Using Aggregated Diagnostic Data in Swine Disease Surveillance and Monitoring

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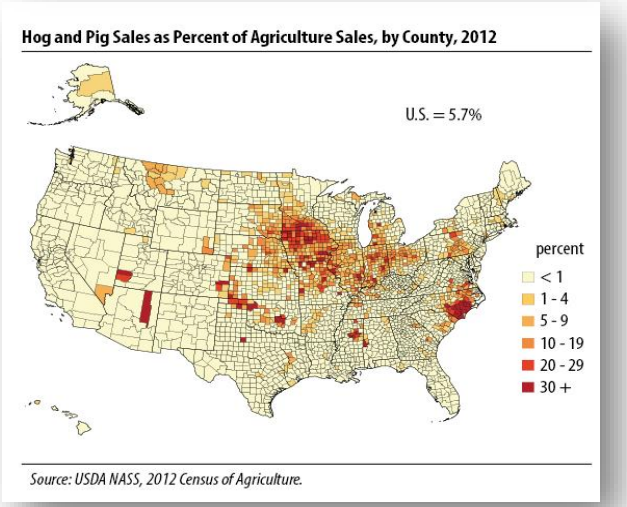
Surveillance vs Monitoring

- While often used interchangeably, there is a difference in intent:
  - Surveillance intends to detect a pathogen if present
    - Often attempts to prove a negative
    - May be used to assess geographic distribution
    - Can be done periodically
    - Is generally 'actionable' if positive
      - *Examples:*
        - *Sick pig surveillance for ASF/CSF*
        - *Processing fluids for PRRSV in a negative herd*
  - Monitoring aims to detect temporal changes or trends
    - Can be pathogen detection or disease expression
    - Typically a process evaluation
    - Is generally performed continually
      - *Examples:*
        - *M. hyopneumoniae ELISA in a negative herd*
        - *Processing fluids for PRRSV in unstable herd*

Surveillance Sampling

- What is your specific goal?
  - Confidence can be considered at various levels:
    - Animal
      - Confidence relates solely to test characteristics (DSe, DSp)
    - Round
      - Where multiple animals are tested around the same time by the same method
      - Expected prevalence impacts sampling and confidence
    - Herd
      - One related unit of animals with a geographical area
      - Rounds of testing over time add to confidence
    - Zone
      - All herds within a geographical area (county, state, region, etc.)
  - Type & amount of testing is dependent upon use case



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Surveillance Sampling

- How Many Samples Do I Need?
  - Classic Statistical Tables (Cannon and Roe, 1982)
    - Simple random sampling
      - Assumes perfect tests, homogeneous distribution, binomial distribution
      - Truly random, not just easiest pigs to catch
    - Best for point in time analysis (confirming regional status)
    - May require many samples to achieve desired confidence in a negative
  - Accumulated Temporal Data (Rotolo et al. 2017)
    - Fixed spatial sampling
      - Collect the same location repeatedly [same pen(s) every time]
    - Best for individual herd surveillance
    - Repeated sampling increases confidence with fewer samples

Surveillance Sampling

- Chase and Polson, 2000
  - Based upon Cannon and Roe
    - Extrapolated for large herd sizes
  - This is where the 30 serum samples per month for PRRSV surveillance is derived
    - If PRRSV enters a negative herd, 95% confident that more than 10% will be positive

Table 1

		Population Size (Detecting One or More Positives)										
Prevalence Estimate % Positive	Confidence Level	100	200	400	600	800	1000	2000	4000	6000	8000	10000
>1%	70%	71	92	105	110	113	114	118	120	120	120	121
	80%	81	112	133	142	147	149	155	158	160	160	160
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>5%	70%	22	24	24	25	25	25	25	25	25	25	25
	80%	28	30	32	32	32	32	33	33	33	33	33
	90%	37	42	44	45	45	45	46	46	46	46	46
	95%	45	52	56	57	58	58	59	59	60	60	60
	99%	60	73	82	85	86	87	89	90	91	91	91
>10%	70%	12	13	13	13	13	13	13	13	13	13	13
	80%	16	16	16	17	17	17	17	17	17	17	17
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	95%	26	28	29	29	29	30	30	30	30	30	30
	99%	37	41	43	44	44	44	45	45	45	45	45

Chase and Polson AASV 2000

Surveillance Sampling

- Chase and Polson, 2000
  - Each month is a new “round” of testing on the herd
    - Can combine the confidence of successive rounds
    - Probability that two independent rounds fail to detect a disease is the product of the probabilities from each

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Chase and Polson AASV 2000

Surveillance Sampling

- Per Cannon (2002):
  - Combining confidence levels for rounds of random testing follows the equation:
    - $\gamma = 1 - [(1 - \gamma_1)(1 - \gamma_2)]$
  - Thus, combined confidence (γ) of 2 rounds of 30 serum samples for PRRSV surveillance would yield:
    - γ = 1 – [(1-0.95)(1-0.95)]
    - γ = 0.9975
  - Four rounds (months):
    - γ = 1 –[(0.05)(0.05)(0.05)(0.05)]
    - γ = 0.99999375
  - *One positive detection resets*.

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Cannon, R M. 2002. Demonstrating disease freedom – combining confidence levels. *Prev Vet Med*. 52(3-4):227-49.

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Surveillance Sampling

- How Many Samples Do I Need?
  - Fixed Spatial Sampling (Rotolo et al. 2017)
    - Technically less complex
      - Collect the same location repeatedly
        - same pen(s) every time
      - Amenable to composite samples
    - Similar sensitivity as random sampling

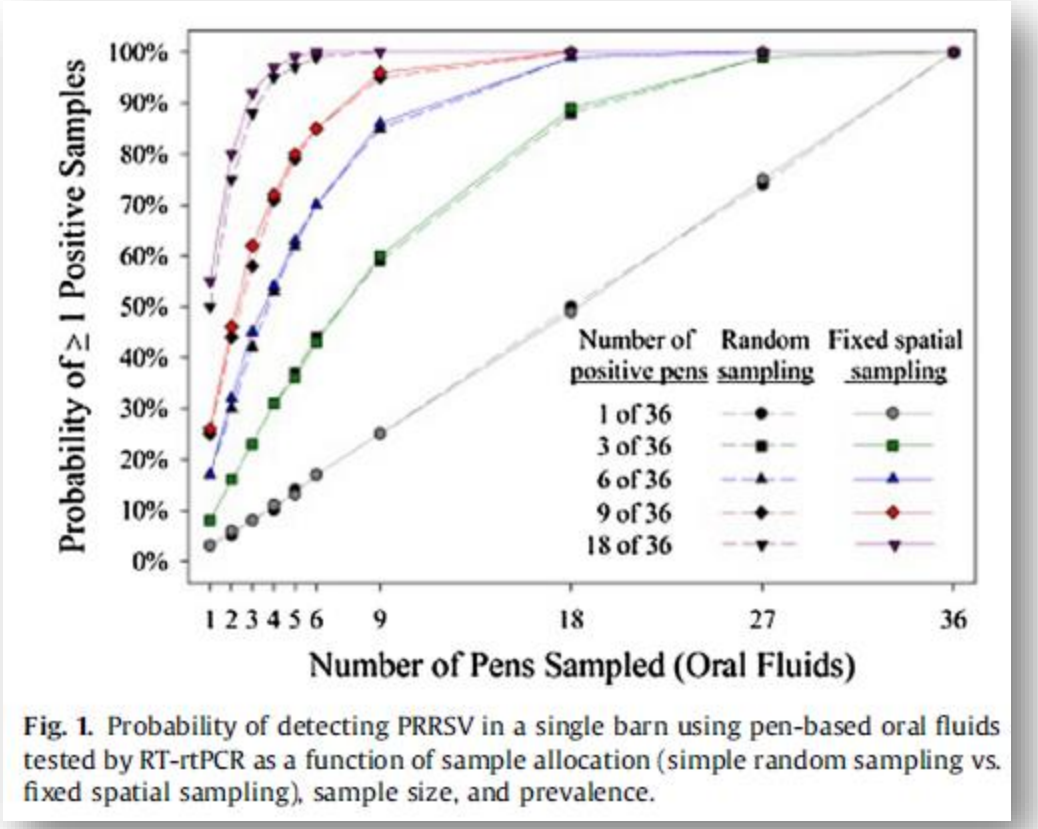

Fig. 1. Probability of detecting PRRSV in a single barn using pen-based oral fluids tested by RT-rtPCR as a function of sample allocation (simple random sampling vs. fixed spatial sampling), sample size, and prevalence.

Rotolo ML, et al. 2017. Sampling guidelines for oral fluid-based surveys of group-housed animals. *Vet Microbiol* 209:20-29.

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Surveillance Sampling

- How Many Samples Do I Need?
  - Fixed Spatial Sampling (Rotolo et al. 2017)
    - In 4 weeks, 95% confidence to detect one positive with 4 or 6 oral fluids / wk
      - 4 x 4 weeks = 16 samples
        - versus 30 sera in one round randomly
    - Number of samples needed would depend upon the expected pathogen dynamics
      - Upper and lower graphs are slower vs faster spread

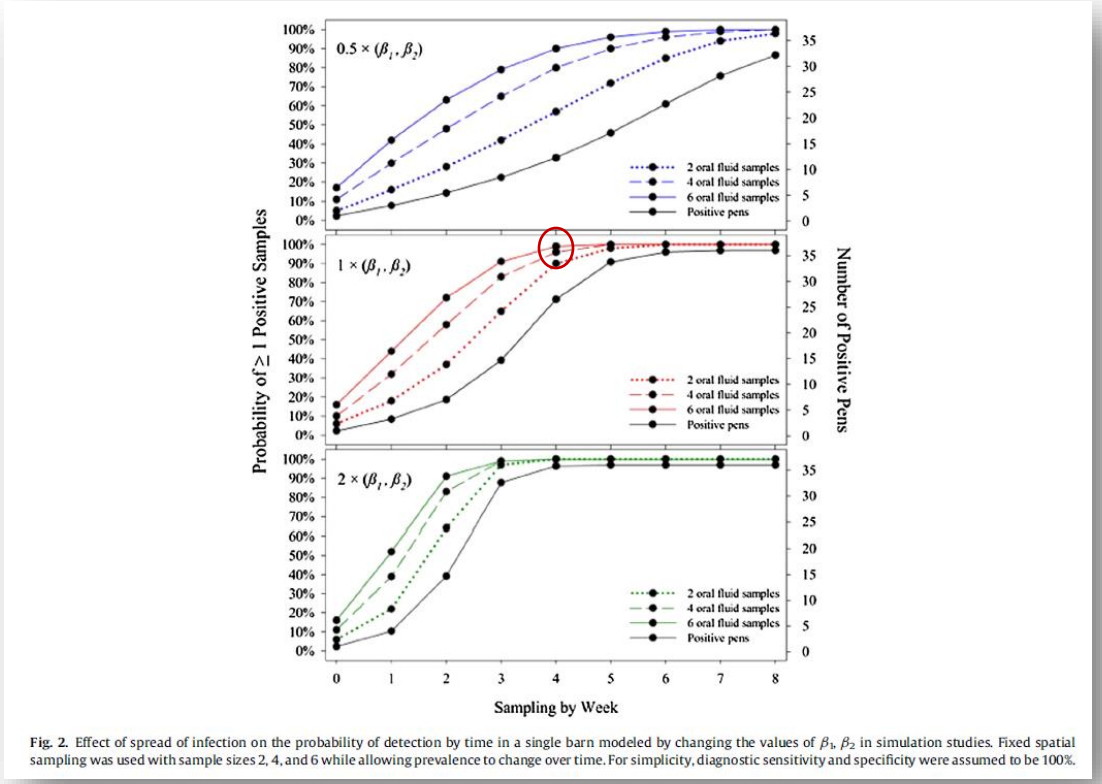

Fig. 2. Effect of spread of infection on the probability of detection by time in a single barn modeled by changing the values of β_1, β_2 in simulation studies. Fixed spatial sampling was used with sample sizes 2, 4, and 6 while allowing prevalence to change over time. For simplicity, diagnostic sensitivity and specificity were assumed to be 100%.

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Surveillance Sampling

- How Many Samples Do I Need?
  - Herd surveillance does not need to be rigid and inflexible (Cannon 2002)
    - Not “one size fits all”
      - Generally, a binary approach (presence/absence)
    - Should be customized to the needs of the user (cost, convenience, speed, etc.)
      - Point in time information or ongoing assessment?
    - Must meet the needs of the customer (replacement stock versus grower/finisher)
    - Can combine different strategies:
      - Random sampling and statistical tables to establish herd or regional status initially
      - Fixed spatial sampling of fewer samples for ongoing surveillance
        - Cumulative rounds of negative testing raise confidence level over time

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Surveillance Sampling

- Potential Application for Dysentery Surveillance on a Sow Farm
  - Subclinical breeding herds likely have low prevalence of *B. hyodysenteriae* <2% (Duff et al. 2014)
    - Traditional surveillance methods require many samples to reach 95% confidence in negative
      - ~145 samples for 2,500 hd
      - Reflects one timepoint
    - Sampling specific subsets can increase detection (lactating animals, just weaned pigs, etc.)

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Duff JW, et al. 2014. Prevalence of *Brachyspira hyodysenteriae* in sows and suckling piglets. *J Swine Health Prod*. 22(2):71-77.

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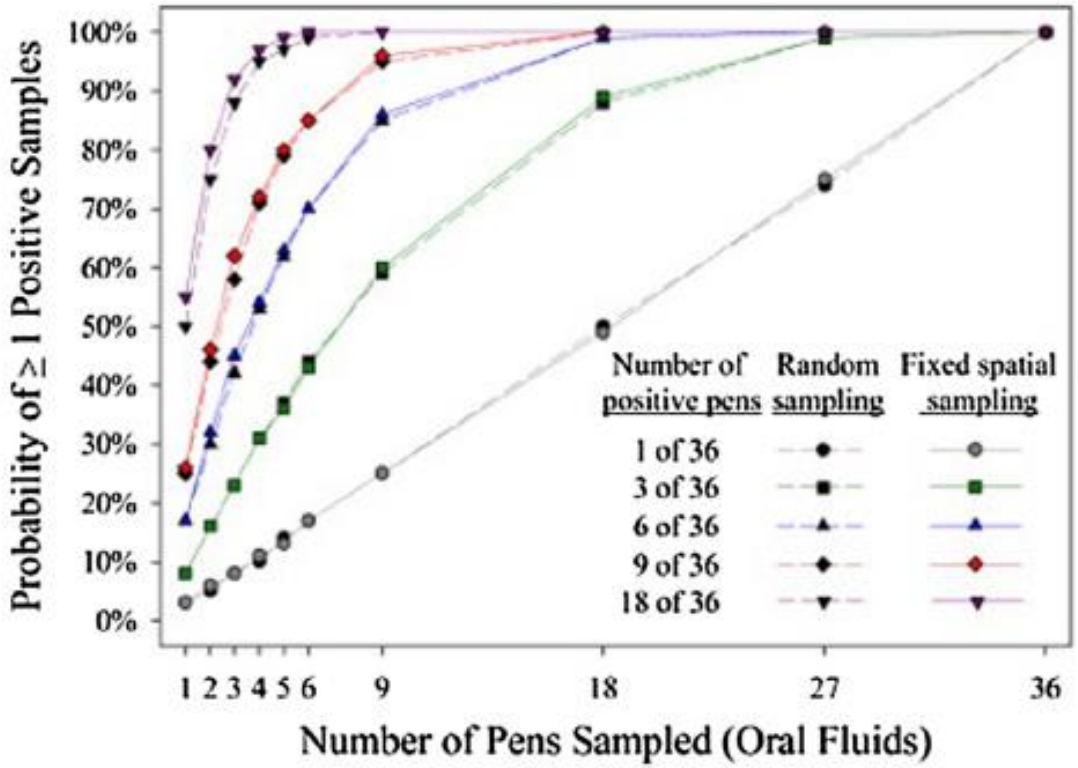
Surveillance Sampling

- Potential Application for Dysentery Surveillance on a Sow Farm
  - How could fixed spatial sampling be used?
    - Select a subset of crates in farrowing
    - Sample the same crates monthly
      - Individual *Brachyspira* culture
      - ± Pooled PCR



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Surveillance Sampling

- Potential Application for Dysentery Surveillance on a Sow Farm
  - How could fixed spatial sampling be used?
    - Select a subset of crates in farrowing (ex. 25)
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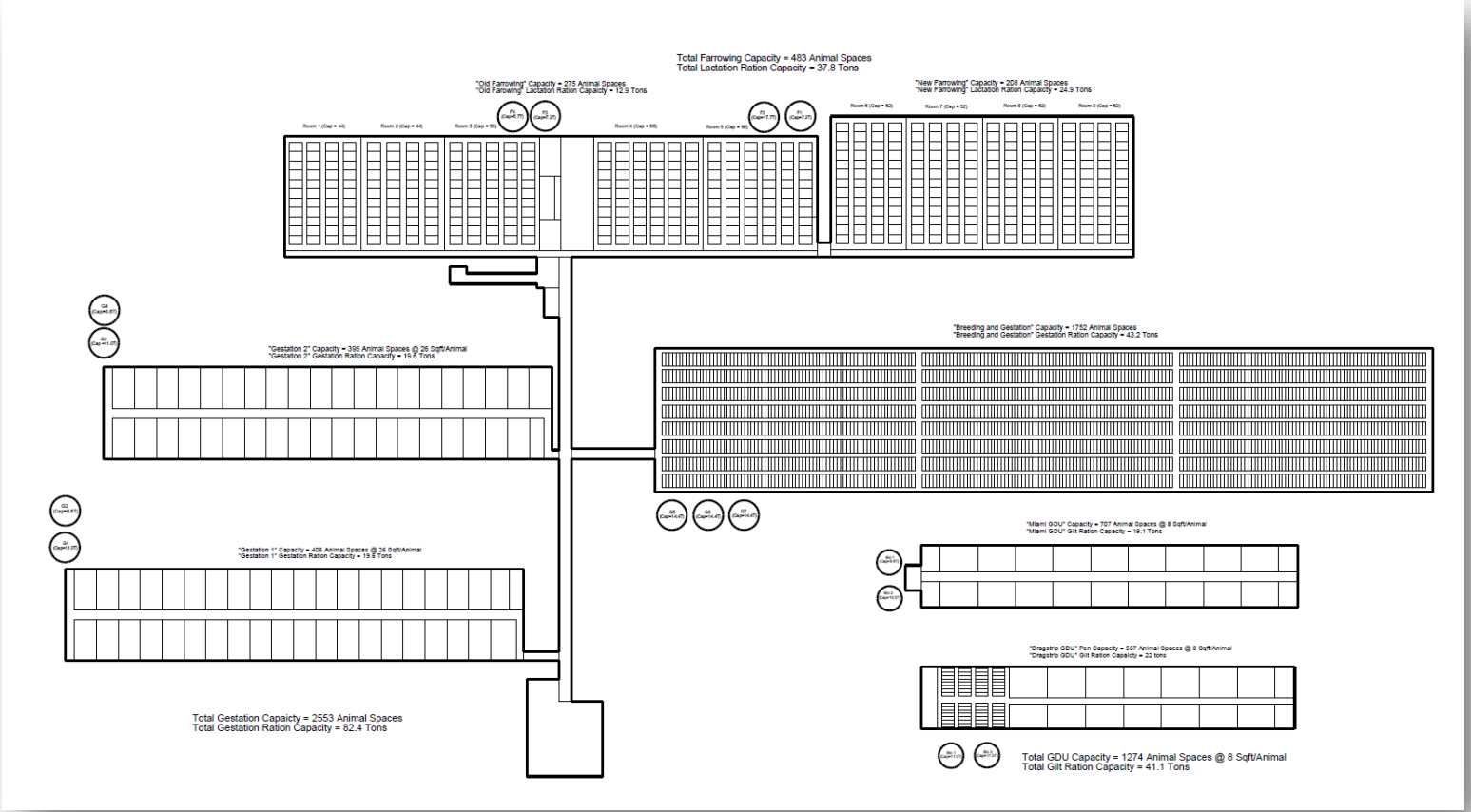

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  - How could fixed spatial sampling be used?
    - Select a subset of crates in farrowing (ex. 25)
    - Sample the same crates monthly
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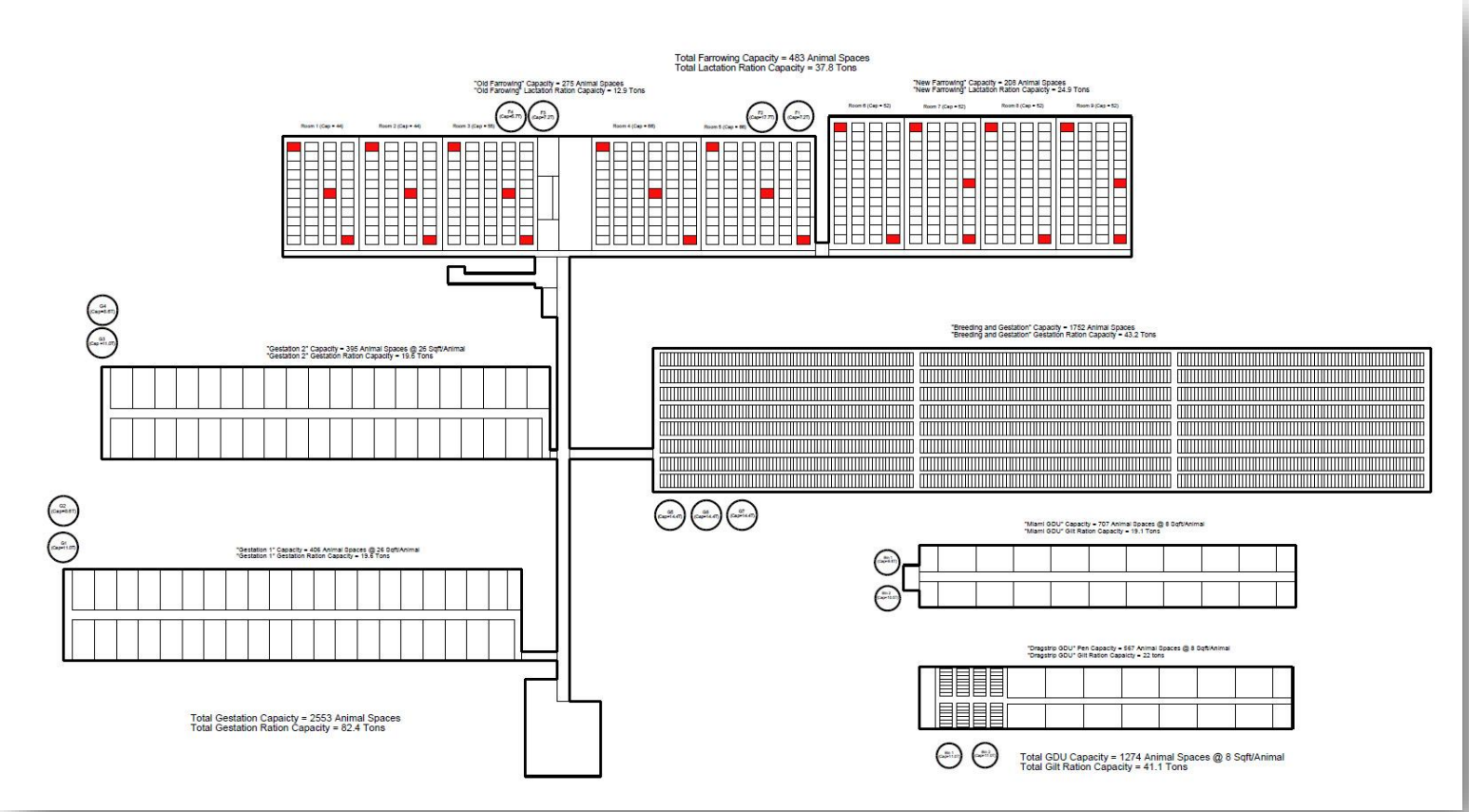
    - So, what is the expected confidence of 25 samples?



Surveillance Sampling

- Potential Application for Dysentery Surveillance on a Sow Farm
  - According to Cannon and Roe (1982):
    - Sampling 25 animals at 2% prev is 60.3% likely to fail to detect (39.7% DSe)
    - Recall the combined confidence eq:
      - $\gamma = 1 - [(1 - \gamma_1)\ (1 - \gamma_2)]$
    - Modify for n = # of repeated rounds
      - $\gamma = 1 - (1 - \gamma_1)^n$
      - $0.95 = 1 - (1 - 0.397)^n$
      - $0.95 = 1 - (0.603)^n$
      - n = ~ 6 months
    - *After 6 months, you may assume with >95% confidence the herd is and remains negative with continued testing*

Table 3: Probability of Failure to Detect Diseased Animals

The table gives the probability of failure to detect diseased animals from an 'infinite' population with the specified proportion of positives in the population.

prevalence	number of animals in sample tested									
	5	10	25	50	75	100	200	250	500	1000
1%	0.951	0.904	0.778	0.605	0.471	0.366	0.134	0.081	0.007	0.000
2%	0.904	0.817	0.603	0.364	0.220	0.133	0.018	0.006	0.000	
3%	0.859	0.737	0.467	0.218	0.102	0.048	0.002	0.000		
4%	0.815	0.665	0.360	0.130	0.047	0.017	0.000			
5%	0.774	0.599	0.277	0.077	0.021	0.006	0.000			
6%	0.734	0.539	0.213	0.045	0.010	0.002	0.000			
7%	0.696	0.484	0.163	0.027	0.004	0.001	0.000			
8%	0.659	0.434	0.124	0.015	0.002	0.000				
9%	0.624	0.389	0.095	0.009	0.001	0.000				
10%	0.590	0.349	0.072	0.005	0.000					
12%	0.528	0.279	0.041	0.002	0.000					
14%	0.470	0.221	0.023	0.001	0.000					
16%	0.418	0.175	0.013	0.000						
18%	0.371	0.137	0.007	0.000						
20%	0.328	0.107	0.004	0.000						
24%	0.254	0.064	0.001	0.000						
28%	0.193	0.037	0.000							
32%	0.145	0.021	0.000							
36%	0.107	0.012	0.000							
40%	0.078	0.006	0.000							
50%	0.031	0.001	0.000							
60%	0.010	0.000								

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      - n = ~ 6 months
    - *After 6 months, you may assume with >95% confidence the herd is and remains negative with continued testing*

<u>Total tests required:</u>

- Traditional (point in time) = 145
- Fixed spatial
  - 25/month * 6months = 150

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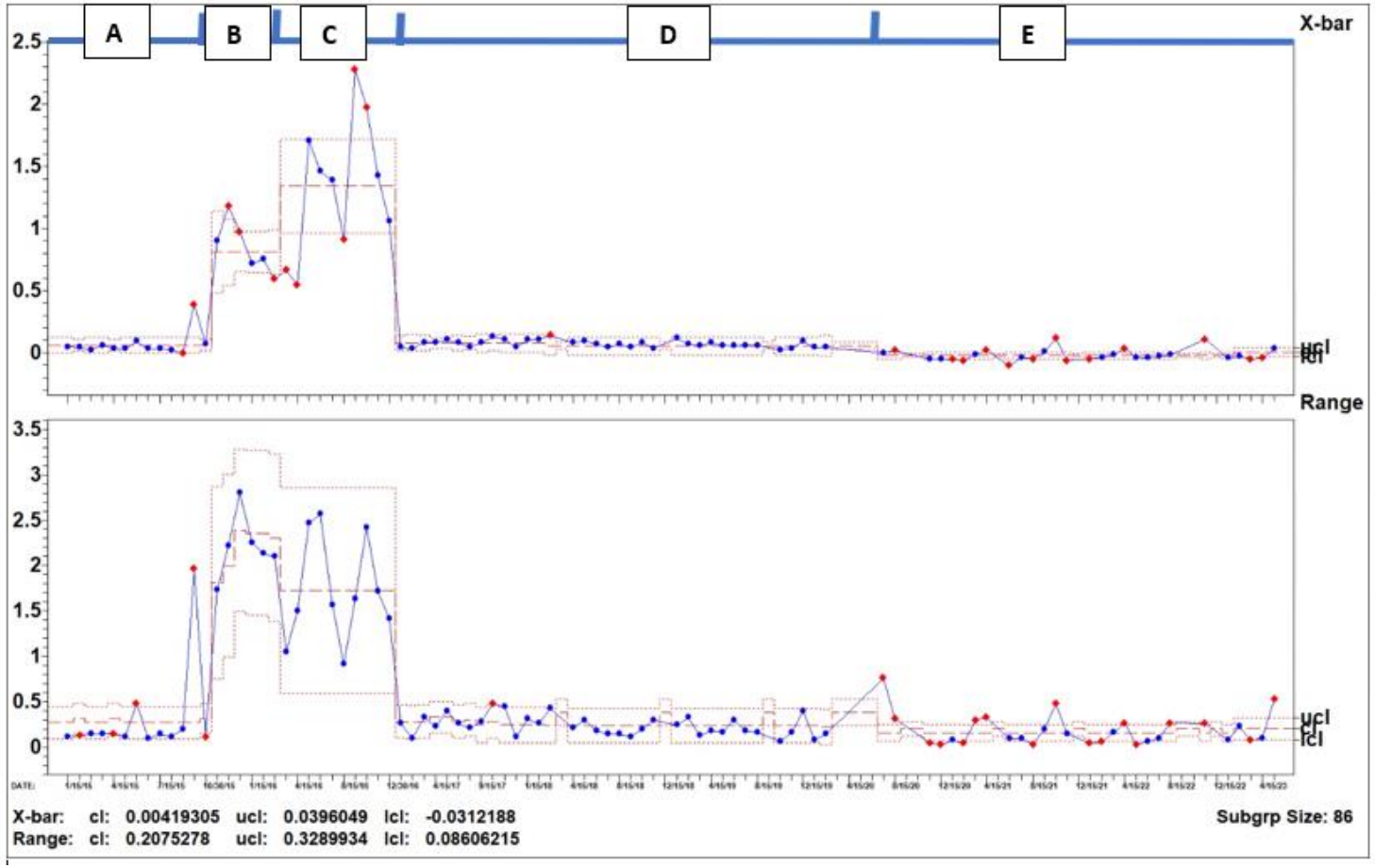
Monitoring

- If a herd is known to be positive for a given pathogen, or vaccinated, it may be desirable to temporally monitor quantitative data
  - ELISA or PCR results

- Specific Process Control (SPC) Charts
  - Well-suited for aggregated quantitative diagnostic data of individual pathogens
    - Looking for variation, loss of stability
  - Several commercial software packages:
    - Northwest Analytics Quality Analyst
      - https://www.nwasoft.com/products/nwa-quality-analyst
    - Microsoft Excel

Monitoring

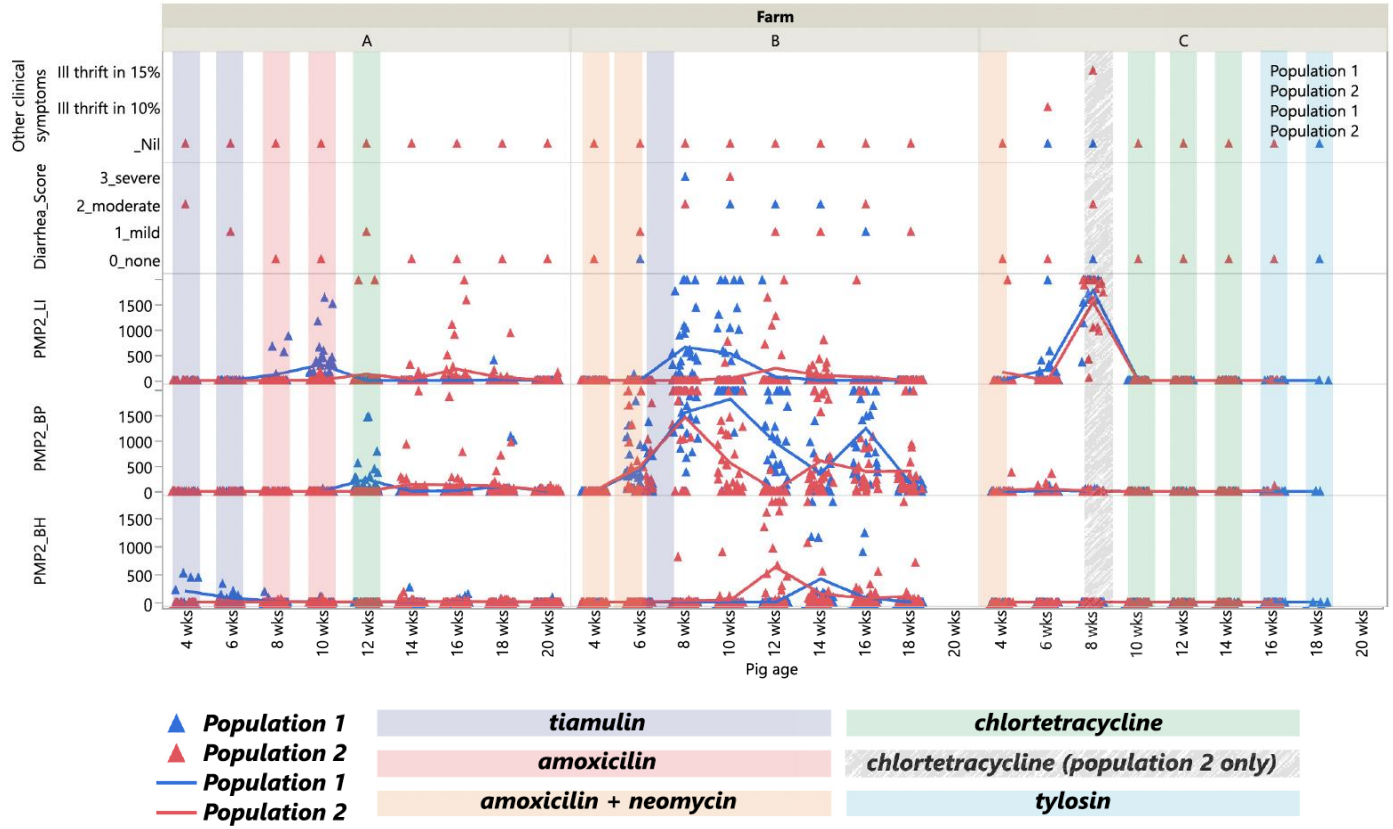
- SPC Chart for Mhp ELISA
  - Results are reported as S/P
    - *positive/negative cutoff is 0.5*
  - The charts' three-sigma limits recalculate when a new method is introduced or if a change in output average is detected
  - A = Mhp negative
  - B = Acute Mhp infection
  - C = Herd closure + vaccination
  - D = Depop / repop
  - E = Unstable variation
    - Needs investigating



Monitoring

- PCR Panels for Endemic Pathogens
  - Copy number or Ct values can be used to estimate pop pathogen burden
  - Useful for composite samples over time
    - Oral fluids, feces
  - Consistency of sampling is important
  - Indirect assessment of mitigation effectiveness
    - Unexpected spikes warrant investigation

Pork MultiPath™ Enteric panel (PMP2) results



Gerszon J, et al. 2024. The use of oral fluids and sock samples for monitoring key pathogens in pig populations for surveillance purposes. *Prev Vet Med* 228:106237.

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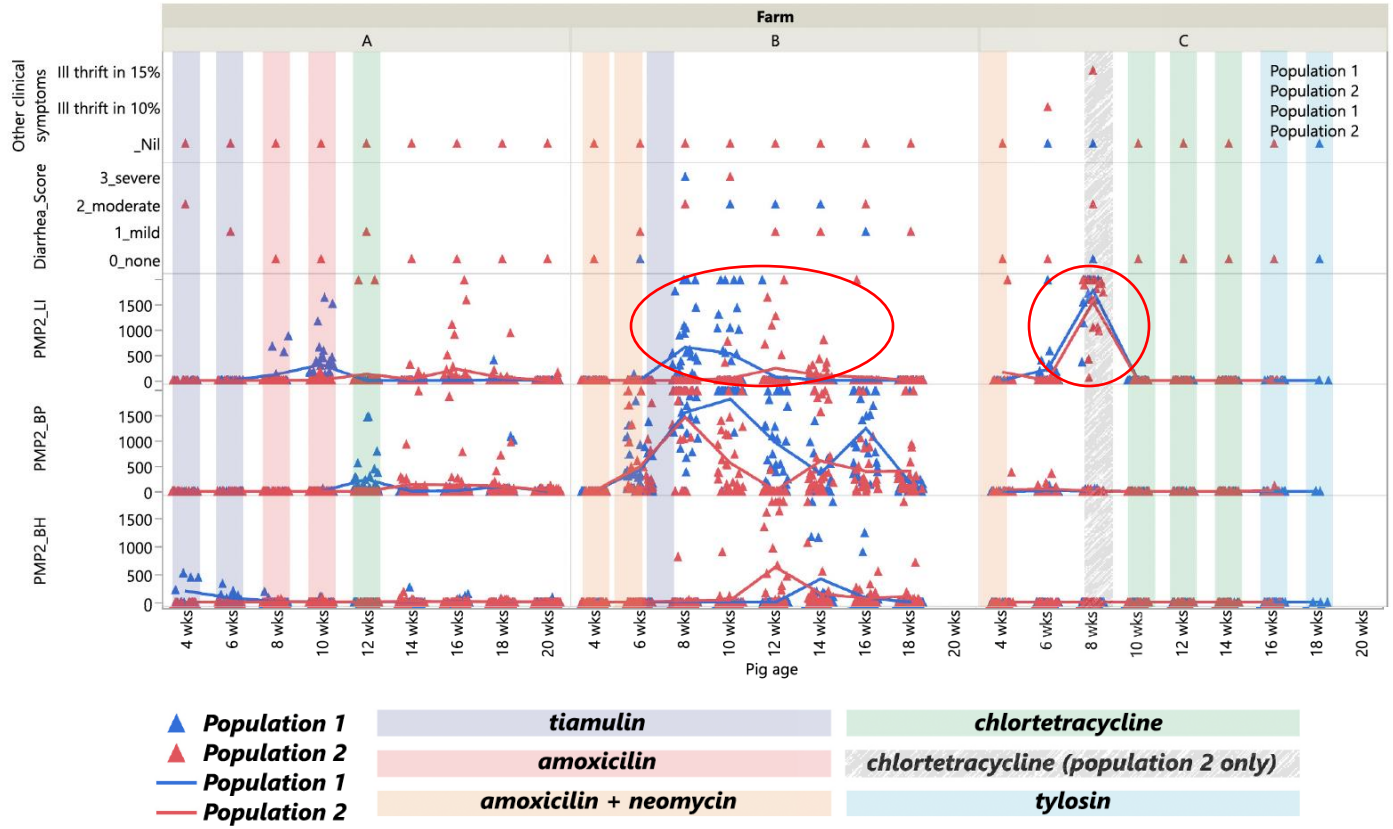
Monitoring

- PCR Panels for Endemic Pathogens
  - Will generate more questions than answers
    - Requires knowledge of the herds behind the data
    - What do these *Lawsonia* detections reflect?
      - Is live vaccine used?

Pork MultiPath™ Enteric panel (PMP2) results



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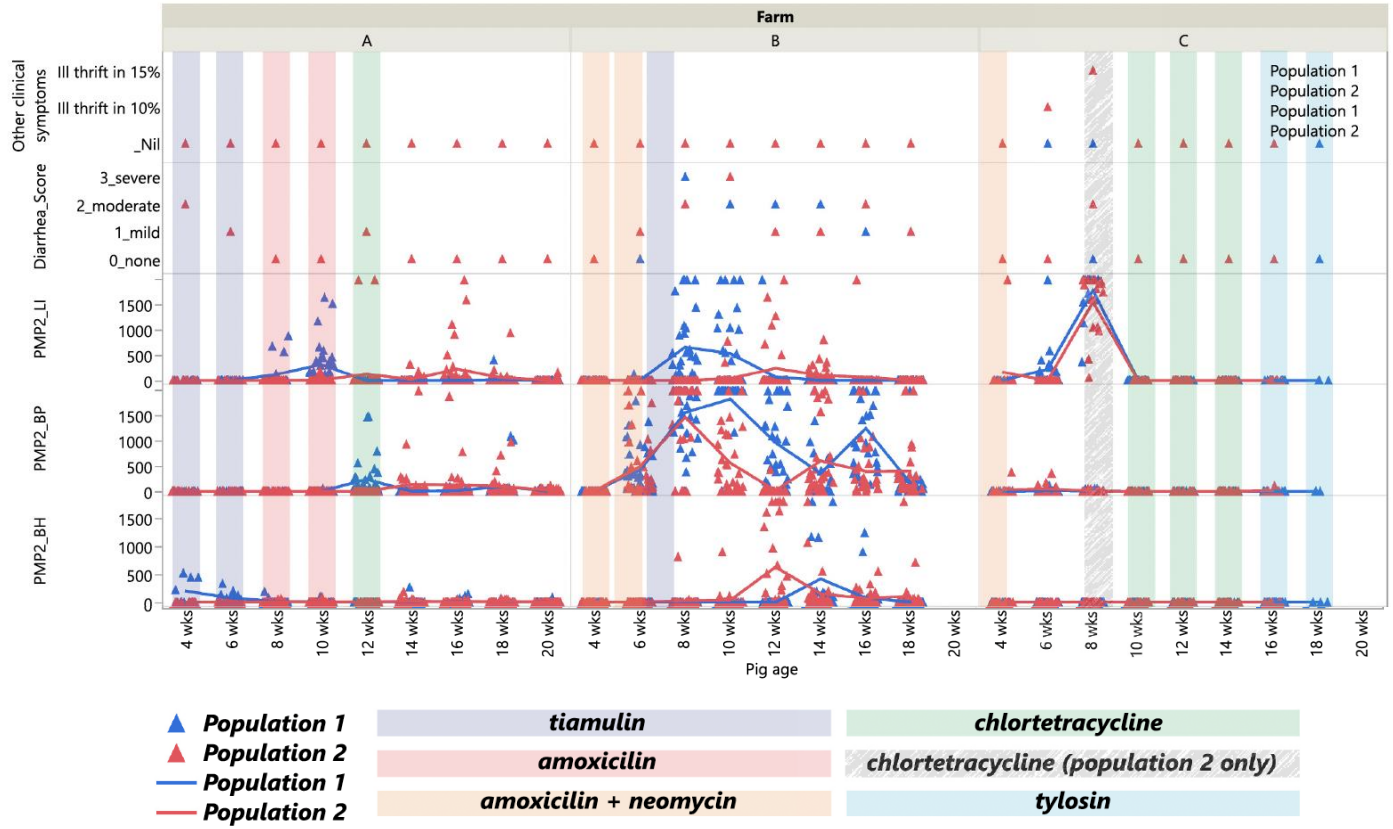
Monitoring

- PCR Panels for Endemic Pathogens
  - Will generate more questions than answers
    - Requires knowledge of the herds behind the data
    - What do these *Lawsonia* detections reflect?
      - Is live vaccine used?
    - *B. pilosicoli* appears tiamulin resistant
      - Is this spreading to *B. hyo* or are these later lateral introductions?
      - Need current MIC and genetic information of both organisms.

Pork MultiPath™ Enteric panel (PMP2) results



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Large Scale Data Aggregation

Combining test data from multiple streams for zone-level monitoring

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Swine Disease Reporting System (SDRS)

sdrs@iastate.edu

Swine Disease Reporting System

www.fieldepi.org/SDRS

Project Coordinator

Dr. Guilherme Cezar

Principal Investigators

Dr. Giovani Trevisan

Dr. Daniel Linhares

SDRS Team

Communications

Dr. Edison Magalhães

Graduate Students

Srijita Chandra

Dr. Elisa De Conti

Jai Tatinani

Alan Moore

Software Developer

Kinath Rupasinghe

Objective

- GOAL: to share information on the detection of endemic and emerging pathogens affecting the US swine population, thereby assisting veterinarians and producers in making informed decisions on disease prevention, detection, and management.

SDRS
Swine Disease Reporting System www.fieldepi.org/SDRS

SDRS

A collaborative project across US Vet. Diagnostic Labs

Participant Labs

Iowa State University Veterinary Diagnostic Laboratory

University of Minnesota Veterinary Diagnostic Lab

South Dakota ADRDL Animal Disease Research & Diagnostic Laboratory

Kansas State Veterinary Diagnostic Laboratory

ADDL Ohio Animal Disease Diagnostic Laboratory

Purdue University Animal Disease Diagnostic Laboratory

Data retrieving

HL7 International

API

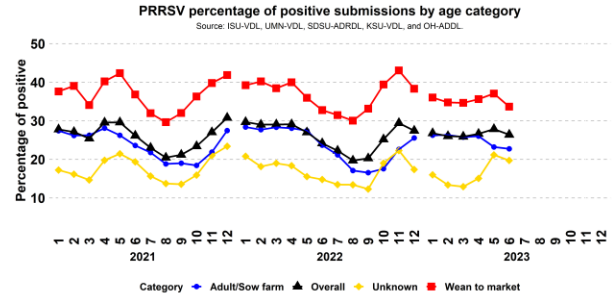
CSV

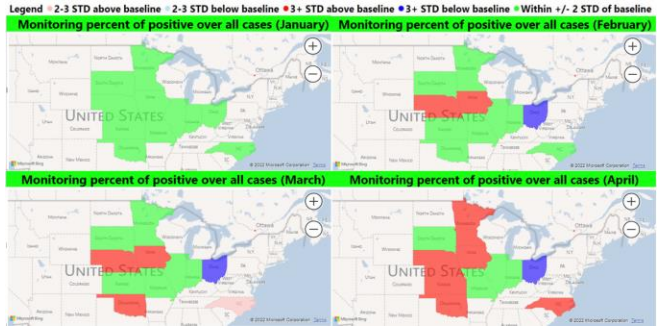
Data collating

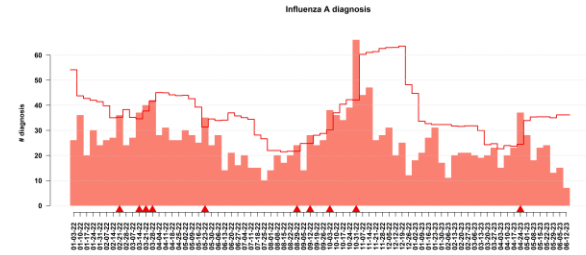
SNOMED CT The global language o healthcare

LOINC

SDRS team compilation







Numbers + Field Specialists comments

Final Report

PRRSV PCR+/- Lineage/RFLP	MHP PCR+/-
PCV2/3 PCR+/- Ct values	IAV PCR+/- subtyping
PDCoV PCR+/-	PEDV PCR+/-
TGEV PCR+/-	

Confirmed porcine tissue diagnosis (ISU VDL only)

Distribution

Swine Disease Reporting System SDRS

Spotify

Swine Health Information Center

YouTube

SWINECAST YOUR CONNECTION. AT YOUR CONVENIENCE.

SDRS timeline

Participant VDLs

Iowa State University Veterinary Diagnostic Laboratory

Feb 2018

PRRSV, PEDV, PEDV, TGEV PCR; PRRSV ORF5 sequence (ISU)

University of Minnesota Veterinary Diagnostic Lab

May 2018

Kansas State Veterinary Diagnostic Laboratory

South Dakota ADRDL Animal Disease Research & Diagnostic Laboratory, Brookings, South Dakota

Aug 2018

Tissue-based diagnoses (ISU)

Mar 2019

ADDL Ohio Animal Disease Diagnostic Laboratory

Mar 2022

IAV PCR

Apr 2022

PCV2 PCR

May 2022

IAV subtype

Oct 2022

Purdue University

Sep 2023

PCV3 PCR

Nov 2023

Funding

SHIC Swine Health Information Center

USDA

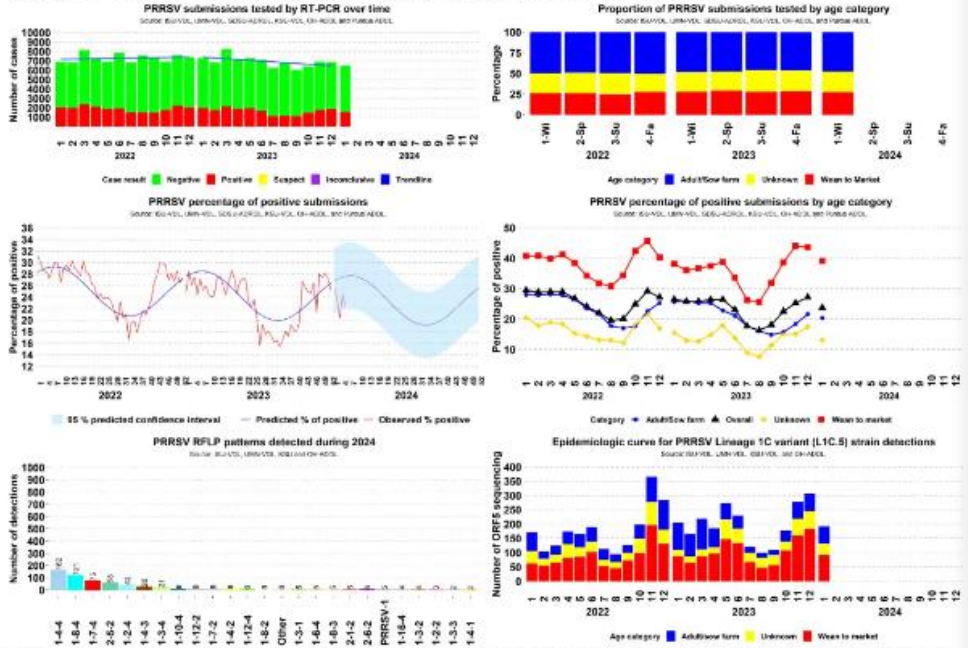
May 2023

Information available through monthly PDF reports

Swine Disease Reporting System

www.fieldepi.org/SDRS

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



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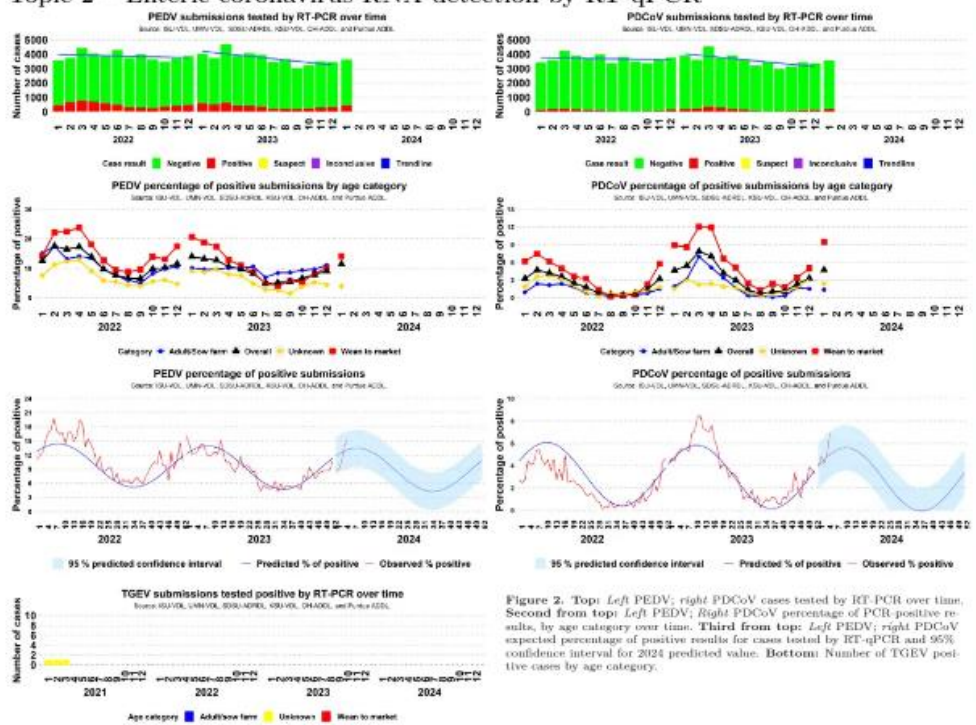
Topic 2 – Enteric coronavirus RNA detection by RT-qPCR



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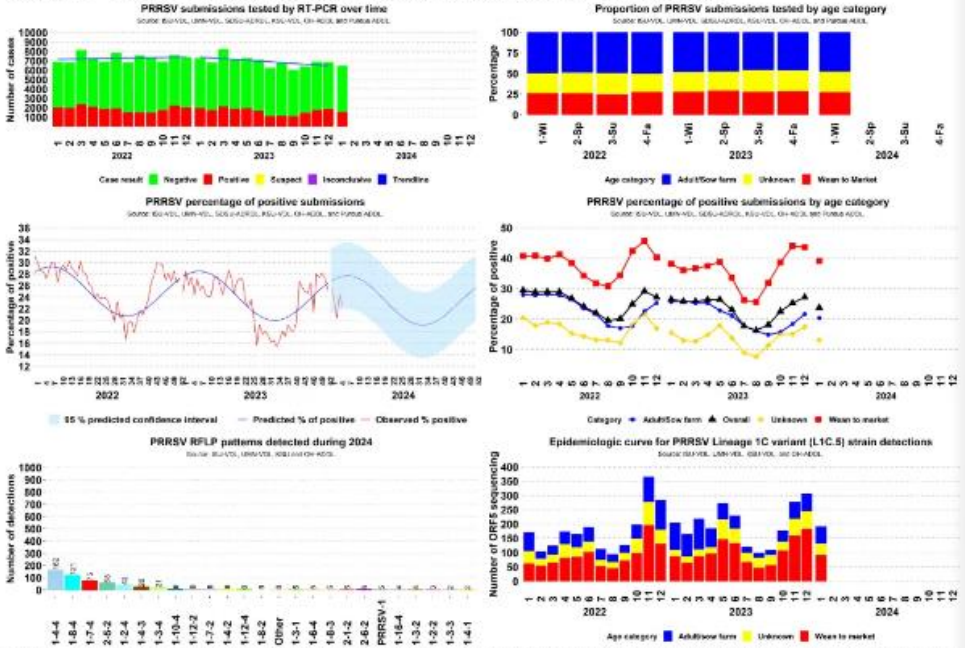

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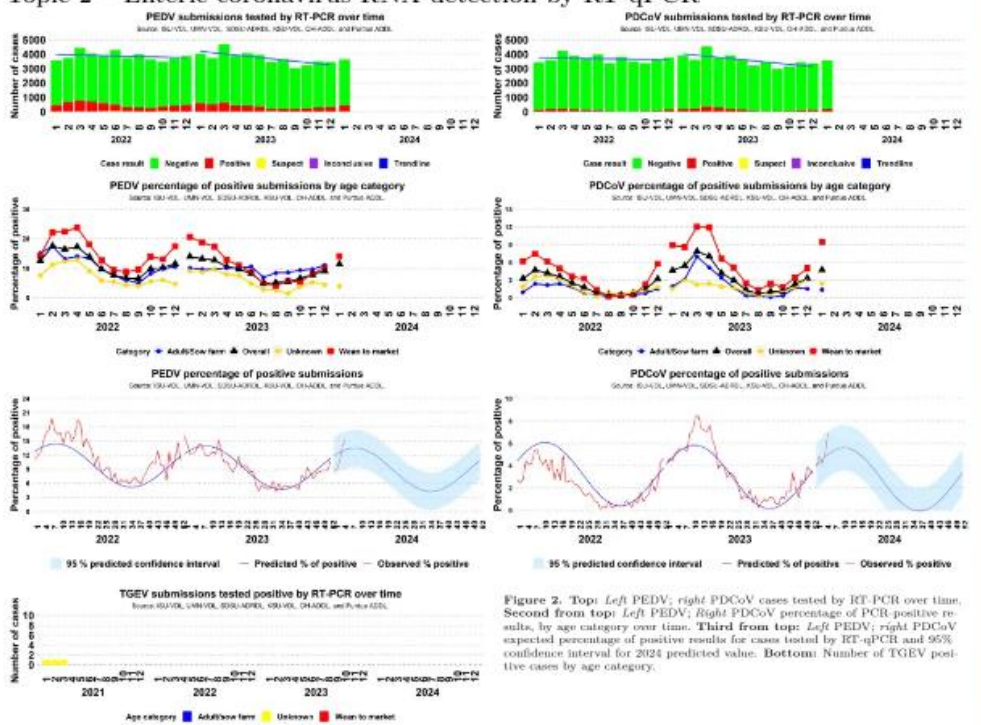

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Information from the Report

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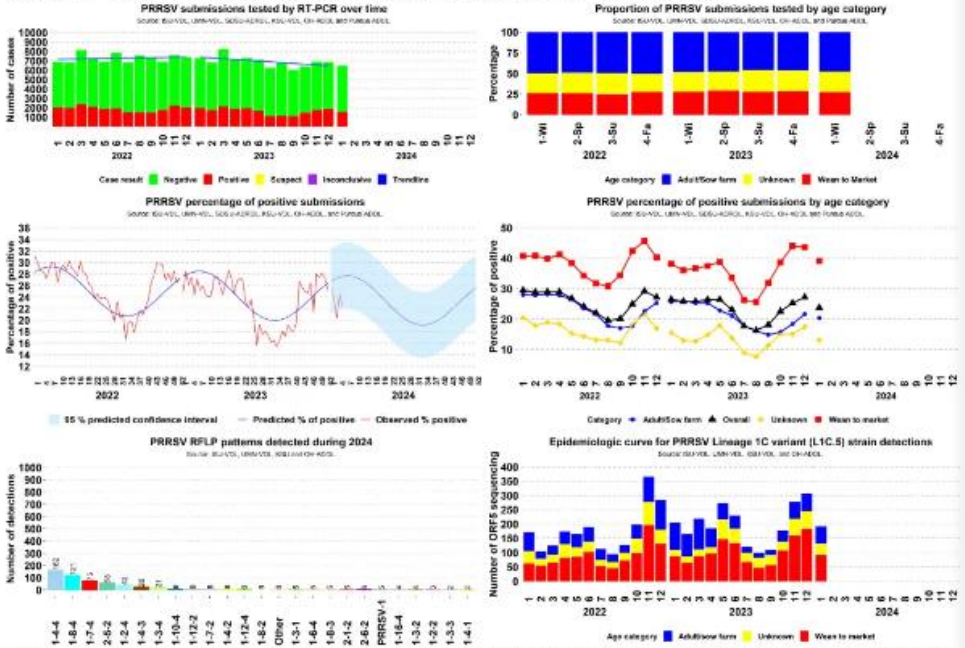

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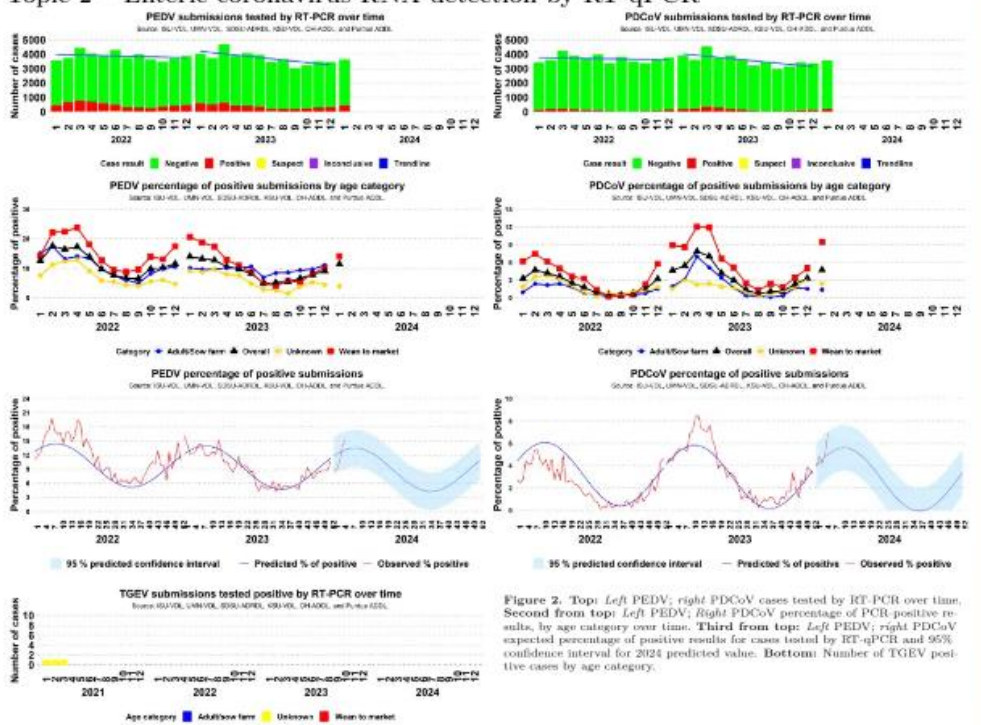
Advisory Comment

Topic 2 – Enteric coronavirus RNA detection by RT-qPCR



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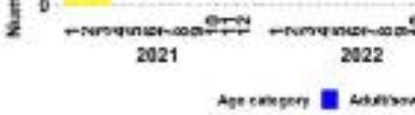
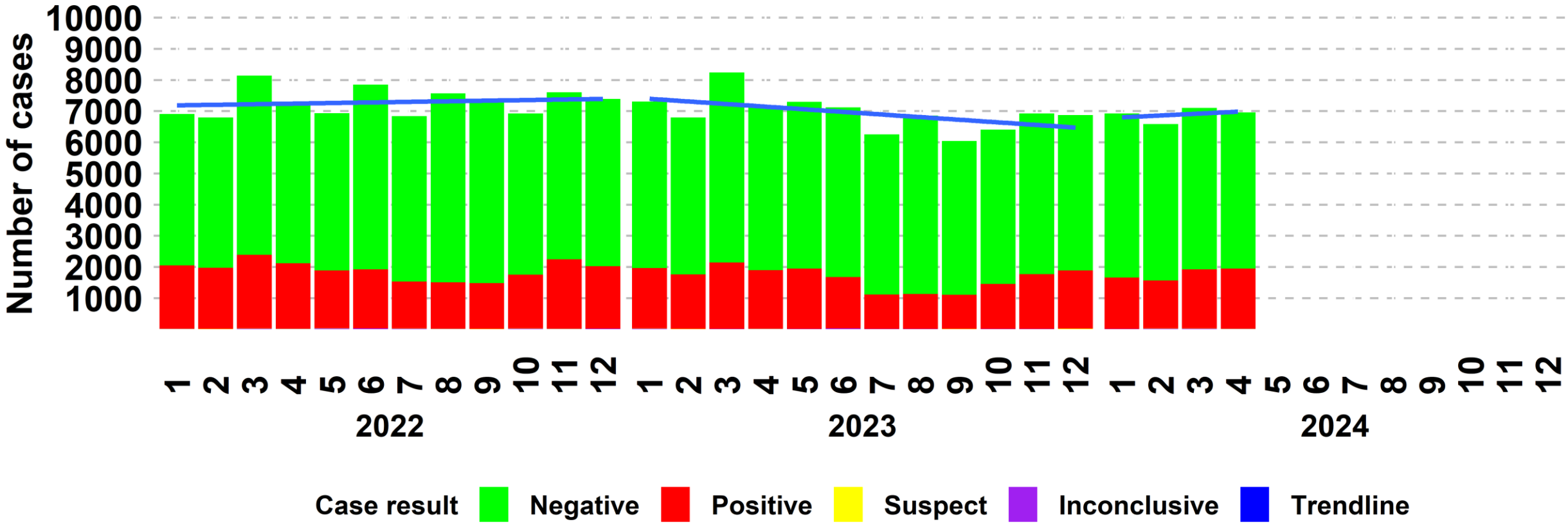


Interpret the decrease in positivity with caution because some production systems are not sampling the animals downstream once the sow farm is positive for PRRSV

PRRSV submissions tested by RT-PCR over time

Source: ISU-VDL, UMN-VDL, SDSU-ADRDL, KSU-VDL, OH-ADDL and Purdue ADDL.



PRRSV percentage of positive submissions by age category

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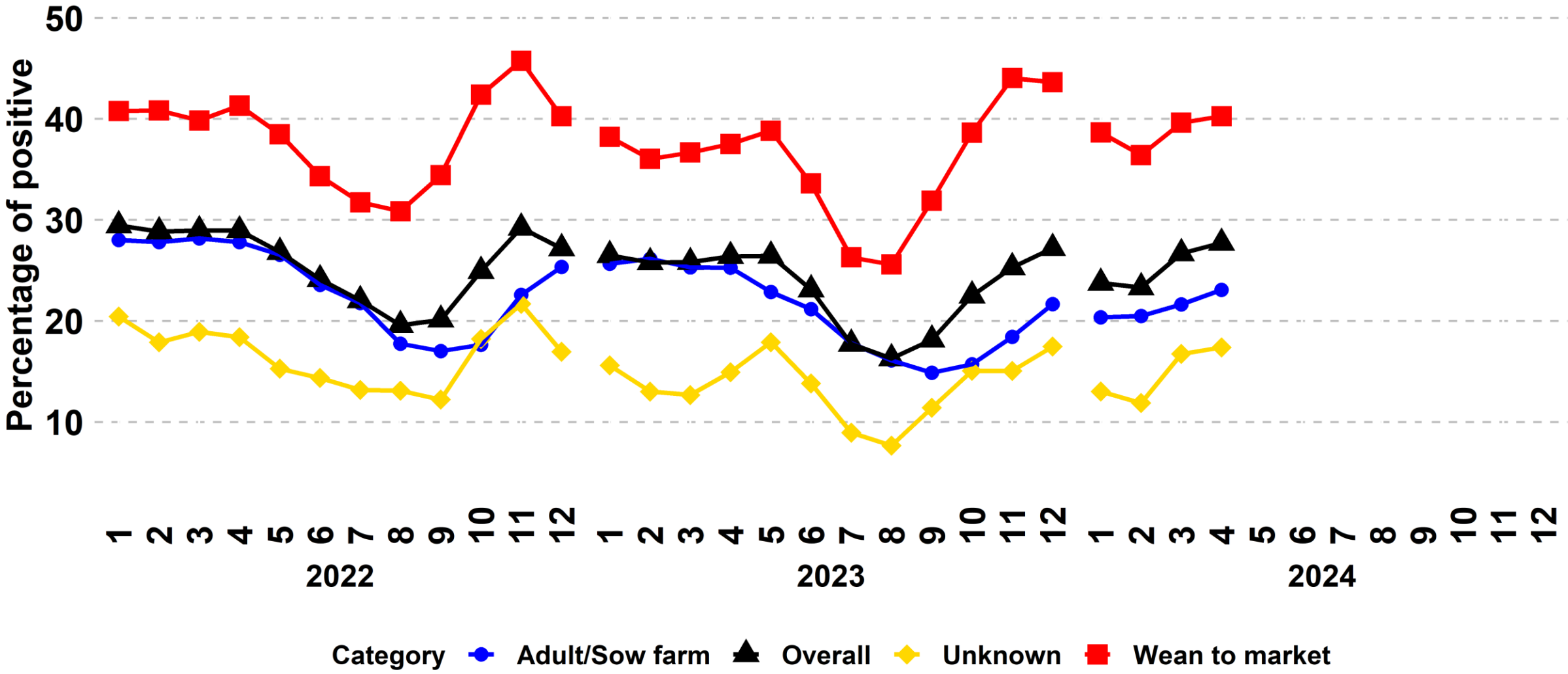

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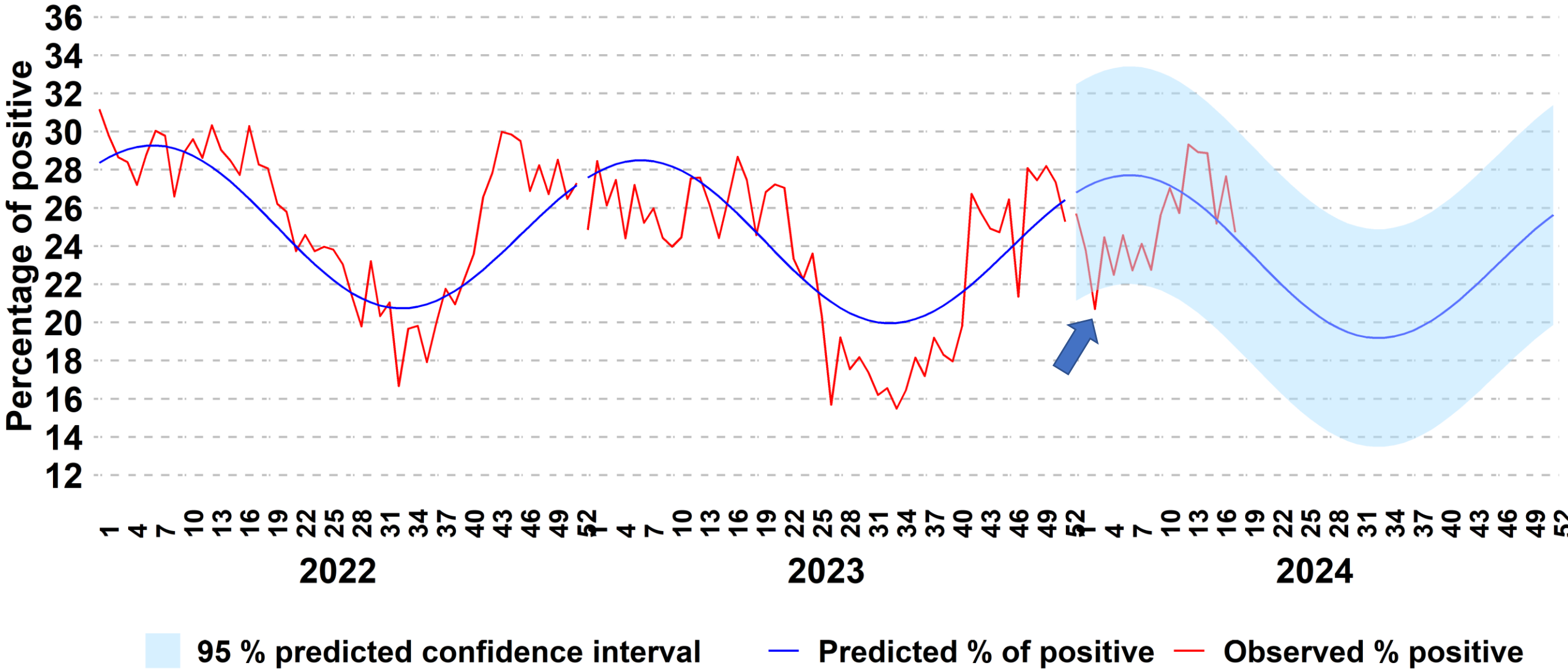


Information available through online dashboards

Swine Disease Reporting System

www.fieldepi.org/SDRS

Analyte

- IAV
- MHP
- PCV2
- PCV3
- PDCoV
- PEDV
- PRRSV
- TGEV

Analyte Over time

Specimen

Map

Age Category

Quality Control

Year & Season: 2013 – 2024

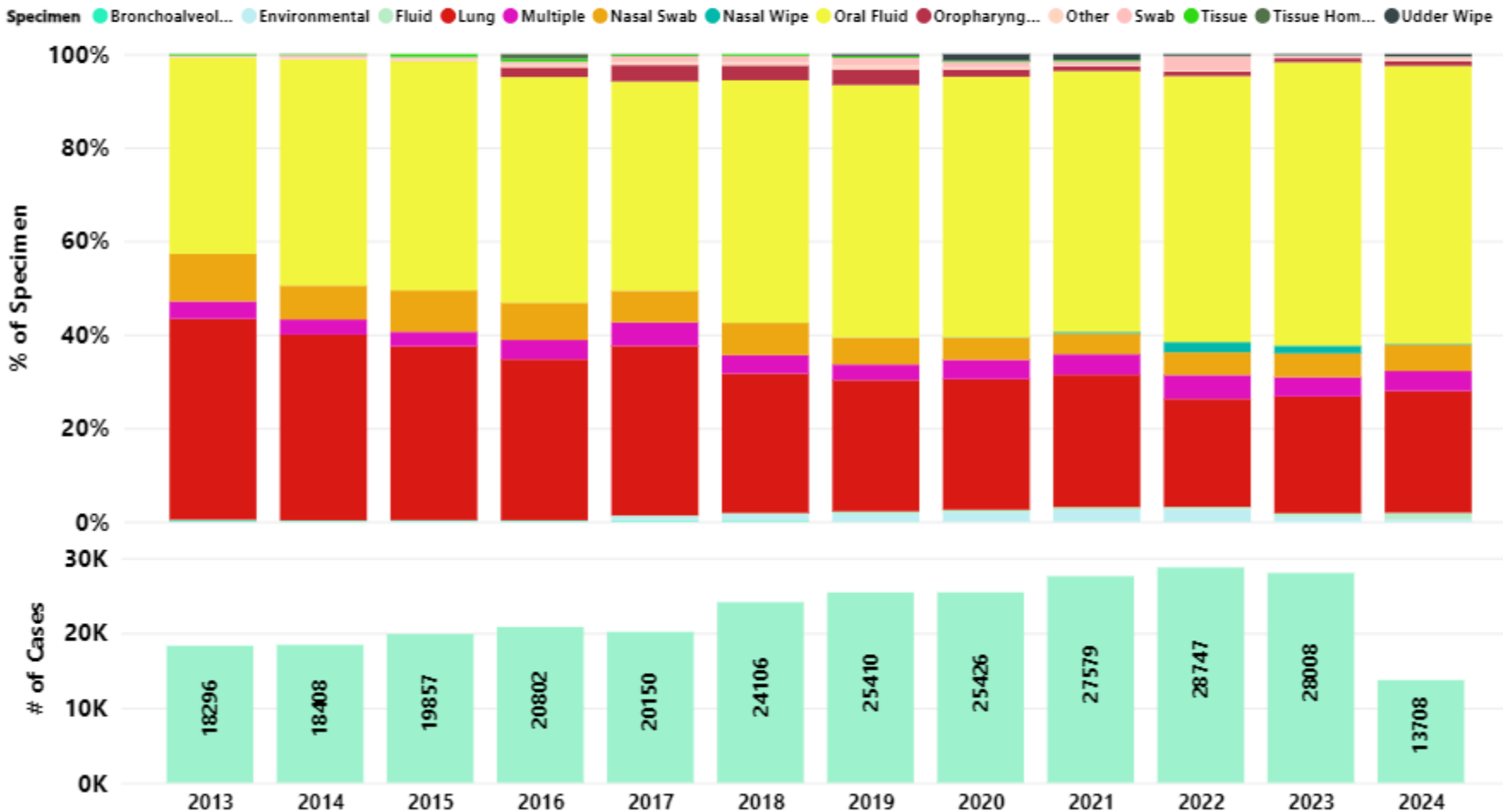
Phase: All

Specimen: All

Site State: All

Tissue: No / Yes

Specimen



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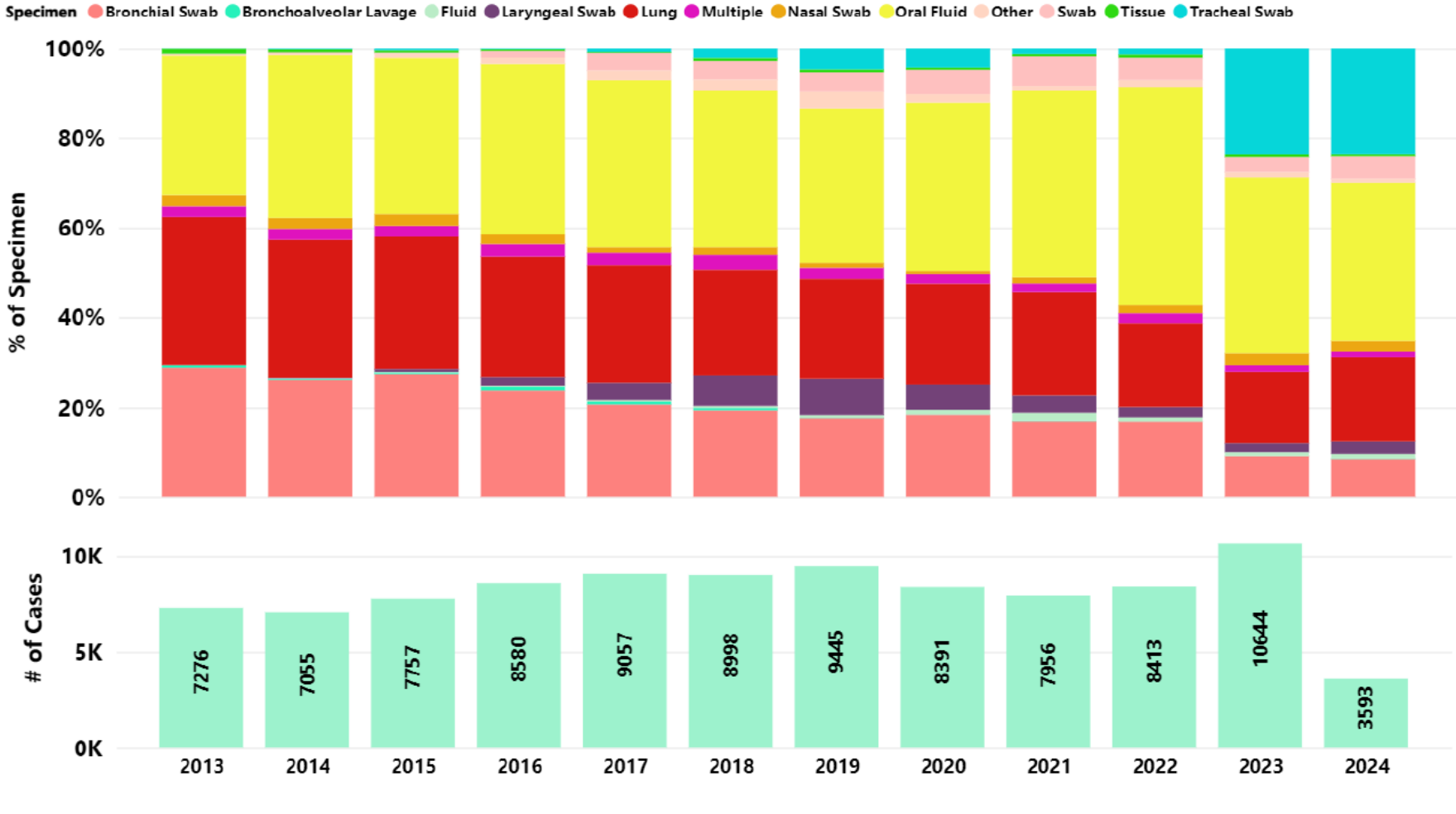

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Large Scale Data Aggregation

- Relatively easy to do for pathogen detection data.
- What about disease diagnosis?
  - For endemic agents, disease diagnosis requires detection + evidence
    - To be of value, there should be standardization of what is accepted an disease confirmation
  - Pathology (gross and microscopic) is the gold standard
    - The narrative nature of traditional pathology reporting makes data aggregation challenging
    - Currently, there is no uniform method for disease reporting in veterinary medicine
  - Can disease be coded in a uniform way?
    - Disease diagnostic codes can be messaged and aggregated similar to other test data

Large Scale Data Aggregation

- Disease Diagnostic Codes (Dx Codes)
  - Have been used at the ISU VDL since 2003
    - Early codes were not standardized, no clear hierarchy
      - Examples:
        - MHD = mulberry heart disease
        - ABOR PPV = parvovirus abortion
        - ENTE SERP HYOD = swine dysentery
  - In 2017, we decided a new hierarchal system was needed
    - Each disease code contains 4 components:
      - **SYSTEM** (respiratory, digestive, nervous, urogenital, etc.)
      - **INSULT** (bacterial, viral, parasitic, toxicity, etc.)
      - **LESION** (pneumonia, enteritis, arthritis, etc.)
      - **ETIOLOGY** (PRRSV, *Salmonella*, *E. coli*, etc.)

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        - **UROG** VIRA ABOR **PARV** = parvovirus abortion
        - **DIGE** BACT COLI **BRACH HYOD** = swine dysentery

Veterinary Diagnostic Laboratory

Large Scale Data Aggregation

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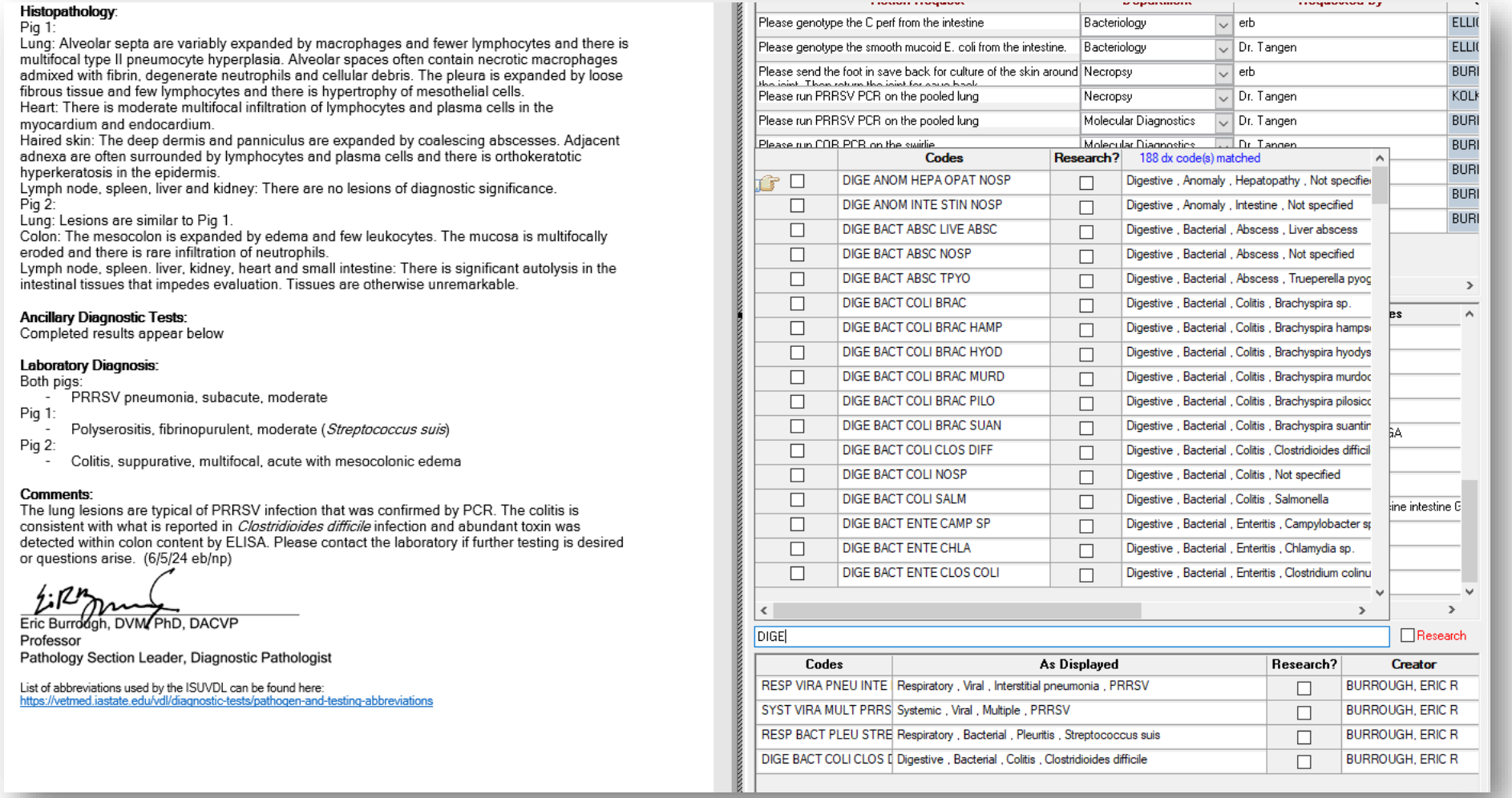

Histopathology:
Pig 1:
Lung: Alveolar septa are variably expanded by macrophages and fewer lymphocytes and there is multifocal type II pneumocyte hyperplasia. Alveolar spaces often contain necrotic macrophages admixed with fibrin, degenerate neutrophils and cellular debris. The pleura is expanded by loose fibrous tissue and few lymphocytes and there is hypertrophy of mesothelial cells.
Heart: There is moderate multifocal infiltration of lymphocytes and plasma cells in the myocardium and endocardium.
Haired skin: The deep dermis and panniculus are expanded by coalescing abscesses. Adjacent adnexa are often surrounded by lymphocytes and plasma cells and there is orthokeratotic hyperkeratosis in the epidermis.
Lymph node, spleen, liver and kidney: There are no lesions of diagnostic significance.
Pig 2:
Lung: Lesions are similar to Pig 1.
Colon: The mesocolon is expanded by edema and few leukocytes. The mucosa is multifocally eroded and there is rare infiltration of neutrophils.
Lymph node, spleen. liver, kidney, heart and small intestine: There is significant autolysis in the intestinal tissues that impedes evaluation. Tissues are otherwise unremarkable.

Ancillary Diagnostic Tests:
Completed results appear below

Laboratory Diagnosis:
Both pigs:
- PRRSV pneumonia, subacute, moderate

Pig 1:
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Pig 2:
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Comments:
The lung lesions are typical of PRRSV infection that was confirmed by PCR. The colitis is consistent with what is reported in *Clostridioides difficile* infection and abundant toxin was detected within colon content by ELISA. Please contact the laboratory if further testing is desired or questions arise. (6/5/24 eb/np)

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Please genotype the C perf from the intestine	Bacteriology	erb
Please genotype the smooth mucoid E. coli from the intestine.	Bacteriology	Dr. Tangen
Please send the foot in save back for culture of the skin around	Necropsy	erb
Please run PRRSV PCR on the pooled lung	Necropsy	Dr. Tangen
Please run PRRSV PCR on the pooled lung	Molecular Diagnostics	Dr. Tangen

Codes	Research?	188 dx code(s) matched
DIGE ANOM HEPA OPAT NOSP		Digestive , Anomaly , Hepatopathy , Not specifie
DIGE ANOM INTE STIN NOSP		Digestive , Anomaly , Intestine , Not specified
DIGE BACT ABSC LIVE ABSC		Digestive , Bacterial , Abscess , Liver abscess
DIGE BACT ABSC NOSP		Digestive , Bacterial , Abscess , Not specified
DIGE BACT ABSC TPYO		Digestive , Bacterial , Abscess , Trueperella pyog
DIGE BACT COLI BRAC		Digestive , Bacterial , Colitis , Brachyspira sp.
DIGE BACT COLI BRAC HAMP		Digestive , Bacterial , Colitis , Brachyspira hamps
DIGE BACT COLI BRAC HYOD		Digestive , Bacterial , Colitis , Brachyspira hyodys
DIGE BACT COLI BRAC MURD		Digestive , Bacterial , Colitis , Brachyspira murdoc
DIGE BACT COLI BRAC PILO		Digestive , Bacterial , Colitis , Brachyspira pilosicc
DIGE BACT COLI BRAC SUAN		Digestive , Bacterial , Colitis , Brachyspira suantir
DIGE BACT COLI CLOS DIFF		Digestive , Bacterial , Colitis , Clostridioides difficil
DIGE BACT COLI NOSP		Digestive , Bacterial , Colitis , Not specified
DIGE BACT COLI SALM		Digestive , Bacterial , Colitis , Salmonella
DIGE BACT ENTE CAMP SP		Digestive , Bacterial , Enteritis , Campylobacter sp
DIGE BACT ENTE CHLA		Digestive , Bacterial , Enteritis , Chlamydia sp.
DIGE BACT ENTE CLOS COLI		Digestive , Bacterial , Enteritis , Clostridium colinu

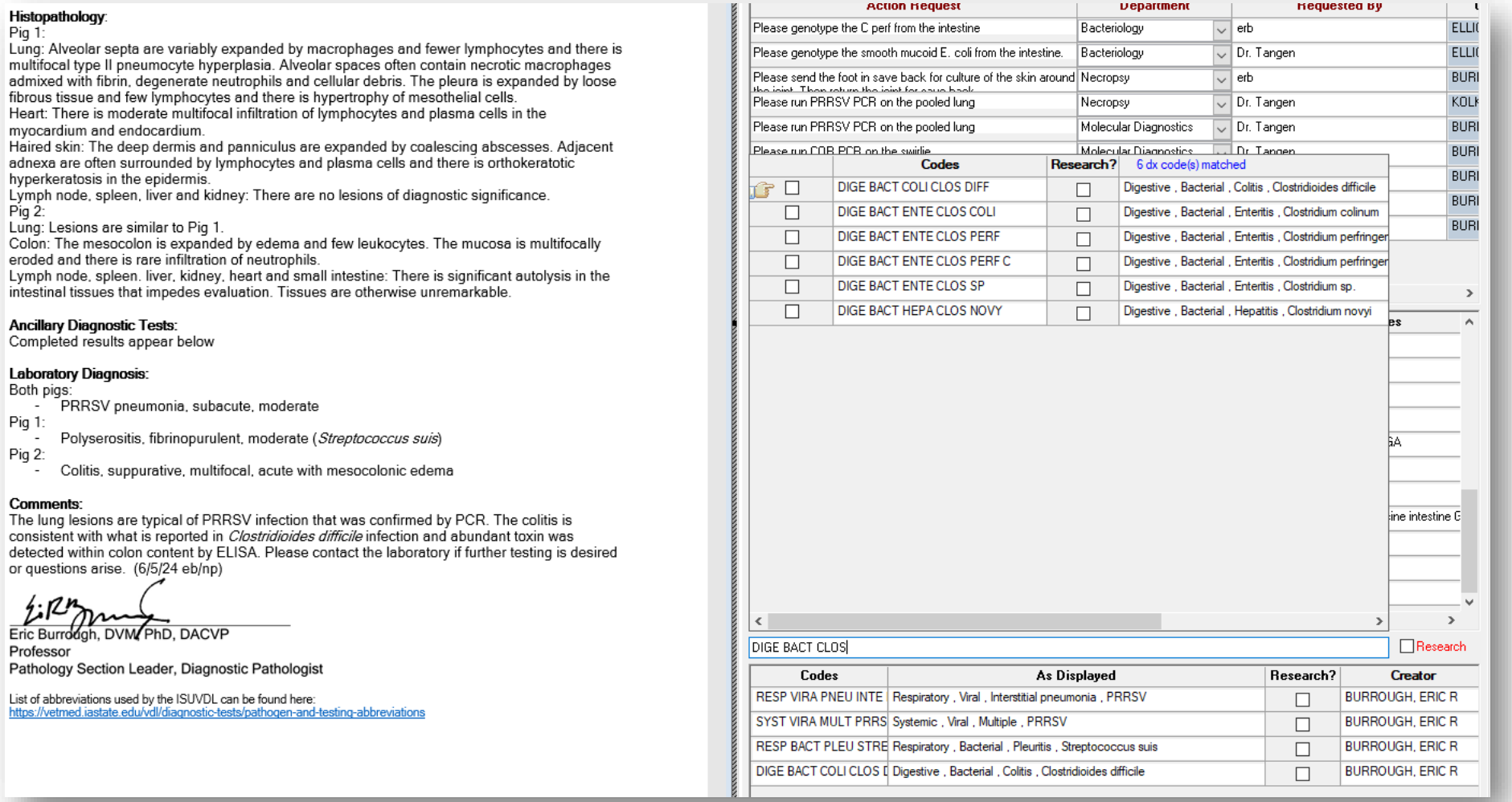
DIGE| Research

Codes	As Displayed	Research?	Creator
RESP VIRA PNEU INTE	Respiratory , Viral , Interstitial pneumonia , PRRSV		BURROUGH, ERIC R
SYST VIRA MULT PRRS	Systemic , Viral , Multiple , PRRSV		BURROUGH, ERIC R
RESP BACT PLEU STRE	Respiratory , Bacterial , Pleuritis , Streptococcus suis		BURROUGH, ERIC R
DIGE BACT COLI CLOS D	Digestive , Bacterial , Colitis , Clostridioides difficile		BURROUGH, ERIC R

Veterinary Diagnostic Laboratory

Large Scale Data Aggregation

- Disease Diagnostic Codes (Dx Codes)



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Please run PRRSV PCR on the pooled lung	Necropsy	Dr. Tangen
Please run PRRSV PCR on the pooled lung	Molecular Diagnostics	Dr. Tangen

	Codes	Research?	6 dx code(s) matched
☐	DIGE BACT COLI CLOS DIFF	☐	Digestive , Bacterial , Colitis , Clostridioides difficile
☐	DIGE BACT ENTE CLOS COLI	☐	Digestive , Bacterial , Enteritis , Clostridium colinum
☐	DIGE BACT ENTE CLOS PERF	☐	Digestive , Bacterial , Enteritis , Clostridium perfringer
☐	DIGE BACT ENTE CLOS PERF C	☐	Digestive , Bacterial , Enteritis , Clostridium perfringer
☐	DIGE BACT ENTE CLOS SP	☐	Digestive , Bacterial , Enteritis , Clostridium sp.
☐	DIGE BACT HEPA CLOS NOVY	☐	Digestive , Bacterial , Hepatitis , Clostridium novyi

DIGE BACT CLOS ☐ Research

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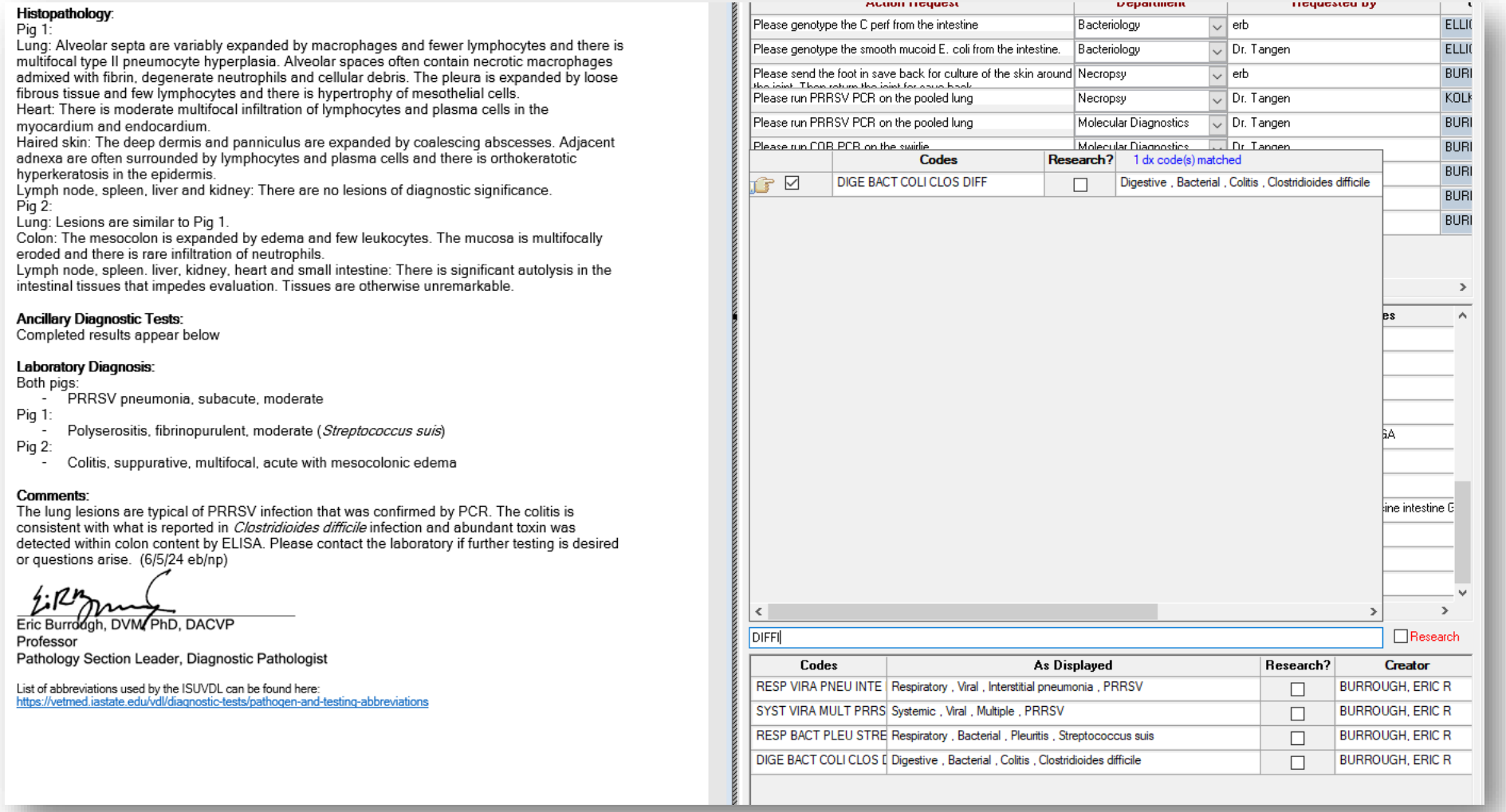
Veterinary Diagnostic Laboratory

Large Scale Data Aggregation

- Disease Diagnostic Codes (Dx Codes)



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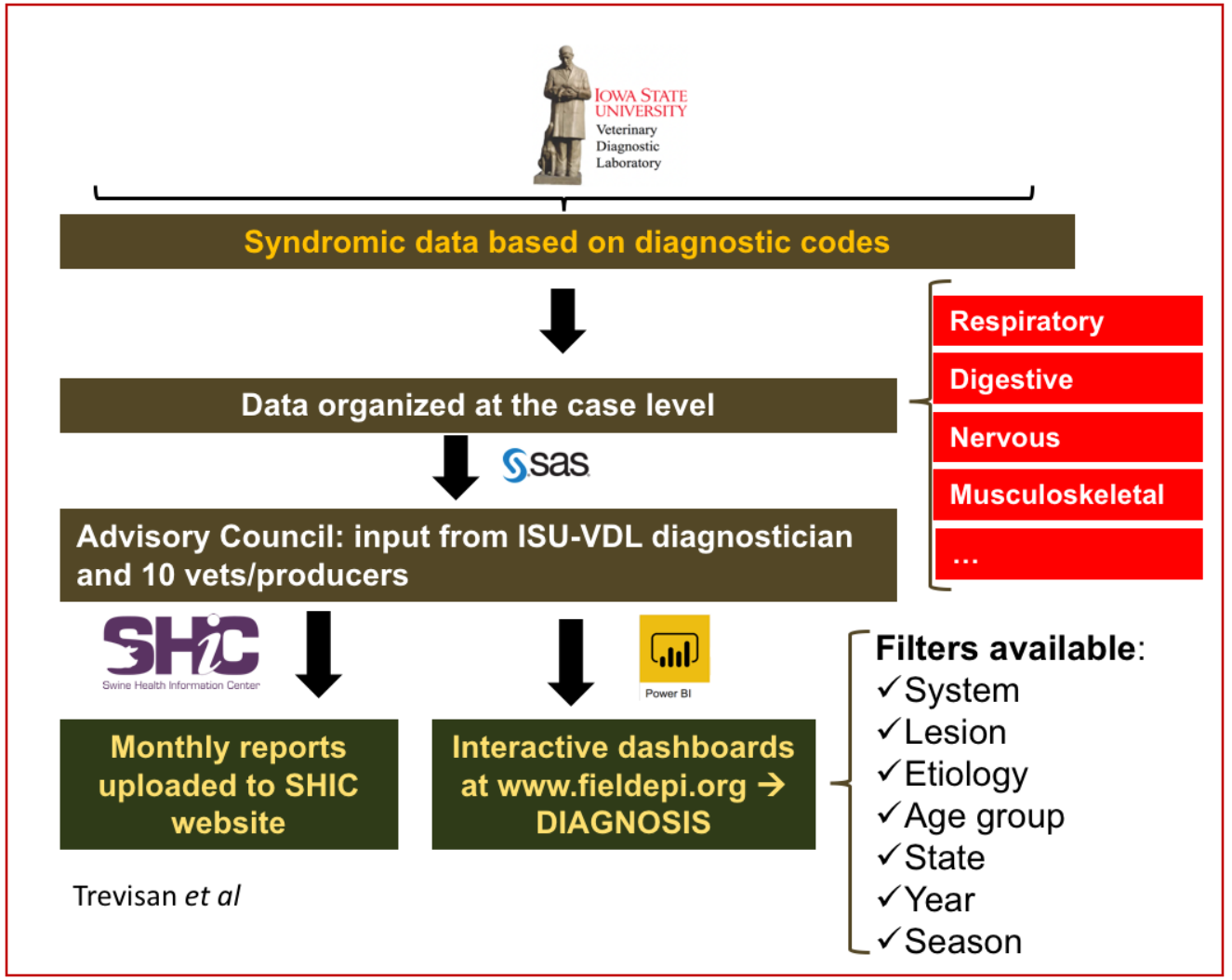
Veterinary Diagnostic Laboratory

Large Scale Data Aggregation

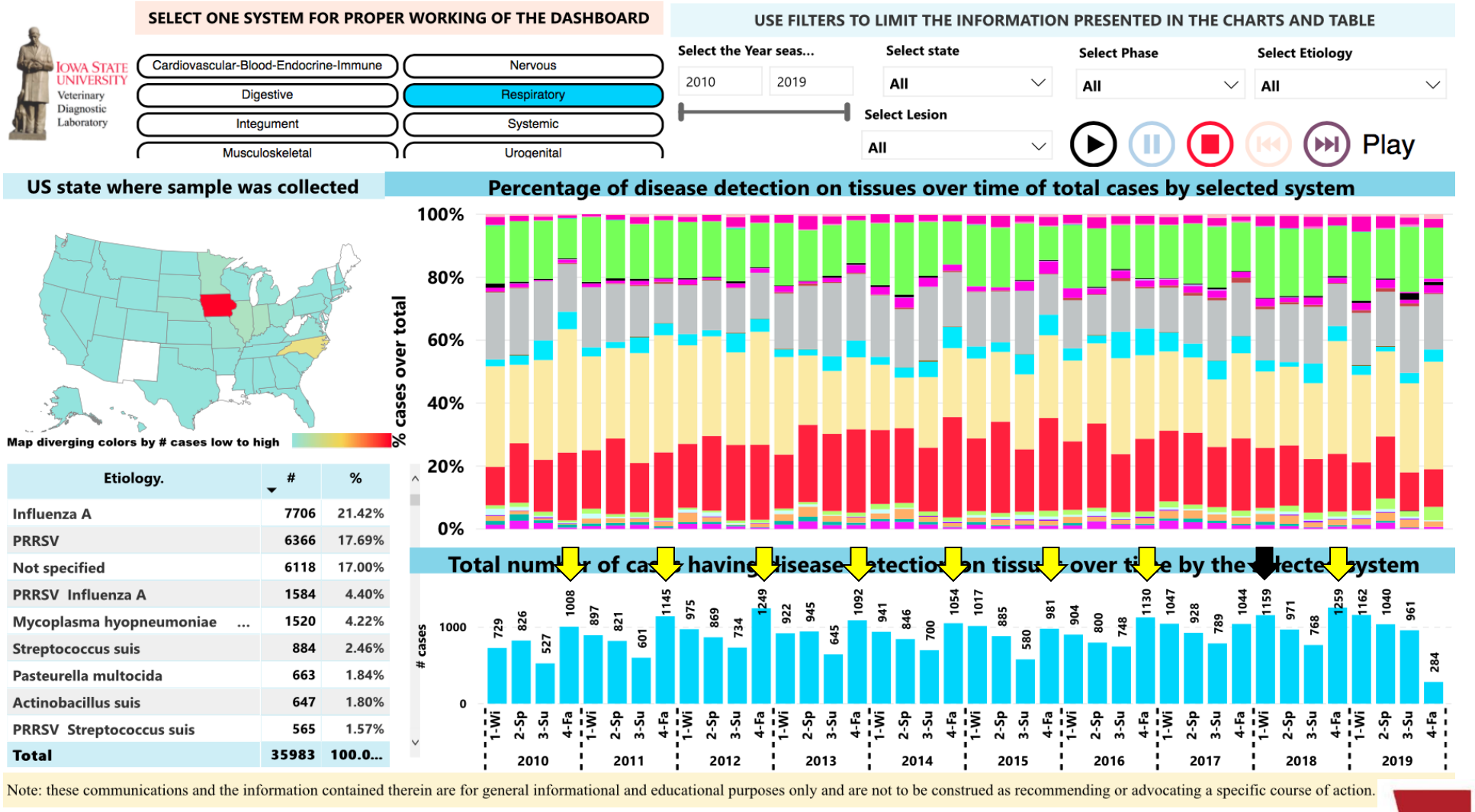
- Disease Diagnostic Codes (Dx Codes)
  - Challenges
    - Requires pathologist training/retraining
    - Codes from previous system must be mapped to new system to avoid
      - This is essential to avoid loss of historical data
  - Opportunities
    - Disease data is now filterable and can be aggregated
      - A completely new stream of data is available
        - Disease data versus test result data (both useful but different)
    - Improved denominators:
      - e.g., number of IAV diagnoses in a period over:
        - Total respiratory cases received
        - Total cases with respiratory viral disease
        - Total cases with bronchitis

Large Scale Data Aggregation



https://fieldepi.org/DIAGNOSIS

Fall / winter months have the highest number of respiratory diagnosis



https://fieldepi.org/DIAGNOSIS

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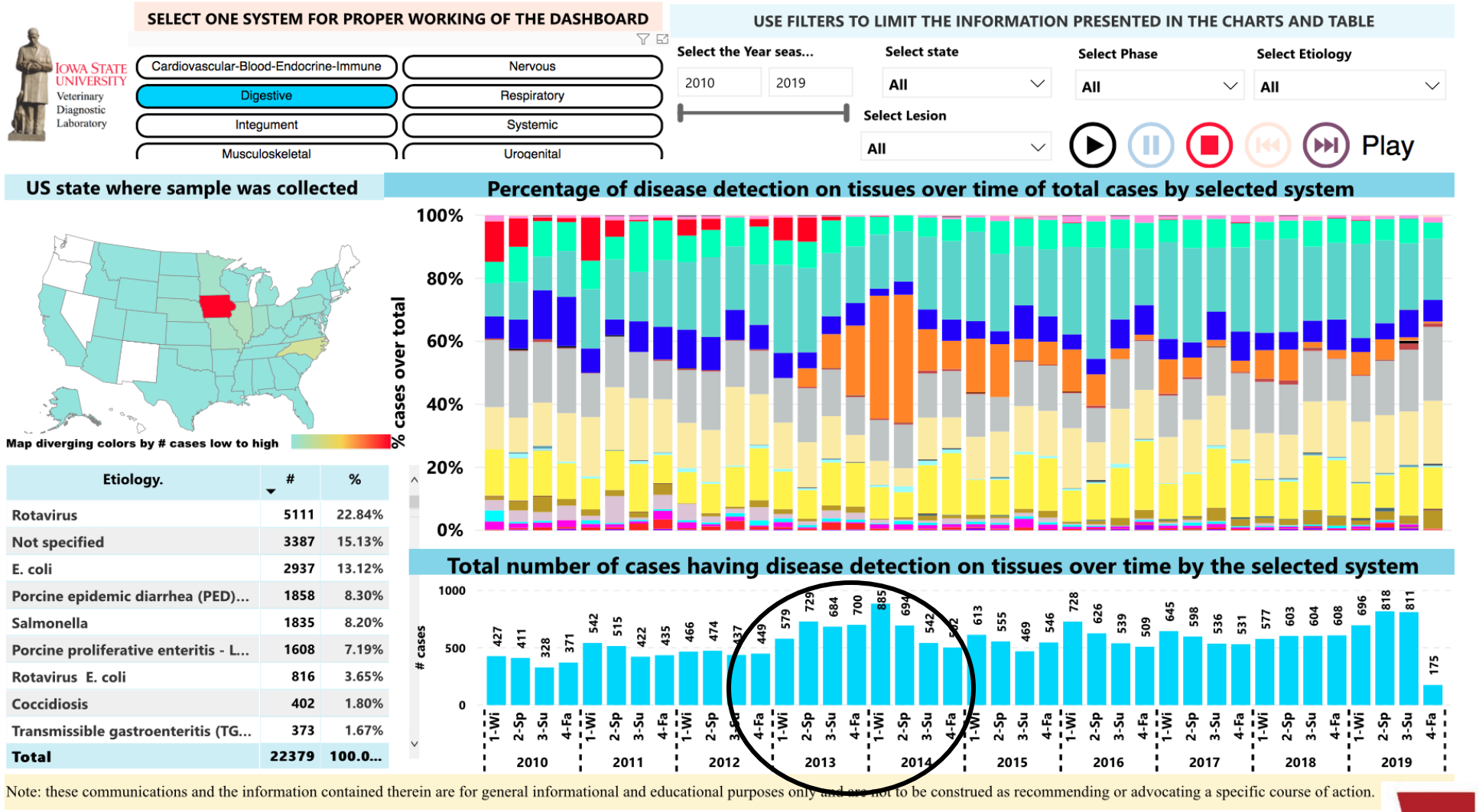
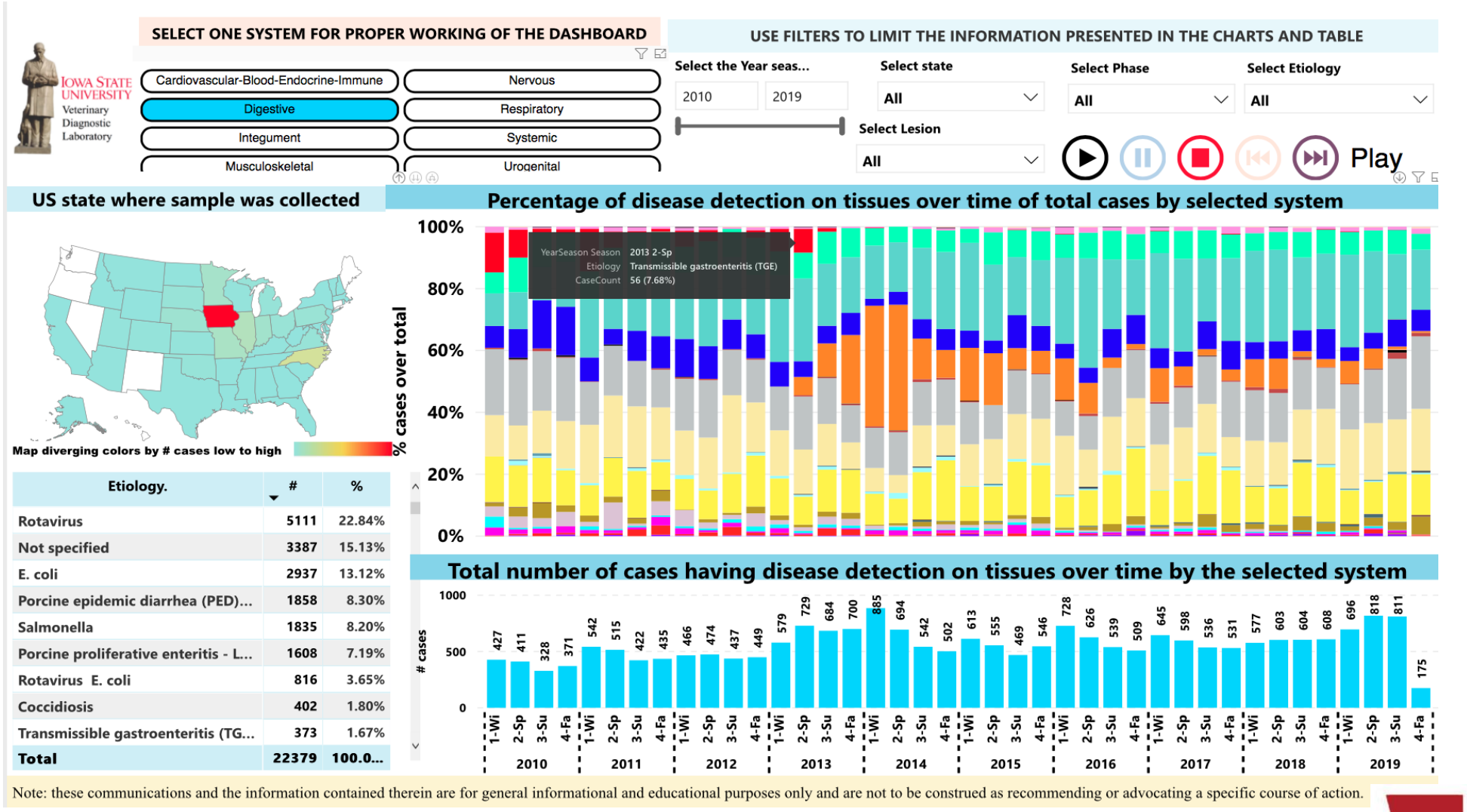
Increased number of digestive diagnosis in 2013/2014



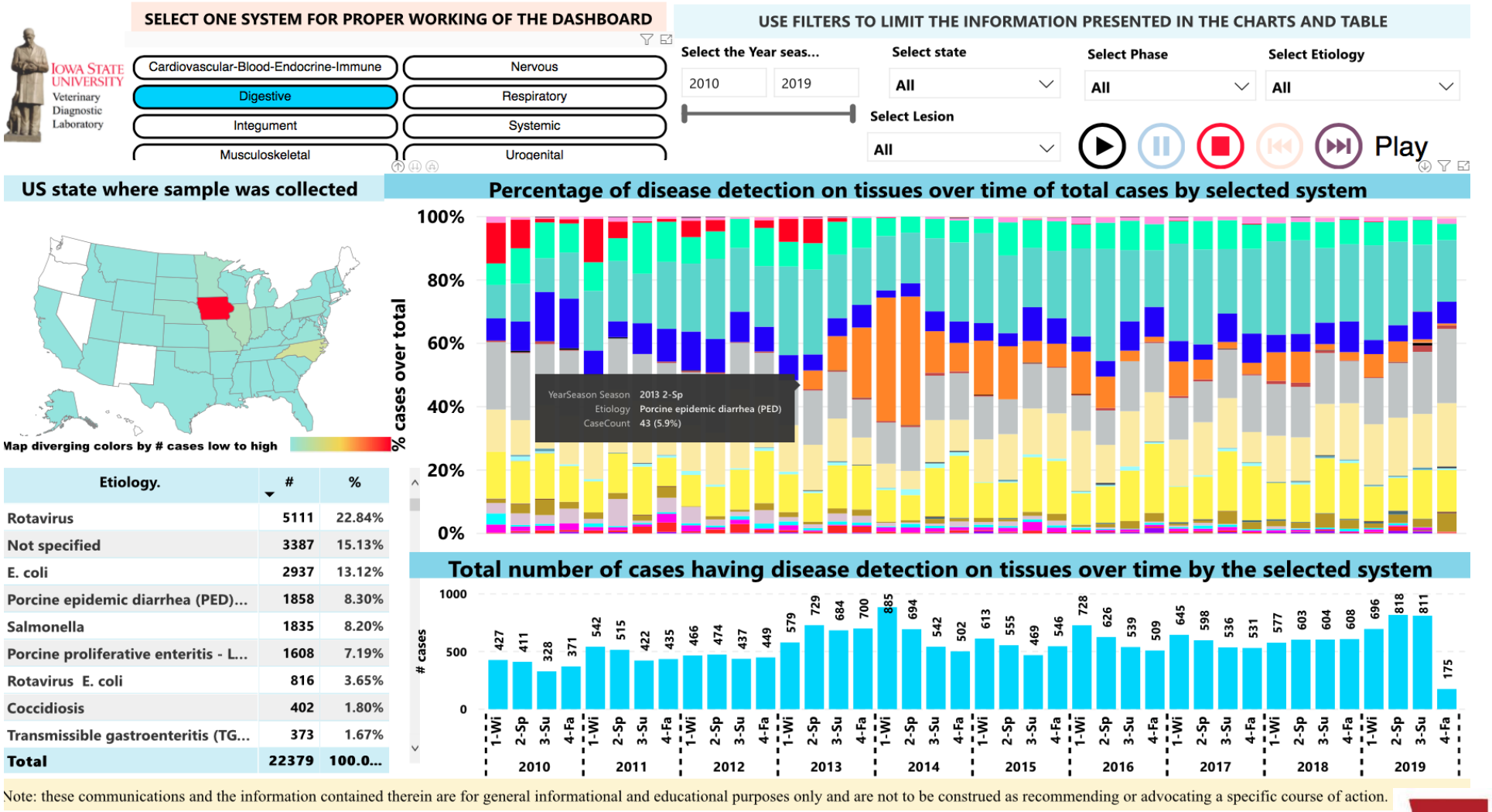
https://fieldepi.org/DIAGNOSIS

Low frequency of TGEV diagnosis after 2013



https://fieldepi.org/DIAGNOSIS

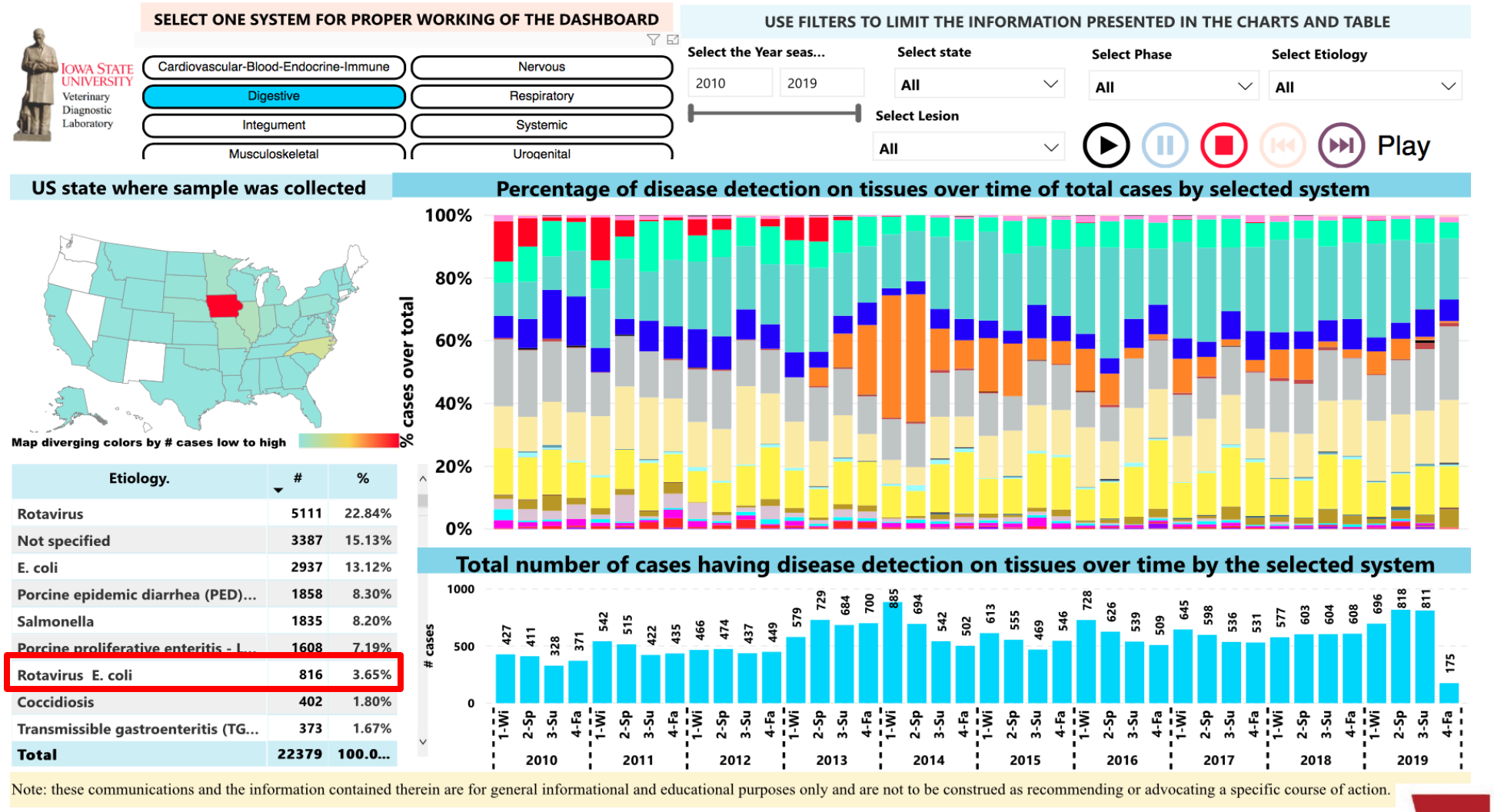
High frequency of PEDV diagnosis in 2013/2014



Etiology.	#	%
Rotavirus	5111	22.84%
Not specified	3387	15.13%
E. coli	2937	13.12%
Porcine epidemic diarrhea (PED)...	1858	8.30%
Salmonella	1835	8.20%
Porcine proliferative enteritis - L...	1608	7.19%
Rotavirus E. coli	816	3.65%
Coccidiosis	402	1.80%
Transmissible gastroenteritis (TG...	373	1.67%
Total	**22379**	**100.0...**

https://fieldepi.org/DIAGNOSIS

Sorted by system the tool has ability to inform multiple agents detected in a case



https://fieldepi.org/DIAGNOSIS

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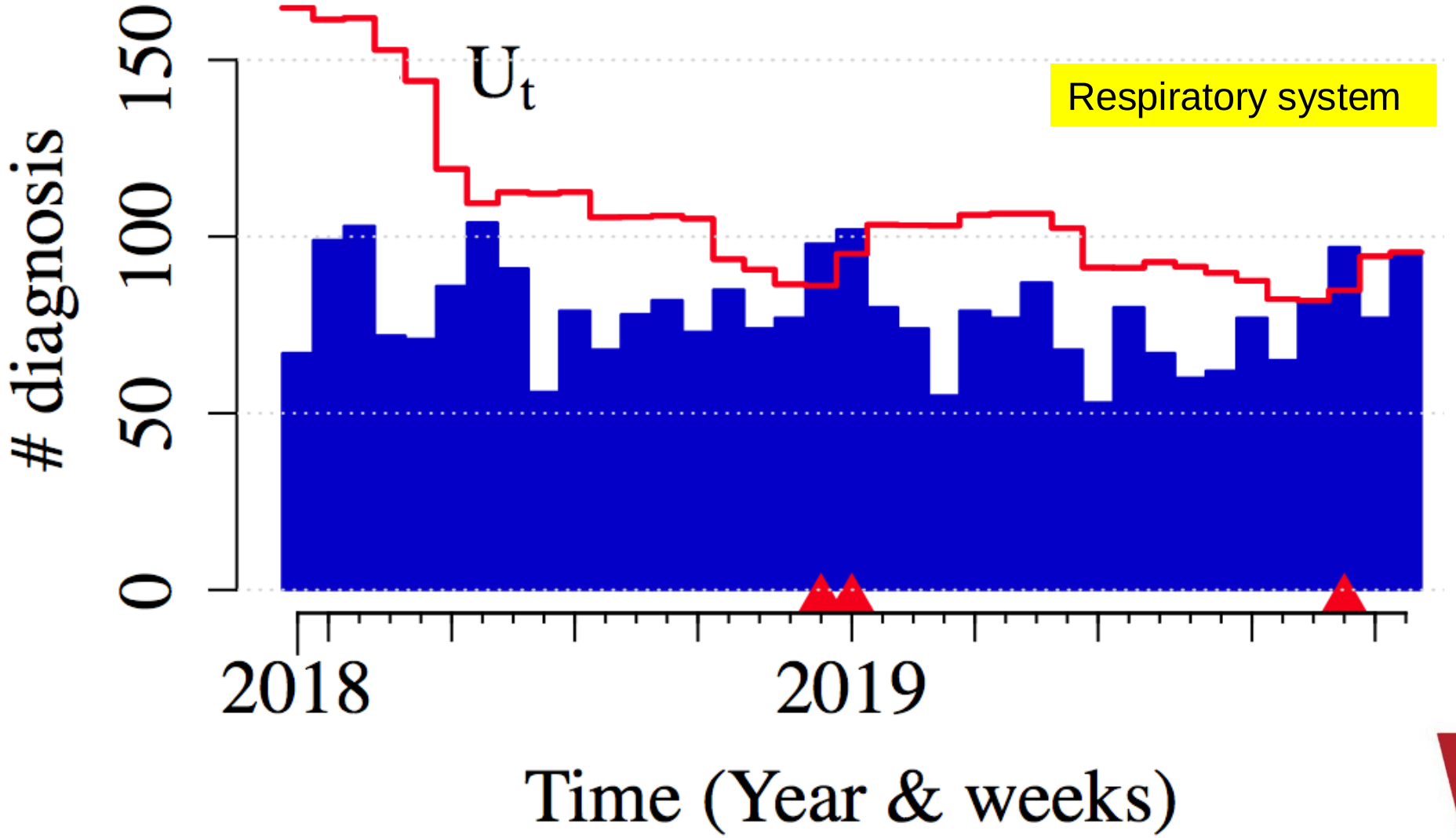
Weekly monitoring of disease diagnosis by system can create alert signals for increased diagnoses



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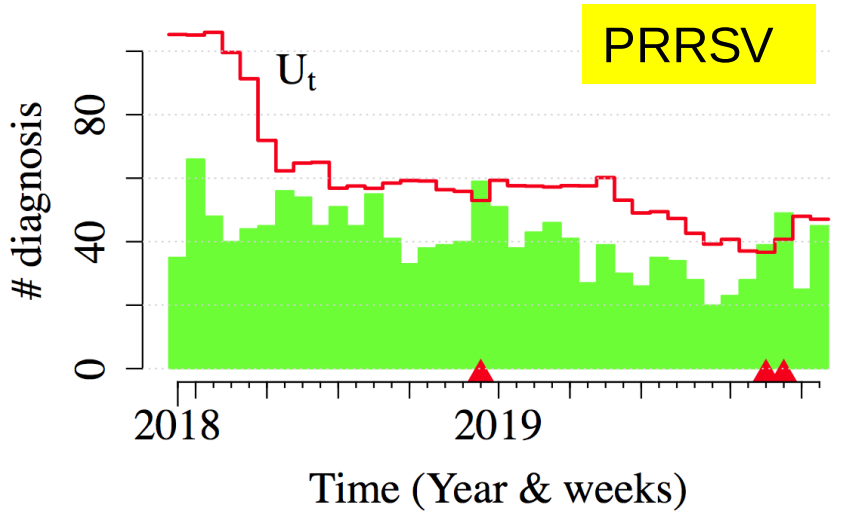
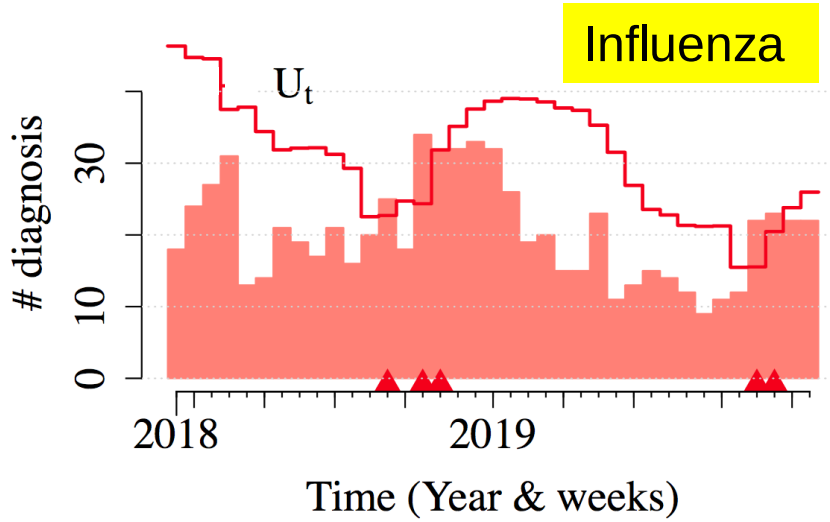
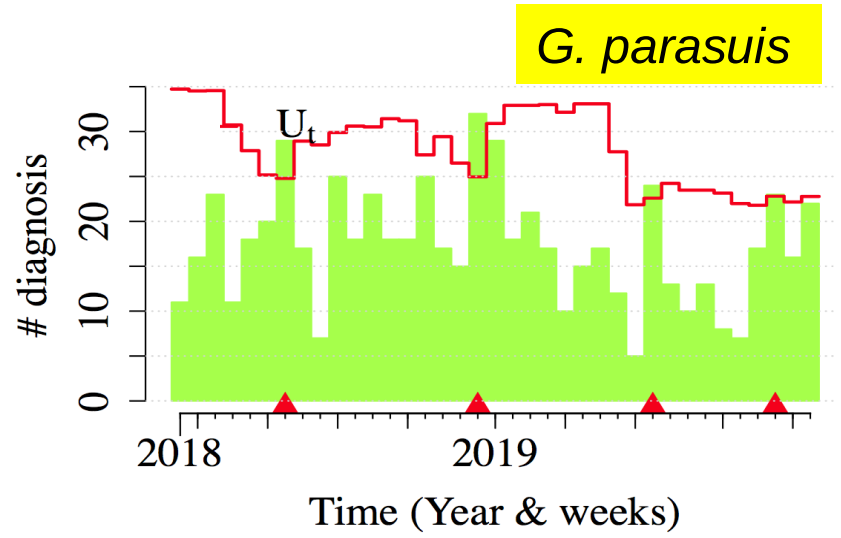
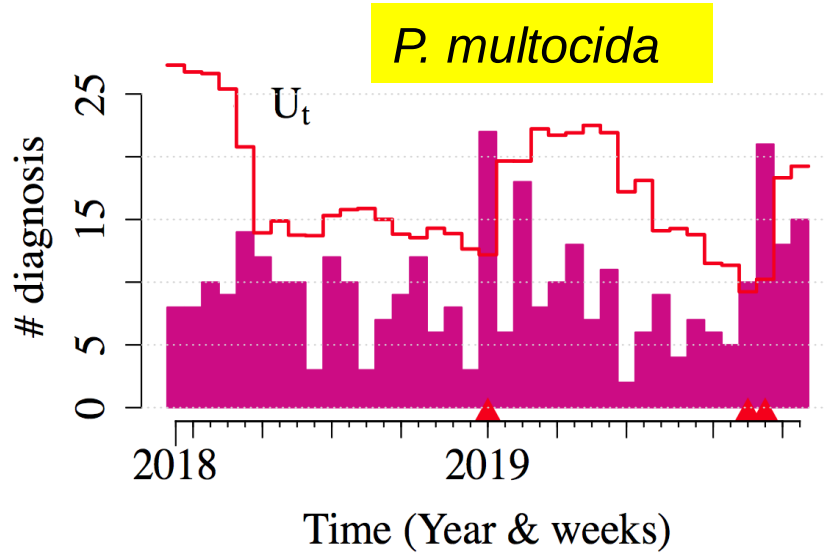
At the agent level, 2 signals in a 4 week interval are suggestive of a potential outbreak









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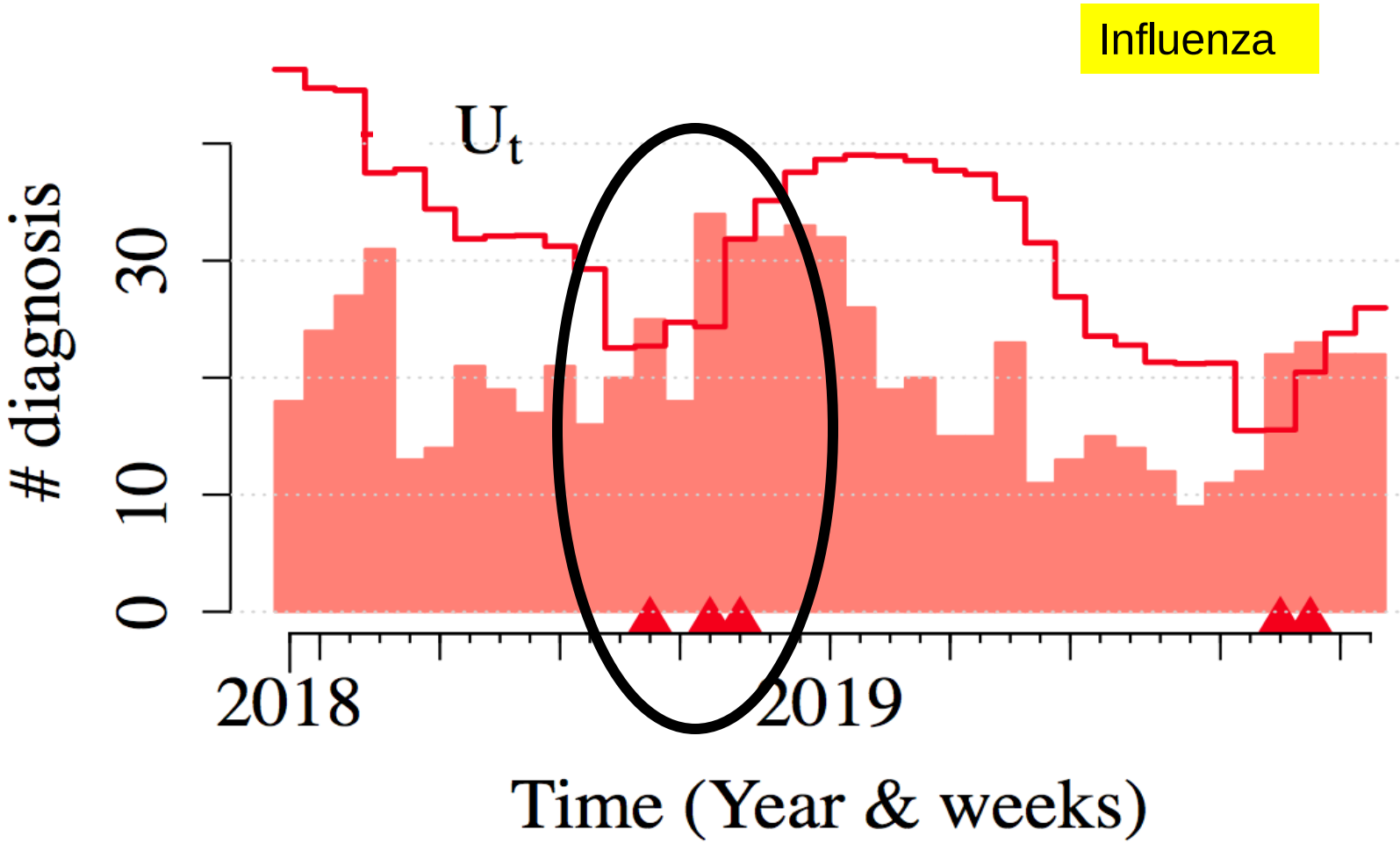
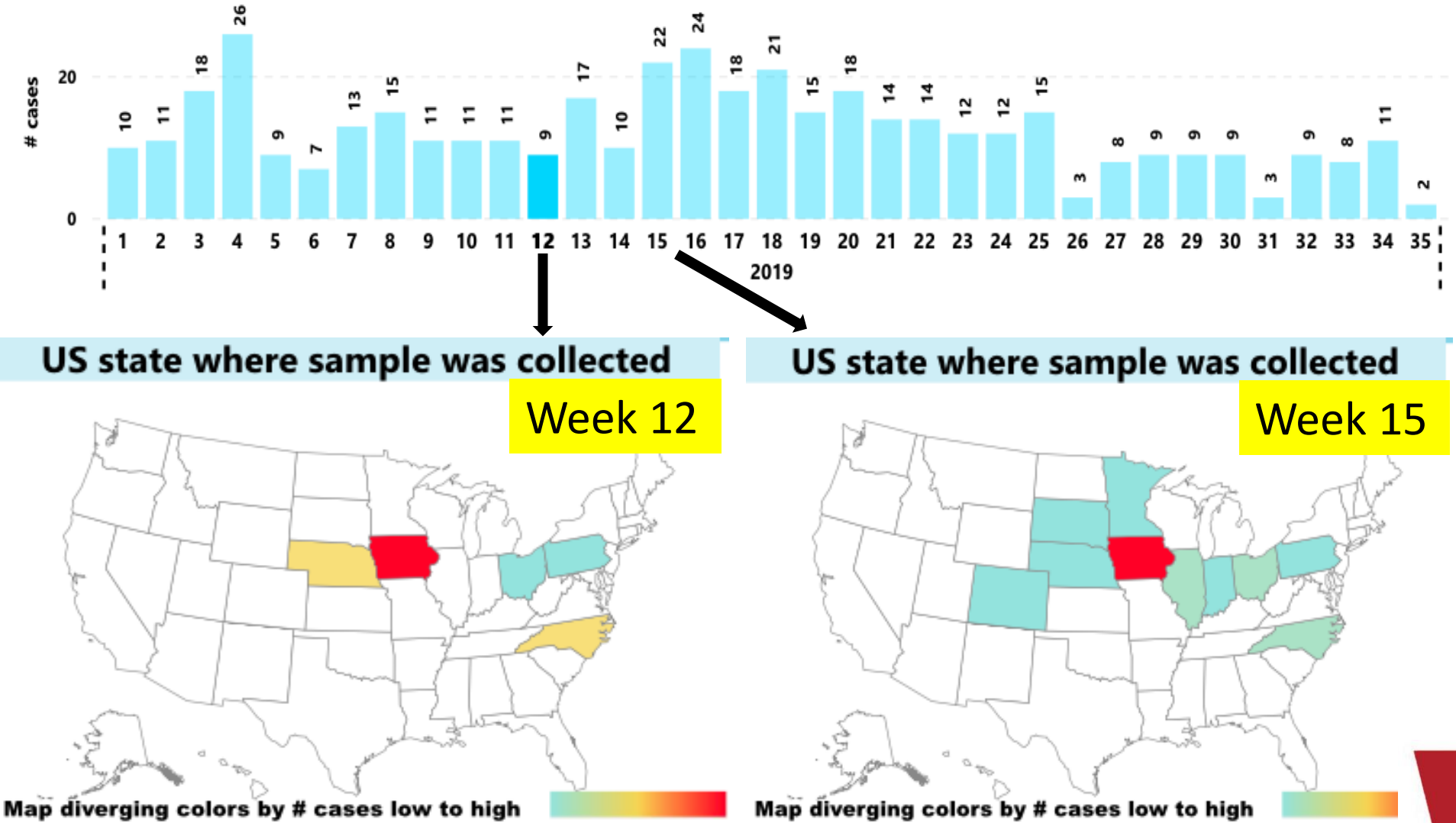
Triggers investigation of geographical distribution of diagnosis signal in week 15



Dashboards are then used to investigate weekly cases of influenza diagnosis



Veterinary Diagnostic Laboratory

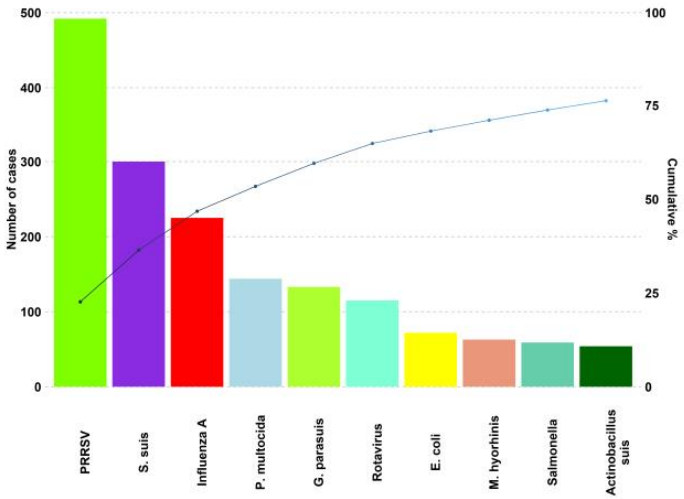
Dx Code Data from ISU VDL is Summarized Monthly in the SDRS Report

SDRS Swine Disease Reporting System
Disease Diagnosis Reports

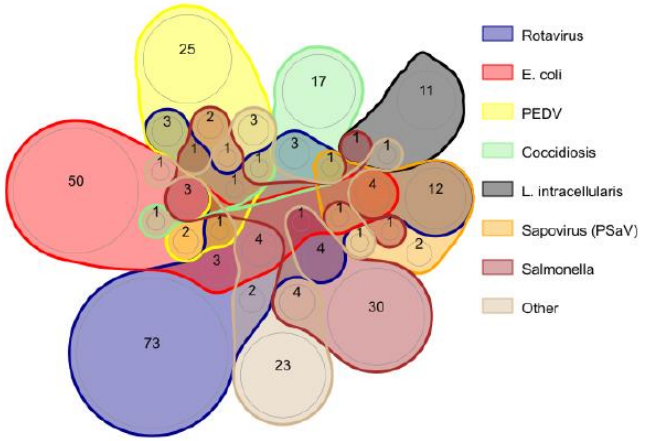
Iowa State University Veterinary Diagnostic Laboratory | SHIC Swine Health Information Center | pork | Iowa Pork Producers Association
Successful farmers. Enriched lives.

Topic 6 – Confirmed tissue cases etiologic/disease diagnosis at the ISU-VDL.

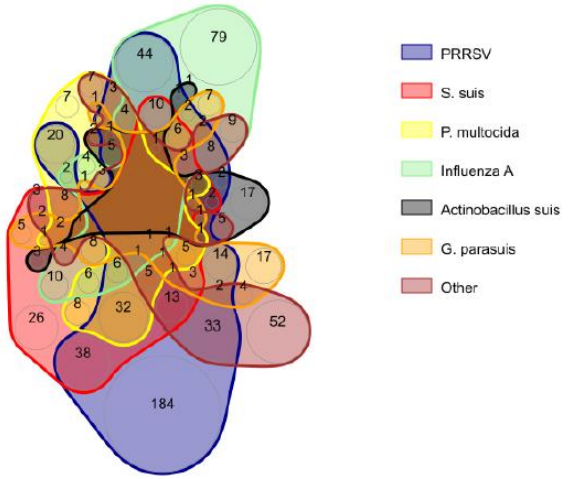
Overall diagnosis



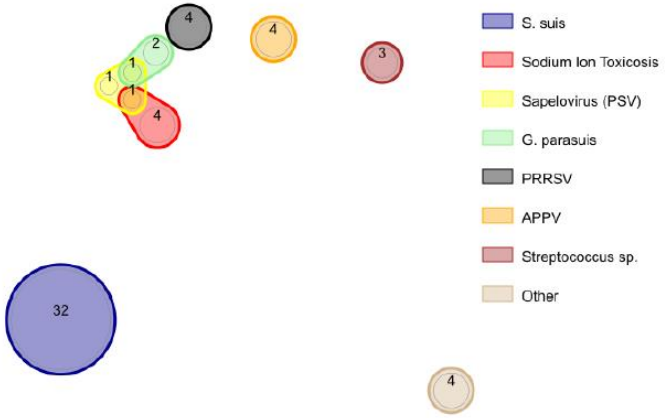
Digestive



Respiratory



Nervous



College of Veterinary Medicine, Iowa State University

Large Scale Data Aggregation – Take Home

- Use of DX code information to monitor swine disease diagnosis:
  - Can keep swine industry informed on endemic disease trends
  - Large scale monitoring of endemic disease diagnosis can help scientists, producers, and veterinarians:
    - Better understand the pattern of disease occurrence
    - Develop better disease control strategies

- Next steps:
  - Explore additional statistical tools to monitor disease diagnosis trends
  - Collaborate with other VDLs in US and globally to aggregate information?
    - Will require standardization of coding for useful messaging

Summary

- Different tools are needed for Surveillance versus Monitoring
  - Surveillance often used to prove freedom from disease
    - Is well suited for binary data (presence/absence)
    - Fixed spatial sampling and combined confidence from successive rounds of testing can reduce sample numbers per round
  - Monitoring is used to observed patterns or changes in endemic disease
    - Poorly suited for binary data (finding it is not unexpected)
    - SPC charts can be used for quantitative data
    - Disease diagnosis data is best, but harder to aggregate
- Aggregated anonymized data is useful for the swine industry
  - Requires purposeful collaboration (and funding)
  - Data access via dashboards help generate new questions

Questions?

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(515) 294-1950 | burrough@iastate.edu | @erburrough

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