Value of selecting for cow and calf livability

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Cow livability (CL) data

- Reasons for disposal have been reported and stored in DHI records since 1970
  - 92 million records on 32 million cows
  - About 17% of cows die instead of being sold across all lactations, averaging 6% per lactation, higher for older and lower for younger cows
- The lost beef income from cows that die in the U.S. = 17% of 9.2 million cows × $1200/cow ÷ 2.8 lactations = $670 million per year.

Cow livability evaluation

- Methods
  - Multibreed model including heterosis and inbreeding
  - Multitrait model with productive life (PL) by lactation using similar edits and same software as other traits
    - Lactation PL not reported, only lifetime PL
  - Pre-adjustment for unequal herd-year-parity variance
- Heritability of 1.3% (Miller et al., JDS, 2008) reestimated to only 0.6% with more data
- Genetic correlation with lactation PL of 0.50

CL reliability and PTA interpretation

- Genomics predictions for CL have good reliability in spite of low heritability. Reliability for young genomic tested HOL bulls without daughters averaged 56% compared to 30% for parent average.
- If Bull A has a PTA of +2.0, then 83% + 2.0% = 85% of his daughters will remain alive to be sold for beef.
- If Bull B has a PTA of –3.0%, then 83% – 3.0% = 80% of his daughters remaining alive to be sold for beef.

PTA correlations of livability with other traits

Bull minimums:
1990 birth year, 50 daughters, 0.50 reliability for PTA livability

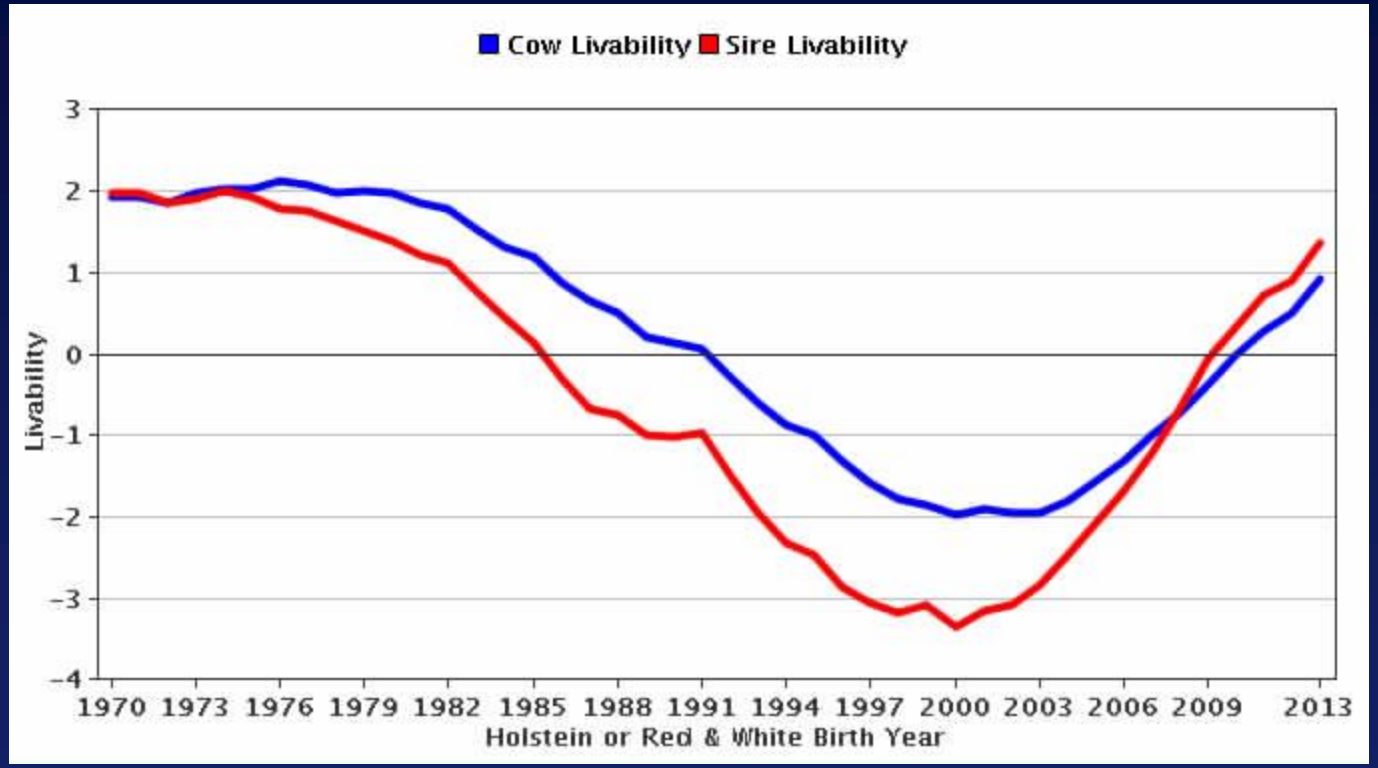
Trait	Holstein	Jersey
Milk	0.09	–0.08
Fat	0.21	0.01
Protein	0.16	–0.01
PL	0.70	0.54
SCS	–0.28	–0.07
DPR	0.40	0.54
CCR	0.40	0.33
HCR	0.28	0.32
Bulls (no.)	45,840	3,893

CL, PL, and health traits

Trait	Estimated genetic correlations		
	CL	PL	Diff
Displaced abomasum	-0.66	-0.62	0.04
Ketosis	-0.64	-0.60	0.04
Lameness	-0.46	-0.31	0.15
Mastitis	-0.23	-0.25	-0.02
Metritis	-0.21	-0.15	0.06
Retained placenta	-0.30	-0.33	-0.03

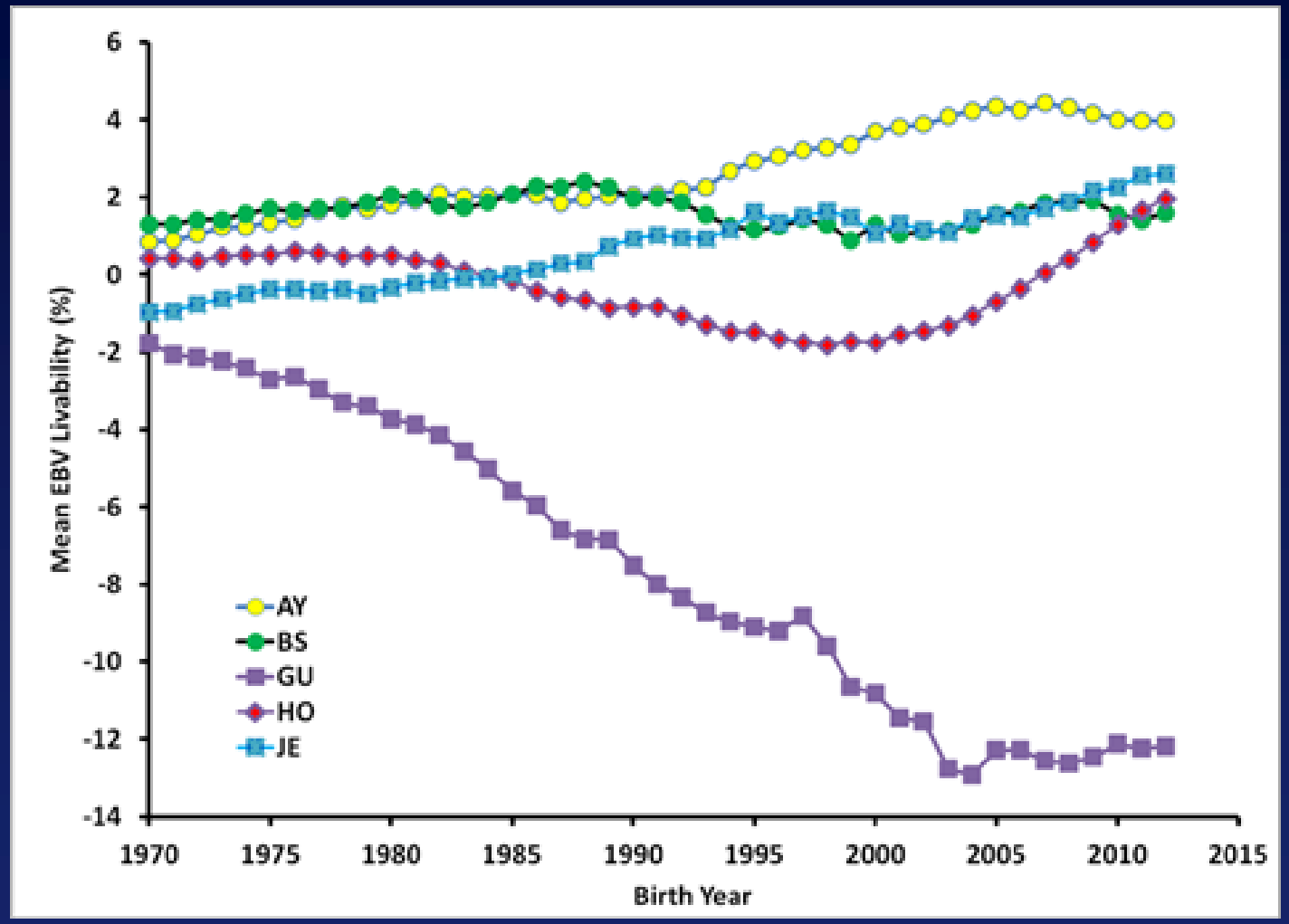
Health trait PTAs for 5,265 bulls from Parker-Gaddis et al.
Correlations estimated by Kristen using Calo method

Genetic trend for cow livability - HOL



Source:
CDCB

Genetic trend for CL – All breeds



Proposal to include CL in net merit

	Relative emphasis in USDA index (%)						
	PD$	MFP$	NM$	NM$	NM$	NM$	NM$
Trait	1971	1976	1994	2000	2003	2014	20??
Milk	52	27	6	5	0	–1	–1
Fat	48	46	25	21	22	22	24
Protein	…	27	43	36	33	20	18
Longevity	…	…	20	14	11	19	13
SCS	…	…	–6	–9	–9	–7	–7
Udder	…	…	…	7	7	8	7
Feet/legs	…	…	…	4	4	3	3
Body size	…	…	…	–4	–3	–5	–6
Pregnancy rate	…	…	…	…	7	7	7
Calving traits	…	…	…	…	4	5	5
Conception rate	…	…	…	…	…	3	3
Cow livability	…	…	…	…	…	…	7

Heifer livability (HL) data

- Extract data from CDCB database
  - 10,976,884 heifer births
  - 495,282 with "left herd" codes (6 = died)
  - 2,061,454 with no calving or breeding to confirm that they lived
  - 6,343,337 calves born 2001–13
  - 2,826,352 in herds where 2–25% died

- >99% of data used from one source (DRMS)

Heifer livability edits

- Heifers ≤2 days not used for HL, used in stillbirth
- Heifers > 18 months old set to 18 months
- Heifers that have a calf are considered alive, also if sold for infertility (code 4), or sold for any other reason (code 5)
- Sold to another dairy (code 2) are not used
- Bull calf deaths are not reported
- After edits, livability scored as 100 or 0

Heifer livability results

- 23% of reported calf deaths during first 2 months
- 33% during month 18 and later but not used because many were near fresh date
- Edited calf livability averaged 95%
- 0.4% heritability estimated by sire model REML (VanRaden, 1986 programs)

HCD haplotype

- Holstein haplotype for cholesterol deficiency (HCD)
  - Discovered by German researchers in 2015
  - Heterozygous animals have reduced cholesterol, but homozygotes have no cholesterol and survive only a few months
- Causative mutation discovered in 2016, lab test results now sent by Holstein USA to CDCB

Heifer livability and HCD

- For reported heifer livability data:
  - 4% more death loss from carrier 3,421 sire × carrier MGS matings (significant, P < 0.0001)
  - 12% expected if carrier × carrier matings are lethal
  - Could be under-reporting of death loss, or homozygous HCD sick calves are sold before they die
- Genomic PTAs not attempted yet

Conclusions

- Cow and heifer livability have low heritability but much data
- Economic value of CL is high ($1200) and should receive 7% of emphasis in net merit, but would remove 6% of emphasis from PL (19% vs. 13%)
- Database for HL is not national yet, but calf losses from HCD carrier matings were confirmed

Acknowledgements

- Data provided by CDCB
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