# Understanding the risks for wild-type PRRS virus infections and introductions

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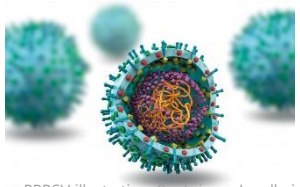
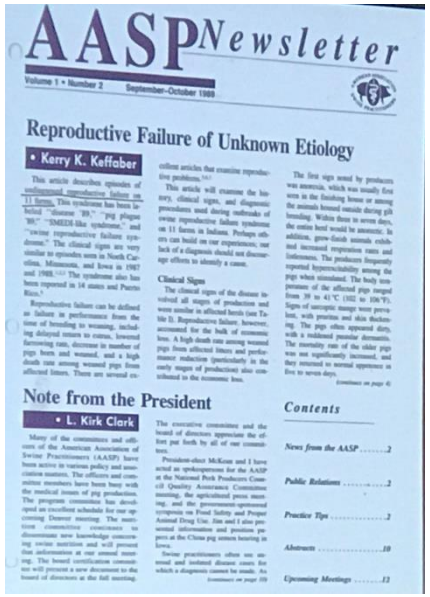
Leman China, October 2024

# Porcine reproductive and respiratory syndrome virus (PRRSV)



PRRSV illustration: Boehringer Ingelheim

- The most important virus affecting the North American swine industry
- First described in the late 80's, and then identified in the early 90's in Europe and North America
- Causes reproductive failure in sows and respiratory problems in pigs
  - Annual cost as an industry = $664 M ($1.8 M per day)
  - $255 USD per sow & $6-15 USD per pig
- Continues to be a problem despite all the investments and advances made to date on prevention, control and elimination



AASP Newsletter

Volume 1 • Number 2 September-October 1989

Reproductive Failure of Unknown Etiology

• Kerry K. Keffaber

Clinical Signs

Note from the President

• L. Kirk Clark

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# Efforts and investment to control and eliminate PRRS have focused largely on breeding herds

**Replacement gilts PRRSV acclimatization**

↓

**PRRS Breeding herd classification**:
Category I-A; Positive Unstable, High Prevalence
Category I-B; Positive unstable, low prevalence
Category II; Positive Stable
Category II-vx; Positive stable with vaccination
Category III; Provisional Negative
Category IV; Negative

→ **PRRSV status of piglets at weaning**

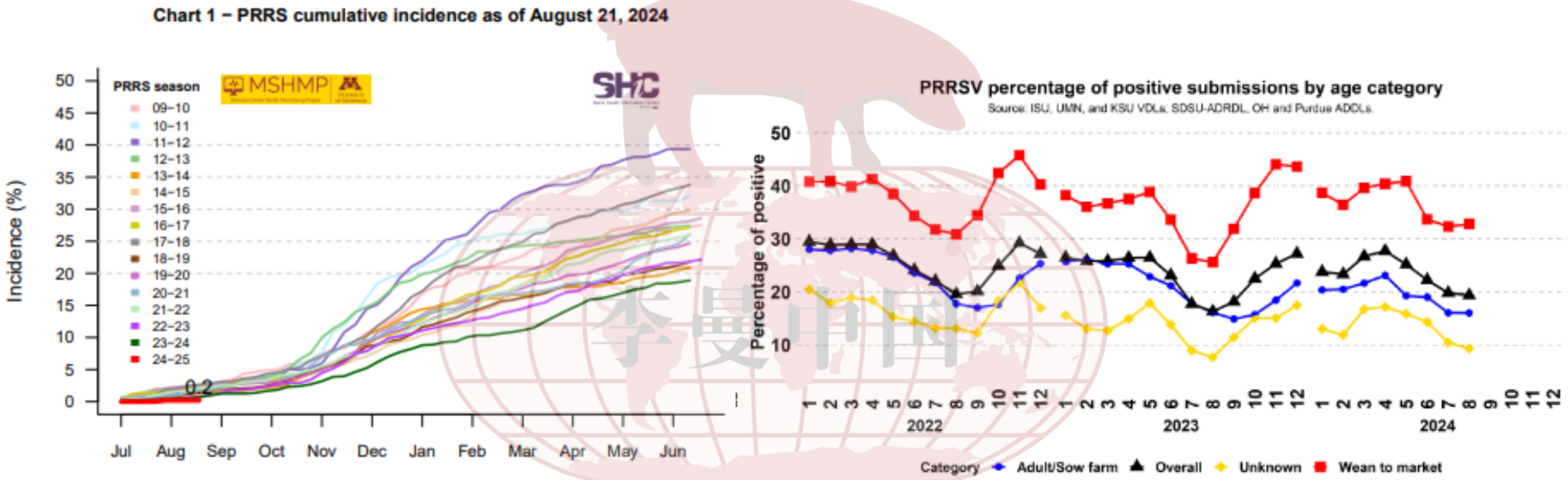



| Breeding herd | Growing pig herd | Transmission | Intervention objective |
|---|---|---|---|
| Positive,[a] Unstable[b] | Positive, Unstable | Vertical and horizontal | Stabilize breeding herd |
| Positive, Stable[c] | Positive, Unstable | Horizontal | Stabilize growing pig herd |
| Positive,Stable | Negative | None | Eliminate virus in breeding herd |
| Negative[d] | Negative | None | Prevention |

[a] Are now/or have been previously infected with PRRSv
[b] Unstable denotes virus is circulating within and/or among production stages (e.g., among sows, and/or between sows and pigs)
[c] Stable denotes virus is not circulating within and/or among production stages
[d] Not infected with PRRSv

# However, we are not making enough progress in controlling PRRS in sows farms

SHIC Domestic Disease Report



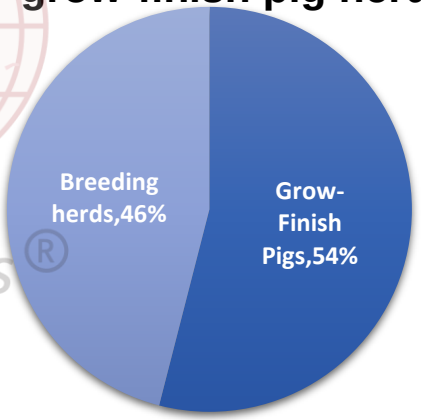



**2023-2024: ~ 20% PRRS incidence**

# There is a need to focus on growing pigs to advance PRRS control

- Growing pig performance is a critical profit driver
- Cost of disease in this population is significant (Holtkamp et al., 2013)
- > 90% of pigs in inventory are growing pigs

**$362M per year in the grow-finish pig herd**



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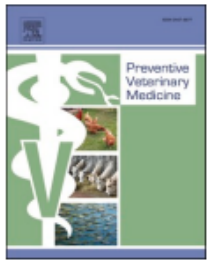

# Infection dynamics and incidence of wild-type porcine reproductive and respiratory syndrome virus in growing pig herds in the U.S. Midwest

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# Material and methods

- 63 wean to finish sites (W-F) enrolled:
  - Ten production companies
  - Located in Minnesota and Iowa

- Inclusion herd criteria:
  1. Pigs sourced from PRRSV negative or stable breeding herds (based on the AASV PRRSV breeding herd classification)
  2. Pigs placed in all-in/all-out sites located in medium to high pig dense areas
  3. Producer willingness to collect monthly oral fluid samples for PRRSV testing
  4. Willingness to share site level information on production parameters and management practices

Note: Both vaccinated and non-vaccinated herds were included

# Sampling, testing and performance data collection

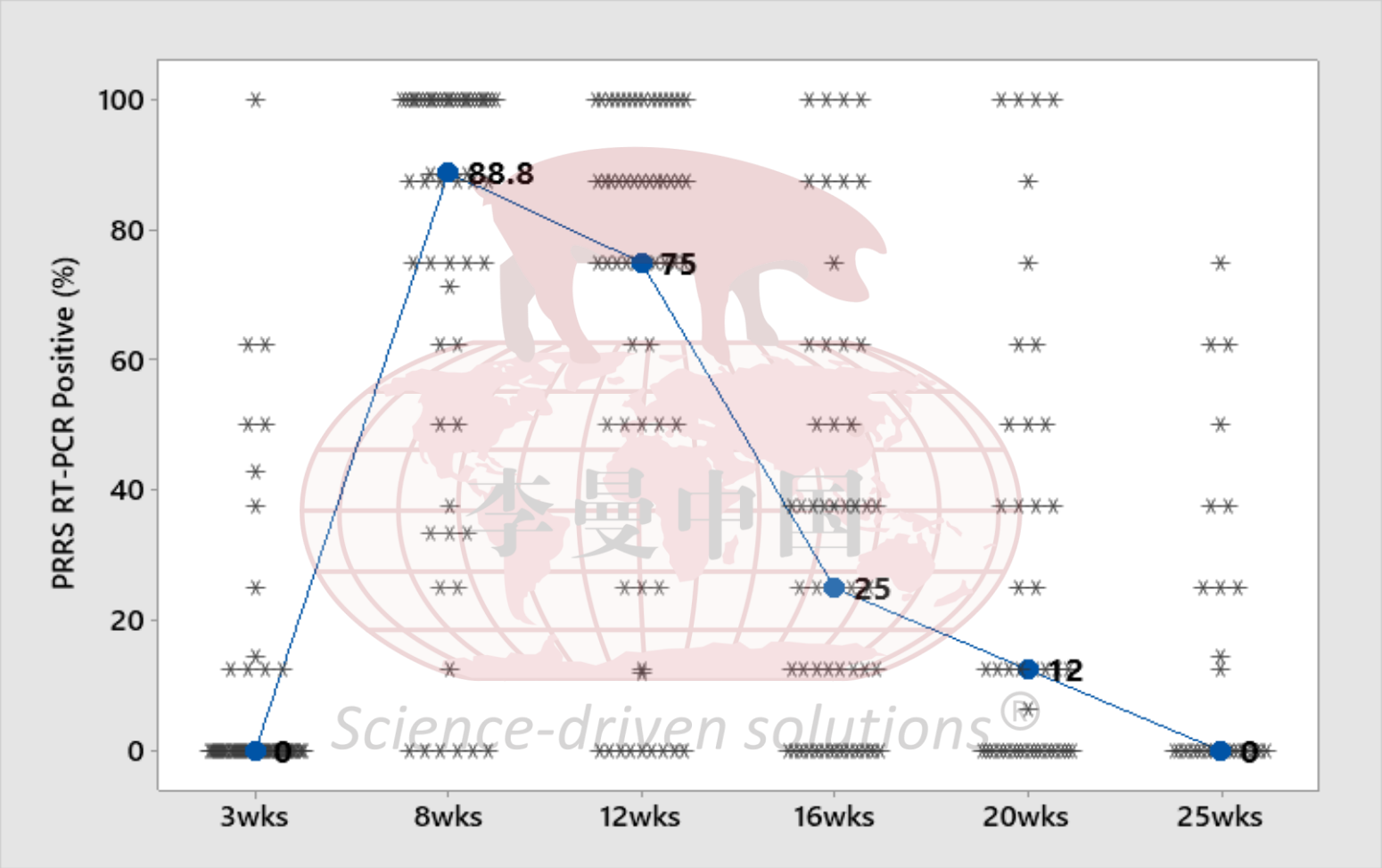
- Oral fluid collection every four weeks, fixed spatial sampling (8 ropes/site/sampling)
- Six sampling events per site at approx. 3, 8, 12, 16, 20 and 25 weeks post placement
- Individual PRRSV RT-PCR and ELISA
- ORF5-sequencing to differentiate vaccine-like from wild type PRRSV
  - Sample with lowest Ct value obtained at each positive sampling event
  - Sequences aligned and classified as WT-PRRSV if > 2.0% nucleotide difference from vaccine reference viruses
- Closeout data with mortality from 58 W-F sites was provided

# Results

## Characteristics of enrolled sites

| Site information | Median | Min-Max |
|---|---|---|
| Number of pig spaces per site | 4,560 | 1,200 - 9,600 |
| Number of barns per site | 2 | 1- 6 |
| Number of pig spaces per barn | 2,400 | 700 - 5,000 |
| PRRS Vaccination | 57 (90%) | Vaccinated |
| | 6 (10%) | Not vaccinated |
| | **No. of sites per production company (%)** | **Production companies** |
| Production companies (n=10) | 16 (25 %) | A |
| | 3 (5%) | B |
| | 1 (2%) | C |
| | 12 (19%) | D |
| | 14 (22%) | E |
| | 5 (8%) | F |
| | 4 (6%) | G |
| | 3 (5%) | H |
| | 1 (2%) | I |
| | 4 (6%) | J |

# PRRS RT-PCR results by sampling event

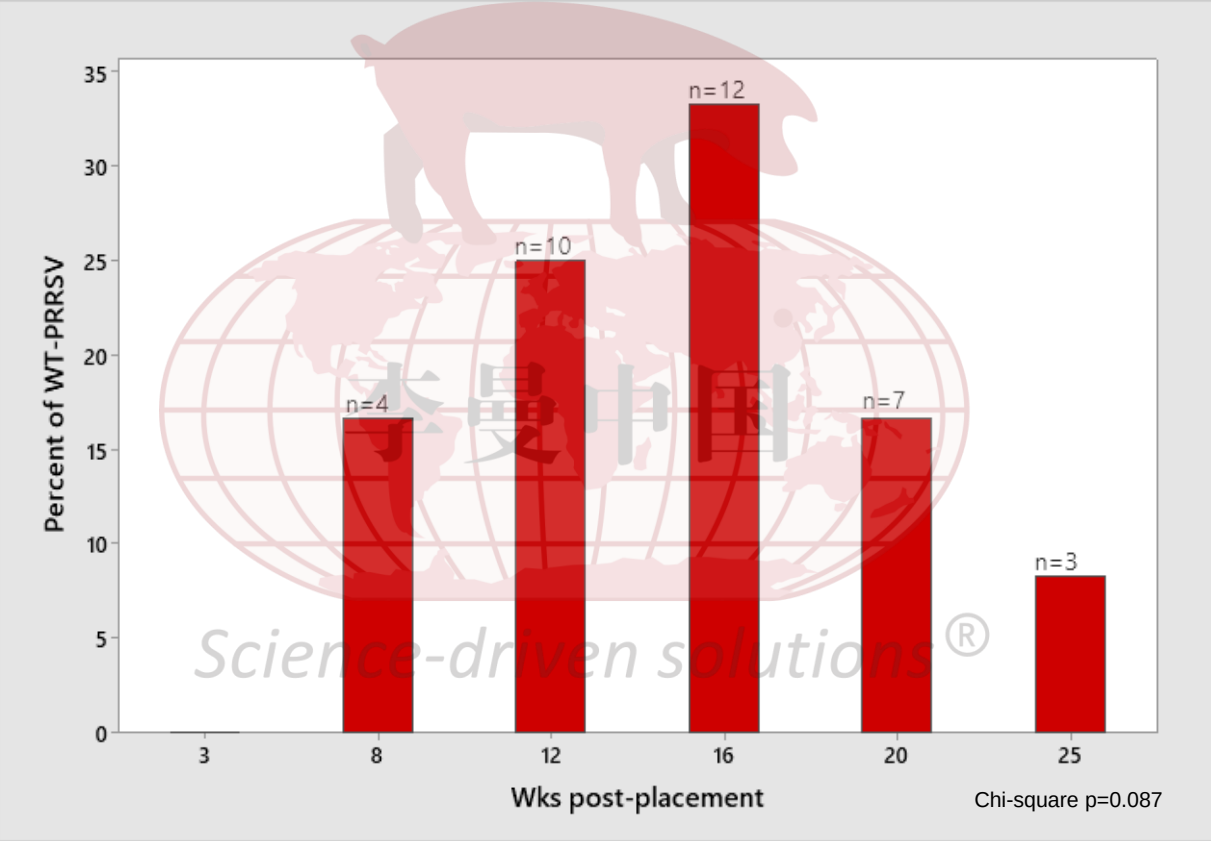





Distribution of the prevalence of positive PRRSV RT-PCR results for each wean to finish herd (n=60) at each sampling event. Numbers in bold are the median prevalence at each sampling event (blue line).

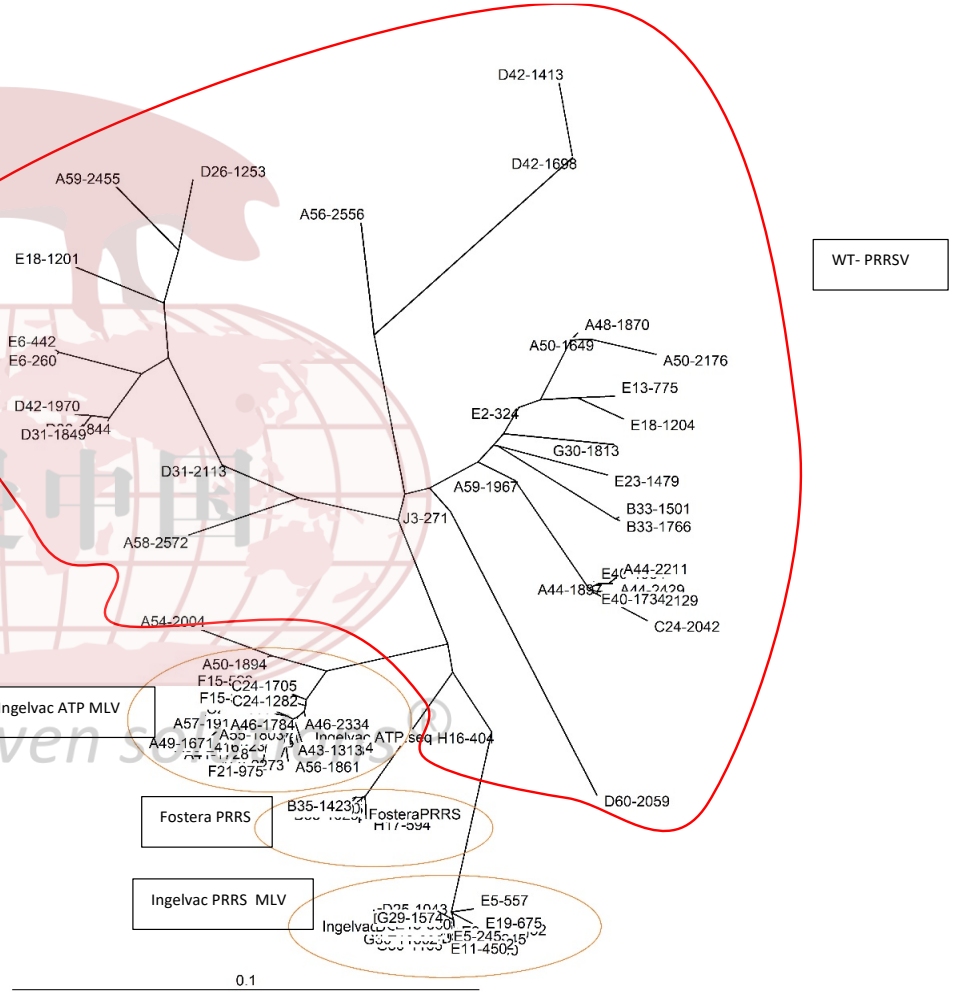
# Distribution of wild-type PRRSV sequences

- 26% (36/139) sequences were classified as WT-PRRSV
- 42% (25/60) of W-F sites had WT-PRRSV



# PRRSV dendrogram

- 19 distinct WT-PRRS viruses
- Different production companies had genetically similar WT-PRRSV (A,C,E,J; A,E; E,D)
  - 70% (7/10) of production companies had at least one site with WT-PRRSV
  - In average there were three (Min 0, Max 6) distinct WT-PRRSV clustered/variants per production company



# Distribution of vaccine and WT-PRRS strains by sampling event

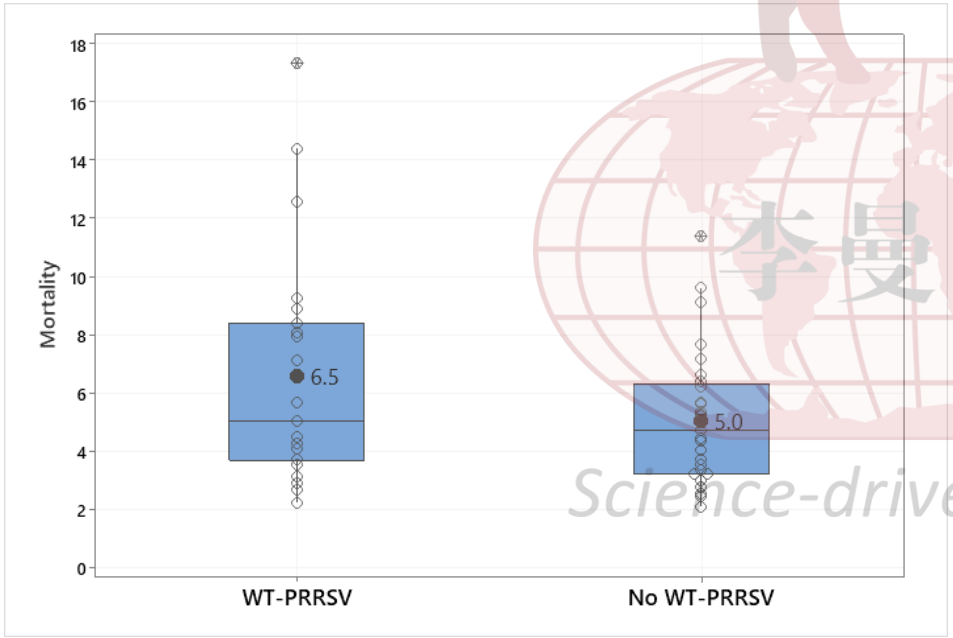
| Site ID | 3wks | 8wks | 12wks | 16wks | 20wks | 25wks |
|---|---|---|---|---|---|---|
| D25 | MLV | MLV | | | | |
| G28 | MLV | MLV | | | | |
| F20 | MLV | MLV | MLV | MLV | | |
| F21 | MLV | MLV | MLV | MLV | | |
| G29 | MLV | MLV | MLV | MLV | | |
| A49 | | MLV | | | | |
| A57 | | MLV | | | | |
| B39 | | MLV | | | | |
| D32 | | MLV | | | | |
| D38 | | MLV | | | | |
| D63 | | MLV | | | | |
| H12 | | MLV | | | | |
| H16 | | MLV | | | | |
| A41 | | MLV | MLV | | | |
| A55 | | MLV | MLV | | | |
| B35 | | MLV | MLV | | | |
| D22 | | MLV | MLV | | | |
| D37 | | MLV | MLV | | | |
| E10 | | MLV | MLV | | | |
| E45 | | MLV | MLV | | | |
| E47 | | MLV | MLV | | | |
| E7 | | MLV | MLV | | | |
| H17 | | MLV | MLV | MLV | | |
| A43 | | MLV | MLV | MLV | | |
| E11 | | MLV | MLV | MLV | | |
| E52 | | MLV | MLV | MLV | | |
| F15 | | MLV | MLV | MLV | | |
| A46 | | MLV | MLV | | MLV | |
| E5 | | MLV | MLV | | MLV | |
| E19 | | MLV | MLV | MLV | | MLV |
| F14 | | | MLV | | | |
| D61 | | | | | | |
| I1 | Neg | Neg | Neg | Neg | Neg | |
| J8 | Neg | Neg | Neg | Neg | Neg | Neg |
| J9 | Neg | Neg | Neg | Neg | Neg | Neg |

| Site ID | 3wks | 8wks | 12wks | 16wks | 20wks | 25wks |
|---|---|---|---|---|---|---|
| D60 | | Wild-Type | | | | |
| A59 | | Wild-Type | | Wild-Type | | |
| D42 | | Wild-Type | Wild-Type | Wild-Type | | |
| A50 | | Wild-Type | MLV | Wild-Type | MLV | |
| J4 | | | Wild-Type | | | |
| A53 | | MLV | Wild-Type | | | |
| A54 | | MLV | Wild-Type | | | |
| A48 | | MLV | Wild-Type | | | |
| E40 | | MLV | Wild-Type | Wild-Type | | |
| E6 | | MLV | Wild-Type | Wild-Type | | |
| B33 | | MLV | Wild-Type | Wild-Type | | |
| A44 | | MLV | Wild-Type | Wild-Type | Wild-Type | |
| D36 | | MLV | | Wild-Type | | |
| E2 | | MLV | MLV | Wild-Type | | |
| G27 | | MLV | MLV | Wild-Type | | |
| D26 | | | MLV | Wild-Type | | |
| E13 | | | MLV | Wild-Type | | |
| J3 | | | | Wild-Type | | |
| E23 | | MLV | | | Wild-Type | |
| A56 | | MLV | MLV | | Wild-Type | |
| G30 | | MLV | MLV | | Wild-Type | |
| E18 | | MLV | MLV | | Wild-Type / Wild-Type | |
| D31 | | MLV | MLV | MLV | Wild-Type | Wild-Type |
| A58 | | MLV | MLV | | | Wild-Type |
| C24 | | MLV | MLV | MLV | MLV | Wild-Type |

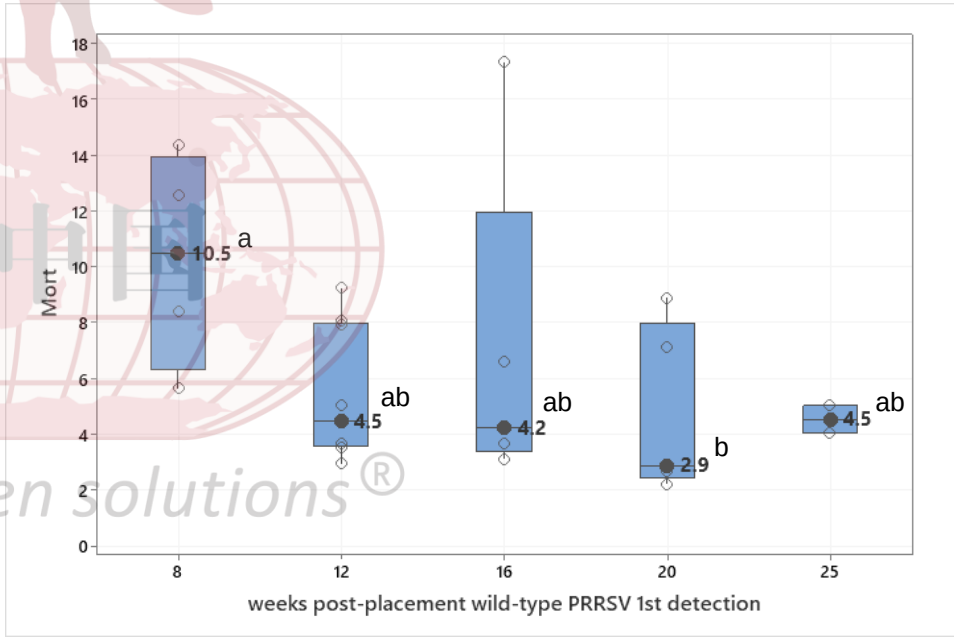
Note: there were 3 herds positive at first sampling event and were removed from the incidence analysis

# Mortality by WT-PRRSV status and weeks post placement

- No statistical differences in mortality in herds with and without WT-PRRSV infections
- Higher mortality when WT-PRRSV was confirmed earlier (8 wks post placement) than later (20 weeks post placement)



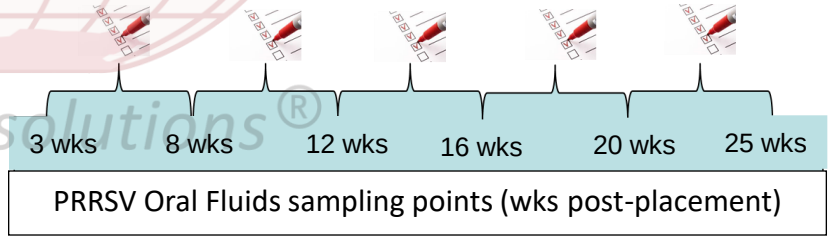

Permutations based on a randomization test for 2-sample means (p=0.07)



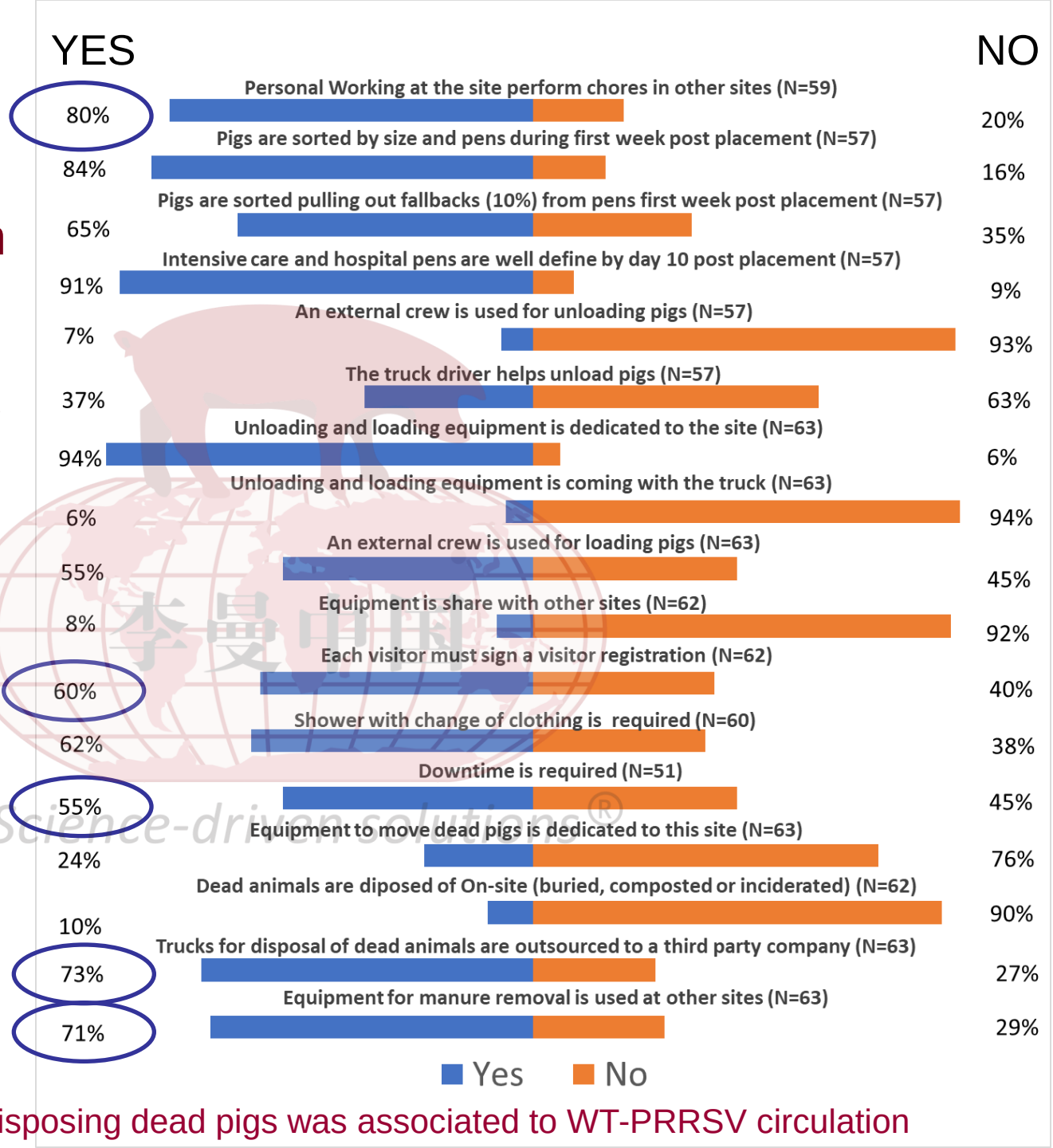

Kruskal-Wallis pairwise comparisons
Different superscripts indicate statistically significant difference (P<0.05)

# Events during the growing phase were captured through a daily log check list

- ✓ Administration of vaccinations
- ✓ Implementation of mass treatments that may have required additional personnel
- ✓ Observation of clinical signs (i.e cough that affected more than 10% of the pigs)
- ✓ Moving a subset of pigs to other sites
- ✓ Removal of culls from the site
- ✓ Entry of visitors and entry of repair and maintenance crews
- ✓ Loading pigs to market
- ✓ Manure removal

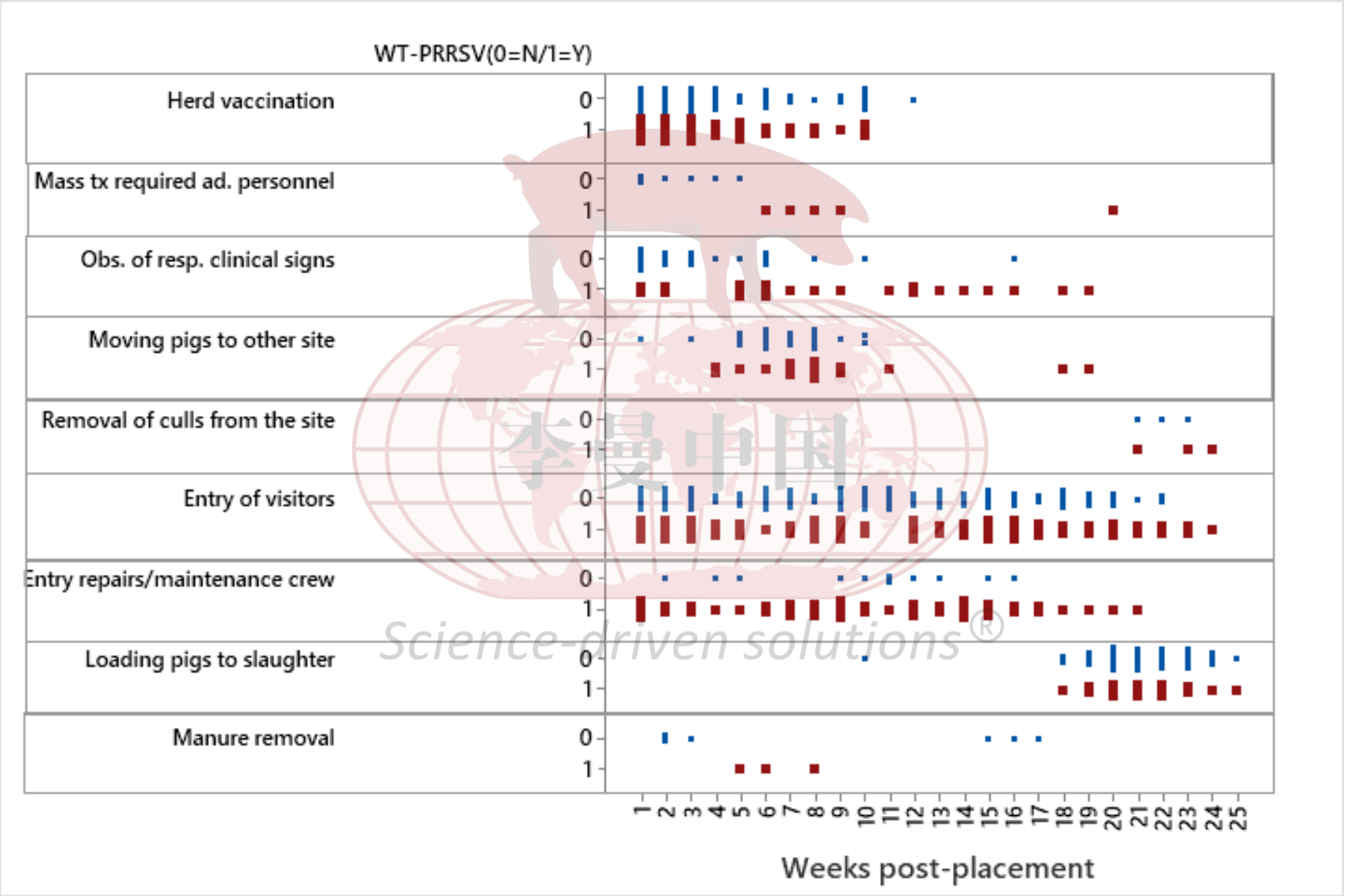


Specific information about **personnel movements, loading/unloading pigs, visitors mortality and manure management** was captured




Outsourcing trucks for disposing dead pigs was associated to WT-PRRSV circulation

# Frequency of events recorded as part of the daily log of activities in sites with and without wild-type PRRSV






Having maintenance and repair crews was associated to WT-PRRSV infections

# Conclusions

- Lateral PRRSV infections are common in growing pigs
- Growing pigs are important reservoirs of genetically diverse PRRS viruses:
- Events associated to transport, removal of mortalities and maintenance and repairs events emphasize the role of indirect routes in the introduction of WT-PRRSV
- There is an urgent need to improve biocontainment and bioexclusion measures in grow-finish pigs

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zoetis