Practical cases in diagnosis, monitoring and control of PRRS

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What is PRRS and what is not

Compatible with PRRS

1. **Abortions after ≈ 90 days of gestation with mummified foetuses**
2. **Stillbirths**
3. **Premature or delayed farrowing with weak born piglets**
4. **Respiratory disease in weaners**

Probably is not PRRS

1. **Cyclic return to oestrus**
2. **Early gestation abortions**

- The virus do not cross the placenta before day 86 of gestation
  - Lack of receptors in macrophages before late gestation?
- Most often foetuses die as a result of the infection
- Respiratory disease not always is overt and often secondary complications reveal the existence of PRRSv
- PRRSv is not found in embryos before the third week of infection
- Infection of sows between 20 and 60 days of gestation does not result in clinical consequences

The cycle of PRRSv in the farm

Lateral introduction

Lateral introduction

Abortion storm
Most sows become infected and then immune

Gilts are infected

Self-replacements re-introduce the virus

Endemic state

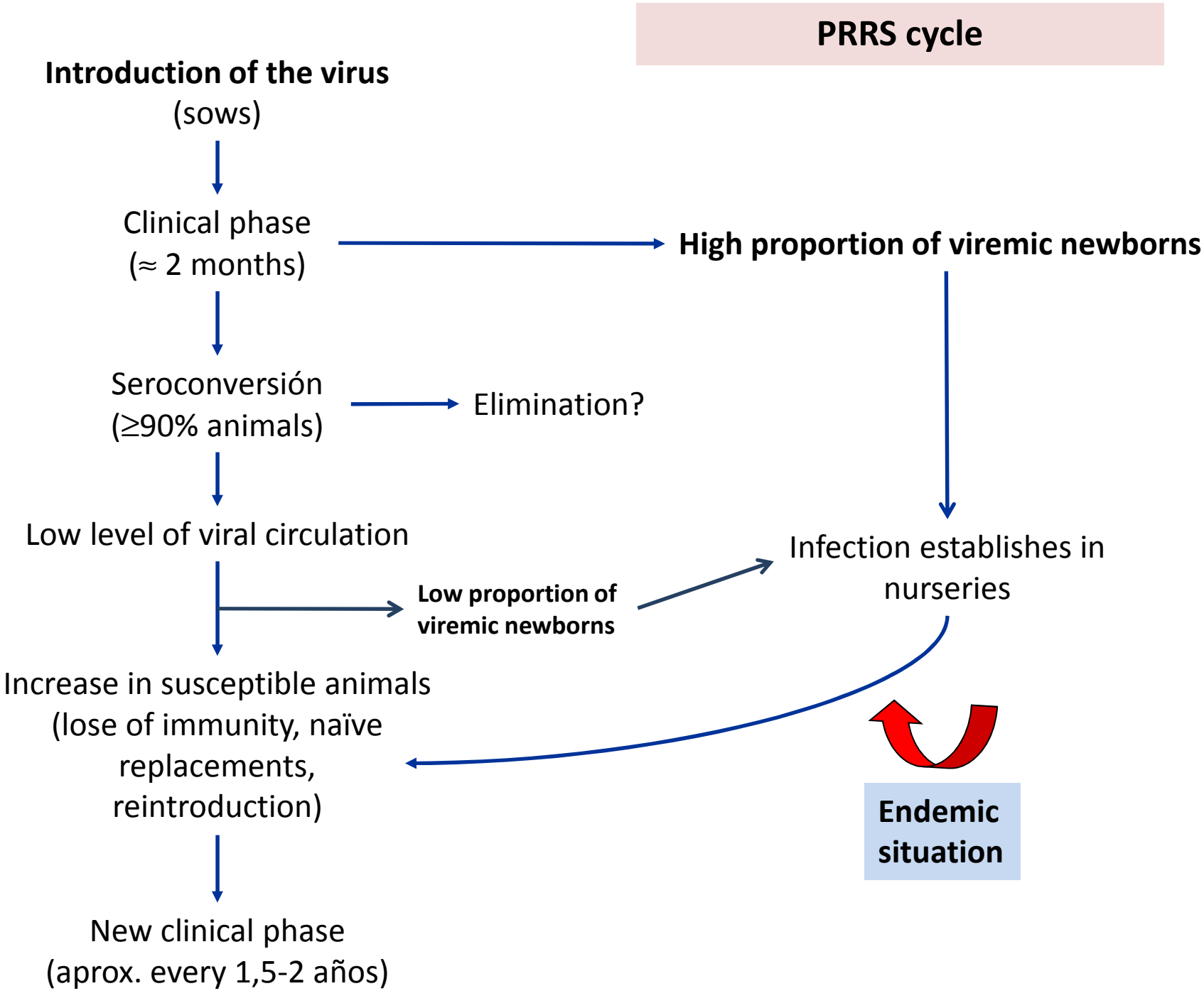
Viremic piglets

Infection flow

Viral circulation in piglets

Flow of virus to sows and farrowing areas

Lateral introduction


PRRS cycle
Introduction of the virus
(sows)
Clinical phase
(≈ 2 months)
High proportion of viremic newborns
Seroconversión
(≥90% animals)
Elimination?
Low level of viral circulation
Low proportion of
viremic newborns
Infection establishes in
nurseries
Increase in susceptible animals
(lose of immunity, naïve
replacements,
reintroduction)
Endemic
situation
New clinical phase
(aprox. every 1,5-2 años)

PRRS cycle

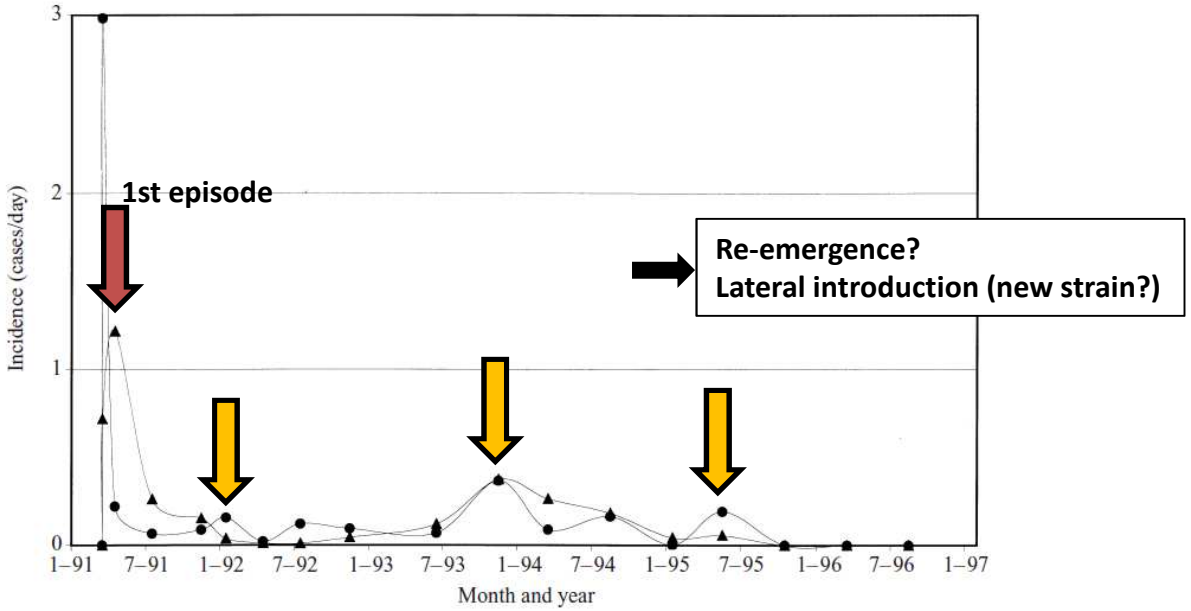


Fig. 1. Incidence of PRRSV among sows (●) and rearing pigs (▲) during a 6-year observation period at the Tolakker herd.

Nodelijk *et al*. 2000. Epidemiol Infect, 124: 173-182

Three different scenarios with different costs and circumstances

a) **First introduction** of PRRSV in a naïve farm:

→ Most probably will cause a **serious outbreak**

Immunity + External Biosecurity

b) **Re-emergence** of a previously present PRRSV strain

→ **Temporary impairment** of reproductive parametres

Immunity + Internal Biosecurity

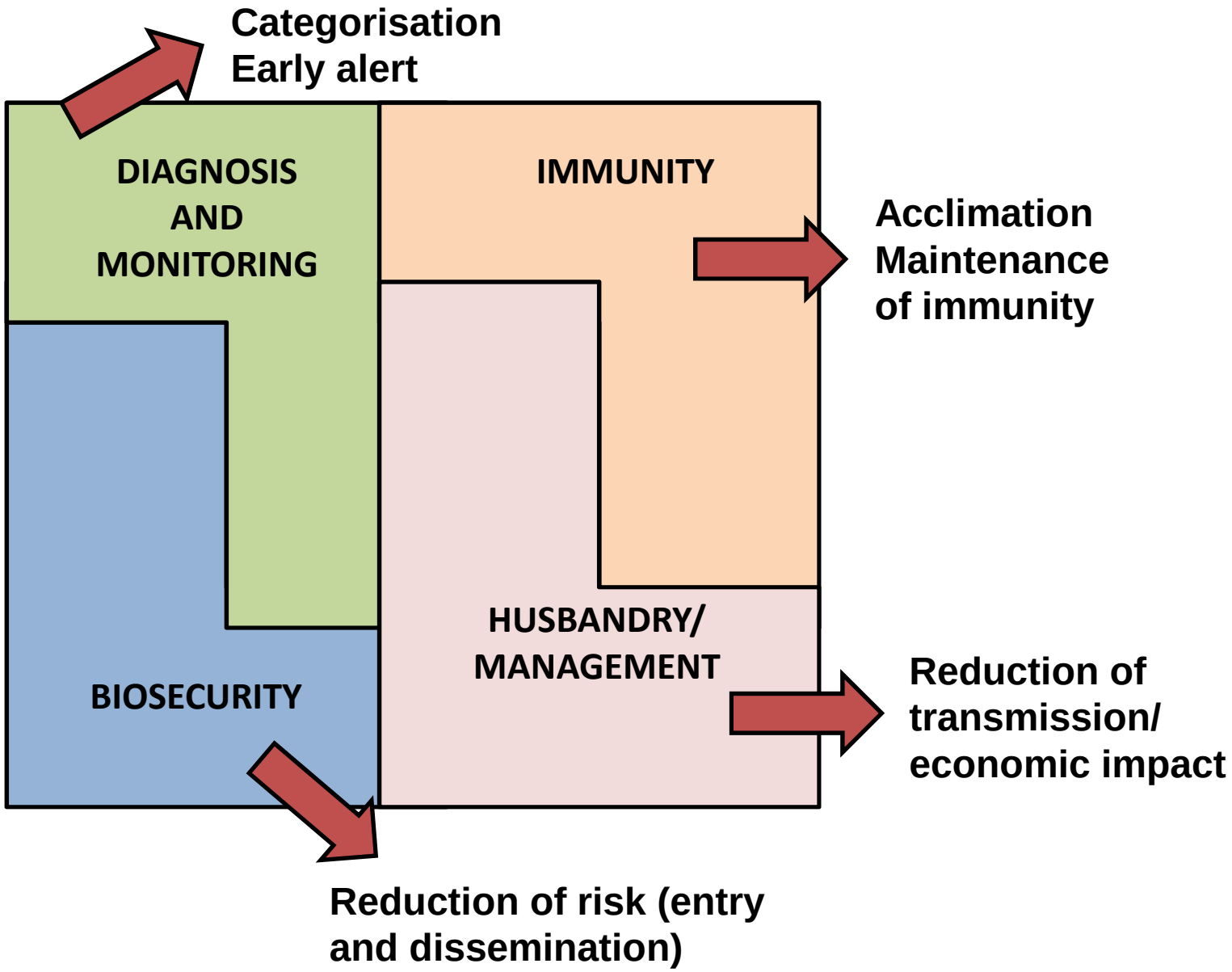
c) **Lateral introduction** of a new PRRSV strain in an infected farm

→ **From nothing** to sub-clinical circulation **to serious outbreak**

Immunity + **External Biosecurity**

Herd category	Shedding status	Exposure status
Positive Unstable (I)	Positive	Positive
Positive Stable (II-A)	Uncertain	Positive
Positive Stable (II-B) (undergoing elimination)	Uncertain	Positive
Provisional Negative (III)	Negative	Positive
Negative (IV)	Negative	Negative

Holtkamp DJ, Polson DD, Torremorell M, *et al.* 2011, Terminology for classifying swine herds by porcine reproductive and respiratory syndrome virus status. *J Swine Health Prod*, **19:**44–56.


Categorisation
Early alert
DIAGNOSIS
AND
MONITORING
IMMUNITY
Acclimation
Maintenance
of immunity
HUSBANDRY/
MANAGEMENT
BIOSECURITY
Reduction of
transmission/
economic impact
Reduction of risk (entry
and dissemination)

Preliminary results (28 small-to-medium farms)

Category	Index	Stable	unstable	P-value
Numerical productivity(PN) Weaned piglets/sow/year	Present sow	24,08	22,67	0,08+
	After 1st gestation	25,19	23,87	0,05*
	By productive sow	26,96	26,03	0,12 n.s.
Piglets and lactation losses	Born alive	12,72	12,99	0,21 n.s.
	Born dead	1,08	1,02	0,34 n.s.
	Weaned	10,94	10,80	0,32 n.s.
	% Losses over born alive	13,94	16,68	0,04 *
Fertility and empty days	Weaning-1st service (días)	6,01	6,66	0,09 +
	Weaning-1st service (fertile) (días)	9,12	11,08	0,05 *
	% return to oestrus	15,21	14,93	0,43 n.s.
Abortions	% abortions	0,82	1,74	0,02 *
Reproduction	Farrowing interval	148,55	151,69	0,02 *
	Farrowing/year/sow	2,18	2,10	0,11 n.s.
	Farrowing/ 1st gestation sow/year	2,29	2,21	0,05 *
	Farrowing/productive sow/year	2,46	2,41	0,02 *
Lactation	Average duration	24,68	25,24	0,28 n.s.

Economic cost

EJEMPLO 1

EXPLOTACIÓN DE 3.000 MADRES

FASE 1 Y 2

	ANTERIOR	BROTE	€
FÁRMACOS CA	44	58	24.000
DESTETADOS/PARTO	10.9	10.1	62.000
IC	1.58	1.74	18.000
GMD	269	228	12.000
MORTALIDAD	1.4%	4.8%	26.000
OCUPACIÓN		-10%	10.000

152.000 €

50 €/cerda

2,0 €/lech. año

SIP – El coste económico del PRRS

Source: J. Rocadembosch. SiP Consultors, 2014

EJEMPLO 2

EXPLOTACIÓN DE 700 MADRES

CICLO CERRADO

	ANTERIOR	BROTE	€
FÁRMACOS CA	31	45	5.000
PARTOS CA	2.40	2.10	28.000
DESTETADOS/PARTO	10.6	9.2	26.000
MORTALIDAD	8.2%	13.3%	18.000
OCUPACIÓN		-20%	20.000
FÁRMACOS CEBO	2,1 €	3,0 €	5.000

102.000 €

145 €/cerda

6,6 €/cerdo año.

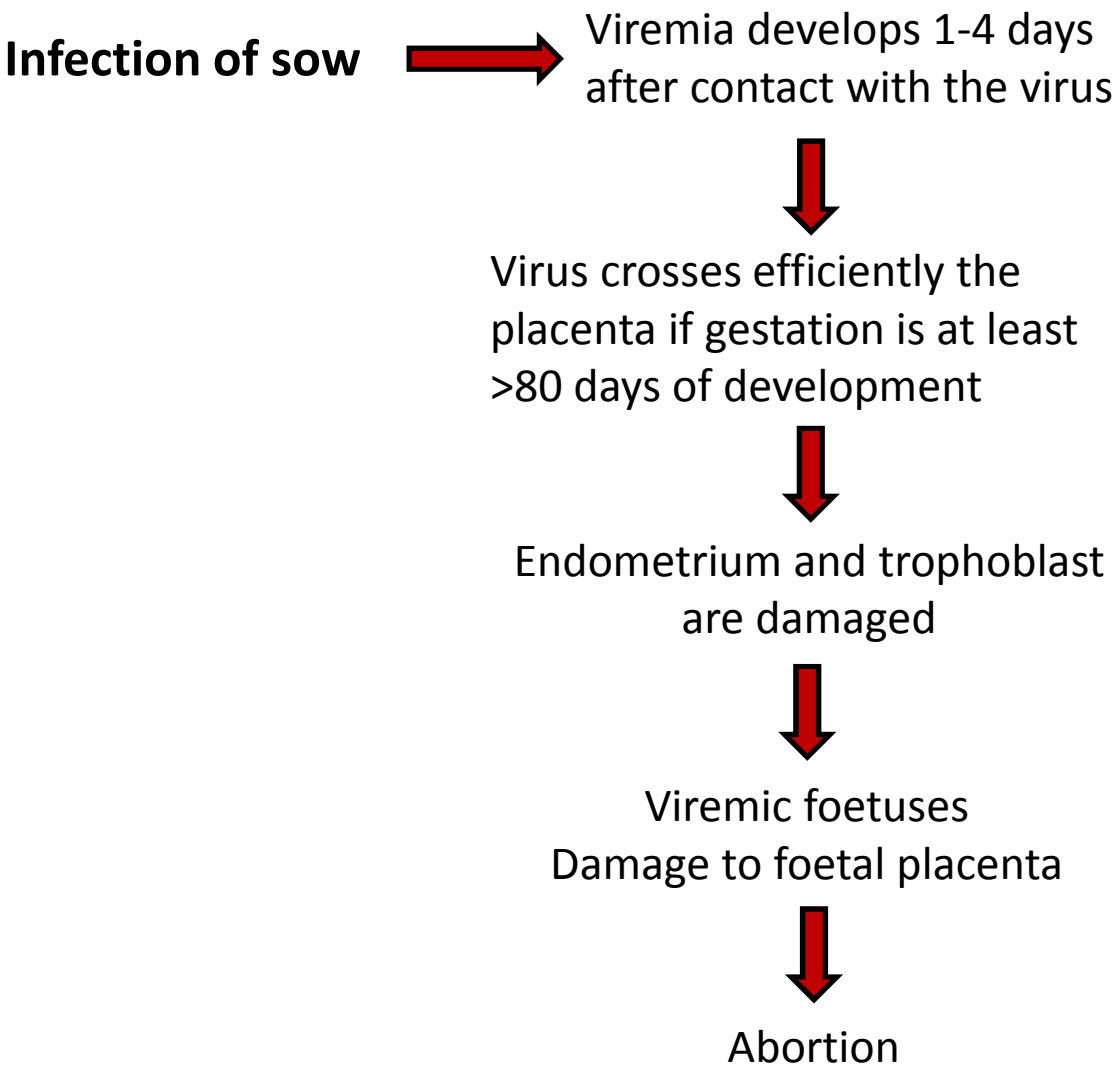
Source: J. Rocadembosch. SiP Consultors, 2014

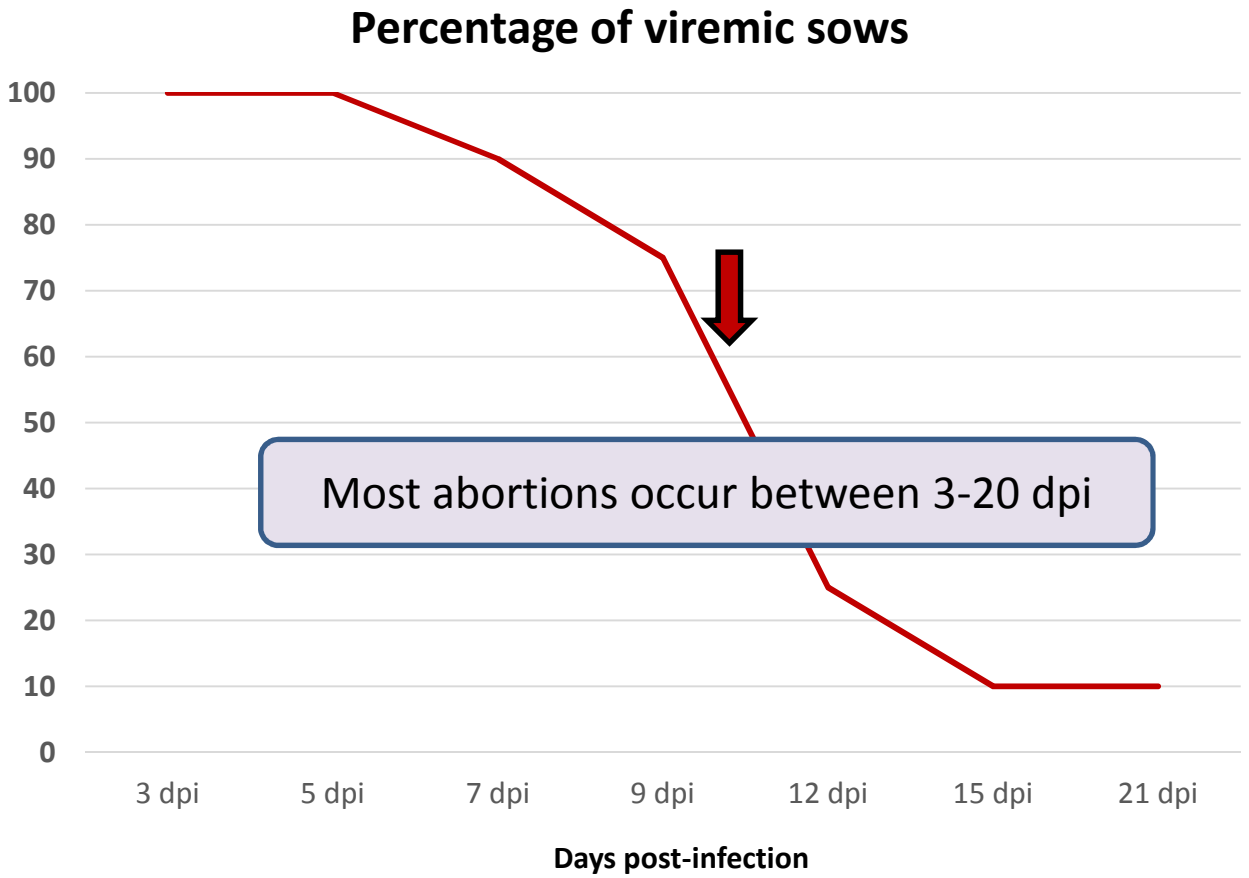
CASE 1: ABORTION OUTBREAK

The case occurred in a 1,000-sow farm that operated on a weekly basis. The farm was once infected by PRRS but for the last 5 years was stable. Some time ago, the veterinarian decided to implement a vaccination program using only killed vaccine. Sows were seropositive but no evidence of circulation of PRRSV was seen (piglets became seronegative in the nurseries and remained so in off-site fattening units).

In April 2014, an outbreak of abortions appeared (see picture below). In just two weeks, some 70 sows aborted at very late gestation (>90 days).

What diagnostic strategy would you choose?


Infection of sow
Viremia develops 1-4 days after contact with the virus
Virus crosses efficiently the placenta if gestation is at least >80 days of development
Endometrium and trophoblast are damaged
Viremic foetuses
Damage to foetal placenta
Abortion



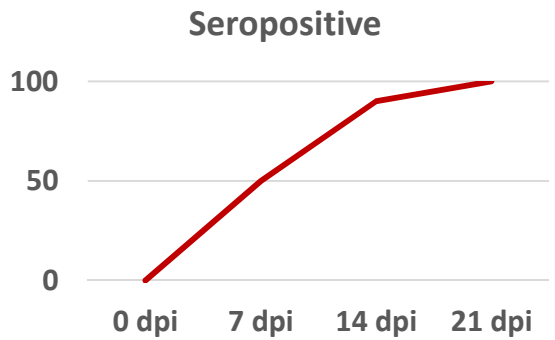
The longer the delay in sampling aborted sows, the lower the probability to have a positive result

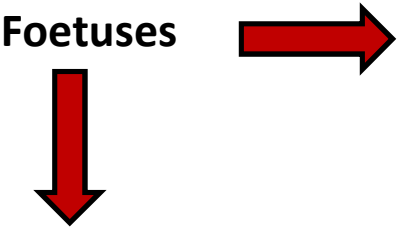
Sow
(day of the abortion)

PCR +ve = PRRS abortion

PCR -ve = No PRRS
PRRS but no longer viremic

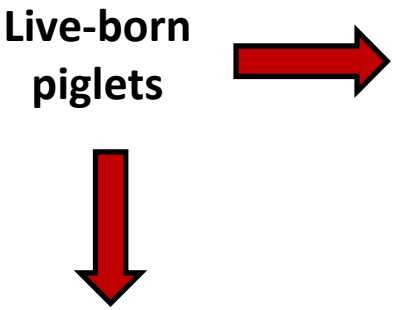
If the farm was PRRS-free
Check seroconversion





PCR +ve = PRRS abortion
(or other techniques)

PCR -ve = No PRRS
PRRS but virus no longer detectable
(other techniques are usually less sensitive)



PCR +ve = Farm is infected by PRRS
Vertical transmission
Consider previous status

PCR -ve = No PRRS
Too early to find viremic piglets

*Day of the abortion
Take rectal temperature of sows

Diagnostic approach of a PRRS outbreak (Summary)

Abortions

1. Blood of aborted sows* **2. Aborted foetuses** **2. Weakborn piglets**

(eventually also non-aborted sows)

Identify samples individually

Keep an aliquot frozen (<-20°C)

PCR

-ve **+ve** **-ve** **+ve** **-ve** **+ve**

If PRRS-free check seroconversion

PRRS confirmed

PRRS confirmed

PRRS Possible (evaluate history of the farm)

Seroconversion

No change

PRRS confirmed

Other pathogens Analyze new cases

Other pathogens Analyze new cases

Other pathogens Analyze new cases

CASE 2: PRRS STABLE OR UNSTABLE?

A farm that was **infected by PRRS some years ago**, established a **vaccination strategy** for trying to stabilise viral circulation in sows. The plan consisted in the **use of MLV PRRS** to acclimate gilts (two doses 1 month apart before the first service) and the vaccination of sows 3 times/year.

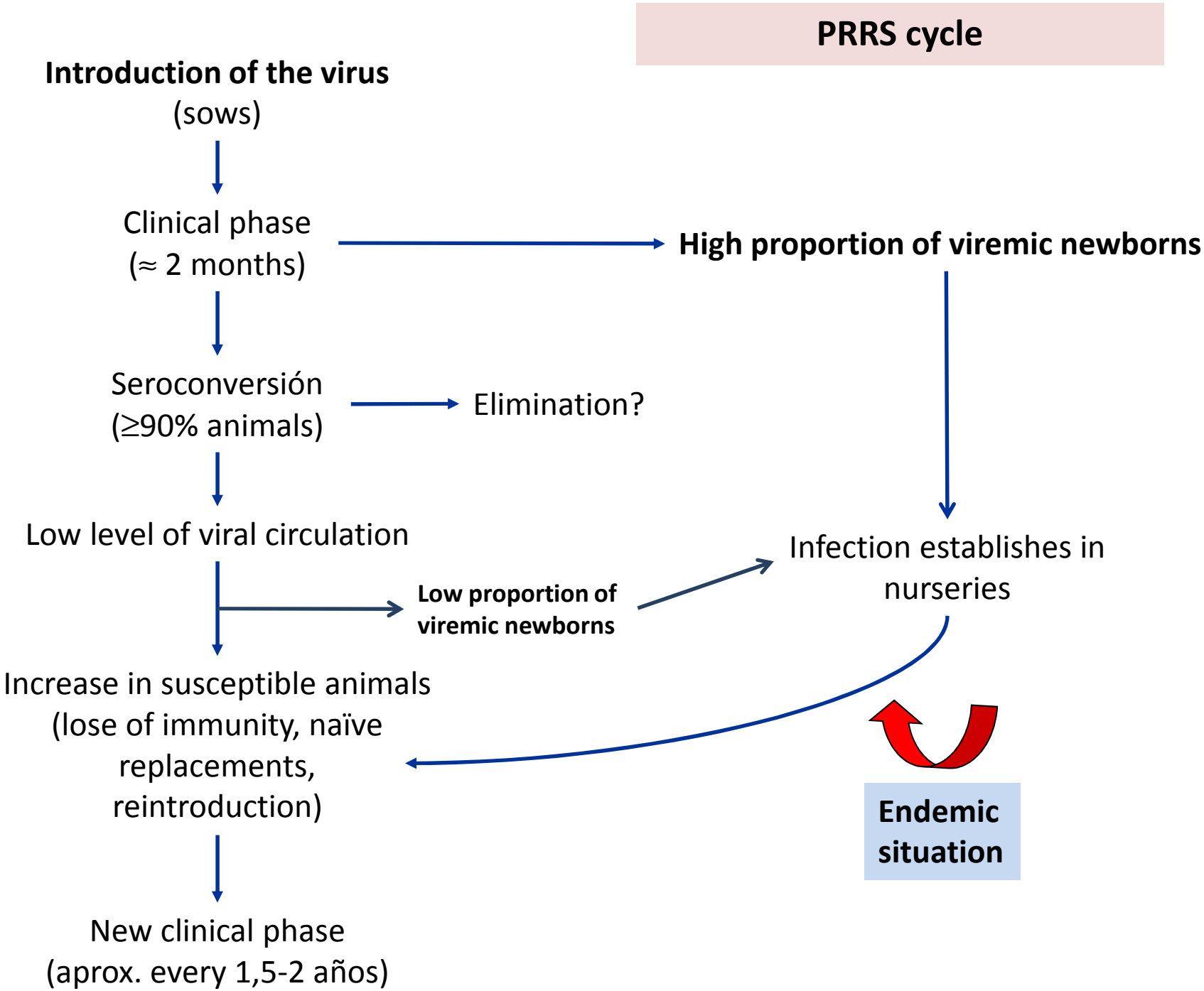
The problem now is that **nurseries are still showing signs of respiratory disease**. However, the reproductive performance of the sows is acceptable and no obvious reproductive problems occur.

Serological testing of 9 week-old piglets (Idexx ELISA) showed that they were seropositive, indicating that **PRRSv is circulating in the nurseries**. Also, when **10 6-week-old piglets** were bled, two of them were **viremic** (PCR).

Since the farm is run in weekly batches and the nurseries physically separated from the sows by some 150 m. (although in the same area) one possibility is to depopulate the facilities for weaners.

The question is whether or not the infection in nurseries come from maternities.

What your sampling strategy would be?


PRRS cycle
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(sows)
Clinical phase
(≈ 2 months)
High proportion of viremic newborns
Seroconversión
(≥90% animals)
Elimination?
Low level of viral circulation
Low proportion of
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Infection establishes in
nurseries
Increase in susceptible animals
(lose of immunity, naïve
replacements,
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Endemic
situation
New clinical phase
(aprox. every 1,5-2 años)

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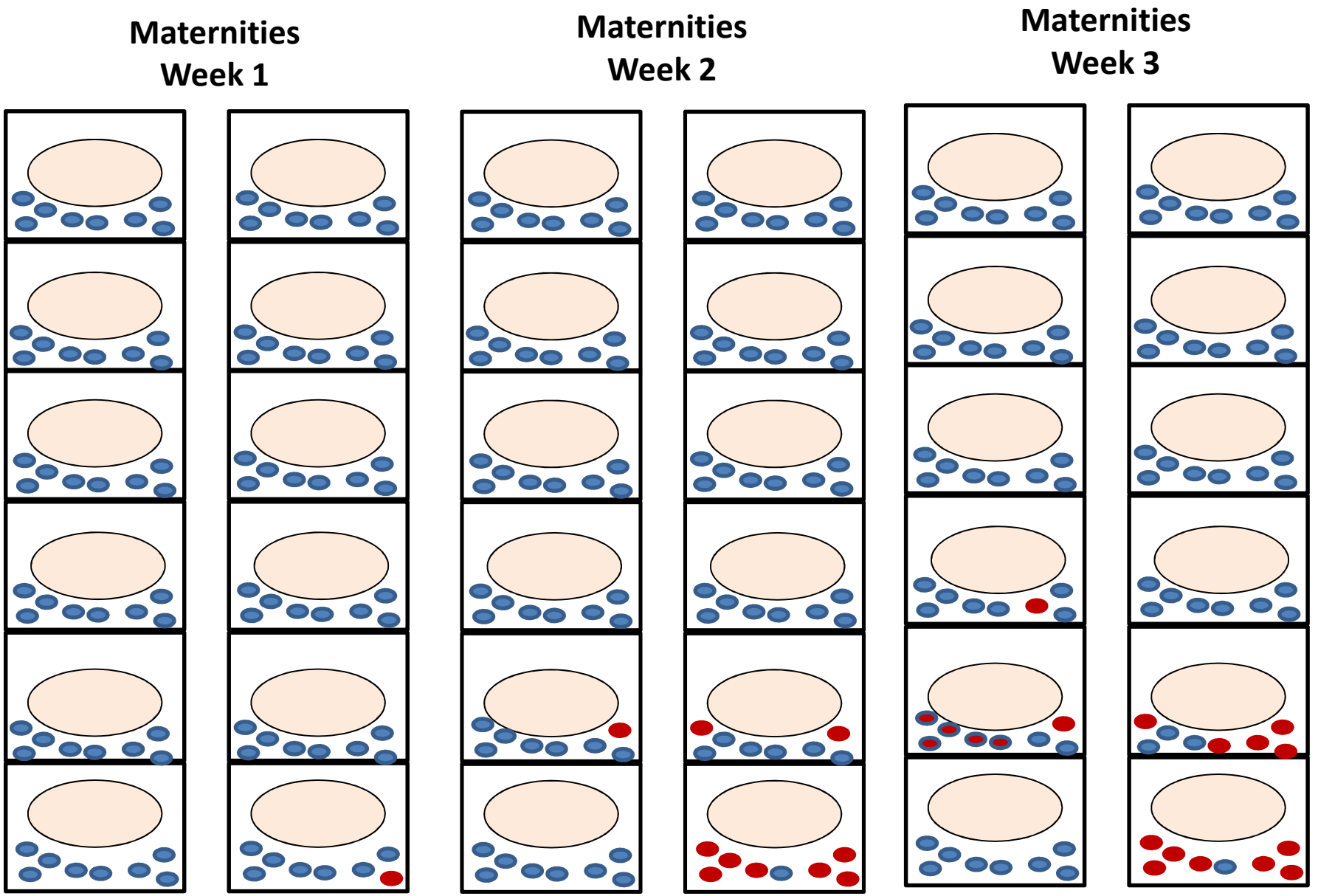
Holtkamp DJ, Polson DD, Torremorell M, *et al.* 2011, Terminology for classifying swine herds by porcine reproductive and respiratory syndrome virus status. *J Swine Health Prod*, **19:**44–56.

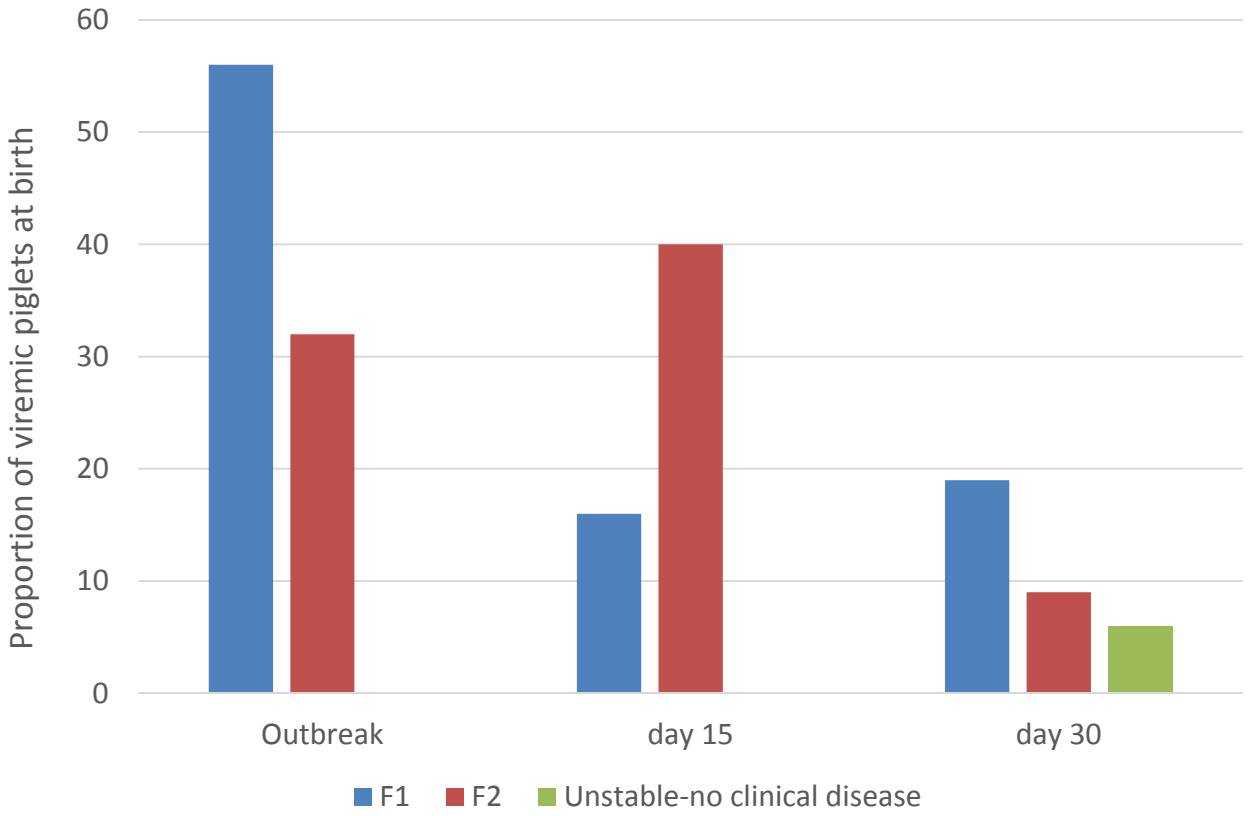
Usually, it is considered that testing of 30 piglets ±3-4 days before/after weaning permits the categorisation of the farm

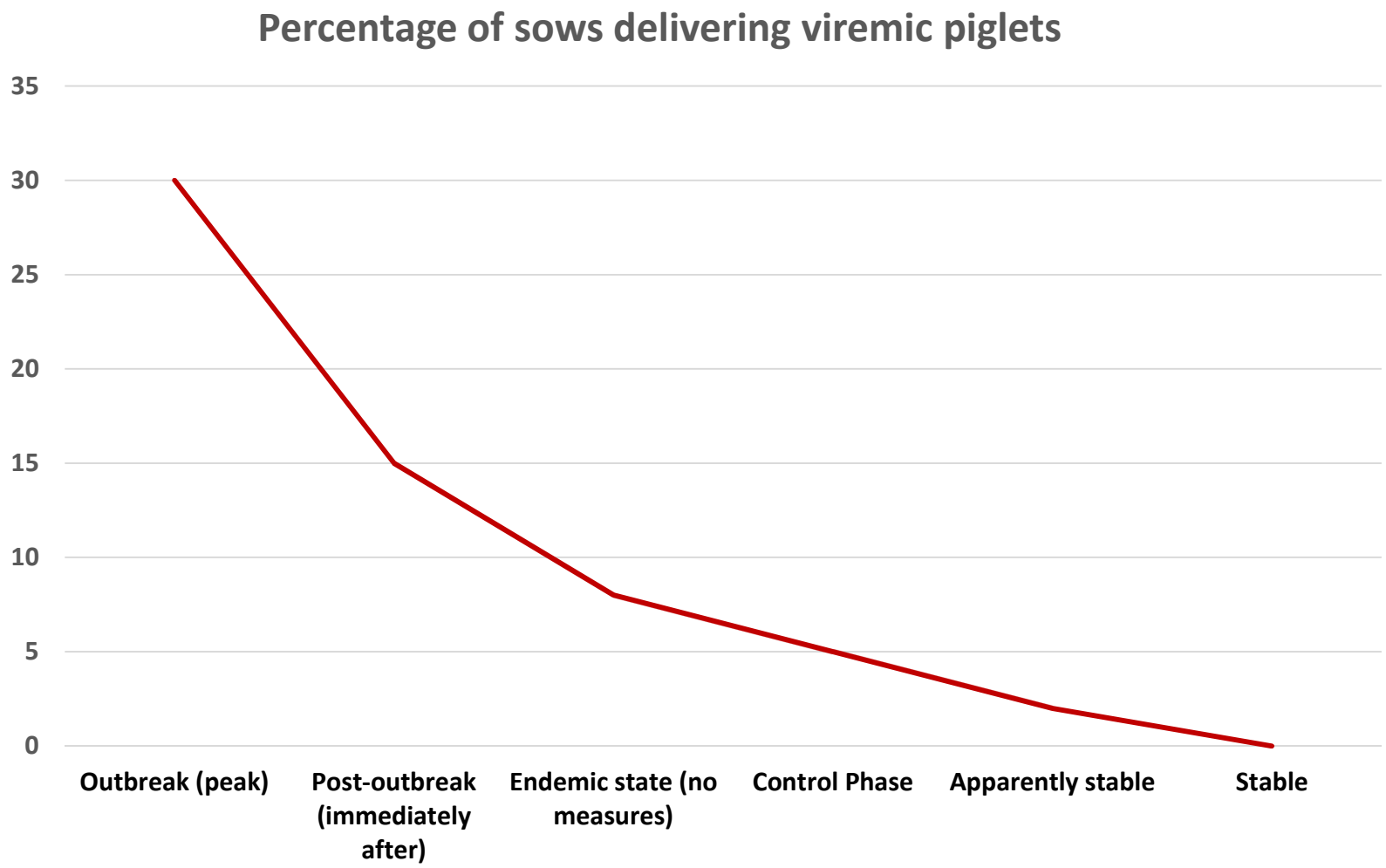
Prevalence estimate	100	500	1000	4000	10000
1%	96	130	259	289	295
5%	45	50	56	58	59
10%	26	28	30	30	30
25%	11	12	12	12	12
50%	8	8	8	8	8


Maternities
Week 1
Maternities
Week 2
Maternities
Week 3

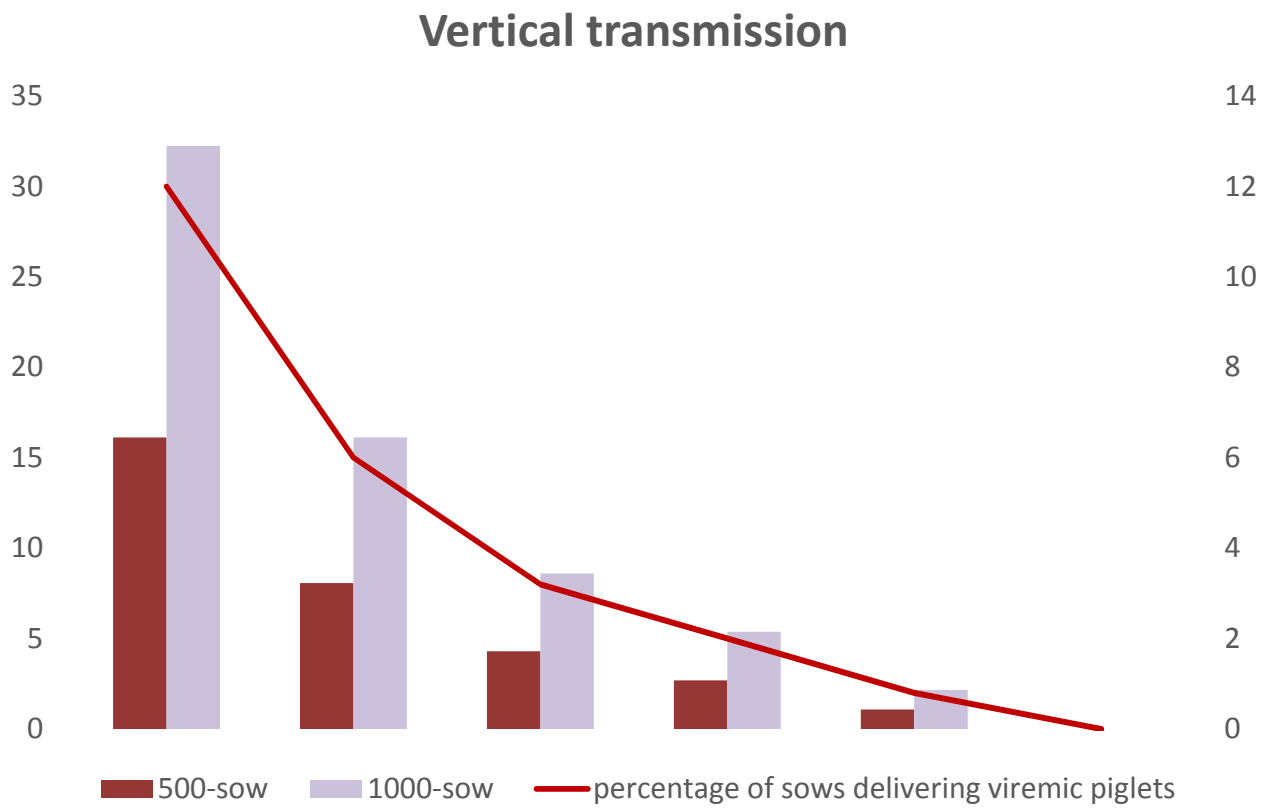
Ex. **F1- 1,200-sow farm, previously thought to be stable**
F2 – 250-sow in bi-weekly batches – Outbreak - MLV
F3-Unstable farm no clinical disease - MLV

Sampling directed to weakborn piglets (1st day of life)



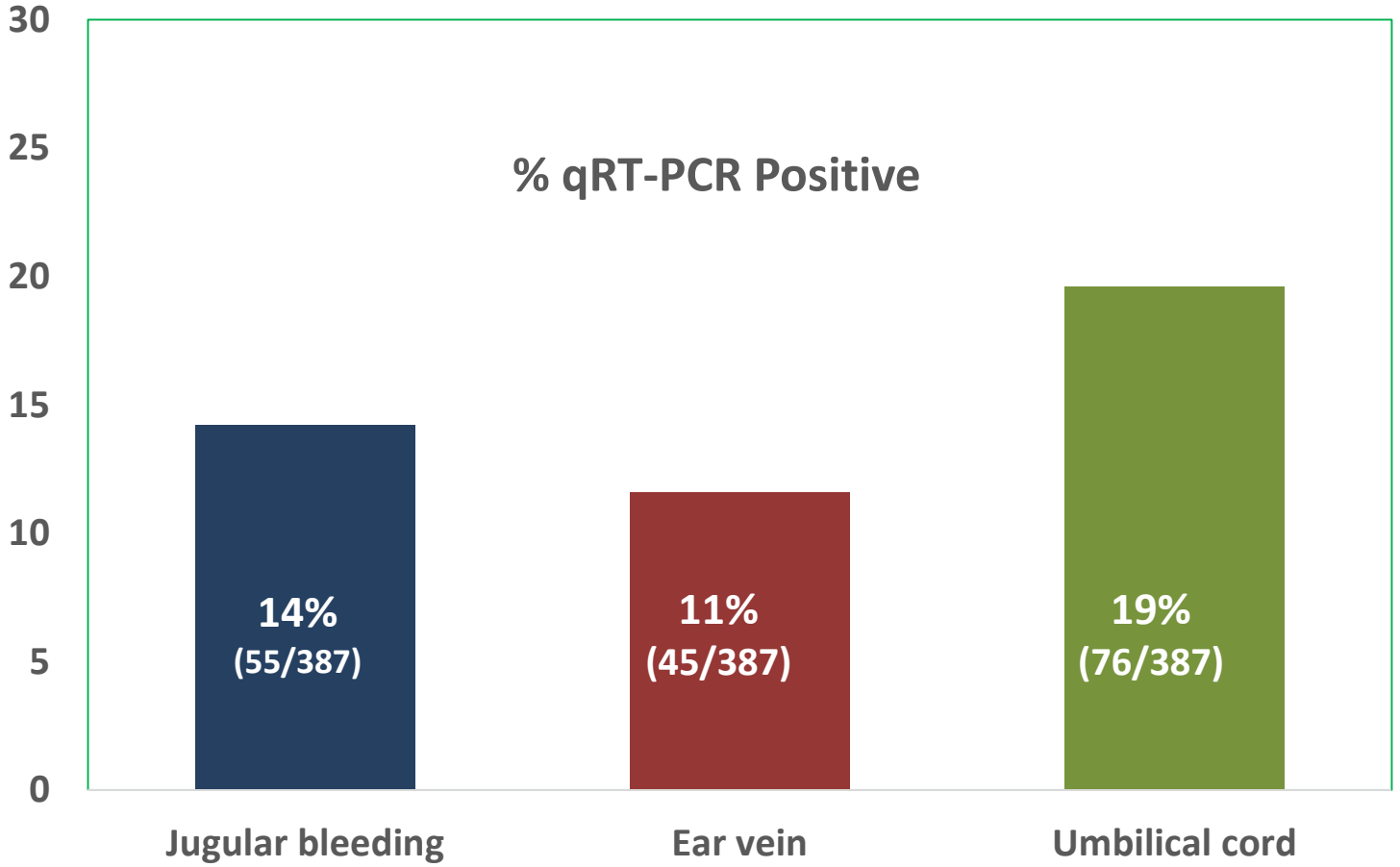

Percentage of sows delivering viremic piglets
35
30
25
20
15
10
5
0
Outbreak (peak)
Post-outbreak (immediately after)
Endemic state (no measures)
Control Phase
Apparently stable
Stable

Ex. **1000-sow farm (weekly batches) ➔ Approx. 43 sows delivering/week**
500-sow farm (weekly batches) ➔ Approx. 22 sows/week



How and when to test piglets?

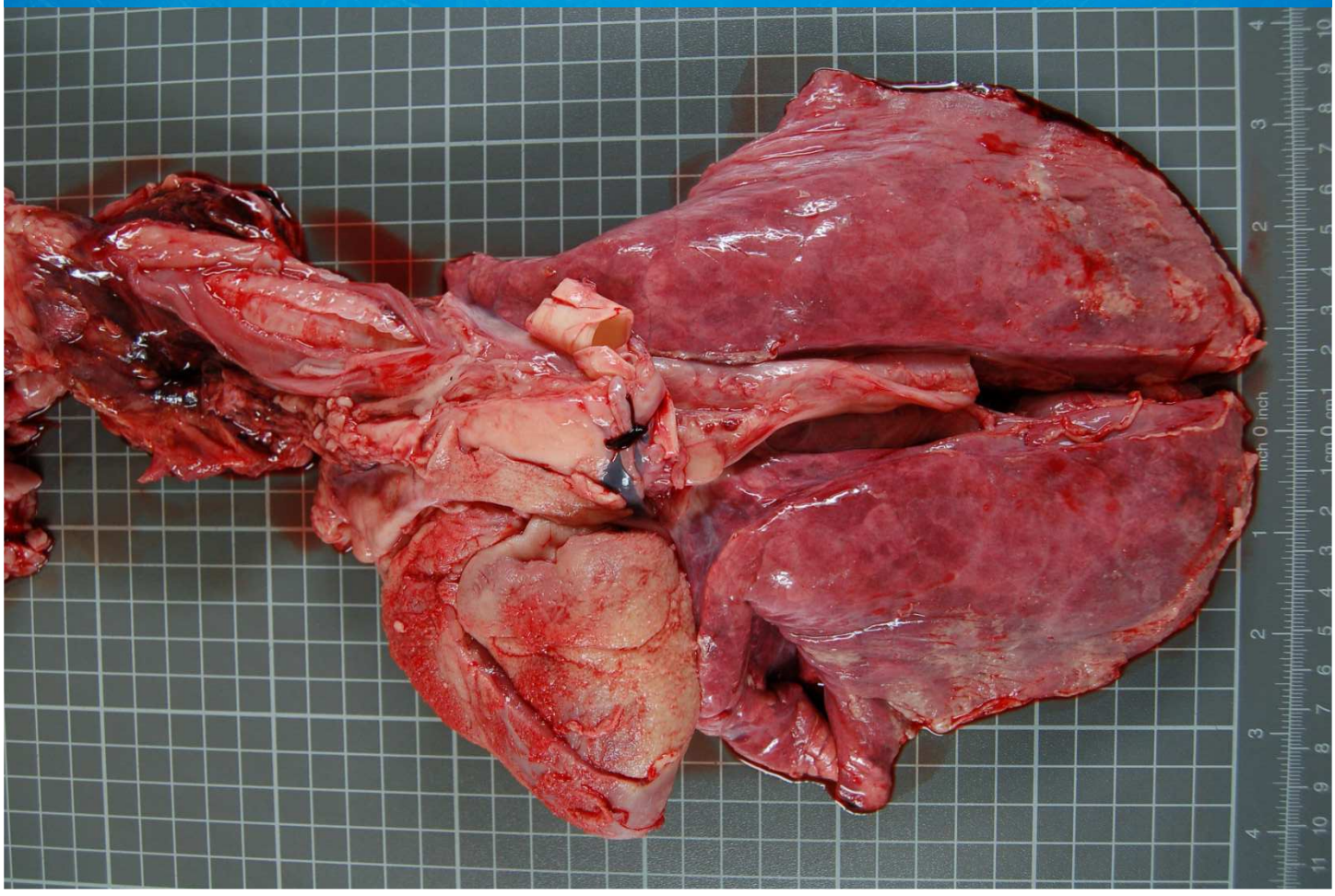
Performance by type of samples in 1-day old piglets in unstable farms

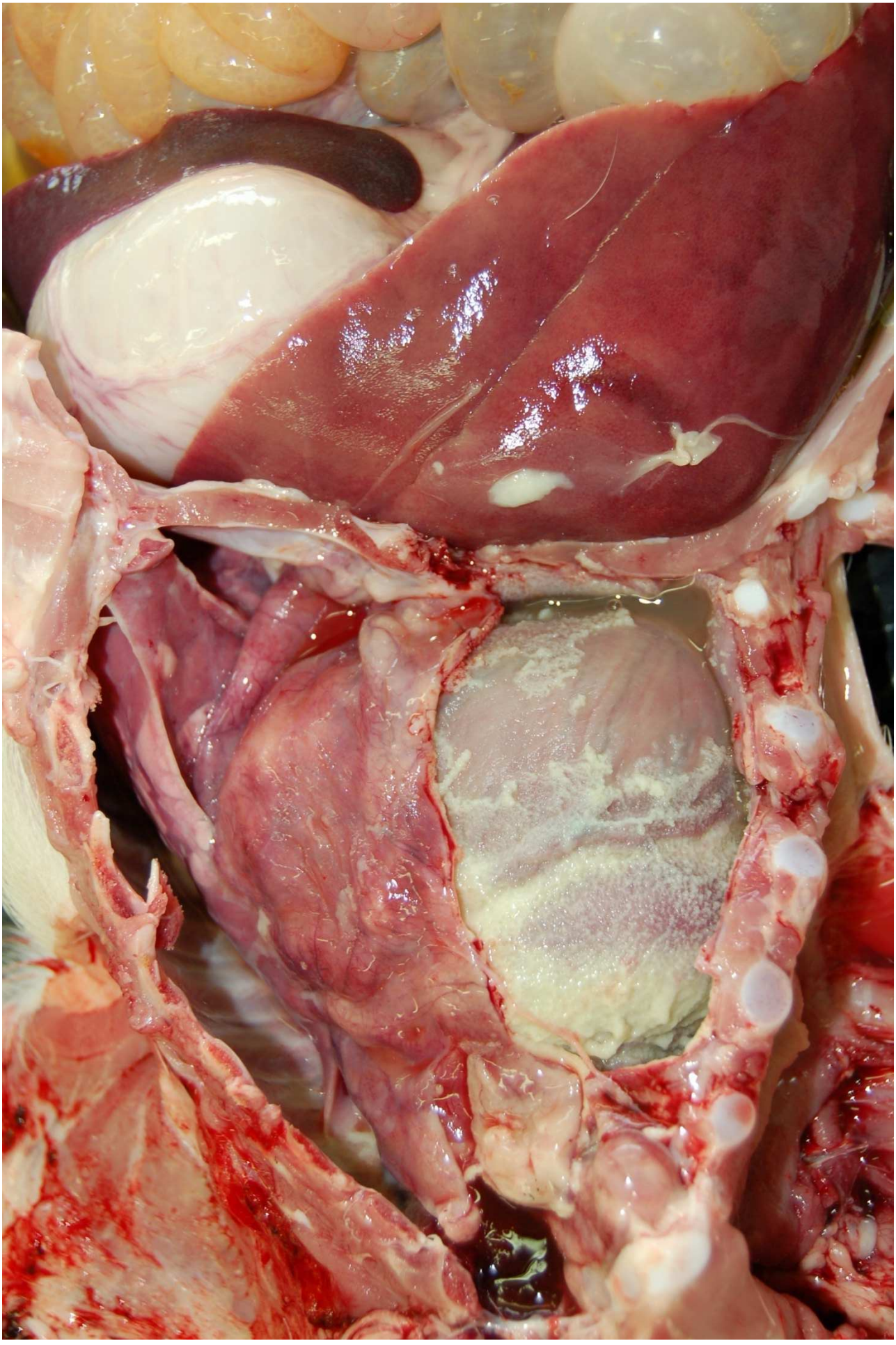


CASE 3: RESPIRATORY DISEASE IN NURSERIES

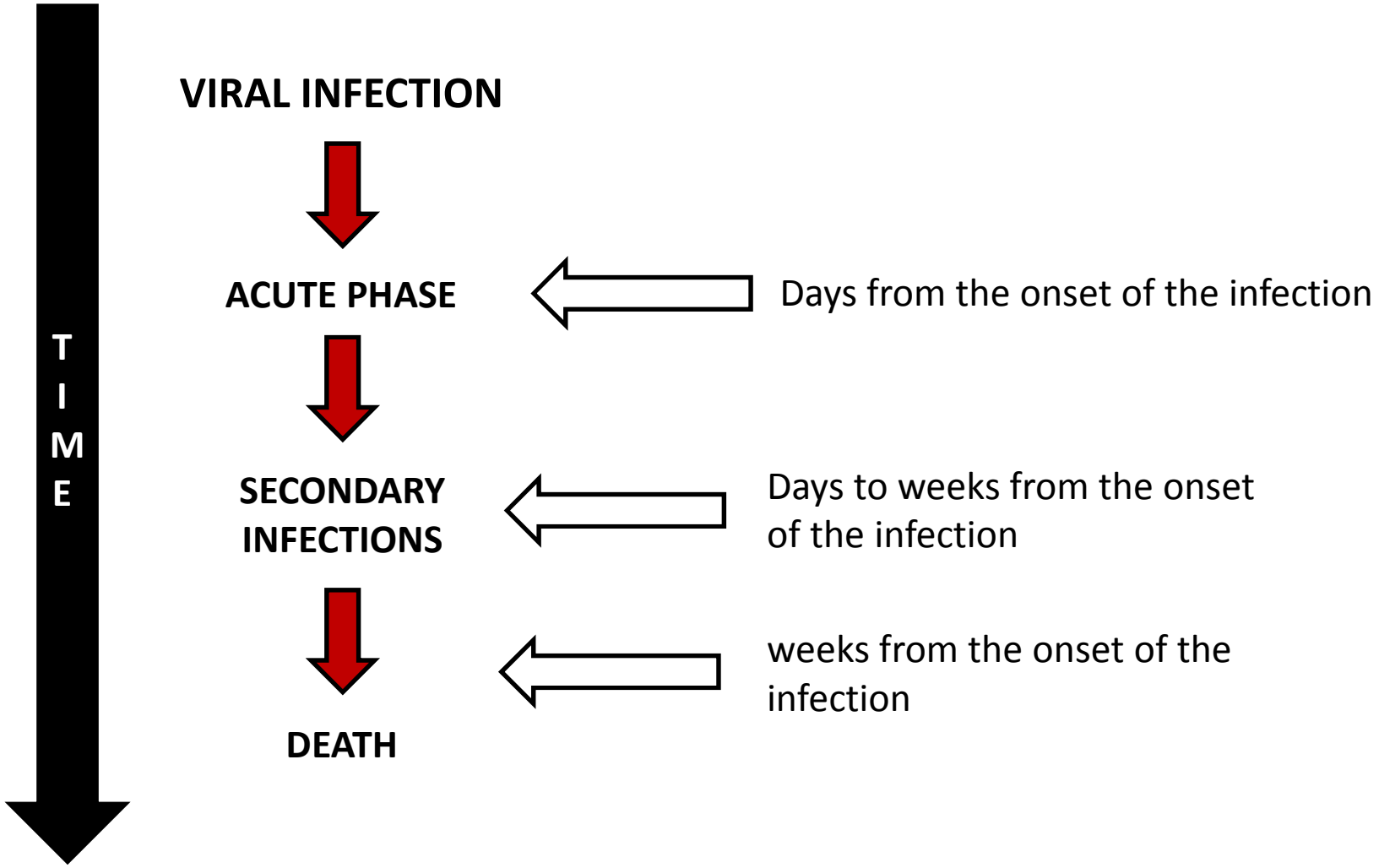
Nursery of 600-sow farm. Productivity in sows is satisfactory and the farm is thought to be stable (although not tested regularly) by using vaccination (MLV). Nurseries (4-9 weeks of age) receive about 320 piglets/week. Animals are vaccinated against PCV2-M. hyo at weaning.

The problema become evident at the end of the nursery phase. Mortality increases (reaching 6% from nursery to finish). The problema starts as a coughing outbreak. Necropsies have shown some lesions.





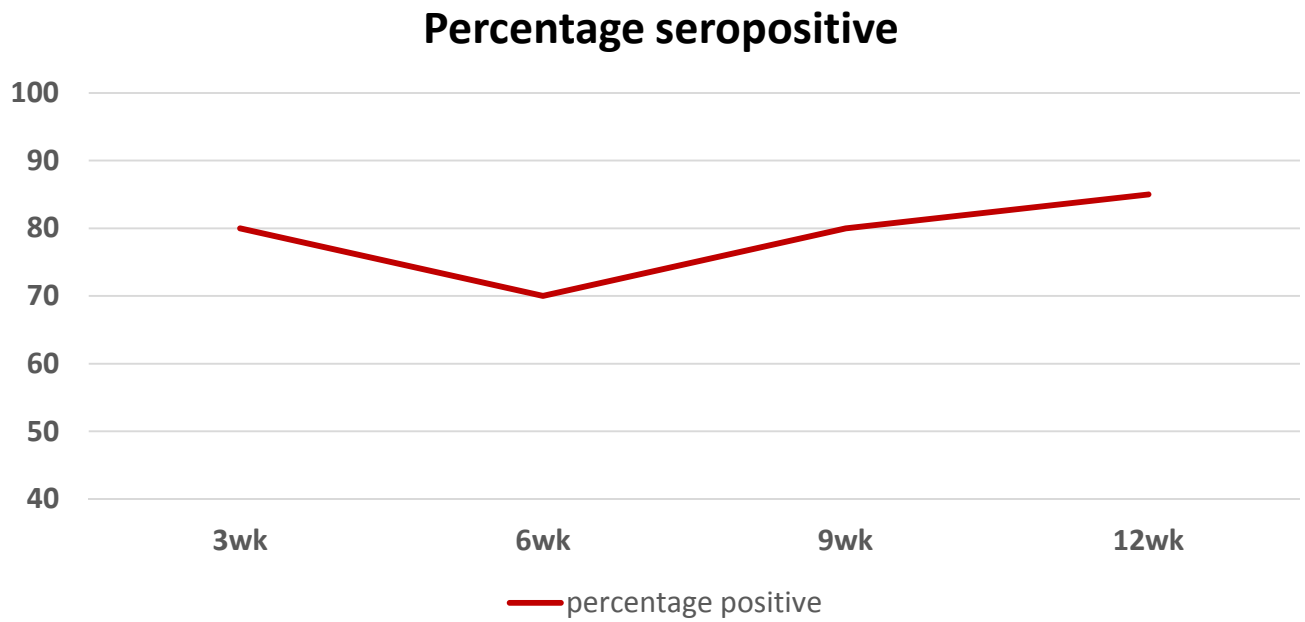
What are these lesions explaining?
What data are needed to interpret correctly their significance?


TIME
VIRAL INFECTION
ACUTE PHASE
Days from the onset of the infection
SECONDARY INFECTIONS
Days to weeks from the onset of the infection
weeks from the onset of the infection
DEATH

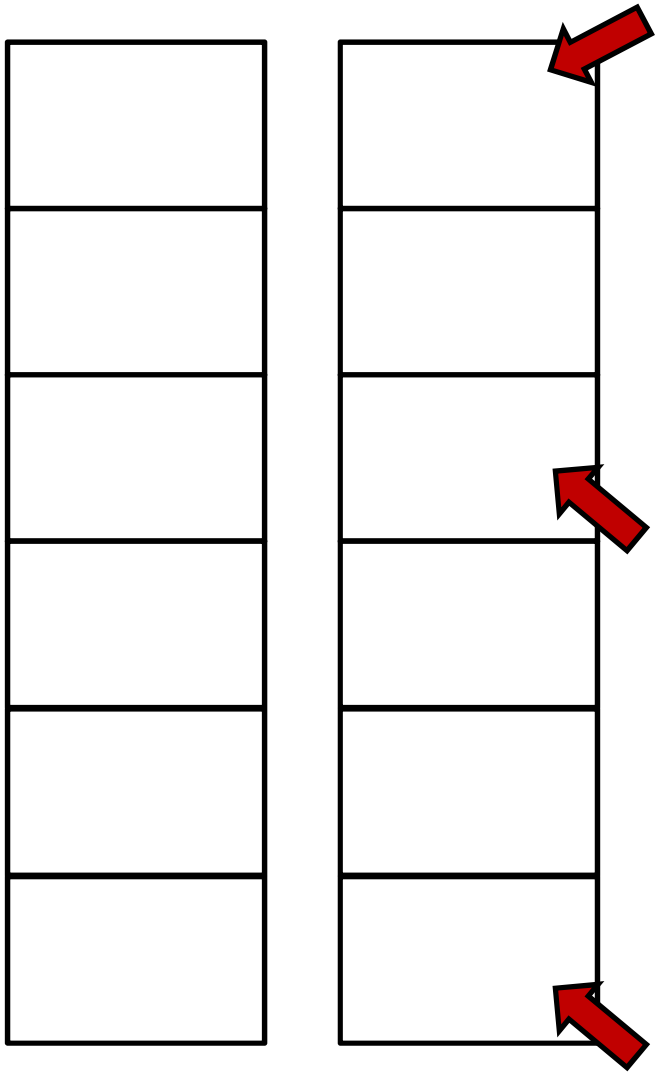
Sample	**Análisis solicitados**
Lungs and hearts of dead pigs	- Microbiological culture for *H. parasuis*, *S. suis*, other eventual pathogens - Detection in lung of PRRSV, PCV2, SIV: (IHC, ISH and PCR, respectively)

1. Are samples adequate?
2. How can be interpreted a negative result for *H. parasuis?*
3. What is the relevance of a PCV2 +ve result?
4. In this context what does it mean a –ve result for PRRSV and SIV?

In order to clarify if PRRSV was involved or not in the outbreak a seroprofile was performed (Idexx ELISA)



What is your interpretation?



Pens were sampled at 4, 6 and 9 weeks of age by collecting oral fluids in 3 pens.

Results were that all three pens were positive at the three sampling times

Since the previous analysis did not contribute to clarify the case, the technical services decide to test individual animals in nurseries by PCR. 10 animals were bled at 3-6-9 weeks of age and sera were sent to the lab. With the aim of saving money samples were analysed as 2 pools of 5 sera.

Age	Result
3 wk.	Pool 1: neg. Pool 2: neg
6 wk.	Pool 1: neg. Pool 2: neg
9 wk.	Pool 1: pos Pool 2: pos

What is your interpretation?

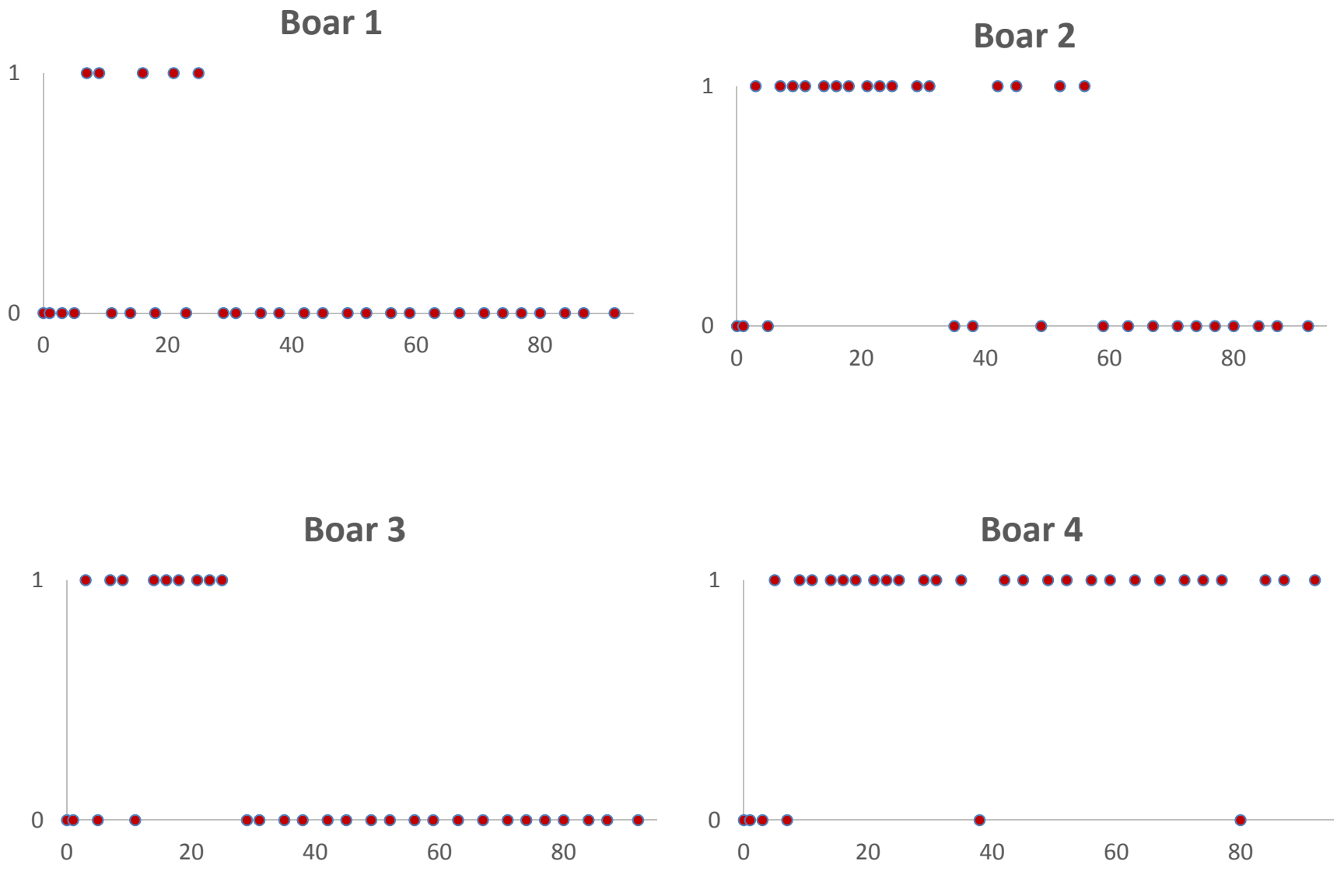
What would have been your approach in this case?

CASE 4: PURCHASING OF SOWS AND SEMEN

One company is purchasing semen (extended) for servicing their sows. They require the semen to be PRRS-free and the provider is giving evidences of that by showing the results of analysis of semen by PCR

What is your advice?

Shedding of PRRS in semen



Source: Christopher-Hennings J et al. 1995. J Vet Diagn Invest.7:456-464.

Table 7. Early detection of PRRSV by PCR as a function of specimen and day post-inoculation*

Specimen	Percent (%) positive by day post-inoculation						
	1	2	3	4	5	6	7
Serum	36.5	79.1	89.5	93.8	95.2	97.4	99.9
Blood swab	30.3	73.3	79.4	86.7	87.9	99.9	99.9
Oral fluid	3.6	59.0	89.4	97.6	99.9	99.9	99.9
Whole semen or supernatant	0	12.8	17.1	26.5	22.0	28.9	30.8
Cell fraction semen	0	0	14.7	21.4	18.8	47.1	43.5

*Probability calculated from the data listed in Tables 5 and 6 using a binomial logistic regression model with estimate values obtained using the least square methods.

Source: Pepin et al. 2015. Transbound Emerg Dis, 62:295-304.

And for the purchase of sows?

CASE 5: IS PRRSV INVOLVED?

- 780-sow farm operated on a weekly basis (expected about 35 parturitions/week). The farm has a history of PRRS for at least the last 10 years and also, mycotoxin problems were suffered last year. One outbreak of Leptospira was suspected one year ago but was apparently controlled by tetracycline treatment (in feed). Replacement rate was very high.
- In November 2015 an abortion storm occured and was diagnosed as PRRS (PCR +ve in newborns of the affected batches). Emergency vaccination is implemented (MLV) (January 2016).
- Shortly afterwards a new abortion storm occur. The owner suspects of an adverse reaction of the vaccination but the virus cannot be found in aborted sows, foetuses or newborns.
- Most of the cases appeared in 1st parity sows and were accompanied by mummified foetuses.
- Some days after the onset of this second outbreak it was evident that some newborn piglets were icteric and sows showed petechiae in ears. The collected placentae showed a yellowish tone.