Swine Disease Reporting System
Report # 61 (March 07, 2023)

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 University VDL, and Ohio Animal Disease and Diagnostic Lab.

Collaborators:

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

Iowa State University: Gustavo Silva, Marcelo Almeida, Bret Crim, Kinath Rupasinghe, Eric Burrough, Phillip Gauger, Christopher Siepker, Panchan Sitthicharoenchai, 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.

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

Ohio Animal Disease and Diag. Lab.: Melanie Prarat, William Hennessy, Ashley Sawyer, 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 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 by specimen, age group, and US State.

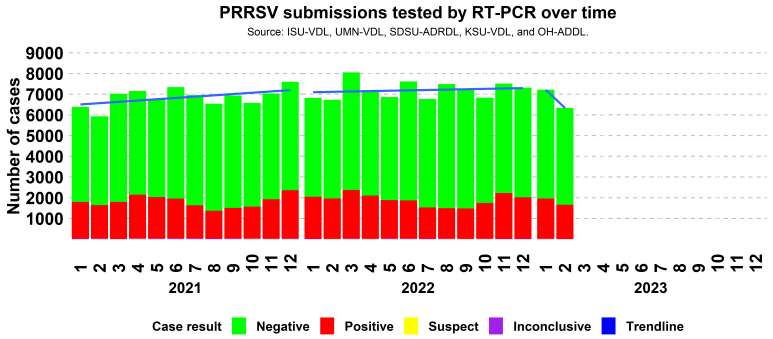
Audio and video reports: Key findings from SDRS projects are summarized monthly in a conversation between investigators and available in the form of an "audio report" and "video report" through Spotify, Apple Podcast, Google podcast, SwineCast, YouTube, LinkedIn, and the SDRS webpage.

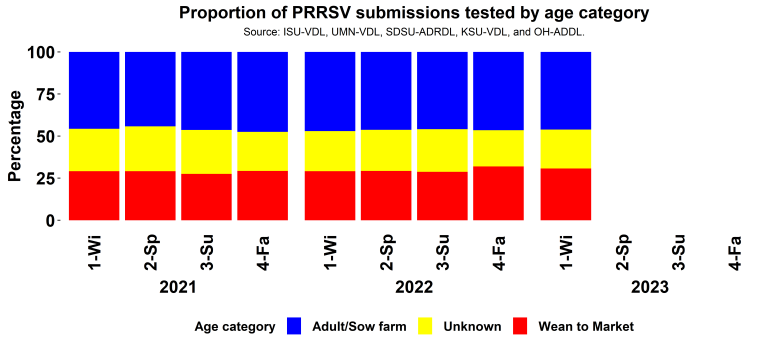
Advisory Group: Reviews and discusses the data, providing their comments and perspectives monthly: Mark Schwartz, Paul Sundberg, Paul Yeske, Tara Donovan, Deborah Murray, Scott Dee, Brigitte Mason, Peter Schneider, Sam Copeland, Luc Dufresne, Daniel Boykin, Corrine Fruge, William Hollis, and Rebecca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

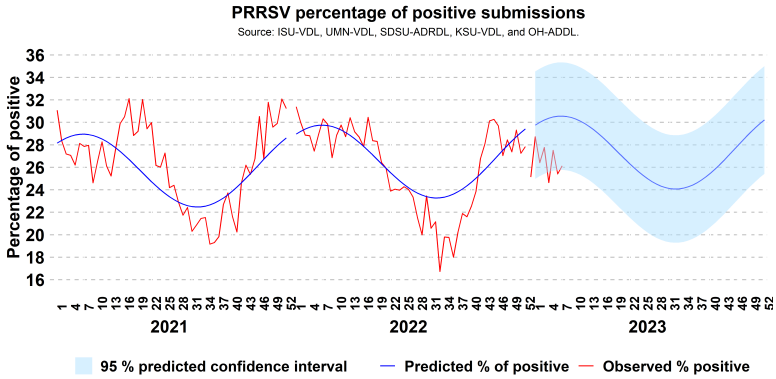
In addition to this report, interactive dashboards with aggregated test results are available at www.fieldepi.org/SDRS.

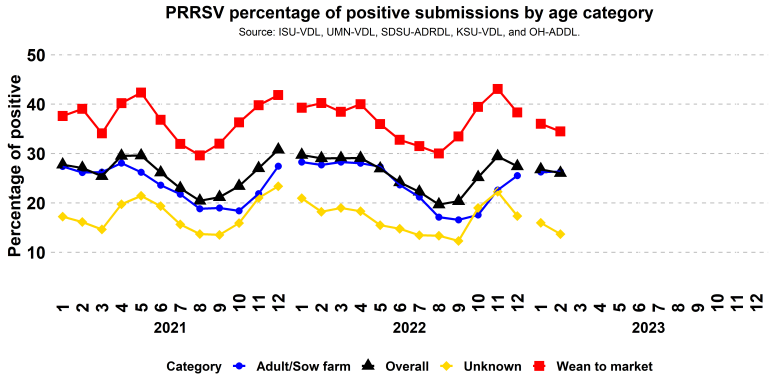
Note: This report contains data up to February 28, 2023.

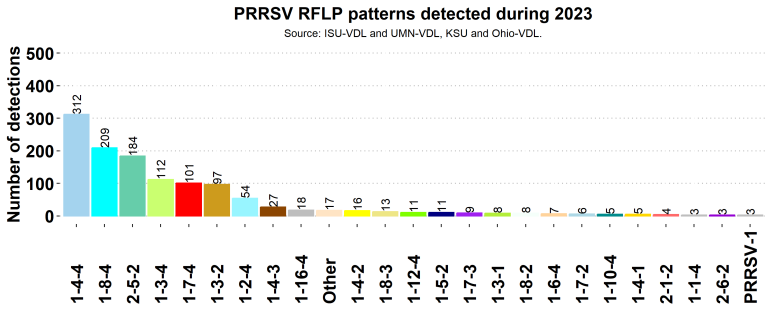
Topic 1 – Detection of PRRSV RNA over time by RT-qPCR.











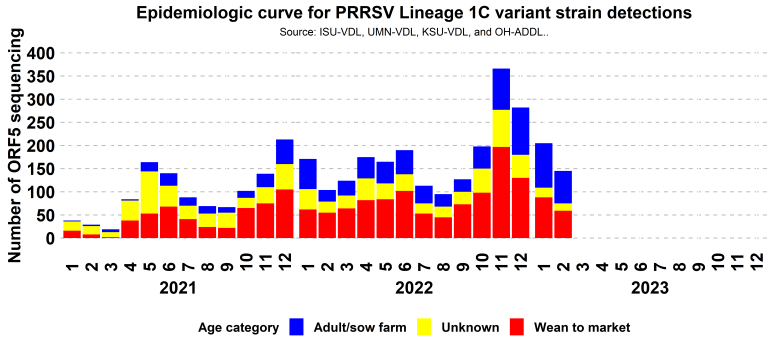


Figure 1. Top: *Left*: Results of PRRSV RT-PCR cases over time; *Right*: Proportion of accession ID cases tested for PRRSV by age group per year and season. **Middle**: *Left* Expected percentage of positive results for PRRSV RNA by RT-qPCR, with 95% confidence interval band for predicted results based 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 during 2023; *Right*: Epidemiological curve of detection for PRRSV Lineage 1C variant strain.

SDRS Advisory Group highlights:

- Overall, 26.06% of 6,339 cases tested PRRSV-positive in February, similar to 26.78% of 7,218 in January;
  - Positivity in the adult/sow category in February was 26.35% (775 of 2,941), similar to 26.26% (870 of 3,313) in January;
  - Positivity in the wean-to-market category in February was 34.48% (683 of 1,981), similar to 36.03% (789 of 2,190) in January;
  - Overall PRRSV-percentage of positive cases was 3 standard deviations from state-specific baselines in KS. Sow farm PRRSV percentage of positive cases was 3 standard deviations from state-specific balines in MO;
- During January and February PRRSV L1C variant strains were detected in Missouri (163), Iowa (103), and Minnesota (38) since January 2023. There was also detections in Indiana (5), Tennessee (3), Ohio (2), and Pennsylvania (2), raising concern for US eastern states;
- The advisory group highlighted that PRRSV L1C variant is an eminent risk for eastern states. Even though there are few movements of animals from Midwest region to eastern states, live haul equipment and trucks are possible PRRSV carriers facilitating the dissemination. In addition, the advisory group emphasize the importance of keep the L1C variant out of states such North Carolina that holds a large breeding inventory;
- The advisory group reminded to continue improving biosecurity and biocontainment approaches related to truck wash, site cleaning and disinfection, feed mill, and hauling trucks to reduce the opportunities for dissemination of PRRSV strains across farms.

Topic 2 – Enteric coronavirus RNA detection by RT-qPCR

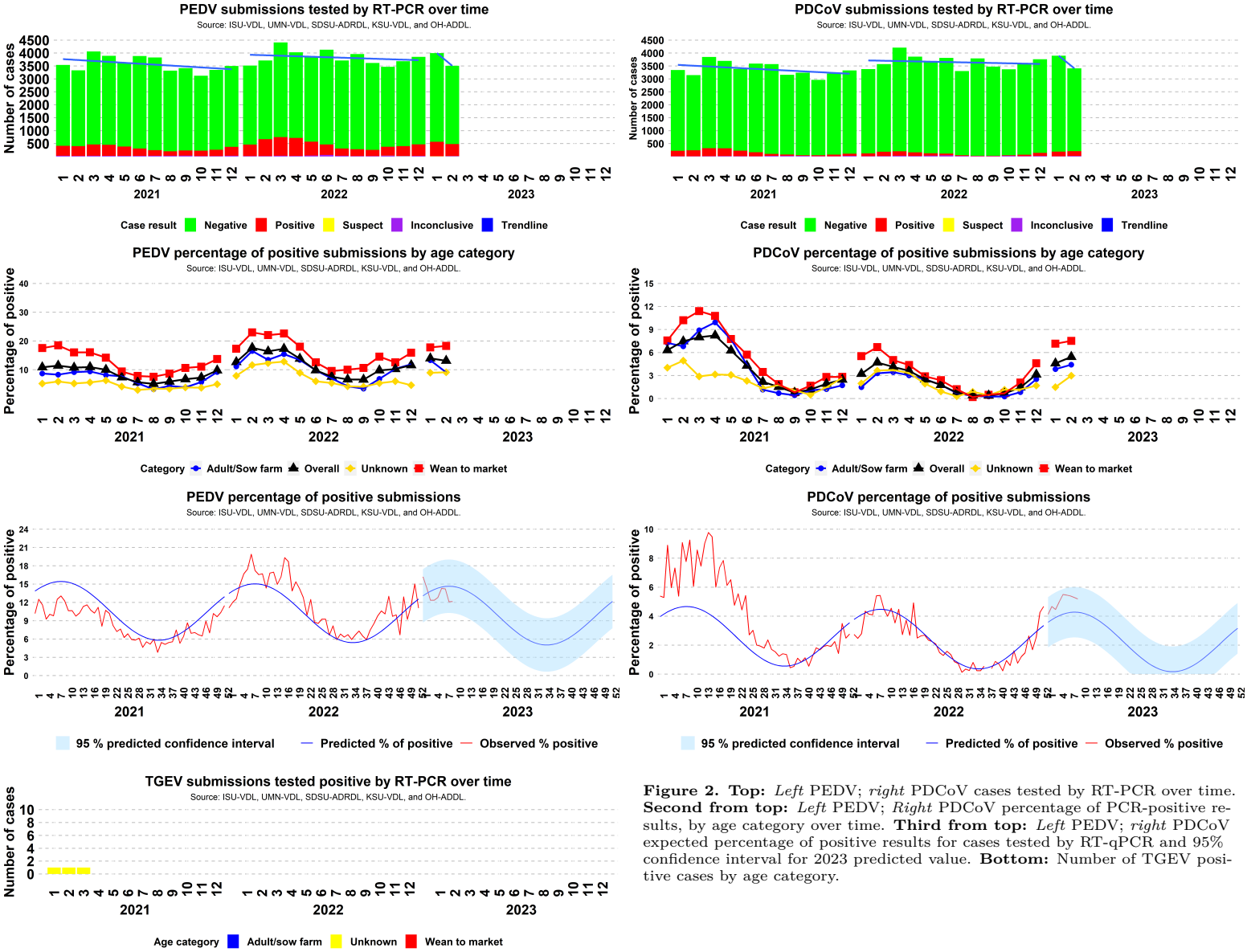


Figure 2. Top: *Left* PEDV; *right* PDCoV cases tested by RT-PCR over time. **Second from top:** *Left* PEDV; *Right* PDCoV percentage of PCR-positive results, by age category over time. **Third from top:** *Left* PEDV; *right* PDCoV expected percentage of positive results for cases tested by RT-qPCR and 95% confidence interval for 2023 predicted value. **Bottom:** Number of TGEV positive cases by age category.

SDRS Advisory Group highlights:

- Overall, 13.16% of 3,503 cases tested PEDV-positive in February, similar to 13.98% of 3,992 in January;
  - Positivity in the adult/sow category in February was 9.11% (96 of 1,054), a moderate decrease from 13.31% (160 of 1,202) in January;
  - Positivity in the wean-to-market category in February was 18.3% (282 of 1,541), similar to 17.78% (298 of 1,676) in January;
- Overall, 5.43% of 3,407 cases tested PDCoV-positive in February, similar to 4.59% of 3,896 in January;
  - Positivity in the adult/sow category in February was 4.42% (45 of 1,019), similar to 3.84% (45 of 1,173) in January;
  - Positivity in the wean-to-market category in February was 7.52% (114 of 1,516), similar to 7.15% (118 of 1,650) in January;
- There was 0 positive case for TGEV RNA in February, 2023 over a total of 3,315 cases tested. It has been 24 months (with a total of 79,052 cases tested) since the last TGEV PCR-positive result;

Topic 3 – Detection of *M. hyopneumoniae* and Porcine Circovirus-2 DNA by PCR.

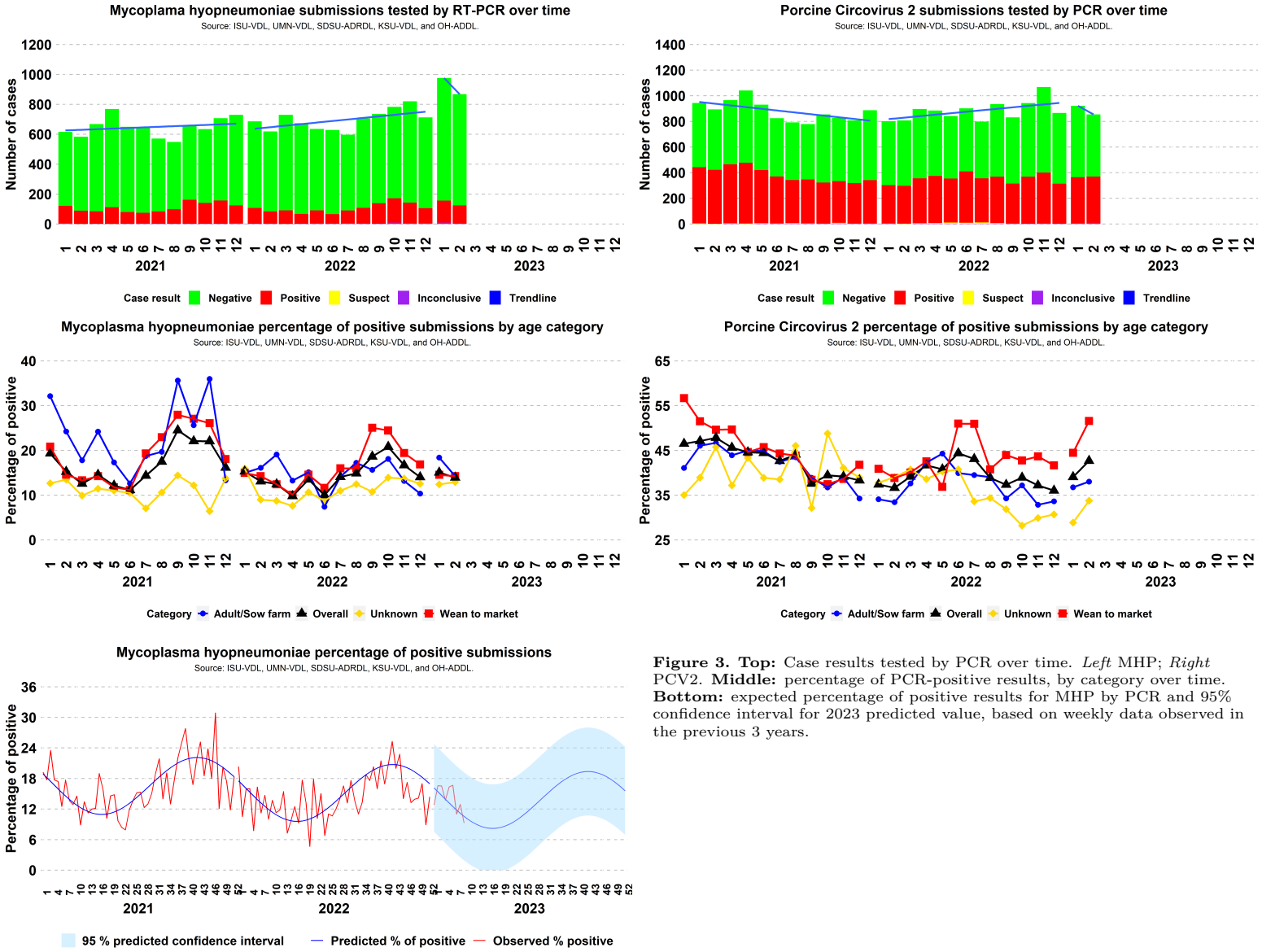
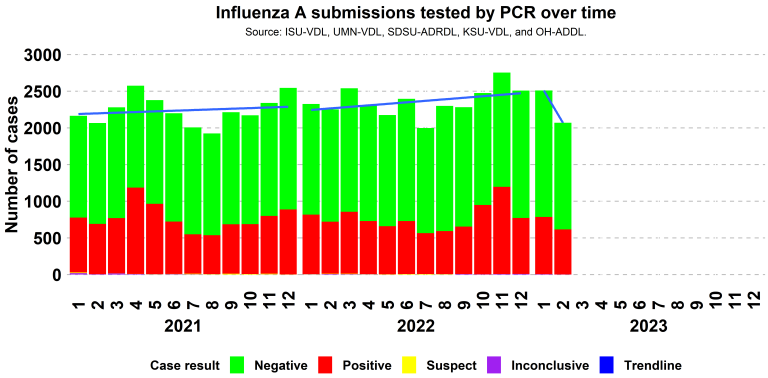


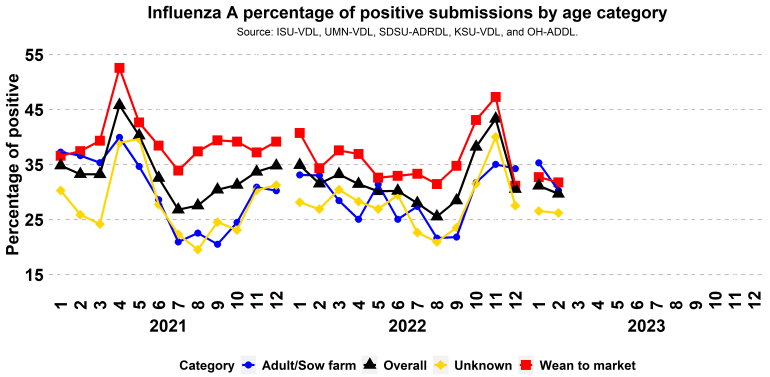
Figure 3. Top: Case results tested by PCR over time. *Left* MHP; *Right* PCV2. **Middle:** percentage of PCR-positive results, by category over time. **Bottom:** expected percentage of positive results for MHP by PCR and 95% confidence interval for 2023 predicted value, based on weekly data observed in the previous 3 years.

SDRS Advisory Group highlights:

- Overall, 13.94% of 868 cases tested *M. hyopneumoniae*-positive cases in February, similar to 15.06% of 976 in January;
  - Positivity in the adult/sow category in February was 14.23% (40 of 281), a moderate decrease from 18.41% (51 of 277) in January;
  - Positivity in the wean-to-market category in February was 14.25% (55 of 386), similar to 14.55% (63 of 433) in January;
  - Overall MHP-percentage of positive was within state-specific baselines in all 11 monitored states;
- Overall, 42.67% of 846 cases tested PCV2-positive in February, a moderate increase from 39.06% of 914 in January;
  - Positivity in the adult/sow category in February was 38.02% (173 of 455),similar to 36.77% (164 of 446) in January;
  - Positivity in the wean-to-market category in February was 51.59% (162 of 314), a substantial increase from 44.47% (165 of 371) in January;
- PCV2 had an increased percentage of positive submissions from wean-to-market in February. SDRS team, in partnership with industry allies, investigated this situation, and the increased positivity was associated with PCV2 vaccination handling issues in the state of Iowa having, as a consequence, increased number of PCV2 positive cases. The SDRS team will keep monitoring this case to ensure it is only a local issue;
- Even though the Mycoplasma hyopneumoniae positivity was within expected for February, there was an increased number of M. hyopneumoniae submissions since the beginning of January. The weekly number of submissions used to be around 40 cases, and in February was over 60 cases per week. The largest number of weekly cases shared with the SDRS;
- The advisory group highlighted that the increased number of submissions for *M. hyopneumoniae* was correlated with PRRSV status of flows favoring *M. hyopneumoniae* co-infections. In addition, multipliers were performing more deep tracheal swab rather than serology tests, increasing the number of PCRs submitted into VDLs.

Topic 4 – Detection of Swine Influenza A Virus (IAV) RNA by RT-PCR.





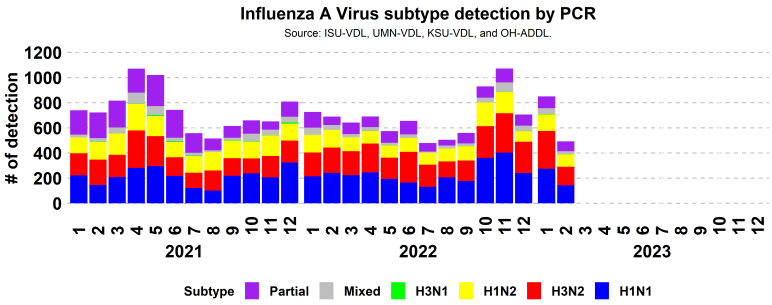


Figure 3. Top: *Left* Results of IAV PCR cases over time. *Right* Percentage of IAV PCR-positive results, by category over time. **Bottom:** Number of IAV subtyping PCR detection over time; (Partial - only hemagglutinin or neuraminidase region detected; Mixed - 3 or more haemagglutinin and neuroaminidase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

SDRS Advisory Group highlights:

- Overall, 29.68% of 2,069 cases tested IAV-positive cases in February, similar to 31.17% of 2,506 in January;
- Positivity in the adult/sow category in February was 30.29% (136 of 449), a substantial decrease from 35.33% (165 of 467) in January;
- Positivity in the wean-to-market category in February was 31.77% (304 of 957), similar to 32.72% (390 of 1,192) in January.
- Overall, 4.87% of 493 samples had mixed subtype detection in February, similar to 5.53% of 850 in January;

Topic 5 – Confirmed tissue cases etiologic/disease diagnosis at the ISU-VDL.

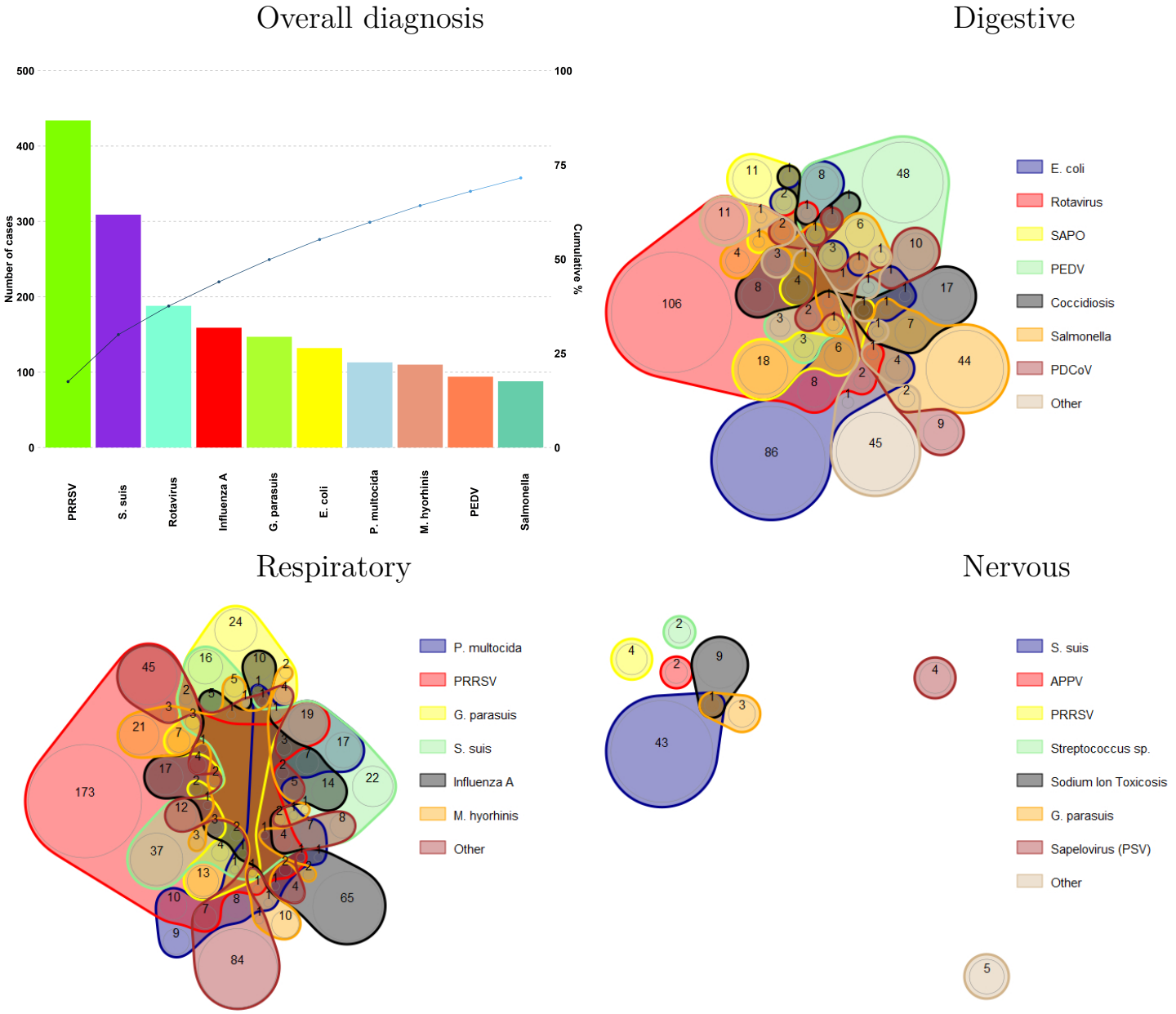


Figure 4. ISU-VDL most frequent overall confirmed tissue disease diagnosis. The presented system is described in the title of the chart. Colors represent one agent; line intersections present diagnosis of 2 or more agents within a submission. Only the most frequent etiology/disease are presented. Less 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 January. 1 to February. 20, 2023.

SDRS Advisory Group highlights:

• PRRSV (434) led cases with confirmed etiology, followed by *S. suis* (309), and Rotavirus (188). PRRSV (408 of 1296) led the number of confirmed respiratory diagnoses, Rotavirus (188 of 689) lead the number of confirmed digestive diagnoses, and *S. suis* (44 of 75) led the number of confirmed neurological diagnoses.

• During the week of February 6th, there were spikes in the number of cardiovascular system confirmed diagnosis;

• During January 23rd to February 6th, there were spikes in the number of PDCoV, Clostridiosis and PCV2 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.*

Preliminary investigations into water line biology and impact on swine health and productivity

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Introduction

Water is an essential nutrient and an integral part of pig production. Most of the previous research on water, water lines and water system management has focused on water as a nutrient, water usage and wastage. Investigations into best practices for management of water biology and water quality, water administered medications and their impact on swine health and productivity needs to be thoroughly explored.

Materials and Methods

Assessment of the literature exposes research gaps on water line biofilm composition, groundwater transportation of pathogens, and provides limited best practices for water line management/ water administered medications to readily apply to farms. Preliminary investigations into water line biofilms were performed in May of 2022 by submitting a 3-inch section of existing PVC pipe ("coupon") from a commercial swine operation located in central Iowa to the ISU VDL for 16S rRNA and metagenomic shotgun sequencing. Future studies assessing biofilm composition, water line disinfection and assessment of swine pathogen transmission via groundwater sources are underway.

Major findings and implications

1. Groundwater is no longer considered a protected source from bacterial, viral, and protozoal contaminants;
2. Human pathogen transmission via well water is documented. Swine pathogen testing is needed;
3. 47 percent of the biofilm composition in the water line coupon was from the *Enterobacteriaceae* family;
4. Antimicrobial resistance genes for multiple drug classes were found. Phenotypic resistance has not yet been tested;
5. It is necessary to test water at least annually for water quality, trace minerals and coliforms;
6. Flush "dead end" water lines frequently to remove debris from the water lines.
7.Prepare fresh drug solutions daily in a clean stock solution bucket and discard any residual medicated water after 48 hours. Cover stock solutions.
8. Flush water medicators with water after all water administered treatment.

Table 1. Antimicrobial resistance genes found in water line coupon sample.

AMR gene	Function
OqxB	Multi drug efflux pump
TetA	Tetracyclines
AacAad	Aminoglycosides
CatB2, cmIA	Chloramphenicol
qnrB	Quinolone
CARB, mrdA	Beta lactams

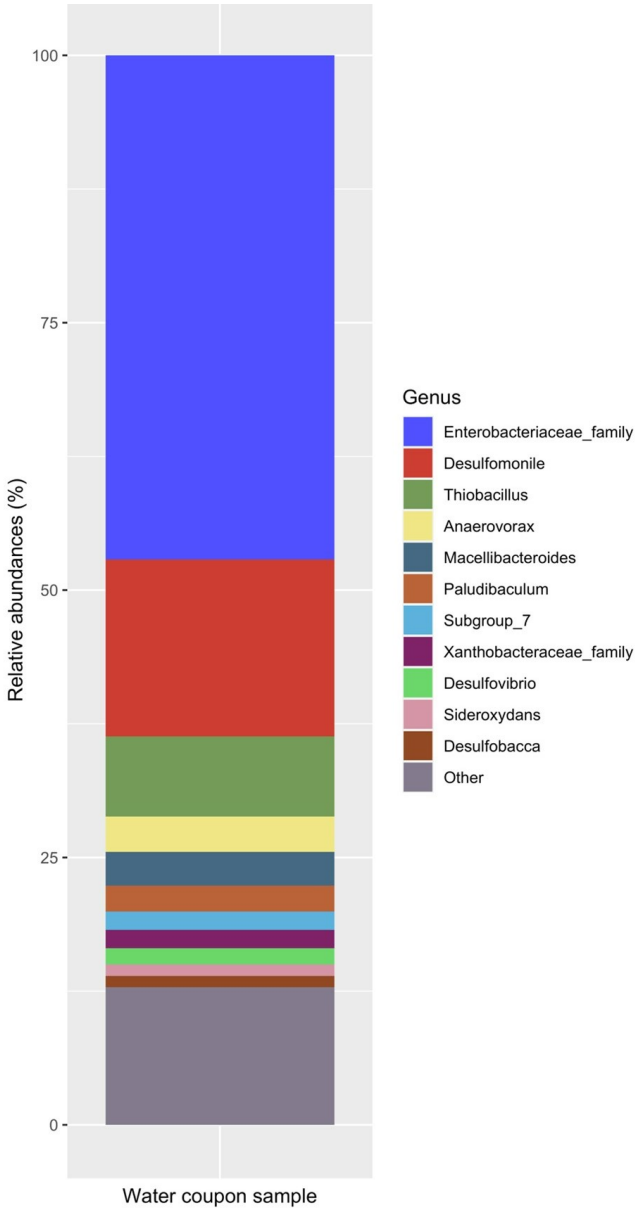

Figure 1. Genera in water coupon identified by 16s rRNA sequencing with relative abundances > 1