





Swine Disease Reporting System Report # 49 (March 1, 2022)

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 investigators: Daniel Linhares, Giovani Trevisan; Interin Project coordinator: Giovani Trevisan, Communications: Edison Magalhães.

Iowa State University: Gustavo Silva, Marcelo Almeida, Bret Crim, Kent Schwartz, Eric Burrough, Phillip Gauger, Pablo Pineyro, Christopher Siepker, Alyona Michael, Panchan Sitthicharoenchai, Rodger Main.

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

Kansas State University: Rob McGaughey, Franco Matias-Ferreyra, Jamie Retallick.

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

Ohio Animal Disease and Diagnostic Lab.: Melanie Prarat, William Hennessy, Yan Zhang, 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 OH-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, Luc Dufresne, and Daniel Boykin.

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



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 during 2022; *right* Epidemiological curve of detection for PRRSV Lineage 1C variant strains.

SDRS Advisory Group highlights:

- Overall, 28.8% of 6,669 cases tested PRRSV-positive in February, similar to 29.7% of 6,818 in January;
 - Positivity in adult/sow category in February was 27.66% (883 of 3,192), similar to 28.25% (914 of 3,235) in January;
 - Positivity in wean-to-market category in February was 39.64% (754 of 1,902), similar to 39.24% (771 of 1,965) in January;
 - Overall PRRSV-percentage of positive cases was 3 standard deviations from state-specific baselines NE and MO;

• During the week of February 6, a historical higher number of submissions (~900) have been tested for PRRSV in the age category adult/sow farm;

• The PRRSV L1C variant has formed a new wave of detection wave during December and January. Interestingly this wave has more sequences in the age category adult/sow farm than previous waves. Most of the detections continue to occur in IA and MN with additional L1C variant occuring in MO, CO, NE, and SD;

• The advisory group highlighted that a couple of PRRSV outbreaks occurred during February in very specific areas. Some of these outbreaks follow the expected annual outbreak incidence, with a mixed reporting of mild and severe outbreaks.



SDRS Advisory Group highlights:

• Overall, 17.63% of 3,681 cases tested PEDV-positive in February, a substantial increase from 12.56% of 3,504 in January;

- Positivity in adult/sow in February was 16.6% (202 of 1,217), a substantial increase from 11.2% (125 of 1,116) in January;
- Positivity in wean-to-market in February was 22.97% (326 of 1,419), a substantial increase from 17.34% (242 of 1,396) in January;
- The overall PEDV-percentage of positive cases was 3 standard deviations from state-specific baselines in NE and IA;
- Overall, 4.66% of 3,541 cases tested PDCoV-positive in February, similar to 3.23% of 3,371 in January;
 - Positivity in adult/sow category in February was 3.23% (38 of 1,176), similar to 1.49% (16 of 1,071) in January;
 - Positivity in wean-to-market category in February was 6.76% (92 of 1,360), similar to 5.54% (74 of 1,336) in January;
 - Overall PDCoV-percentage of positive cases was was within state-specific baselines in all 10 monitored states;
- There was 0 positive case for TGEV RNA in February, 2021 over a total of 3,444 cases tested;

• During the week of February 6, a historical higher number of submissions (~300) have been tested for PEDV in the age category adult/sow farm. Most PEDV activity has been detected in IA, where detection has increased from 10% in January to above 30% of positive submissions in February. Other states like NC and OK have had activity of PEDV, and more recently increased detection occurred in NE, OH, and MO;

• Increased detection of PDCoV has been also detected at the end of February in MO, OH, and MN;

• The advisory group highlighted that many of the PEDV outbreaks, occurring at distinct regions, have had similar route causes as failures of on-farm biosecurity practices, connection with routes of trailers movements, failures on trailer washing, time of the year with cold weather favoring the virus survivability in the environment, more positive animals shedding virus and increasing the pressure of infection. Outbreaks with PDCoV have been reported to be mild and following an expected spike in cases for this time of the year.

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95 % predicted confidence interval 🛛 — Predicted % of positive — Observed % positive

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 2022 predicted value, based on weekly data observed in the previous 3 years.

SDRS Advisory Group highlights:

- Overall, 13.3% of 609 cases tested M. hyopneumoniae-positive cases in February, similar to 15.25% of 682 in January;
 - Positivity in adult/sow category in February was 16.38% (19 of 116), similar to 15.15% (15 of 99) in January;
 - Positivity in wean-to-market category in February was 14.47% (46 of 318), similar to 14.81% (52 of 351) in January;
 - Overall MHP-percentage of positive was within state-specific baselines in all 11 monitored states;



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



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

This work is made possible due to the commitment and teamwork from the ISU-VDL diagnosticians who assign standardized diagnostic codes to each case submitted for histopathology: Drs. Almeida, Burrough, Derscheid, Gauger, Harm, Magstadt, Mainenti, Michael, Piñeyro, Rahe, Schumacher, Siepker, Sitthicharoenchai, and previous VDL diagnosticians who have contributed to this process.

Note: Disease diagnosis takes 1 to 2 weeks to be performed. The graphs and analysis contain data from Jan. 11 to Feb. 14, 2022.

SDRS Advisory Group highlights:

• PRRSV (380) leads cases with confirmed etiology/disease, followed by *S. suis* (263), and Rotavirus (175). PRRSV (347 of 1139) leads the number of confirmed respiratory diagnoses, *Rotavirus* (175 of 491) leads the number of confirmed digestive diagnoses, and *S. suis* (34 of 48) leads the number of confirmed neurological diagnosis;

• During the week of January 17, there was a significant increase (signal) in tissue diagnosis of urogenital agents, and during the weeks of January 24 for nervous agents;

• A signal for an increased number of PED diagnoses was identified from the weeks of 01/17 to 01/31;

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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.

The recently emerged PRRSV 1-4-4 L1C variant strain is highly virulent based on the experimental pig study

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Introduction

Since October 2020, high mortality and morbidity of pigs associated with PRRSV have been observed in U.S. swine farms. ORF5 sequence analysis suggested that the detected PRRS viruses from these cases had a 1-4-4 RFLP pattern and formed a distinct cluster within the Lineage 1C; these PRRS viruses were tentatively referred to as "1-4-4 L1C variant" or "L1C variant". However, no unequivocal experimental data was available to confirm the perception that the 1-4-4 L1C variant is more virulent than other PRRSV strains. The objective of this study was to experimentally characterize the pathogenicity and transmissibility of PRRSV 1-4-4 L1C variant strain in comparison with other PRRSV strains.

Materials and Methods

In 2020-2021, most RFLP 1-4-4 PRRSVs belonged to L1A, L1C variant, L1C non-variant, and L1H sublineages in the U.S. Thus, in this study, four 1-4-4 PRRSV strains (L1C variant, L1C non-variant, L1A, and L1H) and one previously described virulent PRRSV 1-7-4 L1A strain were included for comparison. Seventy-two 3-week-old PRRSV-naive pigs were blocked by weight and randomly divided into 6 groups with 12 pigs per group. Forty-eight pigs (8/group) were for inoculation and 24 pigs (4/group) served as contact pigs. After one-week acclimation, 8 pigs in each group were inoculated with the corresponding virus (10⁶ TCID50/pig, based on titration in ZMAC cells) or negative media intramuscularly and intranasally. At 2 days post inoculation (DPI), contact pigs were added to the pen adjacent to the inoculated pigs in each room. Daily temperature and clinical signs were recorded. Serum and oral fluids were collected at 0, 2, 4, 7, 10, 14, 21 and 28 DPI. Pigs were necropsied at 10 & 28 DPI.

Results

The 1-4-4 L1C variant-inoculated pigs became more anorectic and lethargic, had higher mortality, had higher fraction of pigs with fever (>40°C) during 0-10 DPI, and had significantly higher average temperature than other virus-inoculated groups at several time points. The mean average daily weight gain in 1-4-4 L1C variant-inoculated group was numerically higher but not statistically significant compared to other virus-inoculated groups. The 1-4-4 L1C variant-inoculated group had significantly higher viremia levels compared to all other virus-inoculated groups at 2 DPI. The same trend of viremia level was found in contact pigs at 2 days post contact (DPC). 4/4, 2/4, 2/4, 0/4, and 2/4 Contact pigs in the 1-4-4 L1C variant, 1-4-4 L1C non-variant, 1-4-4 L1A, 1-4-4 L1H, and 1-7-4 L1A groups became viremic at 2 DPC, respectively, implying the potential higher transmissibility of the 1-4-4 L1C variant virus. There were more severe gross lung lesions (percentage of interstitial pneumonia) in the 1-4-4 L1C variant-inoculated group compared to others except for the 1-7-4 L1A group at 10 DPI. The differences of microscopic lung lesion score and PRRSV IHC score in lung tissues at 10 DPI were not statistically significant between virus-inoculated groups (Figure 1).

Discussion and Conclusion

This study provides experimental data in weaned pigs regarding the clinical impact, pathogenicity, and transmissibility of the newly emerged 1-4-4 L1C variant strain, along with comparisons with other PRRSV strains. The findings from this experimental study align with what field veterinarians observed for the L1C variant outbreak and confirm that the 1-4-4 L1C variant is highly virulent in weaned pigs. The higher number of contact pigs becoming viremic at 2 days post contact implies that the L1C variant strain may have higher transmissibility than other PRRSV strains. However, it is complicated to assess virus transmissibility accurately, and the result needs to be confirmed with a study involving more pigs. Future studies are needed to investigate the protective efficacy of PRRS MLV vaccines against the 1-4-4 L1C variant strain.

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