Progress in biosecurity and risk assessment of swine diseases

Iowa Swine Day

Ames, Iowa
June 29, 2017

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Outline

• PRRS Outbreak Investigation Program
• Evaluation of a bench entry into sow farms
Three decades later... PRRSV is still an issue!

- Despite significant research and industry resources, PRRSV remains:
  - COSTLY - $664 million per year (Holtkamp et al. 2013)
- U.S. Swine Industry has not yet learned how to slow the transmission of the virus from one herd to another
  - PREVALENT - 20% to 40% of breeding herds in the United State break annually (SHMP, 2016)
How do we stop transmission of pathogens from one herd to another?

What agents CAN carry pathogens into a herd?

Experimental Research

- Feed
- People
- Air
- Etc.

What agents MOST FREQUENTLY carry pathogens into a herd?

Systematic Observation

- ??
- ??
- ??
- ??

Veterinary Diagnostic and Production Animal Medicine, ISU College of Veterinary Medicine
PRRSV Outbreak Investigation Program

- Pilot project developed in 2013
- Funded by Iowa Pork Producers Association (IPPA) *(Checkoff $)*
- Work with PRRS Regional Control projects
- 28 breeding herds currently enrolled
Objectives

- Identify cause of outbreaks
- Identify gaps in biosecurity
- Reduce frequency of outbreaks in breeding herds
  - A single outbreak is not a measure of success or failure!
  - Must measure over longer period of time
Systematic observation to learn from every outbreak

- Comprehensive
- Consistent set of information collected
- Timing is important
  - Can identify mistakes
  - Pain is fresh
Standardized investigation form used

- Background information
  - PRRSV History
  - Current Outbreak Information
  - Herd Characteristics
  - Premises Characteristics
- Set of standard questions on risk events that are known to occur on swine farms
Investigation form is organized by risk events and carrying agents

- Pathogens are not capable of independent locomotion
- Must be carried by something else
- Call this “something else” a carrying agent
  - Contamination
  - Infection

http://www.quickanddirtytips.com/sites/default/files/images/3004/virusdetected.png
Examples of carrying agents when semen is delivered to a farm

Risk event:
Semen delivered to farm

- **Carrying agent:** Semen
- **Carrying agent:** Semen packaging and container(s)
- **Carrying agent:** Semen delivery vehicle
- **Carrying agent:** Semen delivery driver
- **Carrying agent:** ???
Examples of carrying agents when feed is delivered to a farm

Carrying agent: Feed

Carrying agent: Feed truck

Carrying agent: Feed truck driver

Carrying agent: Feed
A risk event occurs when carrying agent(s) enter the premises

- Some risk events identified by a specific date and time
- Some are continuous
Examples of risk events

- Semen delivery
- Cull sow removal
- Feed delivery
- On-farm employee entry
- Manure removal
Procedures

• Interview
  – Veterinary outbreak facilitators
  – Herd veterinarians
  – Farm personnel
• Questions
  – Open-ended questions
  – Closed-ended questions embedded in the form
    • Guide investigation
    • Create consistent set of information for database
• 4 week investigation period prior to first clinical signs
Looking for **operational connections** to other premises with similar isolates
Investigations where identification of operational connections were important

• Case 1
  – Farm employee also worked on finisher with pigs infected with similar virus
  – Toilet on “dirty” side of shower
  – Shower but no bench

• Case 2
  – Received semen from boar stud that became infected with similar isolate
Investigations where identification of operational connections were important

- Case 3
  - Vaccines and other supplies picked up at veterinary clinic once per week
  - Similar isolate of virus prepared at clinic and used for LVI by several clients of the clinic
  - No disinfection or downtime before entry into farm
Observation of **first clinical signs** can be useful

- **Timing and location**
  - Clinical signs were observed before diagnostic confirmation in 15 of 17 investigations
  - In 13 investigations, first clinical signs observed in specific location
Investigations where timing and location of first clinical signs were important

• Case 1
  – First clinical signs (sows off feed) observed where feed line was repaired
  – Signs observed 4 to 5 days after repair
  – Farm manager was absent day parts were entered into farm

• Case 2
  – First clinical signs observed in area of barn where dirty manure pump was parked outside
  – Signs observed (sows off feed) 1 to 2 days after
  – Forty year-old barn with large population of mice with easy access to barn
Geographic proximity to other premises with similar isolates can provide clues
In 3 of 17 investigations, there was a swine premises with a similar isolate within 3 miles.

- In all 3 cases, weather was not optimal for aerosol transmission during the 4 week investigation period
  - Case 1
    - Similar isolate at breeding herd within 3 miles
    - Wind frequently down wind from site
    - Occurred in May/June
  - Case 2
    - Similar isolate at breeding herd within 3 miles
    - Occurred in February
    - Several operational connections to same farm and others in area
There was a swine premises with a similar isolate within 3 miles in 3 of 17 investigations.

- In all 3 cases, weather was not optimal for aerosol transmission during the 4 week investigation period
  - Case 3
    - Similar isolate at 2 finishing sites within 3 miles
    - Occurred in November
    - Several operational connections to same farm and others in area
      - One employee also worked on another finisher with similar isolate
Sharing virus sequences is required to identify operational connections and nearby premises with similar isolates

- Database of sequences was available in 15 of 17 investigations
  - Regional PRRS control project
  - Production system
  - Veterinary clinic
Subjective ratings of likelihood risk events were responsible for outbreak

- Operational connections, geographic proximity and timing and location of first clinical signs
- Likelihood of series of failures:
  - Carrying agent is contaminated or infected with PRRSV
  - Contamination or infection is not mitigated
  - Frequency of Risk Event
  - PRRSV gets from carrying agent to pigs in herd
Entry of employees, removal of culls and repairs inside barn were risk events rated high most frequently.

17 cases, 2015 to 2017
What made **cull sow removal** a high risk event

- Multiple types of pigs hauled with same trailers and drivers
- Not washed between loads
- Bumper-to-bumper transfer on road
  - Cart not washed
  - Cart hauled gilts from on-site GDU to gestation barn
What made cull sow removal a high risk event

• Investigations where 3rd party contractor hauled culls
  – Used same trailers and drivers to haul culls for sow farm (different system) with similar isolate
    • Recent change made just before outbreak
  – No knowledge of who else contractor hauled pigs for
  – Contractor established protocols for cleaning and decontamination of trailers
    • No oversight or auditing
  – 3rd party driver w/ record of biosecurity violations
What made repairs inside barns a high risk event

• Contracted repair crew worked inside barns 3 days prior to outbreak
  – Not exclusive to system
  – Did not shower in
  – Tools and supplies directly entered
• Supplies transferred from a parts depot
  – Located next to house where temporary employees sometimes stayed
• Most common “smoking gun”
What made **employee entry** a high risk event

- Most frequent entry event on every farm
- Working on other farms
  - Maintenance on other swine farms
  - Driving feed trucks
  - Delivering gilts
  - Managing feed mill
  - Loading market hogs
What made employee entry a high risk event

- Shower in detached shed next to barns
  - No walk through separating clean and dirty area
- No bench entry
- Towels on dirty side of shower
- Enter and exit farm multiple times every day
  - Other duties
  - Lunch
  - Smoking
- Do not shower when reentering
- Treat area around the barns as “clean”
What made employee entry a high risk event

- Farm manager transitioning to new job
- High employee turnover
- Disgruntled employees
  - Purposely violating biosecurity procedures
  - Visiting other farms to interview
Outline

- PRRS Outbreak Investigation Program
- Evaluation of a bench entry into sow farms
Objective of the study

- Determine if installing a bench entry system in swine facilities is effective at preventing entry of swine pathogen contaminated particles from on-farm employee footwear.
Fluorescent powder was used to simulate contamination

- **Fluorescent Powder**
  - Glo-Germ
    - Particles around 5 microns in size,
    - Similar to size of many bacteria
Study Design

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Replicates</th>
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<tbody>
<tr>
<td>Bench</td>
<td>10</td>
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<td>NoBench</td>
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</tbody>
</table>

- Randomized block design
- Entry of four female employees
  - 1 day
  - 1 shower stall

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Entry setup

- Shower
- Bench
- Glo-Germ
- Shoe Rack
Sampling Points

- Shower
- Bench
- Glo-Germ
- Shoe Rack

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Using a Bench Entry System

**Step 1:** Sit down on the bench. Take one shoe off without touching socked foot to ground or bench.

1: Siéntase en la banca. Quite uno de los zapatos sin que sus calcetines toquen el piso o la banca

**Step 2:** Swing leg over the bench and place socked foot on the clean side.

2: Tire su pierna sobre la banca y ponga el pie con su calcetín en el lado limpio.

**Step 3:** Put your shoe on the shoe rack beside bench.

3: Ponga su zapato en el zapatero al lado de la banca.

**Step 4:** Remove other shoe without touching socked foot to dirty side. Swing leg over and place socked foot on the clean side. Place shoe on shoe rack beside bench and proceed to shower room.

4: Quite el otro zapato sin que su calcetín toque el lado sucio. Tire su pierna al otro lado y ponga el pie con su calcetín en el lado limpio. Ponga su zapato en el zapatero al lado de la banca y proceda a las regaderas.
Environmental Contamination Assessment

- Grids
  - PVC pipes, metal eyelets, fluorescent paint, and flat plastic string
  - 90 cm x 75 cm
    - 270, 5 cm x 5 cm squares
### Average Count of Contaminated Squares For Each Treatment and Sampling Point

<table>
<thead>
<tr>
<th></th>
<th>Before Bench (A)</th>
<th>After Bench (B)</th>
<th>Dirty Side of Shower (C)</th>
<th>Clean Side of Shower (D)</th>
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<td>222.6(^b)</td>
<td>47.7(^a)</td>
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Different superscripts indicate statistical significance (P< 0.05)
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Glo-Germ on Door Handle
Glo-Germ on Bench
Glo-Germ on Locker Handle
Take-away message

• Inconsistent reduction in level of contamination due to bench entry
  – Focus on compliance and execution

• Footwear handling
  – Aware of what hands touch

• Employee clothing
  – Consider clothing that drags on the ground

• Biosecurity layers
  – No Glo-Germ found on clean side of shower with bench and shower
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