Swine Disease Reporting System
Report # 45 (November 2, 2021)

What is the Swine Disease Reporting System (SDRS)? SDRS includes multiple projects that aggregate data from participating veterinary diagnostic laboratories (VDLs) in the United States of America (USA), and reports the major findings to the swine industry. Our goal is to share information on endemic and emerging diseases affecting the swine population in the USA, assisting veterinarians and producers in making informed decisions on disease prevention, detection, and management.

After aggregating information from participating VDLs and summarizing the data, we ask the input of our advisory group, which consists of veterinarians and producers across the USA swine industry. The intent is to provide an interpretation of the observed data, and summarize the implications to the industry. Major findings are also discussed in monthly podcasts. All SDRS reports and podcasts are available at www.fieldepi.org/SDRS. The SDRS projects are:

Swine Health Information Center (SHIC)-funded Domestic Swine Disease Surveillance Program: collaborative project among multiple VDLs, with the goal to aggregate swine diagnostic data and report in an intuitive format (web dashboards and monthly PDF report), describing dynamics of pathogen detection by PCR-based assays over time, specimen, age group, and geographical area. Data is from the Iowa State University VDL, South Dakota State University ADRDL, University of Minnesota VDL, and Kansas State University VDL.

Collaborators:

Swine Disease Reporting System office: Principal investigator: Daniel Linhares, Project coordinator: Giovani Trevisan, Communications: Edison Magalhães.

Iowa State University: Gustavo Silva, Bret Crim, Kent Schwartz, Eric Burrough, Phillip Gauger, Pablo Pineyro, Christopher Siepker, Rodger Main.

University of Minnesota: Mary Thurn, Paulo Lages, Cesar Corzo, Jerry Torrison.

Kansas State University: Rob McGaughey, Roman Pogranichniy, Rachel Palinski, Jamie Retallick.

South Dakota State University: Jon Greseth, Darren Kersey, Travis Clement, Jane Christopher-Hennings.

Ohio Animal Disease and Diagnostic Lab.: Melanie Prarat, Yan Zhang, Richard French, Dennis Summers.

The Ohio State University: Andreia Arruda.

Disease Diagnosis System: A pilot program with the ISU-VDL consisting of reporting disease detection (not just pathogen detection by PCR), based on diagnostic codes assigned by veterinary diagnosticians.

FLUture: Aggregates influenza A virus (IAV) diagnostic data from the ISU-VDL and reports results, metadata, and sequences.

PRRS virus RFLP and Lineage report: Benchmarks patterns of PRRSV RFLP pattern and Lineages detected at the ISU-VDL, UMN-VDL, KSU-VDL, and Ohio-ADDL over time, USA state, specimen, and age group.

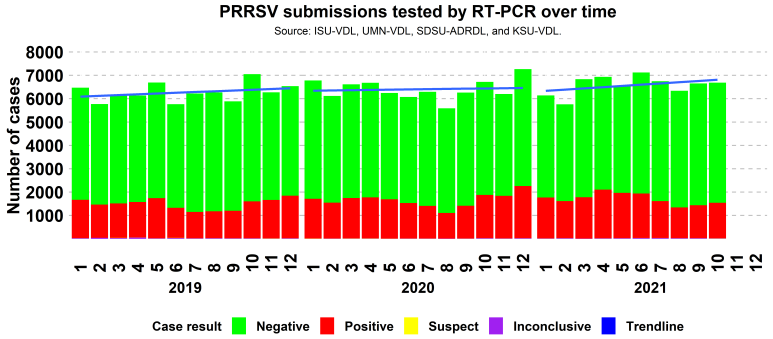
Audio and video reports: Key findings from SDRS projects are summarized monthly in a conversation between investigators, and available in the form of an 'audio report', and "video report" through SwineCast, YouTube, LinkedIn, and the SDRS webpage.

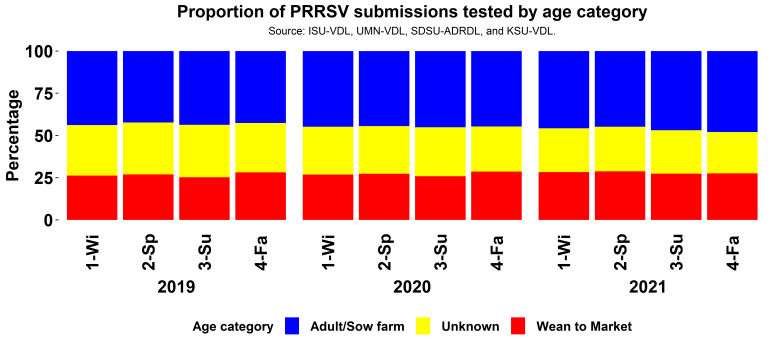
Advisory Group: Reviews and discusses the data, providing their comments and perspectives on a monthly: Mark Schwartz, Paul Sundberg, Paul Yeske, Tara Donovan, Deborah Murray, Scott Dee, Melissa Hensch, Brigitte Mason, Peter Schneider, Sam Copeland, and Luc Dufresne.

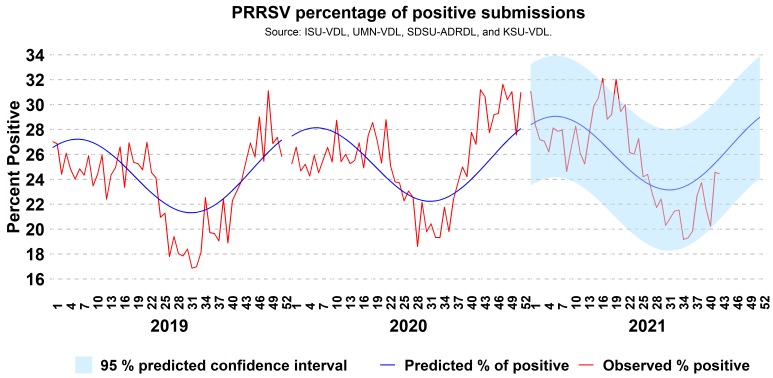
In addition to this report, interactive dashboards with aggregated test results are available at www.fieldepi.org/SDRS.

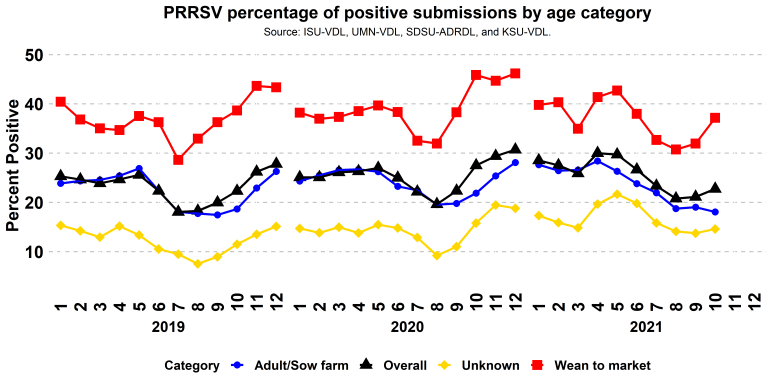
Note: This report contains data up to October 31, 2021.

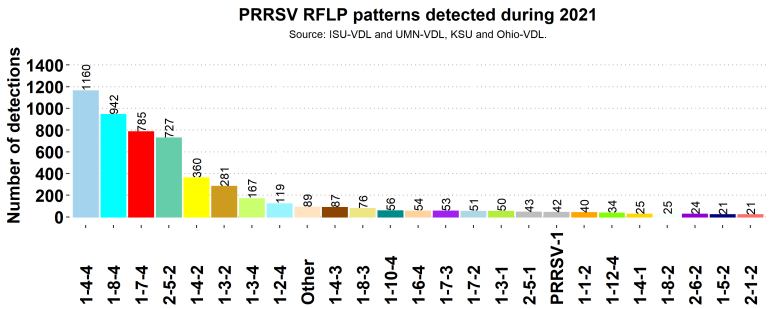
Topic 1 – Detection of PRRSV RNA over time by RT-qPCR.











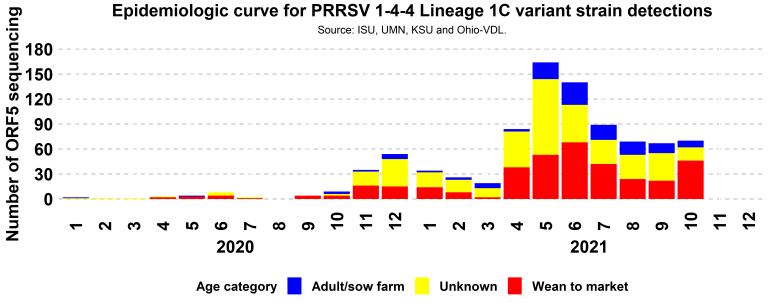


Figure 1. Top: *left*: Results of PRRSV RT-PCR cases over time. *Right*: Proportion of accession ID cases tested for PRRSV by age group per year and season. **Middle**: *Left* expected percentage of positive results for PRRSV RNA by RT-qPCR, with 95% confidence interval band for predicted results based on weekly data observed in the previous 3 years. *Right*: percentage of PRRSV PCR-positive results, by age category over time. Wean to market corresponds to nursery and grow-finish. Adult/Sow correspond to Adult, boar stud, breeding herd, replacement, and suckling piglets. Unknown corresponds to not informed site type or farm category. **Bottom** *left* the 25 most frequently detected RFLP patterns druing 2021; *right* Epidemiological curve of detection for PRRSV 1-4-4 Lineage 1C variant strain.

SDRS Advisory Group highlights:

- Overall, 22.74% of 6,689 cases tested PRRSV-positive in October, similar to 21.12% of 6,652 in September;
  - Positivity in adult/sow category in October was 18.08% (566 of 3,131), similar to 19.03% (622 of 3,268) in September;
  - Positivity in wean-to-market category in October was 37.17% (717 of 1,929), a substantial increase from 31.94% (558 of 1,747) in September;
  - Overall PRRSV-percentage of positive cases was wihin 3 standard deviations from state-specific baselines in OH;
  - **An increase (signals) for detection of PRRSV sequences classified as PRRSV L1C variant has been detected during October for the wean-to-market category. A new wave of detection has been formed;**
- Even though the overall PRRSV-positivity is within expected, the detection curve in grow-finish is increasing for 2 consecutive months, mainly driven by 1-4-4 L1C variant strains;
- Past reports have highlighted that spike in grow-finish pigs usually is followed by increased activity in breeding herds;
- The advisory group recommends adopting measures in preparation for a potential challenging PRRSV season. Across the recommended measures are:
  - Keep practicing and improve transportation biossecurities, truck wash, truck segregation for sows farms from finishing sites.
  - Keep practicing and improve site biosecurity plans to contain PRRSV spread, especially try to avoid re-introduction of PRRSV into sow farms.
  - PRRS MLV vaccines are a tool available that can be used to stimulate immunity development.
  - Work within and between production systems/neighbors in coordinating the placement of positive pigs.
  - Continue to use filters and feed mitigants.

Topic 2 – Detection of RNA of enteric coronavirus by RT-qPCR

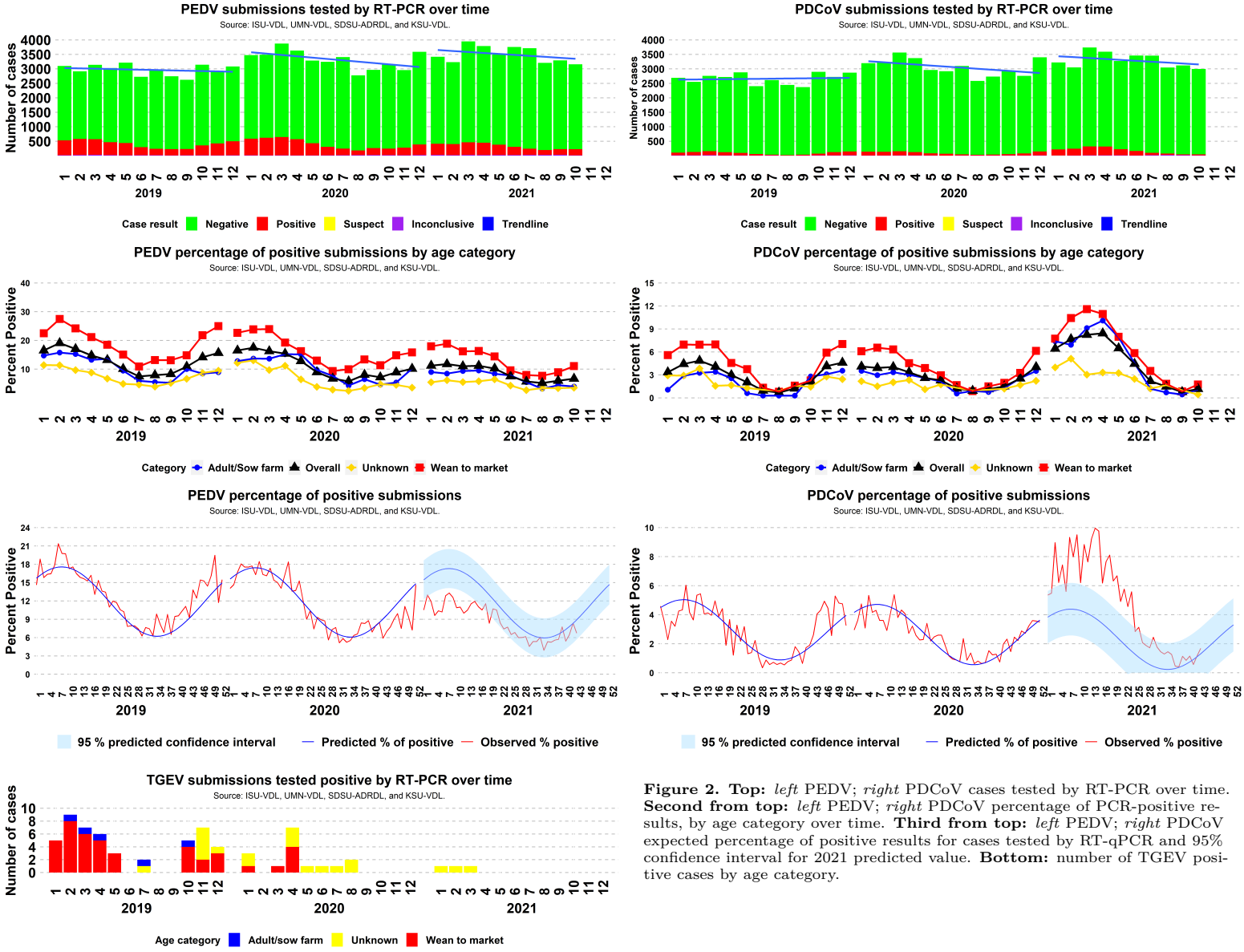


Figure 2. Top: *left* PEDV; *right* PDCoV cases tested by RT-PCR over time. **Second from top:** *left* PEDV; *right* PDCoV percentage of PCR-positive results, by age category over time. **Third from top:** *left* PEDV; *right* PDCoV expected percentage of positive results for cases tested by RT-qPCR and 95% confidence interval for 2021 predicted value. **Bottom:** number of TGEV positive cases by age category.

SDRS Advisory Group highlights:

- Overall, 6.68% of 3,157 cases tested PEDV-positive in October, similar to 5.98% of 3,293 in September;
  - Positivity in adult/sow category in October was 3.95% (38 of 961), similar to 4.43% (43 of 971) in September;
  - Positivity in wean-to-market category in October was 11.07% (140 of 1,265), a moderate increase from 8.89% (122 of 1,372) in September;
  - The overall PEDV-percentage of positive cases was 3 standard deviations from state-specific baselines in IL and OK;
- Overall, 1.17% of 2,997 cases tested PDCoV-positive in October, similar to 0.77% of 3,120 in September;
  - The overall PDCoV detection was outside of the upper boundaries of the forecasted levels since January;
  - Positivity in adult/sow category in October was 1.11% (10 of 902), similar to 0.44% (4 of 903) in September;
  - Positivity in wean-to-market category in October was 1.75% (21 of 1,201), similar to 0.84% (11 of 1,309) in September;
  - Overall PDCoV-percentage of positive cases was 3 standard deviations from state-specific baselines in all 10 monitored states;
- There was 0 positive case for TGEV RNA in October, 2021 over a total of 2,937 cases tested;
- The advisory group has suggested that there may be an opportunity for a national plan to control and eliminate PEDV. Even though no unanimous measures have been adopted across all of the industry, the industry has obtained know-how of control measures during the last years and successfully eliminated this agent from many sow farms. Still exists a great challenge to early detect and contain the spread of PEDV in wean to market sites.

Topic 3 – Detection of *Mycoplasma hyopneumoniae* (MHP) DNA by PCR.

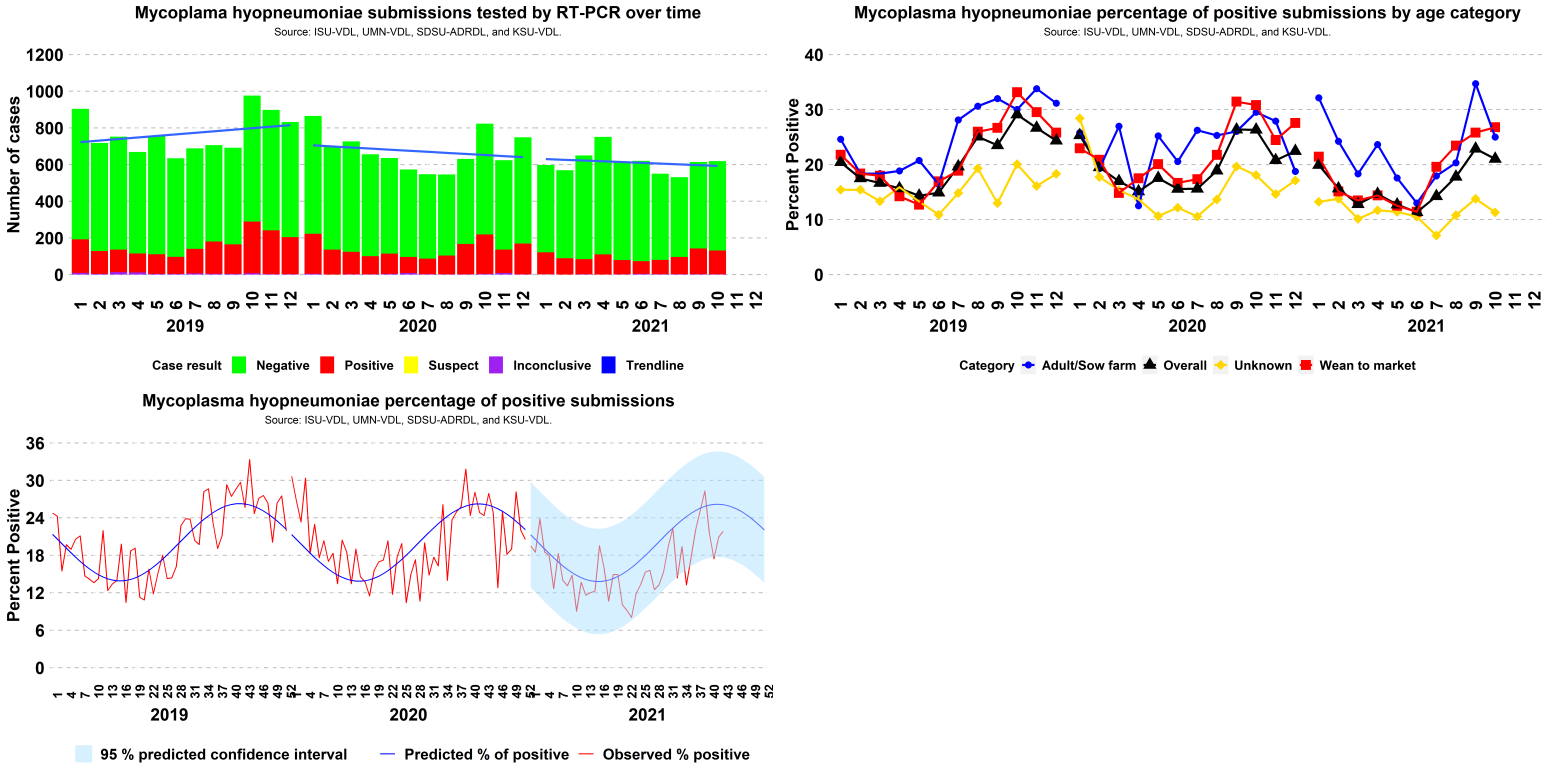


Figure 3. *Left top*: results of *M. hyopneumoniae* (MHP) PCR cases over time. *Right top*: percentage of MHP PCR-positive results, by category over time. *Bottom*: expected percentage of positive results for MHP by PCR and 95% confidence interval for 2020 predicted value, based on weekly data observed in the previous 3 years.

SDRS Advisory Group highlights:

- Overall, 21.04% of 618 cases tested *M. hyopneumoniae*-positive in October, similar to 22.88% of 612 in September;
  - Positivity in adult/sow category in October was 25% (19 of 76), a substantial decrease from 34.72% (25 of 72) in September;
  - Positivity in wean-to-market category in October was 26.79% (86 of 321), similar to 25.82% (87 of 337) in September;
  - Overall MHP-percentage of positive was within expected state-specific baselines in all 11 monitored states;
- The advisory group considered that the recent increase in detection of *M. hyopneumoniae* expected for this time of year;
- There has been several reports of a great momentum on *M. hyopneumoniae* control and elimination at from many production systems. We will continue to monitor *M. hyopneumoniae* activity closely as the industry continues to make progress towards *M. hyopneumoniae* management.

Topic 4 – Confirmed tissue cases etiologic/disease diagnosis at the ISU-VDL.

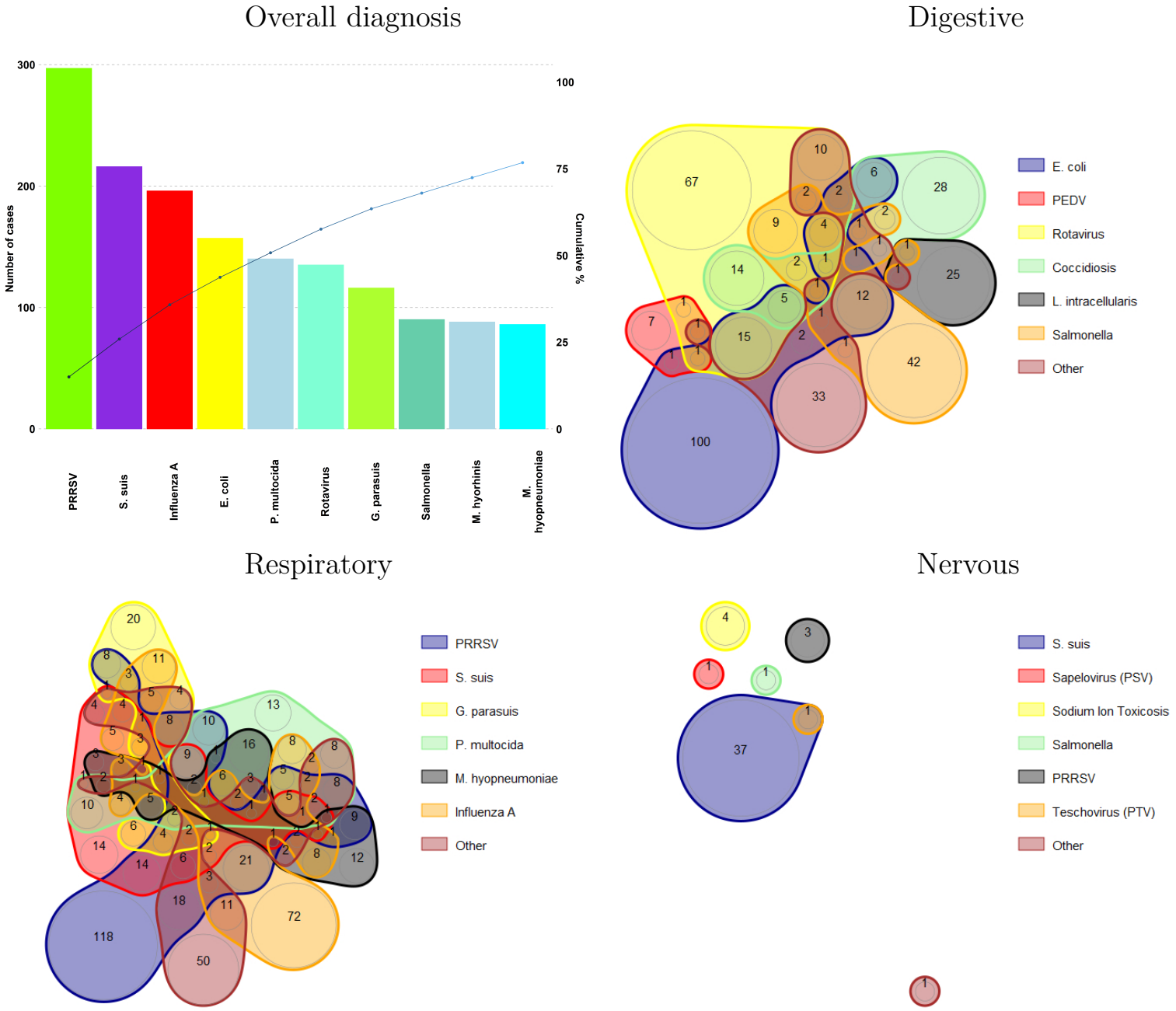


Figure 4. ISU-VDL most frequent overall confirmed tissue disease diagnosis and by system. The presented system is described in the title of the chart. Colors represent one agent. Diagnosis of 2 or more agents within a submission are presented by lines intersections. Only the frequent etiology/disease are presented. Less frequent etiology/disease are grouped as other. Non-confirmed diagnoses are not presented.

Note: Disease diagnosis takes 1 to 2 weeks to be performed. The graphs and analysis contain data from Sep. 1 to Oct. 17, 2021.

SDRS Advisory Group highlights:

- PRRSV (297) leads cases with confirmed etiology/disease, followed by *S. suis* (216), and *Influenza A* (196). PRRSV (271 of 1065) leads the number of confirmed respiratory diagnoses, *E. coli* (151 of 523) leads the number of confirmed digestive diagnoses, and *S. suis* (38 of 49) leads the number of confirmed neurological diagnosis.
- During August 23 to September 19 , there was a significant increase (signal) in diagnosis of *M. hyopneumoniae*;
- During September 13 to 25 , there was a significant increase (signal) in diagnosis of Influenza A;
- There have been some reports of severe Influenza A infections. On the other side Influenza A, PRRSV, and association with other respiratory agents have been pointed as being within the expected severity by the advisory group.

Note: *The SDRS is a collaborative project among multiple VDLs in the US swine industry. The VDL collaborators and industry partners are all invited to submit content to share on this bonus page related to disease prevention, control, and management.Stay tuned for more content in future editions.*

PRRSV 1-4-4 L1C: A Rapid Response to a National Crisis

Joel Nerem[1], Scott Dee[1], Dan Hanson[1], Roy Edler[1], Jenna Schuld[1], Janel Peterson[1], Taylor Swenson[1], Joe Ward[1], Erin Little[1], Francisco Cabezon[1], Amanda Sponheim[2], Reid Philips[2], Justin Rustvold[2], Ethan Schmaling[2], Steve Tousignant[2], Dale Polson[2], Olaya Iturbe[2]

1 - Pipestone Research, LLC, Pipestone, Minnesota, USA. 2 - Boehringer Ingelheim Animal Health USA, Inc., Duluth, Georgia, USA.

In partnership with Boehringer Ingelheim Animal Health USA Inc., Pipestone Research has provided a rapid response to bring science-based answers to managing the emergence of PRRSV 1-4-4. Based on field observations from practitioners and producers, stating that, "This is the worst strain of PRRSV ever," "Vaccines don't work anymore", and "Biosecurity protocols are ineffective," the team determined that immediate action was needed.

This industry-wide feeling of panic encouraged PIPESTONE to respond using science to generate answers to these concerns. PIPESTONE Chief Veterinary Officer, Dr. Joel Nerem responded with a Call to Arms, stating that, "Answering difficult questions with production-driven research for farmers is our wheelhouse." stated Dr. Joel Nerem. "We need answers. Let's do a study and share the results." Pipestone Research team members, Dr. Scott Dee, Roy Edler and Dan Hanson put the wheels in motion, joined forces with Dr. Amanda Sponheim, Dr. Reid Philips, and Justin Rustvold from Boehringer Ingelheim Animal Health USA, Inc., and completed three studies targeting the field concerns, including:

Study 1 (pathogenicity): Is PRRSV 1-4-4 worse than PRRSV 1-7-4?
Design: Naïve pigs were challenged with either PRRSV 1-4-4 or PRRSV 1-7-4.
Outcomes included Average Daily Gain (ADG), percent mortality, viral load, clinical scores, pyrexia, and number of treatment events.
Results: Across all metrics, PRRS 1-7-4 was more pathogenic than PRRSV 1-4-4.

Study 2: Do vaccines still work on PRRSV 1-4-4?
Design: Pigs were vaccinated either with Ingelvac PRRS® MLV (BI) or Prevacent® PRRS (Elanco) and compared to a non-vaccinated control group. Vaccination was applied according to label instructions and challenge occurred 28-day post-vaccination.
Results: Both vaccines were effective against PRRSV 1-4-4 and performance in vaccinated groups was significantly better than non-vaccinates.

Study 3: Can biosecurity protocols prevent PRRSV 1-4-4 introduction?
Design: Six biosecurity protocols were tested on pigs challenged with PRRSV 1-4-4. The study evaluated transmission of 1-4-4 through feed, using natural feeding behavior, transmission via contaminated personal and fomites (boots, coveralls, and hands), the ability of PRRSV 1-4-4 to be detected in aerosols from infected pigs, survival in slurry (14 vs. 21 days), and whether the transport (feed truck) could serve as a vehicle for viral movement between sites. In addition, intervention strategies, including 2 disinfectants (Ag Forte Pro or Synergize™), 2 feed mitigants (Guardian™ or Sal CURB®), air filtration (Camfill Farr MERV 14) and a shower protocol with a boots/coverall change, were tested to determine if the respective risks could be managed.
Results:

- Disinfectants: Ag Forte Pro and Synergize™ neutralized PRRSV 1-4-4 after 60 minutes of contact.
- Contaminated feed: PRRSV 1-4-4 was transmitted through feed via natural feeding behavior. Both feed mitigants (Guardian™ or Sal CURB®) prevented infection.
- Feed transport: PRRSV 1-4-4 survived in the feed transport model and infected pigs.
- Survival in slurry: PRRSV survived in slurry for 14 days, but not 21 days.
- Contaminated fomites/Shower in protocol: Following 30 minutes of contact with infected pigs, PRRSV 1-4-4 was detected on hands, boots, and coveralls of personnel. In the absence of a shower and clothes/footwear change, virus was transmitted to contact controls. After a shower and clothes/footwear change, virus was not transmitted to contact controls.

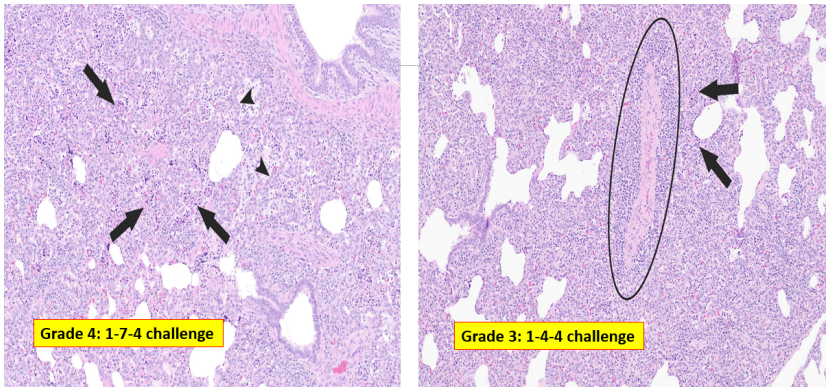


Figure 1. Lung histopathologic lesions of challenge groups 1-7-4 and 1-4-4 demonstrating interstitial pneumonia, necrotic PAMs, and perivascular cuffing. Image Dr. C. Siepker.

- Filtration: PRRSV RNA was detected in 28%-43% of interior air samples during the challenge period. In contrast, there was no detectable PRRSV 1-4-4 in exterior air samples post-filtration.

Continued: PRRSV 1-4-4 L1C: A Rapid Response to a National Crisis

In closing, under the conditions of this study, it appeared that PRRSV 1-7-4 was more pathogenic than PRRSV 1-4-4 and modified live virus vaccines were effective against PRRSV 1-4-4. In addition, standard protocols of biosecurity such as disinfection, showering, changing boots and coveralls between infected and non-infected populations are still effective. Aerosols and feed appear to be risk factors for PRRSV 1-4-4 spread, but risk is reduced through filtration and feed mitigation. Finally, the risk of contaminated transport (feed truck) continues to be a risk factor for viral movement between farms.

As a results of this study, PIPESTONE and Boehringer Ingelheim Animal Health USA Inc., recommend keeping up on all practices related to biosecurity. "You know what to do, don't give up," said Dr. Scott Dee, PIPESTONE Director of Research. "We know the routes of transmission and how to manage these risks. Don't take shortcuts, keep using modified live virus vaccines according to label, and don't relax. PRRS season is almost upon us!"

Highlights:

Under the conditions of this study

- PRRSV 1-7-4 was more pathogenic than PRRSV 1-4-4;
- MLV vaccines were effective against PRRSV 1-4-4 spread, keep using them;
- Aerosols and feed are risk factors for PRRSV 1-4-4 spread, but risk is reduced through filtration and feed mitigation.

Funding: *Pipestone Research, LLC and Boehringer Ingelheim Animal Health USA, Inc.*
Article written by: *Abby Hopp, Marketing and Communications, PIPESTONE*