Swine Disease Reporting System
Report 19 (September 3rd, 2019)

What is the Swine Disease Reporting System (SDRS)?

SDRS includes multiple projects that aggregates 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 endemic and emerging diseases affecting the swine population in the USA, assisting veterinarians and producers to make 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 interpretation of the data observed, and summarize the implications to the industry. Major findings are also discussed in monthly podcasts. All SDRS programs are available at www.fieldepi.org/SDRS:

Swine Health Information Center (SHIC)-funded Domestic Disease Surveillance Program: collaborative project among multiple VDLs, with the goal to aggregate swine diagnostic data and report in an intuitive formats (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, Leticia Linhares, Bret Crim, Poonam Dubey, Kent Schwartz, Eric Burrough, Phillip Gauger, Rodger Main, Daniel Linhares**.

* Project coordinator (trevisan@iastate.edu). ** Principal investigator (linhares@iastate.edu).

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

Kansas State University: Rob McGaughey, Eric Herrman, Gregg Hanzlicek, Douglas Marthaler, Jamie Henningson.

South Dakota State University: Shivali Gupta, Jon Greseth, Travis Clement, Jane C. Hennings.

Disease Diagnosis System: This is a pilot program with the ISU-VDL, which consists of reporting *disease detection* (not just pathogen detection by PCR), based on diagnostic codes assigned by veterinary diagnosticians.

FLUture: This is a project that aggregates *Influenza A virus (IAV) diagnostic data* from the ISU-VDL, including test results, metadata, and sequences.

PRRS virus RFLP report: Benchmarks patterns of PRRSV RFLP type detected at the ISU-VDL over time, USA state, specimen, and age group.

Audio and video reports: Key findings are summarized monthly in a conversation between investigators, and available in form of an 'audio report', and "video report" though YouTube.

Advisory Council:

The advisory group reviews the data to discuss it and provide their comments to try to give the data some context and thoughts about its interpretation: Clayton Johnson, Emily Byers, Mark Schwartz, Paul Sundberg, Paul Yeske, Rebecca Robbins, Tara Donovan, Deborah Murray, Scott Dee, Melissa Hensch.

This report is an abbreviated version of the content available online at www.fieldepi.org/SDRS.

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

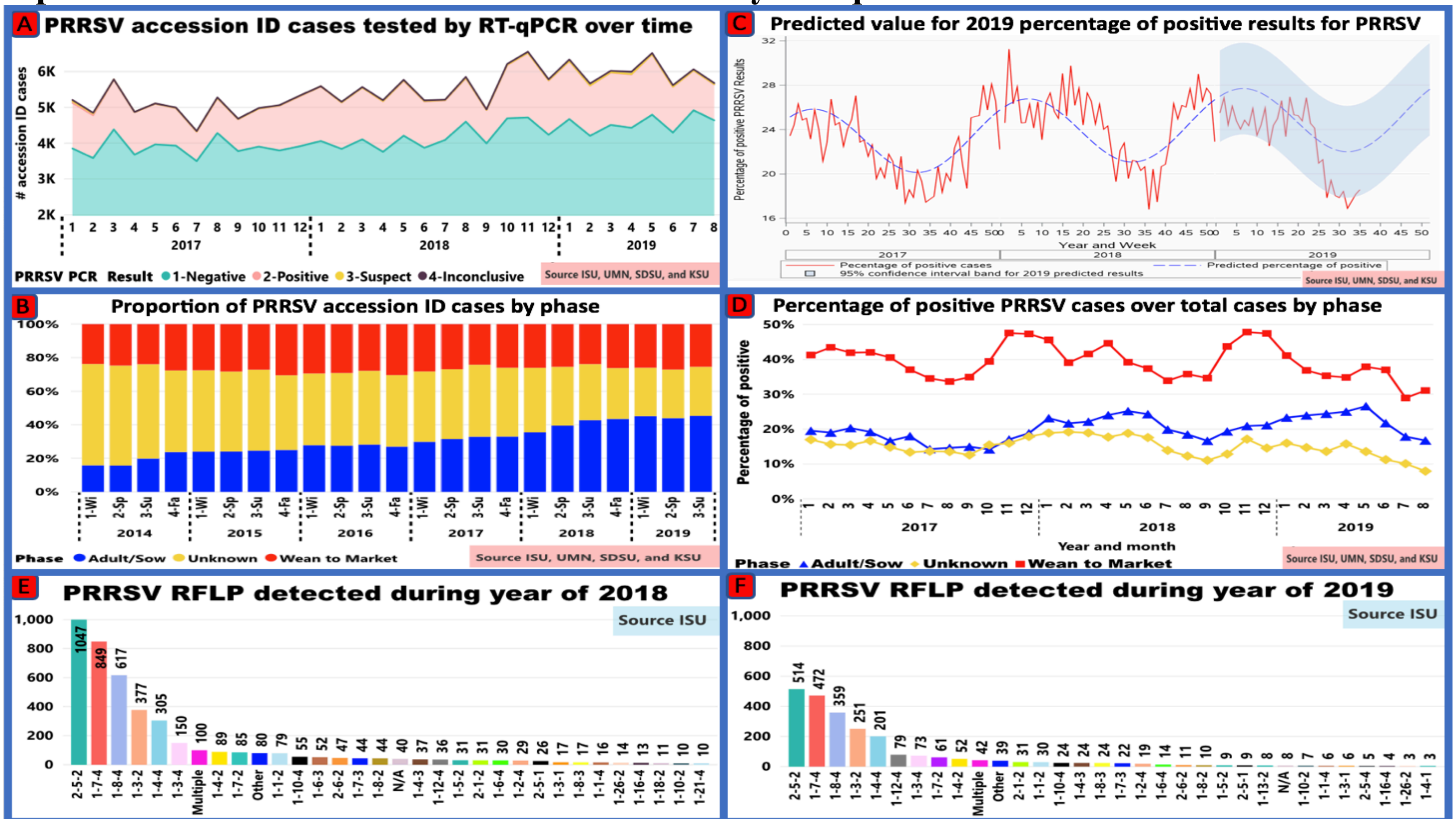

Figure 1. A: Results of PRRS RT-qPCR cases over time. **B**: Proportion of accession ID cases tested for PRRSV by age group per year and season. **C**: expected percentage of positive results for PRRSV RNA by RT-qPCR, with 95% confidence interval band for predicted results based on weekly data observed in the previous 3 years. **D**: percentage of PRRS 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. **E**: RFLP type detected during year of 2019. **F**: RFLP type detected during year of 2018. RFLPs indicated as N/A represents not detected, or European PRRSV type.

SDRS Advisory Council highlights:

- During August the PRRSV activity was at the lower boundaries for the predicted value for 2019;
- The percentage of positive cases from wean-to-market age category in August was 31.06% (it was 28.95% in July);
- Altogether, age categories adult/sow and unknown represented 75.51% of all PRRSV RNA RT-qPCR testing and both had the smallest percentage of positive results for the year of 2018/2019 at 16.72% and 7.93% respectively;
- Increased use of vaccines has been pointed by the advisory council as a potential contributor for higher detection of PRRSV in wean-to-market, but this is not consistent with sequencing patterns detected at the ISU-VDL. Detection of wild-type PRRSV (< 99% similarity with attenuated vaccines) in wean-to-market cases was less frequent in the initial winter months of 2019 compared to 2018 (69.29% vs 73.73%). It was also lower in the spring of 2019 compared to 2018 (63.95% vs 71.87%). However, for summer months the detection of wild-type strains was-higher in 2019 compared to same period of 2018 (62.37% vs 56.97%), suggesting recent elevation of pressure of wild type infection in that age group;
- Multiple factors were pointed by the Advisory Council as potential contributors for the recently increased detection of PRRSV in wean-to-market cases: a) decreased compliance and biosecurity protocols on truck washing sites during summer months; b) Lateral contamination of finishing sites; c) Existent, despite in lower incidence compared with previous years, summer breaks in sow farms; d) Sow farms unable to eliminate the virus (and/or taking longer time than typical), contributing for PRRSV spread to grow-finishing sites.

Topic 2 – Detection of enteric coronaviruses by RT-qPCR

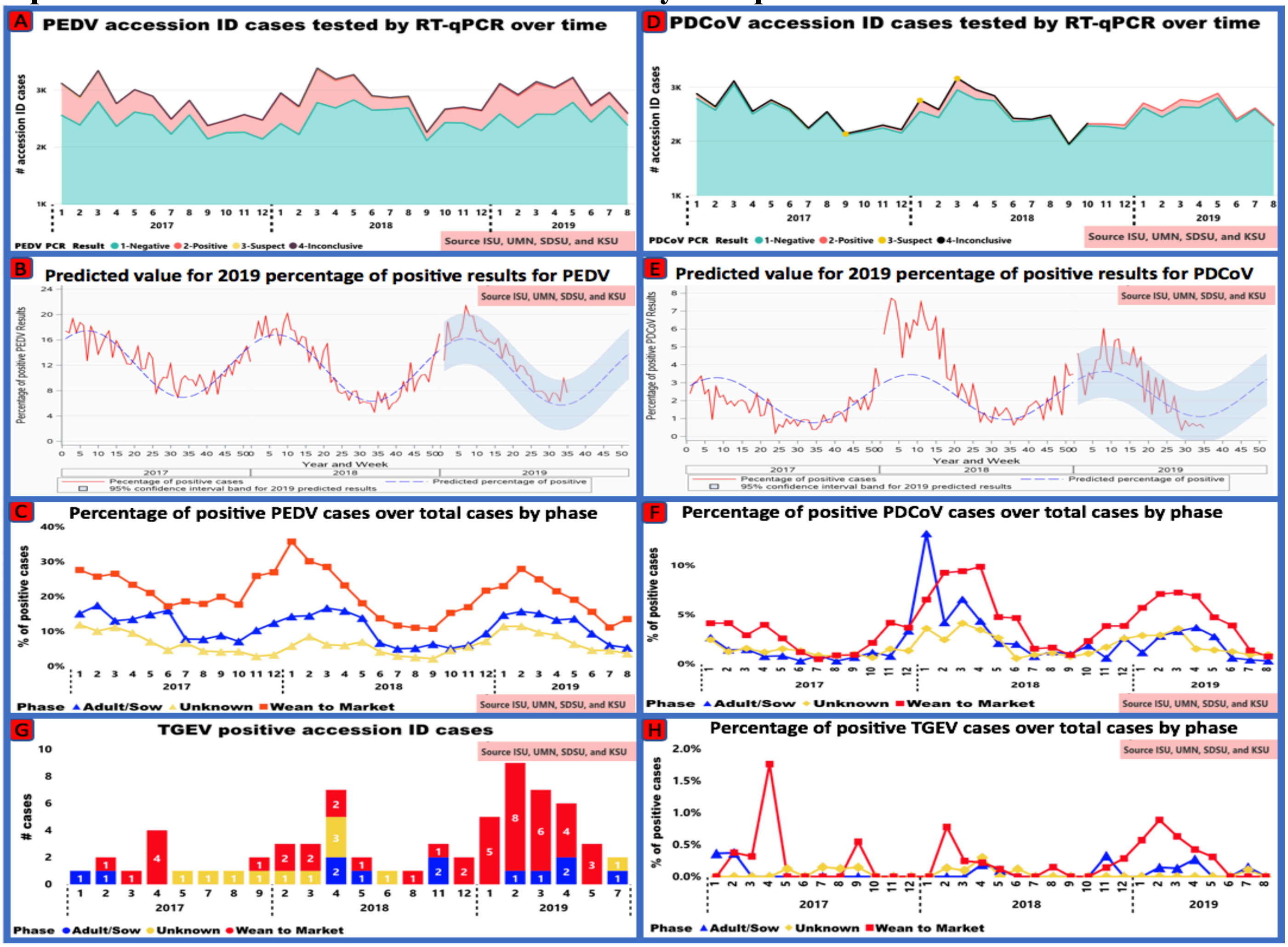

Figure 2. A: results of PEDV RT-qPCR cases over time. **B**: expected percentage of positive results for PEDV by RT-qPCR and 95% confidence interval for 2019 predicted value. **C:** percentage of PEDV PCR-positive results, by category over time. **D**: results of PDCoV RT-qPCR cases over time. **E**: expected percentage of positive results for PDCoV by RT-qPCR and 95% confidence interval for 2019 predicted value, based on weekly data observed in the previous 3 years. **F:** percentage of PDCoV PCR-positive results, by age category over time. **G**: number of PCR-positive accession ID results of TGEV by age category. **H**: percentage of PCR-positive results for TGEV by age category. Each color represents one distinct age category.

SDRS Advisory Council highlights:

- The level of detection of PEDV RNA during week 34 (August 18th to 24th) was slightly above the expected value for this period of the year;
- Wean-to-market represented 37.2% of the PEDV testing in August and the percentage of positive results increased from 11.15% in July to 13.56% in August;
- The level of detection of PDCoV RNA was within the expected values for August, with an overall monthly percentage of positive results at 0.69% (16 positive cases) among 2,309 tested cases;
- There were no positive cases for TGEV over a total of 2,235 cases tested in August (28.28% of cases tested were from breeding herds, and 34.41% of cases from grow-finish sites);
- Similar to PRRSV, two factors were pointed by the Advisory Council as potential contributors for the recent increase in detection of PEDV in the age category wean-to-market: a) Presence of herds seeking stability instead of elimination; b) Less compliance to biosecurity protocols on truck washing sites during summer months.

Topic 3 – Detection of MHP by PCR

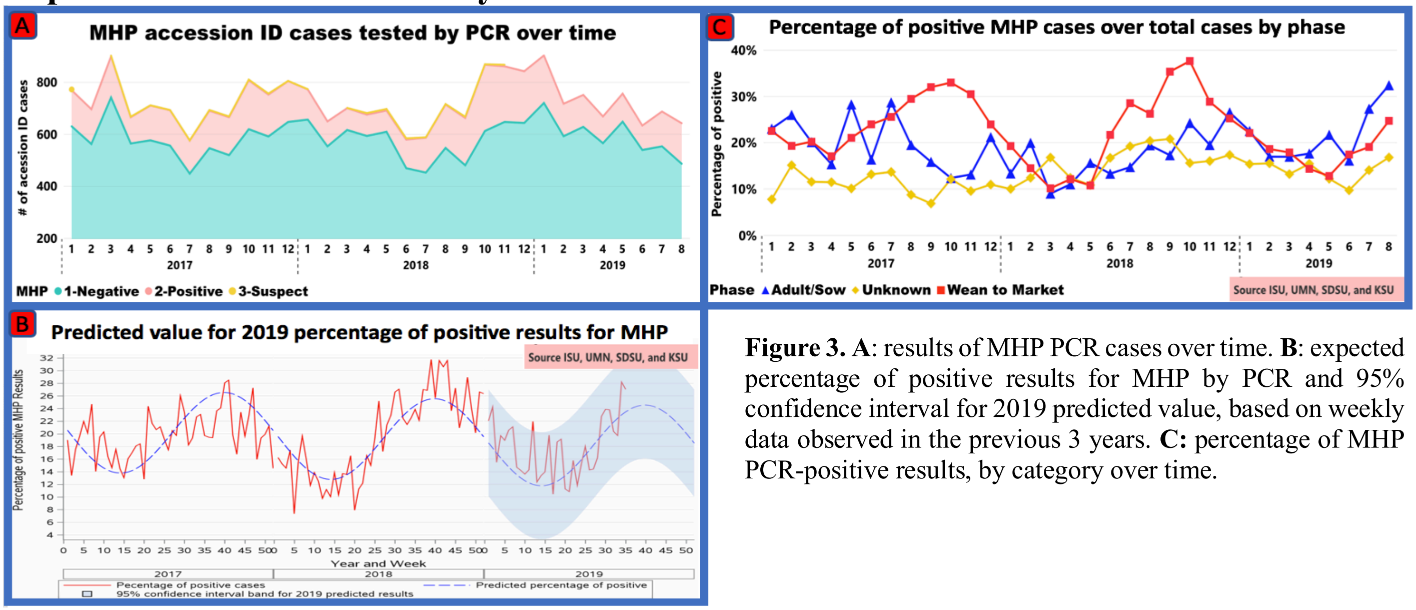

Figure 3. A: results of MHP PCR cases over time. **B**: expected percentage of positive results for MHP by PCR and 95% confidence interval for 2019 predicted value, based on weekly data observed in the previous 3 years. **C:** percentage of MHP PCR-positive results, by category over time.

SDRS Advisory Council highlights:

- There was a trend of increasing the level of detection of *Mycoplasma hyopneumoniae* DNA in all age categories. However, the increased detection for this period of the year is more accentuated for the age category adult/sow farms;
- The advisory group reminds that more sensitive techniques for *Mycoplasma hyopneumoniae* detection by PCR have been recently reported by multiple researchers and practitioners (i.e. deep tracheal and/or laryngeal sampling). This may have contributeds for the increased detection of the pathogen. In other words, the increased detection can be a reflection of better testing and techniques and not necessarily signaling and out of normality bacterial activity;

This month the advisory month was inquired if the USA swine industry should take advantage of low detection of TGEV and PDCoV for an elimination program. As expected from a multidisciplinary group there were different opinions, which can be summarized as:

- There is the need to start eliminating pathogens from the US swine industry. TGEV may be a good start even though it currently has a low impact in the industry as a whole, and does not affect trade. Anyways, could be a good exercise to get the industry together in an effort of this magnitude.
- PDCoV has a higher production impact, with the seasonal spikes in detection levels along with PEDV. Tackling both agents at the same time would be worth for the industry, even though there are potential difficulties due to existence of replacement gilts receiving field exposure for PEDV, and not rare events of truck contamination at the packing plant transferring both agents back to the field;

Topic 4 – Disease diagnosis at ISU-VDL

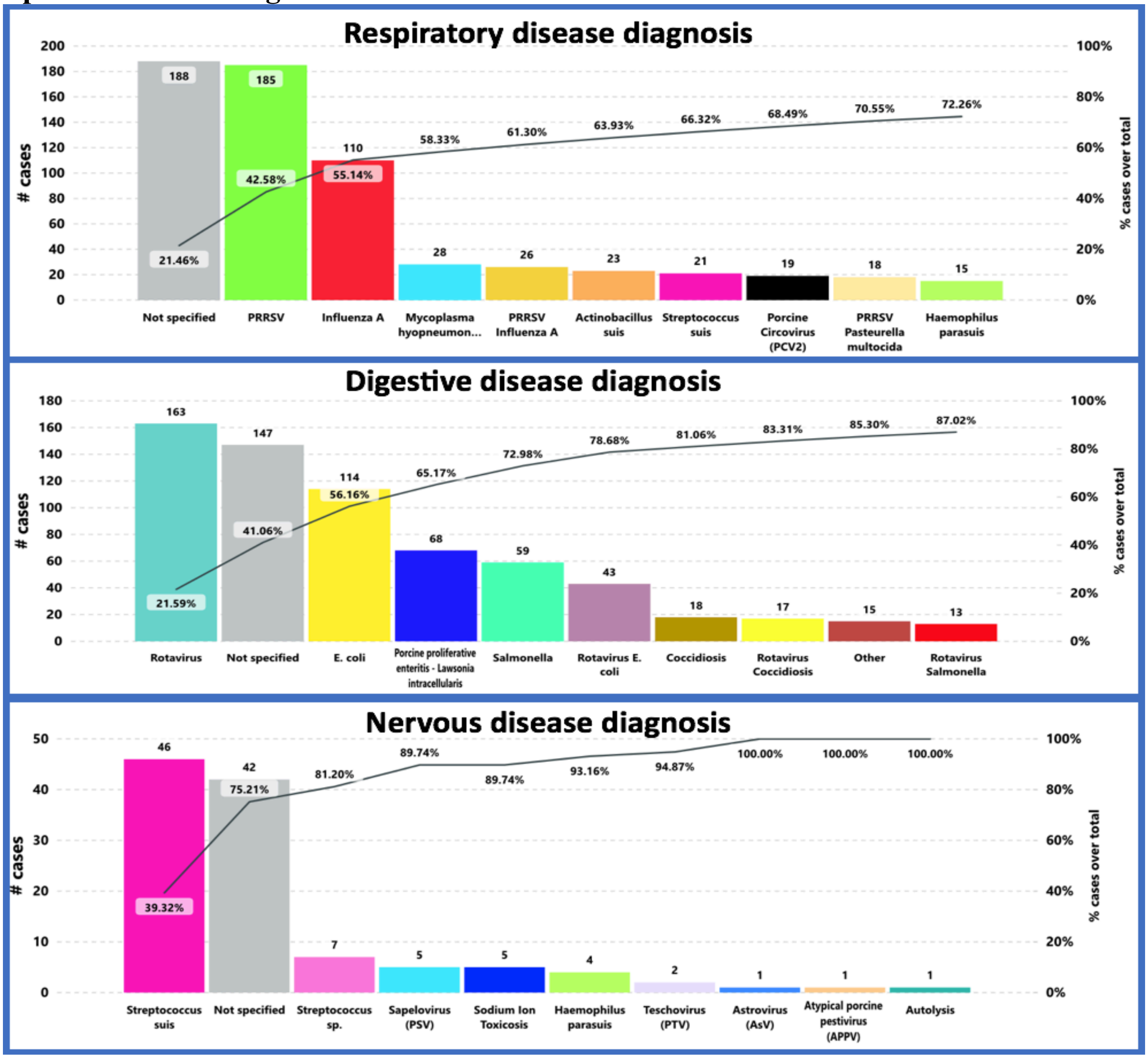

Figure 5. Most frequent disease diagnosis by physiologic system at ISU-VDL . Presented system is described in the title of the chart. Presented information corresponds to 2019 summer months (June, July, August). Colors represent one agent and/or the combination of 2 or more agents. Only the physiologic systems with historic number of cases per season above 100 are presented in the report. Information for other systems can be accessed online at www.fieldepi.org/diagnosis

SDRS Advisory Council highlights:

- In August there was no disease diagnosis alert signals detected for the following monitored systems: nervous, urogenital, digestive, repiratory, systemic, musculoskeletal, and cardiovascular-blood-endocrine-immune. In other words, the number of cases having each disease diagnosis was within the expected based on historic data;
- A signal for integument cases was detected at the beginning of August, but they were related to unspecific findings, and not associated with the detection of a particular pathogen.

Bonus page

Monitoring swine disease detection at ISU-VDL - the algorhitms behind scenes

Giovani Trevisan, Kent Schwartz, Edison Magalhães, Leticia Linhares, Bret Crim, Poonam Dubey, Eric Burrough, Rodger Main, Daniel Linhares

On report 18th the SDRS brought to live a new format to report disease detection at ISU-VDL. The dynamic dashboards are available at www.fieldepi.org/SDRS. Starting on this month the SDRS reports are going to report under topic # 4 disease detection by physiologic systems including respiratory, digestive, nervous, systemic, urogenital, and others. Only systems previous reported in the SDRS will be reported. Based on these criteria charts for urogenital, systemic, integument, cardiovascular-blood-endocrine-immune, and musculoskeletal will not be displayed in the report. Information on the number of disease diagnosis will be used to proactive inform the USA swine industry for increased disease detection within a system and or by an agent.

The monitoring of disease detection comprised a two-step procedure. The first procedure relies on the monitoring of diagnosis by system. The second monitors the diagnosis of the most frequent detected agents.

The procedure for monitoring disease diagnosis by the systems will be based on a model developed by the Center for Disease Control and Prevention (CDC) and named as CDC EARS. The algorithm assists in early identification of outbreaks of diseases. The model uses the last 7 weeks as a baseline and based on statistical calculations defines an outbreak when the number of diagnosis exceeds 3 standard deviations from the expected number of diagnosis. As an example, figure 1 shows the monitoring of the digestive number of diagnosis at ISU-VDL. Outbreaks are noted as triangles in the x-axis . In this example, the triangle signals an outbreak for the increased digestive disease diagnosis. The chart contains 3 alert signals. The first on week 8 (February 17th to 23rd), second on week 25 (June 16th to 22nd) and third on week 28 (July 7th to 13th).

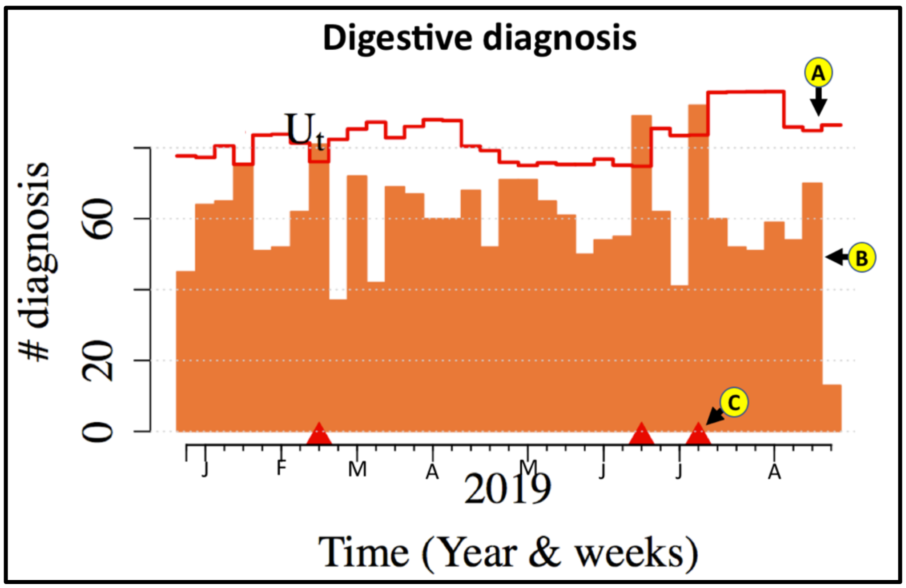

Figure 1. CDC EARS model for the SDRS disease diagnosis monitoring at ISU-VDL. **A)** Weekly upper threshold expected number of cases. **B)** Bars for the real number of cases within a week. **C)** Triangle shape singnaling alert. Letter on the x-axis corresponds to the first week of each month.

An additional algorithm was designed to scan the data for detection of outbreak signal for the major agents. On week 8 there was a signal for higher detection of PEDV. Additionally PEDV alert was detected on week 10. On week 25 and 28 there were signals for increased detection of rotaviruses.

The use of algorithms to scan the diagnosis data will enhance the ability to monitor trends in disease diagnosis over time and agents providing quick and statistical evidence to closely watch the occurrence of specific agents. After a signal is issued there is the need to further investigate and watch the detection in the upcoming weeks. The models will help to request specific input from the advisory council providing more precise information to the USA swine industry. When facing an increased disease diagnosis, reinforcement on disease prevention and control measures can be implemented for better preparedness to deal with the disease.