Swine Disease Reporting System
Report # 43 (September 7, 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:

Iowa State University: Giovani Trevisan, Edison Magalhães, Bret Crim, Poonam Dubey, Kent Schwartz, Eric Burrough, Phillip Gauger, Pablo Pineyro, Christopher Siepker; Rodger Main, Daniel Linhares.

Project coordinator Giovani Trevisan. Principal investigator Daniel Linhares.

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

Kansas State University: Rob McGaughey, Eric Herrman, Roman Pogranichniy, Rachel Palinski, Jamie Henningson.

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

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, and KSU-VDL 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 August 31, 2021.

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

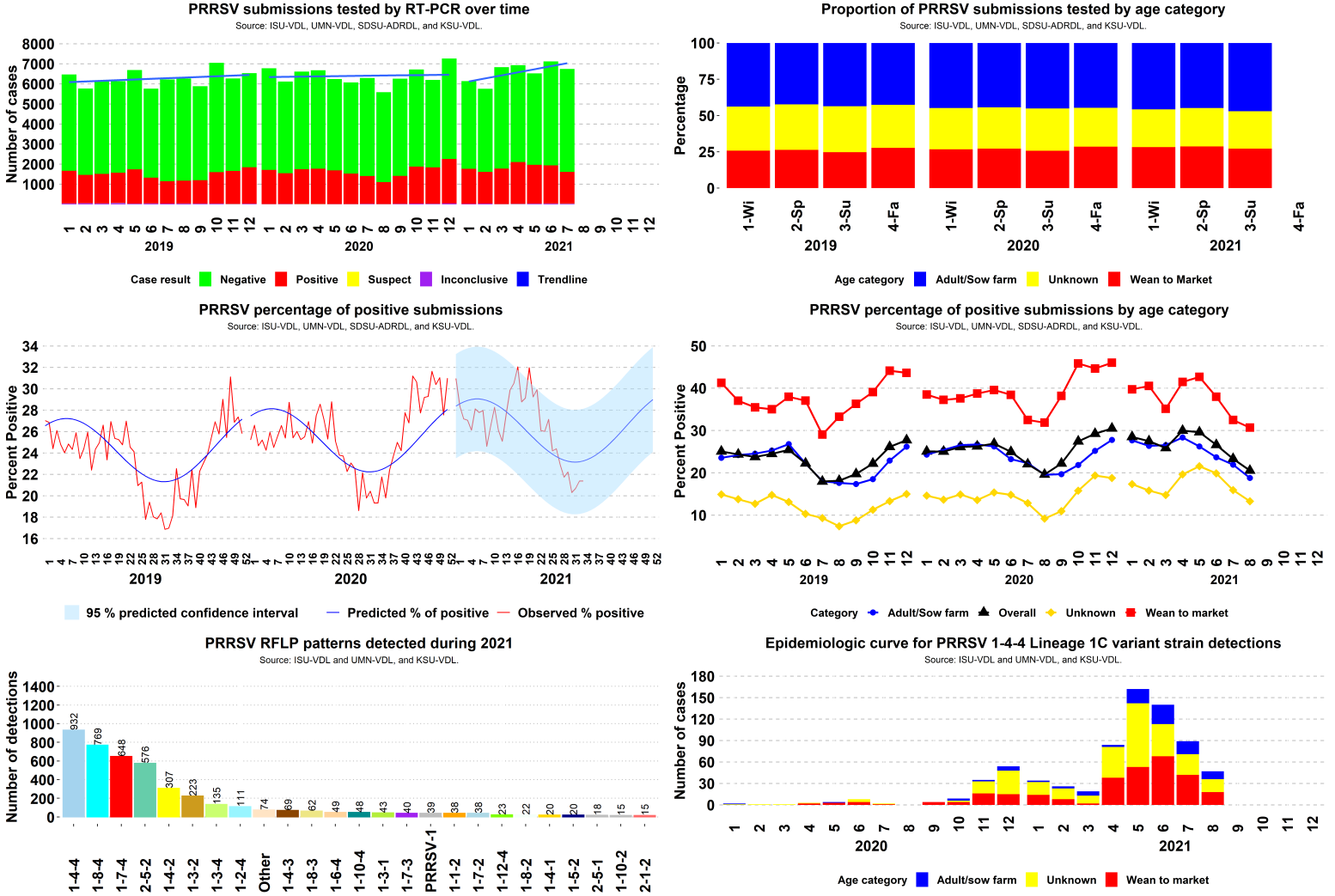

Figure 1. Top: *left*: Results of PRRSV RT-PCR cases over time. *Right*: Proportion of accession ID cases tested for PRRSV by age group per year and season. **Middle**: *Left* expected percentage of positive results for PRRSV RNA by RT-qPCR, with 95% confidence interval band for predicted results based 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, 20.54% of 6,204 cases tested PRRSV-positive in August, a moderate decrease from 23.31% of 6,748 in July;
  - Positivity in adult/sow category in August was 18.78% (572 of 3,045), a moderate decrease from 21.92% (688 of 3,138) in July;
  - Positivity in wean-to-market category in August was 30.68% (498 of 1,623), similar to 32.5% (608 of 1,871) in July;
  - Overall PRRSV-percentage of positive cases was 3 standard deviations from state-specific baselines in OH;
- The advisory group pointed out that we should expect a similar PRRSV trend of detection during the 2021-2022 fall and winter months as previous years.
- Not all regions dealt with abnormal number of PRRSV outbreaks in 2020-2021. Across the affected areas, different PRRSV strains were involved. No similar or unique strategies have been implemented to deal with the breaks. In general, strategies implemented to control the 2020-2021 PRRSV outbreaks were considered successful.
- There is a perception that time-to-stability is taking longer, and many breeding herds are still sending PRRSV-positive pigs to downstream sites what may contribute to re-circulation of PRRSV. These same breeding herds are expected to have developed some level of protective immunity and be more prepared to deal with new PRRS outbreaks. Additionally, reports of increased usage of PRRSV immunization strategies, mostly by using modified-live vaccines, are also expected to contribute to herd immunity development.
- The advisory group strongly suggests to keep practicing and improve biosecurity, biocontainment, and biomanagement practices.

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

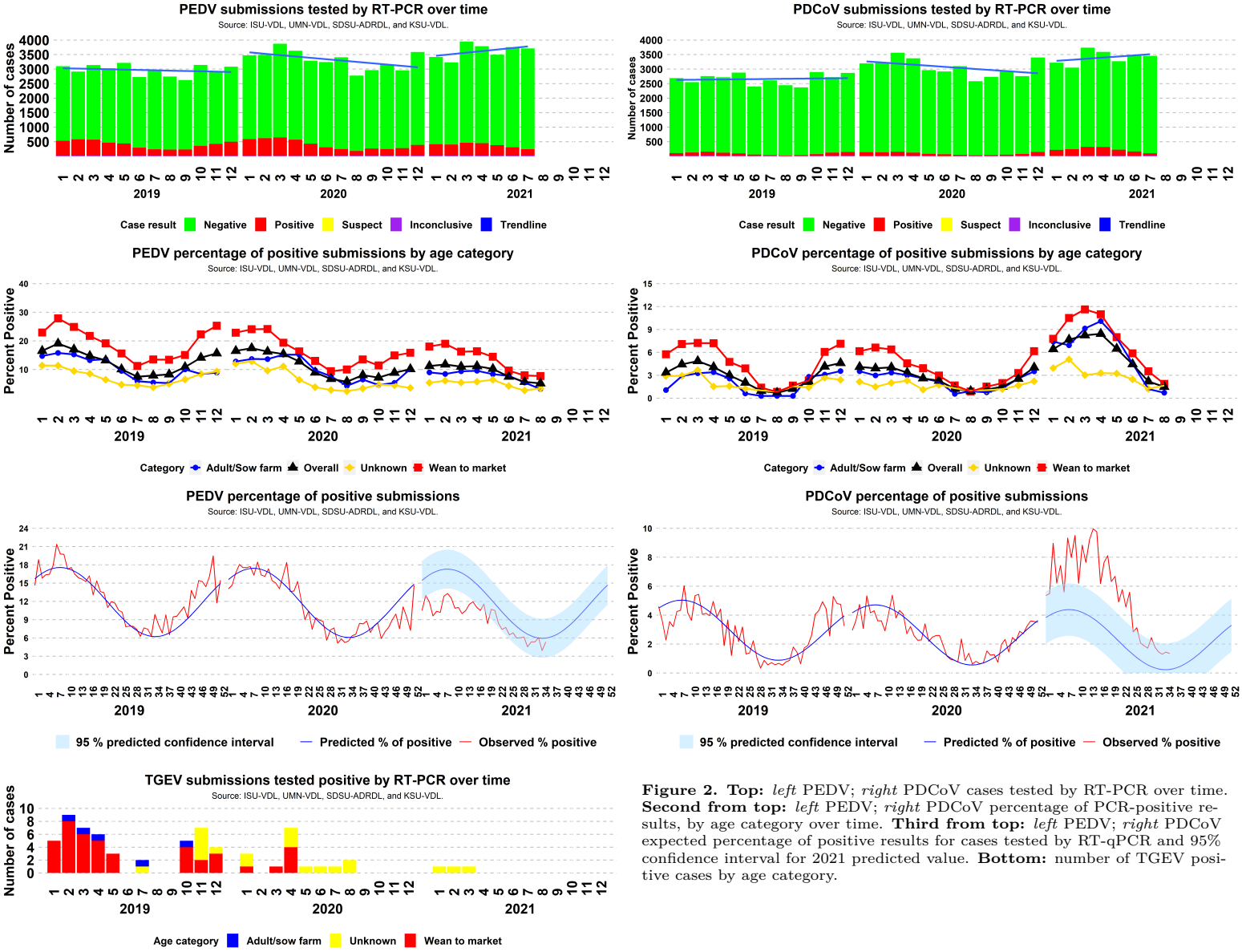

Figure 2. Top: *left* PEDV; *right* PDCoV cases tested by RT-PCR over time. **Second from top:** *left* PEDV; *right* PDCoV percentage of PCR-positive results, by age category over time. **Third from top:** *left* PEDV; *right* PDCoV expected percentage of positive results for cases tested by RT-qPCR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

SDRS Advisory Group highlights:

- Overall, 5.19% of 3,179 cases tested PEDV-positive in August, similar to 5.71% of 3,713 in July;
  - Positivity in adult/sow category in August was 3.22% (29 of 902), a moderate decrease from 5.47% (55 of 1,006) in July;
  - Positivity in wean-to-market category in August was 7.73% (104 of 1,345), similar to 7.97% (127 of 1,594) in July;
  - The overall PEDV-percentage of positive cases was 3 standard deviations from state-specific baselines in IL;
- Overall, 1.49% of 3,025 cases tested PDCoV-positive in August, similar to 2.2% of 3,457 in July;
  - The overall PDCoV detection was outside of the upper boundaries of the forecasted levels since January;
  - Positivity in adult/sow category in August was 0.72% (6 of 836), similar to 1.19% (11 of 922) in July;
  - Positivity in wean-to-market category in August was 1.87% (24 of 1,283), similar to 3.52% (52 of 1,476) in July;
  - Overall PDCoV-percentage of positive cases was 3 standard deviations from state-specific baselines in OK and MO;
- There was 0 positive case for TGEV RNA in August, 2021 over a total of 2,935 cases tested;
- The advisory group pointed out that in general, the industry has made some level of improvement in the way it washes and decontaminates hauling trucks and believes that these practices may have contributed to a lower spread and detection of PEDV during 2021;
- Since the level of PEDV-detection in the wean-to-market age category in August was similar to July the advisory group encourages to close monitoring PEDV for early detection of abnormal activity of this agent within system-specific networks.

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

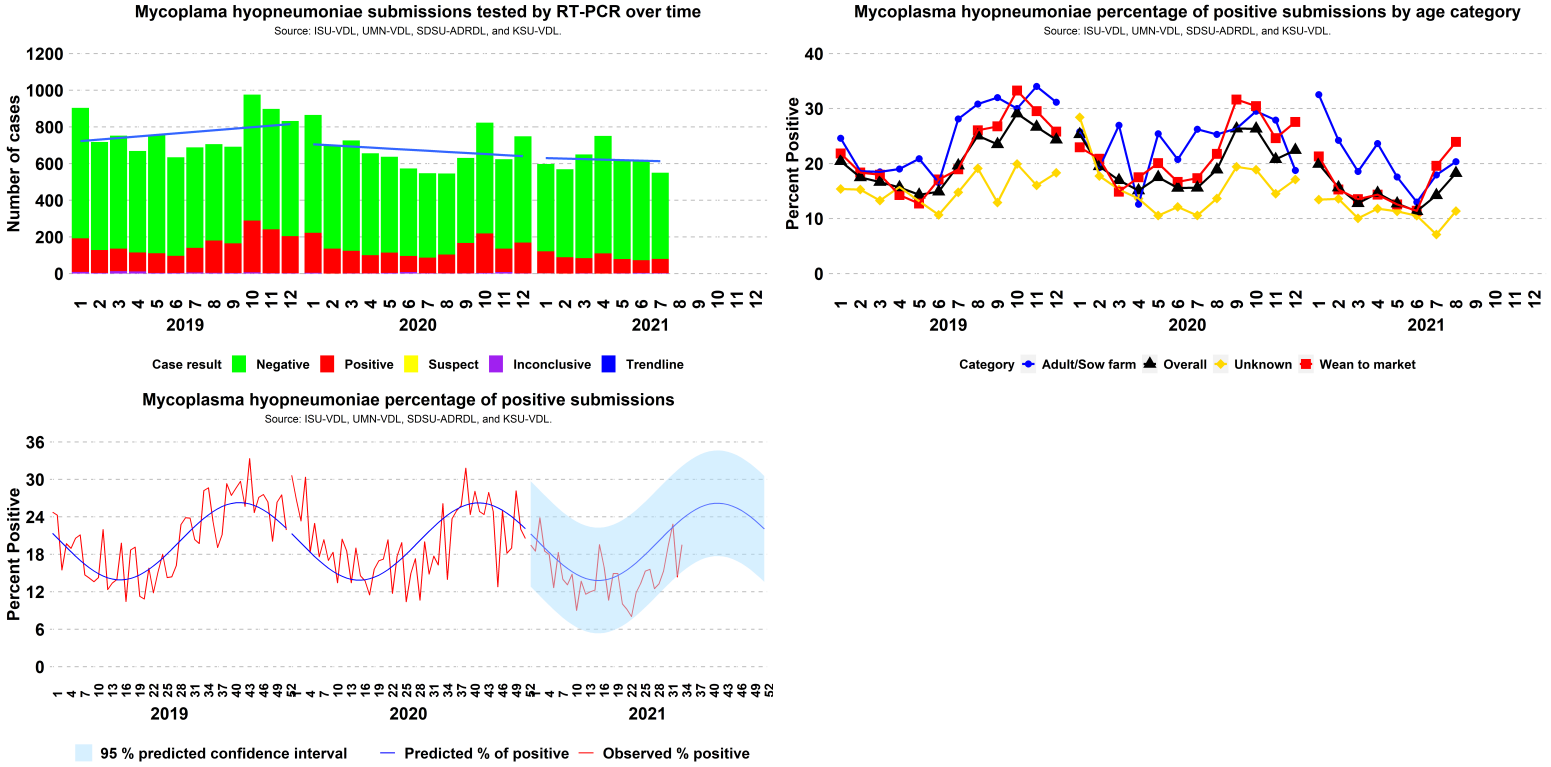

Figure 3. *Left top*: results of MHP PCR cases over time. *Right top*: percentage of MHP PCR-positive results, by category over time. *Bottom*: expected percentage of positive results for MHP by PCR and 95% confidence interval for 2020 predicted value, based on weekly data observed in the previous 3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

SDRS Advisory Group highlights:

- Overall, 18.25% of 504 cases tested *M. hyopneumoniae*-positive in August, a moderate increase from 14.23% of 548 in July;
  - Positivity in adult/sow category in August was 20.34% (12 of 59), a moderate increase from 17.95% (14 of 78) in July;
  - Positivity in wean-to-market category in August was 23.93% (56 of 234), a moderate increase from 19.59% (48 of 245) in July;
  - Overall MHP-percentage of positive was within 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. Summer challenges with other diseases like PRRS can potentially be affecting herd level immunity and opening the opportunity for other endemic agents to affect the herd.

Topic 4 – Disease diagnosis at the ISU-VDL.

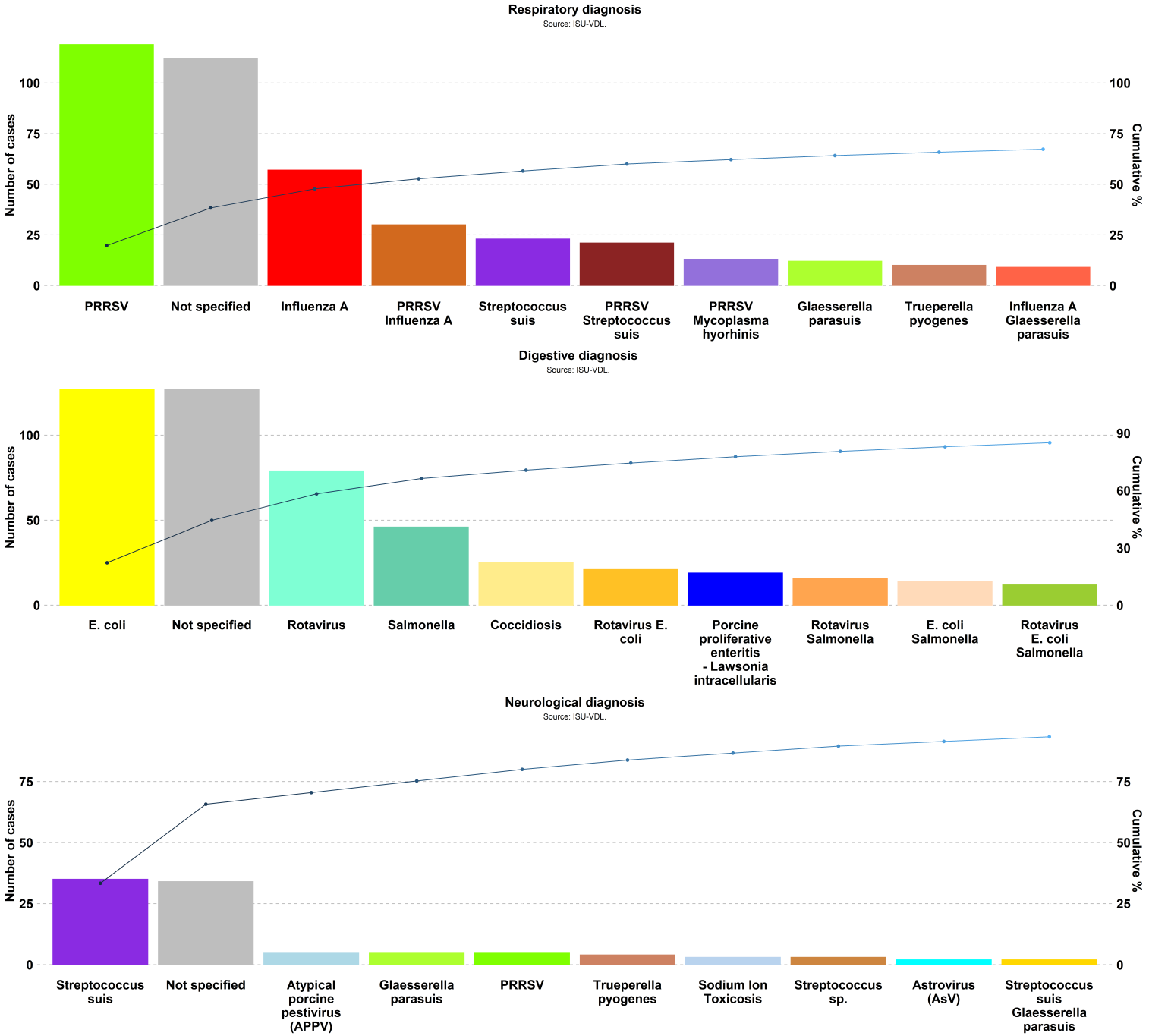

Figure 4. Most frequent disease diagnosis by physiologic system at ISU-VDL . Presented system is described in the title of the chart. Colors represent one agent and/or the combination of 2 or more agents. Only the physiologic systems with historic number of cases per season above 100 are presented in the report.

Note: Disease diagnosis takes one to two weeks to be performed. The graphs and analysis contain data from July 1, 2021 to August 21,2021.

SDRS Advisory Group highlights:

- PRRSV (119 of 603) continues to lead the number of respiratory diagnoses. *E. coli* (127 of 571) continues to lead the number of digestive diagnoses. *S. suis* (35 of 105) continues to lead the number of neurological diagnosis;
- From July 19 to 25, there was a significant increase (signal) in digestive diagnosis;
- From July 5 to 25, there was a significant increase (signal) in the diagnosis of *M. hyopneumoniae*.

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.*

International benchmarking of key performance indicators in pork production: 2019

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Who are the world's best pork producers, and why? Data from an international benchmarking network known as InterPIG and data from experts and published sources in China and Japan were used to address that question. The data from InterPIG is assembled annually by representatives from seventeen countries in Europe, North America, and Brazil in South America. The representatives are from producer organizations, scientific or governmental institutions. The result reported here are for 2019, the most recent available from InterPIG. The data for China and Japan was obtained with help from Merck Animal Health's technical, marketing, and sales staff. If "best" is defined by the lowest cost of production on a per kg of pork basis, then producers in Brazil, The United States (USA), and Canada lead the way in 2019 (Figure 1) .

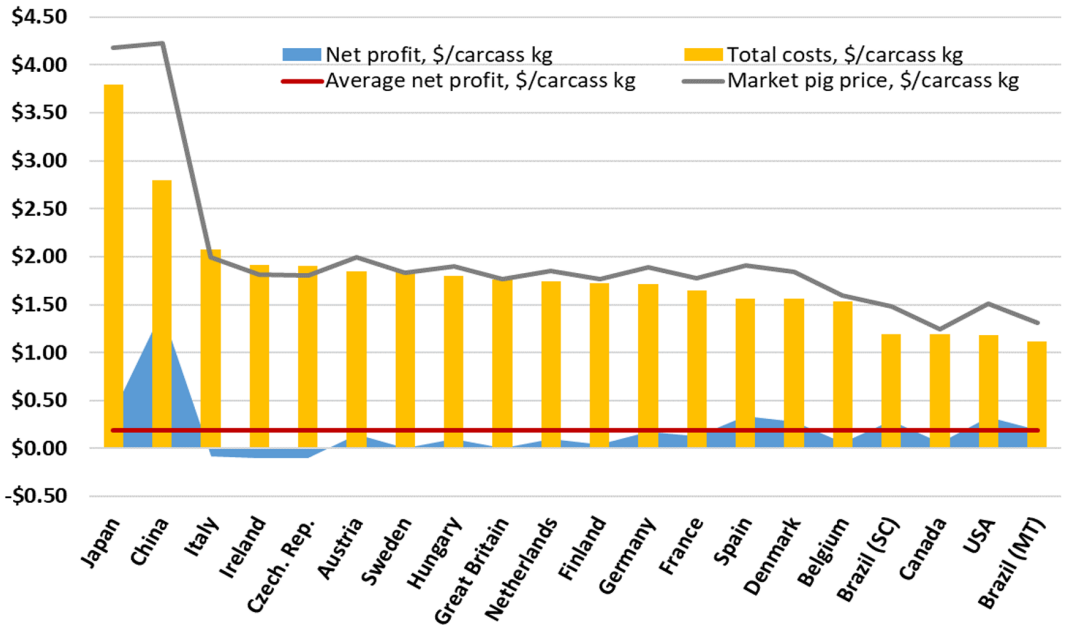

Figure 1. Revenue, cost, and profit per kg of carcass sold by country - 2019. USA: United States. SC: Santa Catarina. MT: Mato Grosso.

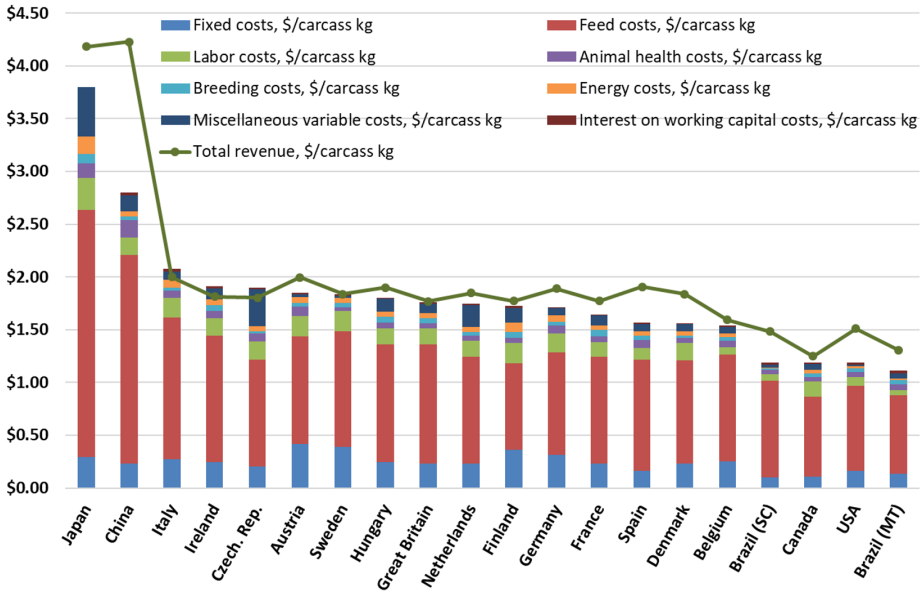

Figure 2. Detailed costs per carcass kg sold by country - 2019. USA: United States. SC: Santa Catarina. MT: Mato Grosso.

If best is defined by the most profitable, producers in China and Japan, with relatively high market pig prices, were on top. Figure 2 shows the total cost per kg of pork by category. The lowest cost producers in North America and Brazil benefited from relatively low feed costs and fixed costs. The USA and Brazil also benefited from relatively low labor costs due to a combination of high labor efficiency (measured by hours of labor required per kg of pork produced) and low wage rates. High feed costs were the primary driver of the high cost of production in China and Japan. Producers in Europe fell in the middle.

Continued: International benchmarking of key performance indicators in pork production: 2019

As measured by kg of pork produced per breeding female per year, the most productive producers were in Italy (Table 1). However, this was because Italian producers raise Italian White hogs that are marketed at very heavy weights for a premium branded ham market. After Italy, producers in the Netherlands, Denmark, Germany, and several other European countries were the most productive by marketing a relatively high number of pigs per female per year.
The correlation coefficients (CC) reported at the bottom of Table 1 measure how closely the kg of pork produced per breeding female per year was associated with each production metric and indicate their relative contribution to the productivity of sows in each country. The kg of pork produced per female is the product of the number of pigs marketed per female per year and the average market weight. Of the two, the number is pigs marketed per female per year (CC=0.65) contributes more to sow productivity than average market weight (CC=0.58). The productivity measures that contribute to the number of pigs marketed, average market weight, and overall sow productivity are also reported in Table 1. Of those, mortality from wean-to-market (CC=-0.55) and the number of pigs born alive per litter farrowed (CC=0.59) contribute the most to sow productivity. The correlation between mortality (preweaning and wean-to-market) and sow productivity was expected to be negative. However, because preweaning mortality is positively correlated with the number of pigs born alive per litter farrowed, it is also positively correlated with sow productivity. Countries with high born alive per litter tend to have higher preweaning mortality, but overall sow productivity was still relatively higher than in countries with fewer pigs born alive.

	Litters farrowed / female / year	Pigs born alive / litter farrowed	Prewean mortality (% of pigs born alive)	Mortality (% of pigs placed)	Average daily gain (kg / day)	Number of pigs marketed per year (pigs/female/year)	Average live weight at end of phase (kg / pig)	Total carcass weight of pork marketed per year (kg/female/year)
Italy	2.22	12.75	12.2%	6.6%	0.63	23.2	170.0	3,234
Netherlands	2.33	14.80	12.7%	4.7%	0.71	28.7	122.3	2,779
Denmark	2.26	17.45	14.8%	6.9%	0.78	31.3	114.8	2,741
Germany	2.30	15.50	16.0%	5.8%	0.71	28.2	122.3	2,719
Czech. Rep.	2.29	15.02	10.5%	6.5%	0.76	28.9	119.0	2,706
Belgium	2.27	14.37	11.2%	7.4%	0.61	26.8	116.1	2,638
France	2.35	14.65	14.6%	6.5%	0.69	27.5	120.8	2,603
Finland	2.25	14.80	14.5%	5.0%	0.77	27.0	122.8	2,523
Canada	2.30	13.00	15.3%	5.4%	0.74	24.0	130.1	2,476
Hungary	2.36	12.82	8.2%	4.3%	0.61	26.6	115.0	2,467
Brazil (SC)	2.32	13.14	7.9%	4.4%	0.72	26.9	120.0	2,449
USA	2.47	13.20	14.6%	8.5%	0.74	25.5	128.0	2,436
Sweden	2.23	14.80	17.7%	3.7%	0.80	26.2	122.7	2,397
Ireland	2.28	14.12	11.3%	5.5%	0.72	27.0	113.5	2,367
Austria	2.29	12.80	13.8%	4.8%	0.69	24.0	121.5	2,332
Brazil (MT)	2.41	13.15	10.6%	5.4%	0.71	26.8	110.0	2,242
Spain	2.30	13.96	13.9%	9.1%	0.63	25.1	115.0	2,211
Great Britain	2.27	13.80	12.3%	7.0%	0.71	25.5	110.5	2,196
Japan	2.38	12.23	10.5%	12.8%	0.65	22.7	115.0	1,718
China	1.91	10.64	9.1%	10.0%	0.66	16.6	115.0	1,433
Correlation (w/carcass weight marketed per year)	0.33	0.59	0.30	-0.55	0.15	0.65	0.58	

Table 1: Productivity by country — 2019.

Highlights:

- Brazil, the United States, and Canada had the lowest cost of production on a per kg of pork basis in 2019;
- Whereas China and Japan were the most profitable producers;
- Italy had the most production measured by kg of pork produced per breeding female per year;
- Netherlands, Denmark, Germany, and several other European countries were the most productive by marketing a relatively high number of pigs per female per year.

Acknowledgment: *This global swine benchmarking study was funded by Merck Animal Health.*