

PEDV Research Updates 2013

Porcine Epidemic Diarrhea virus (PEDV) has caused significant challenges to the swine industry. The virus had not been previously identified in the United States prior to April of 2013. To assist producers and their veterinarians in the management, control and potential elimination of the virus, the National Pork Board funded key research projects to better understand PEDV. In order to provide timely information to producers from those projects, the objectives and initial updates will be periodically reported.

NOTE: The updates from the proposal represent interim information only and are not intended to be a final report. The final and formal reports will be provided at the end of the terms of the projects and then posted online at pork.org. The update information is intended to inform stakeholders of progress but are not intended to be the final outcome. For further information, please contact Dr. Lisa Becton at lbecton@pork.org.

#13-216: University of Minnesota

Epidemiologic investigation on propensity for lateral spread of PED virus

Objectives:

Objective 1. Prevalence & incidence of PED virus contamination in transport vehicles at slaughter.
Objective 2. Determine incidence of infection in unrelated sites adjacent to known infected sites and identify site-level risk factors associated with infection.

Update: 12-12-13

Project 4: Epidemiologic investigation on propensity for lateral spread of PED virus

PI: Robert B Morrison; Co-Investigators: Peter Davies, Dane Goede

North Carolina Cluster Updated Preliminary Results

Data from the first 52 / 62 questionnaires including 28 positive and 24 negative sites were summarized.* These findings are preliminary and presented for informational purpose. These results WILL change as more data are available and analyzed.

- There was approximately double the frequency of feed truck deliveries to positive sites compared to negative sites.
- There was approximately triple the frequency of trucks visiting to remove pigs of any age from positive sites compared to negative sites
- There was approximately 5 times the frequency of trash pickups from positive sites compared to negative sites.
- There was approximately double the percentage of positive sites that had culls removed from the site in the two weeks preceding infection.
- There was approximately double the percentage of positive sites that had removed weaned pigs to a nursery or finisher site in the two weeks preceding infection
- Approximately double the percentage of positive sites had dead haul vehicles visit the site in the two weeks preceding infection.

**Note: the negative sites in this preliminary analysis are NOT the identified controls for the specific positive sites, simply the control sites that we have questionnaires completed for at this time.*

- A preliminary spatial analysis has been completed for the Oklahoma cluster data by USDA CEAH epidemiologists. Our results provide some support to the hypothesis of airborne PEDv spread, since the direction of disease spread appears to correlate with wind direction.

Update: 11-27-13

Project 4: Epidemiologic investigation on propensity for lateral spread of PED virus

PI: Robert B Morrison; Co-Investigators: Peter Davies, Dane Goede

North Carolina Cluster Preliminary Results

- There is an average incidence of 46 newly infected sites per week being reported over the last 4 weeks (from lateral spread and movement of pigs).
- There is an average incidence of 31 newly infected sites from lateral spread being reported over the last 4 weeks (not including sites infected from movement of pigs).

Data from the first 26 / 54 questionnaires including 11 positive and 15 negative sites were summarized.* These findings are preliminary and presented for informational purpose. These results WILL change as more data are available and analyzed.

- There was approximately double the frequency of feed truck deliveries to positive sites compared to negative sites.
- There was approximately half the frequency of company service person visits to positive sites compared to negative sites.
- There was approximately double the frequency of trucks visiting to remove pigs of any age from positive sites compared to negative sites
- There was approximately 5 times the frequency of trash pickups from positive sites compared to negative sites.
- There was approximately double the percentage of positive sites that had culls removed from the site in the two weeks preceding infection.
- Approximately 30% more positive sites had dead haul vehicles visit the site in the two weeks preceding infection.
- There was approximately 3 times the percentage of positive sites that had producers/family members working off farm in an abattoir or other swine farm.

**Note: the negative sites in this preliminary analysis are NOT the identified controls for the specific positive sites, simply the control sites that we have questionnaires completed for at this time.*

Oklahoma Cluster Preliminary Results

Validation of geo-coordinates was completed for all farms in the dataset. The report "Preliminary Spatial Analysis of PEDv" is currently being updated using the new final dataset. A report is being drafted to assess the possibility of airborne spread of PED. A qualitative comparison will be done between the predominant wind direction and the direction of disease spread. If they appear to be in the same direction, this will provide some support to the hypothesis of airborne virus spread, and we

will recommend further research on the topic. Without any information on truck movement or other contacts between sites, we felt that a qualitative comparison was all that could be done.

Update: 11-13-13

Project 4: Epidemiologic investigation on propensity for lateral spread of PED virus

PI: Robert B Morrison; Co-Investigators: Peter Davies, Dane Goede

Retrospective & Prospective Lateral Spread Studies: 30 case farms have been identified (3 either declined/showed false positive) and 21 have agreed to participate. 17 of the farms that agreed have sent VDL releases and consent form. Seven of the farms have completed questionnaires to identify risk factors for PEDV lateral spread. Questionnaires are still being collected and input for analysis, but preliminary univariable analysis between positive and negative farms suggests the following: feed truck visits may be more frequent during the two weeks prior to a positive farm outbreak, and less inspection at the truck/trailer washing facility for dryness and organic materials after the wash seems significant between positive and negative sites.

OK Cluster Lateral Spread Study: The three producers in the area have all shared their information and provided VDL releases with consent forms. The data of all farms in the area has been analyzed spatially and temporally. Updates with results and preliminary conclusions will follow.

NC Cluster Lateral Spread Study: Of the three companies participating in North Carolina, there were 155 positive sites with unknown route of transmission as of 10/25 that have been matched to controls. We have started administering questionnaires for the farms identified this week and have 21 completed so far. Preliminary analysis of all participating farms in North Carolina using spatial tools identify the following conclusions:

- There is one significant cluster of sites where nearly twice the number of positive farms expected is present (44 km radius)
- Cases immediately following other infections occur 20 degrees NE on average
- Farms within 1 mile of a PED positive farm had an 8.4 times higher risk of infection
- Farms within 2 miles of a ped positive farm had a 6.3 times higher risk of infection
- Greater than 3 miles from a positive farm had no increased risk of infection
- Risk of infection decreases 27% for every 1 mile away from a positive farm
- Sites with sow s and finishing pigs have the highest incidence of PEDV (48.8%) followed by sow/nursery/finisher sites (31.6%)
- Site capacity was not significantly associated with PEDV

Update: 10-28-13

Project 4: Epidemiologic investigation on propensity for lateral spread of PED virus

PI: Robert B Morrison; Co-Investigators: Peter Davies, Dane Goede

Retrospective & Prospective Lateral Spread Studies: Out of 103 potential candidate farms infected prior to ay 27th, 2013 and unknown true accession numbers since, 26 have been identified (3 either declined/showed false positive) and 21 have agreed to participate. 15 of the farms that agreed have sent VDL releases and consent form. Six of the farms have completed questionnaires to identify risk factors for PEDv lateral spread. Questionnaires are still being collected and input for analysis

OK Cluster Lateral Spread Study: The three producers in the area have all shared their information and provided VDL releases with consent forms. The data of all farms in the area has been analyzed spatially and temporally. Updates with results and preliminary conclusions will follow.

NC Cluster Lateral Spread Study: We have the ability to analyze 3 of the companies' data accounting for most of the sites in the area. The data for positive and negative farms from these 3 companies has been received this week and a preliminary spatial analysis is underway. This information is also being used to assign cases and controls for the administration of questionnaires. There are 274 farms that have been infected with PED I the data set out of 2071 total sites. A modified questionnaire will be used to separate production company standard practices from potential farm-specific risk factors for transmission.

Update: 10-16-13

Project 4: Epidemiologic investigation on propensity for lateral spread of PED virus

PI: Robert B Morrison; Co-Investigators: Peter Davies, Dane Goede

OK Cluster Lateral Spread Study: The three producers in the area have all shared their information and provided VDL releases with consent forms. The data is with CEAH and analysis has been completed to an extent, but the end results are currently furloughed along with the government.

NC Cluster Lateral Spread Study: The 4 producers in the area have all agreed to share. The data for positive farms has been received and is being scrutinized to identify positive case farms (without history of PED positive pigs being placed there) for the case-control study. Sixty positive farms in the area will be utilized as cases with 2 matched controls chosen both by matched random 1:1 selection (matching on farm type and company) and by distance-matched 1:1 selection. A modified questionnaire will be used to separate production company standard practices from potential farm-specific risk factors for transmission.

Swine Health Monitoring Project: There are 292 premises signed up for the SHMP currently, not all of which are PED positive.

Update: 10-3-13

Project 4: Epidemiologic investigation on propensity for lateral spread of PED virus

PI: Robert B Morrison; Co-Investigators: Peter Davies, Dane Goede

Retrospective & Prospective Lateral Spread Studies: Out of 103 potential candidate farms infected prior to May 27th 2013 and unknown true accessions numbers since, 23 have been identified (3 either declined/showed false positive) and 19 have agreed to participate. 14 of the farms that agreed have sent VDL releases and consent form. Six of the farms have completed questionnaires to identify risk factors for PEDv lateral spread. Questionnaires are still being collected and input for analysis.

OK Cluster Lateral Spread Study: The three producers in the area have all shared their information and provided VDL releases with consent forms. The data is with CEAH and analysis is underway.

NC Cluster Lateral Spread Study: The 4 producers in the area have all agreed to share information and we are only missing VDL release and consent form for 1 of them. The data is being gathered and collated prior to being sent to CEAH for analysis. All positive farms in the area will be utilized as cases with matched controls chosen at random 1:1 (matching on farm type, company, and capacity). A modified questionnaire will be used to separate production company standard practices from potential farm-specific risk factors for transmission.

Swine Health Monitoring Project: There are 292 premises signed up for the SHMP currently, not all of which are PED positive.

Update: 9-21-13

Project 4: Epidemiologic investigation on propensity for lateral spread of PED virus

PI: Robert B Morrison

Retrospective Lateral Spread Study: Out of 103 potential candidate farms infected prior to May 27th 2013 and unknown true accessions numbers since, 17 have been identified (3 either declined/showed false positive) and 15 have verbally agreed to participate. 10 of the farms that agreed have sent VDL releases and consent form. Five of the farms have completed questionnaires to identify risk factors for PEDv lateral spread. Six of the neighboring farms to the retrospective case farms have been identified and 3 have not yet agreed to participate.

Prospective Lateral Spread Study: Six potential prospective case farms have been identified with 4 already signed VDL release and consent form. The questionnaire has been completed for one prospective case, 6 nearby neighbors have been identified and 3 have completed questionnaires.

OK Cluster Lateral Spread Study: The three producers in the area have all shared their information and provided VDL releases with consent forms. The data is with CEAH and analysis is beginning.

NC Cluster Lateral Spread Study: The 4 producers in the area have all agreed to share information and we are only missing VDL release and consent form for 1 of them. The data is being gathered and collated prior to being sent to CEAH for analysis.

Swine Health Monitoring Project: There are 292 premises signed up for the SHMP currently, not all of which are PED positive.

Update 9-2-13:

Retrospective Lateral Spread Study: Of the 103 potential candidate farms infected prior to May 27th 2013, 15 were identified and approached; 14 have verbally agreed to participate. Nine of the farms that agreed have sent VDL releases and consent form. Two of the farms have completed questionnaires to identify risk factors for PEDv lateral spread. Six of the neighboring farms (with respect to the retrospective case farms) have been identified and 3 have not yet agreed to participate.

Prospective Lateral Spread Study: Three potential prospective case farms have been identified; one has already signed VDL release and consent form. The questionnaire has been completed for the prospective case, all 3 nearby neighbors have been identified and 2 of the 3 have completed questionnaires.

OK Cluster Lateral Spread Study: The three producers in the area have all shared their information and provided VDL releases with consent forms. The data are with CEAH and analysis is beginning.

Swine Health Monitoring Project: A total of 292 premises have signed up for the SHMP, not all of which are PED positive.

Quick Take

PEDV can spread from farm to farm, but the extent of this ability is not fully known.

Update: 8-21-13

Epidemiologic investigation on propensity for lateral spread of PED virus

Retrospective Lateral Spread Study: Out of 103 potential candidate farms infected prior to May 27th 2013, 13 have been identified (3 either declined/showed false positive) and 8 have verbally agreed to participate. Seven of the farms that agreed have sent VDL releases and consent form. Two of the farms have completed questionnaires to identify risk factors for PEDv lateral spread. Two of the neighboring farms to the retrospective case farms have been identified and have not yet agreed to participate.

Prospective Lateral Spread Study: Three potential prospective case farms have been identified with 1 already signed VDL release and consent form. The questionnaire has been completed for the prospective case, all 3 nearby neighbors have been identified and 2 of the 3 have completed questionnaires.

OK Cluster Lateral Spread Study: The three producers in the area have all shared their information and provided VDL releases with consent forms. The data is with CEAH and analysis is beginning.

Swine Health Monitoring Project: There are 290 premises signed up for the SHMP currently, not all of which are PED positive.

The Role of Harvest Plant Lairage and Transportation in Propagating the Initial Stages of an Outbreak of Porcine Epidemic Diarrhea Virus in the United States in 2013– Preliminary Results

July 17, 2013 —

The objective of the study were to assess the risk that collection points like harvest plants play in promoting the initial outbreak of a novel disease organism by estimating the rate of contamination of trailers with PEDV during the unloading process. Preliminary results have been obtained from environmental samples collected from 669 livestock trailers prior to and after unloading pigs into the lairage at seven harvest plants located in central US. Eighty-nine to 102 samples were collected over a 2-3 day period at each facility between 14 June and 20 June 2013. All samples were analyzed for the presence of PEDV DNA by a commercially available PCR test at the ISU VDL. Across all six harvest plants 17.3% (95% Confidence Interval 14.4, 20.3%) of the trailers were contaminated prior to unloading. Contamination rates ranged from 2.0% (0.0, 5.2%) to 69.7% (60.2, 79.2%) between plants. Of the trailers that were not contaminated at arrival, 11.4% (8.9, 13.8%) were contaminated during the unloading process. Plants with higher contamination rates at arrival tended to have higher rates of trailers that were contaminated during the unloading process ($R^2=0.98$). Across all plants, each contaminated trailer at arrival resulted in 0.96 additional trailers that were contaminated during the unloading process. These data suggest that harvest plants and similar livestock collection points serve as an effective method of contaminating fomites with PEDV and could play an important role in expanding the outbreak of PEDV in the US. (Diagnostic testing and supplies were funded by the NPB, NPPC, and the AASV.)

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