



Genetic Tools for Healthier Calves

John B. Cole

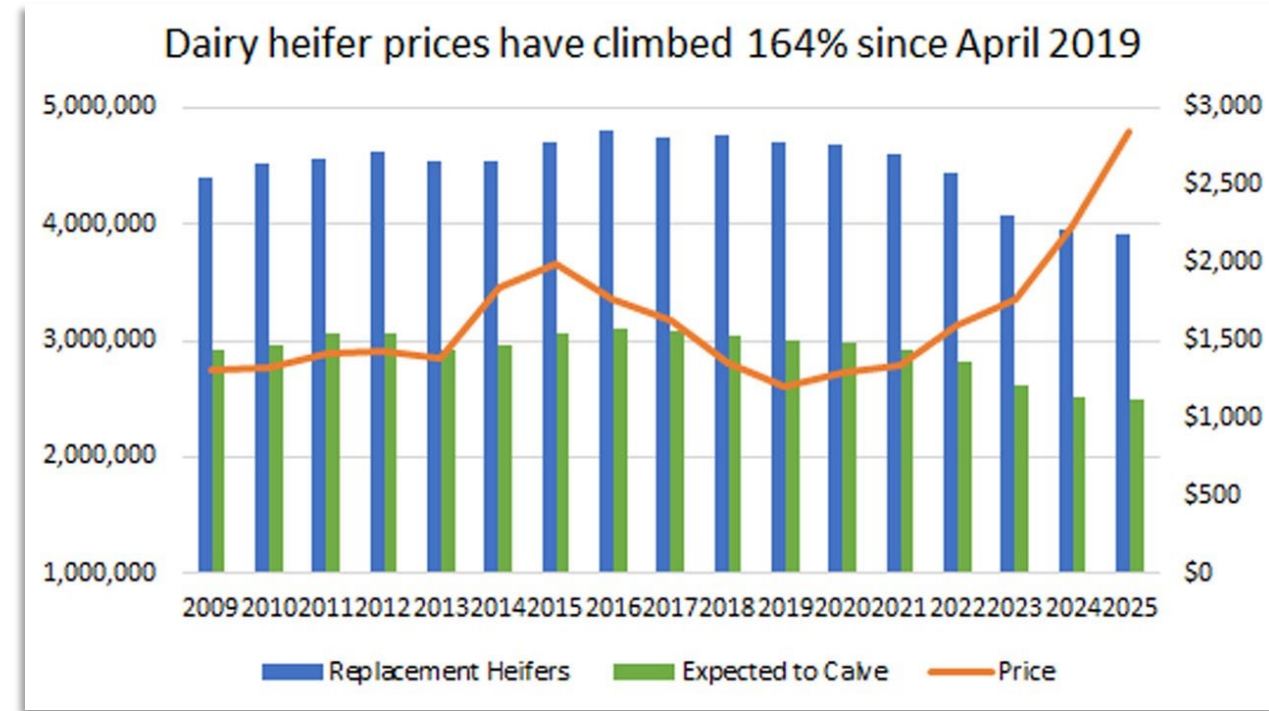
CDCB Industry Meeting | October 1, 2025

Collaborators

- ▶ **AGIL:** Mahesh Neupane, Sajjad Toghiani, Asha M. Miles, Jason R. Graham, Curtis P. Van Tassell, and Paul M. VanRaden
- ▶ **University of Maryland:** Jeffrey R. O'Connell
- ▶ **CDCB:** Kristen L. Parker Gaddis, Javier F. Burchard, João W. Dürr, John B. Cole

Background

- ▶ Calf health is critical for dairy sustainability and profitability
- ▶ 75% of preweaned calf mortality is due to diarrhea (53–56%) and respiratory disease (21–23%)
- ▶ Respiratory disease accounts for 50% of postweaning mortality
- ▶ Dairy replacement prices are at record highs



Format 6 is the way DRPCs transmit health records

- ▶ Developed in 2008, revised in 2017 & 2025
 - 20 health traits and 5 management traits
- ▶ Evaluations for 6 cow health traits
 - DSAB, MFEV, KETO, MAST, METR, RETP
 - Holstein (2018), Jersey (2020), and Brown Swiss (2022)
- ▶ Have you given permission to your DRPC to send your data?

Description	Standard Code ¹	Usage ²
Health traits		
Cystic Ovary	CYST	Y
Diarrhea/Scours	DIAR	N
Digestive Problem/Off Feed	DIGE	Y
Displaced Abomasum	DA--	Y
Downer Cow	DOWN	Y
Dystocia	DYST	Y
Johne's Disease/Paratuberculosis	JOHN	Y
Ketosis/Acetonemia	KETO	Y
Lameness	LAME	Y
Leukosis (bovine leukemia virus)	LEUK	Y
Mastitis (clinical)	MAST	Y
Metritis	METR	Y
Milk Fever/Hypocalcemia	MFEV ³	Y
Nervous System Problem	NERV	Y
Reproductive problem other than CYST, DYST, METR, RETP	REPR	Y
Respiratory Problem	RESP	Y
Retained Placenta	RETP	Y
Stillbirth/Perinatal Survival	STIL	Y
Teat Injury	TEAT	N
Udder Edema	EDEM	Y
Management Traits		
Body Condition Score	BCS-	Y
Hoof Trim	TRIM	Y
Locomotion Score	LOCO	Y
Milking Speed	MSPD	Y
Temperament/Behavior	BHAV ³	Y
Control Codes		
Delete records for the specified health event date	DELE	Y

Objectives of this research



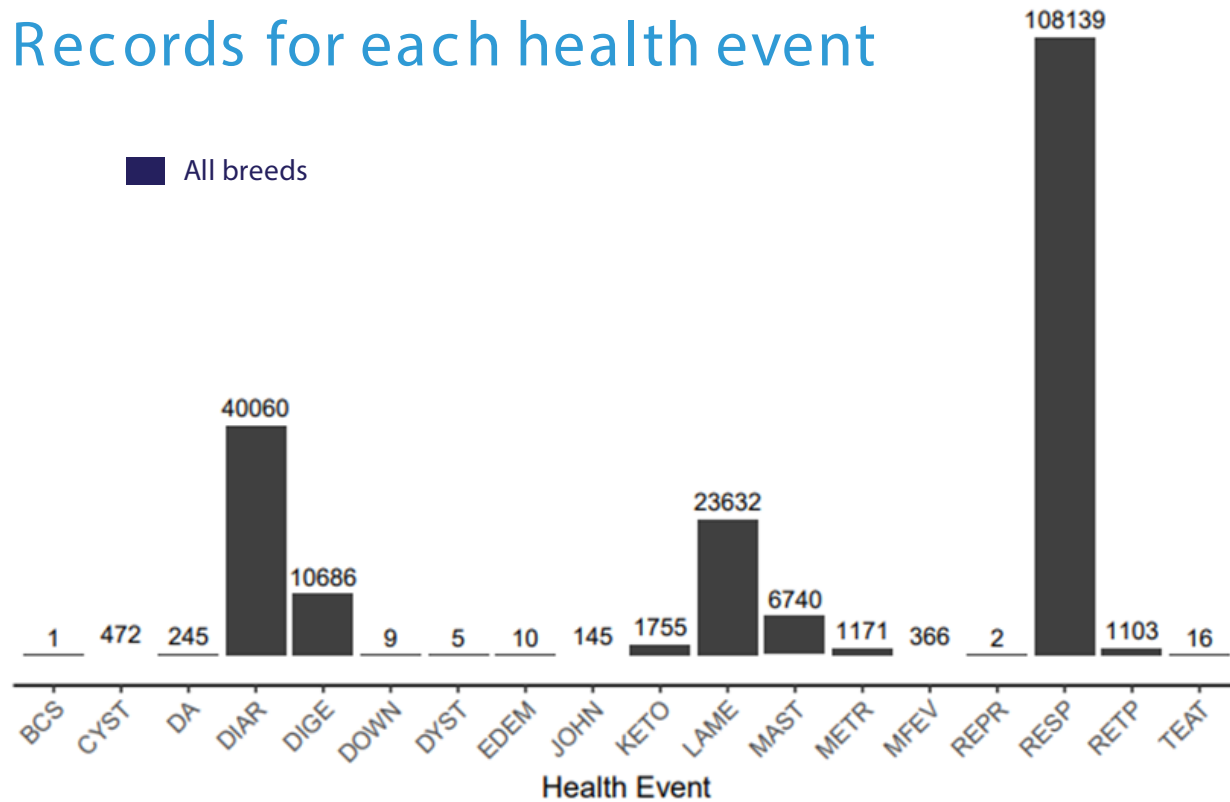
Develop a comprehensive national genetic evaluation system for dairy calf health traits using producer-recorded health event data (Format 6)



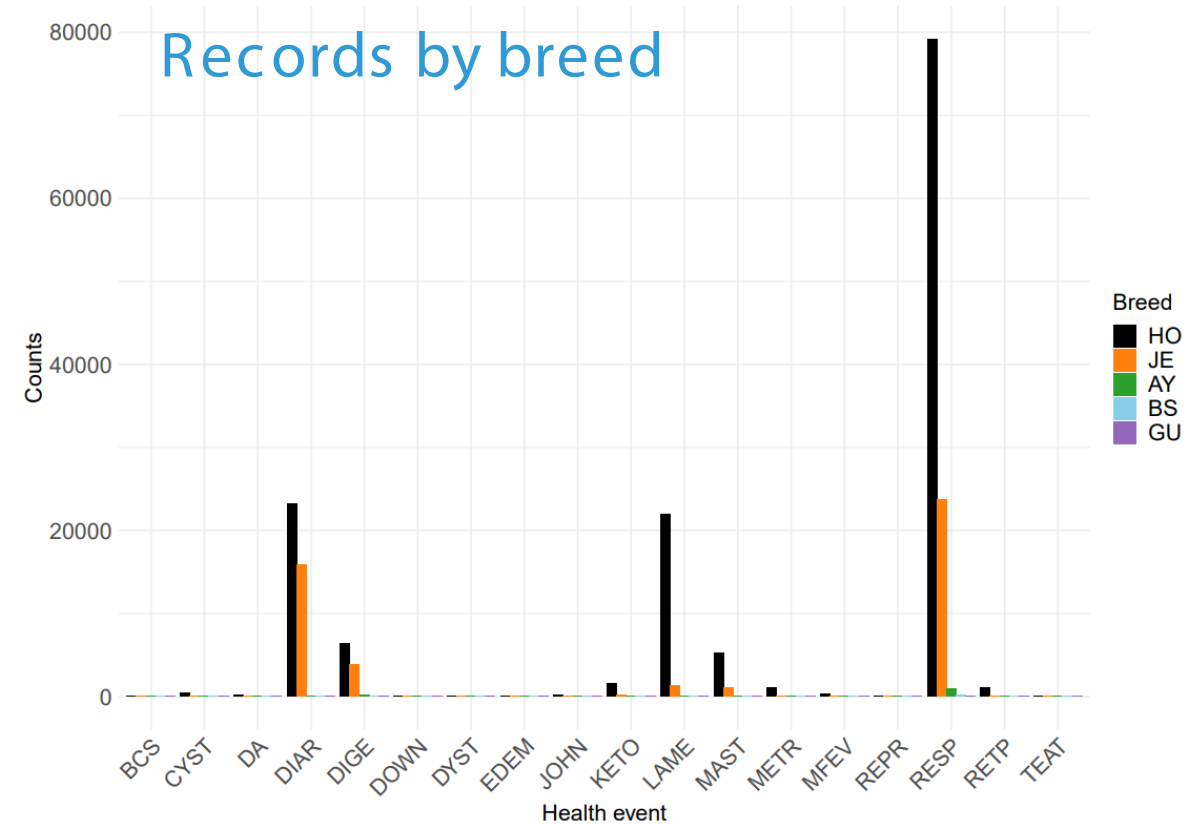
Identify genetic markers associated with key health traits in dairy calves and their possible inclusion in genomic marker panel

What data are available (2013-2024)?

Records for each health event



Records by breed

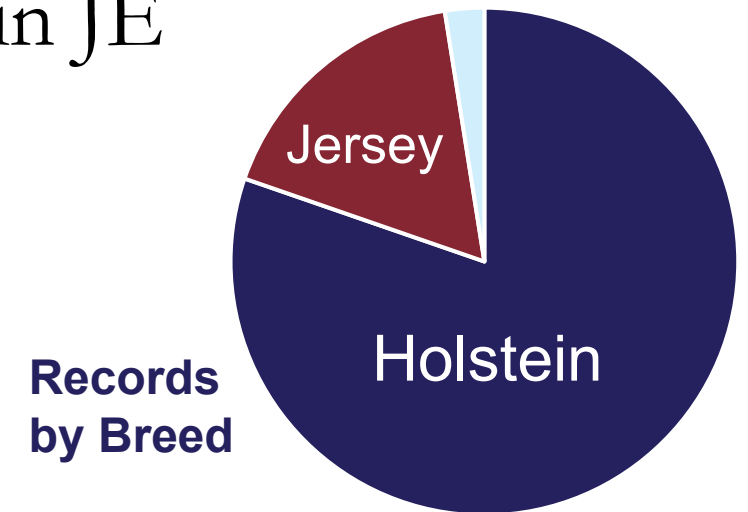


Data quality control (edits)

- ▶ Calves in the same herd-year without recorded health events were treated as **healthy** animals
 - We need information about healthy animals, not just sick animals
- ▶ Only the first event reported is used
 - Use of additional records being studied by CDCB intern Yijing Gong
- ▶ Complete animal ID is important
 - We need good calf ID including parents and birth date
 - Sire identification is mandatory for use in the evaluation

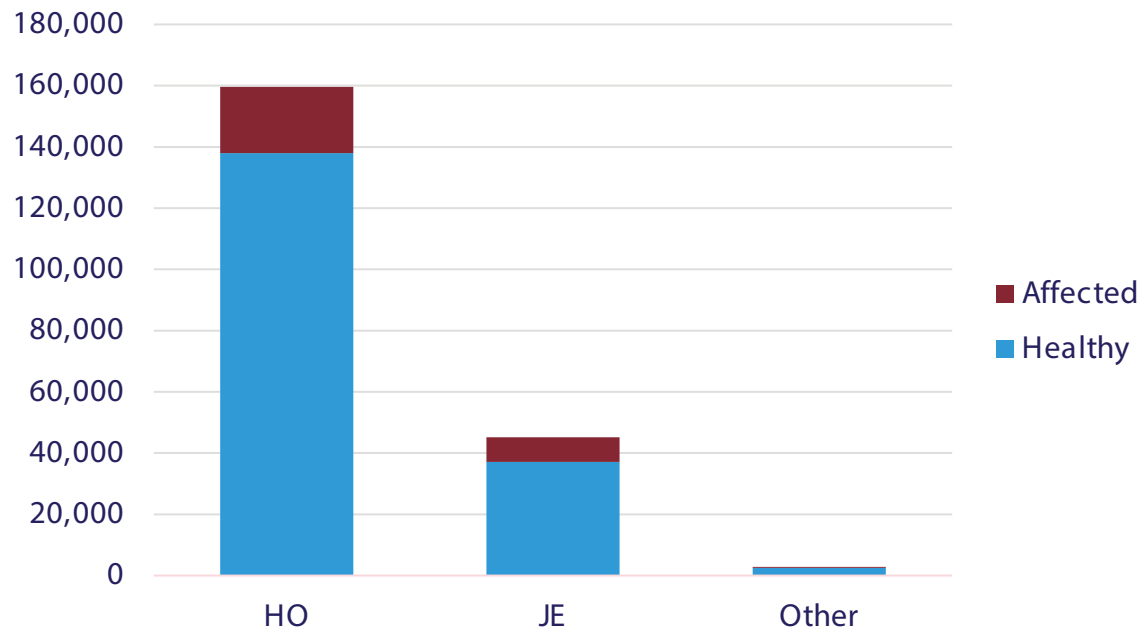
Information in the National Database

- ▶ Binary trait: **0** (diseased) and **100** (healthy)
 - DIAR: 207,602 total across all breeds (14.46% diseased)
 - RESP: 681,741 total across all breeds (16.05% diseased)
- ▶ Higher incidence of both DIAR and RESP in JE than HO
 - DIAR: 13.5% in HO vs. 17.8% in JE
 - RESP: 14.5% in HO vs. 23.7% in JE
- ▶ Heritability estimates (all-breed model)
 - **DIAR** = 2.6% and **RESP** = 2.2%

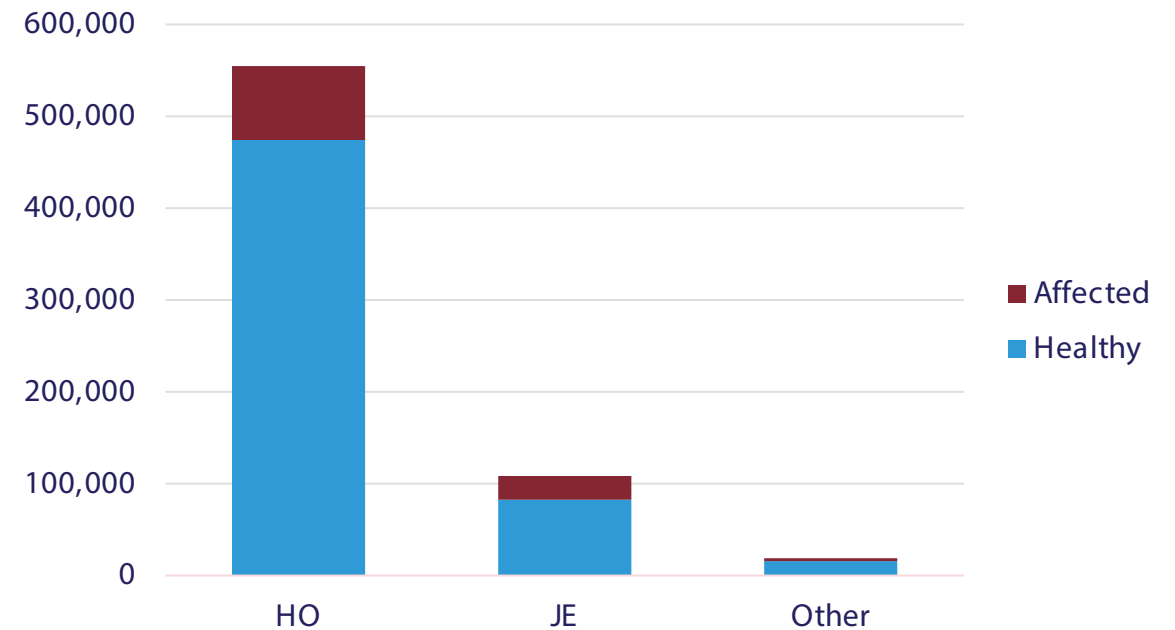


Incidence rates are similar across breeds

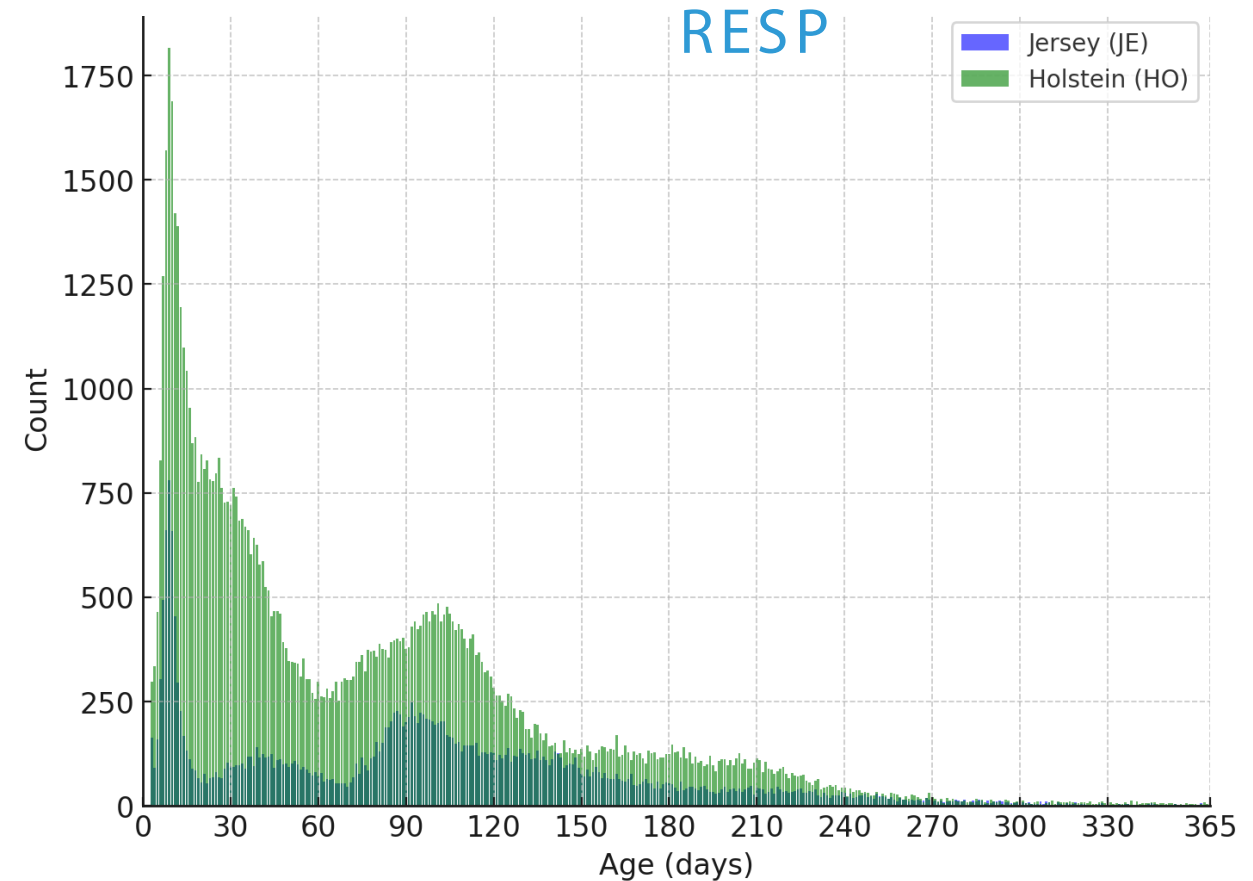
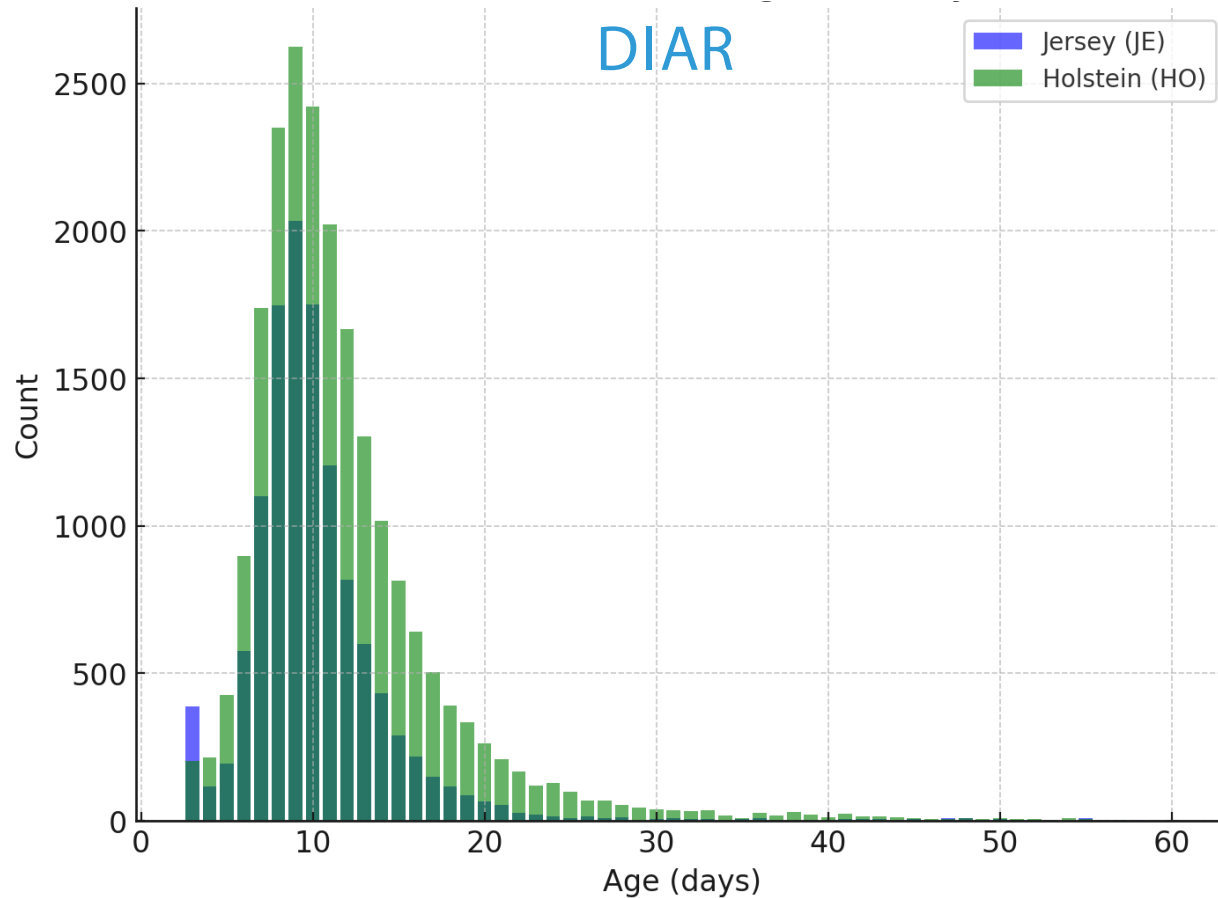
Diarrhea (Scours)



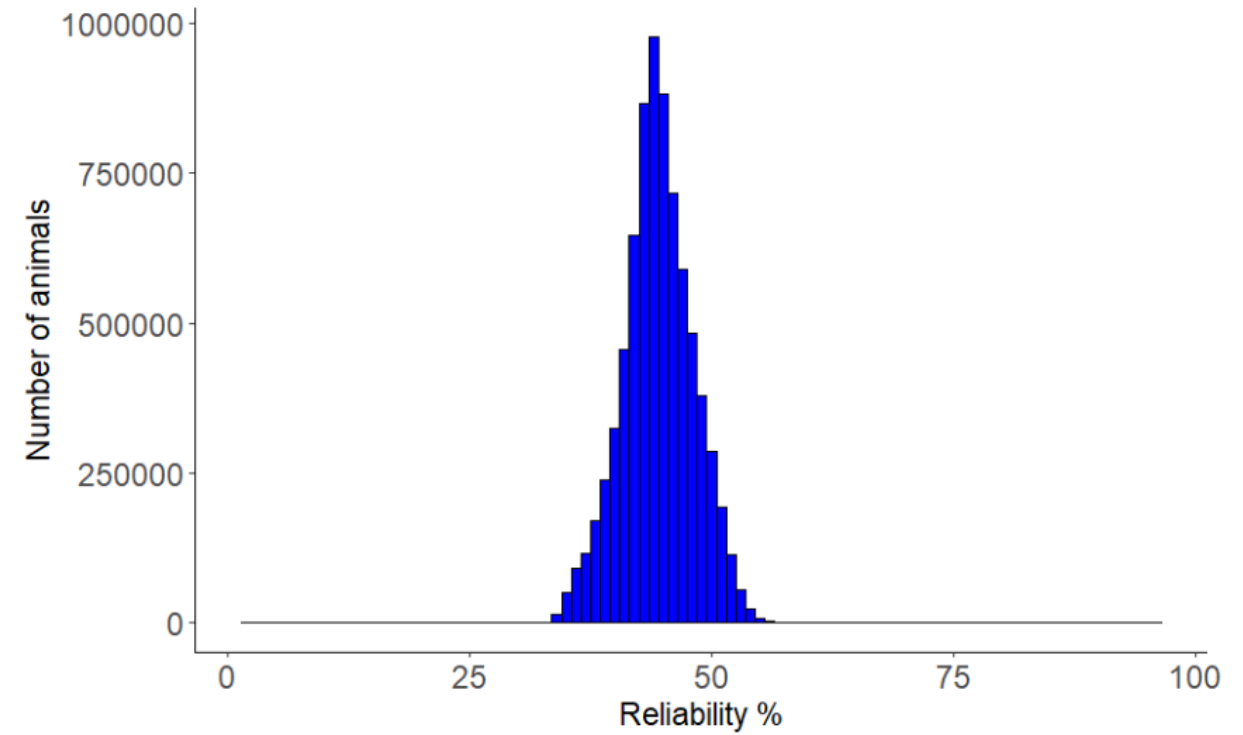
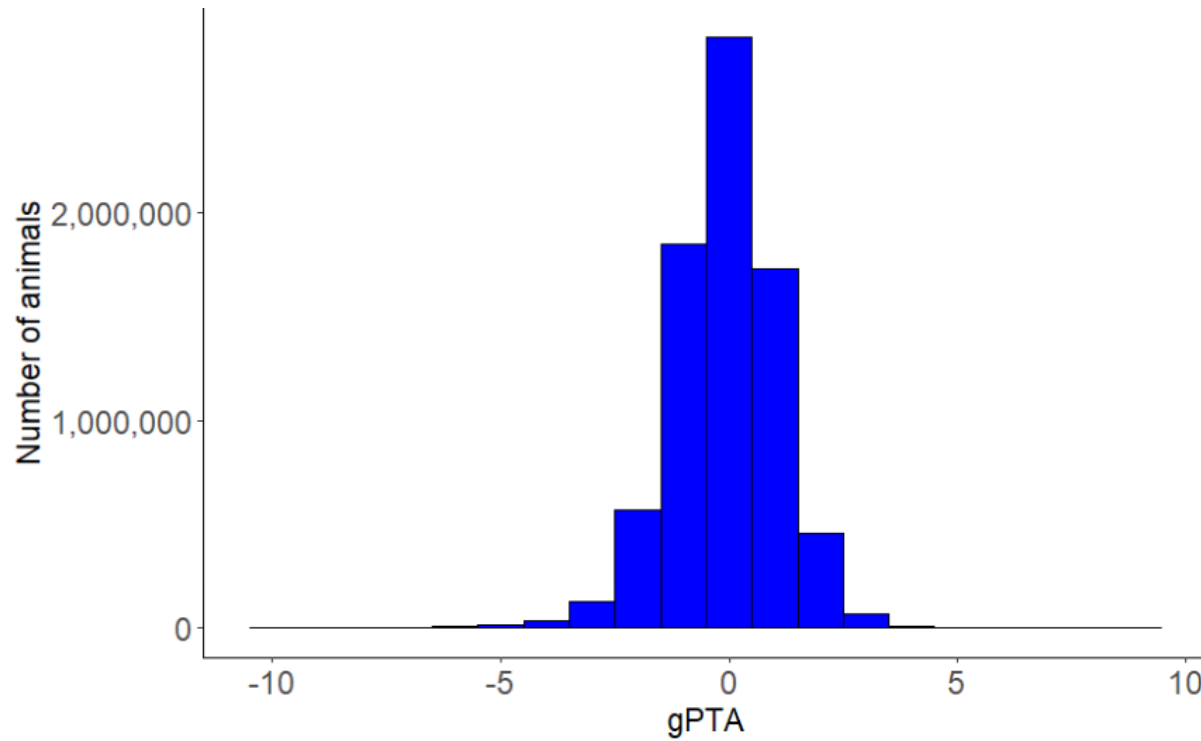
Respiratory Disease



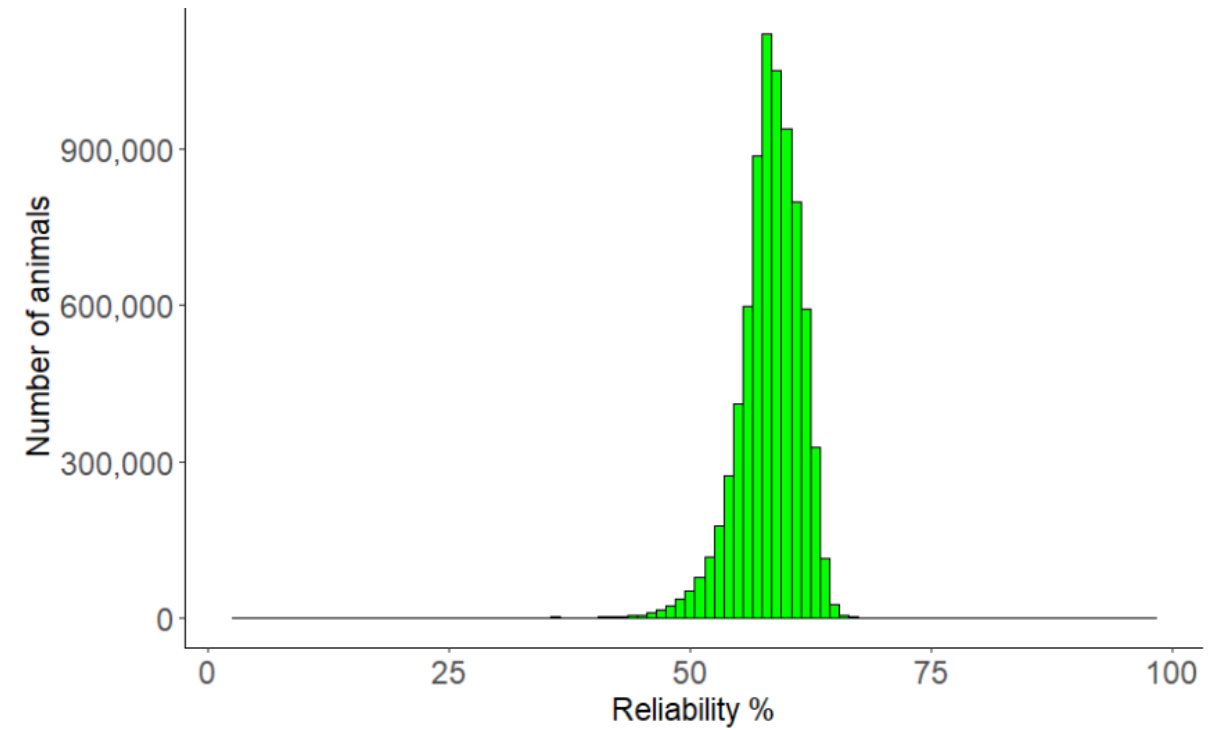
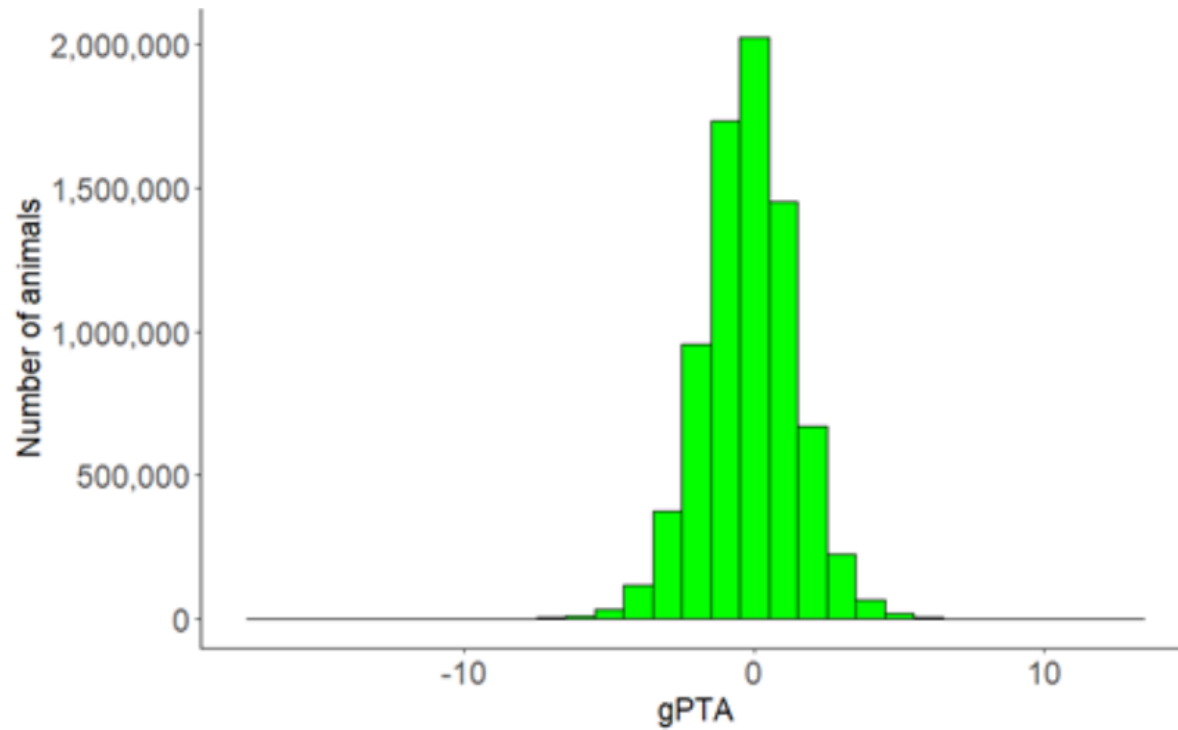
Occurrence of diseases by calf age



Genomic PTA and reliabilities (HO DIAR)



Genomic PTA and reliabilities (HO RESP)



PTA correlations with other traits

Trait	DIAR	RESP	Trait	DIAR	RESP
Heifer livability	0.13	0.35	Heifer conception rate	0.04	0.06
Diarrhea	1.00	0.22	Cow conception rate	-0.06	0.03
Respiratory illness	0.22	1.00	Livability	0.03	0.09
Milk	-0.05	-0.03	Gestation length	0.07	0.04
Fat	0.04	-0.00	Health trait subindex	0.00	0.03
Protein	-0.02	-0.03	Residual feed intake	-0.01	-0.08
Productive life	0.02	0.13	Milk fever	-0.02	0.01
Somatic cell score	-0.02	-0.10	Displaced abomasum	0.01	-0.01
Body weight composite	0.01	0.02	Ketosis	-0.02	-0.02
Udder composite	-0.06	-0.02	Mastitis	0.039	0.09
Feet and leg composite	-0.02	-0.01	Metritis	-0.05	-0.01
Daughter pregnancy rate	-0.06	0.03	Retained placenta	0.03	0.01
Calving trait subindex	0.03	-0.06	Early first calving	0.02	0.09

The research has been published

- ▶ Independent reviewers have examined the work and found it has scientific merit, is free of significant technical errors, and its conclusions are supported by the evidence presented.



J. Dairy Sci. TBC

<https://doi.org/10.3168/jds.2025-26497>

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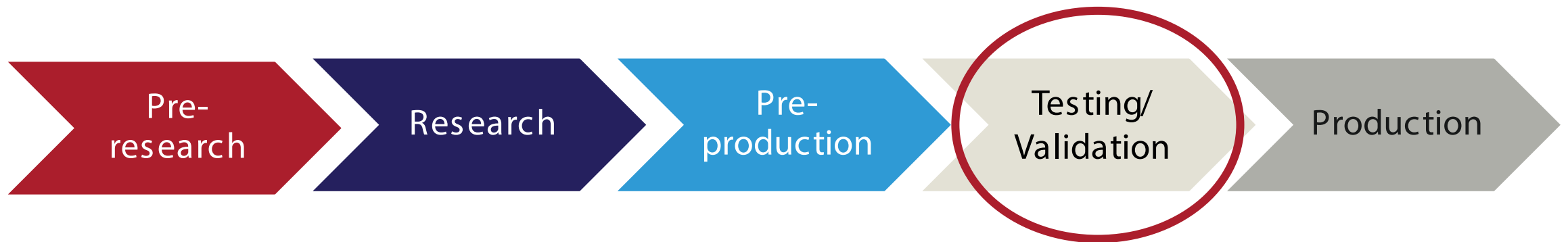
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Improving dairy calf health through inclusion of diarrhea and respiratory health data into a US national genetic evaluation

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and Paul M. VanRaden¹ 

Future work

- ▶ Increase data collection and accurate recording of phenotypes
- ▶ Improve models as more data become available
- ▶ Internal testing and integration in progress



Conclusions

- ▶ National evaluations will provide dairy producers with tools to improve calf health through selective breeding
- ▶ More precise recording of calf health data will help increase reliabilities
- ▶ Continuous recording and sharing of data is necessary
- ▶ Keep good records on healthy and sick calves and check with your DRPC to ensure your data are flowing into the National Database

Acknowledgments

- ▶ USDA-ARS project 8042-31000-113-00-D, “Improving Dairy Animals by Increasing Accuracy of Genomic Prediction, Evaluating New Traits, and Redefining Selection Goals”
- ▶ Dairy Records Management Systems (Raleigh, NC)
- ▶ US dairy producers, member sectors and collaborators, and USDA, University of Maryland, and CDCB staff

Questions?

Thank you for your attention!

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