

Health Watch: *Now & Forward*

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Disease Update Topics

1. PED
2. Senecavirus A
3. Strep Zoo
4. Circovirus

PED Update for Ontario

- Currently... 4 active PED cases – Huron (2), Oxford, Middlesex
1 active case of PDCoV - Huron
- Annual *reported* cases:

	PED	PDCoV
2021	6	2
2020	28	2
2019	10	0
2018	12	0
2017	6	0

*OMAF no longer reports provincial cases as of April 2021

Swine Health Ontario

PED/PDCoV Tracking Map

<http://www.swinehealthontario.ca/Disease-Information/PED-PDCoV-Tracking-Map>

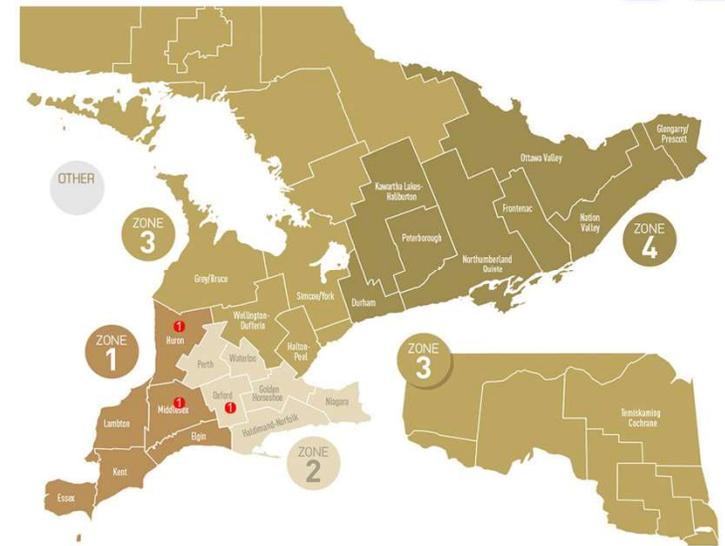


The Porcine Epidemic Diarrhea (PED) virus can affect all pigs and is often fatal to newborn pigs under 7 to 10 days of age. However, it does not affect any other species, including humans, and is not a food safety issue. On January 22, 2014, the first case of PED in Ontario was identified. Porcine Deltacoronavirus (PDCoV) – formerly referred to as ‘swine deltacoronavirus (SDCV)’ – belongs to the same viral family as PED. The symptoms of PDCoV are indistinguishable from those of PED, although tend to be less severe than PED. On March 14, 2014, the first case of PDCoV was identified in Ontario.

Swine Health Ontario took over PED and PDCoV tracking and reporting in the province of Ontario on March 31, 2020. All information prior to March 31, 2020 is historical. Current PED and PDCoV positive cases are reported as of March 31, 2020 onwards.

PED & PDCoV Current

Current Annually



► PED

Middlesex - 1 Huron - 1 Oxford - 1

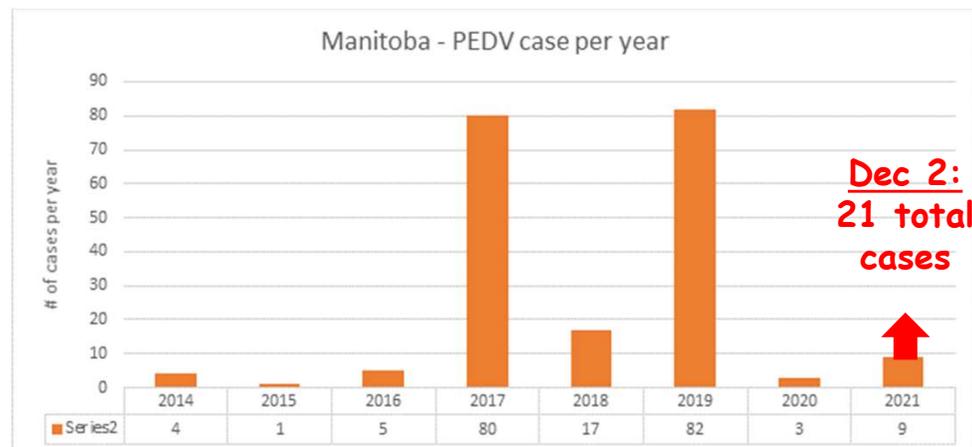
► PDCoV

No records found for that period

Date	County Name	Disease Type	Farm Type
Nov 04, 2021	Middlesex	PED	Finisher
Oct 13, 2021	Huron	PED	Nursery
Nov 12, 2021	Oxford	PED	Finisher

PED in Western Provinces

- Manitoba has had a bad fall after a good year
- Alberta has no active cases; 4 cases in 2019
- Saskatchewan has never reported a case



*updated Nov 16, 2021

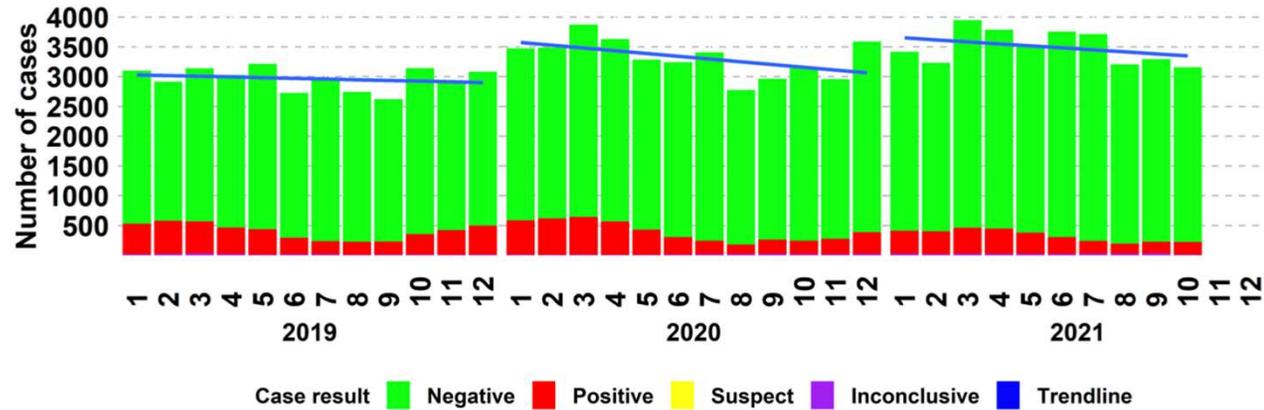
PED in Quebec

	January - March 2021		April - June 2021		July - September 2021		October - November 2nd, 2021
	# tests	# positive	# tests	# positive	# tests	# positive	# positive
Abbatoir PED	1421	2	1520	10	1563	0	1
Trasport PED	3564	2	323	0	3117	0	3
Assembly PED	83	0	106	0	86	0	0
Abbatoir PDCoV	313	0	2611	0	289	0	1
Transport PDCoV	965	4*	738	1*	884	1*	4
Assembly PDCoV	38	0	53	0	37	0	0
	*4 trailers from Ontario (2 both PED/PDCoV positive)		*Ontario trailer 2 Quebec PED cases from May		*Quebec truck, unknown source		5 Ontario trucks implicated

PEDV in the US

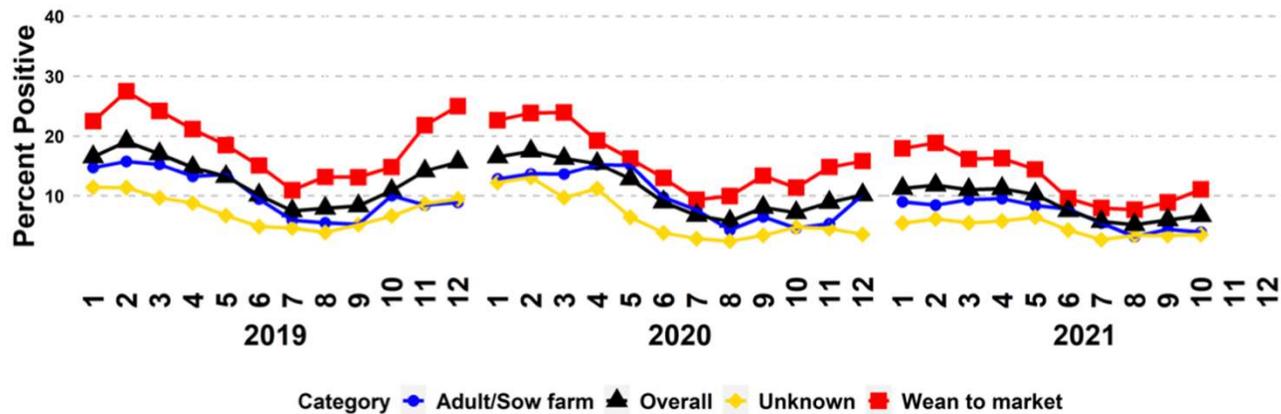
PEDV submissions tested by RT-PCR over time

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



PEDV percentage of positive submissions by age category

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



Swine Disease Reporting System,
Report 45 (November 2, 2021)
<https://www.swinehealth.org/wp-content/uploads/2021/11/SDRS-report-45.pdf>



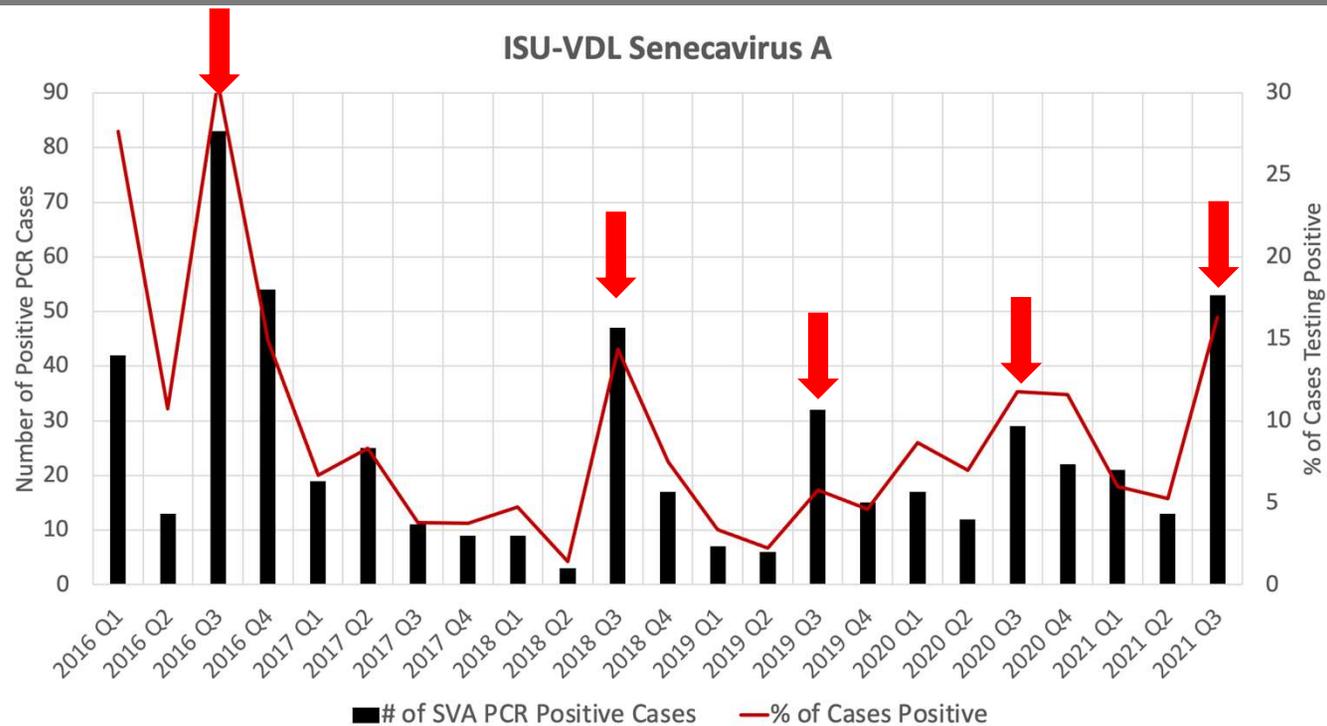


Senecavirus A

- 2 sow sites test positive in July 2019
- October 2019 both sow herds were testing negative
- Last finishing barn positive result was also October
- December/January 2020 herds classified as SVA-negative

No reported cases in Ontario since!

Senecavirus A in the US



Courtesy of Daniel Linhares, DVM, MBA, PhD
 Veterinary Diagnostic and Production Animal Medicine
 Iowa State University College of Veterinary Medicine



Strep Zoo

- *Streptococcus equi* subspecies *zooepidemicus*
- Commensal/opportunistic organism affecting a wide range of hosts
 - Horses, pigs, ruminants, guinea pigs, monkeys, cats, dogs, poultry, humans
- Zoonotic potential, exposure to infected animals
- Often associated with sudden epizootics in animals
- Reported in Asia predominately before 2019 in North America
 - 4 sow barns in Manitoba
 - Multiple states in US, most notably Tennessee assembly yard with 40% sow mortality
- Single strain in particular causes significant disease in pigs (ATCC 35246)

Kuchipudi et al., (2021) A Novel Real-Time PCR Assay for the Rapid Detection of Virulent *Streptococcus equi* Subspecies *zooepidemicus*—An Emerging Pathogen of Swine. *Front. Vet. Sci.* 8:604675.



Ontario Case in December 2020

- Farrow-to-finish system, multi-site
- First signs of disease was pregnancy fall-out (theory)
 - Batch farrowing, started to have poor farrowing rate and conception
- Then sows started dying about 3 months later...
- 6 months saw 20% of sows die over multiple outbreaks
 - **Annualized = 40% sow mortality**
 - Clusters of cases, pig-to-pig spread
 - Off-feed, high fevers
 - Post mortem findings minimal – subtle signs of septicemia
- Farrowing rate batch-to-batch = 50-75%
- Decision was made to depopulate in summer 2021

Grow-finish Infection

- Nursery remained stable overall
 - Small increase in mortality and scour, but not specific
- Grow-finish was a different story...
 - Severe mortality spikes
 - 15-50% mortality, batches of pigs were different
 - Sudden deaths, signs of septicemia
 - Lagged sow barn mortality by 4-5 months

PIGLETTER

Facts and opinions from around the world ■ July 2000 ■ Vol. 20, No. 5

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Australia will capture some of the export market Page 28

Desrosiers declares victory and retires Page 28

Muirhead comments on an uncertain future Page 29

Circovirus type 2: Where will it stop?

BY ROBERT DESROSIERS

Recently two different teams of researchers from Iowa apparently succeeded in reproducing the clinical signs, lesions, and mortality of PMWS (Post-weaning Multisystemic Wasting Syndrome) using just porcine circovirus type 2 (PCV2) (Bolin, Proceedings Swine Disease Conference for Swine Practitioners, 1999; 51-55). Previously, it appeared as if other organisms were needed to reproduce the severe condition sometimes observed in field situations. This by itself is already quite interesting, but there is more. PMWS was first diagnosed in Canada in 1991 (Clark, Proceedings AASP, 1997; 499-501), but it was not until 1997 that Canadian researchers reported that the condition was regularly being recognized in western Canada. Since then, it has been reported in other Canadian provinces, the USA, Ireland, England, Germany, Spain, France, Belgium, Denmark, Taiwan, and, South Korea. There is little doubt that this list will grow rapidly in the years to come. Furthermore, in less than a year, the list of new conditions to which PCV2 could be associated also has grown:

- abortions, mummified fetuses and myocarditis
- hepatitis, jaundice and mortality of caesarian derived-colostrum deprived pigs
- congenital tremors
- porcine dermatitis and nephropathy syndrome

Let's have a quick look at literature reports for each of these conditions.

Myocarditis and abortion associated with intrauterine infection of sows with porcine circovirus 2 (West et al., *J Vet Diagn Invest*, 1999; 11: 530-532)

"Late term abortions and farrowings with stillborn and mummified piglets occurred in a new 450-sow swine facility, which was stocked entirely with first parity gilts. The facility had a farrowing rate of ~ 58 % for the first 4 months of operation, with 20% of the reduced farrowing rate accounted for by losses after 13 weeks of gestation. Of the gilts that farrowed, mummified and stillborn piglets initially accounted for 75% of an average litter of 12... A litter received for postmortem examination consisted of 9 fetuses that appeared to have died at various stages of gestation. There were 2 mummified, 2 macerated, 3 autolyzed, and 2 fresh stillborn piglets... Severe, diffuse myocarditis was present in 1 piglet associated with extensive immunohistochemical staining for PCV2 antigen. Variable amounts of PCV2 antigen were also present in liver, lung, and kidney of multiple fetuses... PCV2 was isolated from the fetus with myocarditis and from a pool of tissues from other fetuses in the litter by inoculating tissue homogenates onto PCV-free PK15 cells... The presence of other agents that have been associated with fetal lesions and abortion in swine, including porcine parvovirus, porcine reproductive respiratory syndrome, encephalomyocarditis virus, and enterovirus, could not be established."

Hepatopathy associated with spontaneous

See **CIRCOVIRUS** on page 26



Conclusion

Need to learn more about the epidemiology of the virus if we expect to be successful in controlling it

First diagnosed in Canada in 1991

1997 is when researchers reported post-weaning wasting syndrome regularly being recognized in Western Canada

After that reported across Canada and internationally

PCV2 associated diseases?

- PMWS
- Reproductive failure
- Jaundice
- Congenital tremours
- PDNS

Comments from Scott Dee

Porcine circovirus type 2: "The root of all evil"

Robert Desrosiers once again has compiled a very comprehensive review of the literature regarding this interesting microbe known throughout the world as porcine circovirus (PCV) type 2. I must say I am intrigued by this virus. I had some experience with Post-Weaning Multi Systemic Wasting Syndrome (PMWS) in Canada and Spain during 1996-1997. PCV-2 antigen was detected in tissue samples collected from affected pigs, as were other pathogens such as rotavirus, *Mycoplasma hyopneumoniae*, and in certain cases, even PRRSV. (What a surprise!) During the last few years, I sat quietly and watched this drama unfold. I kept looking for PMWS, but could not find it, despite the fact that I regularly visited farms in 20 countries each year.

After reading Robert's review, I recommend we change the name of this organism to CIRCUSVIRUS—this whole situation is turning into a regular 3-ring affair! In my opinion, PCV type 2 is a virus looking for a disease, and PMWS is a syndrome looking for a cause. It now seems that PCV type 2 is capable of causing almost every clinical disease entity known to the swine veterinary profession. The next thing it will be blamed for is poor pig

meat prices! I agree with Robert's title: "Where will it stop?" Has anyone looked for the virus in the tissues of "healthy" pigs? My guess is that you will find evidence of this virus in normal, perfectly healthy animals, if you want to take the time to look for it.

I admit that many people in our industry disagree with my opinion. I don't mean to be abrasive or reduce the significance of someone's hard work in the lab or in the field. I just want to be sure that we are being critical thinkers when it comes to this subject. If PCV-2 is indeed the true etiology of PMWS, it needs to be proven. Until that time, it is important that practitioners critically evaluate diagnostic results and our industrial partners do not initiate the production and sale of biologics that feed off emotion, rather than science. Remember, we do not want to fall into a similar trap that an infamous little virus sprung on us back in the late 1980's. Unfortunately, I am having trouble recalling the name of that organism... hmmm, let me think... I think it was something along the lines of... E,... followed by a M,... then I think there was a... C!

Circusvirus!

- ✓ Virus looking for a disease
- ✓ PMWS a syndrome looking for a cause

PCV2: Guilty as charged. By Robert Desrosiers

In his comments on my Porcine Circovirus type 2 (PCV2) article, Scott raises one very good point: We need to be careful about how we interpret the role of this virus when it is identified in sick pigs. What happened with the Encephalomyocarditis (EMC) virus and the "Mystery Swine Disease" should, as he mentions, be fresh enough in our minds to avoid making the same mistakes again. Nevertheless, I think there are important differences between the two situations. Let's have a quick look at that.

The first cases of the Mystery Swine Disease (PRRS) in North America occurred in 1987. Three years later one of the first meetings on this condition was organized in the US. Potential candidates deemed to explain part, or all, of the losses and clinical signs associated with the condition included the EMC virus, atypical strains of Influenza, *Lep-tospira bratislava*, *Chlamidia*, fumonisin and other mycotoxins, aerotolerant *Campylobacter*, the pseudorabies virus, etc. Nobody had yet been able to reproduce the disease with any of these hypothetical causes, no organism was consistently identified from tissues of affected pigs and the situation was as confused as could be.

Now, what about PCV2? Several groups of researchers, from all over the world, have reproduced much of PMWS by experimentally infecting pigs with PCV2 alone, or in combination with parvovirus.

An Iowa State University team led by Drs. Steve Sorden and Perry Harms has recently shown that in pigs experimentally infected with strains of the PRRS virus alone, PCV2 alone or both organisms, the mortality rate was 0 %, 50 % and 100 % respectively. Scientists at the National Animal Disease Center used a separate isolate of PCV2 and were able to reproduce fatal PMWS (Post-weaning Multisystemic Wasting Syndrome). Examination of 200 cases of PMWS from North America and Europe has always demonstrated an abundance of PCV2 antigen associated with lesions. PMWS does not seem to occur without PCV2, and no other infectious agent is consistently identified in tissues of affected pigs.

The credibility of the Iowa State University Diagnostic Laboratory team removes all doubt. When

one looks at the number of their cases per year where they considered PCV2 to have played a primary or secondary role in the disease process, it was 2, 16, 111 and about 400 for 1996, 1997, 1998 and 1999 respectively. Finally, many diagnoses of PMWS in Western Canada have come from herds of high health status that are free of many common diseases such as *Mycoplasma pneumonia*, pleuropneumonia, salmonellosis, atrophic rhinitis, swine dysentery, transmissible gastroenteritis, pseudorabies and, importantly, PRRS. This shows that PMWS can be significant even in the absence of many other swine diseases.

For all these reasons, my personal vote goes to those who believe that Circovirus type 2 is a pathogen and is causing PMWS. I realize that it may not always explain everything by itself and that other factors (genetics, the presence of other infectious agents, stresses, environment, etc.) can contribute to the clinical picture and lesions observed in field situations. So, nothing is clear and simple or totally understood. But, at the same time, what we have now certainly indicates that there is a very close link between PCV2 and PMWS. As far as the other conditions (hepatitis in young colostrum deprived/caesarian derived pigs, abortions and myocarditis, congenital tremors, porcine dermatitis and nephropathy syndrome, proliferative and necrotizing pneumonia) for which a potential connection has recently been suggested with PCV2, there seems to be a link, but some more work needs to be done before definitive conclusions can be reached.

Going back to Scott's comments, he is absolutely right when he suspects that the virus can be found in normal, healthy pigs. In a recent communication, investigators reported that of 30 Scottish herds (none with clinical signs suggestive of PMWS) 100 % were serologically positive for PCV2. The same is true in Canada where it seems to be very difficult, using the serological tests presently available, to find herds that are negative. This is in spite of the fact that clinical signs are seen in only a small minority of these herds. In a study conducted in Quebec, researchers found that the virus could be detected in animals with or without clinical signs and lesions suggestive of PMWS. This, however, is no different than what we see with many other dis-

BACK TALK

Several groups of researchers, from all over the world, have reproduced much of PMWS by experimentally infecting pigs with PCV2 alone, or in combination with parvovirus.

An Iowa State University team led by Drs. Steve Sorden and Perry

Harms has recently shown that in pigs experimentally infected with strains of the PRRS virus alone, PCV2 alone or both organisms, the mortality rate was 0 %, 50 % and 100 % respectively. Scientists at the National Animal Disease Center used a separate isolate of PCV2 and were able to reproduce fatal PMWS (Post-weaning Multisystemic Wasting Syndrome). Examination of 200 cases of PMWS from North America and Europe has always demonstrated an abundance of PCV2 antigen associated with lesions. PMWS does not seem to occur without PCV2, and no other infectious agent is consistently identified in tissues of affected pigs.

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See PCV2
on page 41

Researchers can reproduce disease with PCV2 alone

Found in healthy pigs easily

Detected in animals with or without clinical signs/lesions

PCV2 versus PCV3

	PCV2	PCV3
¹ Syndromes	PMSW Reproductive failure PDNS	PMSW Reproductive failure PDNS
² Experimentally reproduce disease?	✓	✓
³ PCR positive tests: Healthy Sick	✓ ✓	✓ ✓

¹ Palinski R et al. A Novel Porcine Circovirus Distantly Related to Known Circoviruses Is Associated with Porcine Dermatitis and Nephropathy Syndrome and Reproductive Failure; J Virol. 2016 Dec 16;91(1).

² Conti et al. Histological Lesions and Replication Sites of PCV3 in Naturally Infected Pigs. *Animals* **2021**, *11*, 1520

³ Yang et al. Geographic distribution and genetic diversity of porcine circovirus type 3 from clinical samples in US swine farms; SHMP 2018.

Demeter Lab

PCV3	# PCR	PCV3 pos	Weak + Ct >30	Medium + Ct 25-30	Strong + Ct <25	Ct min
2017	2	50%	50%	0%	0.0%	34.8
2018	94	48%	44%	4%	0.0%	26.4
2019	242	62%	38%	19%	5.0%	17.9
2020	390	59%	32%	17%	9.5%	18.7
2021 (Jan-Nov)	841	53%	29%	14%	10.8%	15.8

	# PCR	PCV3 pos	Weak + Ct >30	Medium + Ct 25-30	Strong + Ct <25	Ct min
Serum	586	42%	31%	10%	1%	17.9
Processing fluid	243	95%	39%	33%	23%	15.8
Tissue/animals	33	48%	36%	12%	0%	27.5
Oral fluid	25	88%	28%	24%	36%	19.0
Semen	2	100%	100%	0%	0%	32.4

PCV3 Disease (Ryan's Opinion!)

- Robert Derosiers, *International Pigletter*, September 2000 on PCV2

Leave it to the pathologists!

- ✓ Virus and specific lesions present with clinical disease = virus is involved in the disease process
- ✓ Virus present but no clinical signs or lesions = no or limited role in the condition



Image: Sow with PDNS-like skin lesions aborting. Dr Ben Hause, College of Veterinary Medicine, Kansas State University

