

Pelvic Organ Prolapse: An industry-wide collaboration to identify putative contributing factors

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Sow mortality frustrates experts | National Hog Farmer

https://www.nationalhogfarmer.com/mag/farming_sow_mortality_frustrates ▼

One of the most common problems facing many sow farms is high **sow death** losses. Some herds have reported monthly mortality rates exceeding 15%.

Increase in U.S. sow mortality a real mystery | National Hog Farmer

<https://www.nationalhogfarmer.com/animal.../increase-us-sow-mortality-real-mystery> ▼

May 23, 2017 - A noticeable trend among hog producers around the globe is a steady climb in **sow mortality**, particularly in the past three years. As Jerry ...

Sow Mortality Rising | National Hog Farmer

https://www.nationalhogfarmer.com/mag/farming_sow_mortality_rising ▼

A variety of factors linked to reproductive physiology, sow management and herd size appears to have triggered a sharp rise in **sow mortality** in U.S. herds.

15 Reasons for Rising Sow Mortality | Pork Business

<https://www.porkbusiness.com/article/15-reasons-rising-sow-mortality> ▼

Jan 17, 2011 - Everyone is searching for answers concerning the industrys increase in **sow mortality**. Changes in pork production, including confinement ...

- Sow mortality, especially due to prolapses, has increased the past 5 years in the US swine industry.
- It has become a significant welfare and production issue.
- No good understanding of root causes are known at this time.
- National Pork Board Released an RFP in October, 2017.

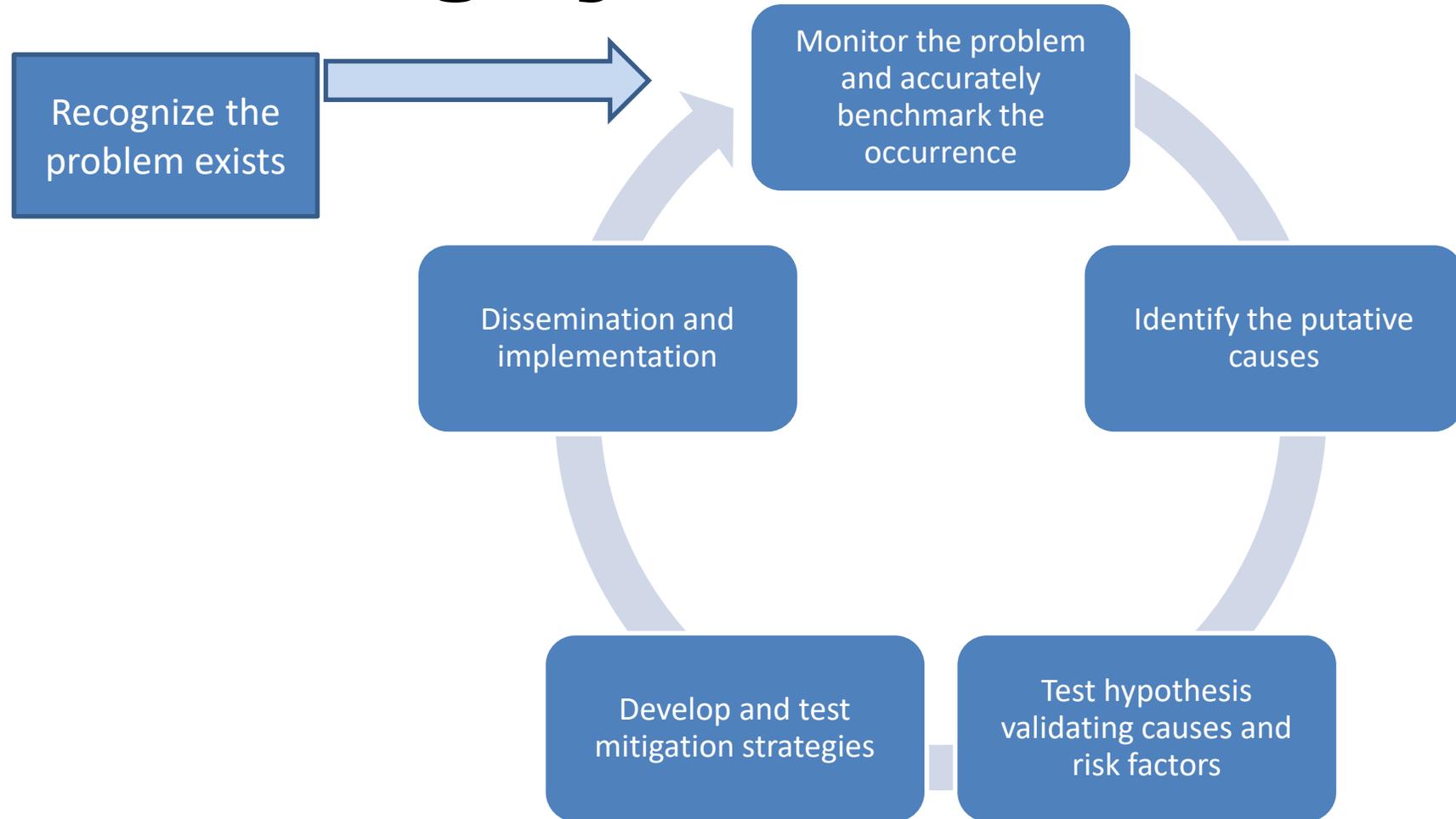


ISU Investigators

- Amanda Chipman, Extension
- Colin Johnson, Extension
- Chris Rademacher, Swine disease and production veterinarian
- Ken Stalder, Genetics and statistics
- Anna Johnson, Welfare and behavior
- Aileen Keating, Reproductive toxicology
- John Patience, Nutritionist
- Nick Gabler, Nutrition and physiology
- Daniel Linhares, Epidemiology and statistics
- Kent Schwartz, Diagnostic veterinarian
- Suzanne Millman, Welfare
- Jason Ross, Reproductive physiology



Problem solving cycle



Objectives of the Initial Prolapse Project

- Identification of risk factors associated with Pelvic Organ Prolapse in the US sow herd.
 1. Establish network of industry partners and Sow Farm Managers (target was 60-80 sow farms).
 2. Develop herd and individual sow survey tool and use it on farm.
 3. Establish communication and advisory network of producers, allied industry, university faculty and staff.
 4. Establish an accessible repository of data, samples and information.

This is a hypothesis generating project

It is expected to provide data used to justify pursuing future research studies that test specific hypotheses



Examples of Data Collected

- **Herd factors:** Sow farm inventory, gestation and lactation diet parameters, distillers dry grain usage, feed type (i.e. pellet or mash), mycotoxin binder usage, bump feeding, prior mortality and prolapse incidence at the farm, disease history, gilt size at breeding.
- **Facility factors:** Water and feed delivery systems, sow housing type (i.e. pen or stall), gestation pen or stall hygiene, environmental conditions.
- **Management factors:** Artificial insemination hygiene/cleanliness, farrowing assistance strategies, sow feedback and vaccinations, protocols on gestation pen/stall management, culling criteria and strategies.
- **Animal based measures:** Data will be collected on sows that are at specific stages of production, assistance on previous farrowing, genetic background, lameness score, perineal region score, tail dock length, genital-anal distance, body condition score.
- **Records and data integrity:** Prior year sow production and mortality records will be extracted and communication on how records were created with farm staff to ensure causes of mortality are accurately defined.
- **Sample Banking:** We will collect representative fecal samples, feed samples, water samples, and swabs of gestation pens/stalls for future distribution and analysis if warranted.



Mortality and Prolapse Record Sheet

Production system _____
 Sow Farm Name _____

Average inventory for the week _____

Week _____
 Date range _____

Sow Mortality and Prolapse Record Sheet

Date of prolapse or mortality	Initials of person collecting data	Sow ID	Cause(s) of death (use code at bottom of sheet)	Prolapse (Y or N)	Type of prolapse (1=rectal, 2=vaginal, 3=both)	Severity of prolapse (Length protruding from body), inches	Timing of prolapse in relation to farrowing	1=Euthanize 2 = Found dead 3=the prolapsed sow was culled	Was she treated for lameness (Y or N)	Was she induced? (Y or N)	Date induced	Additional comments

Scope of the project

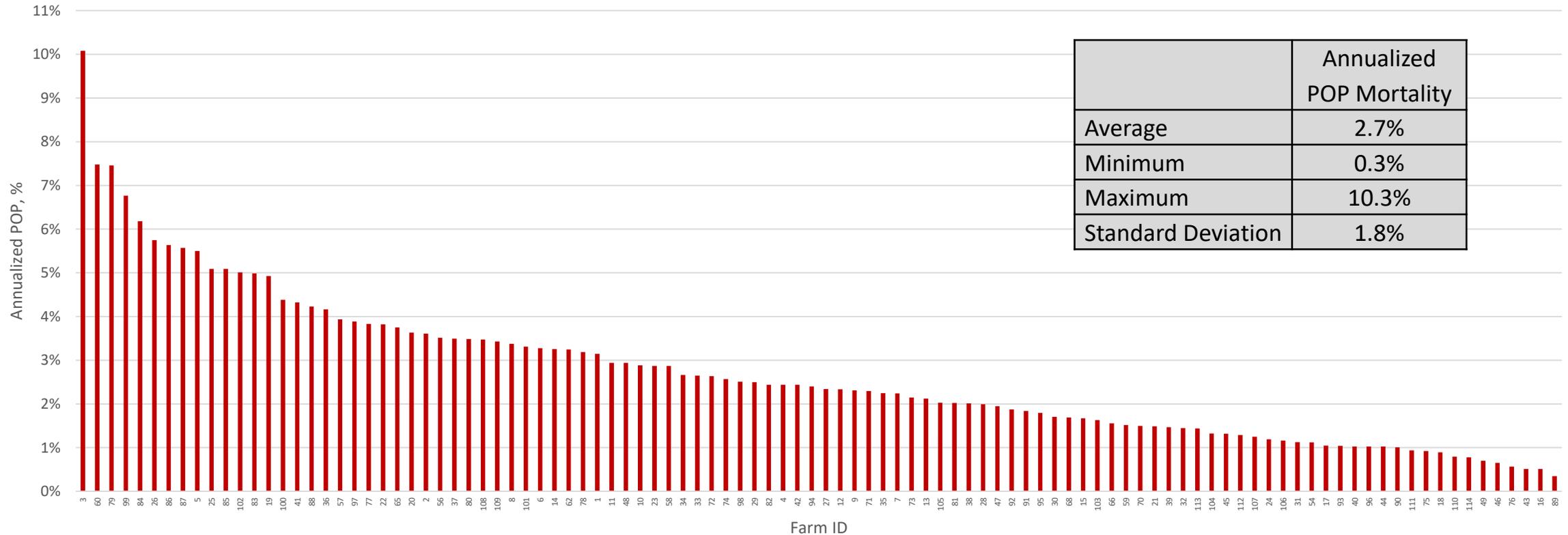
Weekly mortality and prolapse data submitted weekly by:

- 104 Farms
 - 85 farms in 13 larger systems
 - 19 independents
- Almost 400,000 sows
- 15 states



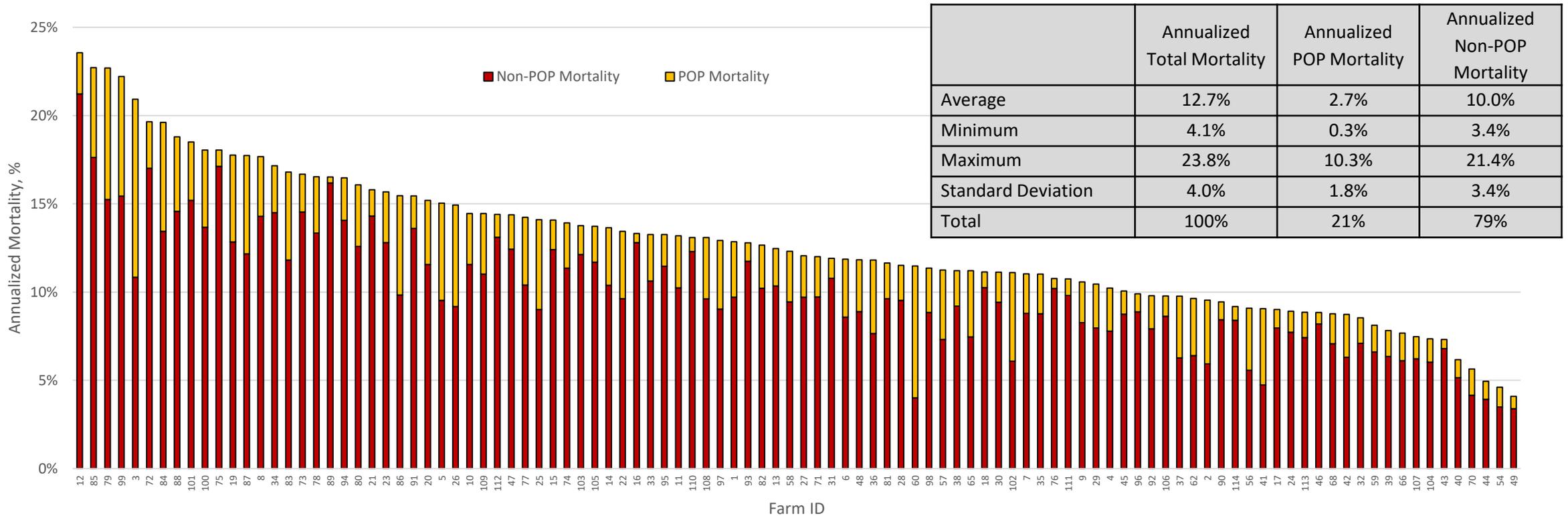
Average POP Rate for 104 farms

Pelvic Organ Prolapse Rate

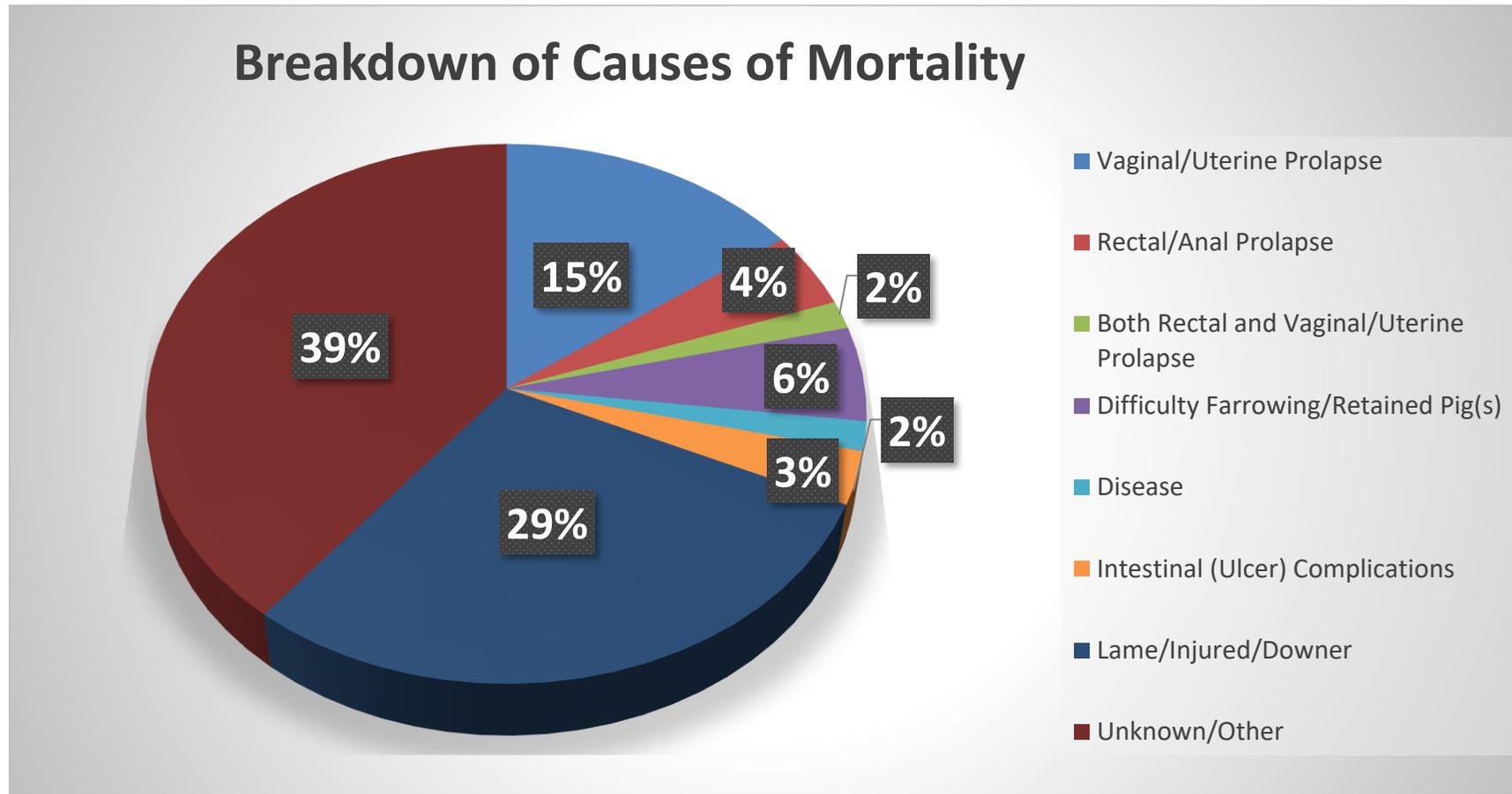


Average Mortality for 104 farms

Cummulative Annualized Mortality

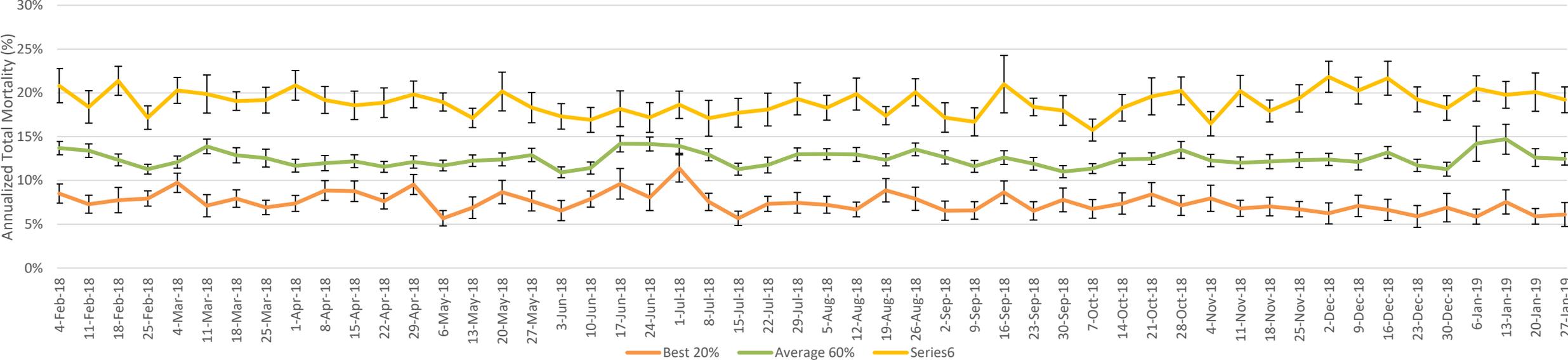


Causes of Mortality



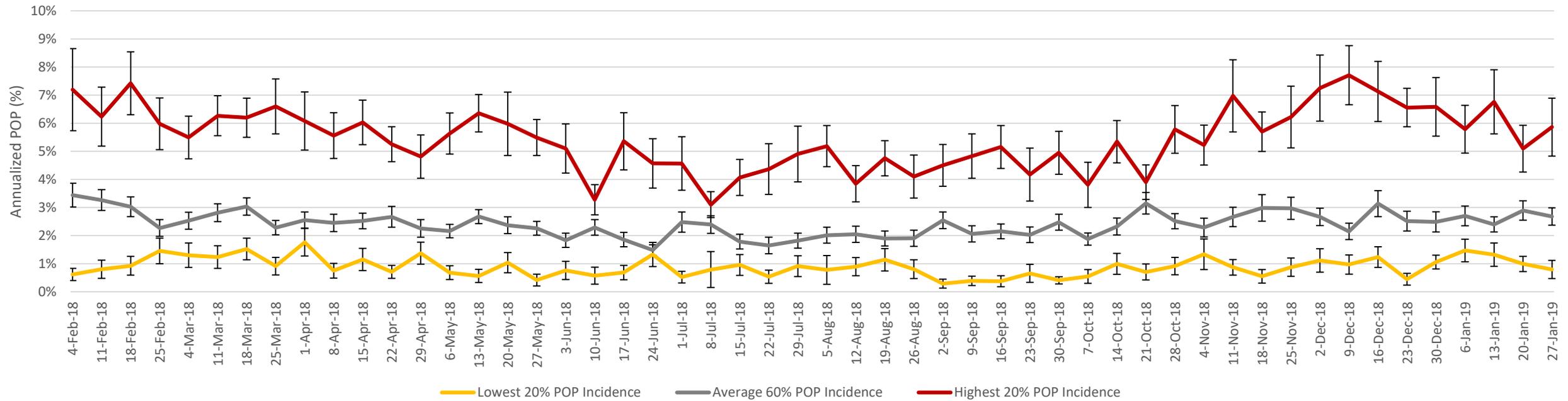
Significant Variation Across Farms Exists

Annualized Total Mortality

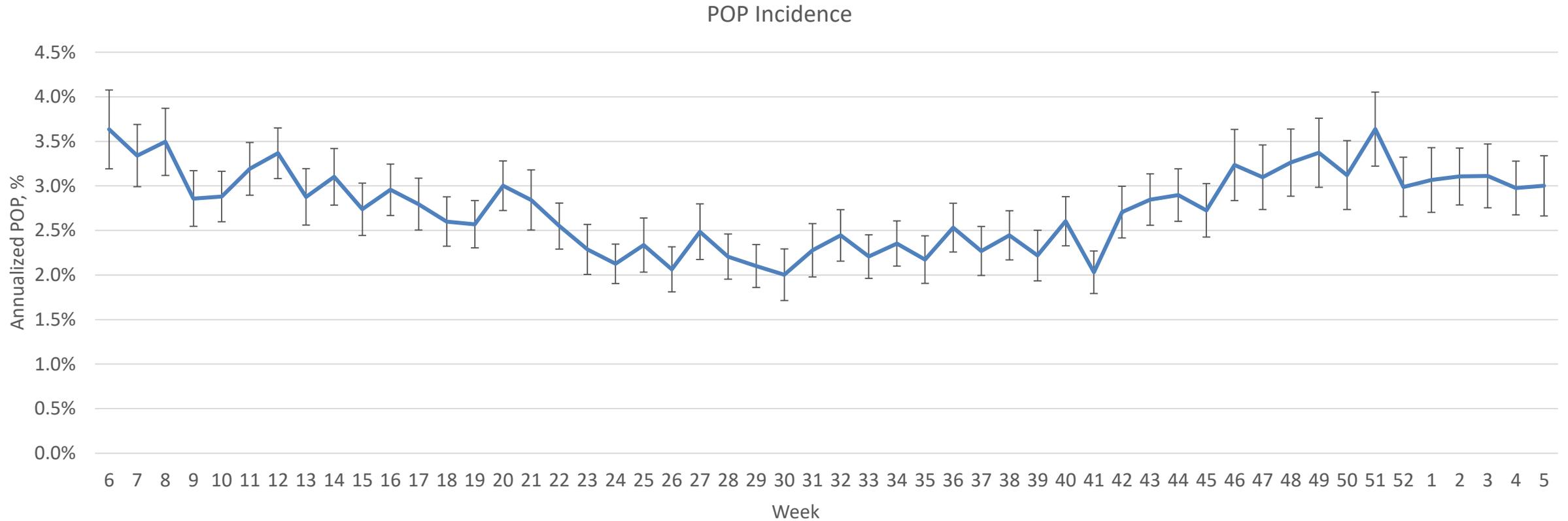


Significant Variation Across Farms Exists

Annualized POP Mortality

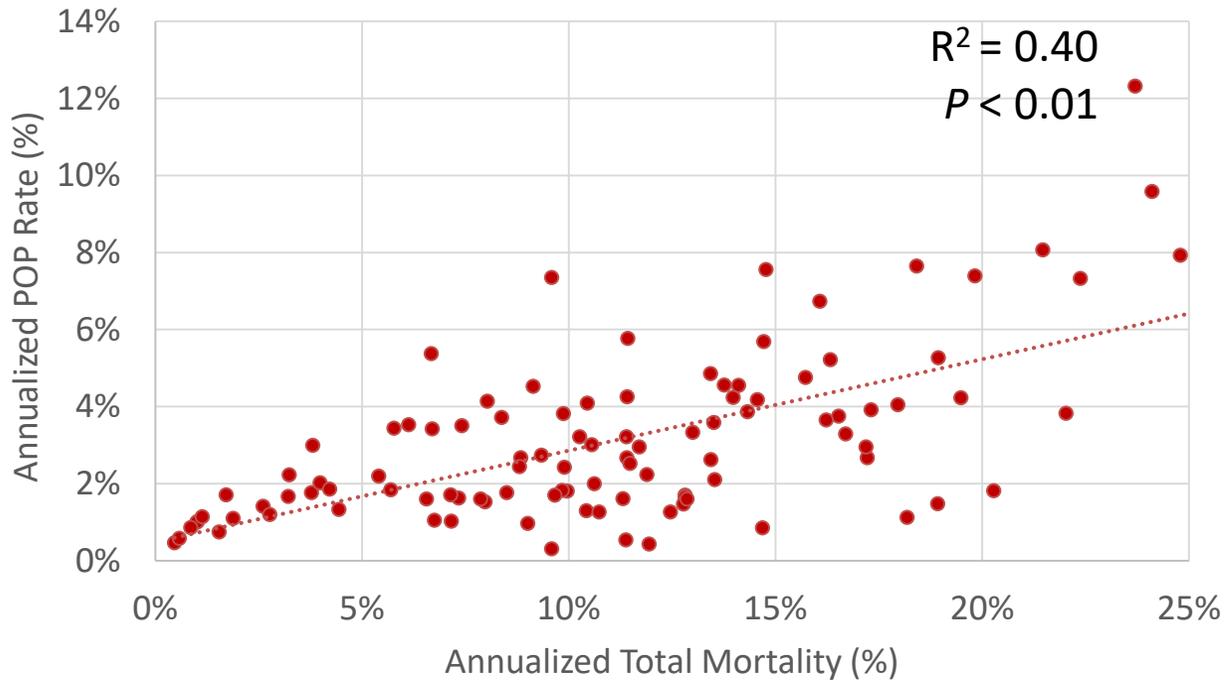


Trends over time-POP

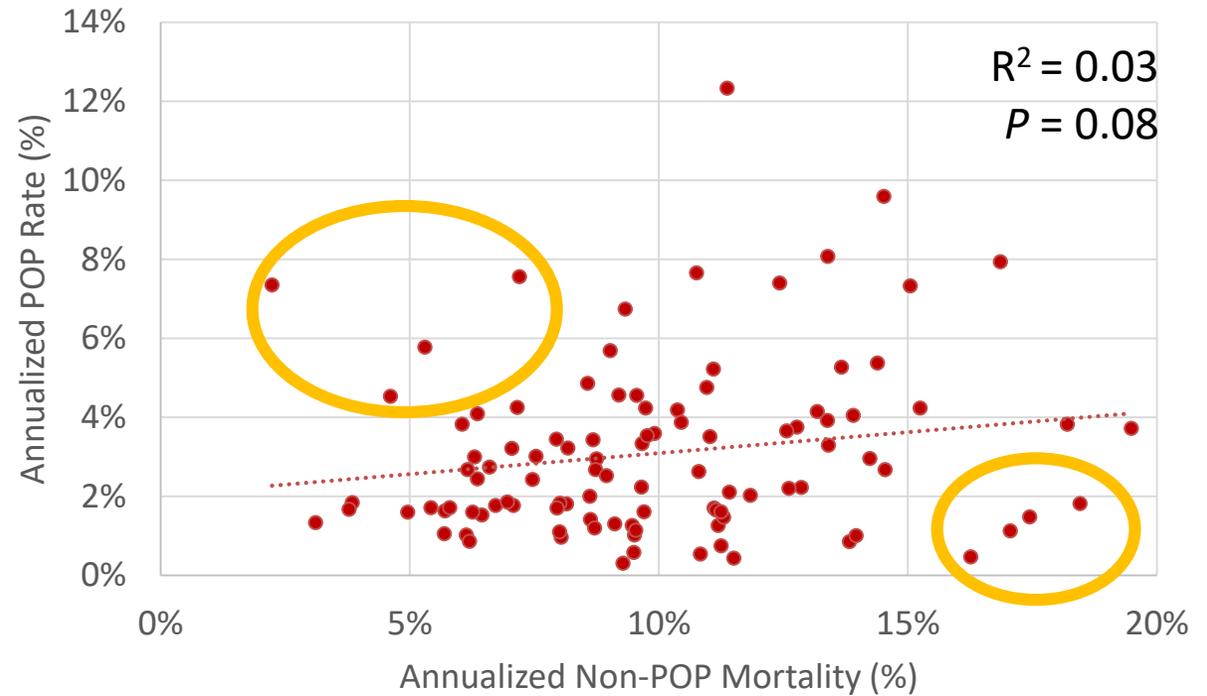


Relationship between POP and Mortality

Total Mortality and Prolapse Incidence



Non-POP Mortality and Prolapse Incidence





Factors that *don't seem to have a relationship* with prolapse incidence according to this dataset

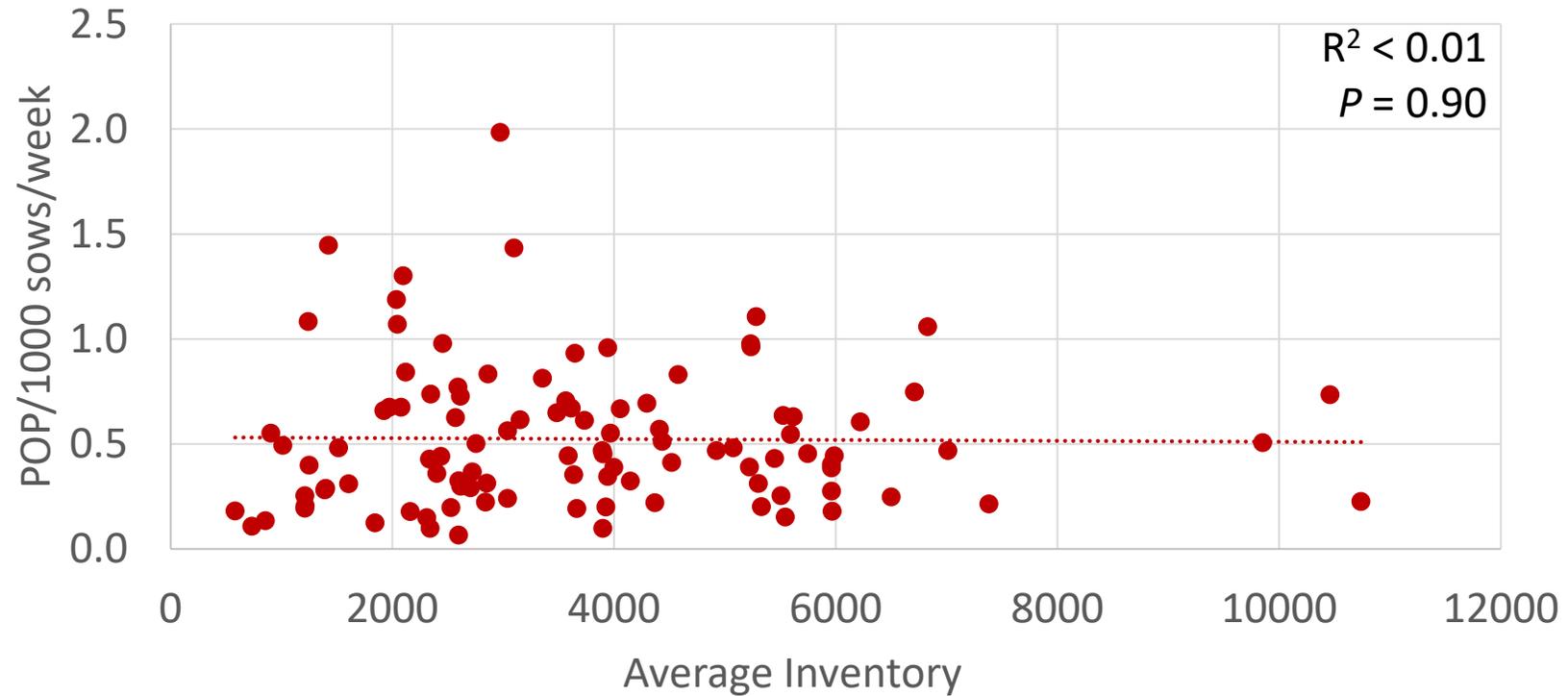
Factors that could have a relationship with prolapse incidence, but *there was only moderate evidence*

Factors that seem to have a relationship with prolapse incidence and therefore *need further investigation* to identify causation

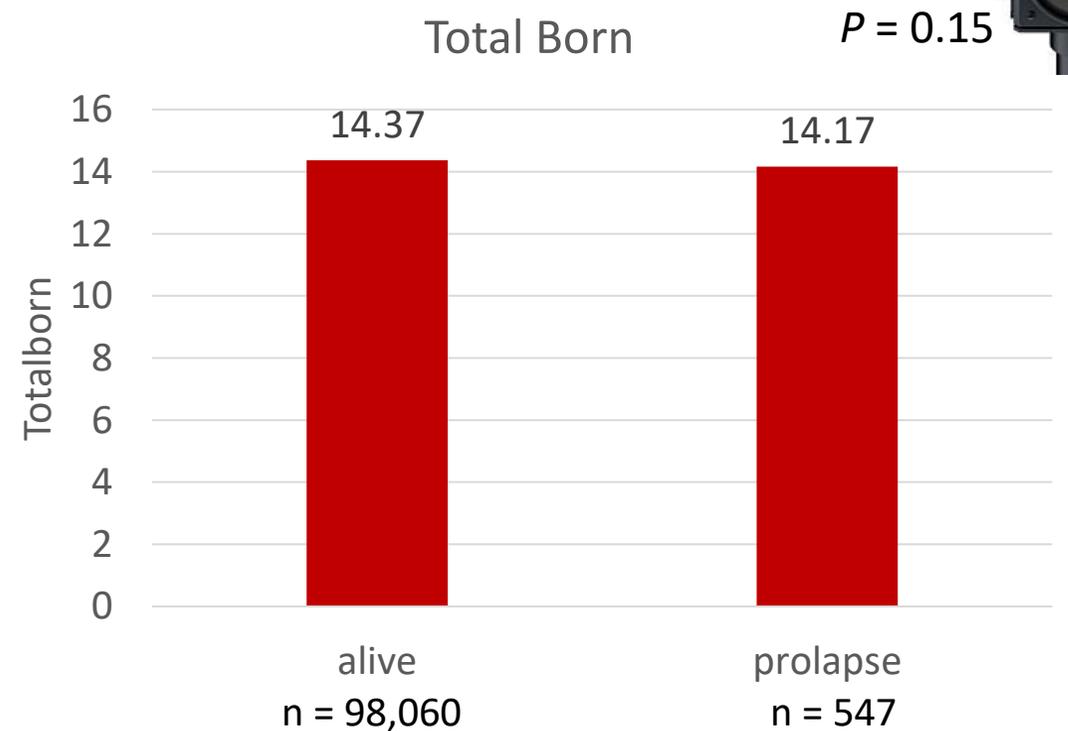
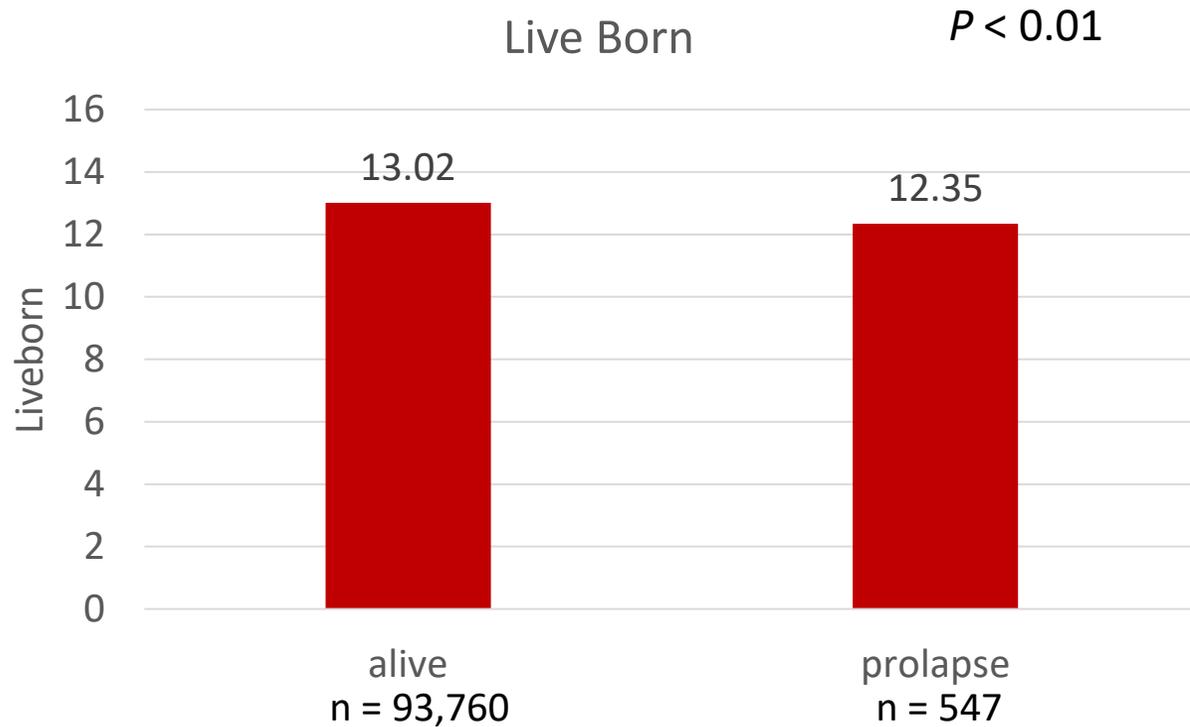
Farm Size



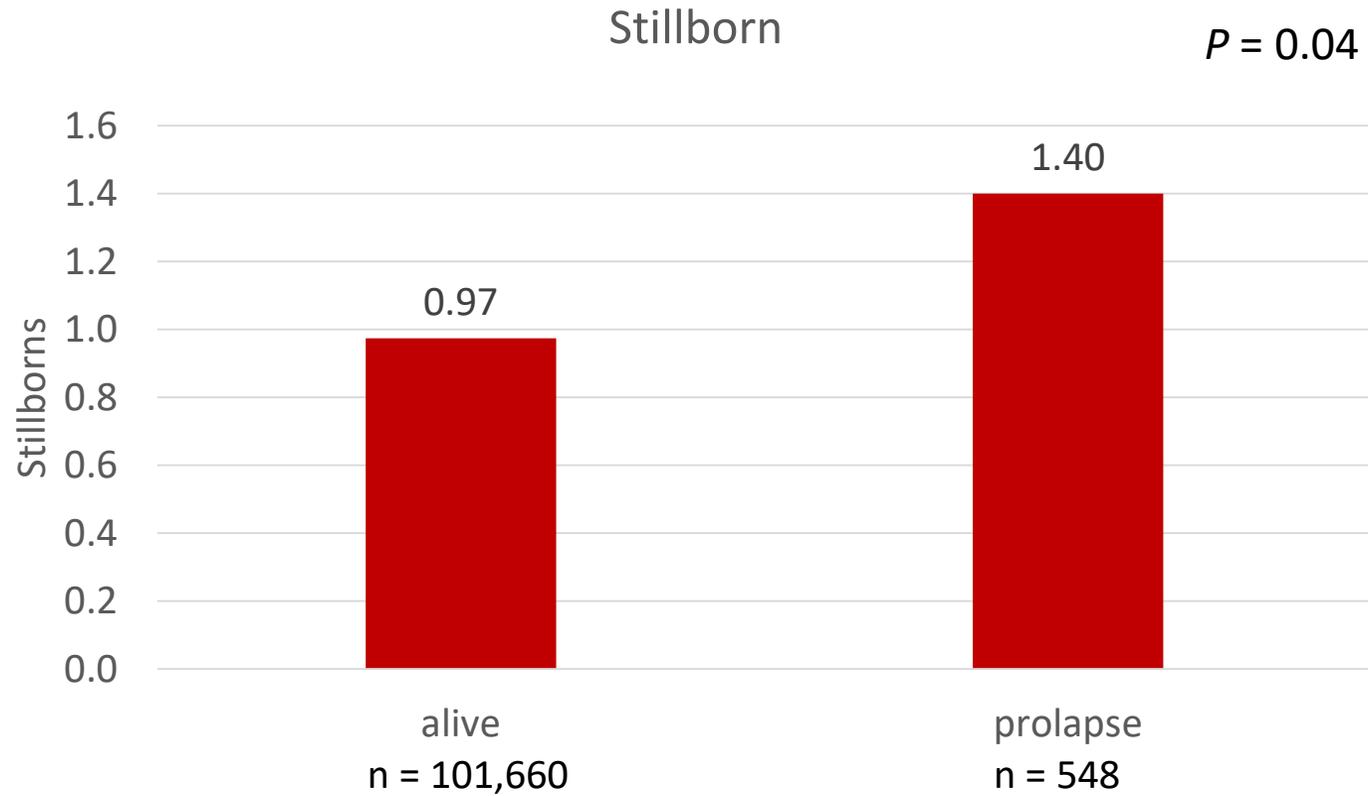
Sow Farm Inventory



Litter Size



Stillborns



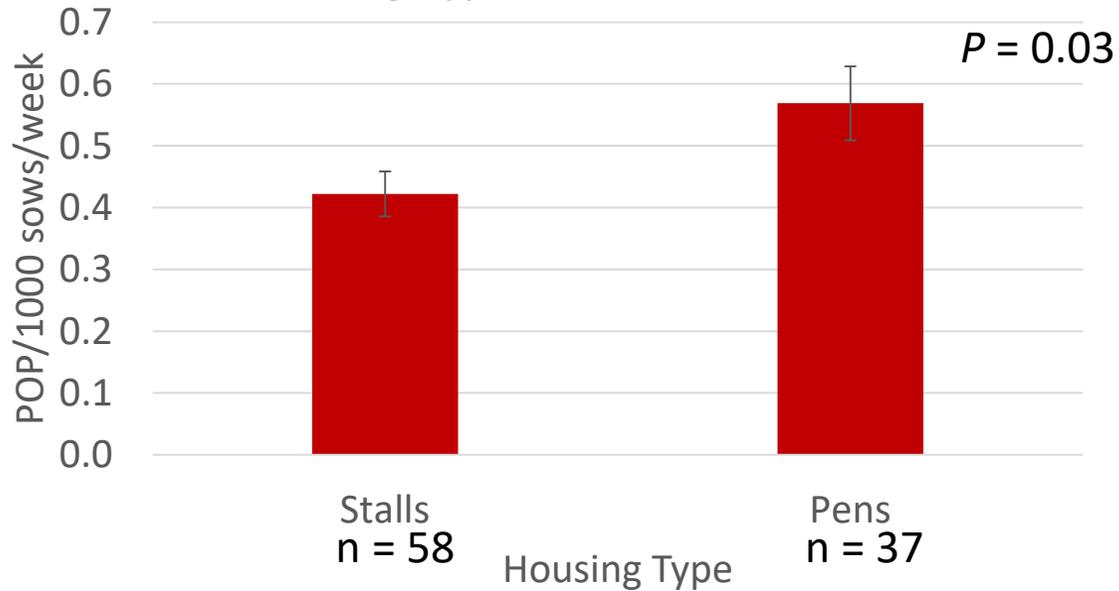
Sow Housing

We still have questions about

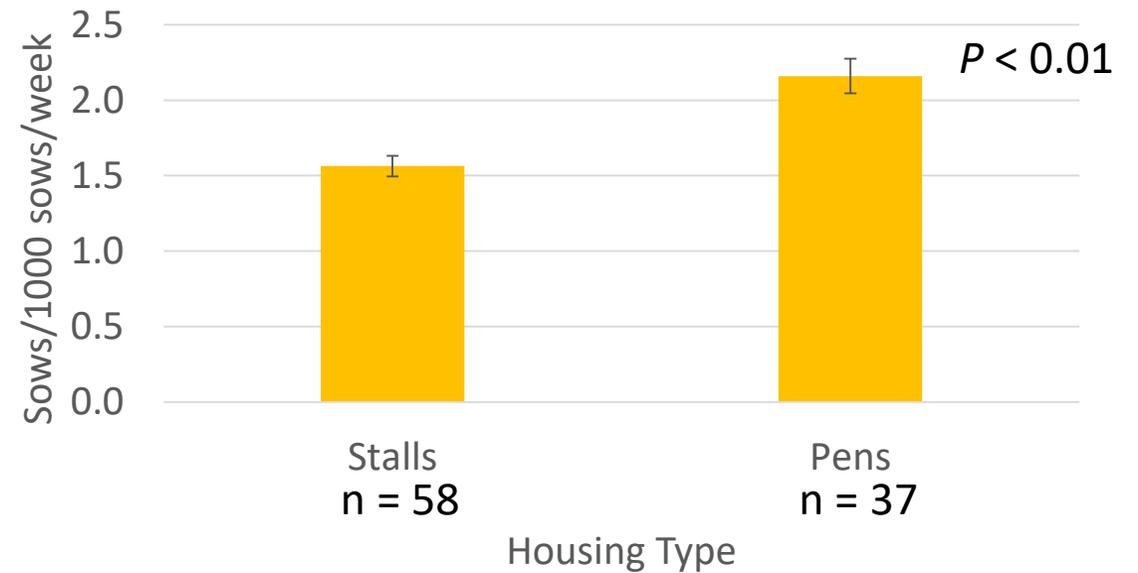
- Stocking density
- Group size
- When are they moved into the pens



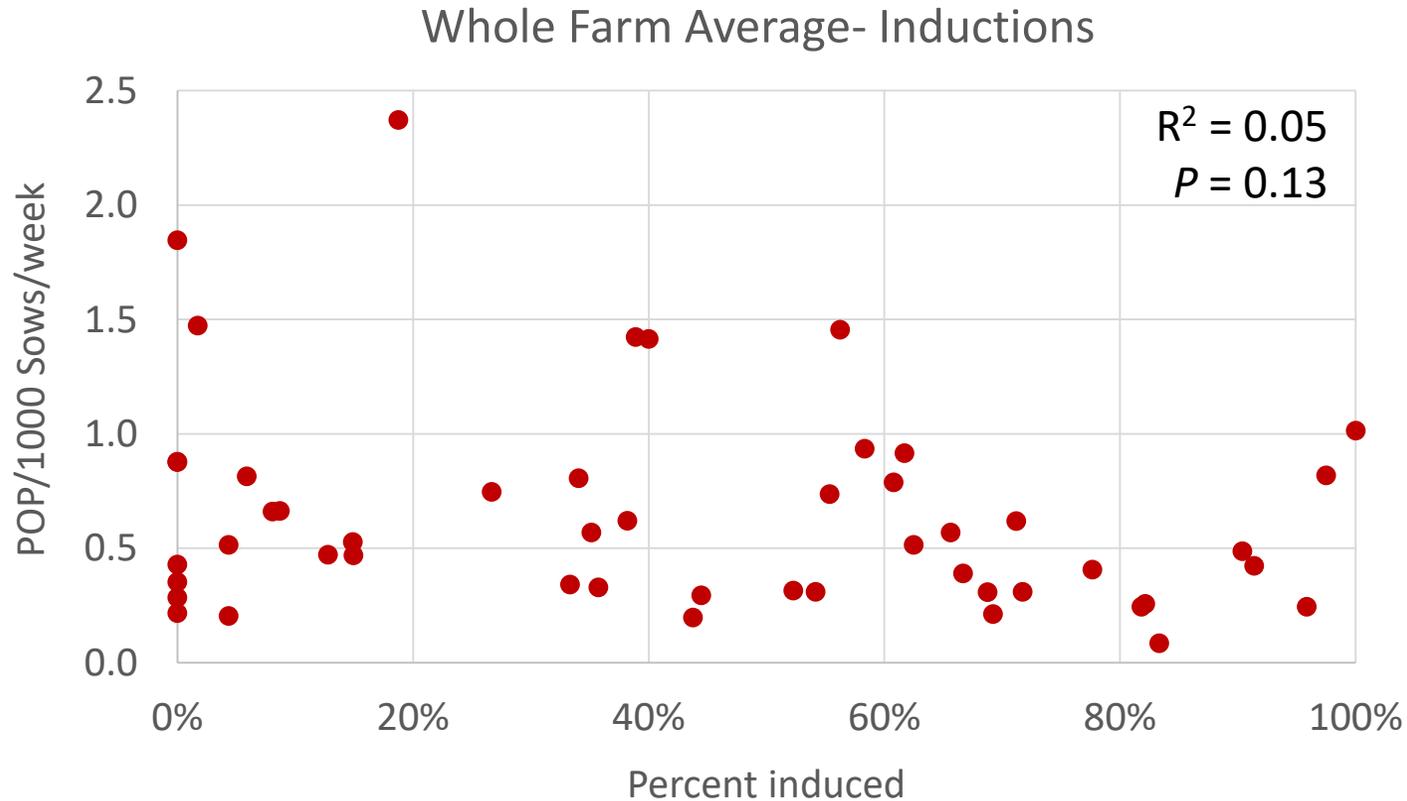
Housing Type and POP Incidence



Housing Type and Non-POP Mortality Rate



Farrowing Management Strategies- Induction of Parturition

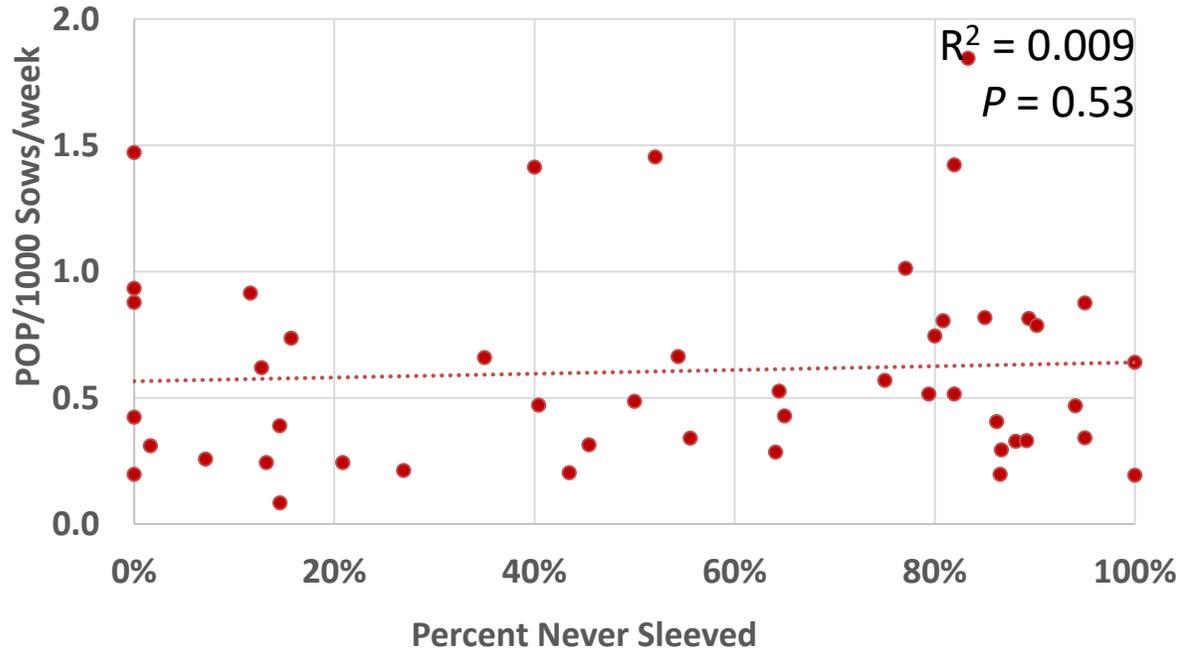


n = 50 farms

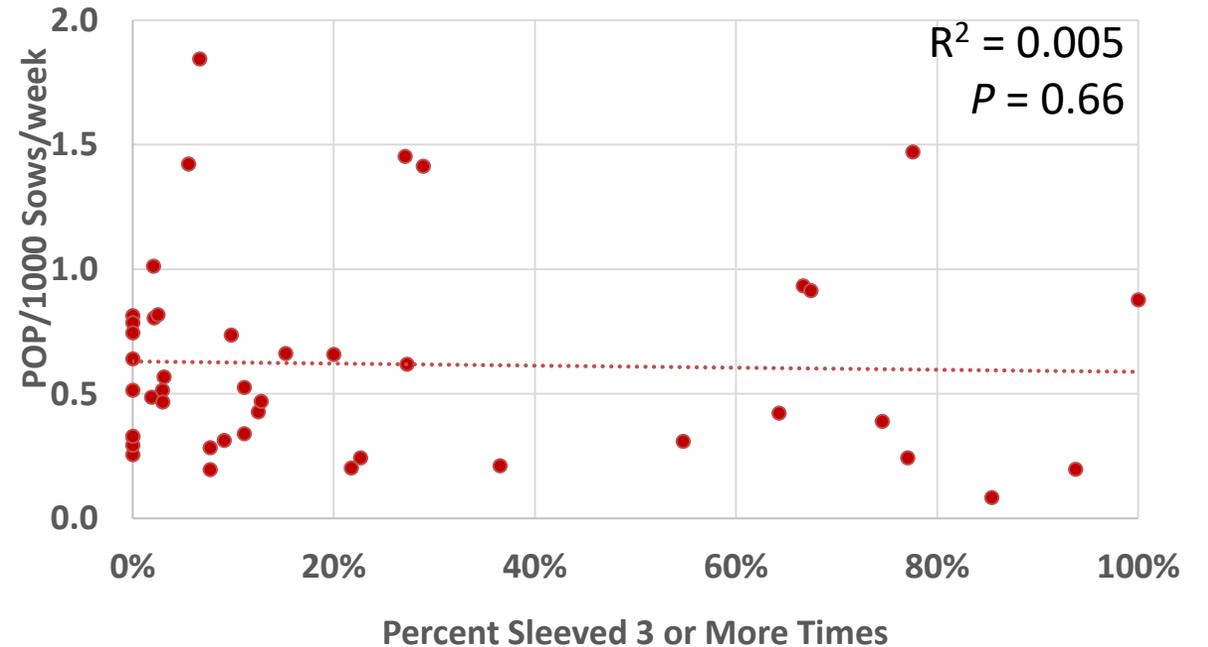
Farrowing Management Strategies- Assistance



Whole Farm Average- Never Sleeved



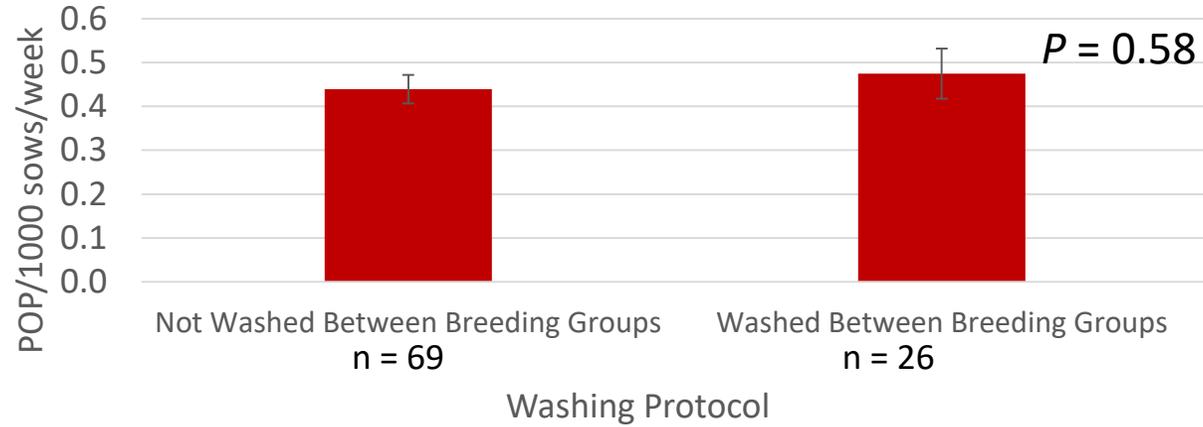
Whole Farm Average- Multiple Sleeving



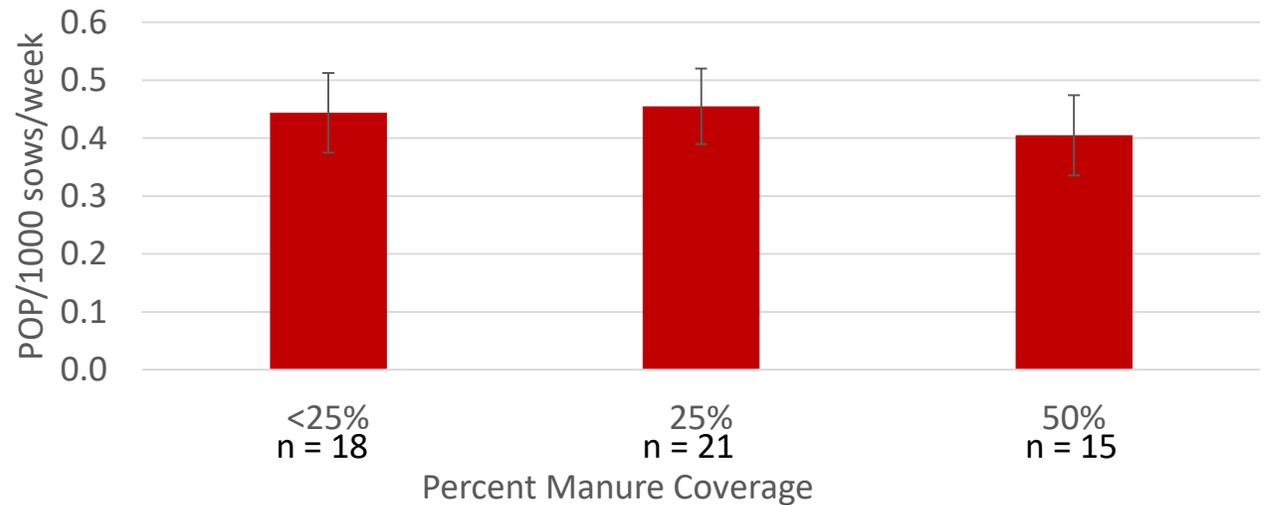
Farm Hygiene



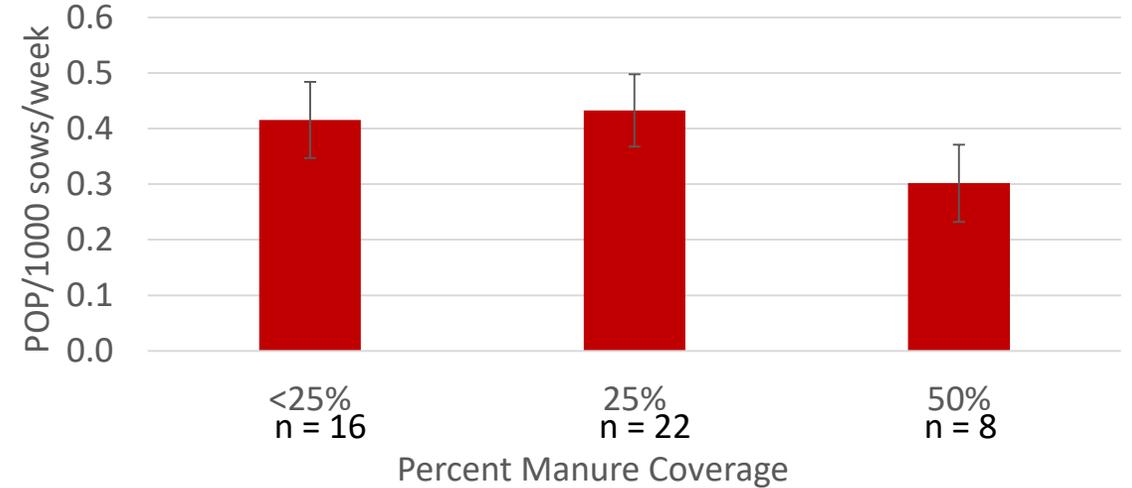
Breed Row Hygiene and POP Incidence



Breeding Row Manure Coverage



Gestation Manure Coverage

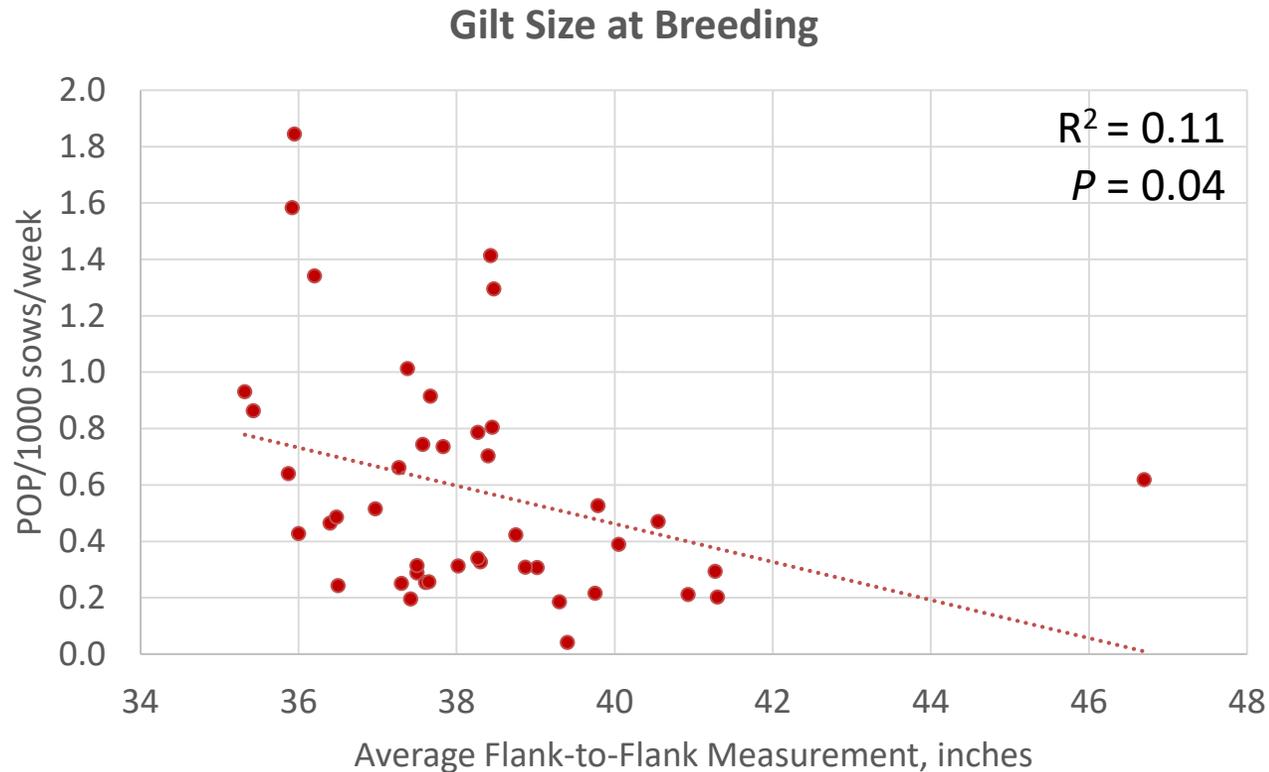


Gilt Size at Breeding



Conversions

36 inches = 339 lb Body Weight
38 inches = 392 lb Body Weight
40 inches = 446 lb Body Weight



n = 43 farms

Individual Animal Measurements

Production System		Farm Name		POPID Number	
Date		ISU collector initials		Days of gestation	

	Sow ID	Tail Length (cm)	Distance from anus/vagina (cm)	Perineal Region Score	Standing or laying down for perineal score	BCS	Comments
1							
2							
3							
4							
5							
6							

Scope of the project
 On-site visits completed on:
 62 of the 104 farms
 Over 5000 sows individually measured
 11 of the 15 states
 4 people collecting data on visits

A Scoring System of the Perineal Region to Identify Sows with Potential Risk for POP



Score 1: Presumed ***“little to not”*** risk of uterine prolapse

Has none of the following: protrusion, vulva swelling, and swelling of the perineal region



Score 2: Presumed ***“moderate”*** risk of uterine prolapse

Has evidence of some but not all of the following: protrusion, moderate vulva swelling, and swelling of the perineal region

Score 3: Presumed ***“high”*** risk of uterine prolapse

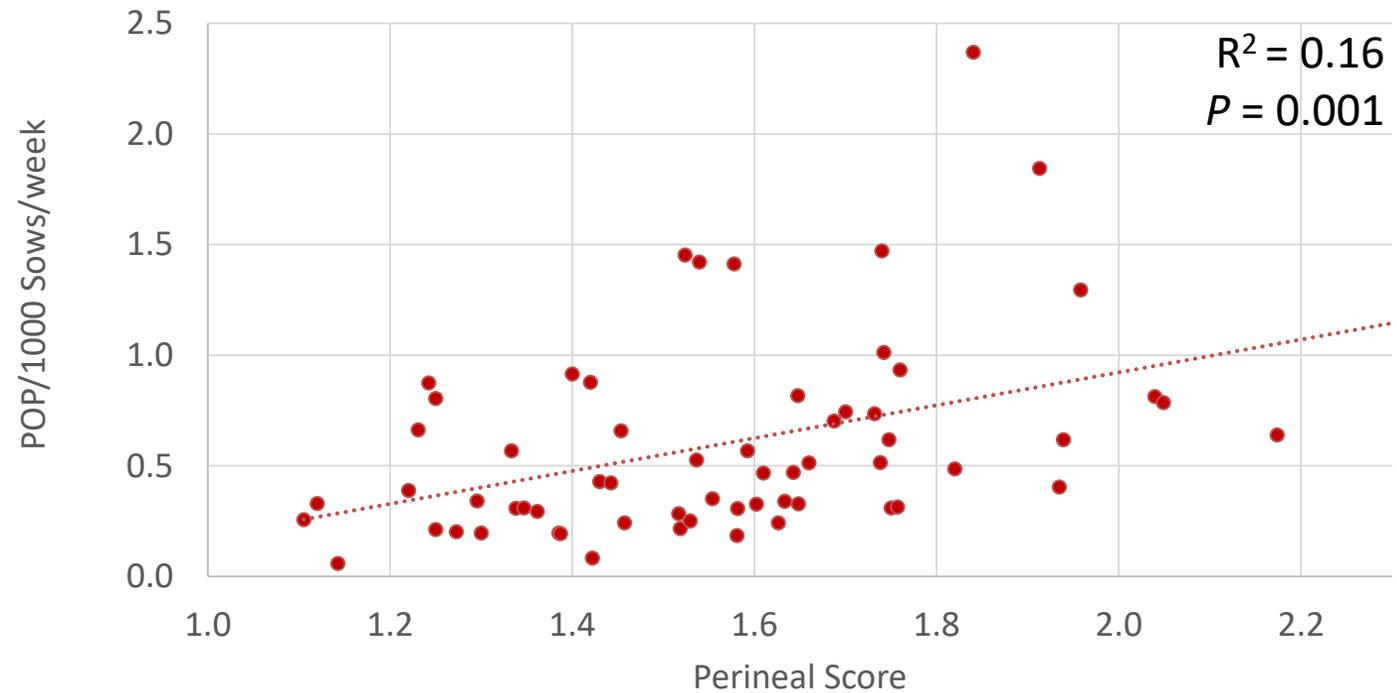
Has all of the following: protrusion, moderate to severe vulva swelling, swelling of the perineal region, and possible beginning of a prolapse



Average Number of Animals Scoring a 3 Correlates to Higher Prolapse Incidence



Whole Farm Average- Perineal Score



Perineal Score in Late Gestation as an Indicator of POP Risk



Score 1

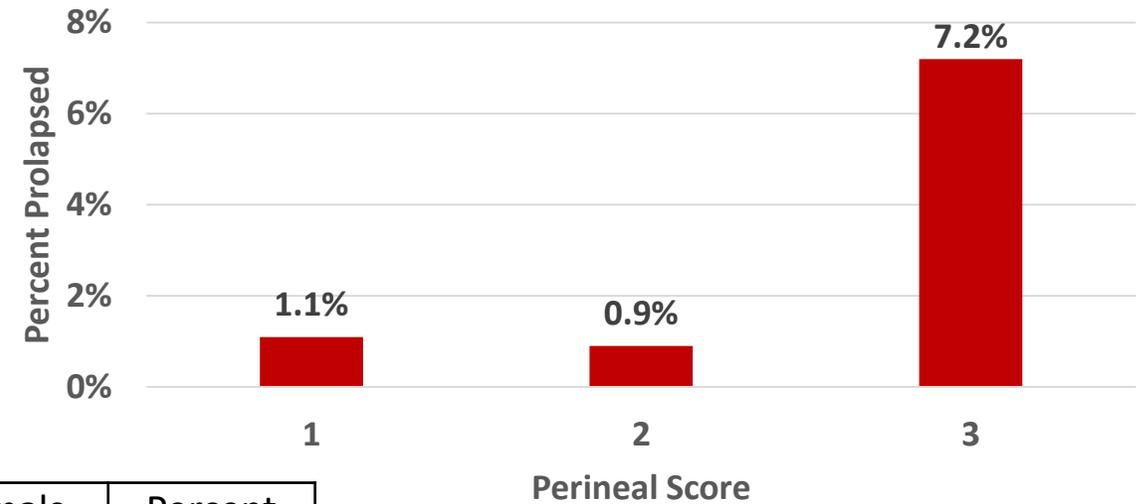


Score 2



Score 3

Percent of Sows Prolapsed According to Perineal Score



	Total scored animals	Animals prolapsed	Percent prolapsed
Score 1	1310	15	1.1%
Score 2	1361	12	0.9%
Score 3	235	17	7.2%
Total	2906	44	1.5%

Why Are Perineal Scores Important?

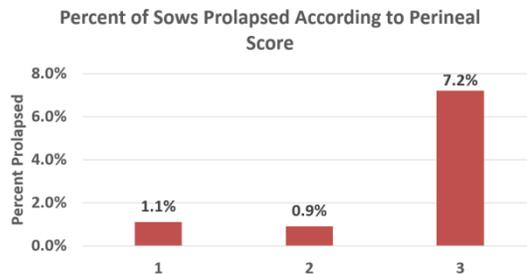
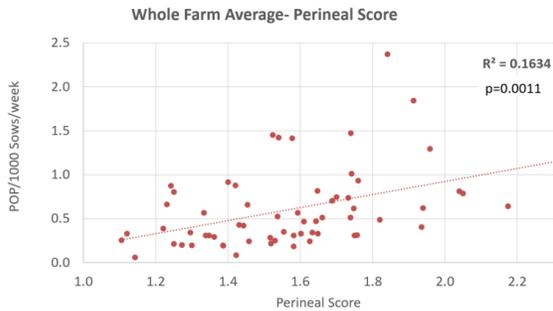
Perineal scores are an indicator of prolapse risk



Something biologically is happening and causing a score 3



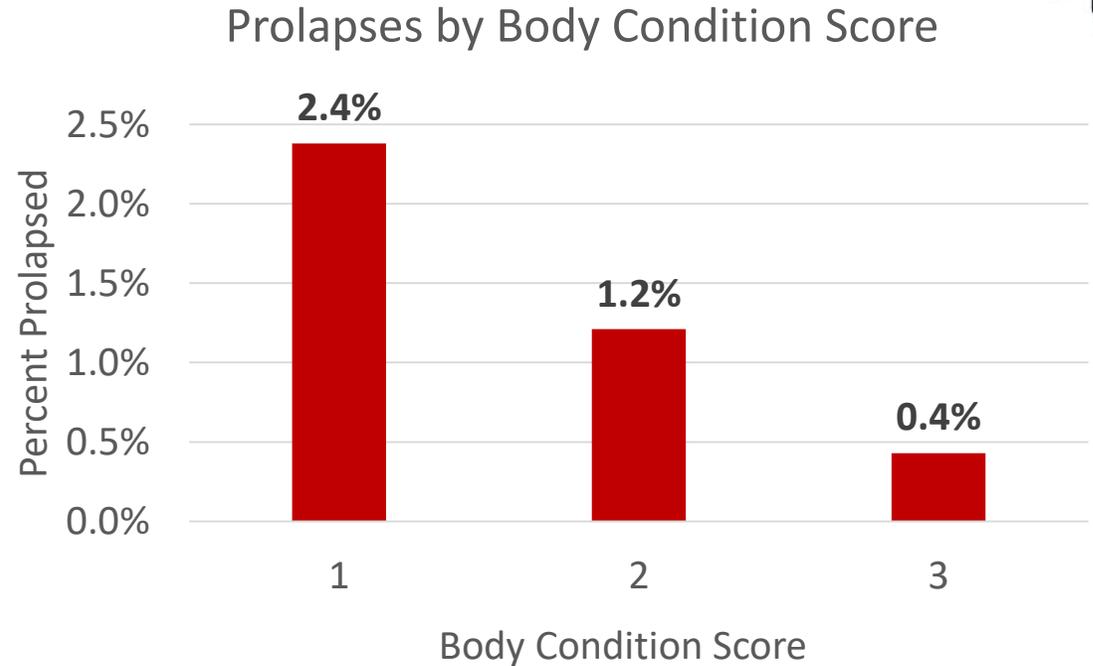
Now we can design experiments before a prolapse happens to further understand what is going on and why is it happening.



Body Condition Score in Late Gestation as an Indicator of POP Risk



	Total scored animals	Animals prolapsed	Percent prolapsed
BCS 1	884	21	2.4%
BCS 2	3378	41	1.2%
BCS 3	691	3	0.4%
Total	4953	65	1.3%



Palpation of hip bones to determine body condition



Thin Sow	Ideal Sow	Heavy Sow
Can feel the hip bones without pressure	Can feel the hip bones with firm pressure	Can't feel hip bones even with hard pressure
Add feed (1-2 lbs)	Leave feed where it is	Reduce feed (1 lb)

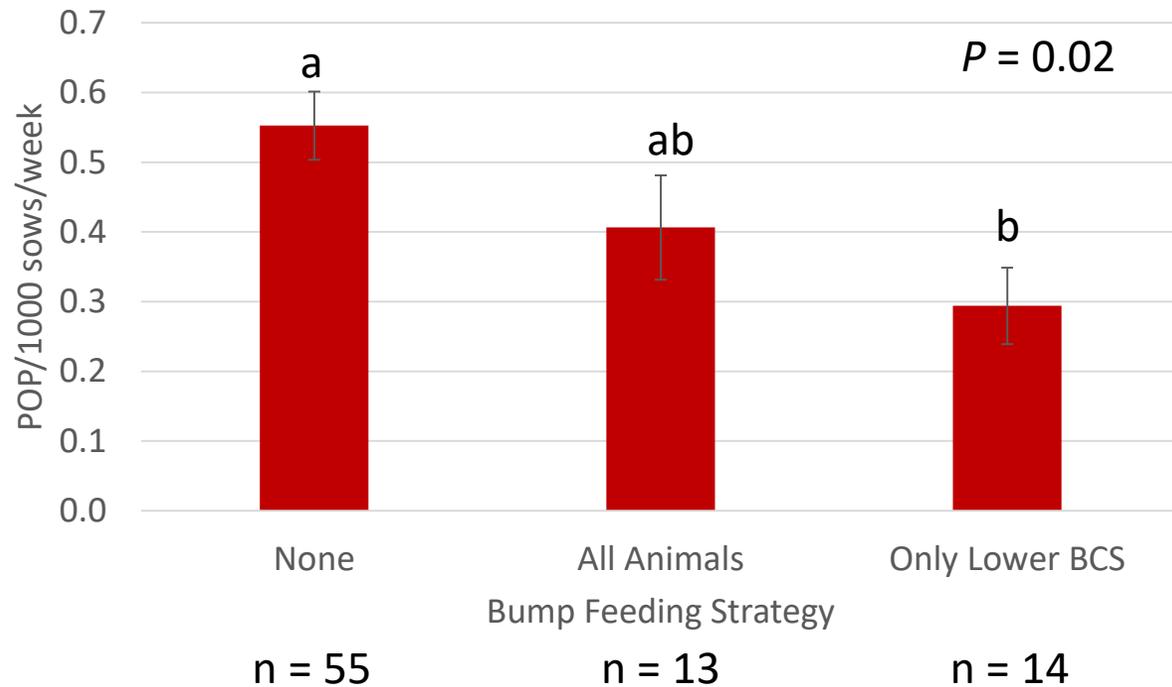


Bump Feeding Strategy

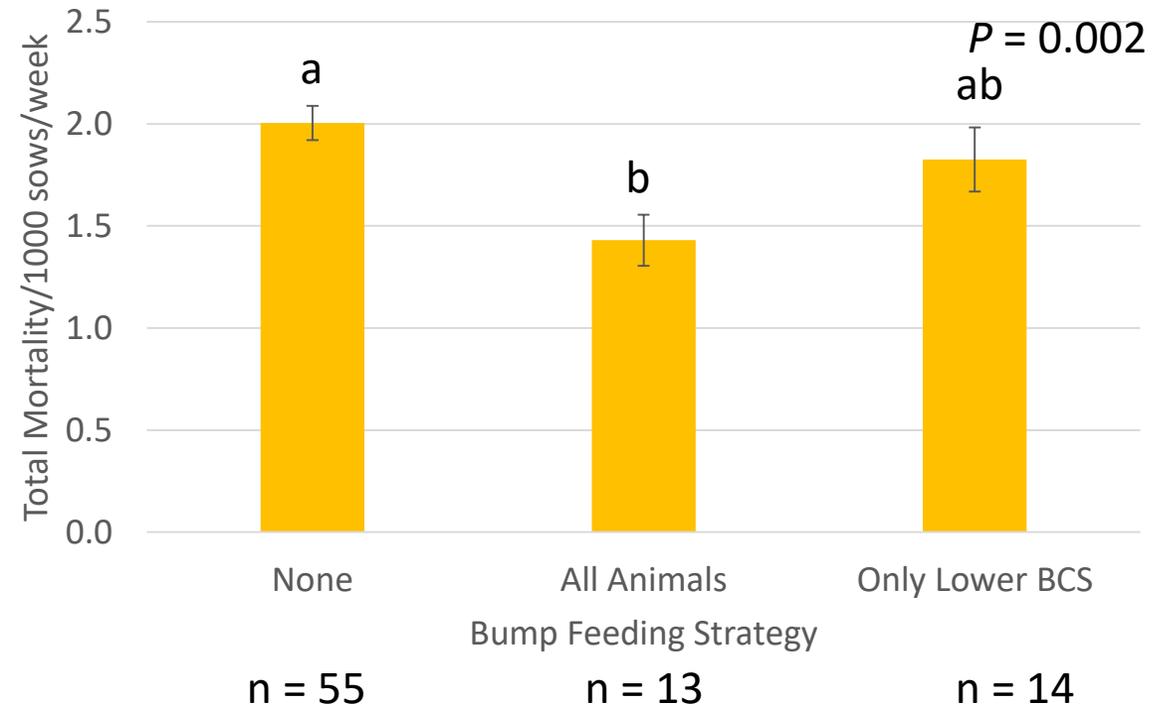
A 0.1 change in POP/1000 sows/week is roughly 0.5% change in annualized mortality



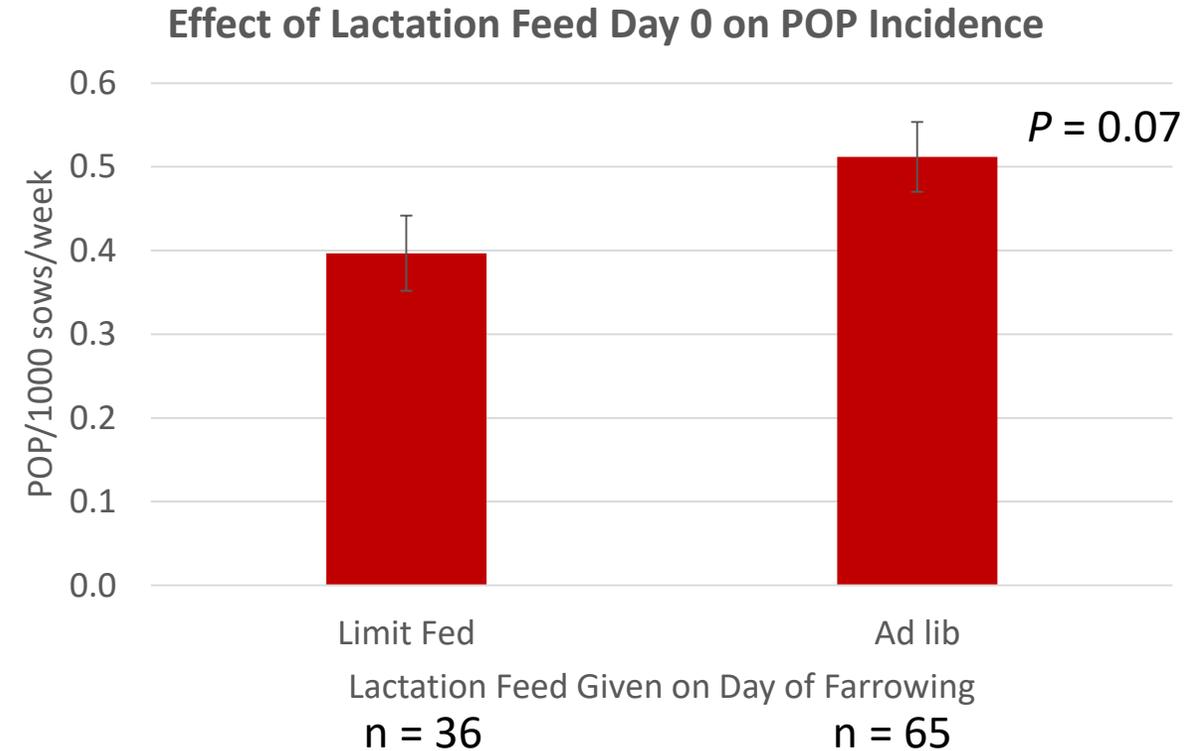
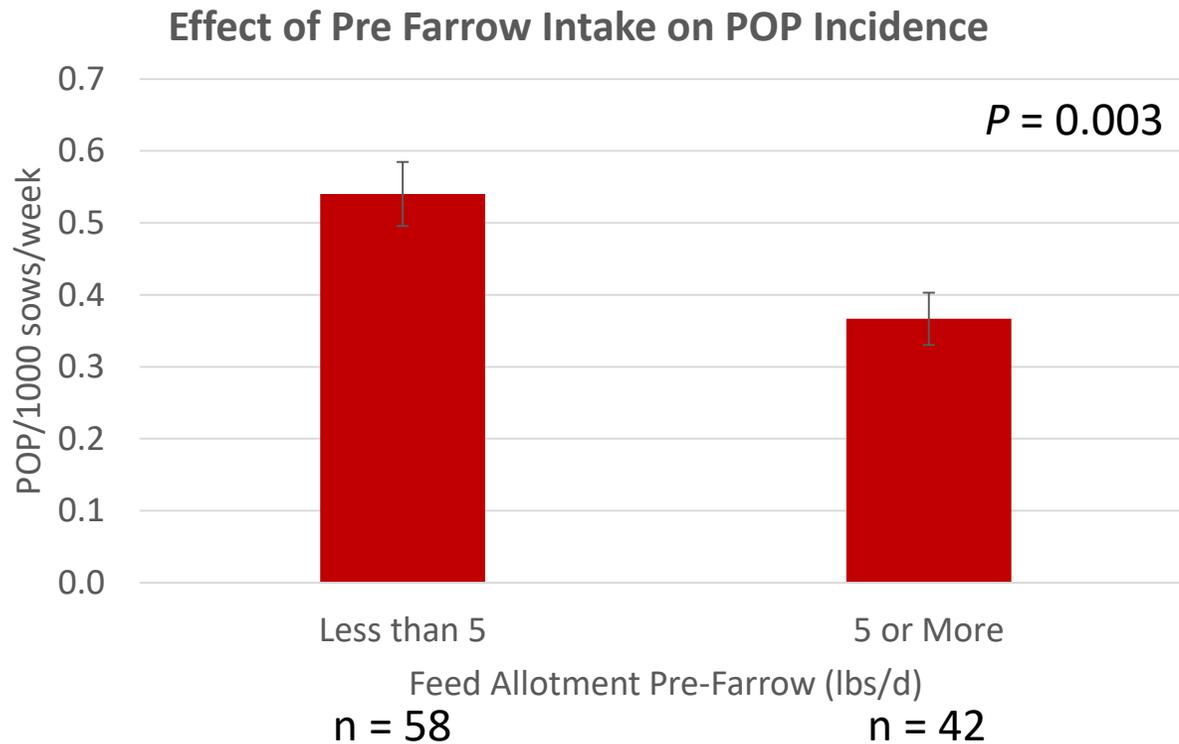
Bump Feeding and POP Incidence



Bump Feeding and Non-Prolapse Mortality



Farrowing Feeding Strategy



Why Are BCS and Feeding Strategy Important?

It seems like body condition or energy intake going into farrowing is important

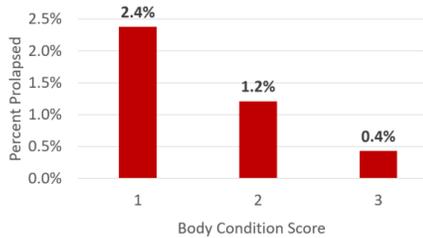


Something in the biology of the animal causes that decreased risk

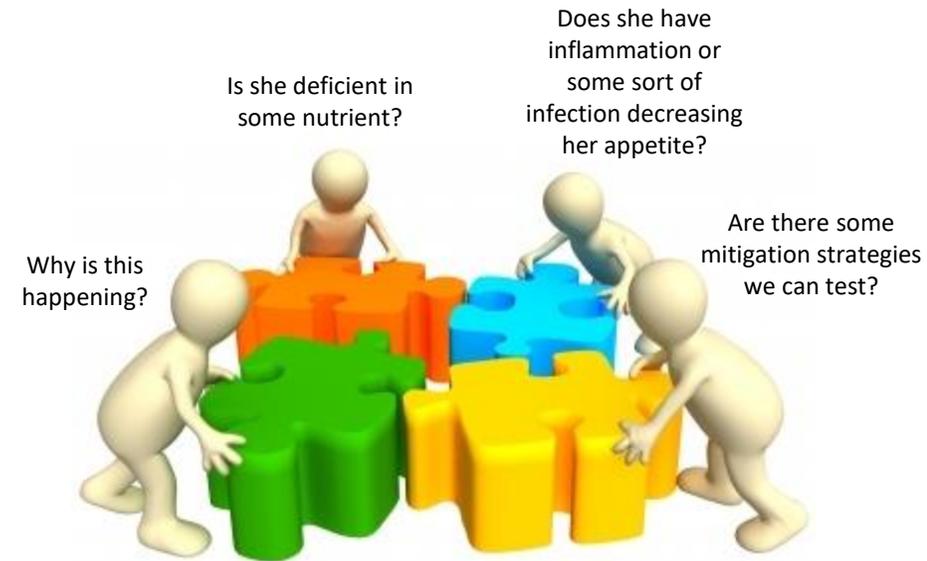
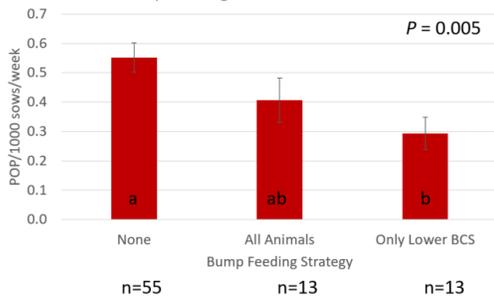


Now we can design experiments to further understand what is going on and why is it happening.

Prolapses by Body Condition Score



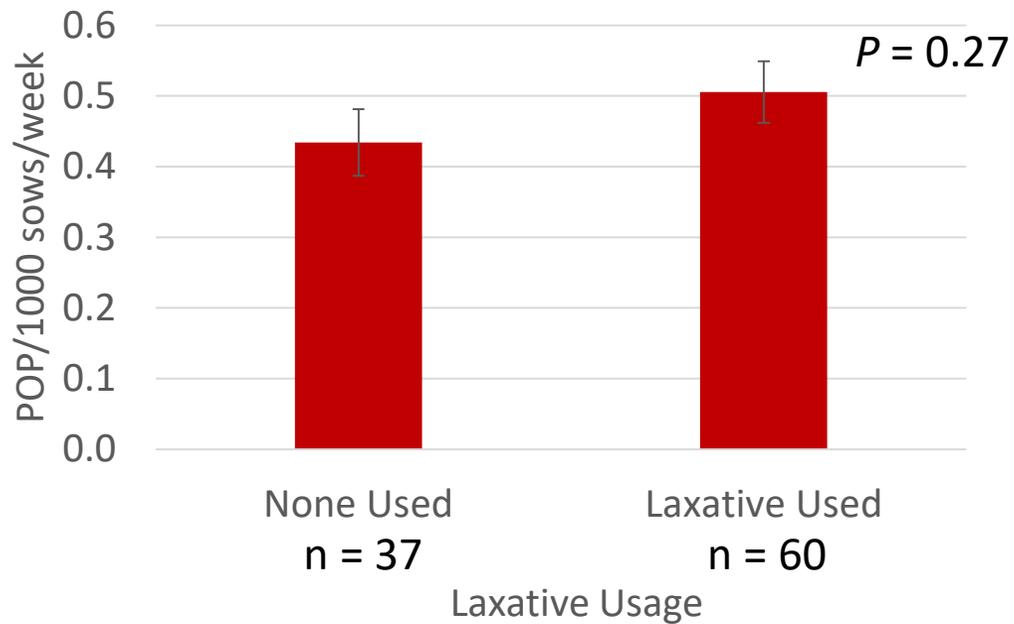
Bump Feeding and POP Incidence



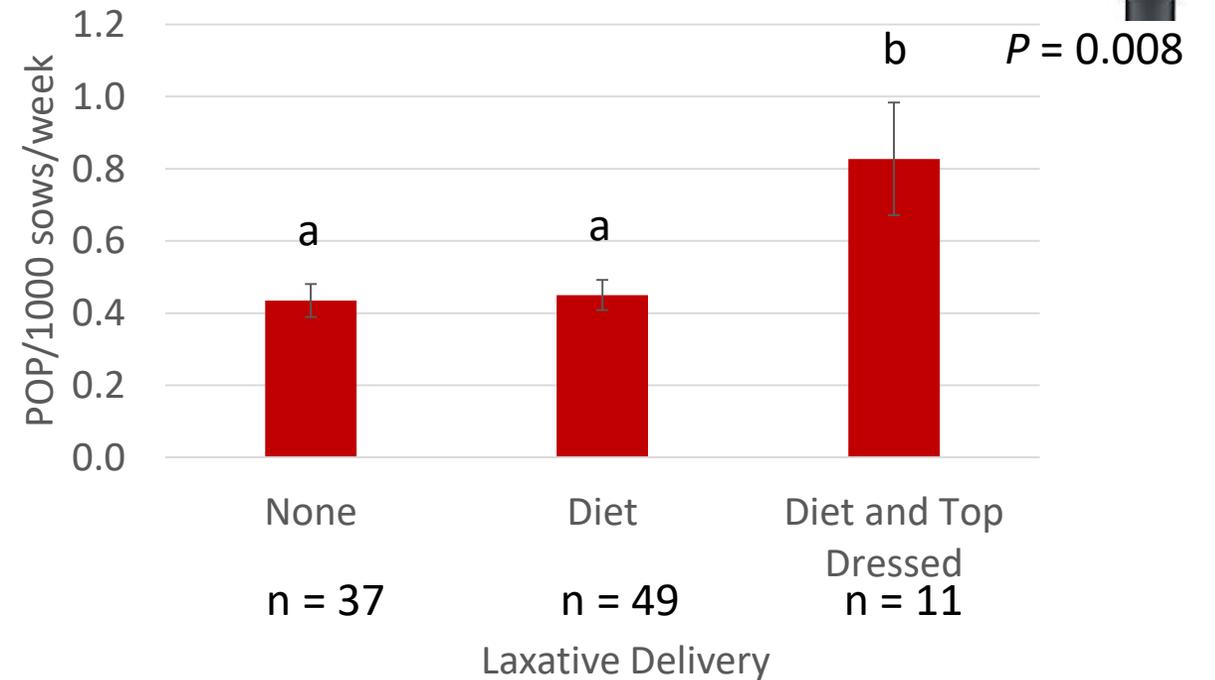
Laxative Usage



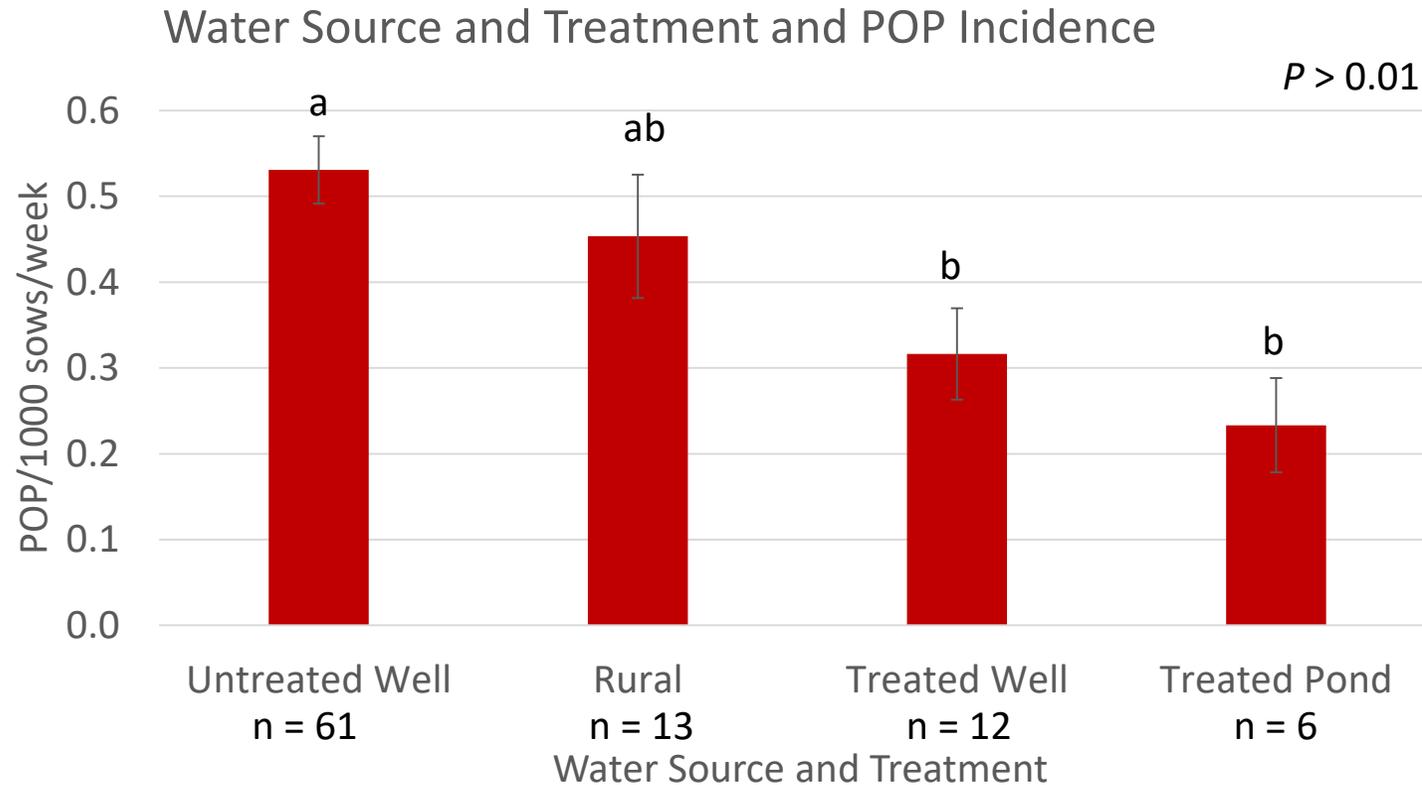
Laxative Usage and POP Incidence



Laxative Delivery and POP Incidence

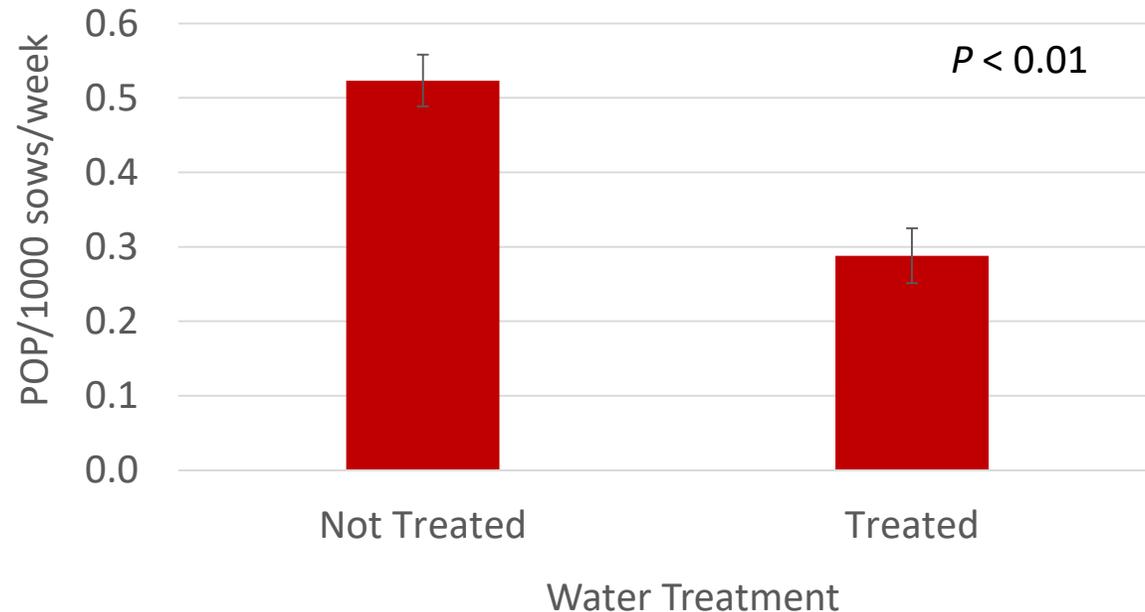


Water Source and Treatment

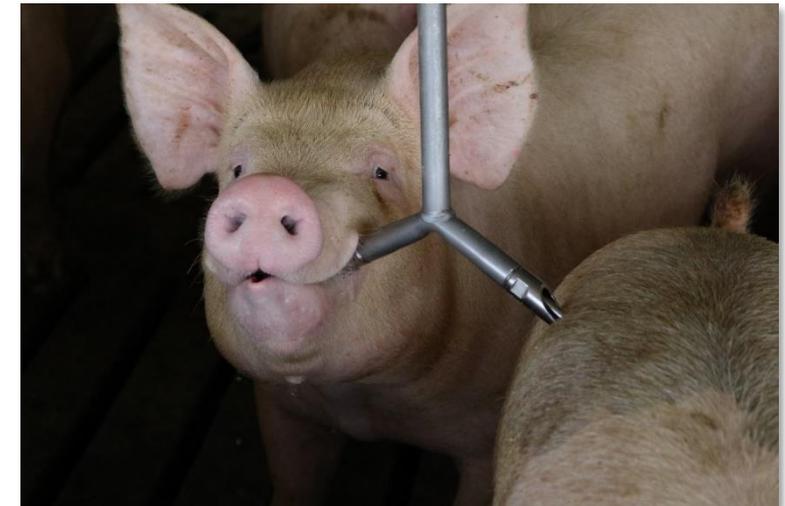
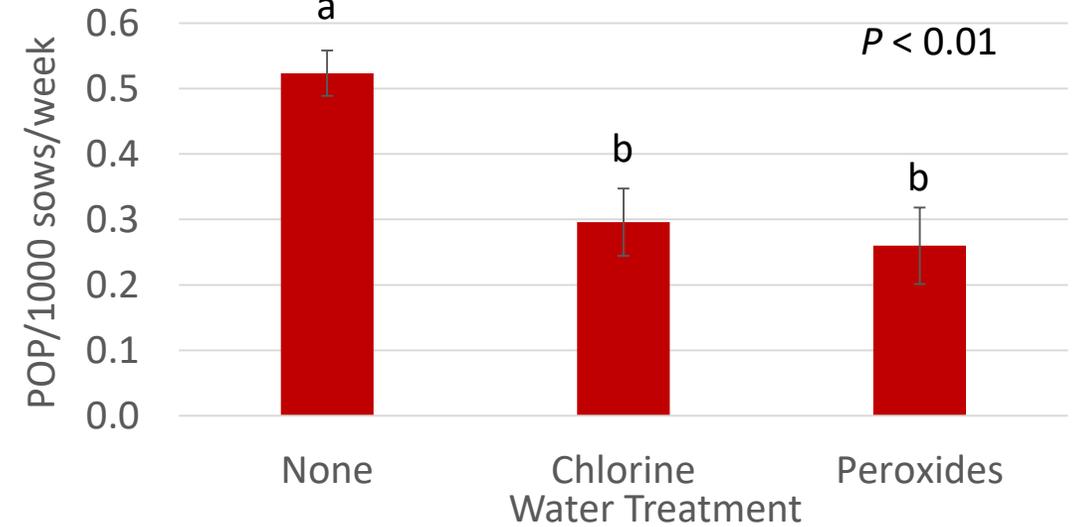


Lower POP Incidence on Farms that Treat the Water

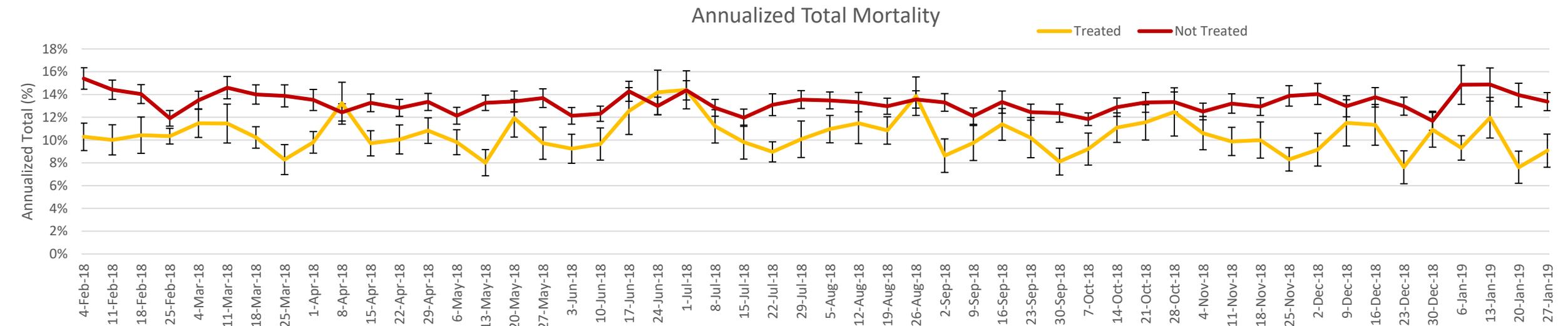
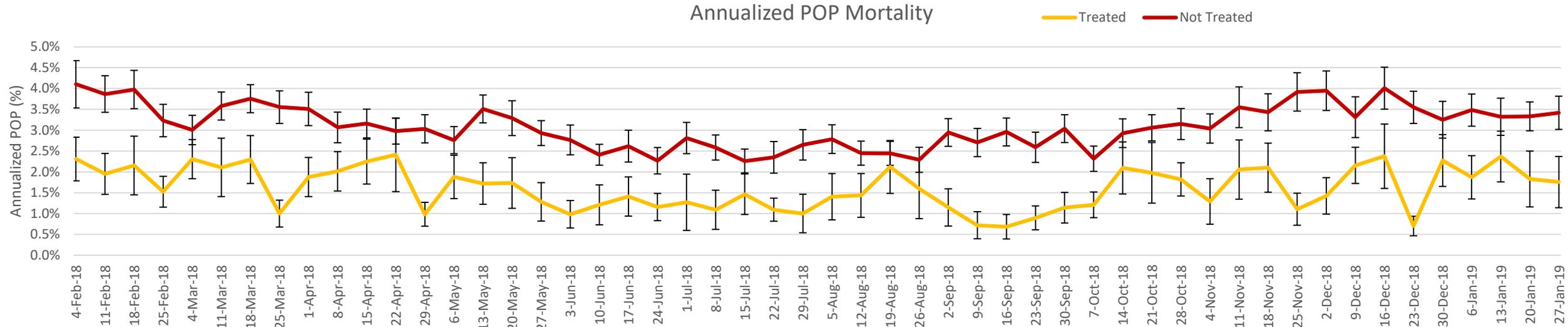
Water Treatment and POP Incidence



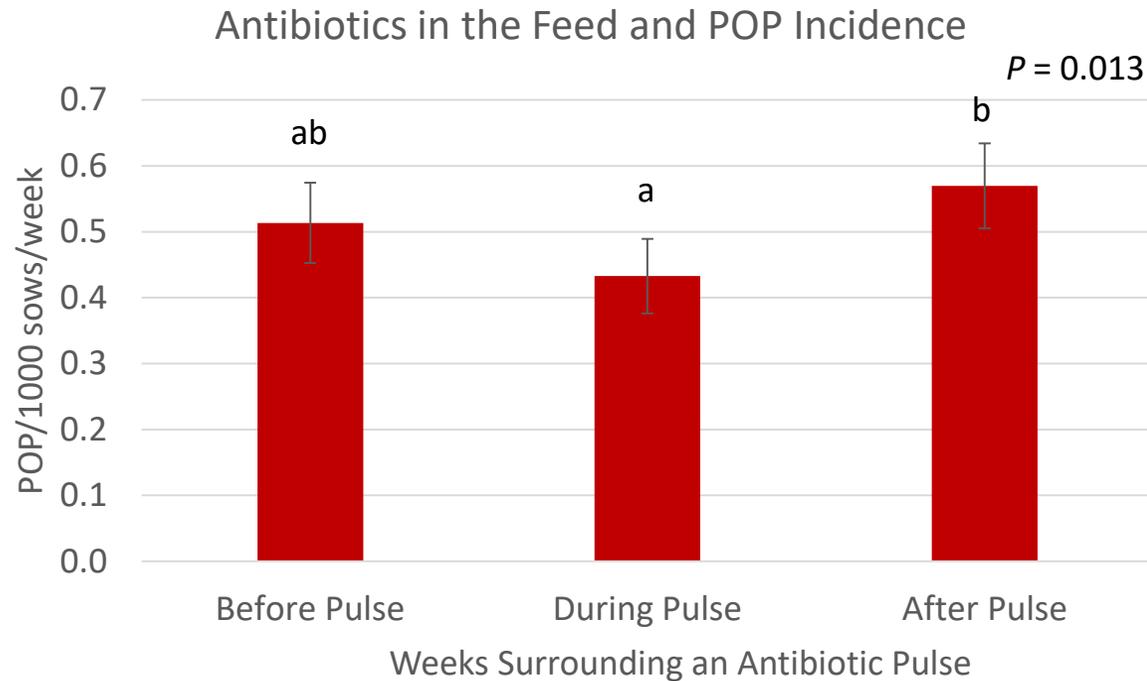
Water Treatment on POP Incidence



Weekly Effect of Water Treatment

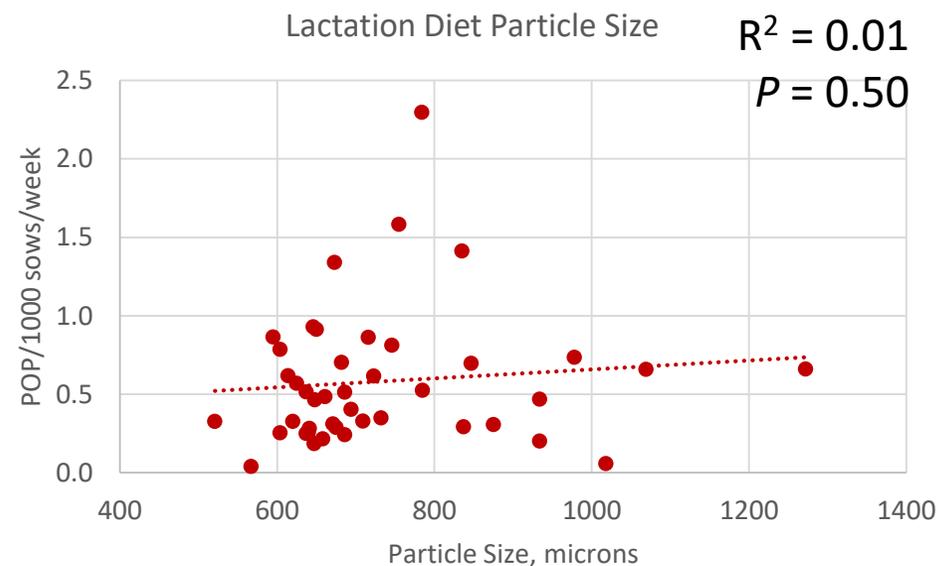
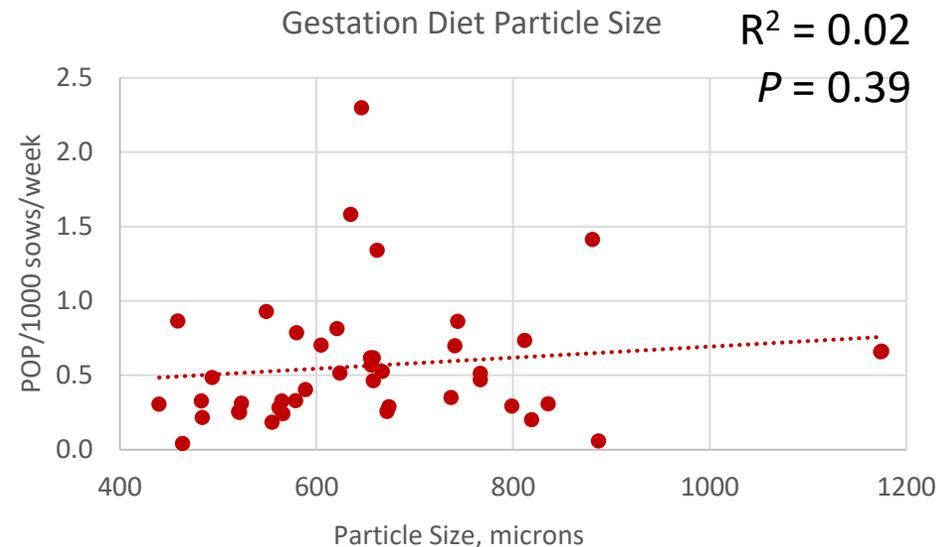
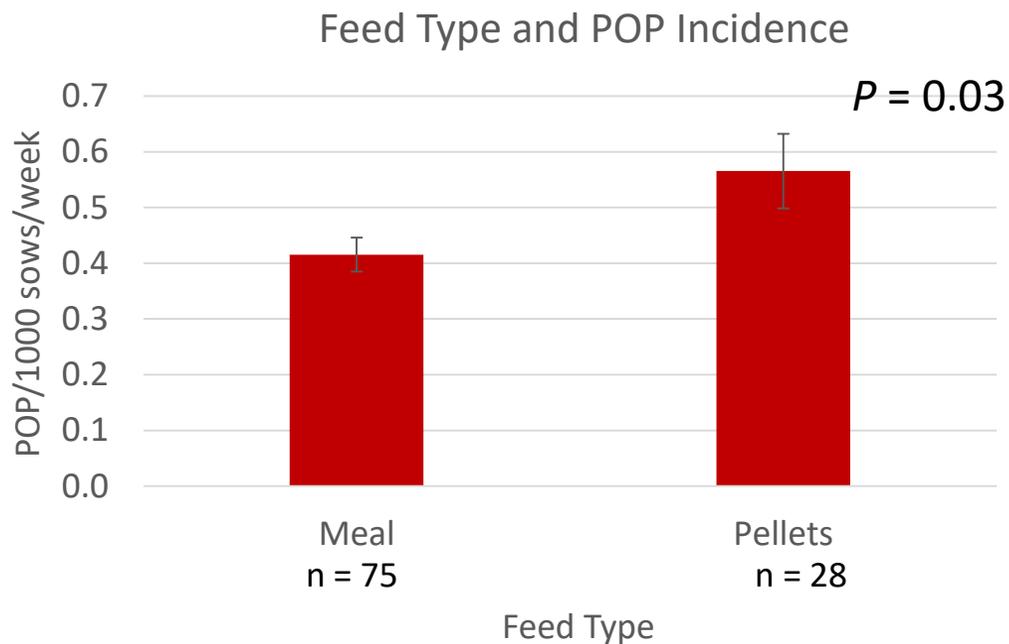


Lower POP Incidence During Antibiotic Pulses



Data included in analysis was from weeks 6-40 of 2018

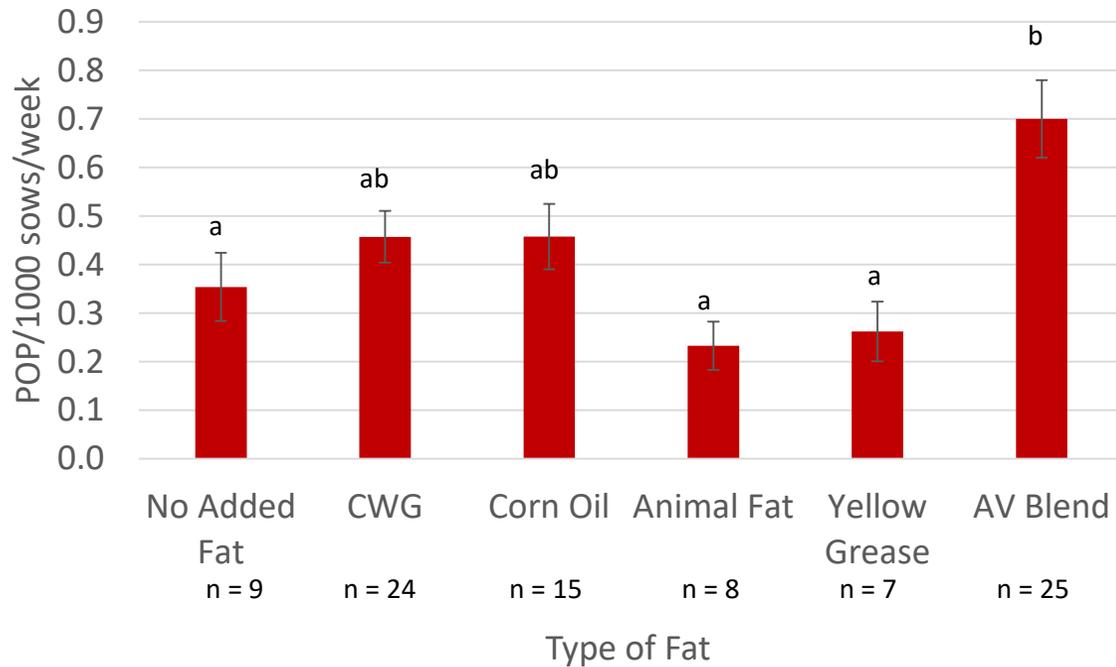
Feed Type and Particle Size



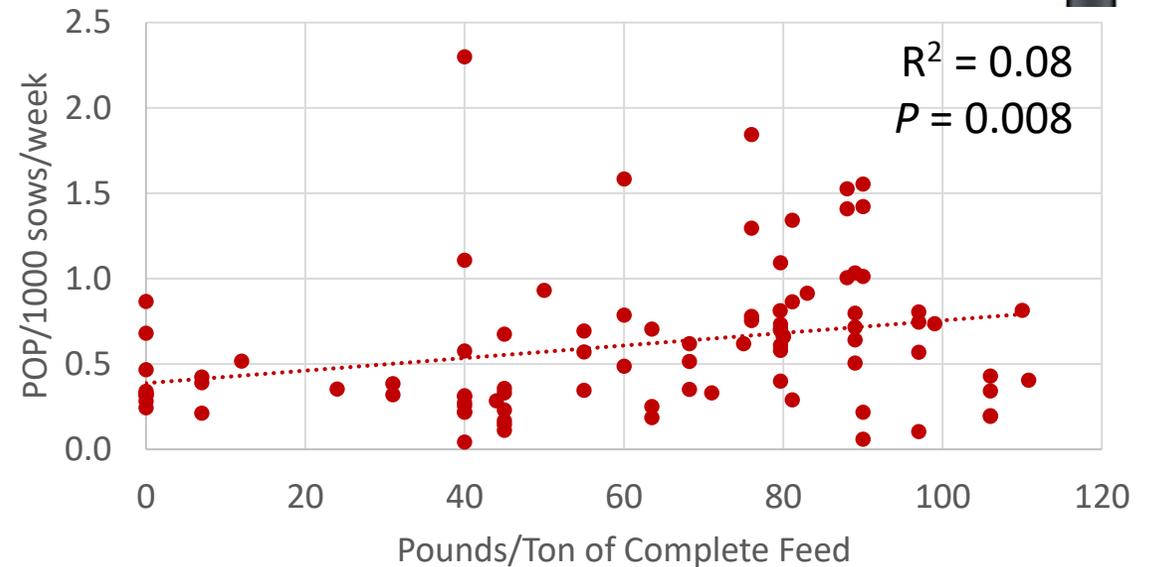
Dietary Fat Source and Level



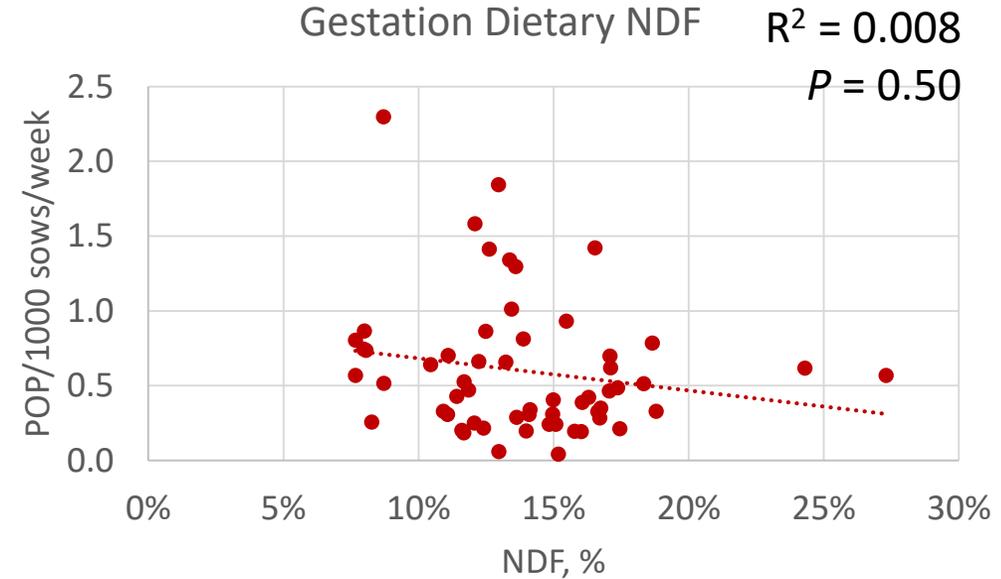
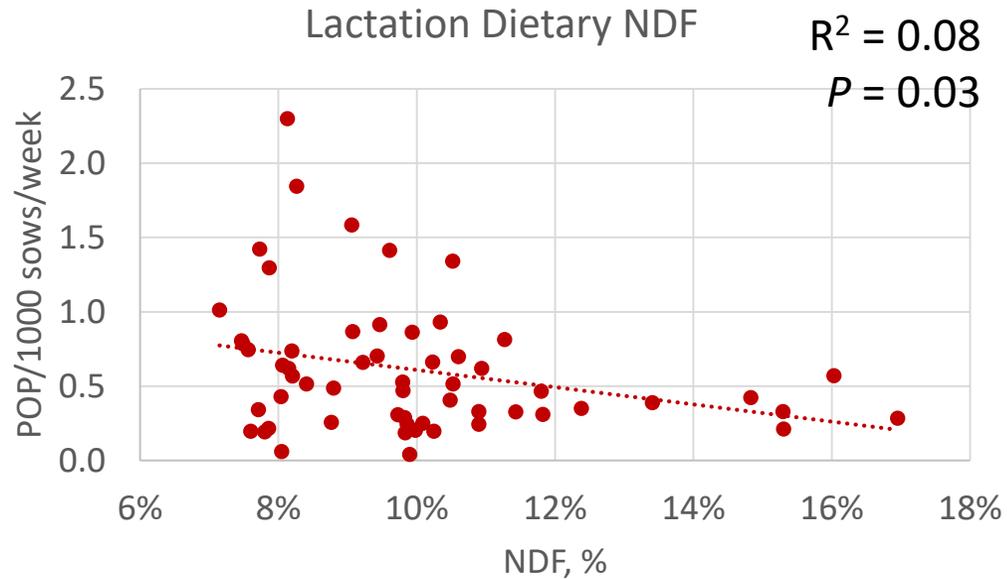
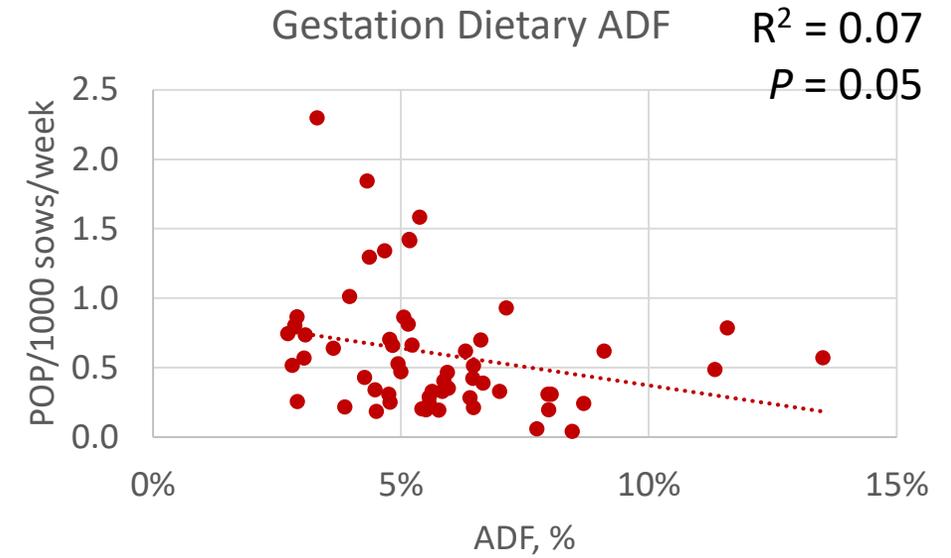
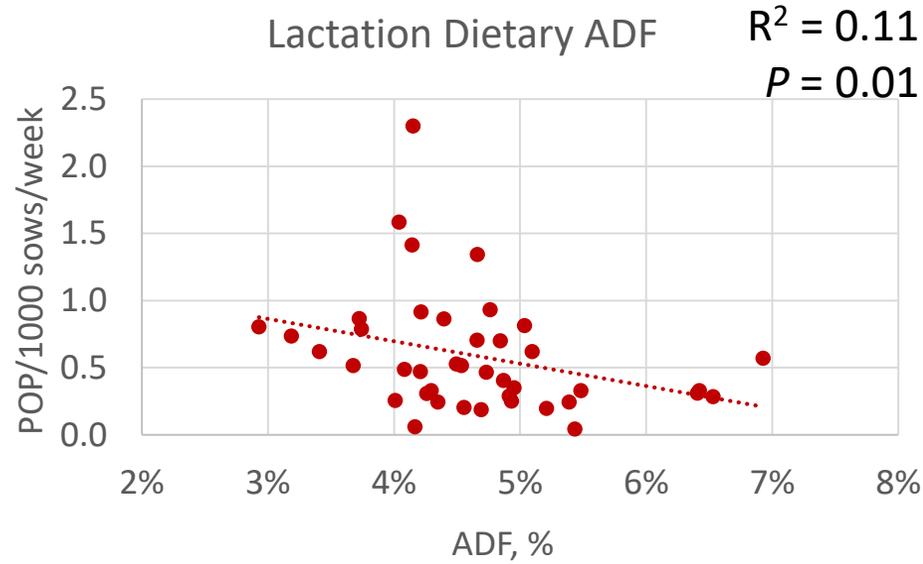
Added Fat Type on POP Incidence $P < 0.01$



Lactation Added Dietary Fat



Fiber





Mycotoxins-Gestation

No samples with detectable Aflatoxin B2, G1, G2, Nivalenol, Ochratoxin A, T2 Toxin, or zearalenol

Gestation	Aflatoxin B1 ³	Fumonisin B1	Fumonisin B2	Fumonisin B3	Total Fumonisin ⁴	Nivalenol	Ochratoxin A	T2 Toxin	Vomitoxin	Zearalenol	Zearalenone
	ppb	ppm	ppm	ppm		ppm	ppm	ppm	ppm	ppm	ppb
Number of Samples	59	59	59	59	59	59	59	59	59	59	59
Samples with Detectable Mycotoxin Levels	3	51	35	28	51	0	0	0	15	0	43
Average of Samples with Positives	16.7	2.3	0.5	0.5	2.9				0.2		56.2
Maximum Value	20	12.9	1.9	2	15.9	0	0	0	0.5	0	249
Detection Limit	< 5 ppb	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm		< 0.1 ppm	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm	< 20 ppb
Risk Limit ¹	100 ppb	10 ppm	10 ppm	10 ppm	10 ppm		0.2 ppm	2 ppm	1 ppm		0
Week 6-18 POP R ²	0.05	0.05	0.04	0.02	0.04				0.01		0.00
Week 6-18 POP P-value	0.10	0.11	0.13	0.24	0.11				0.51		0.73
Weeks around visit ² POP R ²	0.06	0.09	0.08	0.05	0.09				0.01		0.00
Weeks around visit ² POP P-value	0.08	0.02	0.03	0.09	0.02				0.60		0.97



Mycotoxins-Lactation

No samples with detectable Aflatoxin B2, G1, G2, Nivalenol, Ochratoxin A, T2 Toxin, or zearalenol

Lactation	Aflatoxin B1 ³	Fumonisin B1	Fumonisin B2	Fumonisin B3	Total Fumonisins ⁴	Nivalenol	Ochratoxin A	T2 Toxin	Vomitoxin	Zearalenol	Zearalenone
	ppb	ppm	ppm	ppm		ppm	ppm	ppm	ppm	ppm	ppb
Number of Samples	59	59	59	59	59	59	59	59	59	59	59
Samples with Detectable Mycotoxin Levels	2	47	28	24	48	0	0	0	10	0	37
Average of Samples with Positives	9.5	2.2	0.3	0.3	2.5				0.2		68.3
Maximum Value	13	13.9	0.9	0.9	15	0	0	0	0.5	0	516
Detection Limit	< 5 ppb	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm		< 0.1 ppm	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm	< 0.1 ppm	< 20 ppb
Risk Limit ¹	100 ppb	10 ppm	10 ppm	10 ppm	10 ppm		0.2 ppm	2 ppm	1 ppm		0
Week 6-18 POP R ²	0.00	0.01	0.00	0.00	0.01				0.01		0.00
Week 6-18 POP P-value	0.92	0.47	0.72	0.90	0.54				0.45		0.71
Weeks around visit ² POP R ²	0.00	0.02	0.01	0.02	0.02				0.00		0.00
Weeks around visit ² POP P-value	0.93	0.36	0.60	0.31	0.35				0.70		0.97

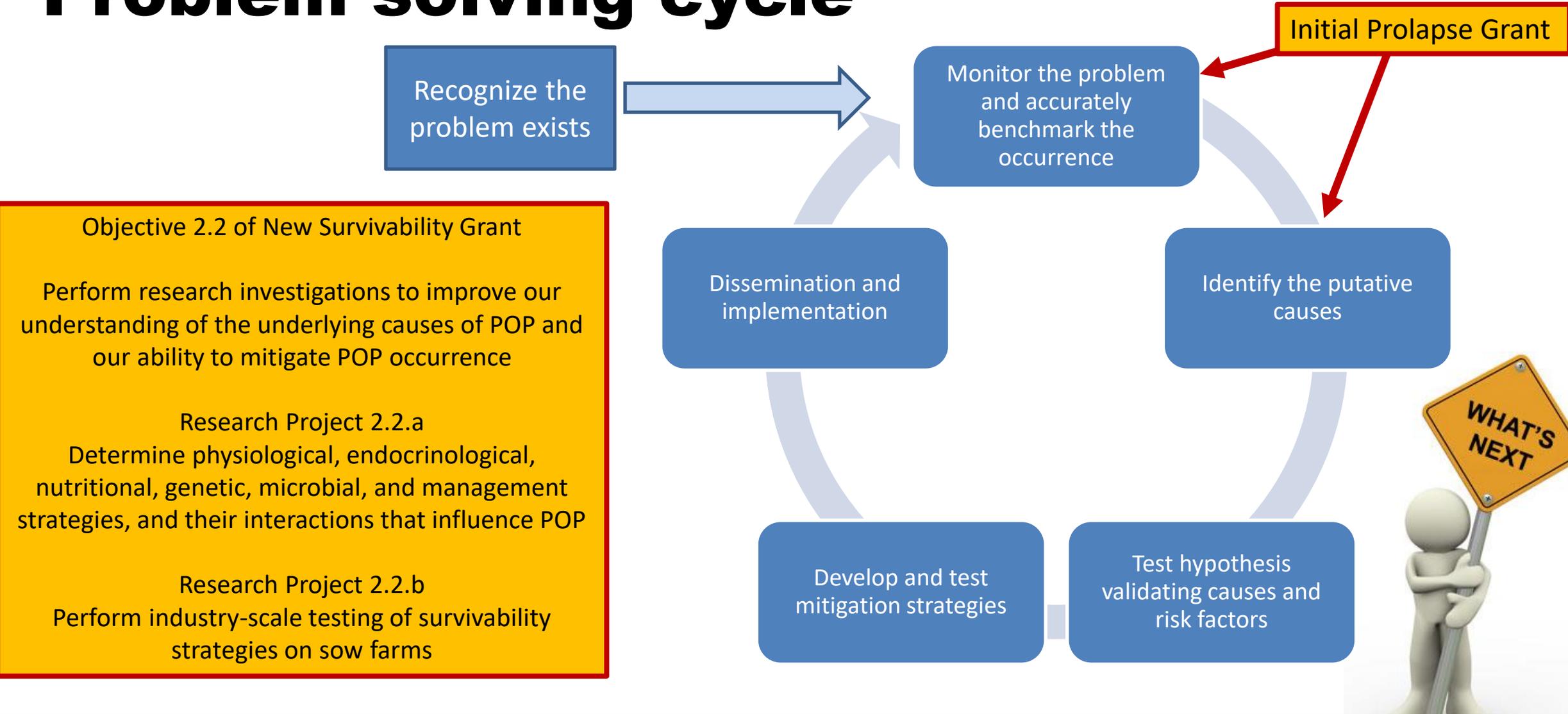


Herd size, induction protocol, sleeving protocol, tail length, hygiene, particle size

Geographical region, sow housing, laxatives, mycotoxins, health status and disease outbreaks, nutrition, genetics

Water quality, body condition, antibiotic usage, bump feeding strategy, perineal score

Problem solving cycle





Improving Pig Survivability Project

<https://pigliability.org>



Welcome to the Improving Pig Survivability project.

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Thank you!



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Iowa Pork Industry Center