Swine Disease Reporting System
Report # 71 (January 02, 2024)

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, and reports the major findings to the swine industry. Our goal is to share information on activity of 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 for the input of our advisory group, which consists of veterinarians and producers across the US 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 it 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, Kansas State VDL, Ohio Animal Disease and Diagnostic Laboratory (ADDL), and Purdue ADDL.

Collaborators:

Swine Disease Reporting System office: Principal investigators: Daniel Linhares & Giovani Trevisan; Project coordinator: Guilherme Cezar, Communications: Edison Magalhães, Data analyst: Srijita Chandra.

Iowa State University: Gustavo Silva, Marcelo Almeida, Bret Crim, Kinath Rupasinghe, Eric Burrough, Phillip Gauger, Christopher Siepker, Marta Mainenti, Michael Zeller, Rodger Main.

University of Minnesota: Mary Thurn, Paulo Lages, Cesar Corzo, Albert Rovira.

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

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

Ohio Animal Disease and Diag. Lab.: Melanie Prarat, Ashley Johnson, Dennis Summers.

Purdue University: Craig Bowen, Kenitra Hendrix, Joseph Boyle.

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. PRRSView and FLUture: Aggregates PRRSV and influenza A virus 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 over time by specimen, age group, and US State.

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 Spotify, Apple Podcast, Google podcast, SwineCast, YouTube, LinkedIn, and the SDRS webpage.

Advisory Group: Reviews and discusses the data, providing their comments and perspectives monthly: Mark Schwartz, Paul Sundberg, Paul Yeske, Deborah Murray, Brigitte Mason, Peter Schneider, Sam Copeland, Luc Dufresne, Daniel Boykin, Corrine Fruge, William Hollis, Rebecca Robbins, Thomas Petznick and Kurt Kuecker.

In addition to this report, interactive dashboards and educational material are available at www.fieldepi.org/SDRS.

Note: This report contains data up to December 31, 2023.

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

PRRSV submissions tested by RT-PCR over time
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL and Purdue ADDL.

Proportion of PRRSV submissions tested by age category
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL, and Purdue ADDL.

PRRSV percentage of positive submissions
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL, and Purdue ADDL.

PRRSV percentage of positive submissions by age category
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL and Purdue ADDL.

PRRSV RFLP patterns detected during 2023
Source: ISU-VDL, UMN-VDL, KSU and OH-ADDL.

Epidemiologic curve for PRRSV Lineage 1C variant (L1C.5) strain detections
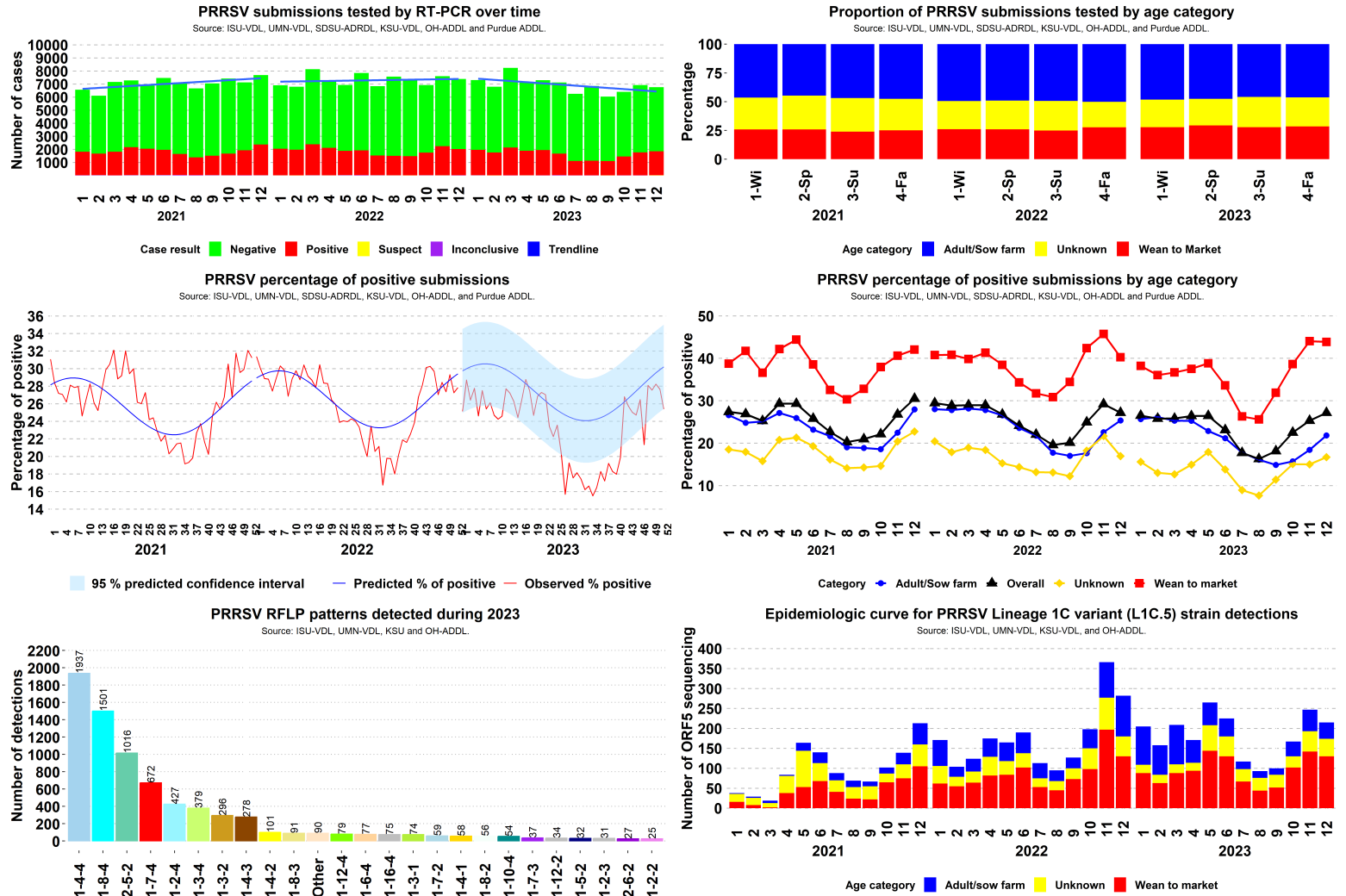Source: ISU-VDL, UMN-VDL, KSU-VDL, and OH-ADDL.

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 2023; *Right*: Epidemiological curve of detection for PRRSV Lineage 1C variant (L1C.5) strain.

SDRS Advisory Group highlights:

- Overall, 27.17% of 6,765 cases tested PRRSV-positive in December, similar to 25.3% of 6,926 in November;
- Positivity in the adult/sow category in December was 21.82% (677 of 3,103), a moderate increase from 18.43% (567 of 3,076) in November;
- Positivity in the wean-to-market category in December was 43.87% (887 of 2,022), similar to 44.05% (921 of 2,091) in November;
- Overall PRRS-percentage of positive cases was 3 standard deviations from state-specific baselines in IA, IL, and OH;
- During December 2023, PRRSV L1C variant (L1C.5) strains were detected in IA (122), MN (34), MO (27), NE (18), OH (6), SD (4), IL (2) and IN (1);
- The advisory group highlighted that they have seen the increased activity of PRRSV in the field with predominantly PRRSV strains as L1C.5 (variant) 1-4-4 and L1A 1-7-4, causing more clinical issues in December.

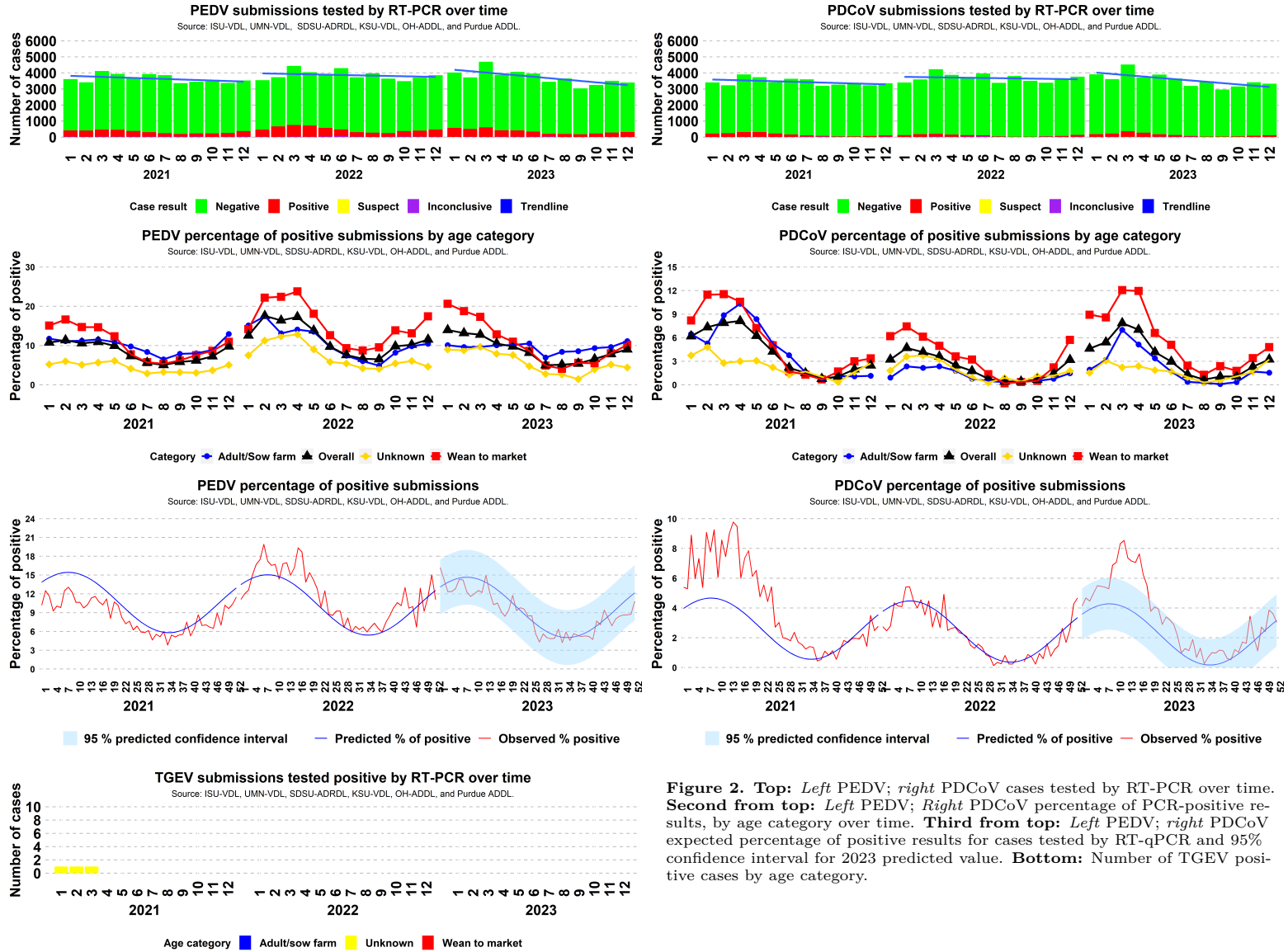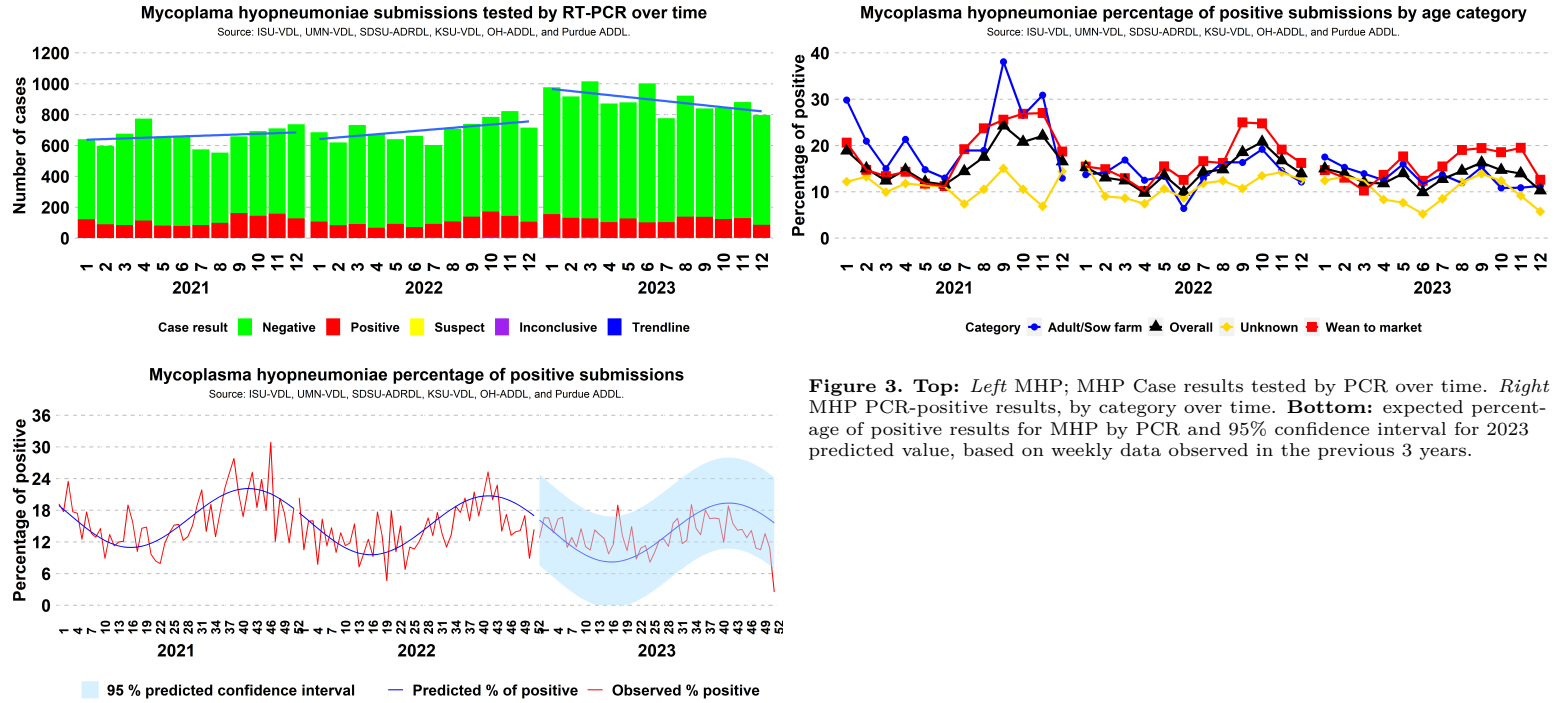# Topic 2 – Enteric coronavirus RNA detection by RT-qPCR

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 2023 predicted value. **Bottom:** Number of TGEV positive cases by age category.

SDRS Advisory Group highlights:

• Overall, 9.02% of 3,402 cases tested PEDV-positive in December, similar to 7.87% of 3,509 in November;

   • Positivity in the adult/sow category in December was 11.14% (136 of 1,221), similar to 9.62% (125 of 1,299) in November;

   • Positivity in the wean-to-market category in December was 10.16% (132 of 1,299), a moderate increase from 8.04% (103 of 1,281) in November;

   • Overall PEDV-percentage of positive cases was 3 standard deviations from state-specific baselines in MO and NC;

• Overall, 3.24% of 3,332 cases tested PDCoV-positive in December, similar to 2.31% of 3,419 in November;

   • Positivity in the adult/sow category in December was 1.53% (18 of 1,175), similar to 1.69% (21 of 1,243) in November;

   • Positivity in the wean-to-market category in December was 4.81% (62 of 1,290), similar to 3.39% (43 of 1,268) in November;

   • Overall PDCoV-percentage of positive cases was within state-specific baselines in all 11 monitored states;

• There was 0 positive case for TGEV RNA-PCR in December, 2023 over a total of 3,239 cases tested. It has been 33 months (with a total of 114,239 cases tested) since the last TGEV PCR-positive result;

• The advisory group highlighted that there have been few PEDV outbreaks, but they reminded us to keep vigilant as increased activity has historically been observed in January. The increase in PEDV positivity for all age categories detected by the SDRS raised an alert for the upcoming January.

Topic 3 – Detection of *M. hyopneumoniae* DNA by PCR.

Mycoplama hyopneumoniae submissions tested by RT-PCR over time
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL, and Purdue ADDL.

Case result: Negative — Positive — Suspect — Inconclusive — Trendline

Mycoplasma hyopneumoniae percentage of positive submissions by age category
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL, and Purdue ADDL.

Category: Adult/Sow farm — Overall — Unknown — Wean to market

Mycoplasma hyopneumoniae percentage of positive submissions
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL, and Purdue ADDL.

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

Figure 3. Top: *Left* MHP; MHP Case results tested by PCR over time. *Right* MHP PCR-positive results, by category over time. **Bottom:** expected percentage of positive results for MHP by PCR and 95% confidence interval for 2023 predicted value, based on weekly data observed in the previous 3 years.

SDRS Advisory Group highlights:

- Overall, 10.28% of 798 cases tested *M. hyopneumoniae*-positive cases in December, a moderate decrease from 13.96% of 881 in November;
  - Positivity in the adult/sow category in December was 11.3% (27 of 239), similar to 10.9% (29 of 266) in November;
  - Positivity in the wean-to-market category in December was 12.61% (42 of 333), a substantial decrease from 19.51% (71 of 364) in November;
- Overall MHP-percentage of positive was within state-specific baselines in all 11 monitored states.

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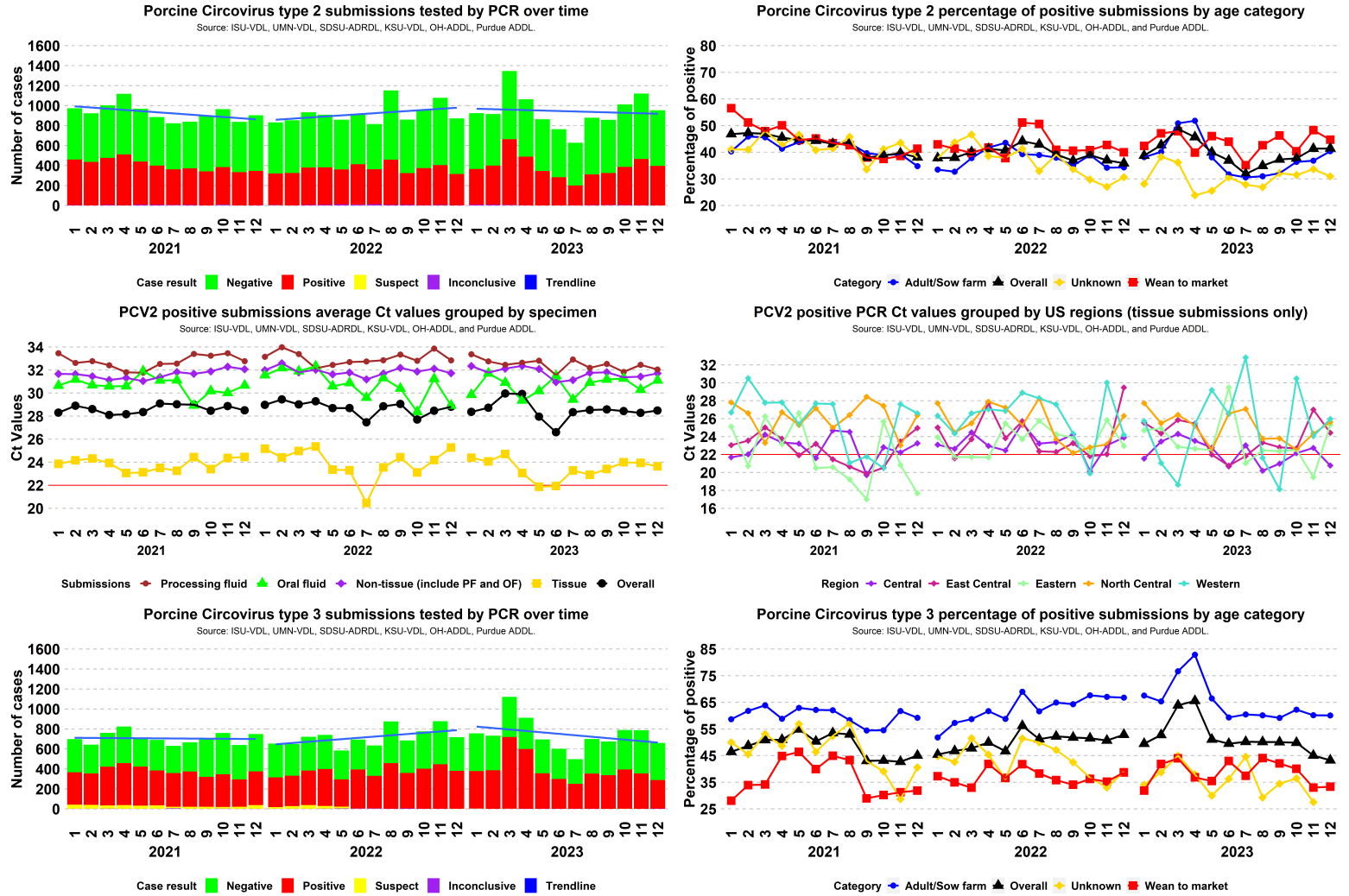# Topic 4 – Detection of Porcine Circoviruses type 2 and 3 DNA by PCR.

Figure 1. Top: *Left*: Results of PCV2 PCR cases over time; *Right*: PCV2 PCR-positive results, by category over time. **Middle**: *Left*: Average Ct values of PCV2 submissions by specimen; *Right*: Average Ct values of PCV2 tissue submissions by U.S. region; Central (IA), East Central (IL, IN, MO and WI), Eastern (AL, AR, CT, DE, FL, GA, KY, LA, MA, ME, MD, MI, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN VA, VT and WA), North Central (MN, ND and SD), Western (AK, AZ, CA, CO, HI, ID, KS, MT, NM, NV, OK, OR, TX, UT, WA and WY). **Bottom** *Left*: Results of PCV3 PCR cases over time; *Right*: PCV3 PCR-positive results, by category over time.

SDRS Advisory Group highlights:

- Overall, 41.45% of 953 cases tested PCV2-positive in December, similar to 41.34% of 1,120 in November;
- Positivity in the adult/sow category in December was 40.4% (183 of 453), a moderate increase from 36.86% (202 of 548) in November;
- Positivity in the wean-to-market category in December was 44.71% (186 of 416), a moderate decrease from 48.29% (226 of 468) in November;
- In the month of December, the regions with the lowest PCV2 average Ct values was Central (70 submissions; average Ct 20.8), East Central (14 submissions; average Ct 24.4), Eastern (22 submissions; average Ct 25.3), North Central (27 submissions; average Ct 25.6), and Western (9 submissions; average Ct 26);
- Overall, 43.27% of 661 cases tested PCV3-positive in December, similar to 45.05% of 788 in November;
- Positivity in the adult/sow category in December was 60.07% (170 of 283), similar to 60.16% (222 of 369) in November;
- Positivity in the wean-to-market category in December was 33.33% (103 of 309), similar to 33.02% (106 of 321) in November;

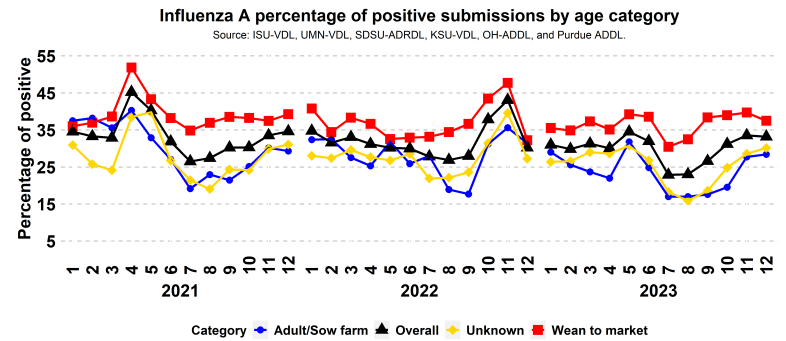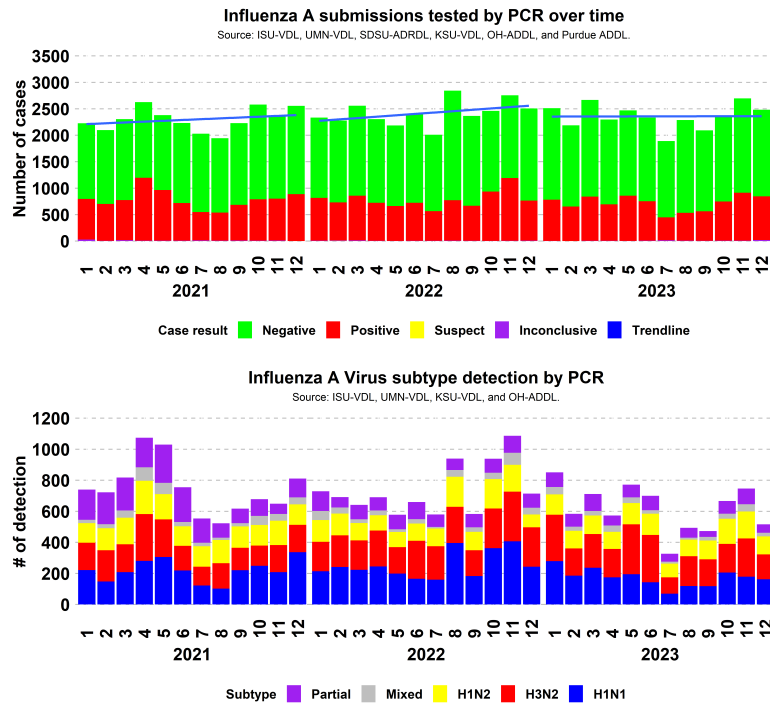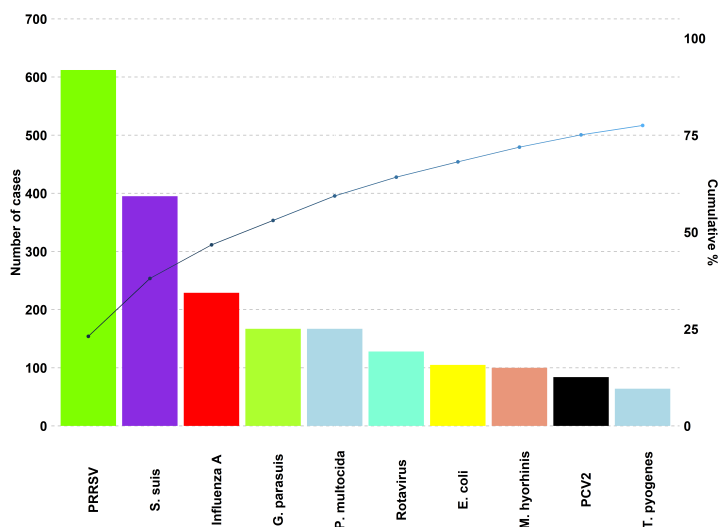# Topic 5 – Detection of Influenza A Virus (IAV) RNA by RT-PCR.

Influenza A submissions tested by PCR over time
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL, and Purdue ADDL.

Case result — Negative · Positive · Suspect · Inconclusive · Trendline

Influenza A percentage of positive submissions by age category
Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL, and Purdue ADDL.

Category — Adult/Sow farm · Overall · Unknown · Wean to market

Influenza A Virus subtype detection by PCR
Source: ISU-VDL, UMN-VDL, KSU-VDL, and OH-ADDL.

Subtype — Partial · Mixed · H1N2 · H3N2 · H1N1

Figure 3. Top: *Left* Results of IAV PCR cases over time. *Right* Percentage of IAV PCR-positive results, by category over time. **Bottom:** Number of IAV subtyping PCR detection over time; (Partial - only hemagglutinin or neuraminidase region detected; Mixed - 3 or more haemagglutinin and neuroaminidase regions detected. i.e., "H1 H3 N1").

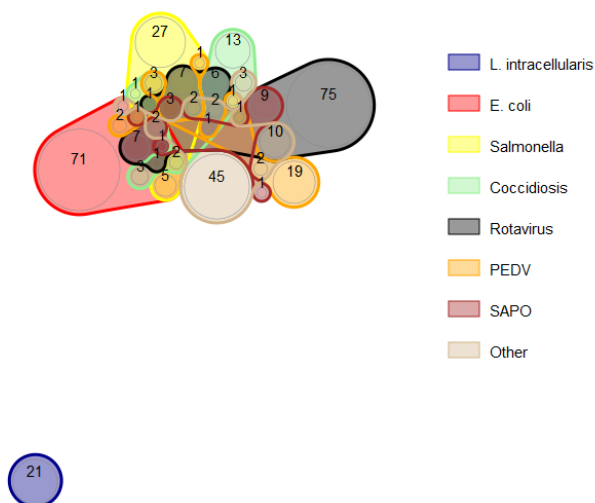## SDRS Advisory Group highlights:

- Overall, 33.2% of 2,482 cases tested IAV-positive cases in December, similar to 33.54% of 2,698 in November;
- Positivity in the adult/sow category in December was 28.44% (126 of 443), similar to 27.73% (132 of 476) in November;
- Positivity in the wean-to-market category in December was 37.48% (425 of 1,134), a moderate decrease from 39.71% (492 of 1,239) in November.
- Overall, 4.46% of 516 samples had mixed subtype detection in December, similar to 6.29% of 747 in November;

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SWINE DISEASE REPORTING SYSTEM
Disease Diagnosis Reports

IOWA STATE UNIVERSITY Veterinary Diagnostic Laboratory

SHiC Swine Health Information Center

pork IOWA PORK PRODUCERS ASSOCIATION
Successful farmers. Enriched lives.

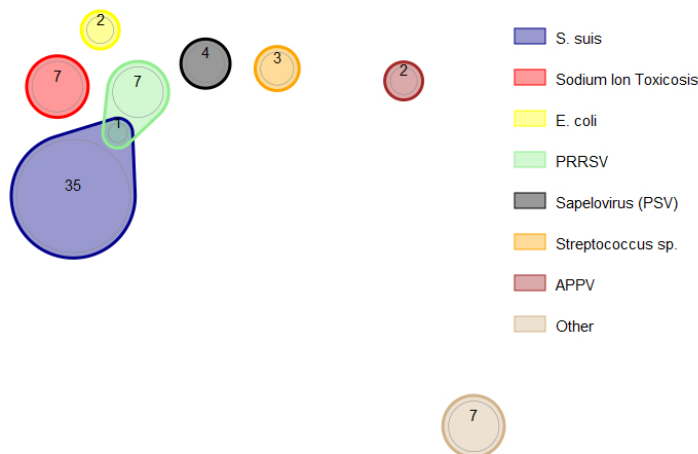# Topic 6 – Confirmed tissue cases etiologic/disease diagnosis at the ISU-VDL.
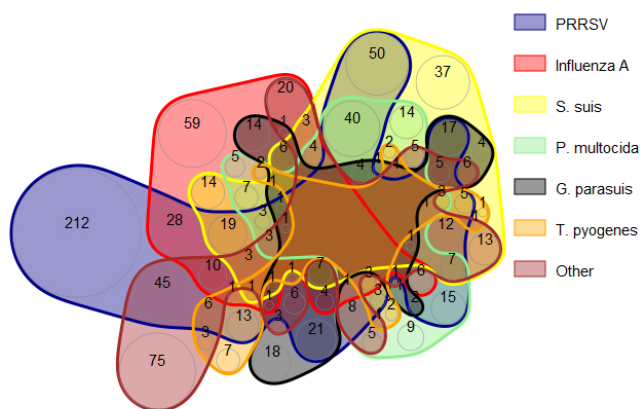
Figure 4. ISU-VDL most frequent overall confirmed tissue disease diagnosis. The presented system is described in the title of the chart. Colors represent one agent; line intersections present diagnosis of 2 or more agents within a submission. Only the most frequent etiology/disease are presented. Less 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, Magstadt, Mainenti, Michael, Piñeyro, Siepker, Madson, Thomas 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 November. 1 to December. 22, 2023.

SDRS Advisory Group highlights:

• PRRSV (612) led cases with confirmed etiology, followed by *S. suis* (395), and Influenza A (229). PRRSV (570 of 1730) led the number of confirmed respiratory diagnoses, *Rotavirus* (128 of 451) lead the number of confirmed digestive diagnoses, and *S. suis* (36 of 69) led the number of confirmed neurological diagnoses.

• Even though it was a small number of cases, there were consecutive spikes in the number of *Trueperella pyogenes*, *Mycoplasma hyorhinis*, and PEDV confirmed diagnosis.

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.*

A 2023 *Swine Disease Reporting System-SDRS* retrospective

Guilherme Cezar[1], Edison Magalhães[1], Daniel Linhares[1], Giovani Trevisan[1]

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The SDRS's goal is to share information on the activity of endemic and emerging pathogens affecting the swine population in the U.S., assisting veterinarians and producers in making informed decisions on disease prevention, detection, and management. Currently, SDRS is the only publicly available source of swine health information from U.S. veterinary diagnostic laboratories (VDLs). With a database containing information for eight porcine endemic agents and more than 1.4 million cases, SDRS is also positioned as one of the largest U.S. and international databases for veterinary diagnostic information. The SDRS has been providing science-based spatiotemporal information on pathogen activity in all age categories, from boar studs to breeding herds to finishing with great representativeness of the U.S. swine industry. Thank you to the six VDL partners, SDRS Advisory Board, and collaborators for all of the accomplishments during 2023.

A 2023 SDRS retrospective includes but is not limited to:

- Addition of a new participant VDL, Purdue Animal Disease Diagnostic Laboratory, with real-time messaging capabilities to the SDRS database of testing and testing results for newly received porcine cases;
- Addition of Porcine Circovirus type 2 PCR Ct monitoring by sample type and geographic regions.
- Addition of Porcine Circovirus type 3 DNA PCR detection;
- PRRSV ORF 5 sequences have been reclassified to display the updated PRRSV lineage classification and a new online dashboard has been built and deployed to display PRRSV ORF5 sequencing trends over time according to lineages and RFLP classifications;
- Addition of SDRS Educational Material made by a series of short videos explaining the SDRS charts;

SDRS generated and distributed free of charge anonymized reports, and its distribution statistics were:

- SDRS project website (*www.fieldepi.org/SDRS*) and online dashboards had more than 6,036 page visits;
- 12 editions of PDF, audio, and video reports have been shared through e-mail for 358 receivers registered from 89 organizations from 7 different countries and posted at the SDRS webpage;
- PDF reports shared at the FieldEpi LinkedIn page were visualized more than 25,514 times;
- SDRS hosted talks during the last 12 editions with 11 special guests:

- Audio reports have been shared through podcast platforms (including *Spotify*, *Apple Podcast*, *Google Podcast*, and *Amazon Music*) with over 662 downloads from 23 different countries;

- SDRS video reports were watched 736 times on the YouTube channel.

Pathogen activity highlights:

- During the summer of 2023 (June to August), PRRSV had the historically lowest percentage of positive submission detection in the wean-to-market category (25.95% of positive cases). Around the week of October second, a substantial increase in PRRSV detection has occurred mostly due to activity in the wean-to-market age category. The increase in detection of PRRSV wean-to-market has followed the historical trend of preceding an increase in detection in the adult/sow farm category;
- The most frequent wild-type PRRSV-2 strains detected were: L1C.5 (L1C variant) 1-4-4, L1A 1-7-4, and L1H 1-8-4. Furthermore, the 2020 emerged L1C.5 PRRSV strains has been kept active. In 2023, L1C.5 was detected in 13 states located in Midwest region and some neighboring states. Since the emergence of this strain, 17 states had this PRRSV strain deteced.
- In 2023, PDCoV overall detection levels were above expected from February to April, with PDCoV activity decreasing throughout the year and returning to the historical expected level around the week of May 8. Atypical PDCoV outbreaks were associated by the advisory group as the root causes for the increased PDCoV activity. Notably, a cycle with increased PDCoV detection every other year has been noticed in the first semester of the year;
- In 2023, PEDV detecition has followed the historical expected levels of detection;
- March 22nd of 2021 marked the last field sample received at the SDRS laboratory network with a RT-PCR positive result for TGEV. Up to December 2023 more than 110,000 submissions, including 250,411 samples, have been tested for TGEV and no TGEV positive result has been detected;
- The average of *M. hyopneumoniae* monthly submissions increased by 27% (698 to 887). From average monthly submissions, 24.81% were deep tracheal swab specimen. SDRS advisory group pointed *M. hyopneumoniae* control and elimination protocols contributed to the increased number of cases tested for *M. hyopneumoniae*;

- PCV3 is the only pathogen monitored by the SDRS having the positivity in the age category Adult/sow farm above the positivity in the wean-to-market category;
- PCV2 had an increased number of submissions and positivity in March of 2023. The advisory group pointed out vaccine compliance issues and the activity of PCV2 genotype D cases in the field as factors contributing to an increase in the number of clinical cases.
- After a break in the bi-seasonality pattern of the Influenza A virus PCR detection cases during fall of 2021 and spring of 2022, spikes in IAV detection were identified in the spring and fall months of 2023 representing the return of IAV seasonality;
- In 2023, H3N2 was the most detected IAV subtype (34,97%) followed by H1N1 (27,48%), and H1N2 (20,14%) by RT-PCR subtyping;

Highlights for disease diagnosis at *Iowa State University Veterinary Diagnostic Laboratory*:

- PRRSV had the highest number of porcine confirmed diagnoses (2,272) followed by *Streptococcus suis* (1,584) and Influenza A virus (989) in 2023;
- Different agents including PRRSV, Influenza A virus, *Glaesserella parasuis*, *P. multocida*, *G. parasuis*, *Streptococcus suis*, and Rotavirus have given signals for increased diagnosis during September and October of 2023.

Happy 2024!!! and keep tuned for new SDRS development in 2024.

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