

# Keep them breathing easy



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“Eyes are the window to the soul” *Shakespeare*

***“Lungs are the window to calf health management”***

**Indicator organ**

***respiratory disease is a symptom of management failure***

Got failure of passive transfer → see it in the lungs

Got diarrhea → see it in the lungs

Got septicemia → see it in the lungs

Got poor nutrition → see it in the lungs

Got dirty environment → see in the lungs

Got cold stress → see it in the lungs

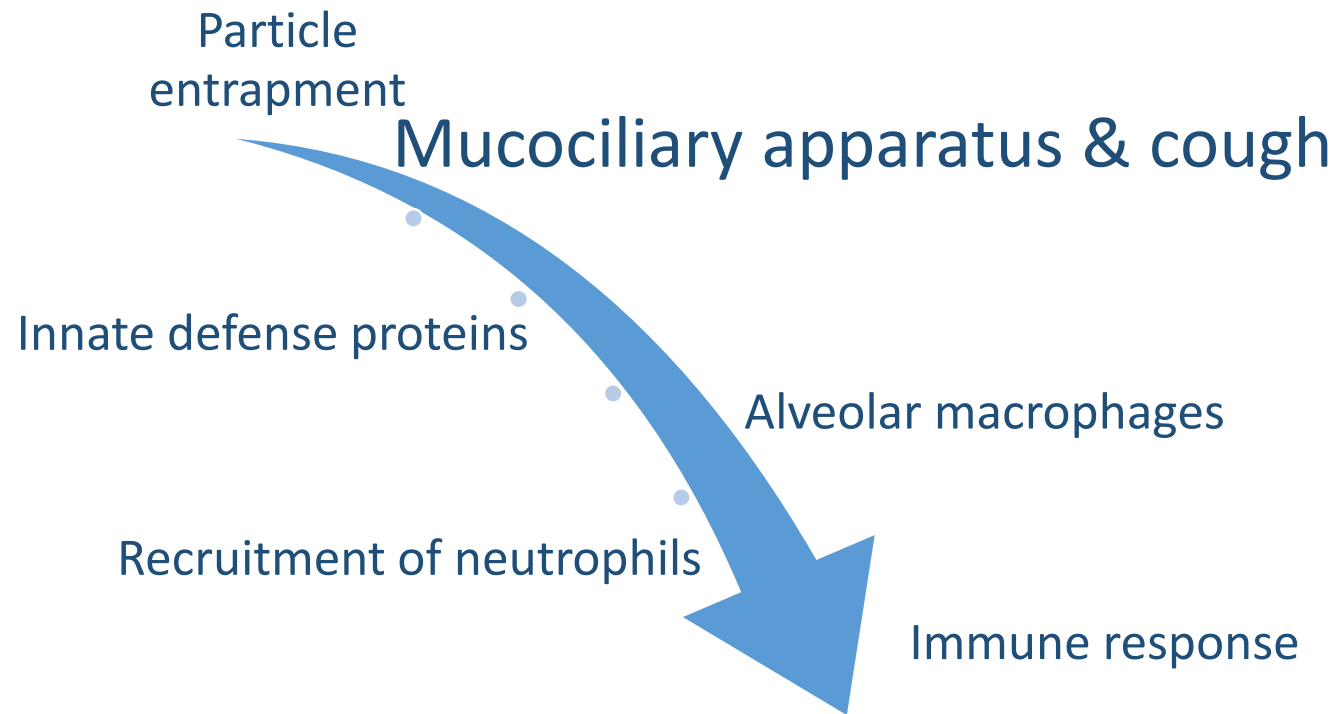
Got heat stress → see it in the lungs

#WeanClean™  
Philosophy

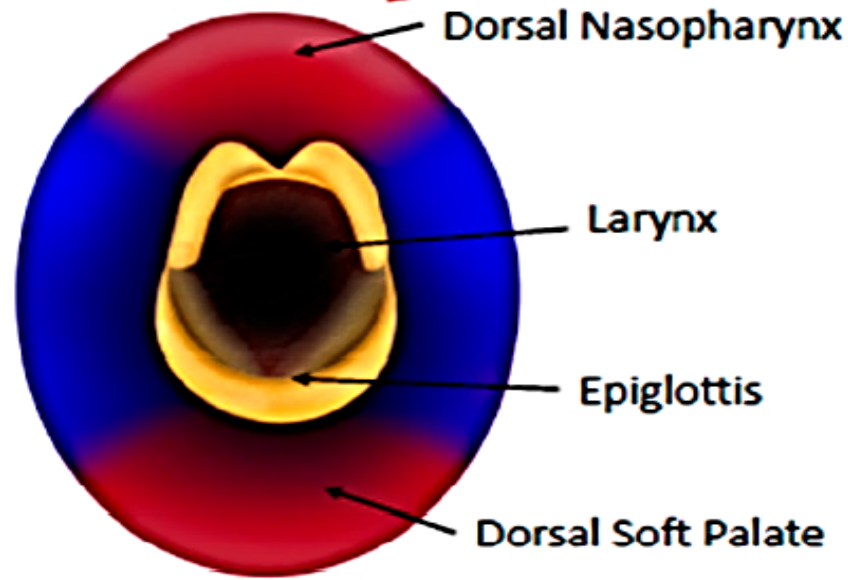
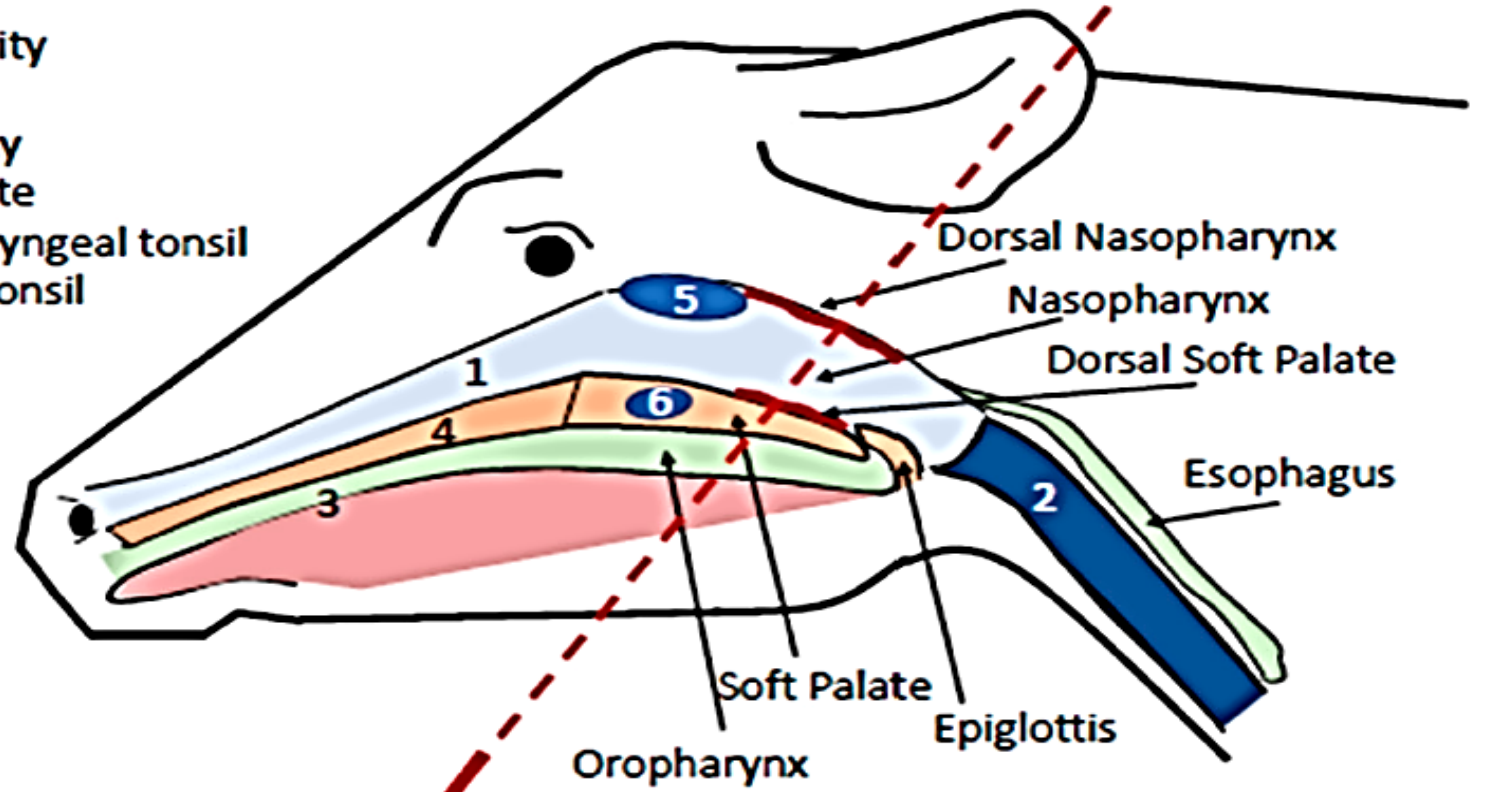


# Airway Defense Mechanisms

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1. Nasal Cavity
2. Trachea
3. Oral Cavity
4. Hard Palate
5. Nasopharyngeal tonsil
6. Palatine tonsil



# Coughing calves have evidence of infection...



Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: [www.elsevier.com/locate/prevetmed](http://www.elsevier.com/locate/prevetmed)

Short communication

Cough sound description in relation to respiratory diseases in dairy calves

S. Ferrari<sup>a,\*</sup>, R. Piccinini<sup>b</sup>, M. Silva<sup>c</sup>, V. Exadaktvlos<sup>c</sup>, D. Berckmans<sup>c</sup>, M. Guarino<sup>a</sup>

- N = 12 weaned dairy calves
- Clinical respiratory disease
  - Cough (+)
- *Pasteurella multocida* >> BRSV/BHV/PI3/BVDV seropositive




Table 2

Results of the bacteriological and serological analysis from nasal swabs and blood samples.

Calf no.	<i>A. pyogenes</i>	<i>P. multocida</i>	<i>M. bovis</i>	<i>H. somni</i>	BRSV	BHV <sub>1</sub>	PI/3	BVD
217	–	+	–	–	Neg	Neg	Neg	Neg
212	–	–	–	–	Neg	Neg	Neg	Neg
211	–	+	–	–	Neg	Neg	Neg	Neg
213	–	+	–	–	Neg	Neg	Weak Pos	Neg
223	–	+	–	–	Neg	Neg	Weak Pos	Neg
215	–	–	–	–	Neg	Pos	Weak Pos	Neg
205	+	+	–	–	Neg	Neg	High Pos	Neg
214	–	+	–	–	Weak Pos	Neg	Pos	Weak Pos
206	–	+	–	–	Weak Pos	Neg	Neg	Neg
226	–	+	–	–	Weak Pos	Neg	Weak Pos	Weak Pos
219	–	+	–	–	Weak Pos	Neg	Pos	Neg
199	–	+	–	–	Weak Pos	Neg	Weak Pos	Neg



## Differences in the association of cough and other clinical signs with ultrasonographic lung consolidation in dairy, veal, and beef calves

T. Lowie,<sup>1\*</sup>  K. Van Leenen,<sup>1,2</sup> S. Jourquin,<sup>1</sup> M. L. Pas,<sup>1</sup> J. Bokma,<sup>1</sup>  and B. Pardon<sup>1</sup> 

<sup>1</sup>Department of <https://orcid.org/0000-0002-9877-3786> Production and Population Medicine, Faculty of Veterinary Medicine, Ghent University, 9820 Merelbeke, Belgium

<sup>2</sup>Department of Biomolecular Health Sciences, Faculty of Veterinary Medicine, Utrecht University, 3584 CL Utrecht, the Netherlands

- Cough was best clinical indicator
- Sensitivity = 37%
- Specificity = 86%
- Prevalence = 42% USS2+, 20% USS3+

Coughing calves have ultrasonographic lung consolidation...but most consolidated calves don't cough – not a good early warning tool

Lung Score	Number Scanned	% with lung score	Cough,n	% with calves in score category with cough
0	2166	57%	36	2%
1	51	1%	3	6%
2	730	19%	46	6%
3	505	13%	55	11%
4	238	6%	32	13%
5	117	3%	21	18%

Coughing calves have ultrasonographic lung consolidation...but most consolidated calves don't cough – not a good early warning tool

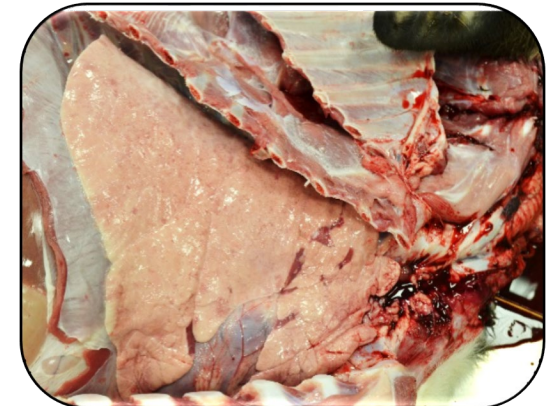
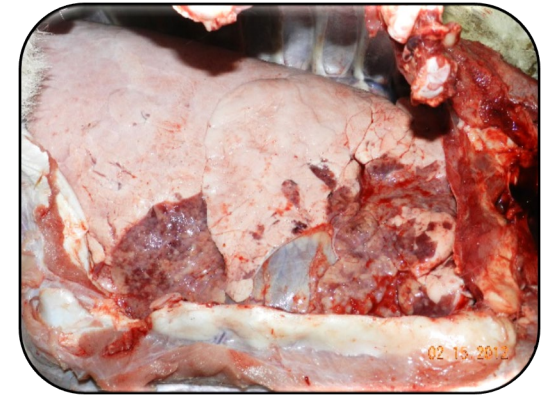
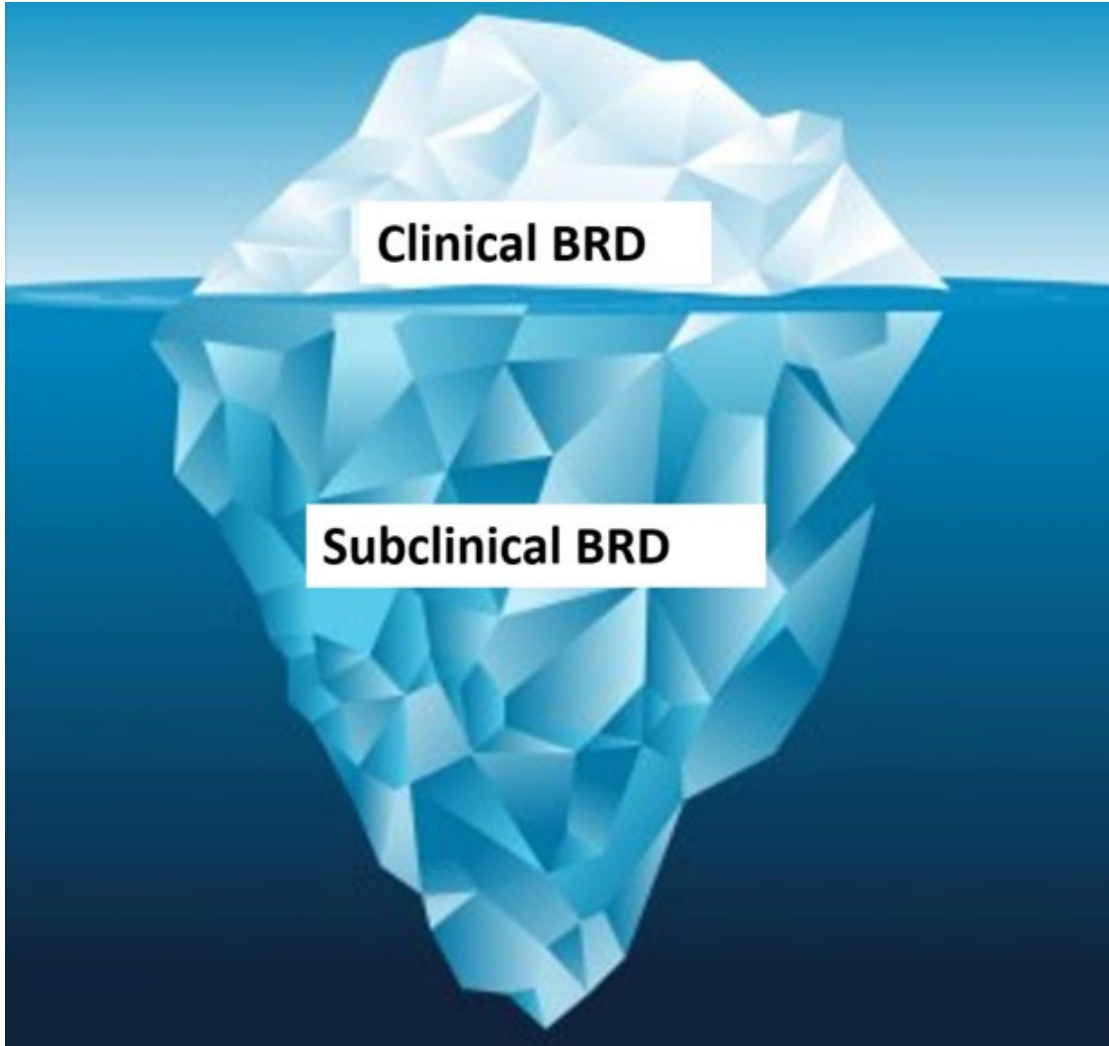
cough	uss2+	uss2-	Total
Yes	154	39	193
No	1436	2178	3614
<b>Total</b>	<b>1590</b>	<b>2217</b>	<b>3807</b>

RR 2.1 (95%CI 1.85, 2.18)

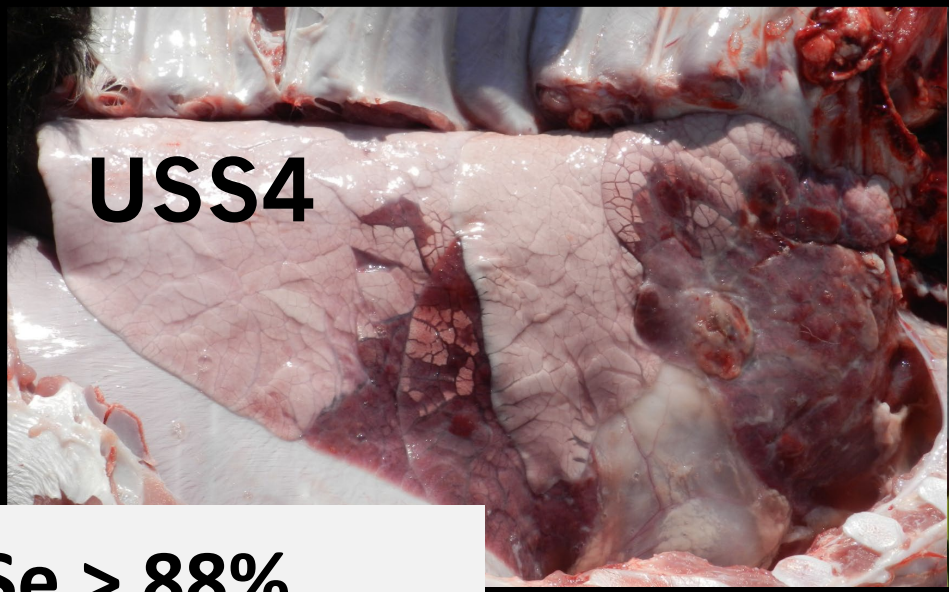
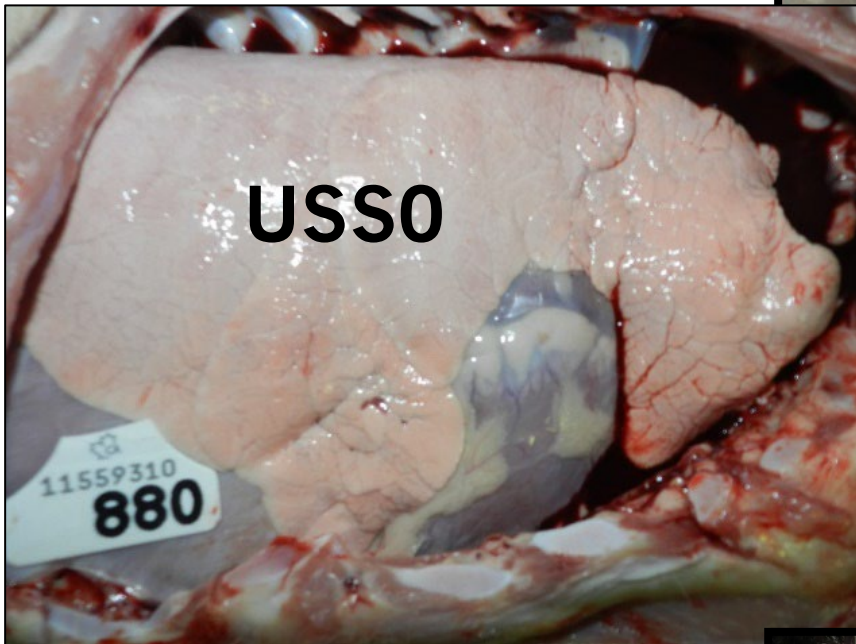
Sensitivity	9.69%	8.28% to 11.25%
Specificity	98.24%	97.60% to 98.

Ollivett unpublished data 2022

# Fidelity of diagnosis







**Lung ultrasound**

**Se > 88%**  
**Sp > 90%**

**Prevention...** everything you hear about maternity management, passive transfer, hygiene, nutrition is critical!!

- BUT...50-80%\* of cases are subclinical for 7 to 14 d before we see them
- AND...failure to cure and relapse of subclinical/clinical disease is occurring right under our noses
- Use lung ultrasound to see what you and your producers are missing and correct the problems
  - \*Salmonella changes this relationship...

$$P \approx I \times D$$

- **Prevalence = incidence x duration of disease**
- Prevention → cuts incidence → drops prevalence
- Proper treatment → cuts duration of disease → drops prevalence

**Effective treatment that reduces duration of disease supports antimicrobial stewardship**

## Why does treatment efficacy matter? → Exposure time

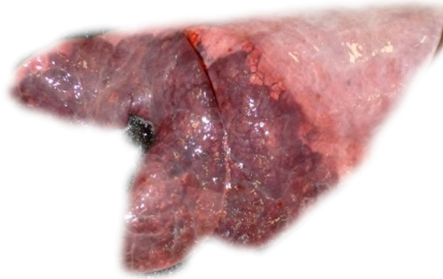
	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8 - Weaning
# new BRD cases	5	5	5	5	5	5
# cures – good (80%)	4	4	4	4	4	5 new 5 chronics
# cures – bad (40%)	2	2	2	2	2	5 new 15 chronics

**Effective treatment that reduces duration of disease supports antimicrobial stewardship**

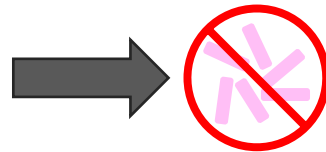
# Evidence of treatment failure:

- Excessive re-treatments of clinical disease (> 25%?)
- Stunted growth in treated calves
- Mortality due to respiratory disease
  - May be delayed weeks to months
- High prevalence of subclinical pneumonia at weaning
- No resolution or poor resolution of ultrasonographic lung consolidation 7 – 10 days after treatment of first case of disease
- Positive bacterial culture from lung tissue following treatment

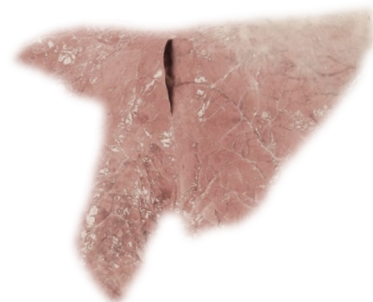
# Respiratory disease and antibiotic therapy



bacteria in lung induces the consolidation associated with **bronchopneumonia**

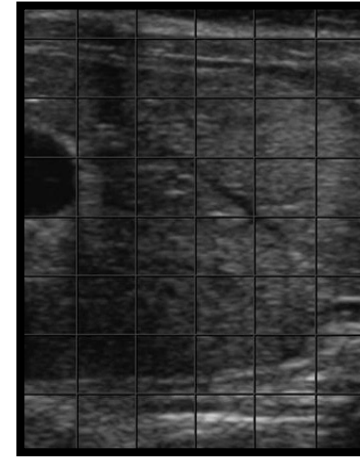
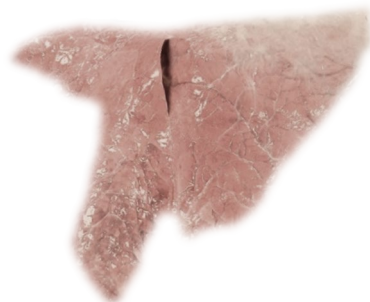
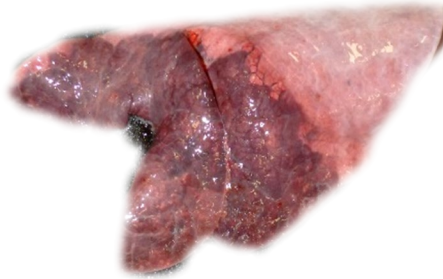


therapeutic concentration of drug in lung **reduces bacterial load**



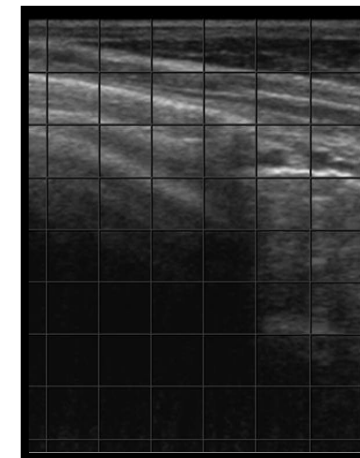
neutrophilic exudate cleared from airways leading to **resolution of bronchopneumonia**

# Respiratory disease and antibiotic therapy



Consolidated Lung

therapeutic concentration of drug in lung reduces bacterial load

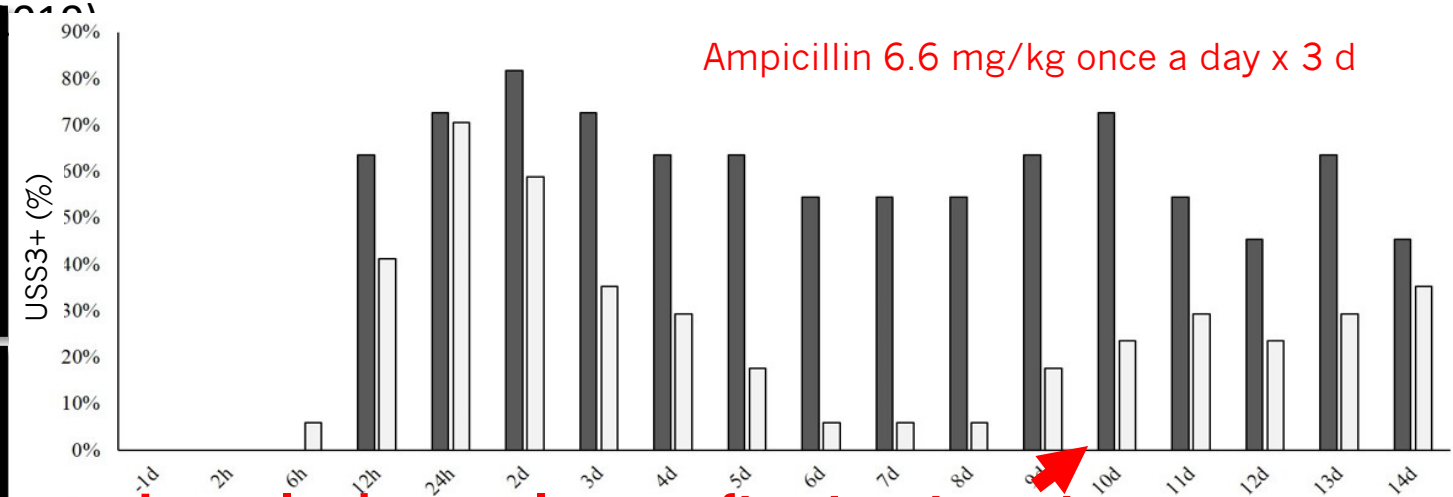


Normal Lung

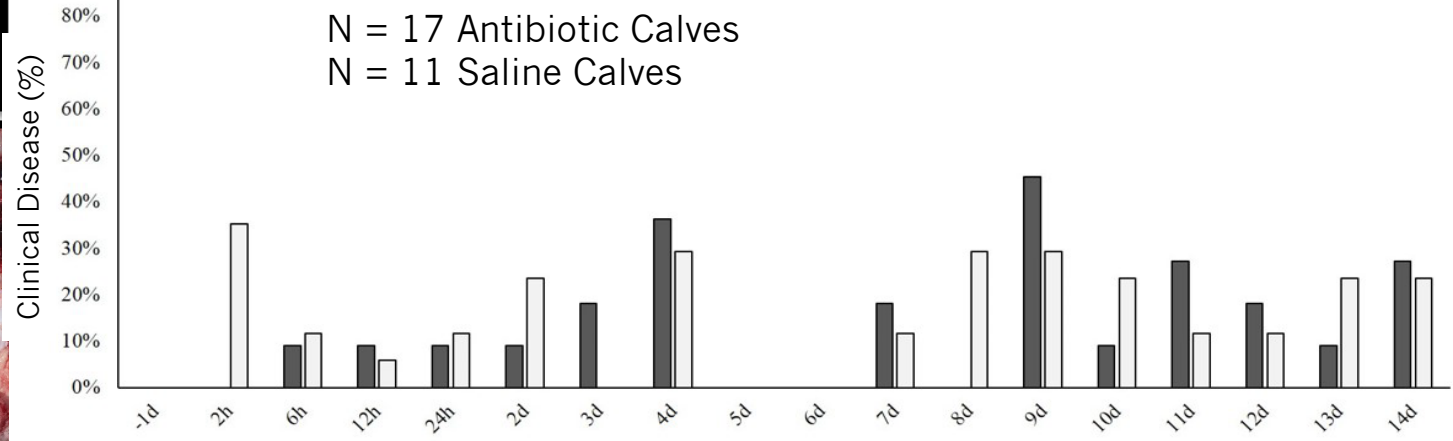
# Lobar pneumonia



# Results – Challenge study (Holschbach



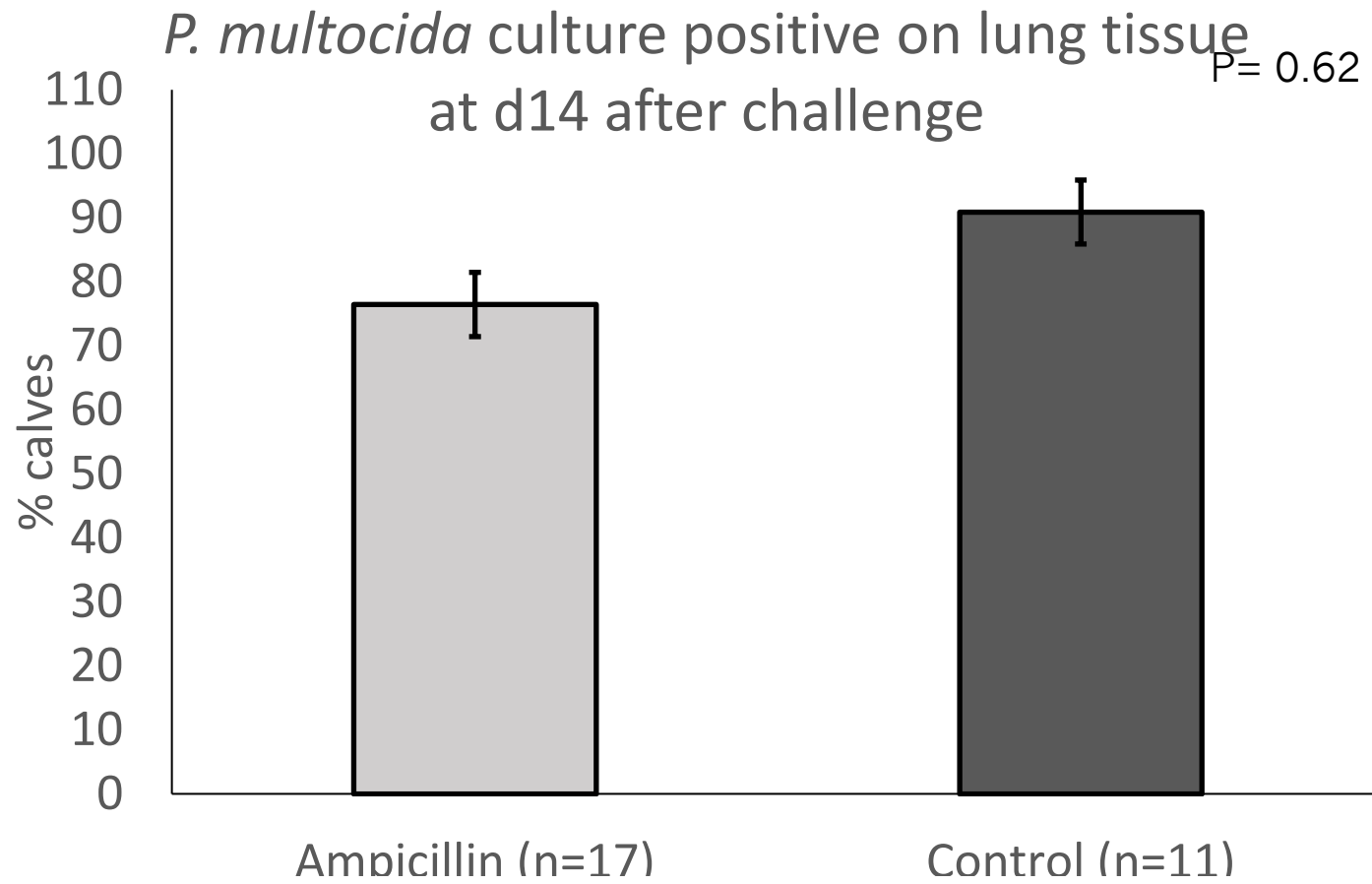
**Lung lesions relapse after treatment**



**Clinical disease – low and variable frequency**

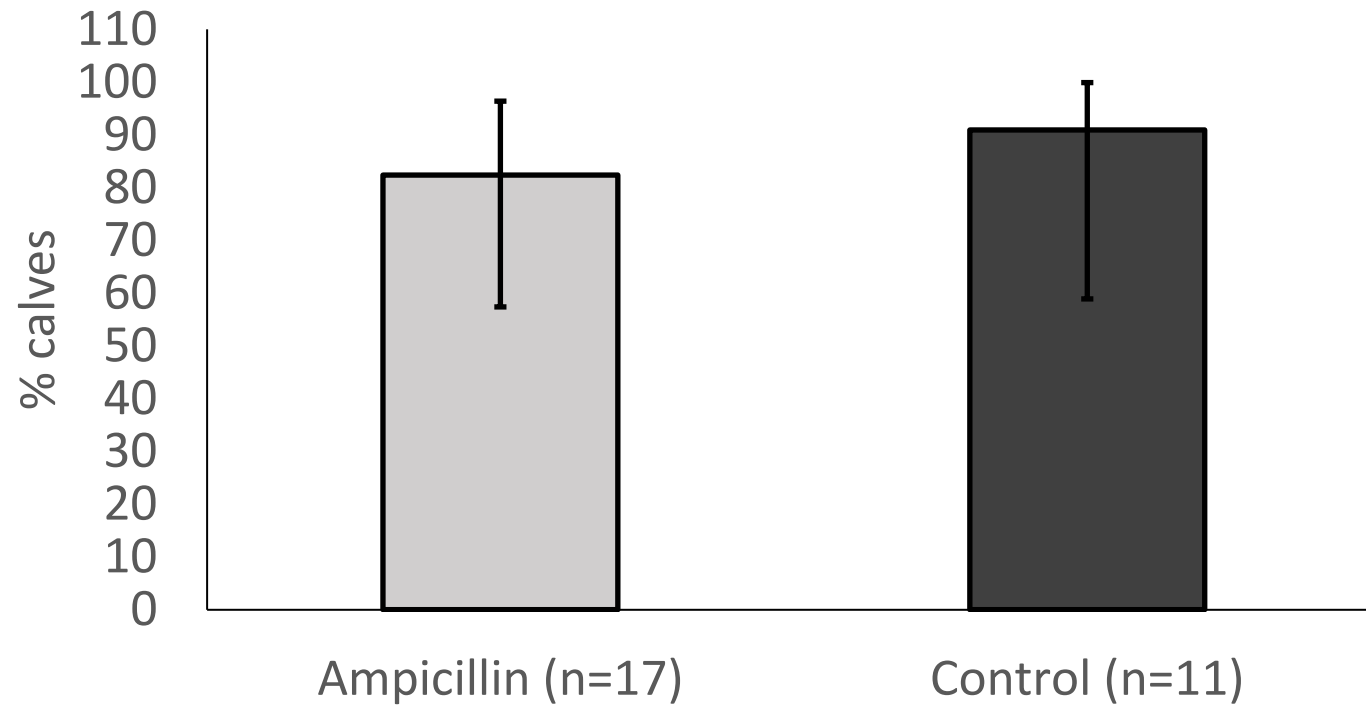


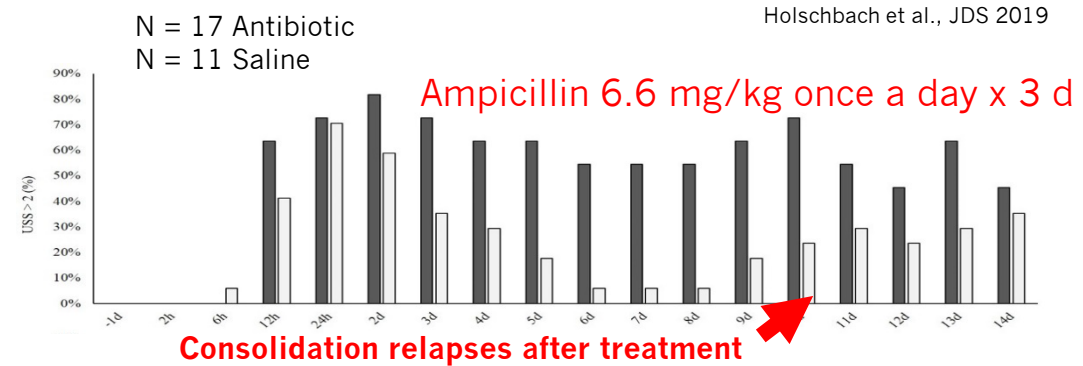
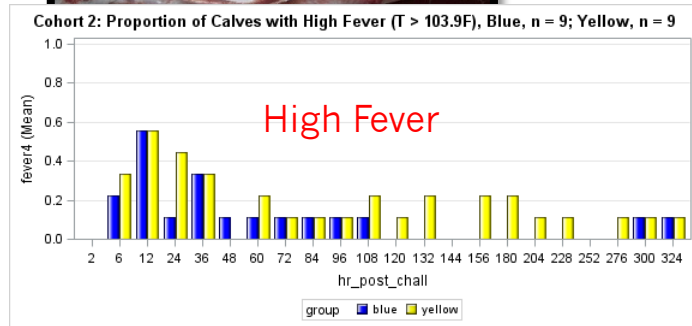




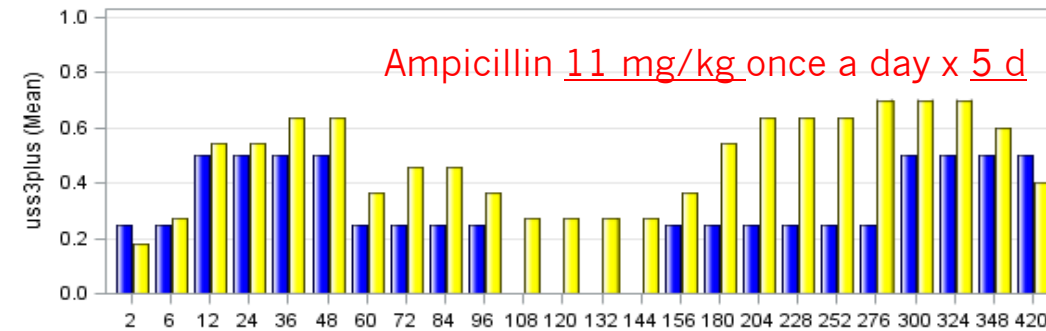
*P. multocida* PCR positive on lung tissue at  
d14 after challenge

P=1.00

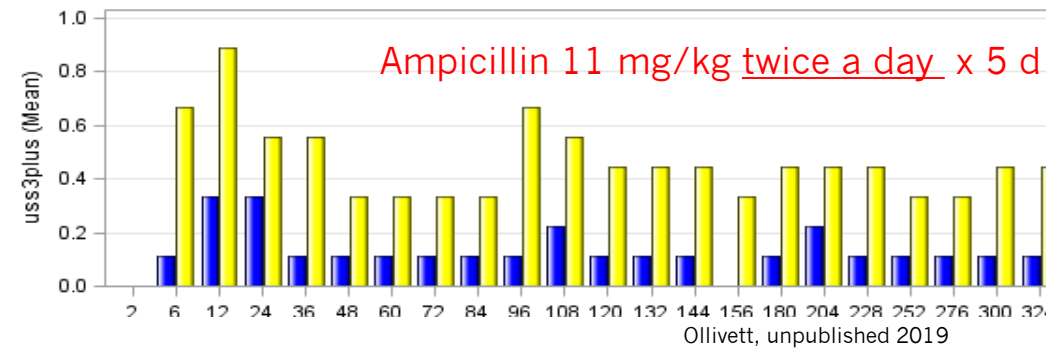




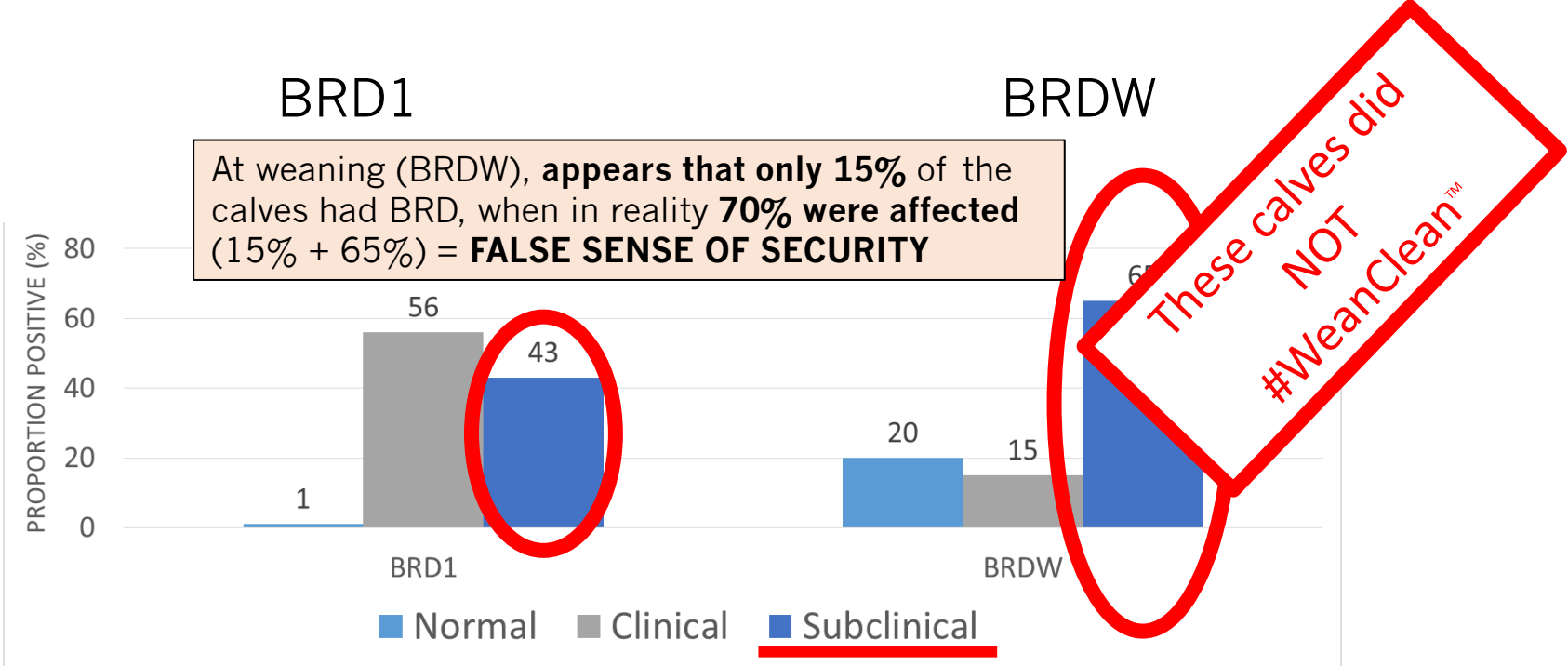
**Cohort 1: Proportion of Lobar Pneumonia Positive Calves, Blue, n = 4; Yellow, n = 11**



**Cohort 2: Proportion of Lobar Pneumonia Positive Calves, Blue, n = 9; Yellow, n = 9**



# Field Study: clinical response to treatment is deceiving

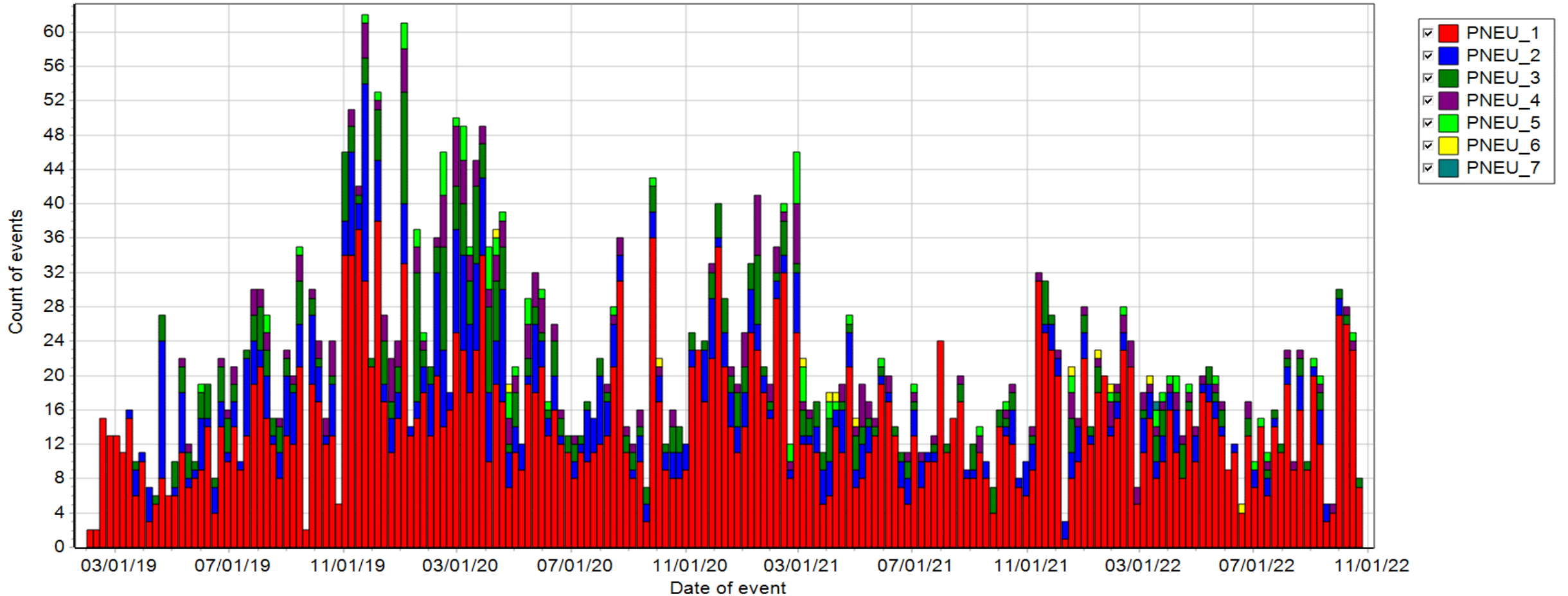


Antibiotic therapy did not affect the probability of having respiratory disease at weaning (P = 0.33) or the odds of completing the 3 drug regimen (P = 0.87).

# Pneumonia treatments since 1.1.2019

pneu treatments by week

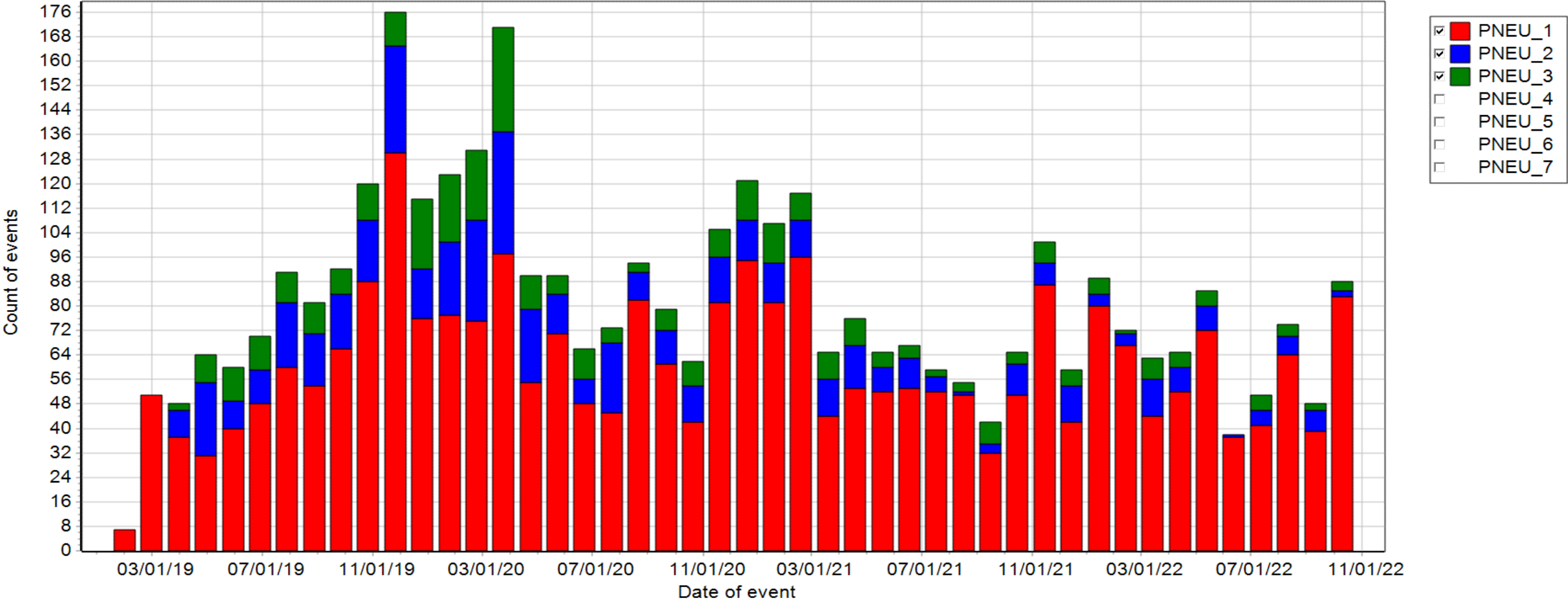
10/25/22 Blue Star Dairy - DeForest  
EGRAPH PNEU:21 FOR BDAT>1.1.2019



# Routine lung scans started 11/2019 – fewer retreats

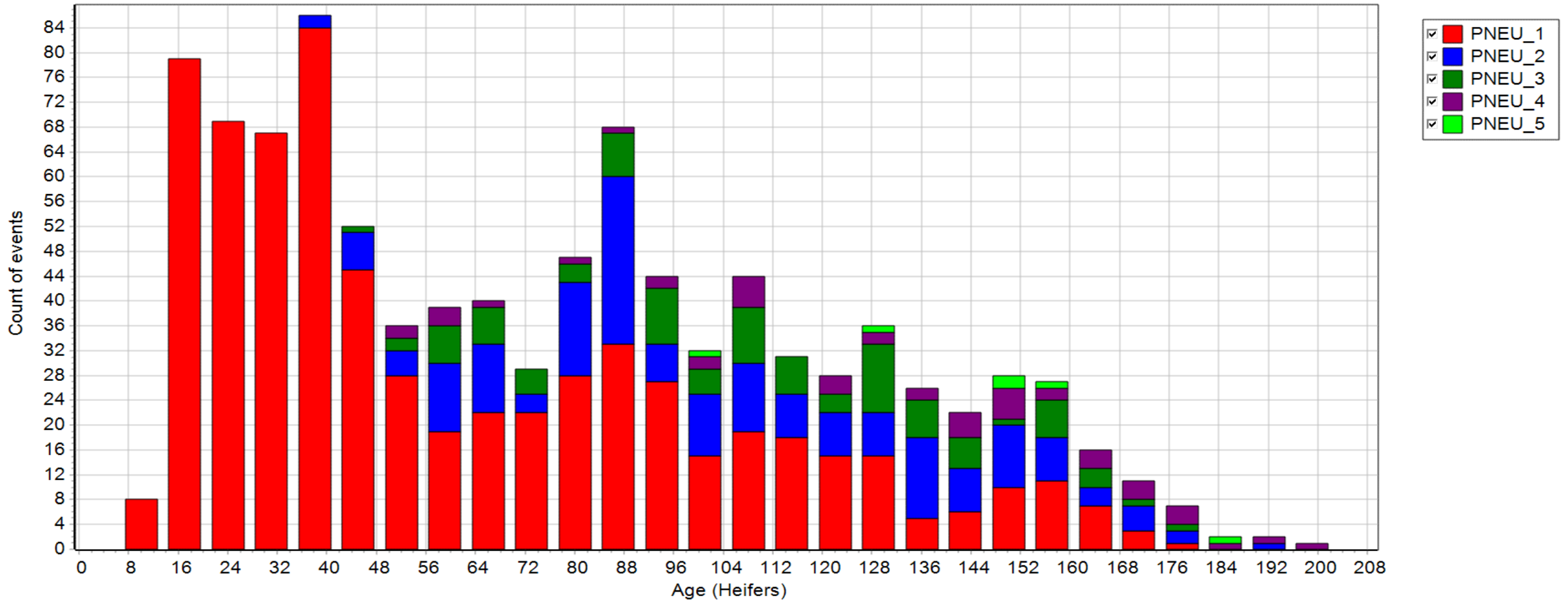
pneu treatments by month

10/25/22 Blue Star Dairy - DeForest  
EGRAPH PNEU:21 FOR BDAT>1.1.2019



# Initial distribution of age at first treatment

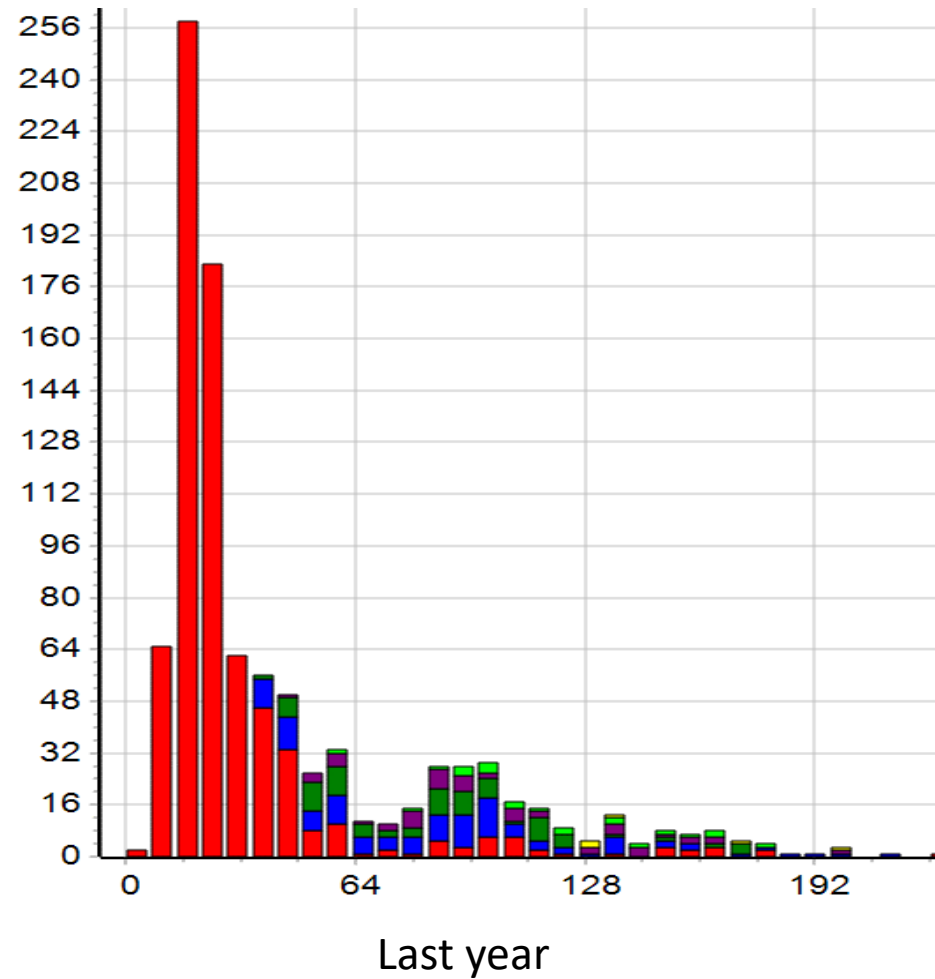
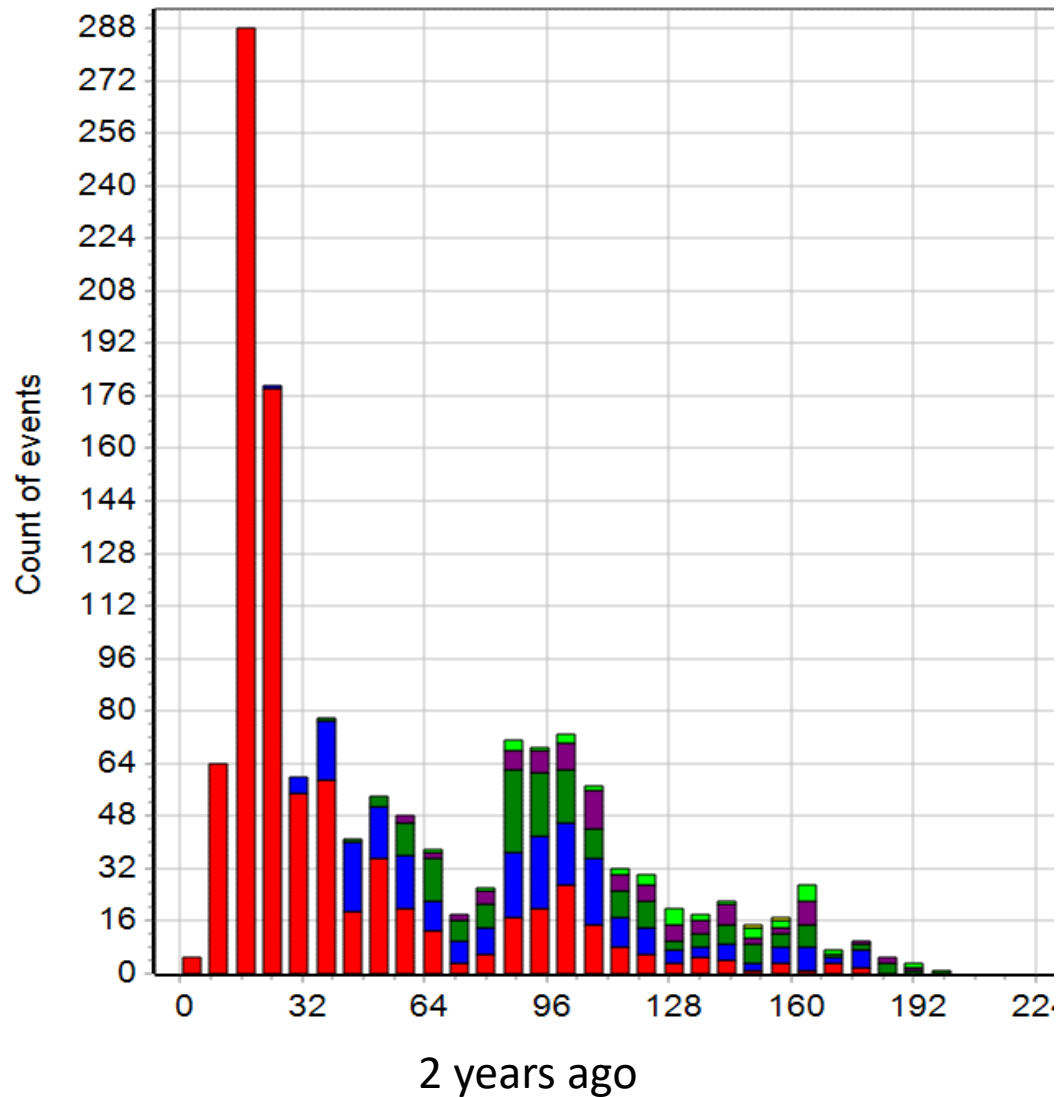
10/25/22 Blue Star Dairy - DeForest  
EGRAPH PNEU:21 FOR BDAT>1.1.2019



3 years ago

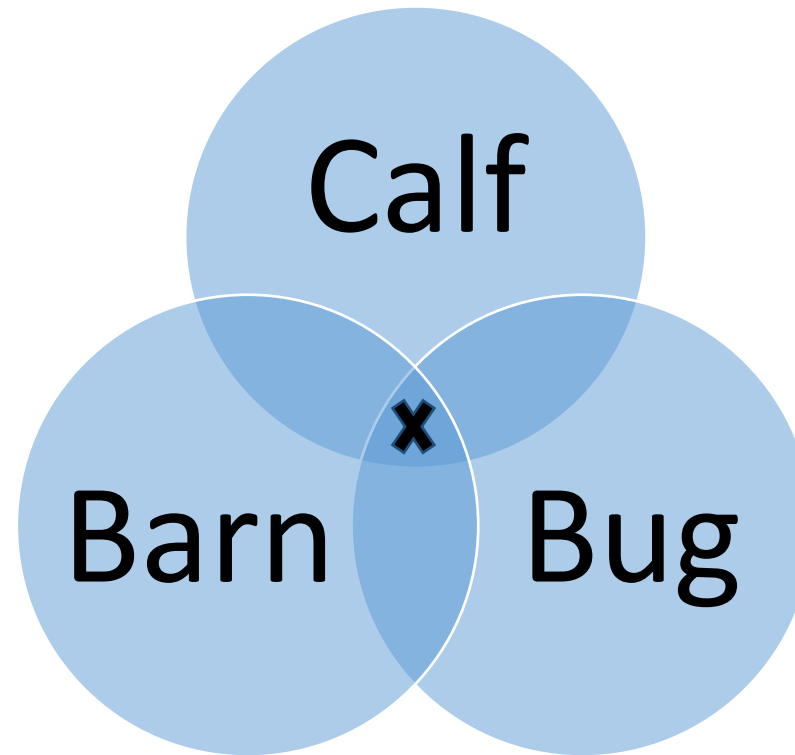


# Early detection and treatment reduced AFTx

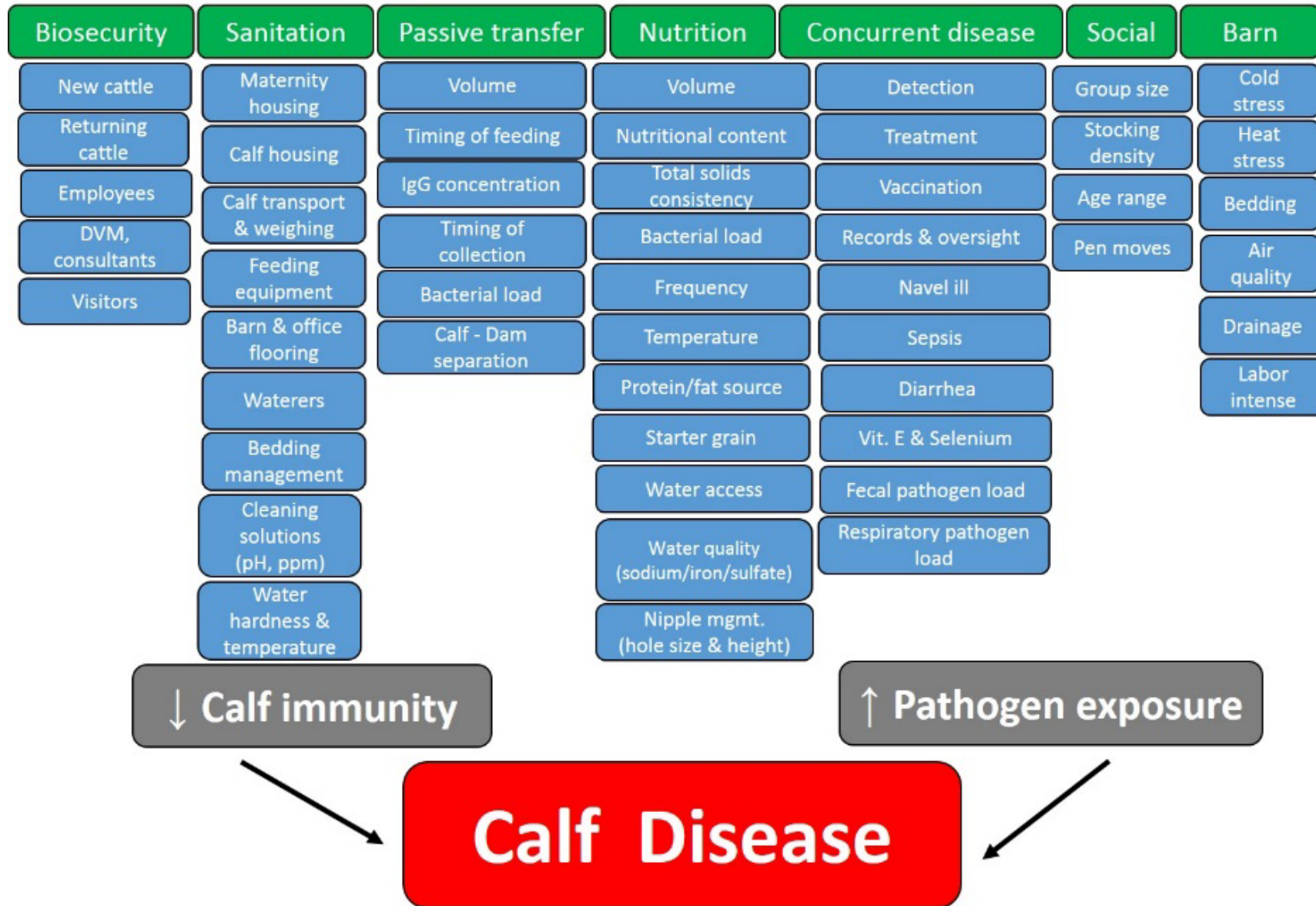


# Interactions resulting in disease

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# Risk Areas



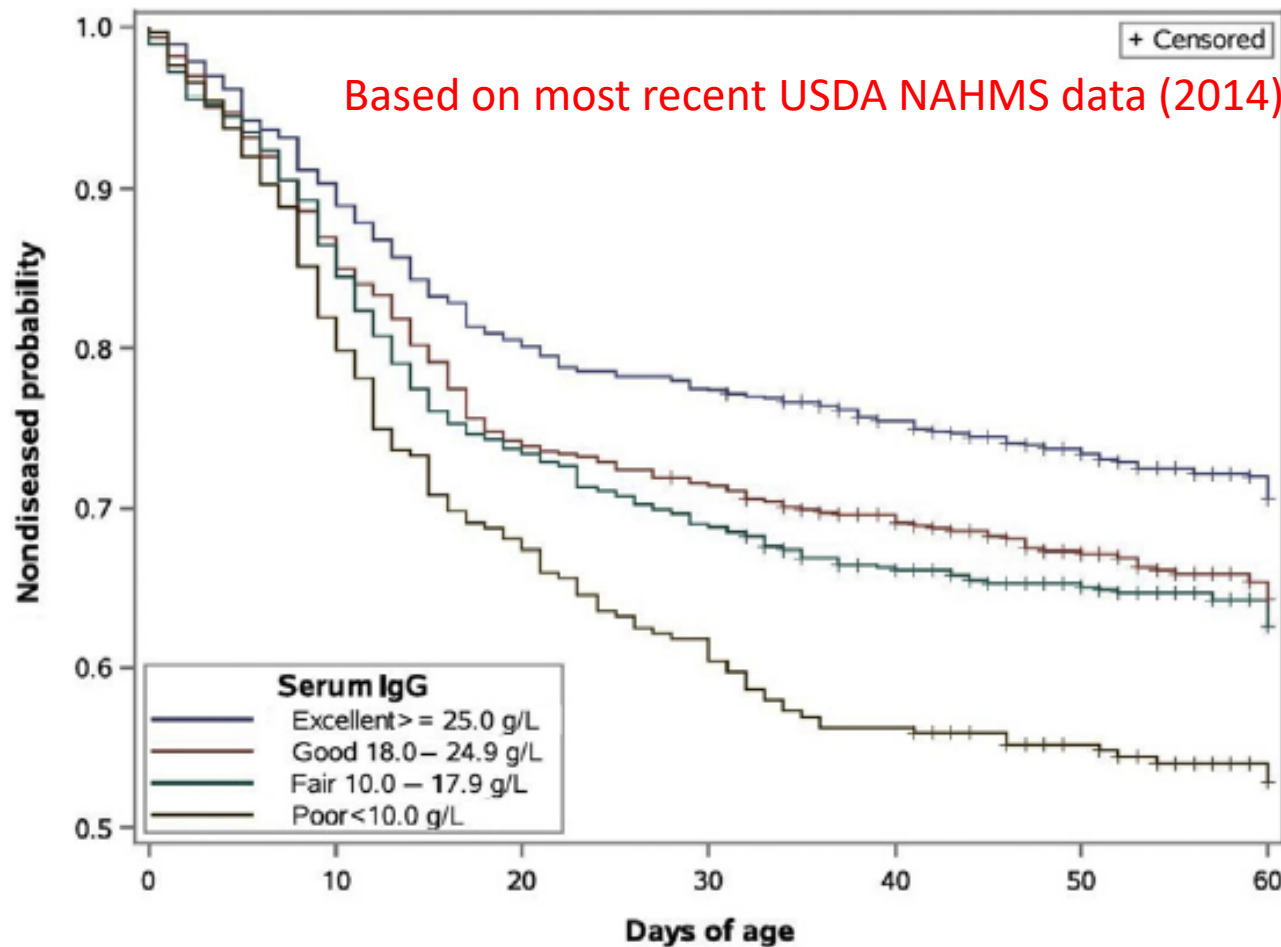


#dfwtg

We are far to comfortable with abnormal manure in 7-14 d calves

# Association between passive transfer and calf morbidity

Based on most recent USDA NAHMS data (2014)



N = 1824 preweaned dairy heifer calves

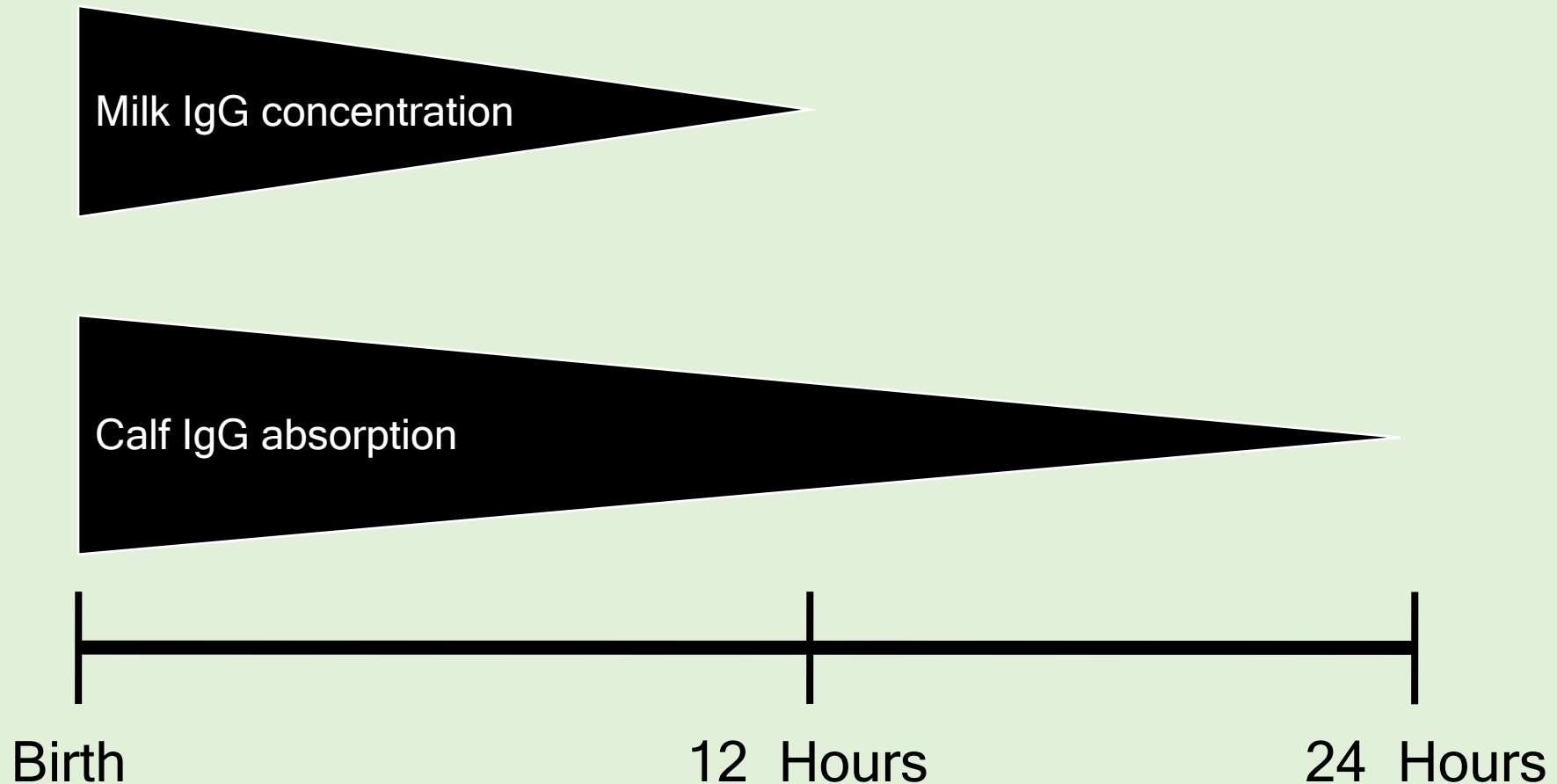
Serum TP > 6.1 g/dL was associated with Lower risk:

- 1) USS2+ (RR 0.87 95%CI:0.80, 0.93)
- 2) USS3+ (RR 0.76 95%CI:0.67, 0.87)
- 3) USS4+ (RR 0.59 95%CI: 0.47, 0.75)



**NEW MANTRA: 4 L in 1 - 2 hr; then 2 L at 12 hrs**

**OLD MANTRA: 4 Liters in 4 Hours (pre-2020)**



# Assessing passing transfer

- Tube feed 4L maternal colostrum within 2h, bottle feed 2L at 12 hr
- Monitor herd's ability to deliver maternal colostrum
  - Collect blood from 12 calves 24 hours after birth to 7d of age
    - Use tubes without additive (red top or serum separator tubes)

**Table 2**  
Proposed categories for immunoglobulin G levels and equivalent total protein and Brix measurements, and percentage of calves recommended in each category

Proposed Categories	Proposed IgG Levels (g/L)	Equivalent STP Levels (g/dL)	Equivalent Serum Brix Levels (%)	Proposed Calves in Each Category (%)
Excellent	≥25.0	≥6.2	≥9.4	>40
Good	18.0–24.9	5.8–6.1	8.9–9.3	~30
Fair	10.0–17.9	5.1–5.7	8.1–8.8	~20
Poor	<10.0	<5.1	<8.1	<10

Godden et al., 2019

N = 1824 preweaned dairy calves

Serum TP > 6.1 g/dL – lower risk:

- 1) USS2+ (RR 0.87 95%CI:0.80, 0.93)
- 2) USS3+ (RR 0.76 95%CI:0.67, 0.87)
- 3) USS4+ (RR 0.59 95%CI: 0.47, 0.75)

(Ollivett unpublished 2022)



# Why is C&D important?

- S. Dublin is NOT on every farm
- Not EVERY calf has EVERY bug

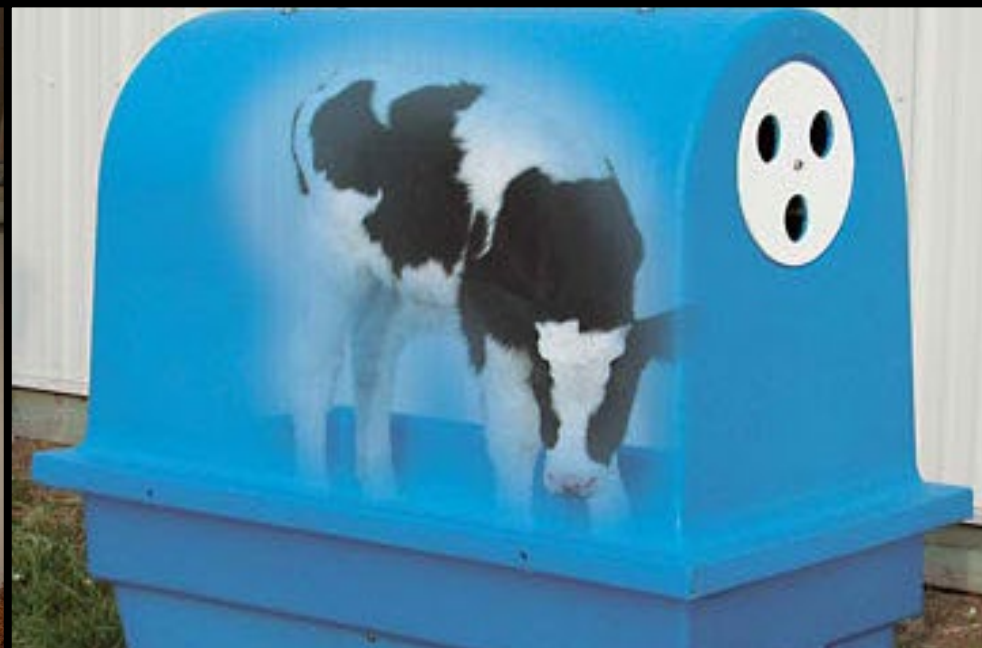


Mitigate interaction between young naïve calves, manure, saliva, and skin contaminants of other animals



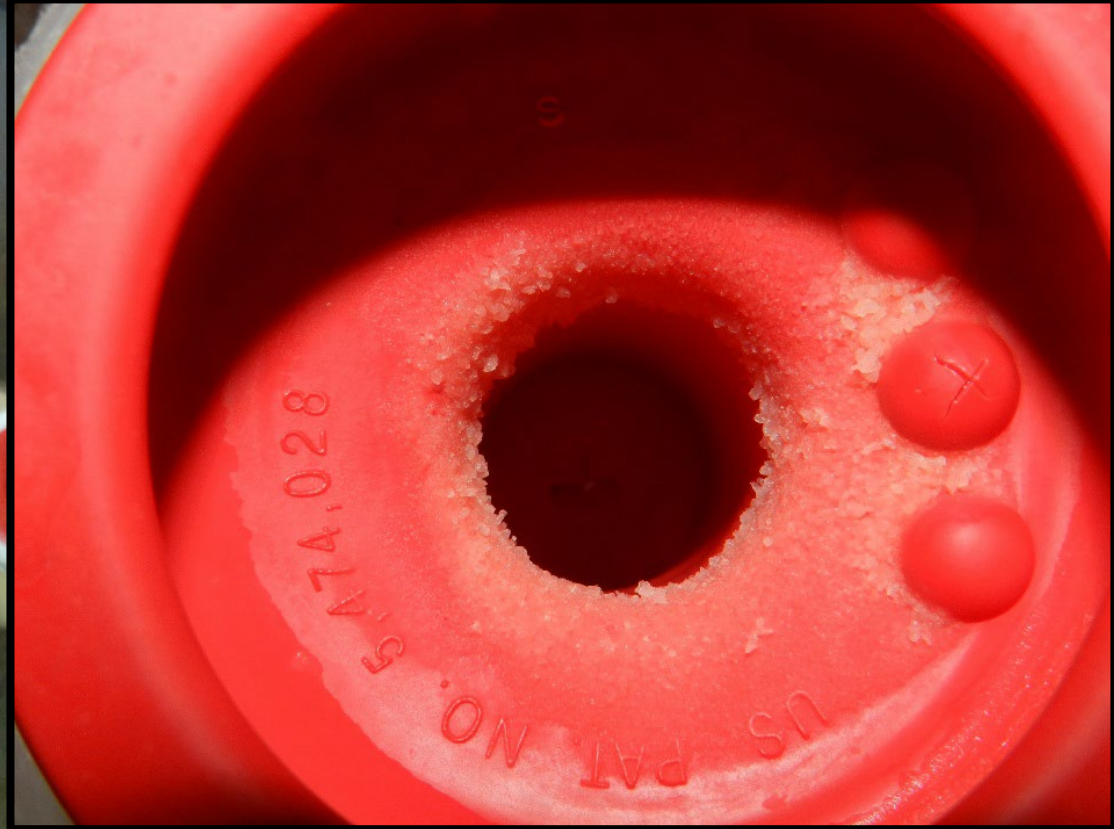














# Dr. Jennifer Van Os in collaboration with Dr. Don Sockett

[https://animalwelfare.cals.wisc.edu/calf\\_pairing/](https://animalwelfare.cals.wisc.edu/calf_pairing/)

## PAIR OR GROUP HOUSING OF DAIRY CALVES

Two heads are better than one: A starter guide to pairing dairy calves

This series of articles is a seven-part starter guide for pairing or group-housing pre-weaned dairy calves. Throughout this guide, we cover best practices to promote good health and welfare in calves raised in pairs or small groups.

View or download each article below. All articles within the guide are meant to be printed out and kept together as a series. The red tabs on the sides of the documents help readers flip to the section of interest.

Three of the articles are available translated into Spanish.



This guide was created by Jennifer Van Os, PhD, with contributions from:

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- Tina Kohlman, MS, UW-Madison Extension Fond du Lac County
- Emily Miller-Cushon, PhD, Department of Animal Sciences, University of Florida
- Theresa Ollivett, DVM, PhD, Department of Medical Sciences, School of Veterinary Medicine, UW-Madison
- Donald Sockett, DVM, PhD, Wisconsin Veterinary Diagnostic Laboratory, UW-Madison
- Sandy Stutgen, DVM, UW-Madison Extension Taylor County

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2. *Benchmarks for calf health before pair housing* [Download](#)

3. *Hygiene practices* [Download](#)

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6. *Feeding practices and reducing cross sucking* [Download](#)

7. *Disbudding and dehorning considerations* [Download](#)





## Hygiene practices

In recent years, an increasing number of dairy producers have been successfully raising calves in pairs or groups. Some of these producers found changing their calf-raising practices came with a few hiccups along the way. For a smooth transition from individual to pair or group housing, it is beneficial to review the principles for promoting good calf health outcomes. These principles are similar, whether managing individuals, pairs, or groups. Although calves within a pair or group have full contact, limiting the spread of disease between different pairs or groups remains a best practice. This includes reducing the buildup of bacteria, viruses, and other pathogens in the calves' environment by paying attention to biosecurity, sanitation practices, and proper bedding management.

### Biocontainment and Biosecurity

Biocontainment and biosecurity practices protect healthy calves from being infected with pathogens spread from elsewhere within or outside the farm. Pathogens can cling to tires, boots, clothing, tools, and other items and get tracked from one area of the farm to another.

Outside visitors should wear clean clothing and clean, disinfected boots or disposable boot covers when entering the calf area. Plan tours to visit calves before older animals. If visitors have interacted with older animals, they should avoid touching calves, or at a minimum, wash their hands with soap first.

To prevent contamination between barns, consider using disinfectant footbaths (see photo) or foamers at calf barn entrances. The disinfectant should be labeled for common pathogens affecting calves, such as salmonella, mycoplasma, and both enveloped and non-enveloped viruses (including bovine coronavirus and rotavirus). For efficient killing of the microorganisms, the disinfectant should also work within short contact times of less than 1 to 2 minutes.

Footbaths are only effective if used consistently and kept clean. Route foot traffic so everyone has to walk through the footbath when entering. Footbath solutions should be maintained daily or more frequently. An alternative to footbaths are doorway entry foamers,



Footbaths at the entrances to a calf-feeding room. Photo: The Dairyland Initiative.

which spray disinfectant foam onto the floor. These can be activated with timers or motion sensors. The foaming surfactant increases disinfectant contact time and surface area contact with boots and equipment wheels.

Check for liquids running off from the calf pens to ensure they do not drain into areas of foot traffic. Also check and make sure liquids from outdoor manure piles do not run into the barn or onto walkways between barns.

When handling calves, the best practice is to wear clean clothing and disposable gloves. It is best to change clothes after working with older cattle because of contamination from manure, saliva, discharge, or amniotic fluid. Work from the youngest calves, with the least-developed immune systems, to the oldest. Handle any sick calves last if possible. If you must work with healthy animals afterward, first disinfect your boots and put on fresh gloves and outerwear.

Some farms have hospital pens to monitor and treat sick calves. To limit the spread of disease, the hospital pen should not allow physical contact or have shared waterers with calves in adjacent pens. The hospital pen should have solid sides or physical distance from other pens.

Although sick animals sometimes seek distance from the herd as part of their natural behavioral response to illness, separating a calf from its social group may cause distress in either the sick animal, its companions, or both. Depending on the illness and its severity, it may be less stressful to allow a calf to remain in its normal pen, as long as there is enough space so the sick calf will not be constantly disturbed by energetic, healthy pen-mates.

# Jennifer Van Os with Donald Sockett

## [https://animalwelfare.cals.wisc.edu/calf\\_pairing/](https://animalwelfare.cals.wisc.edu/calf_pairing/)

## Sanitation

When cleaning calf feeding equipment, the best practice is to follow the steps below. This protocol was developed by Dr. Donald Sockett of the Wisconsin Veterinary Diagnostic Laboratory.

1. Rinse surfaces with cool or lukewarm water.
2. Wash with hot water and a chlorinated alkaline detergent (pH = 11 to 12). Physically scrub to break down biofilms. Note some detergents are labeled for use with 160°F water, which is too hot for comfortable use by most people. Choose a detergent labeled for 140°F and which will work with the hardness of your water.
3. Rinse with lukewarm water.
4. Rinse with an acid solution (pH = 2 to 3) and warm water (around 100°F) to remove mineral buildups.
5. Rinse again with lukewarm water.
6. Just before use, sanitize calf feeding equipment. The sanitizer should not be applied more than 1 to 2 hours before the feeding equipment will be used.

### Box 1

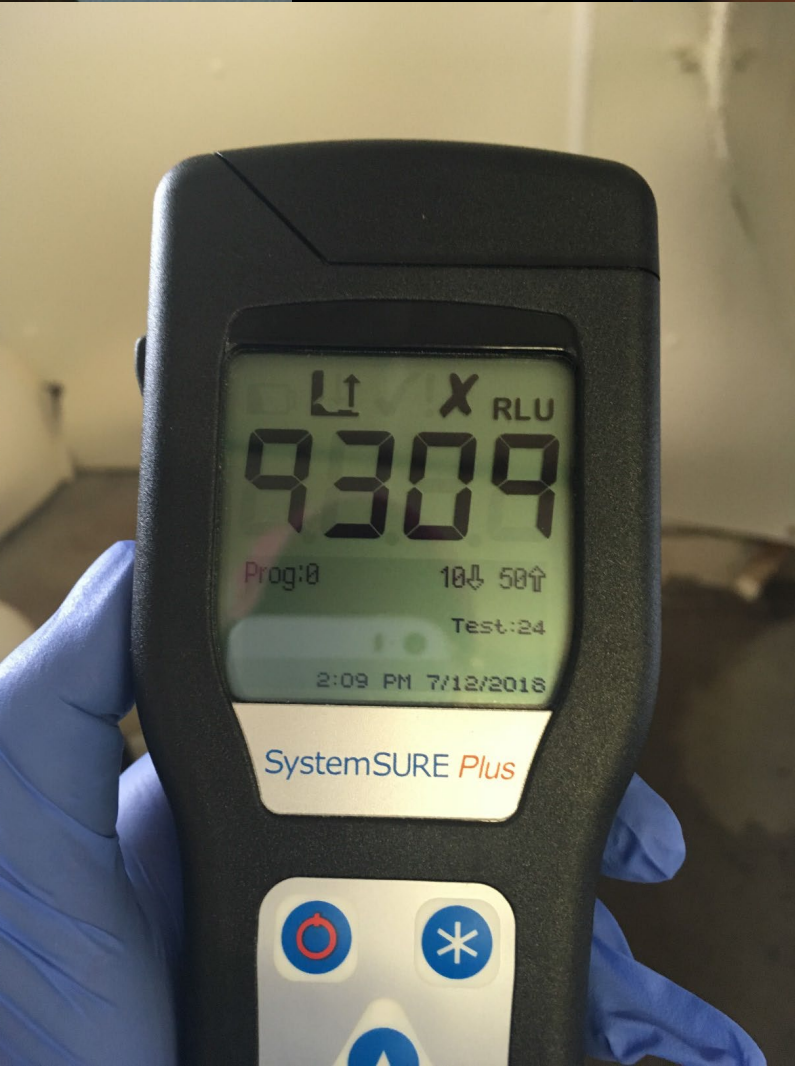
#### Choice of Disinfectant

By Donald C. Sockett, DVM, MS, PHD, DACVIM (large animal)<sup>4</sup>

It is important for livestock barns, calf pens, and calf feeding equipment to be properly cleaned *before* the disinfectant is applied. If surfaces are not properly cleaned, the disinfection step is much less effective at killing disease-causing microorganisms.

Many disinfectants available are effective against microorganisms under laboratory conditions. Unfortunately, many fail to mention whether the disinfectant can penetrate biofilms, is inactivated by organic material, or is adversely affected by low temperatures, hard water, or by pH. As well, minimum contact time information is often not available.

Chlorine dioxide has emerged as an excellent choice because it can be used at low concentrations, it has very short contact times for pathogen inactivation, resistance does not develop, and it is the least corrosive of all the oxidizing disinfectants. Corrosion of metal surfaces, including some types of stainless steel, is a significant problem with oxidizing disinfectants. Chlorine dioxide activity is not affected by pH or organic material, it can



# Luminometer tips

- Goal < 50
- Clean, dry, disinfected surface
  - If it looks dirty, it is dirty
- False negatives are possible
  - Visible debris on swab
  - pH of acid rinse < 2



# Keep them breathing easy – top priorities

- **Before birth**

- Strategize early – don't breed all your heifers at once, balance out cows
- Limit dam stress in close up/maternity – 150 ft<sup>2</sup>, 30" bunk space, heat abatement, diet

- **At birth**

- No wearing and sharing of bugs on day 1 – clean/dry bedding, ≥ 25 lbs straw per cow per day
- Clean and disinfect any/all feeding equipment, scales, transport, and newborn facilities
- Bury the calf in straw when ≤ 60°F
- Bleed every calf - Meet new passive transfer goals - ≥ 40% > 6.1 g/dL; ≥ 70% > 5.7 g/dL

- **After birth**

- Ensure ≥ 1 lb ADG in first week of life regardless of weather – feed > 1.5 lbs, 13% TS, #dfwtg, same meal, same way, everyday, deep straw bedding, jackets as needed
- Clean and disinfect any/all feeding equipment, scales, transport, and newborn facilities
- #WeanClean™ Routine lung scans – signal when something broke; find, treat, cure early
- Prevent antibiotic pressure on calf biome

Questions?



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608.358.1640

#WeanClean™

<https://thedairylandinitiative.vetmed.wisc.edu/home/calf-health-module/>

