Improving Feedyard Mortality Rates

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Conflict of Interest Disclosure

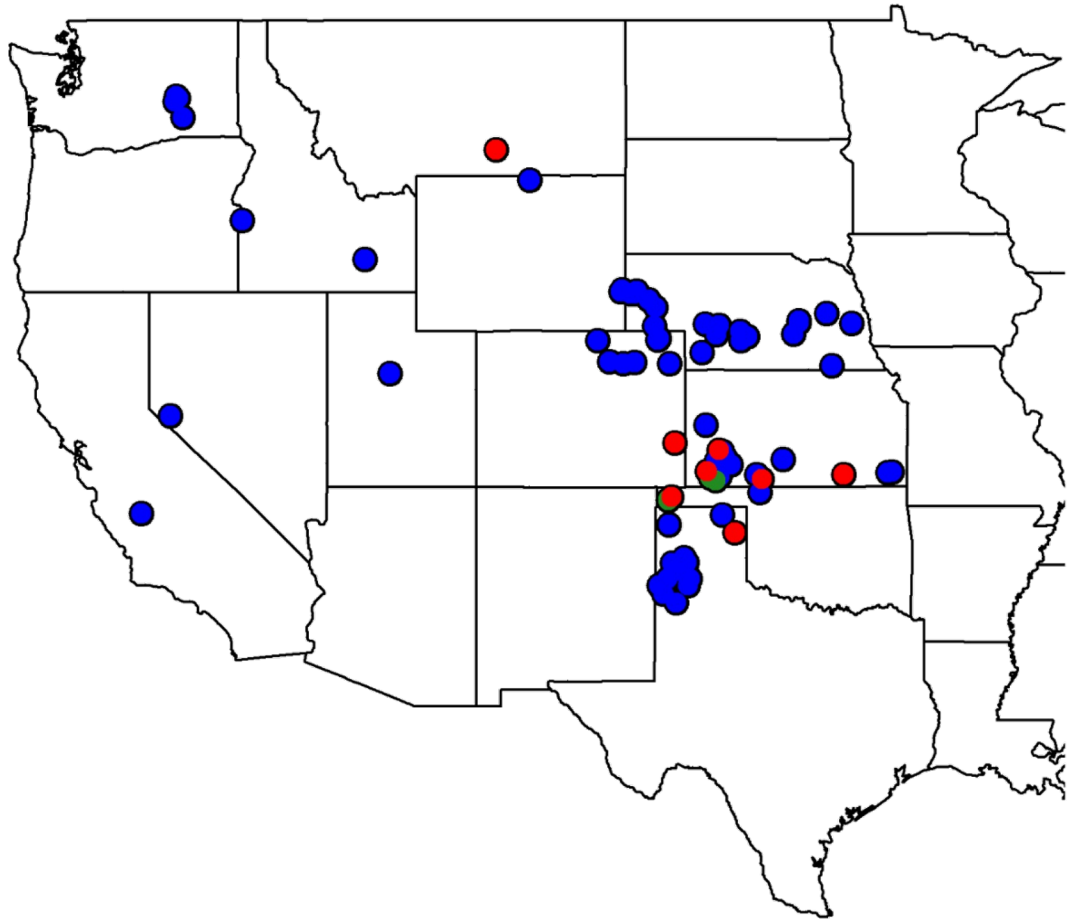
- I have received financial support for research to evaluate cattle health and performance or served as a consultant for:
  - Alltech Inc., American Association of Bovine Practitioners, Bayer Animal Health, Bimeda Animal Health, Boehringer-Ingelheim Animal Health, Elanco Animal Health, Foundational for Food and Agriculture Research, Lallemand Animal Nutrition, Land O'Lakes Inc., Merck Animal Health, MS Biotec, National Cattlemen's Beef Association, Vytelle Holdings, Zinpro Corporation, and Zoetis

Veterinary Research and Consulting Services, LLC

- Veterinary Research and Consulting Services, LLC; Hays, KS
  - Founded in 1984 by Del Miles
  - 12 Veterinarian think tank

- Trent Fox, DVM, MS, PhD
- Simon Timmermans, DVM, MS
- Travis McCarty, DVM
- Del Miles, DVM, MS
- Miles Theurer, DVM, PhD
- Bob Smith, DVM, MS
- Karen Rogers, DVM, MS
- Randy Hunter, DVM
- Tom Portillo, DVM
- Ryan McCollum, DVM
- Jim Sears, DVM
- John Lynch, DVM

VRCS Consulting Locations



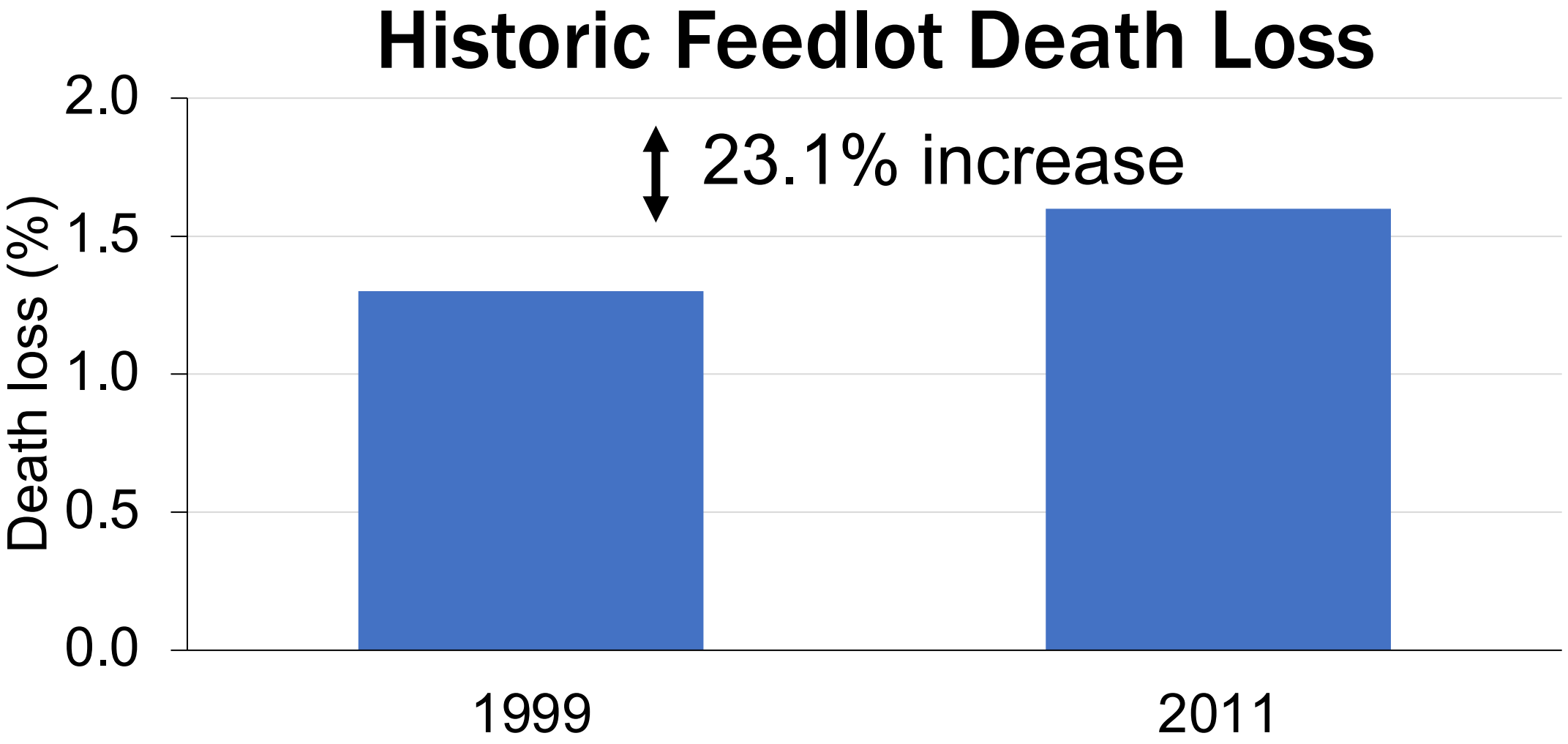
• Background • Dairy • Feedlot

Introduction

- Selection for high-performing cattle has increased
  - High ADG, improved feed efficiency and carcass quality
- Anecdotal observations of increased incidence of BRD later days on feed
  - Results in antibiotic treatment
  - Significant resources invested at this stage of production
  - Morbidity detracts from the advantages of selecting genetically superior animals
- No formal studies have been performed evaluating potential causes of morbidity in high-performing cattle

Frustrations with Later Day Morbidity

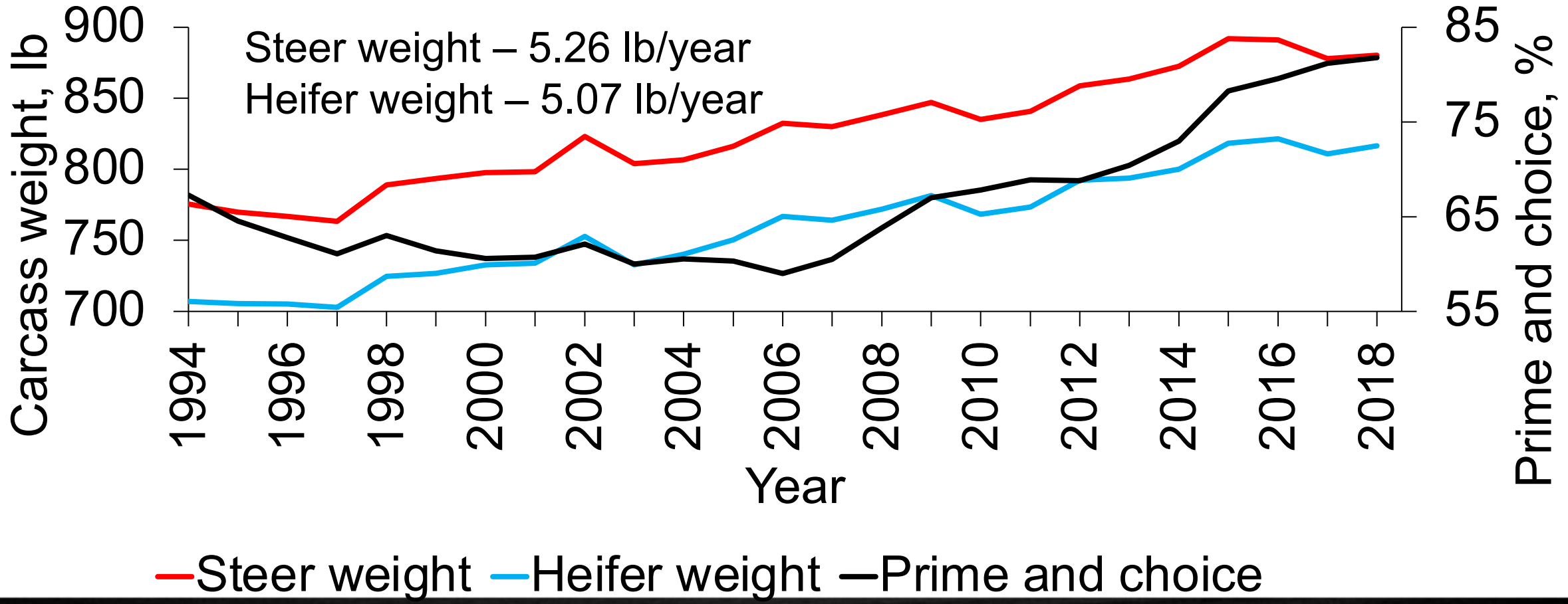
- Rapid progression
  - Affected calves appear normal in the morning
  - Severely morbid or dead by the afternoon
- More antibiotics required due to increased body weight
  - Costly to administer
  - Judicious in use, but increasing pressure not to use
  - Must determine drivers of the issue, not just treat with a needle
- Progression, timing, & population makes this very frustrating


Historic Feedlot Death Loss
23.1% increase
Death loss (%)
2.0
1.5
1.0
0.5
0.0
1999
2011

USDA NAHMS

Historic Carcass Outcomes

USDA Economic Research Service



Retrospective temporal BRD patterns in high-performing and high-risk populations

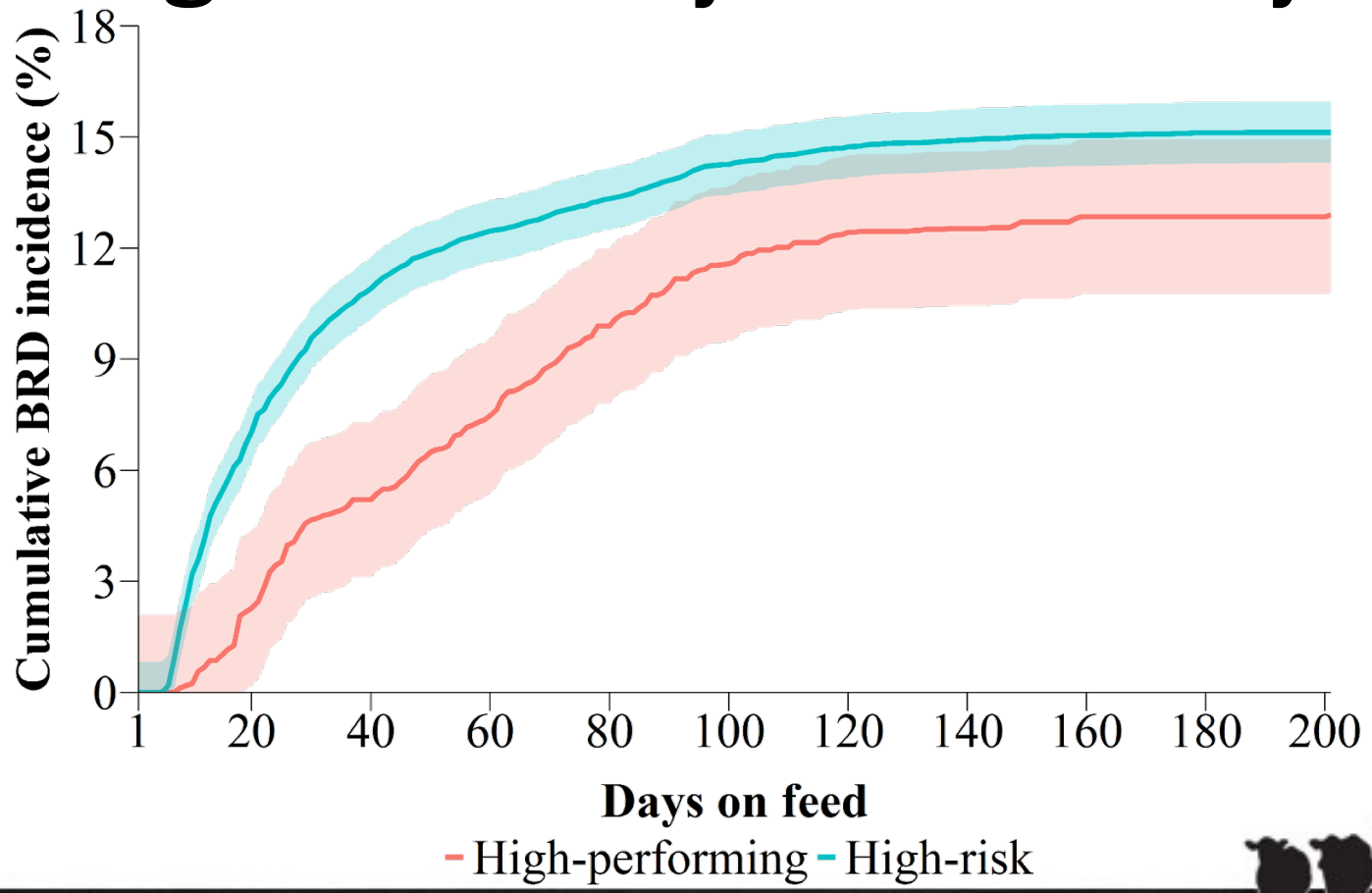
Retrospective Data

- Retrospective data from Hy-Plains Feedyard located in southwest Kansas from 2017 and 2018
- First treatment for BRD health records extracted
- Traditional feedlot case definition of BRD by pen riders

High-Performing and High-Risk Classification

- High-performing classification:
  - Performance potential of top 25% of cattle fed in the industry for ADG and F:G
  - Carcass characteristics >90% prime and choice
  - Performance potential was categorized based on breeding decisions made at cow-calf operation
  - Single sex lots
- High-risk classification:
  - Administered a macrolide antimicrobial during arrival processing
  - Decision to metaphylactically treat individual lots based on subjective risk classification of feedlot personnel
    - Origin, distance traveled, arrival weight, shrink, visual appearance, and environmental conditions

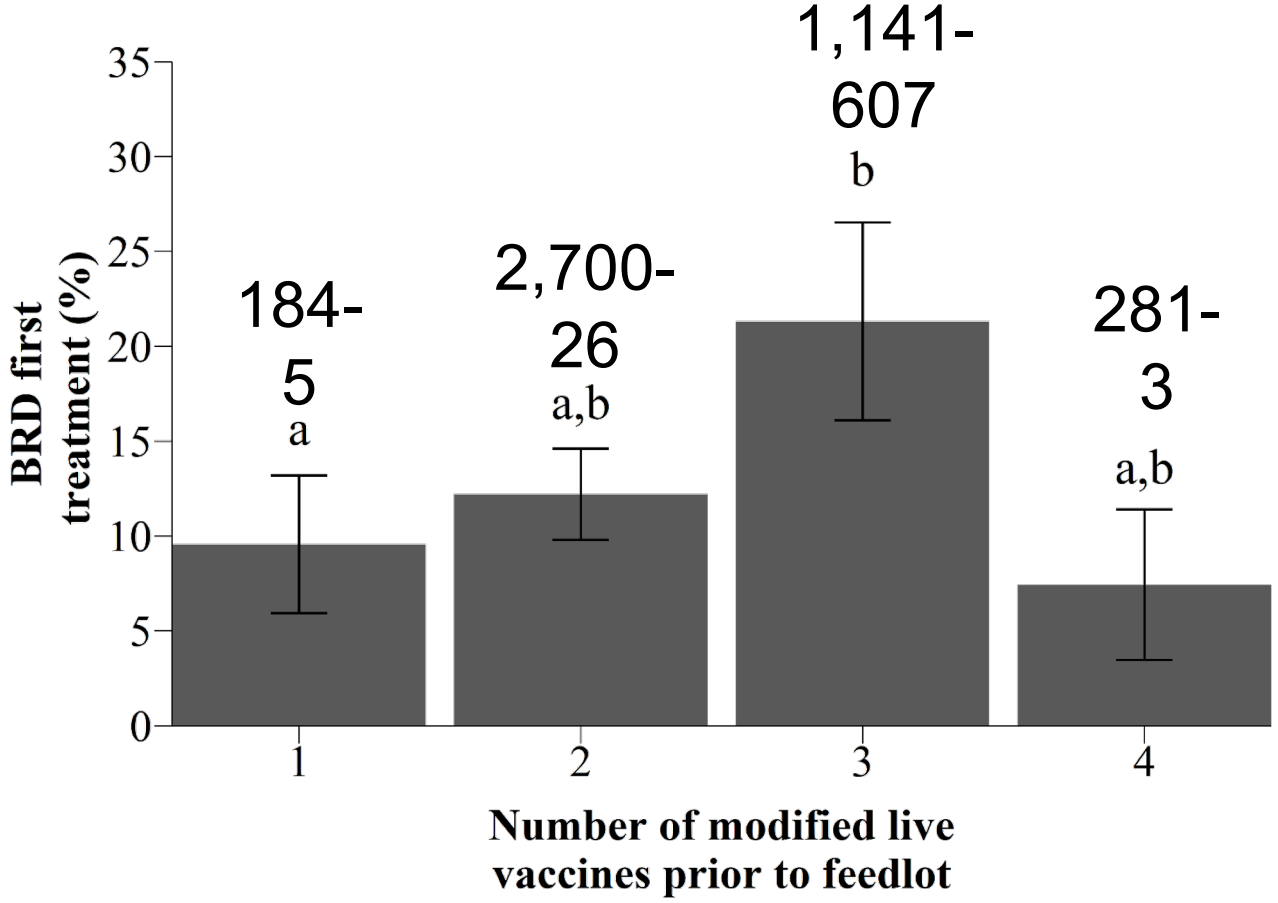
Cumulative BRD Morbidity in High-Performing and High-Risk at Hy-Plains Feedyard



Effects of Previous Vaccines

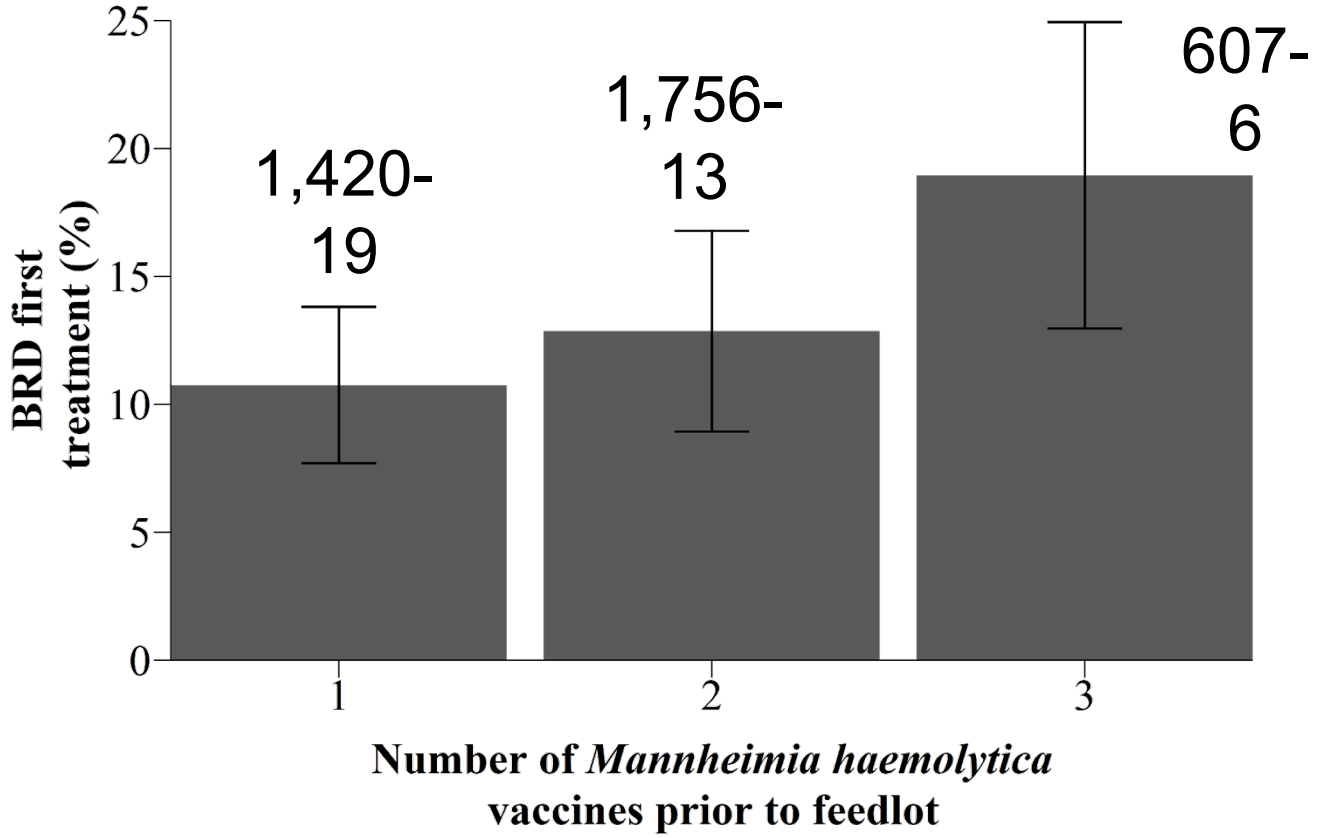
- Variation in individual producer vaccination protocols allowed for retrospective analysis
- Individual animal health outcomes from the feedlot were traced back to the vaccine programs used on the cow-calf operation on the same 4,346 cattle fed in Kansas
- Health outcomes evaluated by number of times a MLV, *Mannheimia haemolytica*, *Histophilus somni*, or *Clostridia* spp. were administered prior to feedlot entry

BRD by Number of MLV Vaccines Administered Prior to Feedlot Arrival



P = 0.02

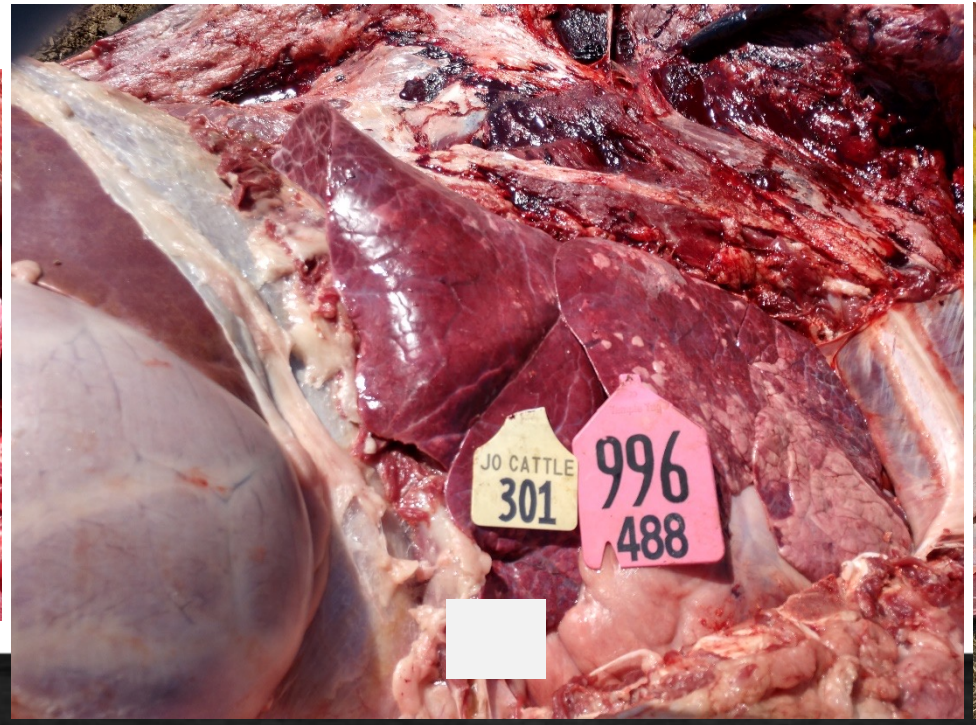
BRD by Number of *Mannheimia haemolytica* Vaccines Prior to Feedlot Arrival



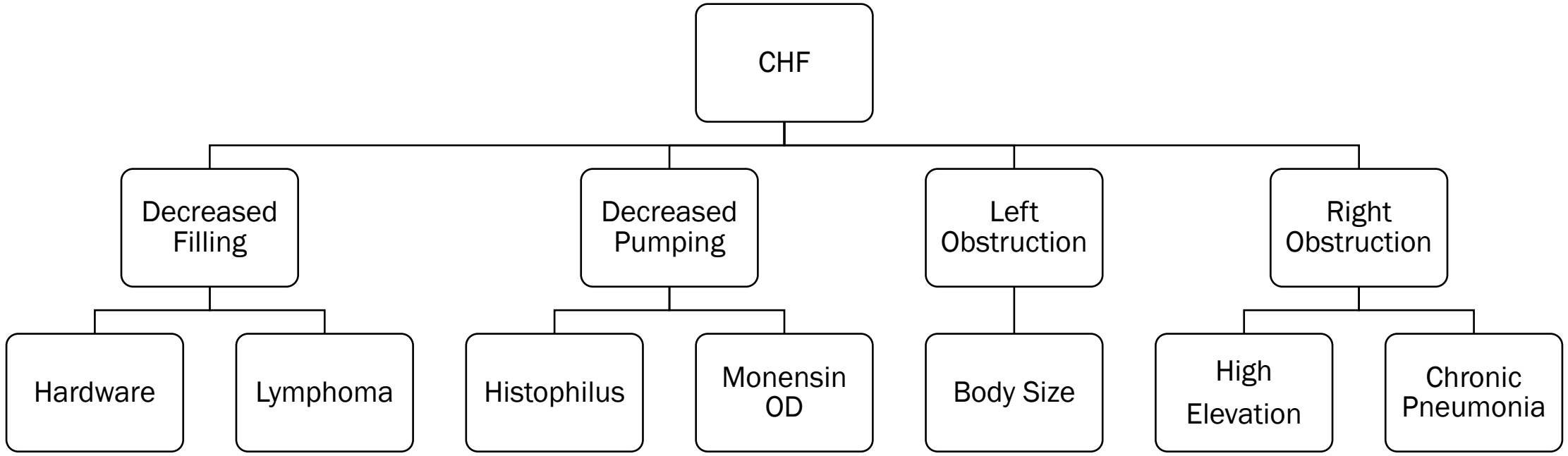
***P* = 0.15**

AIP (Atypical Interstitial Pneumonia)

- Checkerboard appearance at top part of lung
- 3-4 times more common in heifers than steers
  - More frequent in summer months during hot period



Paths to Congestive Heart Failure



“New” Brisket Disease

Michael Heaton, USMARC

Occurrence and Impact

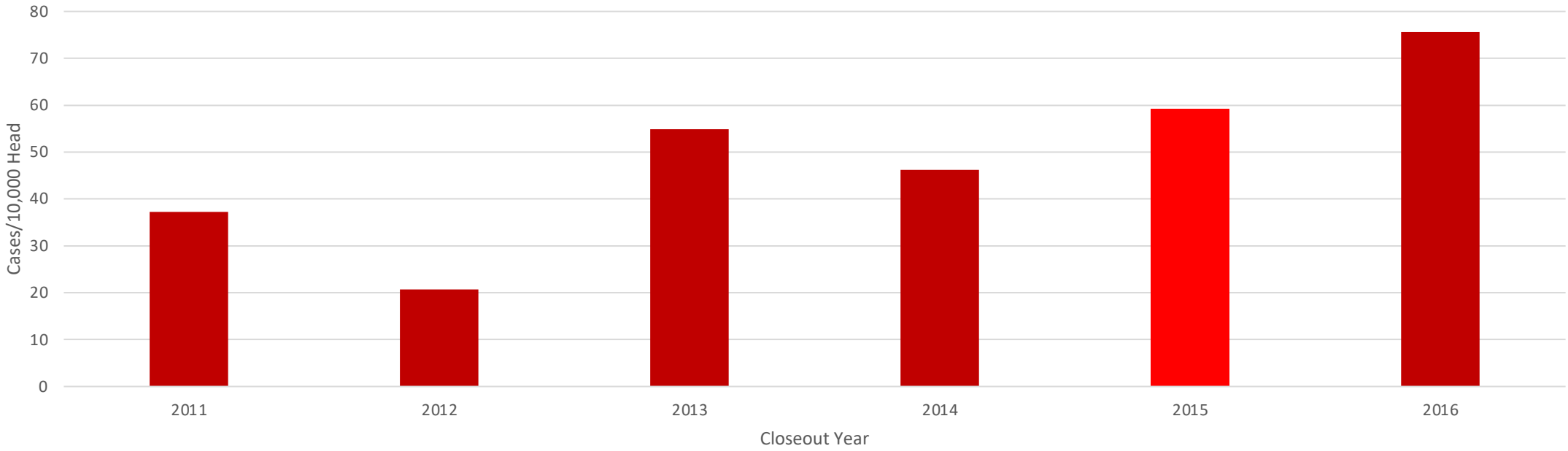
- Neary et al. 2016
  - Retrospective analysis of US and Canadian feedlots
  - Number of cases has doubled from 2000-2012
    - 11 cases/10,000 head in 2012
  - Caveats
    - Survey included 1.5 million cattle from all classes (low, medium, high, ultra-high risk)
    - Anecdotally, we observe higher incidence in low risk, high quality cattle (high genetic merit, exceptional management)
- Our Anecdotes
  - Up to 6% mortality/early removal in affected lots
  - Up to 0.5% feedlot wide mortality

Epidemiologic Characteristics

- 6 Years of Data
- 1361 Lots
- ≈600 Cases

Cases/Lot	*Frequency*
0	1125
1	130
2	47
3	21
4	14
5	6
6	4
7	1
8	2
9	2
10	0
More	9

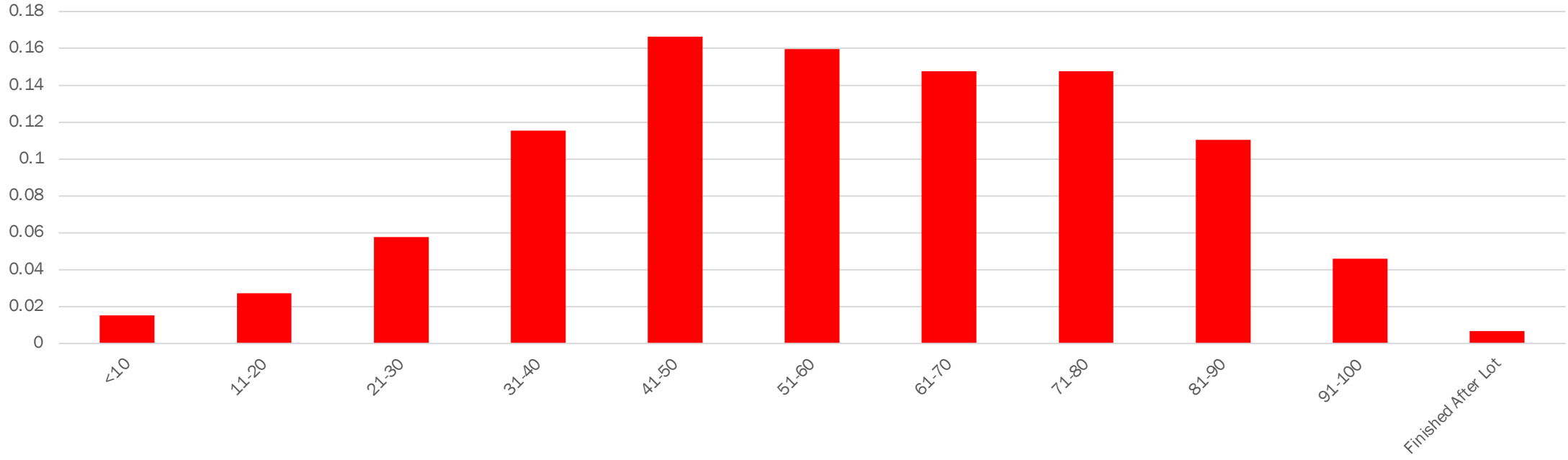
Cases/10,000 Head Placed



FEEDING QUALITY FORUM

Cases by Degree of Finish (DOF Based)

Figure 1. Proportion of Cases by Degree of Finish Based on Days on Feed

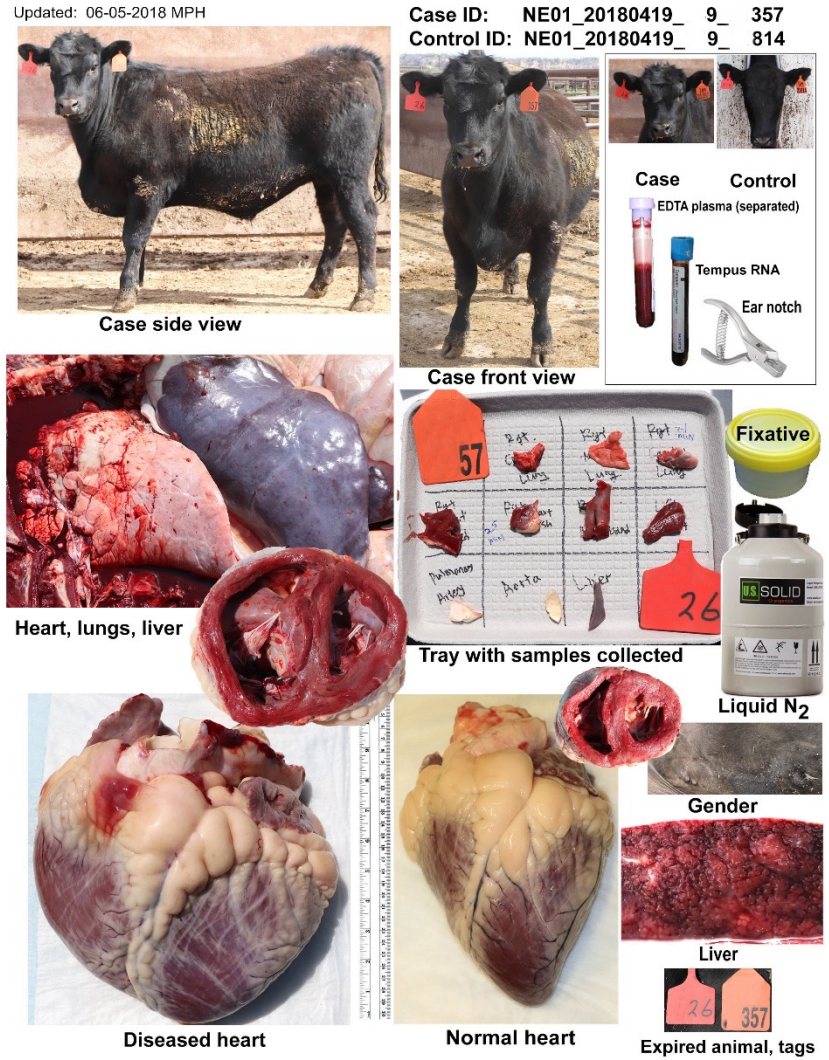


Study design

- 100 matched case-control pairs
  - *A priori* power: 80% to detect OR of 2.5
  - Four feedyards ~4000 ft
  - Pen riders identify clinical cases

- Presumptive diagnosis
  - Clinical presentation, necropsy, histopathology

- Preserve tissues
  - DNA, RNA, protein



Sample Summary

Site	Altitude (ft)	Pairs	Sources
NE01	4,075	76	20
NE02	3,816	17	9
WY01	4,143	6	6
WY02	4,198	3	2
Average:	4,058	Totals: 102	37

- 95 black, 5 red, 2 red whiteface
- 71 males, 31 females

Two Major Genetic Risk Factors

- NF1A-8X increase in odds of disease
- ARRDC3-7X increase in odds of disease
- Both-28X increase in odds of disease

- Both have a recessive inheritance pattern
  - Carriers
  - Hard to see, easier to control

- Low PPV
  - 8-10% of animals with both risk factors actually develop BCHF
  - Appears to require other factors to induce disease
- High NPV
  - <1% of animals with neither risk factor develop BCHF
  - High leverage breeding target

Table 3. ***ARRDC3*** **and** ***NFIA*** **genotype configurations, expected disease risk, and relative breeding rank.**

Possible risk allele configurations (*ARRDC3*, *NFIA*)[a]	Total combined risk alleles	Disease risk (1 to 28 scale)[b]	Probability of risk allele transmision (%)	Breeding rank[c]
0,0	0	1x	0	1
1,0	1	1x	25	2
0,1	1	1x	25	2
1,1	2	1x	50	3
2,0	2	8x	50	3
0,2	2	8x	50	3
2,1	3	8x	75	4
1,2	3	8x	75	4
2,2	4	28x	100	5

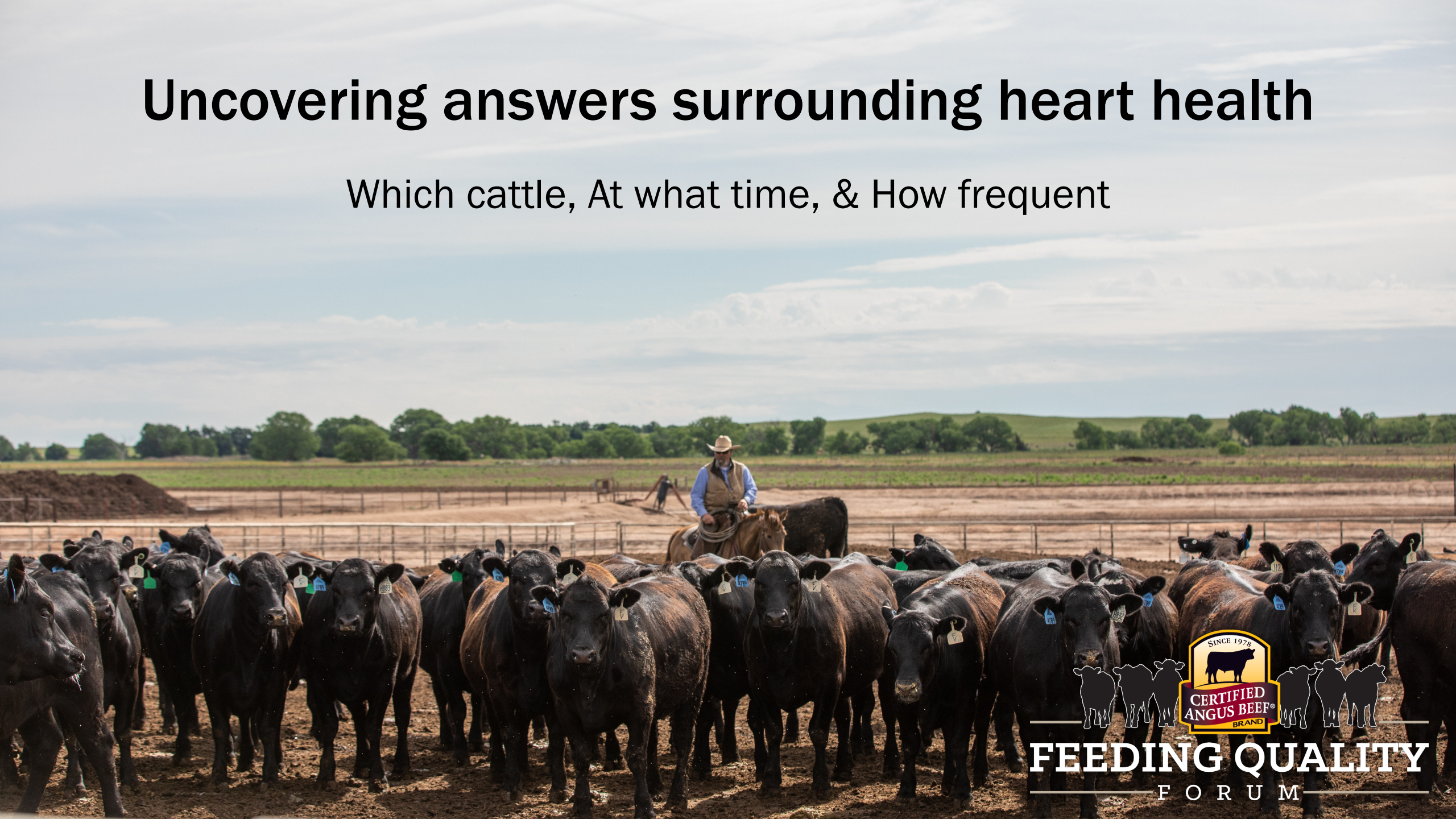
[a]Diploid combinations of risk alleles for each gene with markers BovineHD0700027239 (*ARRDC3*) and BovineHD0300024308 (*NFIA*).
[b]The risk of developing BCHF in a feedlot with animals and environments like those described here.
[c]The relative breeding rank of an animal based on risk genotypes for *ARRDC3* and *NFIA* from best (1) to worst (5).

U.S. Cattle Status

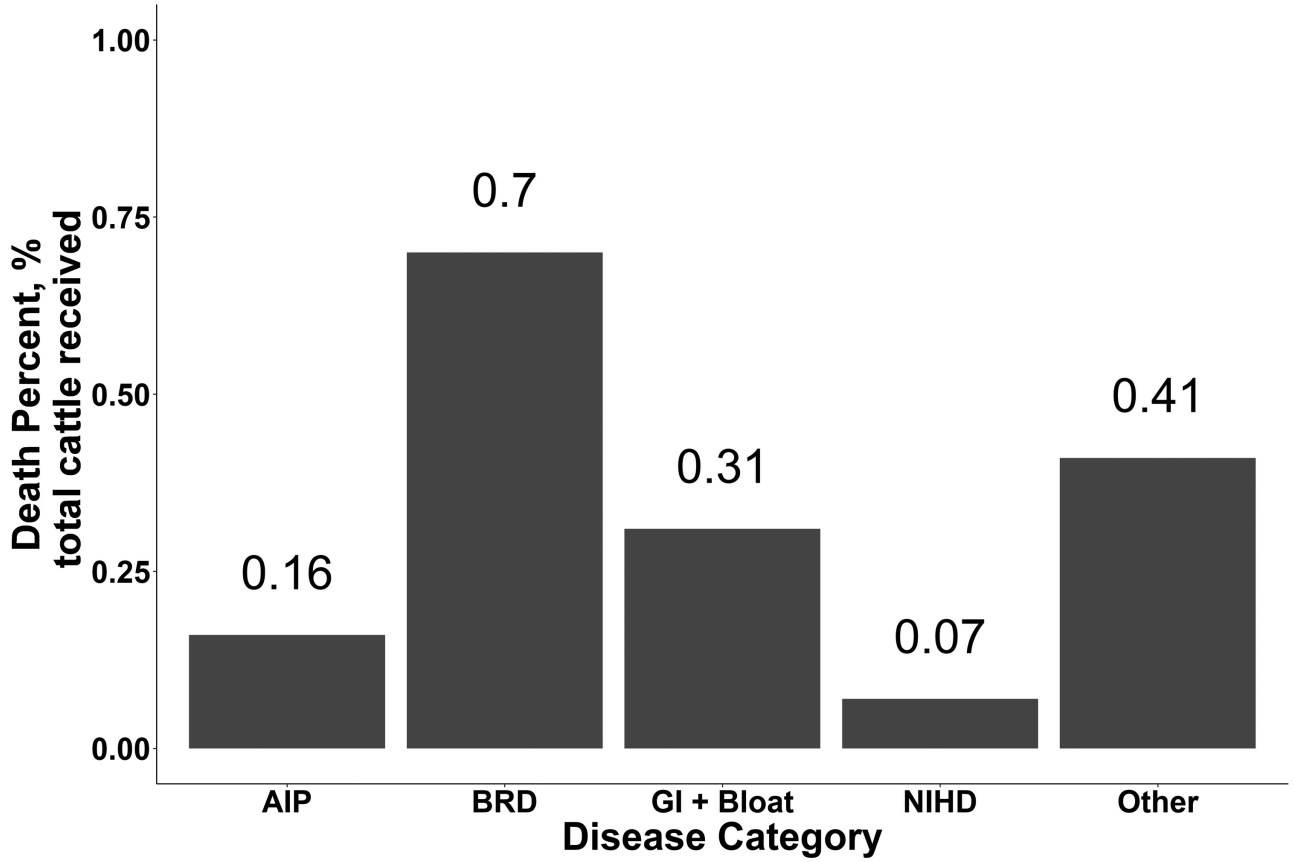
		% of Risk Alleles		BCHF Risk Group			Breeding Rank				
Breed	Bulls Genotyped	ARRDC3	NF1A	1	8	28	1	2	3	4	5
Angus	30	0.72	0.65	9	16	5	0	3	7	15	5
Charolais	30	0.05	0.48	24	6	0	7	15	7	1	0
Hereford	30	0.58	0.5	13	17	0	2	2	15	11	0
Red Angus	30	0.73	0.42	12	16	2	0	5	13	10	2
Simmental	30	0.13	0.42	23	6	1	9	13	5	2	1
Brahman	30	0	0.05	29	0	0	26	3	0	0	0

Uncovering answers surrounding heart health

Which cattle, At what time, & How frequent

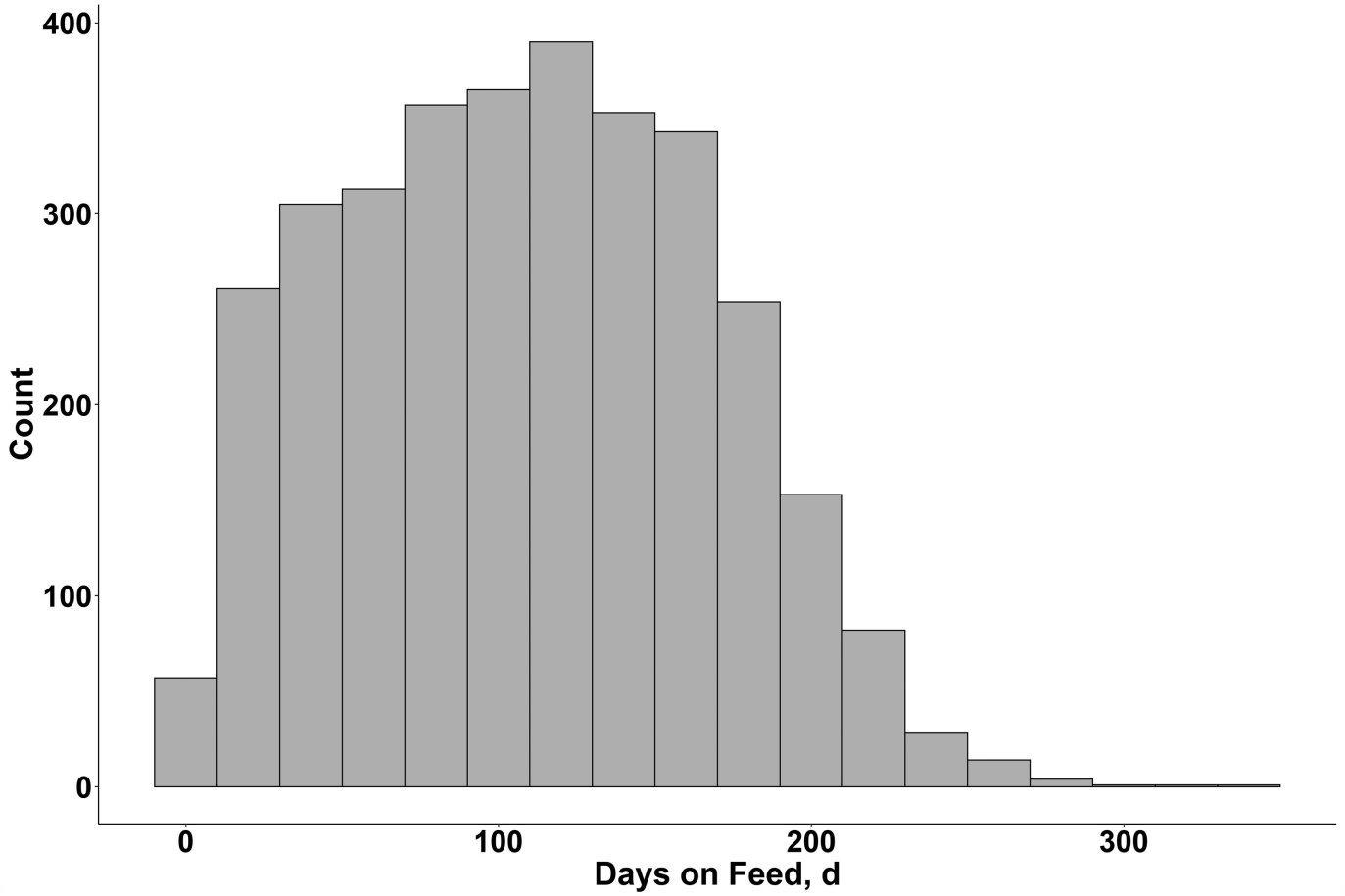


NIHD accounted for 0.07% of deaths in total cattle received



- Percent of diagnosis per disease category expressed as percent of total cattle received. Abbreviations: AIP, atypical/acute interstitial pneumonia; BRD, bovine respiratory disease; GI + Bloat, gastrointestinal disorders and bloat; NIHD, noninfectious heart disease; Other, all other non-categorized diseases.

NIHD deaths are spread across the feeding period



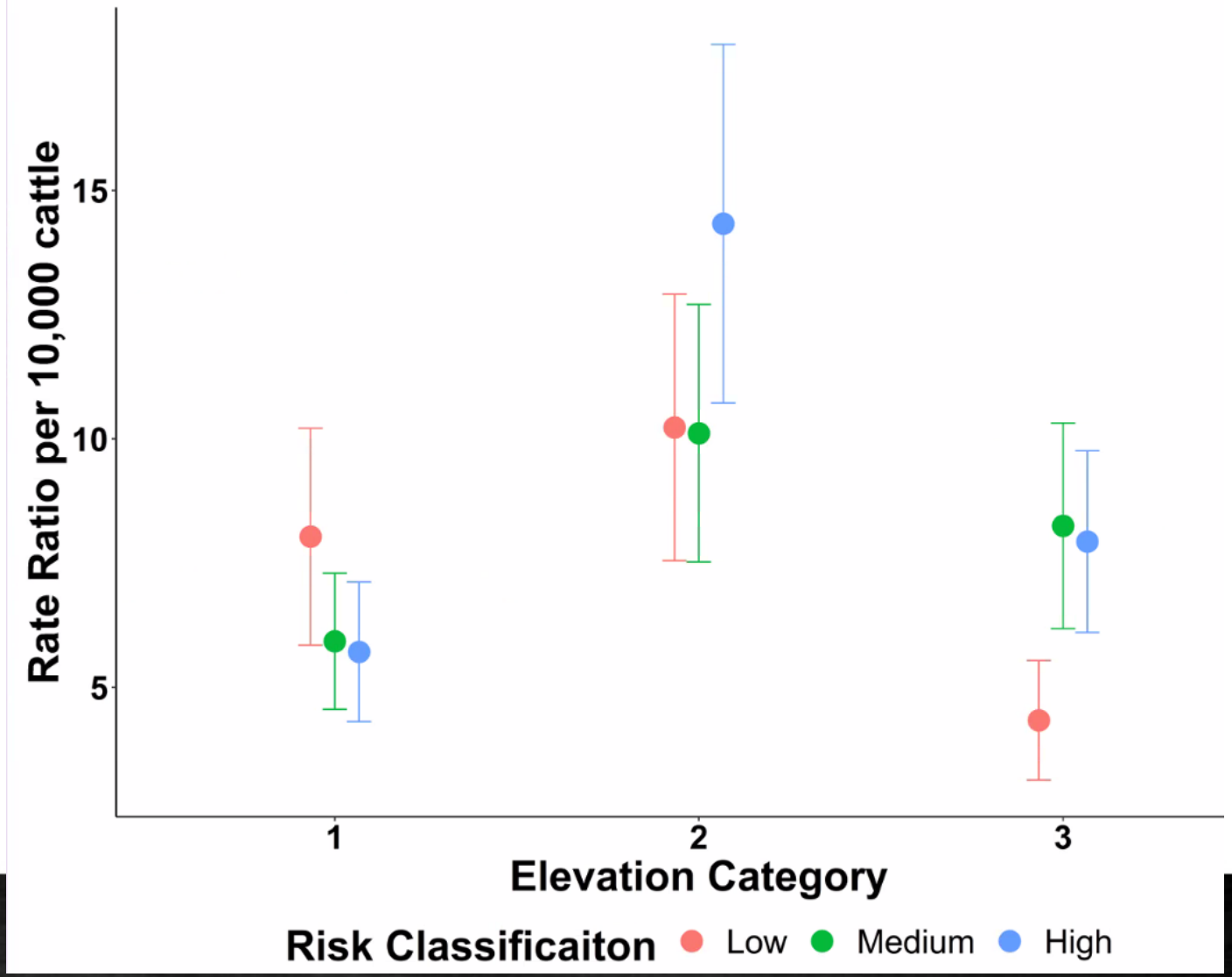
- Count of NIHD deaths by DOF at the time of death (mean and median = 110 d); totaling 3,282 NIHD deaths observed over 3 yr from 19 U.S. feedyards.

Study 2: Frequency of heart disease cases

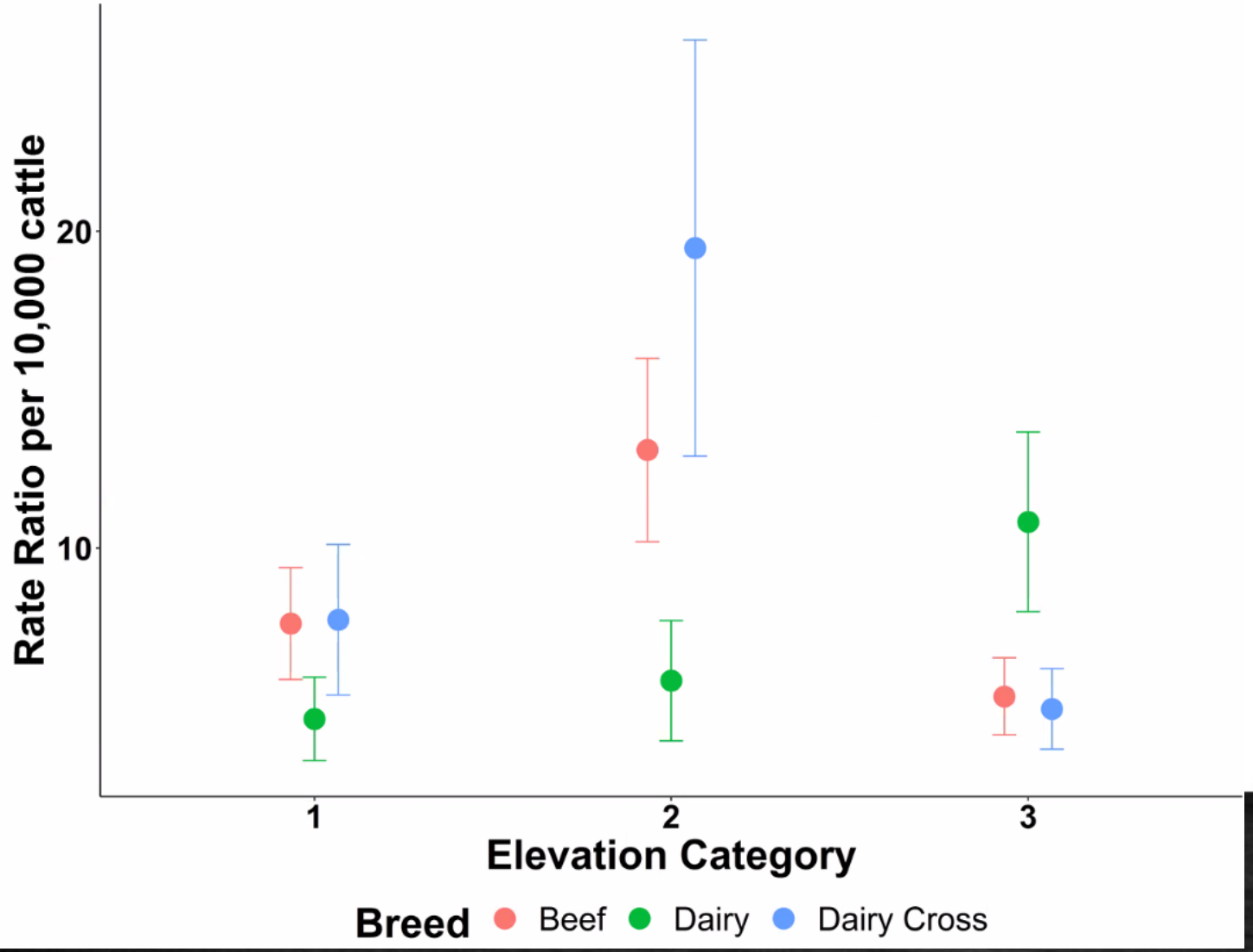
- 15 in 10,000 cattle placed in four years affected by heart disease
  - 6 in 10,000 cattle disease
  - 9 in 10,000 cattle railed with final diagnosis

Elevation did not have a clear relationship to NIHD

- Similar rate ratio between all elevation categories supports



Study 2: “Breed-type” versus rate ratio of cattle succumbing to NIHD



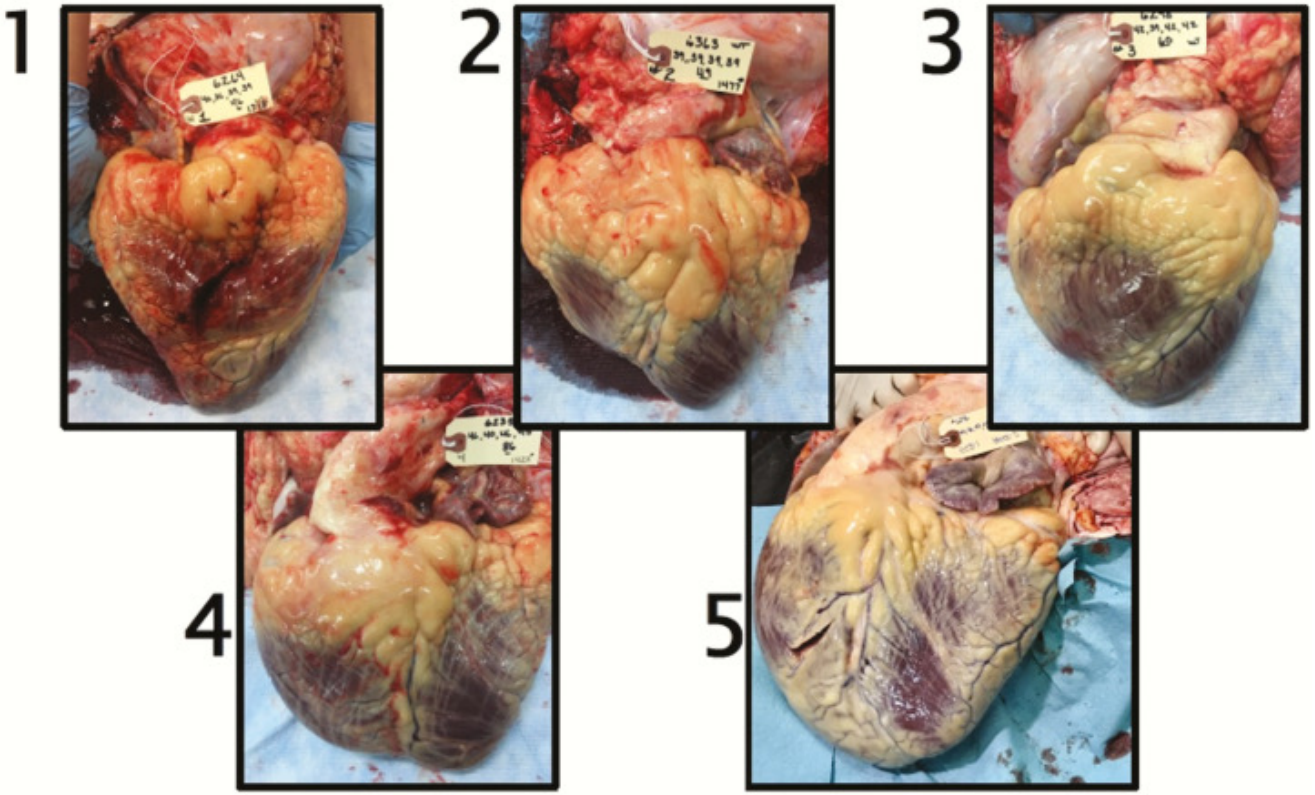
Similar rate ratio between beef, dairy and Dairy cross individuals.

Take-aways at 30,000 feet – Myth Busters

- They are not all late-term feedlot deaths.
- No apparent evidence of a strong relationship heart disease at elevation and in the feedlot.
- Heart disease is happening in non-native beef cattle as well.

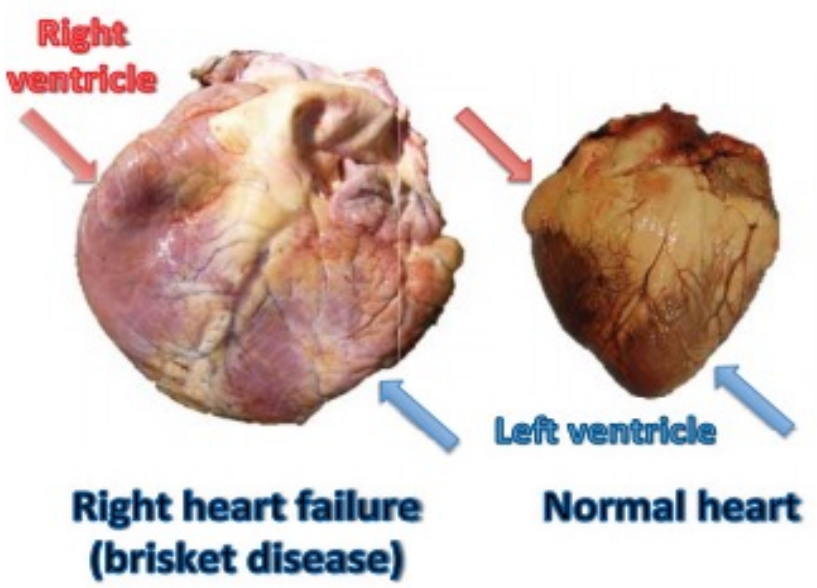
Where do we go?

- Finding large clusters to target don't appear to be the answer.
- Heart scoring large groups of cattle with the ability to be traced back to sire.

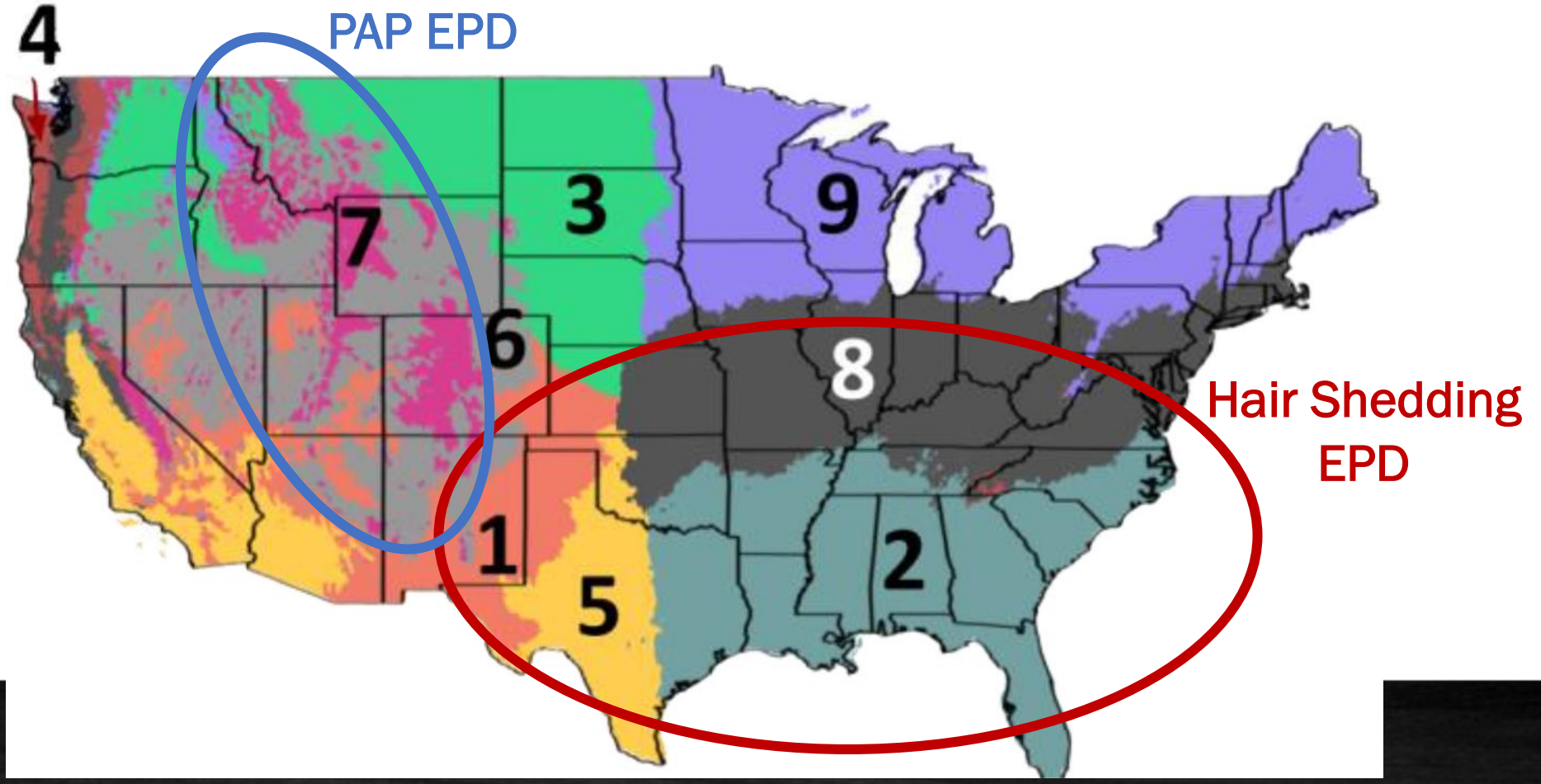


Similar heart structure to those cattle that experienced heart failure at altitude

- Phenotyping in Angus seedstock has reduced the incidence of high altitude disease
  - Mean pulmonary arterial pressure measurements
  - PAP EPD to select against this



Targeting tools for increase adaptation and production systems



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