



KELLI RETALLICK-RILEY

2025
FEEDING QUALITY
FORUM

THE HEART OF THE MATTER





The Heart of the Matter

Kelli Retallick-Riley, AGI President

Concerns around heart deaths, BCHF have grown over the last several years

HEALTHY HEARTS

start with knowing

Bovine congestive heart failure research reveals new

by Miranda Reiman, senior associate editor

What is six or seven in 10,000? It's a small chance — only 0.07%. What if it's 15 in 10,000? Still a low probability.

The odds aren't impossible, but they don't feel likely. If you're trying to win the lottery, but if you're trying to avoid cattle deaths related to bovine congestive heart failure, the numbers feel like a win.

Those statistics are from a recent Kansas State University (K-State) retrospective study on 4.5 million head of cattle fed across the United States. The research, part by the Angus Foundation, quantified the incidence of BCHF across the country and identified patterns in the data.

"We were just trying to find answers," says Kelli Retallick-Riley, president of the Angus Foundation (AGF). "At the beginning of this conversation, when we have these cattle populations, of congestive heart failure at very low elevations, it raised a lot of questions. It was anecdotal thoughts out there about what types of cattle were succumbing to heart failure, at what age they were, how far along they were on their days on feed, what types of cattle were dying, but we didn't have a lot of data."



Bovine congestive heart failure is a growing concern for feedyards

BY GREG HENDERSON

Veterinarian Randall Raymond sees too many dead cattle that are close to the finish line.

"Those late days-on-feed mortalities are both frustrating and expensive," says Raymond, director of research and veterinary medicine at Simplot Land and Livestock. Indeed, the incidence of bovine congestive heart failure (BCHF) is increasing throughout the industry, especially as cattle are fed to heavier end points.

Over the past several years, late-term losses have spiked to 30 to 40 mortalities per week in one

in the Pacific Northwest, to invest in research to identify root causes and robust solutions for BCHF.

Simplot began with intense training of feedyard personnel to accurately diagnose the stages of heart failure upon gross necropsy. Simultaneously, pen riding staff were trained to assess the subtle and early signs of cattle experiencing cardiac insufficiency. Simplot

of end-stage heart failure varied significantly by breed type, with more than 5% of black-hided calves in normal scheduled harvest shipments assigned heart scores consistent with end-stage heart failure. Simplot says the project confirms a dramatic prevalence of this syndrome in U.S. cattle, a condition it says can be greatly reduced through genetic selection.

It (BCHF) isn't quite as cut and dried as you might expect. —Mark McCully

Congestive Heart Failure Feedlot Survey



BT, Feedlot, Heiler

By **DROVERS CATTLENETWORK** January 26, 2016

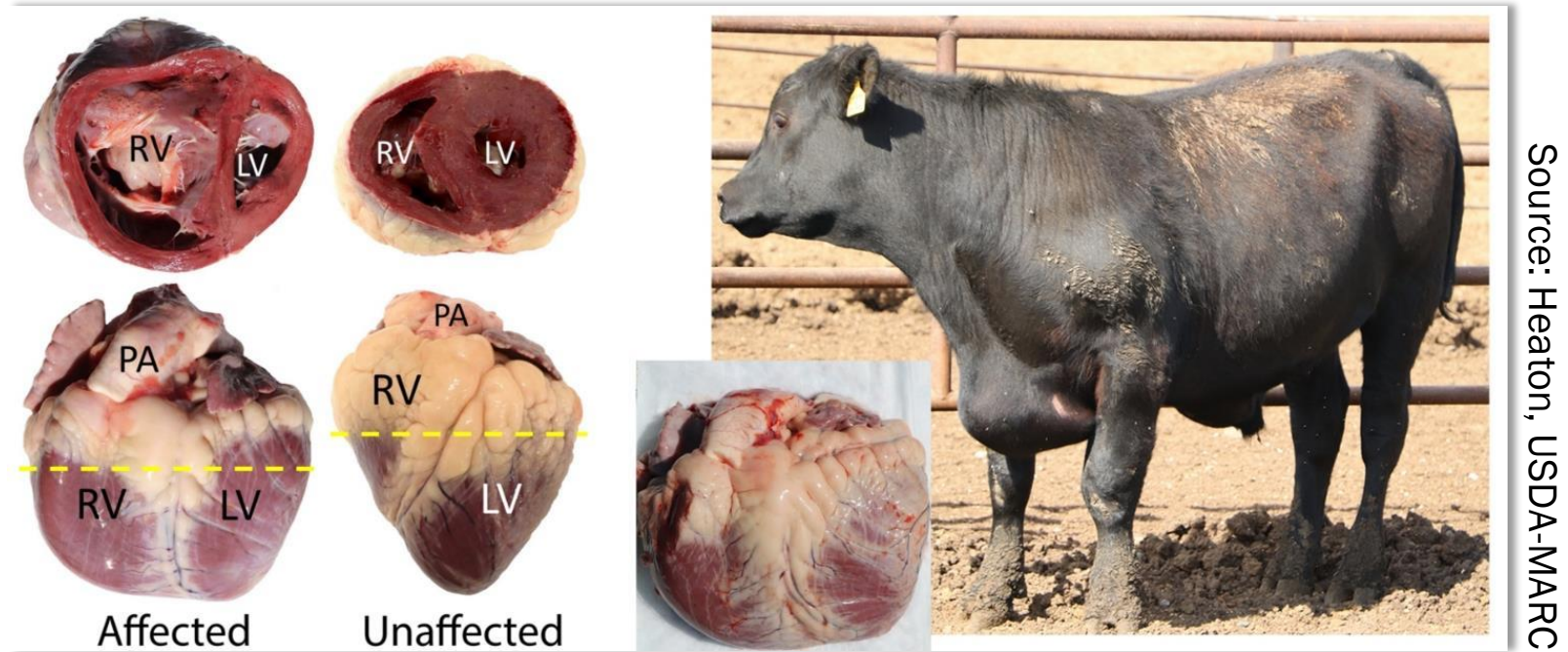
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By: John Maday, editor, Bovine Veterinarian

Clinical signs of congestive heart failure (CHF) in feedyard cattle can resemble those associated with respiratory disease. It is possible that CHF accounts for some of the recent increase in feedyard mortality, but little information is available.

To learn more, a group of researchers are conducting an online survey to measure awareness and prevalence of CHF in feedlot cattle. The survey, managed by researchers at the University of Nebraska, Kansas State University and Texas Tech, in cooperation with NCBA, is

Cattle succumbing to congestive heart failure have severe remodeling of the heart



Tackling Heart Health (Remodeling) through genetic selection.

STEP 1:



Heritability:
Target Trait is heritable

STEP 2:



Scalability:
Measurable & accessible

STEP 3:



Utility:
Actionable for Selection

STEP 4:



Compatibility:
Trait relationships

Pathophysiology Bovine High Altitude Disease

– congestive heart failure at +5,000 feet

Stressor: Hypoxic environment:
lower levels of pressurized oxygen

Primary Cause: Altitude (Glover & Newsome, 1917)

Cure: None

Screening Test: Available

Result: High altitude disease (HAD)

1. Hypertension
2. Right heart failure
3. Death

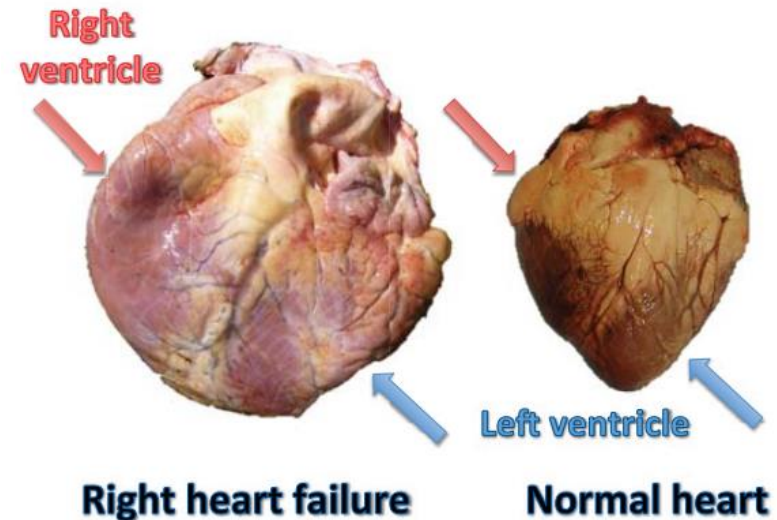


Image courtesy of Dr. Jim Neary (2016)

Understanding the genetics of PAP testing and its relationship to pulmonary hypertension and congestive heart failure

Study	Heritability	Breed
Enns, et al. 1992	0.46	Angus (Seedstock, registered)
Shirley, et al., 2008	0.34	Angus (Seedstock, registered)
Crawford, 2016	0.26	Angus (Seedstock, research)
Zeng, 2013	0.56 (weaning) 0.31 (yearling)	Angus (Seedstock, research)
Pauling, 2016	0.25	Angus (registered)

Put this in perspective

American Angus Association	Heritability
Weaning weight	0.27
Postweaning Gain	0.28
Marbling	0.48
Carcass weight	0.40

PAP Scores heritable and (somewhat) scalable

Provides opportunity to collect more data

- Correlations between moderate elevation and high elevation PAP

	PAP > 5,500	PAP < 5,500
PAP > 5,500	0.37 ± 0.10	0.79 ± 0.23
PAP < 5,500		0.26 ± 0.08

Culbertson et al., 2016

	PAP > 5,250	PAP < 5,250
PAP > 5,250	0.34 ± 0.03	0.83 ± 0.15
PAP < 5,250		0.29 ± 0.09

Pauling et al., 2018

- Heritability on the diagonal.
- Genetic correlation above diagonal.

Management				
Doc Acc % Prog	Claw Acc % Prog	Angle Acc % Prog	PAP Acc % Prog	HS Acc % Prog
+12	+28	+28	+55	+75
.84	.79	.78	.38	.69
80%	2%	1%	40%	85%
290	311	311	45	78

Performance and Carcass Traits Relationship to Cardiovascular Health

- Carcass traits tend to have a weak to moderate correlation with yearling PAP.
- Larger cattle tend to have higher PAP scores.
- Heavily muscled cattle may be more prone to higher risk of PH.
- High PAP cattle are less efficient in terms of feed efficiency and average dry matter intake.
- Stress in cattle can influence meat quality, possible to see this if cortisol levels increase (as shown in humans with pulmonary hypertension) quality of meat could be affected.



High Altitude Disease

- Condition affecting cattle at altitudes of >5,000 ft
- Pulmonary artery begins to constrict and thicken in response to low oxygen being transported.
- Selecting bulls with lower PAP has been successful in producing progeny with lower PAP scores

Congestive Heart Failure

- Condition affecting feedlot cattle at low to moderate altitudes
- Direct cause is currently unknown, but these individuals experience heart remodeling which is like animals experiencing brisket disease



As the condition has gained recognition, lots of anecdotes came to the surface

- Only a cattle in their last days of life.
- Heavy weight, high performing steers.
- Only black-hided cattle.
- Only in feedlots at elevations of 4,000 feet or greater.

Preliminary research efforts coming to light

- Researchers with the US Meat Animal Research Center and University of Lincoln focusing on a subset of markers to control the disease.



Improving cattle health & wellbeing: WHAT

STEP 1 – WHAT IS THE PREVALENCE OF BCHF

As reports were coming out, we were hearing all sorts of anecdotal information. We needed to get a better grasp on what we were dealing with.

- Could we replicate something like the USDA MARC day on a large scale to ensure it was the best tool for users of Angus genetics?

STEP 2 – WHICH CATTLE ARE MOST SUSCEPTIBLE

STEP 3 – HOW CAN GENETICS HELP

STEP 4 – WHERE DO WE GO FROM HERE



Retrospective analysis of risk factors of BCHF and the interactions with the feeding phase

28,950 cohorts comprised of
4,596,205 head of cattle

3 year period: 2017, 2018, 2019

Disease categories

- AIP (Atypical Interstitial Pneumonia)
- GI + Bloat (Gastrointestinal + Bloat)
- BRD (Bovine Respiratory Disease)
- Heart disease
- Other

Retrospective analysis of cohort risk factors and feeding phase timing associated with noninfectious heart disease deaths in U.S. feedlot cattle

Blaine T Johnson, David E Amrine, Robert L Larson, Robert L Weaver, Brad J White

Translational Animal Science, Volume 5, Issue 4, October 2021, txab220,

<https://doi.org/10.1093/tas/txab220>

Published: 24 November 2021 Article history



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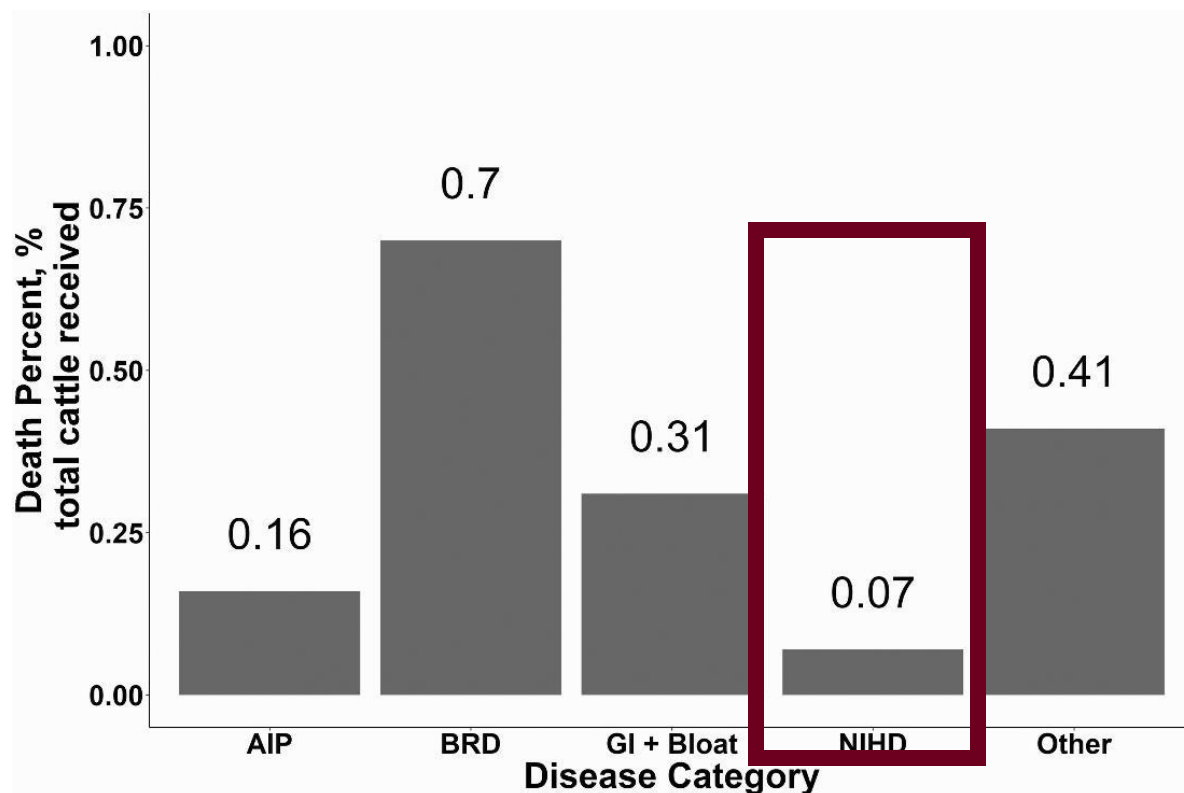
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Abstract

Heart disease, specifically congestive heart failure, has become of increased interest to geneticists and cattle feeders. Data on cohort associations of risk factors related to heart disease and when heart disease deaths occur in U.S. feedlot cattle are limited. The study objectives were to 1) determine potential associations between feedlot cohort demographics and the risk of at least one noninfectious heart disease (NIHD) death occurrence and 2) determine potential association between feedlot cohort demographics and the timing of NIHD deaths during the feeding phase. Data were downloaded from commercial

Prevalence – BCHF deaths accounted for 0.07% of 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, non-infectious heart disease; Other, all other non-categorized diseases.

Johnson et al., 2021

Improving cattle health & wellbeing: WHAT

STEP 1 – WHAT IS THE PREVALENCE OF CHF

Large retrospective analysis have help us understand the prevalence of this disease across the industry

- While prevalence is low; BCHF is a real issue
- Reports suggest that prevalence or at least correct diagnosis of the disease has risen.
- Other reports in the literature (Nreary, 2016) seemed to find similar results

WHAT DOES THIS MEAN;

- The problem is not going to take care of itself.
- Large case-control studies are not manageable in large scale feeding operations.
- With low prevalence (~0.07% of total cattle received), genotyping or even sampling large enough groups inside the feedlot are unattainable.

STEP 2 – WHICH CATTLE ARE MOST SUSCEPTIBLE

STEP 3 – HOW CAN GENETICS HELP

STEP 4 – WHERE DO WE GO FROM HERE

Improving cattle health & wellbeing: which animals do we target for a case-control study?

STEP 1 – WHAT IS THE PREVALENCE OF CHF

STEP 2 – WHICH CATTLE ARE MOST SUSCEPTIBLE

Can we identify which groups are most susceptible and target those for collection?

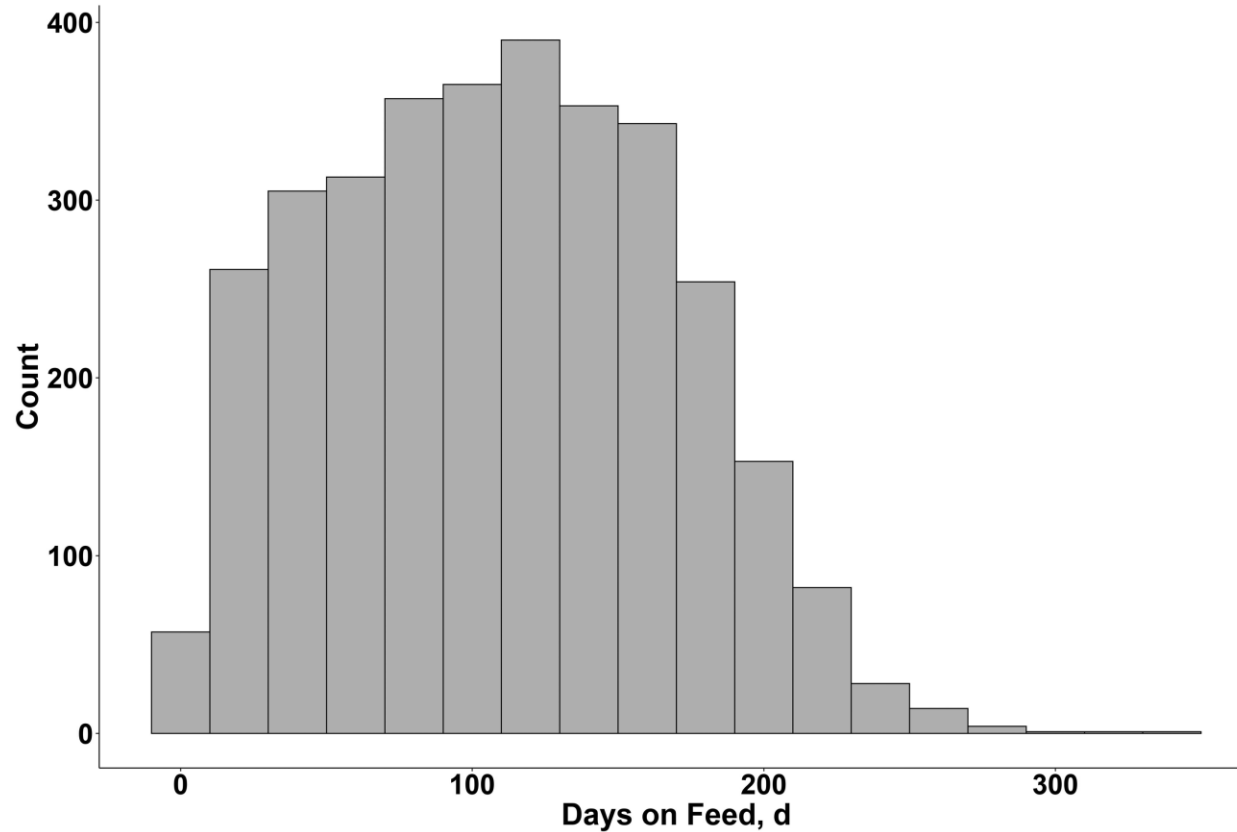
- Days on feed
- Sex (male versus female)
- Quarter placed in the feed yard
- Arrival weight
- Breed “type”: Beef, Beef x Dairy, Dairy

STEP 3 – HOW CAN GENETICS HELP

STEP 4 – WHERE DO WE GO FROM HERE



CHF deaths are spread across the feeding period

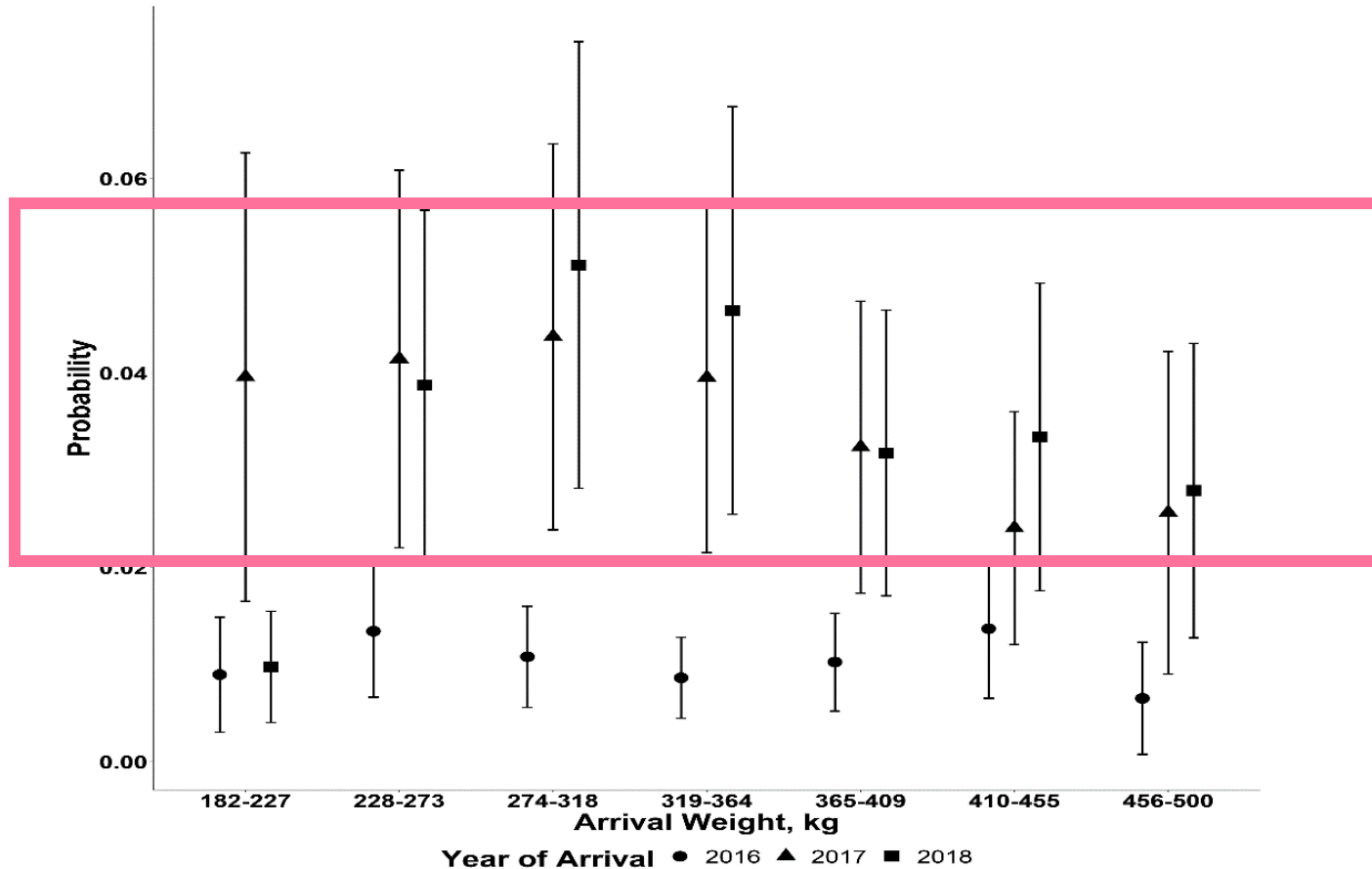


- Count of BCHF deaths by DOF at the time of death (mean and median = 110 d); totaling 3,282 BCHF deaths observed over 3 yr from 22 U.S. feed yards.

Johnson et al., 2021



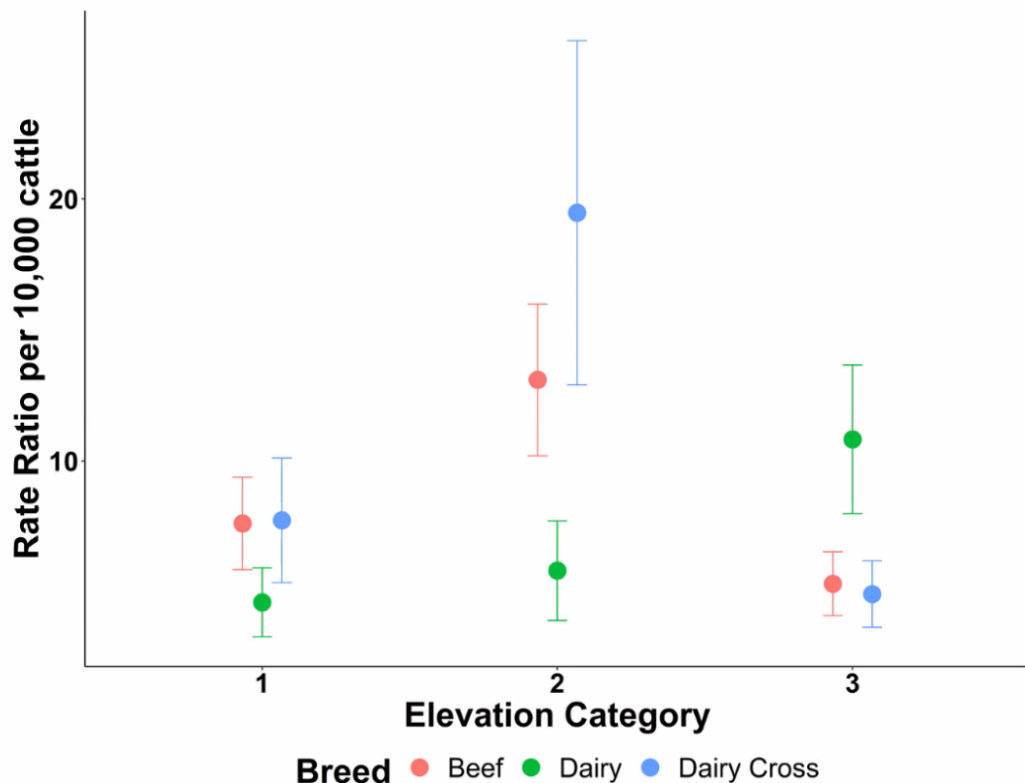
Placement weights by year had little to no differences in the probability of CHF deaths



- Model estimated means with one standard error of at least one CHF death by cohort arrival weight influenced by cohort arrival year (shape).
- Prevalence of CHF could be increasing or the awareness of tracking the condition is increasing.

Johnson et al., 2021

“Breed-type” versus rate ratio of cattle succumbing to CHF



Similar rate ratio between beef, dairy and Dairy cross individuals, while not breed necessarily Dairy and Dairy-cross cattle had very similar incidence rates of bovine congestive heart failure

Johnson et al., 2021



Improving cattle health & wellbeing: WHICH

STEP 1 – WHAT IS THE PREVALENCE OF BCHF

STEP 2 – WHICH CATTLE ARE MOST SUSCEPTIBLE

No clear attributes narrowed down the target groups

- Days on feed
- Sex (male versus female)
- Quarter placed in the feed yard
- Arrival weight
- Breed “type”: Beef, Beef x Dairy, Dairy

WHAT DOES THIS MEAN;

- Need to find an alternative that allows for collection of thousands of phenotypes in a cost effective manner - post mortem heart scoring system.

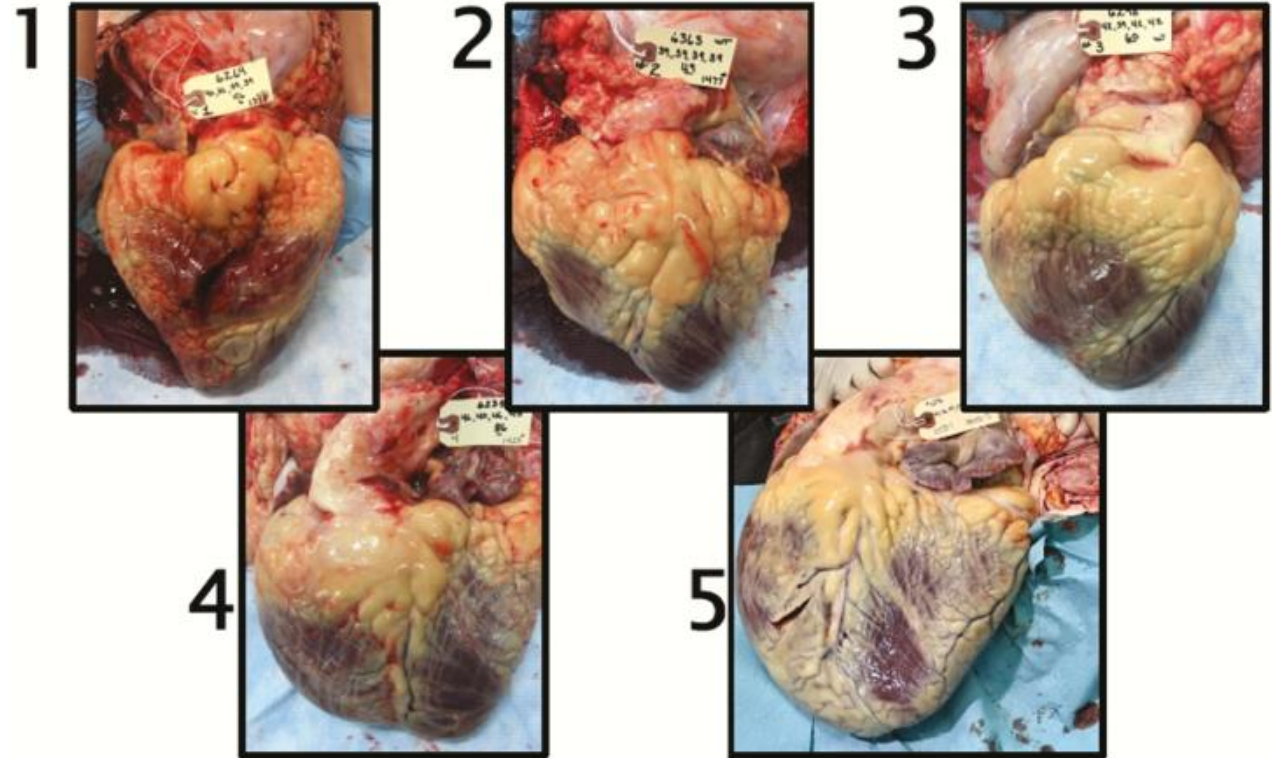
STEP 3 – HOW CAN GENETICS HELP

STEP 4 – WHERE DO WE GO FROM HERE



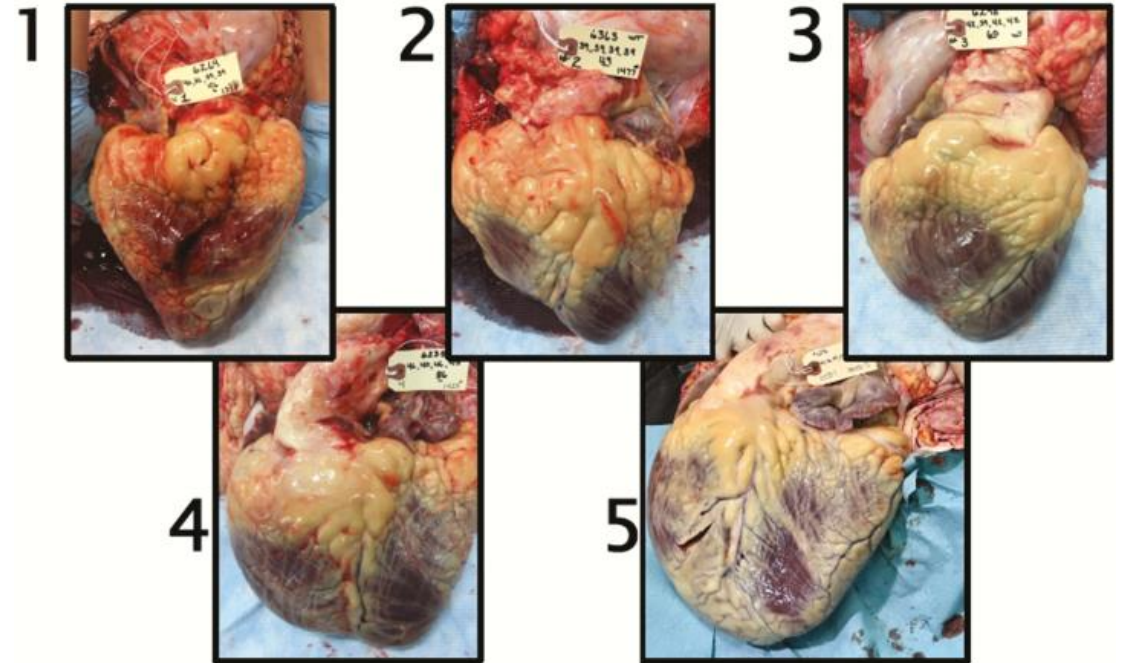
Heart Scoring system championed by Dr. Tim Holt

- Collect a large number of phenotypes: affordably and easily.
 - Good for genetic evaluations.
- An issue: heart score of 5 don't show up in the plant.



The goal: Objectives of the heart health project

- Estimate the **heritability** of **heart score remodeling** in Angus cattle
- Estimate the **relationships** between **heart score** and other **performance traits**
- **Develop** a **prototype genetic tool** for healthier hearts



Improving cattle health & wellbeing: HOW

STEP 1 – WHAT IS THE PREVALENCE OF BCHF

STEP 2 – WHICH CATTLE ARE MOST SUSCEPTIBLE

STEP 3 – HOW CAN GENETICS HELP

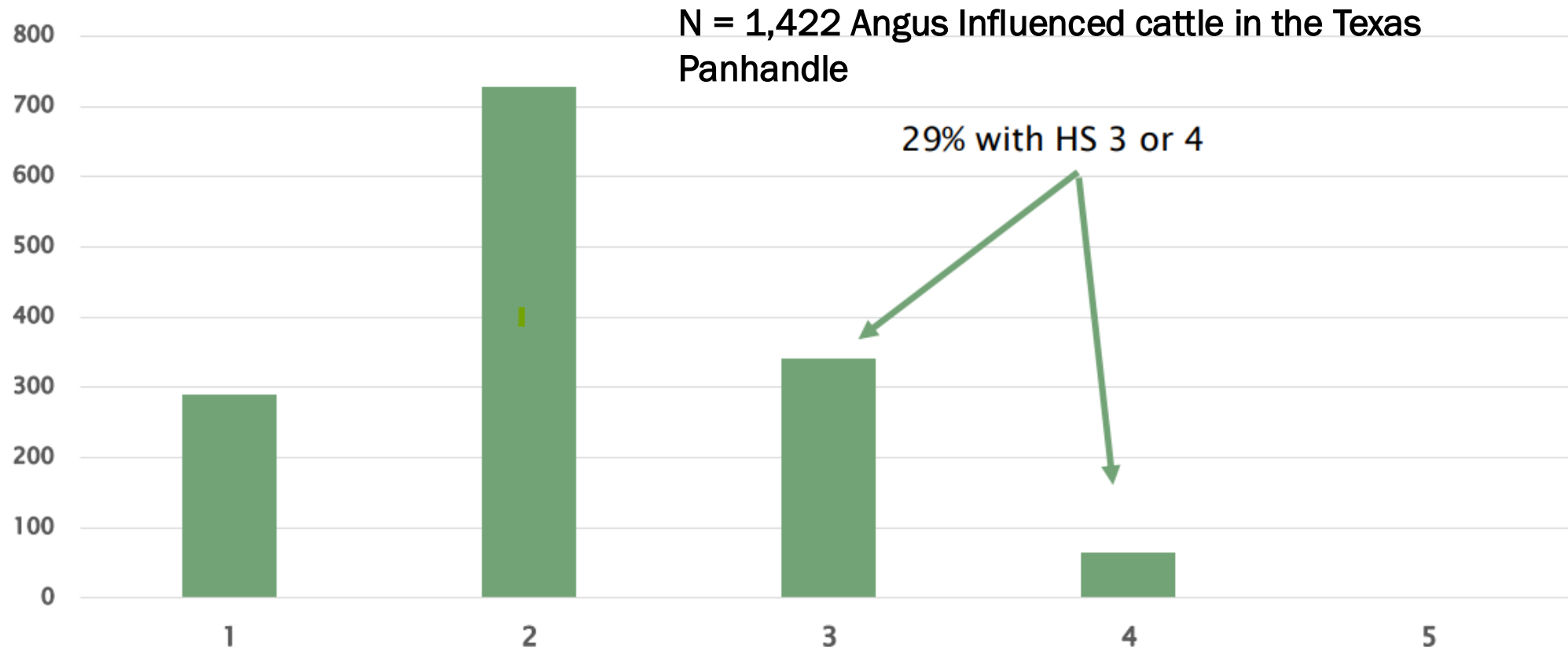
Creating genetic progress with Angus.

- If a trait is heritable, we can select for genetic progress of the trait.
- Need large scale phenotyping of known-origin (descent) to estimate these effects
- Angus producers have been keen as using genetic tools known as expected progeny differences to make change inside the U.S. beef industry

STEP 4 – WHERE DO WE GO FROM HERE



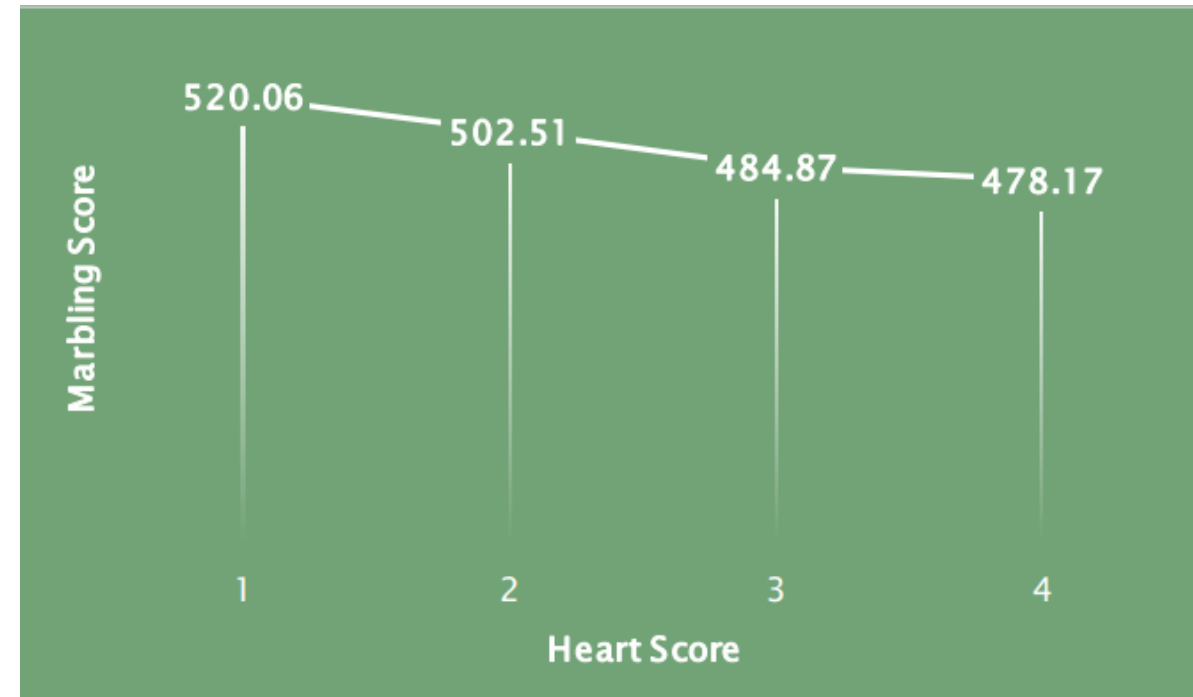
29% incidence of heart scores 3 & 4 in this dataset.



Phenotypic differences with increasing heart score – Carcass Traits

Heart Score	Marbling Score	Standard Deviation
1	520.06	107.09
2	502.51	96.49
3	484.87	102.43
4	478.17	92.73

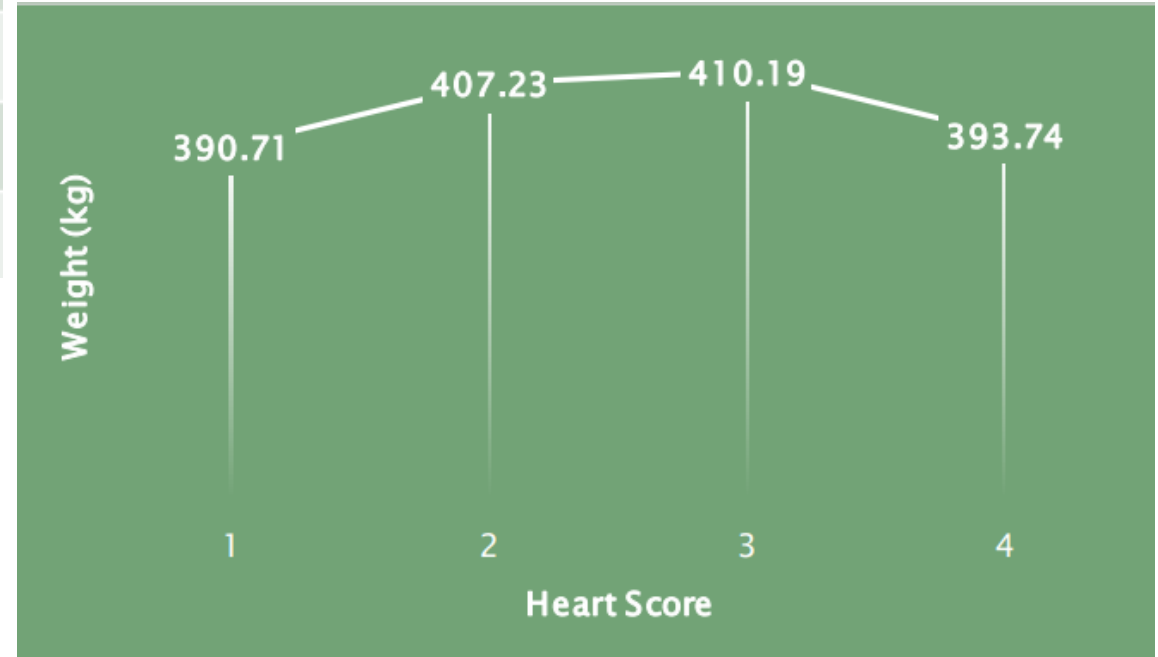
Marbling Score



Phenotypic differences with increasing heart score – Carcass Traits

Heart Score	Carcass Weight	Standard Deviation
1	390.71	51.49
2	407.23	47.37
3	410.19	51.51
4	393.74	57.28

Carcass Weight



Heritability Estimates and Genetic Correlations to carcass traits

	Heritability	Genetic Correlations to Heart Score			
	Heart Score	Ribeye	Marbling	Backfat	HCW
Buchanan et al., 2023	0.35	0.06	-0.11	-0.12	0.40
Kukor et al., 2022	0.28	0.27	0.07	0.15	0.63
Current CSU, Ongoing	0.23	0.23	-0.11	0.22	0.70



Genomics association support polygenic behavior of heart score – Controlled by lots of genes!



Improving cattle health & wellbeing: HOW

STEP 1 – WHAT IS THE PREVALENCE OF BCHF

STEP 2 – WHICH CATTLE ARE MOST SUSCEPTIBLE

STEP 3 – HOW CAN GENETICS HELP

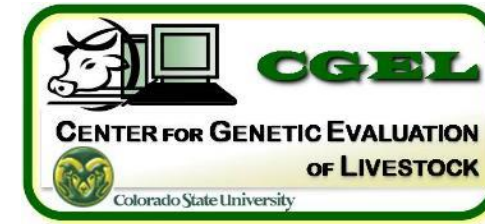
STEP 4 – WHERE DO WE GO FROM HERE

Creating genetic progress with Angus.

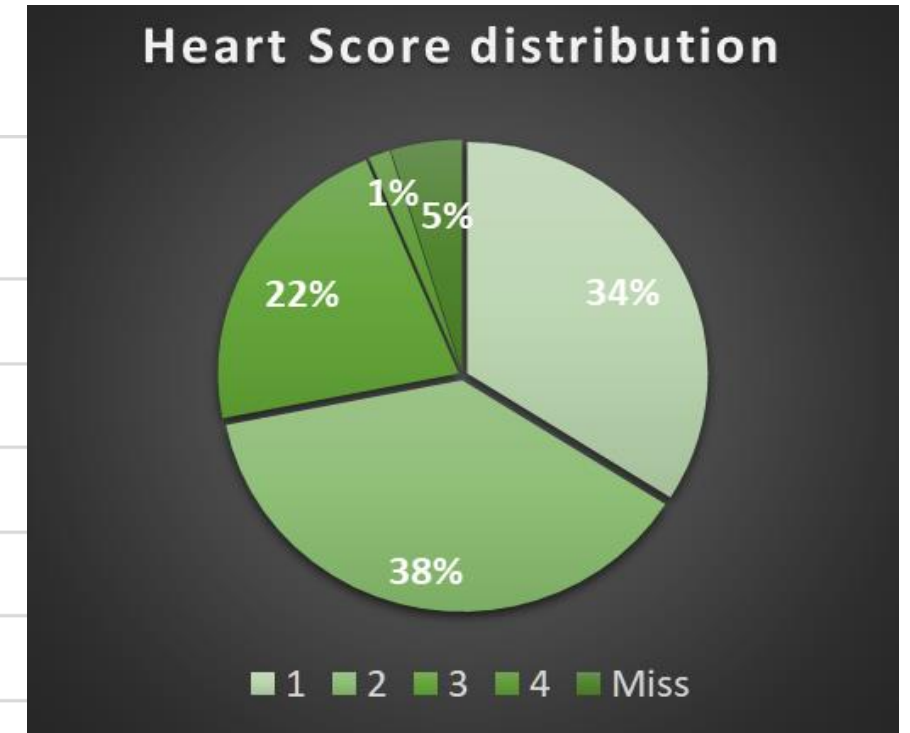
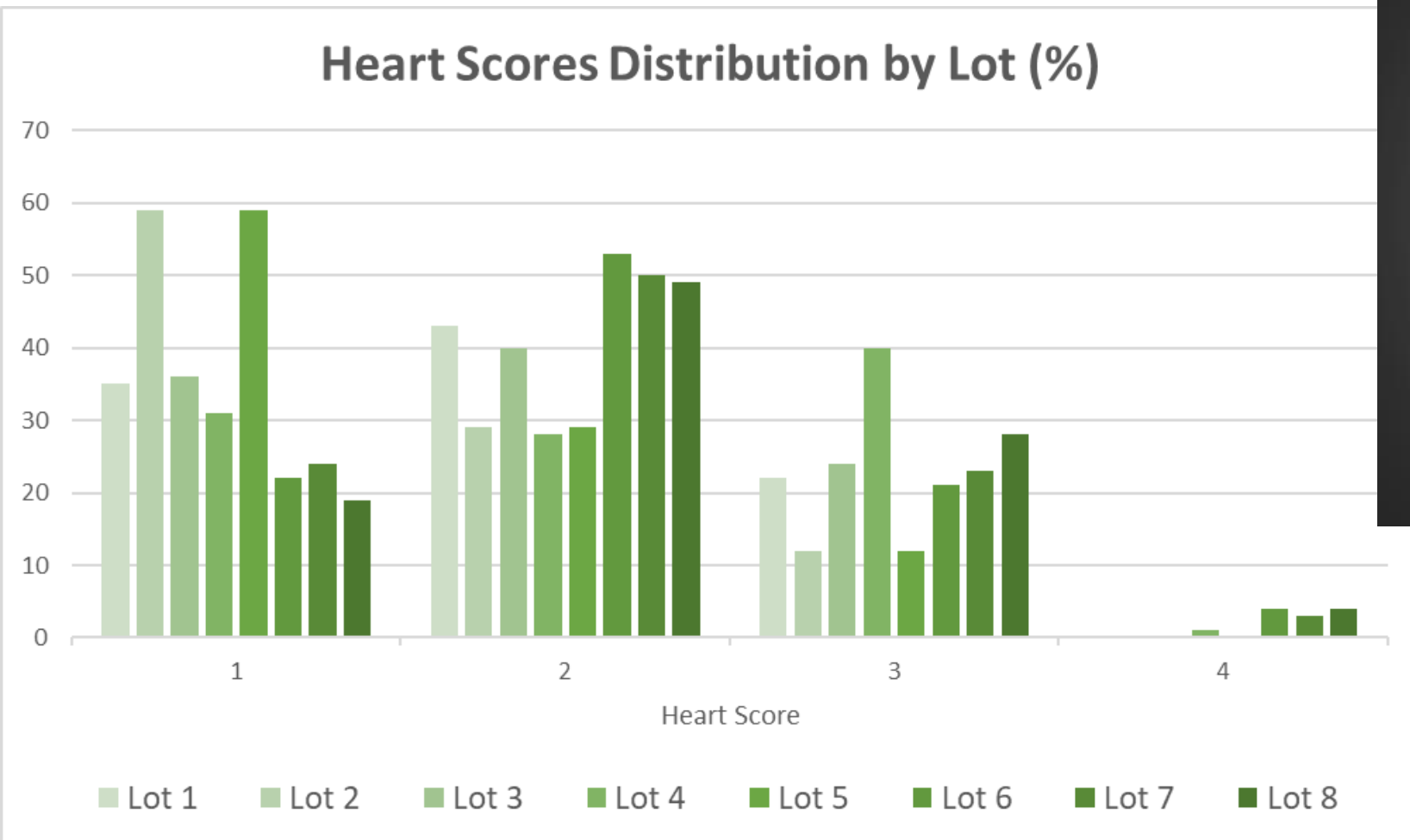
- Cattle necropsied and determined as heart disease failures possess a heart that would score a 5.
- Early reports suggest that cattle with healthier hearts convert and gain better than those with unhealthy hearts.
- Preliminary research reports that a component that heart remodeling is partially controlled by genetics.
- If this is true in Angus, a genetic tool for heart health (i.e. heart remodeling) could be identified.



Reaching out beyond Angus borders: Heart Health Initiative – launched in 2022



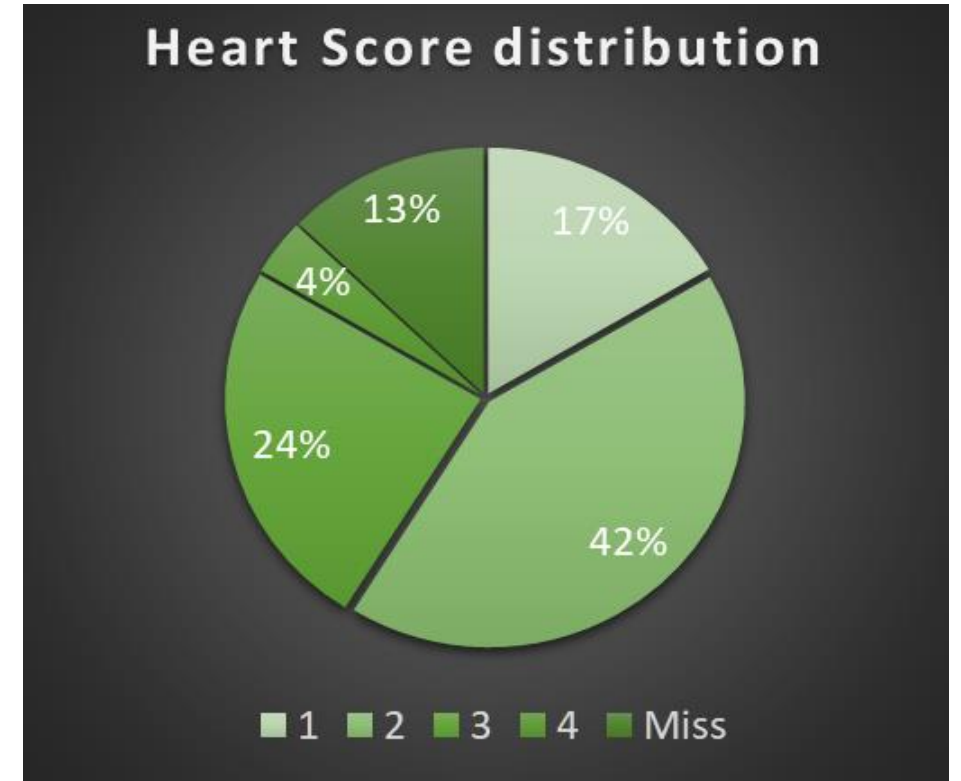
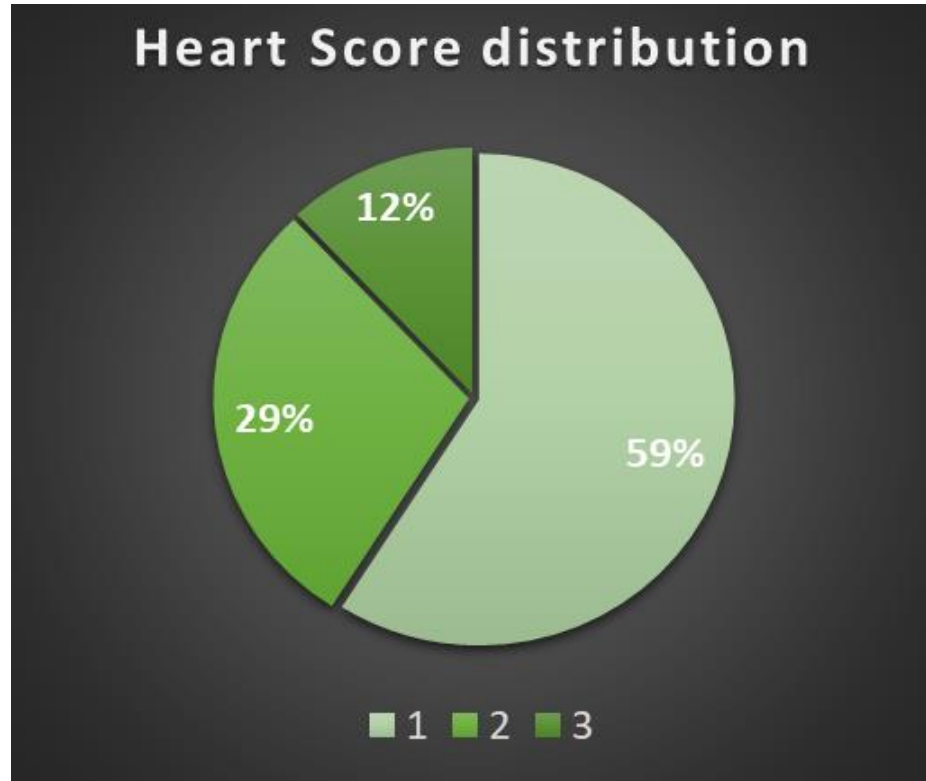
Variation amongst scores do exist in the collected population. – 23% incidence



Isaac F. Torres, CSU Graduate student

n=1,559

Comparing differences among different groups of cattle – the best and the worse.



Like PAP is an indicator of high altitude disease, is heart score is an indicator trait of CHF?

- Good data recording in the field is crucial to continue to find answers.
 - Debate to the case definition – only focusing on heart remodeling could lead us to heart remodeling that isn't CHF (non-infectious heart disease).
- Heart score genetic tools could potentially help reduce the case load, but won't eliminate the disease entirely.

A challenge: Very few issues have been solved with genetics alone, so what else can we be doing to combat BCHF deaths.

What management practices have been put in place?



Tackling Heart Health (Remodeling) through genetic selection.

STEP 1:



Heritability:
Target Trait is heritable

STEP 2:



Scalability:
Measurable & accessible

STEP 3:



Utility:
Actionable for Selection

STEP 4:



Compatibility:
Trait relationships



FEEDING QUALITY FORUM

THANK YOU!

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