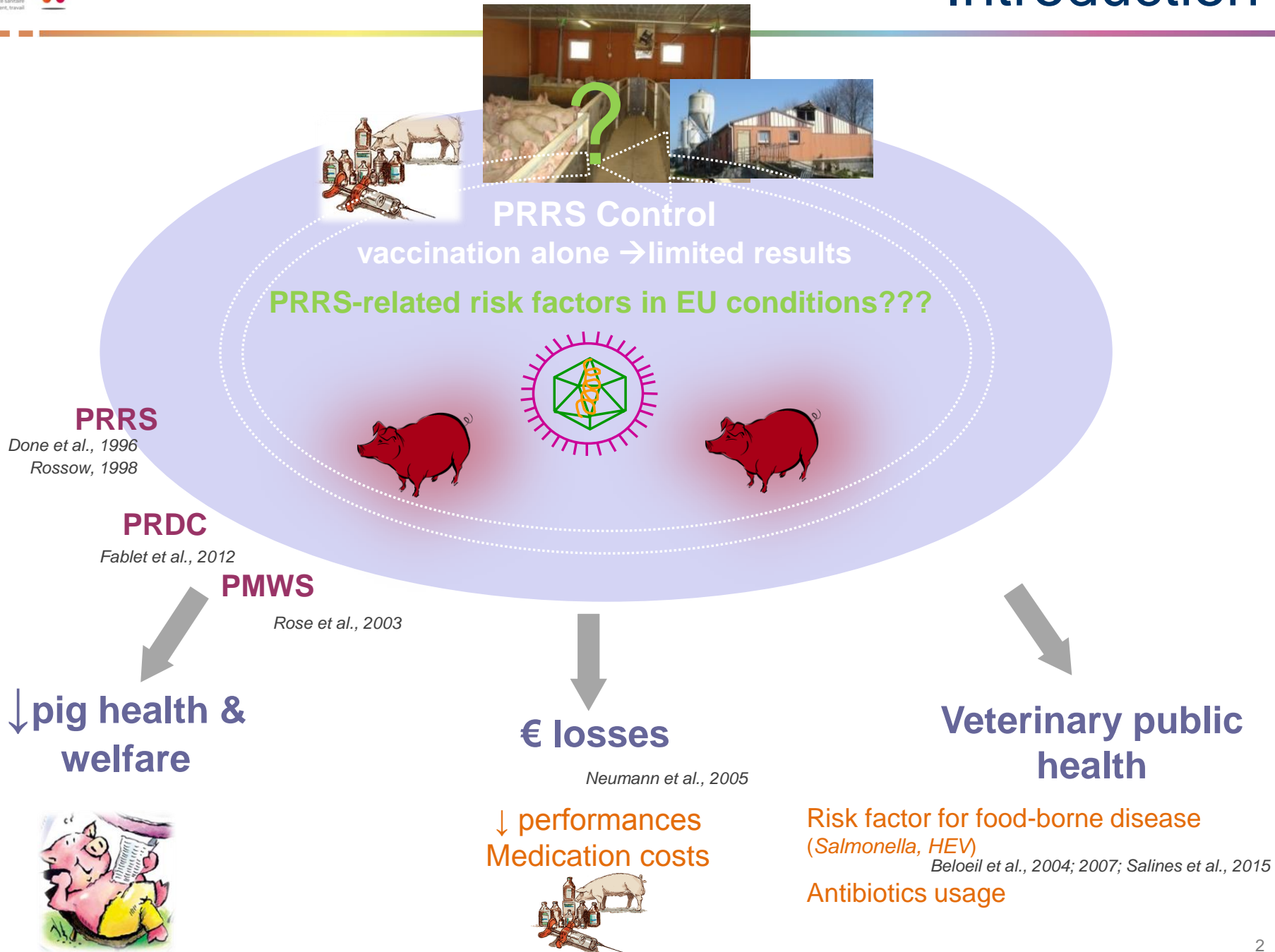


# Factors associated with porcine reproductive and respiratory syndrome virus (PRRSV) infection

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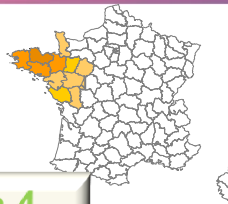
*Anses-Ploufragan-Plouzané Laboratory - France*





- Identify and quantify the effect of PRRS-infection related risk factors
- Explore the effects of factors associated with PRRSV **age-time to seroconversion** in infected herds

In herds without PRRS vaccination in growing pigs



### ➤ 109 farrow-to-finish herds (cross-sectional study on respiratory diseases)

#### • Data collection & sampling (4 batches)

Age

**Batch 1**  
4 week-old

**Batch 2**  
10 week-old

**Batch 3**  
16 week-old

**Batch 4**  
>22 week-old

#### ▪ Blood

(15 pigs)

#### ▪ Tracheal swabs

(10 pigs)

#### ▪ Climatic conditions

- T°, humidity
- CO<sub>2</sub>, NH<sub>3</sub>
- Respirable dust



#### • Questionnaire

- Herd characteristics & neighbourhood
- Biosecurity & hygiene practices
- Management & housing



#### • Laboratory analyses

##### ▪ PCR

- *M. hyopneumoniae*

(batches 1, 2, 3; n-PCR)

- PCV2 (batches 1, 2, 3; qPCR)



##### ▪ Antibodies

- PRRSV (ELISA-Idexx X2)



- *M. hyopneumoniae* (batches 1,2,3,4; ELISA)
- *A. pleuropneumoniae* (batch 4; ELISA)
- SIV (H1N1, H1N2) (batch 4 ; HI tests)

## ➤ Outcome

- PRRS infection status (n=109 farms)



Estimated using the PRRS status of the 10, 16 and 22 wo batches  $\Rightarrow$  at least 1 positive pig

## ➤ Explanatory variables

- Climatic conditions

*Nursery & fattening*



- Herd characteristics, management, housing, husbandry & biosecurity

*Questionnaires*



- Co-infections (Mhp, App, SIV, PCV-2)

*Laboratory analyses*



**Logistic  
regression**

Univariable analysis ( $p < 0.25$ )



Multivariable analysis

*Logistic regression model ( $p < 0.05$ )*

- **Outcome** • Herd level: age-time to seroconversion (n=65 farms)



Estimated using the within batch frequencies of seropositive pigs

## ➤ Explanatory variables

- Climatic conditions



*Nursery & fattening*



- Herd characteristics, management, housing, husbandry & biosecurity

*Questionnaires*



- Co-infections (Mhp, App, SIV, PCV-2)

*Laboratory analyses*



## Survival analysis

Univariable analysis ( $p < 0.25$ )



Multivariable analysis

*Cox proportional hazards model ( $p < 0.05$ )*

swIAV H1N2 +

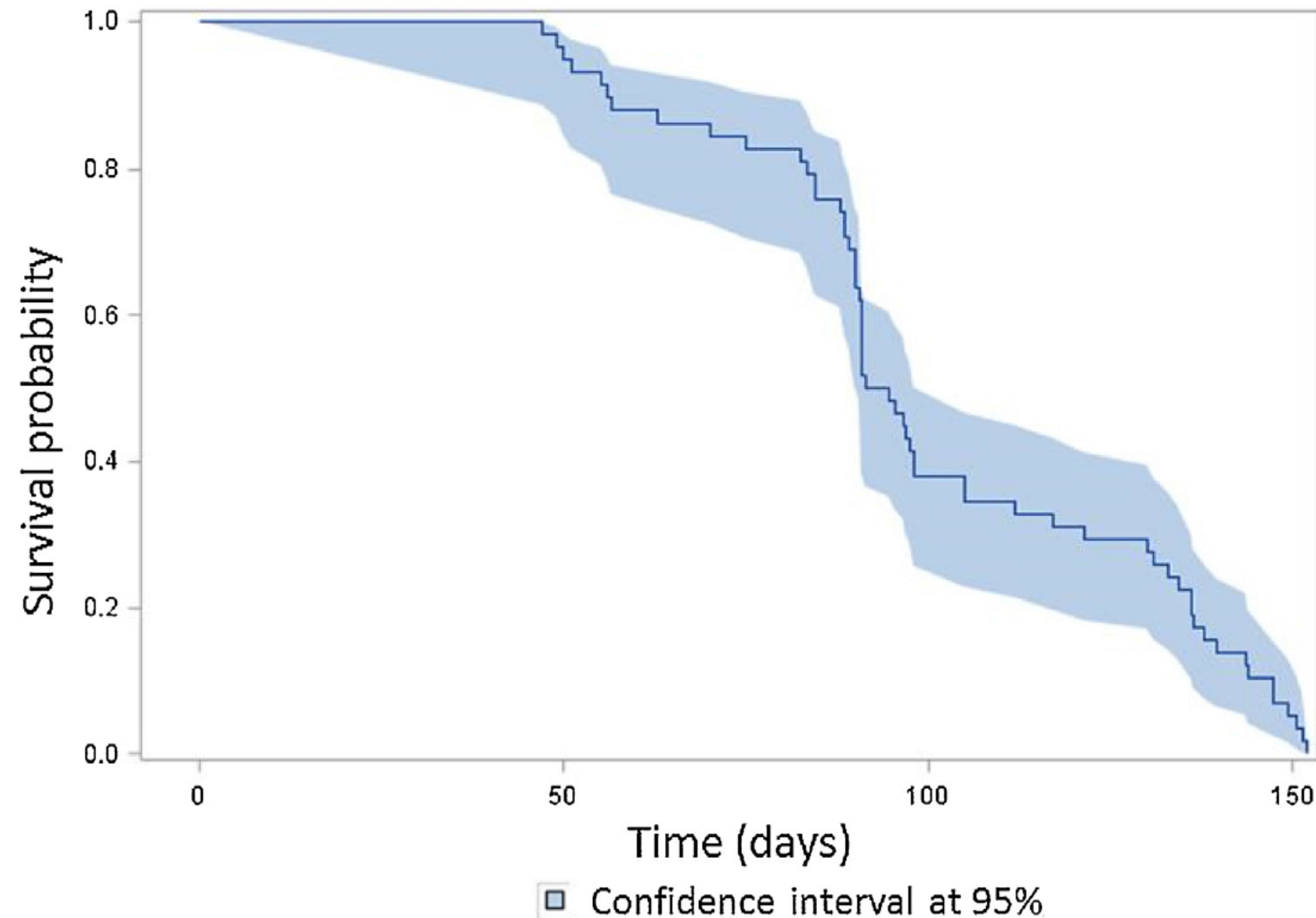
**OR = 3,1****CI<sub>95%</sub> : 1,1 - 8,5**Farm size  $\geq 200$  sows**OR = 5,5****CI<sub>95%</sub> : 1,8 - 16,4**

Mhp + at 16 weeks-old

**OR = 5,5****CI<sub>95%</sub> : 1,8 - 5,6**

On-farm semen collection

**OR = 5,9****CI<sub>95%</sub> : 1,4 - 25,9**No disinsectization in  
the farrowing sector**OR = 3,8****CI<sub>95%</sub> : 1,2 - 11,5**Acclimatization phase for gilts  
 $\leq 49$  jours**OR = 4,9****CI<sub>95%</sub> : 1,4 - 17,9**Ventilation settings in  
fattening rooms  $\leq 24^{\circ}\text{C}$ **OR = 3,4****CI<sub>95%</sub> : 1,0 - 11,3****PRRS positive farm**





## ➤ Cox proportional hazards model

Highest PCV2 genome  
load from 4 batches  
 $>4,5.10^6$  copies

**HR = 4.6**  
**CI<sub>95%</sub> : 3.1 – 6.9**

Range of temperature  
values for ventilation  
control in the nursery  
room  $\leq 5^{\circ}\text{C}$

**HR = 3.9**  
**CI<sub>95%</sub> : 2.8 – 5.4**

+ *M. hyopneumoniae*  
at 16 weeks old

**HR = 3.2**  
**CI<sub>95%</sub> : 2.3 – 4.5**

$\geq 28$  pigs/nursery  
pen

**HR = 2.9**  
**CI<sub>95%</sub> : 2.0 – 4.1**

Common housing for  
the gilts & sows  
when lactating

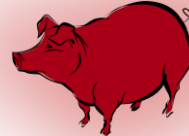
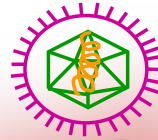
**HR = 3.0**  
**CI<sub>95%</sub> : 2.0 – 4.3**

$\leq 12$  pens in  
fattening room

**HR = 2.5**  
**CI<sub>95%</sub> : 1.7 – 3.6**

Lack of all-in all-out in  
the fattening section

**HR = 2.5**  
**CI<sub>95%</sub> : 1.8 – 3.4**





## ➤ Non-infectious & infectious factors associated with PRRSV Herd infection

### ➤ Non-infectious

#### ◆ Farm structure

- **Large herds** (Mortensen et al., 2002; Firkins and Weigel, 2004; Evans et al., 2008).
  - high contact risk, increased risk of introduction
  - increased persistence
  - showed in mathematical models [Nodelijk et al., 2000; Evans et al., 2010]

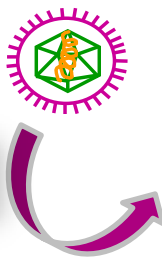
#### ◆ Biosecurity

- **On-farm semen collection**  
(Weigel et al., 2000; Mortensen et al., 2002; Firkins and Weigel, 2004). ).
  - virus shedding in semen
  - introduction of infected semen
  - proximity on-farm boars / sow herd
- **Short quarantine for gilts**
- **Lack of disinsectization**

#### ◆ Climatic conditions

- **Temperature set point in fattening rooms**

↑ **virus introduction**



**Immune responses**

### ➤ Infectious

#### ◆ swIAV H1N2 positive

- **Observed associations: not causal relationships**
- **Pathogens interaction**

#### ◆ M. hyo infection at 16 weeks old

## ➤ Non-infectious & infectious factors associated with PRRSV early seroconversion

### ➤ Non-infectious

#### ◆ Herd management

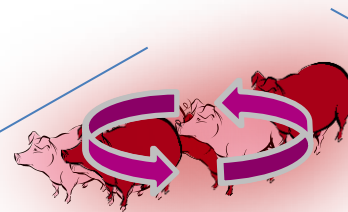
- *Common housing for gilts & sows (farrowing)*  
*Freese and Joo, 1994; Dee et al., 1995*
  - Heterogeneous PRRS immune and infection statuses of the breeding herd → instability and active infection of the litter
- *Lack of all-in-all out in the fattening section*  
*Goldberg et al., 2000*
  - ↑ likelihood of direct contact between older and younger pigs

#### ◆ Housing

- *Large nursery pens*
- *Few pens in fattening room*
- Mingling of pigs of ≠ immune & infection statuses
- ↑ direct contacts between penmates

#### ◆ Climatic conditions

- *Parameter settings for the control of ventilation*
- Climatic stress (cold, draught)



↑ virus transmission

Immune responses

### ➤ Infectious

#### ◆ High PCV2 infection pressure

- *Observed associations: not causal relationships*
  - Prospective study to clarify temporality and causal links
- *Pathogens interaction*  
*Opriessnig et al., 2012*
- *Common risk factors (PRDC)*

#### ◆ M. hyo infection at 16 weeks old

## PRRSv infection recommended measures

### ➤ External Biosecurity

↓ Risk of virus introduction from external vectors

### ➤ Management practices

↓ direct & indirect virus transmission between & within batches ⇒ decrease the risk of PRRSv maintenance

### ➤ Favourable microclimate

Provide the pigs good conditions to cope with co-infections

# Thanks for your attention



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***Thanks to the farmers***