection with replicating virus



KEY TO FIGURE

Live virus

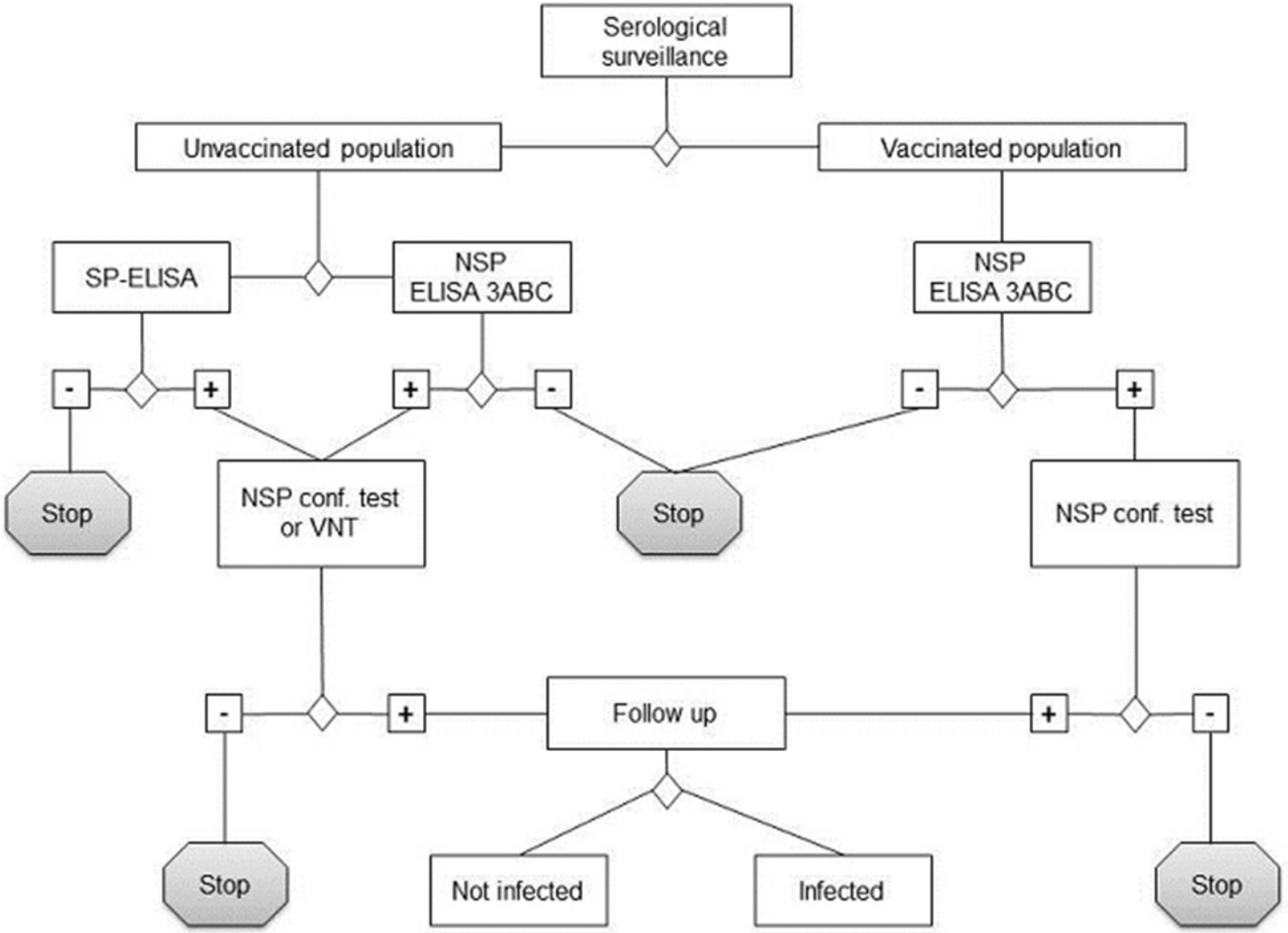
Inactivated purified virus (structural proteins)

Viral non-structural proteins

Antibodies to viral structural proteins
- Serotype-specific
- Correlate to protection

Antibodies to viral non-structural proteins
- Pan-serotype reactive
- Used for DIVA testing

Lab tests for serological surveys to determine evidence of FMDV infection



Interpreting NSP seroreactors

- Understand NSP responses to vaccine in use
- Target surveillance to reduce non-specific results
  - Risk based to reduce overall scale of testing
  - Focus on 6-12 month old animals
- Complementary investigations and evidence
  - Disease
  - Epidemiological links
- Number, strength and clustering of sero-reactors
- Repeat testing
- Revisits, re-sampling, retesting, paired tests, virological tests

Critical issues of surveillance

- It is of crucial importance to REACH AND MAINTAIN freedom from an infection (but also to build up a strong confidence into trading partners)

- The results of any survey are valid only for the point in time in which the survey was performed

- A system operating CONTINOUSLY on the basis of clear and sound procedures finalized to early detection - and early reaction in case of infection/disease occurrence - provides a more solid and durable confidence on the level of risk for all stakeholders, including trade partners

Example flow chart for substantiating FMD freedom with NSP tests

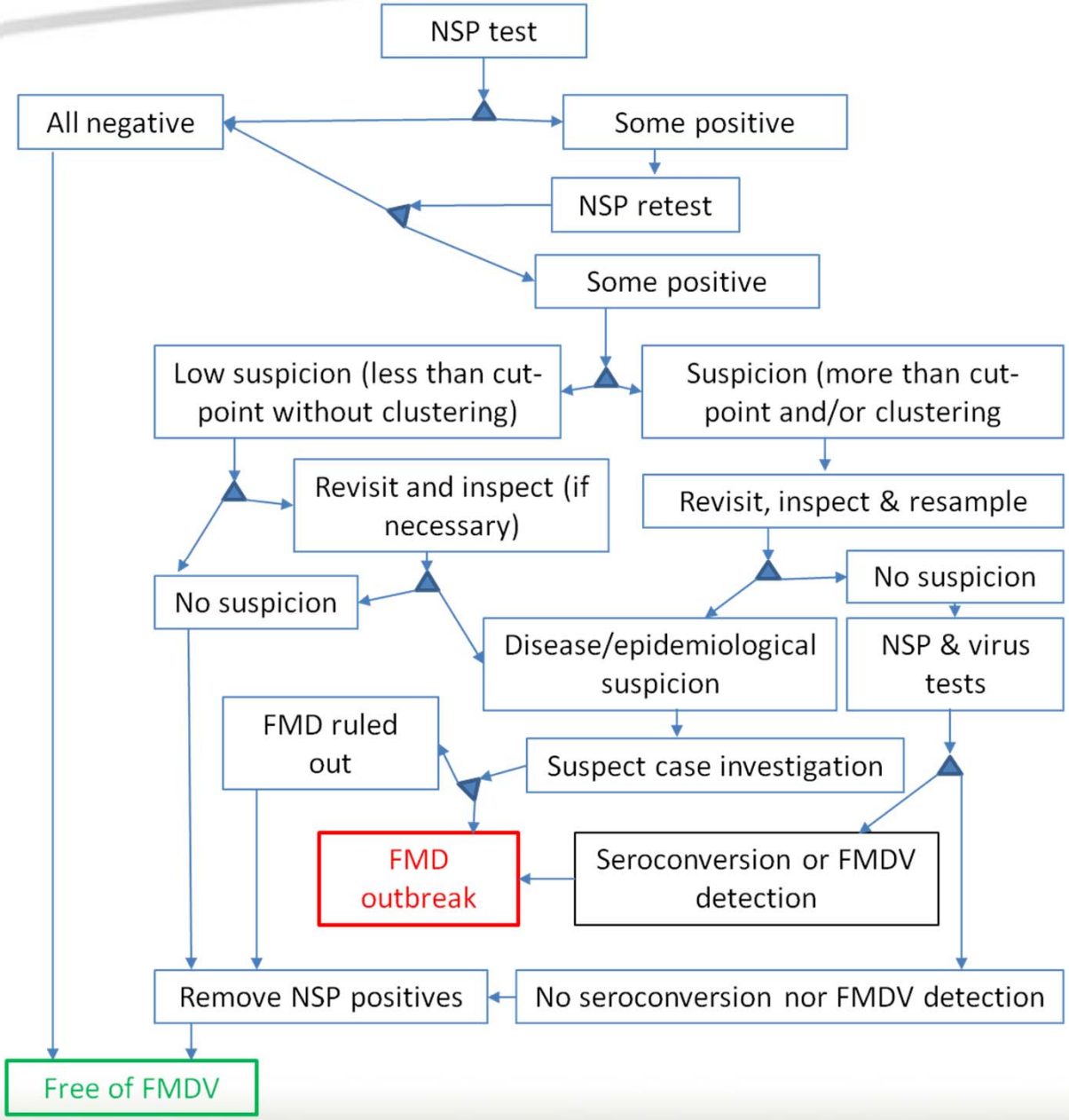


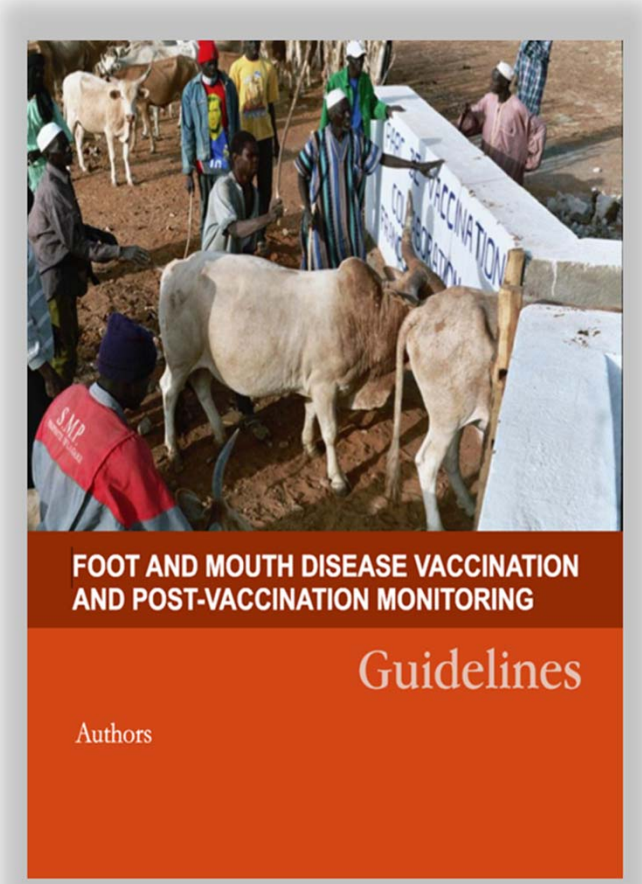
Figure taken from:
The use of serosurveys following emergency vaccination, to recover the status of "foot-and-mouth disease free where vaccination is not practised"
Paton, Füssel, Vosloo, Dekker, De Clercq (2014) Vaccine, 32: 7050–7056

Evaluating vaccines before and after purchase

- Advice from OIE Reference Laboratories on vaccine selection
- Evidence from vaccine manufacturer – potency and batch release tests
- A pre-purchase study of elicited immunity in a small group of local animals
- A larger study in the field when vaccination is implemented
- Monitoring vaccine coverage and population immunity

Establishing PVM serology thresholds

- Test for expected response or for protection
- For the former need sera from the vaccine batch produced under controlled conditions
- For the latter - correlate serology with potency test results for homologous protection threshold
- Substitute field virus for vaccine virus in serology test to estimate heterologous protection
- Work closely with the vaccine manufacturer and a reference laboratory



Conclusions on surveillance

- The main goal of a FMD surveillance system is the management of the control of the disease. The proof of the absence of disease and absence of viral circulation is “consequential
- The use of random surveys as the main mean to prove absence of disease/infection when FMD occurs at very low level of prevalence has severe limitations, in particular in mass vaccinated populations
- Ongoing targeted risk based surveillance is the method of choice in case of low prevalence and clustering as in case of mass vaccinated populations

Acknowledgement: V. Caporale

Conclusions on surveillance

- When risk based surveillance systems are implemented the use of a proper method to identify risks is mandatory to avoid serious drawbacks
- Surveillance system should involve all stakeholders in an interactive manner
- Field and laboratory veterinarians should operate in an integrated mode and have prompt reciprocal access to data
- No effective surveillance can exist in the absence of a solid veterinary service infrastructure diffusely present in the territory and operating as an integrated system
- Surveillance data should reflect honesty/transparency – also report suspicious findings – not only negatives!

Thank you for your attention!

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