Porcine Epidemic Diarrhea Virus: Update on Status, Research and Future Preparedness

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National Pork Board
Initial Events and Virus Review
PED Diagnosis and Response

• PEDV was officially confirmed in the US on May 17th, 2013
  – Initially diagnosed at Iowa State University Vet Diagnostic Lab
  – Confirmed at the USDA National Veterinary Services Lab

• Coordinated effort by all key stakeholders:
  – United States Department of Agriculture (USDA)
  – State Animal Health Organization representatives (SAHO)
  – National Pork Board (NPB)
  – National Pork Producers Council (NPPC)
  – American Association of Swine Veterinarians (AASV)
Why did it take > week to confirm?

• Two coronaviruses currently in the U.S.
  – Transmissible Gastroenteritis (TGE)
  – Porcine Respiratory Coronavirus (PRCV)

• TGE and PED have the same clinical signs
  – Diagnostic tests not fully developed (for PEDV)

• Third virus identified in the fall of 2013
  – Porcine Deltacoronavirus
  – Similar symptoms to TGE & PED
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<td>5 1st Phone Call</td>
<td>6 1st Indiana – Sow Farm</td>
<td>7 2nd Indiana – Sow</td>
<td>8 Initial TGE PCR neg</td>
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<td>16 NVSL confirms PEDV</td>
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Early Knowledge About PEDV in the US

• PEDV is in the same virus family as TGE & PRCV

• Different strains of PEDV exist with varying severity of clinical signs

• Genomic evaluation showed:
  – U.S. PEDV strain was 99.4% similar to a Chinese isolate from 2012 (strain info from Genbank)
  – Subsequent strains from Canada are similar to US strain
PED Worldwide Status

• PEDV currently is active and considered endemic in different parts of the world
  – China, South Korea, Thailand, Vietnam
  – Different from UK strain seen in the 1970’s
  – More virulent strains appeared in 2010 + and continues to be problematic
PED Control & Management

• Biosecurity efforts = Primary management tools
  – Focus on prevention of entry into a herd and contamination of equipment

• Vaccines?
  – Used in different parts of the world
  – Two products currently available in the US
  – Efficacy is variable and not protect naive herds
PEDV Messaging

- PEDV = fecal/oral method of infection and transmission
  - Transmits through contaminated manure
  - Keep from spreading through use of biosecurity plans

- PEDV does NOT affect pork and cannot infect humans...
  - PEDV is not a public health or food safety issue
  - Pork Is Safe!!!
Clinical Presentation of PEDV

• 100% acute mortality of baby pigs < 4wks of age

• Diarrhea and vomiting in older animals
  – PDCoV has similar clinical presentation

• Animals do recover post-infection

• Estimate of losses range from 10 + million – no formal way to confirm/disprove prior to June 2014
  – Utilize USDA Hogs and Pigs Report + other
Clinical Signs in Sows

- Sows were febrile, lethargic and scouring during late gestation or 2-3 days before farrowing
PED in baby piglets – most severe

Day 1

Day 2

Day 3

Day 4

Courtesy of Dr. Joe Connor
Clinical Signs in Growing Pigs

Courtesy of Dr. Joe Connor
Epidemiologic Investigation of First Cases 2013
Survey of Initial Farms (June 2013)

- AASV coordinated the study:
  - Survey data were collected by veterinarians associated with swine herds affected by PEDV
  - Veterinarians were requested to complete questionnaires for case and control herds.
Results

• A number of **feed and feed practices** may be indicators of risk (But...*no definitive factor identified*):
  – Off-site manufactured feed
  – Use of multiple meal rations in Nursery or GF
  – Contents of supplements

• A number of practices may protective including:
  – Number of pelleted rations fed to sows
  – Replacements from the same state as home farm

Provided an theory on why herds broke initially but no “smoking gun”.

People. Pigs. Planet.
Status Update
National Status of PEDV

• Three key sources of information:
NAHLN Case Count

www.aasv.org NAHLN case count

• 31 total states PEDV +
• # 8,506 of total cases since April 15th, 2013
• Cases are NOT premises
• Does provide for trend of # in time/season
USDA SECD Tracking


- Federal Order on June 5, 2014
- Information is site-specific for PEDV + locations
- Count is from June 5th to current
  - 376 total premises confirmed + SECD
    - 339 PEDV
    - 18 PDCoV
    - 14 Mixed infection
US Swine Health Monitoring Project

Swine Health Monitoring Project
SHMP@umn.edu
10/3/2014

These producers are willing to share their premises IDs and pathogen status in the interests of national disease control.

751 breeding herds
(20 systems)

2.5M sows

http://www.cvm.umn.edu/sdec/SwineDiseases/pedv/index.htm
As of 10-1-14
PEDV Research Efforts

• Since June of 2013, the Board has approved $>3 million for use for PEDV
  – Additional $$$ from State Associations
  – Feed industry funding
  – Leveraging other non-NPB funds:

• **Limited international resources available so started “from scratch”

• Majority of projects were completed within 6 months timeframe
Research Challenges

• PEDV/PDCoV difficult to propagate in cell culture

• Searching for alternatives to assess live vs. dead virus for a positive PCR result
  – Have to rely on bioassay for confirmation
  – Not as sensitive, costly, and requires large # of pigs

• Diagnostic tests very limited during the initial phase of the outbreak; still underway as course of the disease evolves
  – ELISA, IFA, FFN, alternative samples = oral fluids
PEDV Research Priorities

Research Priorities – 2013:

• Initial Research focus:
  – Study of how PEDV effects pigs
  – Development of diagnostic tests and growth methods for virus
  – Transportation risk evaluation
  – Survivability in various substrates

• Sow immunity: (project duration ~ 12 months)
  • Duration of immunity
  • Optimizing feedback protocols
  • Diagnostic tests to assess sow and piglet immunity to PEDV
Research priorities – 2014:

• **Feed Focus:**
  – Risk assessment for feed as transmission source
    • Feed mill; Birds; General assessment
  – Intervention methods for feed (pelleting/additives)
  – Post-processing time on virus
  – Novel bioassay models

• **Animal Focus:**
  – PEDV immunity development
  – PDCoV = pathogenicity & diagnostic test development
Initial Evaluation of Transportation as a Risk Factor (June 2013)

• Evaluation of 7 Midwest area market hog plants
  – 669 environmental samples collected from trailers, cabs, loading chutes
  – Wanted to know the baseline level of PEDV contamination during the early phase of the outbreak
There are some differences between plants.
Key Learning Points

1. Trailers can become contaminated at packing plants.

2. There is contact by EVERY driver with the plant lairage and that appears to be sufficient to allow for PEDV movement between trailers.

3. More contact between trailer and plant is associated with higher rates of PEDV spread.
Biosecurity Practice Focus

Provide a barrier between you and the plant (boots/coveralls)

- Limit or eliminate contact with the plant (contact in the plant lairage; scales; receiving office)

Removal of all organic material is critical!!!

- We don’t have to have perfect hygiene of trailers to have a meaningful impact, but focus on clean and disinfected.
Additional Transportation Risks

• Buying station survey NC – 4 locations
  – Swabbed chutes and pigs = found PEDV in both

• Identified virus in buying stations prior to seeing full-on outbreaks in herds

• High risk area also due to continued cross-over of people/pigs
PEDV Research Results:

- **PEDV spread = fecal/oral**
  - Transmits through contaminated manure; anything in contact with PEDV + manure can be a potential source of infection

- **Virus survives in various matrices and under different conditions:**
  - Survive in cold conditions
  - Can survive in dry and slurried feed, and in various feed ingredients
  - Can survive in manure slurry, feces, water (fresh and recycled)
    - PEDV survivability can be time dependent (pit manure)

- **Virus characteristics:**
  - Virus is shed in large amount into the environment early-on
  - Takes very small amount of virus for infection
PEDV Research Results:

• Evidence of sow immunity for at least 4 months post-infection (studies for longer duration are ongoing)

• Feed interventions being studied
  – Some promise with Termin-8 for PED control (interim results)

• Focus on feed and feed system biosecurity is critical to avoid contamination

• Heat can kill virus: 160˚ F for 10 minutes or 7 days at 68˚ F for 7 days

• Packing plants and other markets are high risk areas for contamination and can contribute to spread of the virus
Research Results

- Research continues for 2014-2015

- RFP just posted for 2015 for PEDV/PDCoV

- See [www.pork.org/PEDV](http://www.pork.org/PEDV) for biweekly updates
Communications Efforts
Work with Key Stakeholders

- NPPC, AASV, NPB Committees
- August 2013 – Market Hog Packer meeting
- August 2013 – Sow Packer/Buyer meeting
- Feed Consortium – March 2014
- Focused Working Groups
  - Biosecurity
  - Diagnostics
  - Management and Control strategies
Communication of Research Results
(All research information is posted at www.pork.org/PEDV)

- Wanted to provide producers with as close to “real time” results as possible
- Utilized PEDV specific site for all information
- Research updates available bi-weekly until project completion
Transportation Guidelines

Transportation Biosecurity Protocols for PEDV Control

Key Points:
- Adhere to Pork Checkoff guidelines.
- Biosecurity training for PEDV control.
- Biosecurity protocols for PEDV transport.

Provisions for Designated Biosecurity Areas:
-commerce of transportation vehicles.
- Designate areas for biosecurity.
- Biosecurity protocols for transportation vehicles.

Protocols for Truck Wash Facilities:
- Biosecurity protocols for truck wash facilities.
- Designate areas for biosecurity.
- Biosecurity protocols for transportation vehicles.
Key Messages

• Prevent contamination as much as possible
  – Create a “Line of Separation”
  – Keep clean and dirty equipment separate
  – Avoid contamination of high risk areas

• Focus on removal of organic material for effective cleaning and disinfection

• Recently infected farms = higher risk than farms with longer time after initial infection
  – HIGH virus load in environment around the farm
  – Biosecurity and sanitation of equipment is critical
Key Messages

• Start with farms that have most time since initial infection and work to most recently infected

• Clean and disinfect between sites (remove organic materials)

• Communication x 10 with all parties involved!!
Other PED Resources

- Recommendations available for:
  - Exhibit Organizer Biosecurity
  - Exhibitor Biosecurity
  - Positive in Breeding Herd
  - Positive in Nursery/Grow-Finish
  - Line of Separation
  - Create Clean Crossing
  - Additional resources...
Next Steps and Future Activities
Emerging Diseases of Swine

• Examples of recent emerging diseases of concern:
  – Porcine Circovirus Type 2b (China)
  – PEDV
  – Porcine kubovirus
Emerging Disease Issues

• PED has highlighted a gap in protection of animal health (domestically and internationally)

• PED has shown the need to focus on identifying key needs and resources to support US agriculture/animal health

• Identified a need for an Emerging Disease Response plan
NPPC 2014 Resolution

NPPC Forum Resolution 2014:

A proposed plan of coordination and program execution for the US Swine Industry in the event of the identification/introduction of any new economically significant swine disease (defined as not currently identified in the United States as of March 1, 2014). This shall include all possible non-reportable diseases which may afflict swine.
Development of an Emerging Disease Plan

- USDA
  - Working on Emerging Disease Response plan
  - National List of Reportable Animal Diseases (NLRAD)

- NPPC
  - Reinstate concept of Swine Health Board
  - Working on Emerging Disease Plan – all stakeholders (USDA included)

- AASV
  - Development of a disease “Matrix” identifying future diseases/risks; review on a yearly basis

- NPB
  - Looking at options for disease data tracking and incorporation of the AASV disease matrix for future annual review of needs/research
Emerging Disease Focus Moving Forward

• USDA APHIS VS – Comprehensive risk pathways assessment

• Continued focus on development of a framework for comprehensive swine disease surveillance plan

• “Rapid Response Team” to investigate unusual cases of PED
  – Early ID of risk factors
  – Future disease response
Summary

- PED is an emerging disease of swine that has proven to be very costly to producers.
- PED has highlighted the need to have solid and workable biosecurity plans in place for disease prevention.
- PEDV probably will not be the last emerging disease the industry faces; therefore, an emerging disease plan is essential!!
- Cooperation and collaboration between all sectors of industry and government is a must.
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