Genetic analysis of calf livability in Dutch dairy cows

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Animal Evaluation Unit

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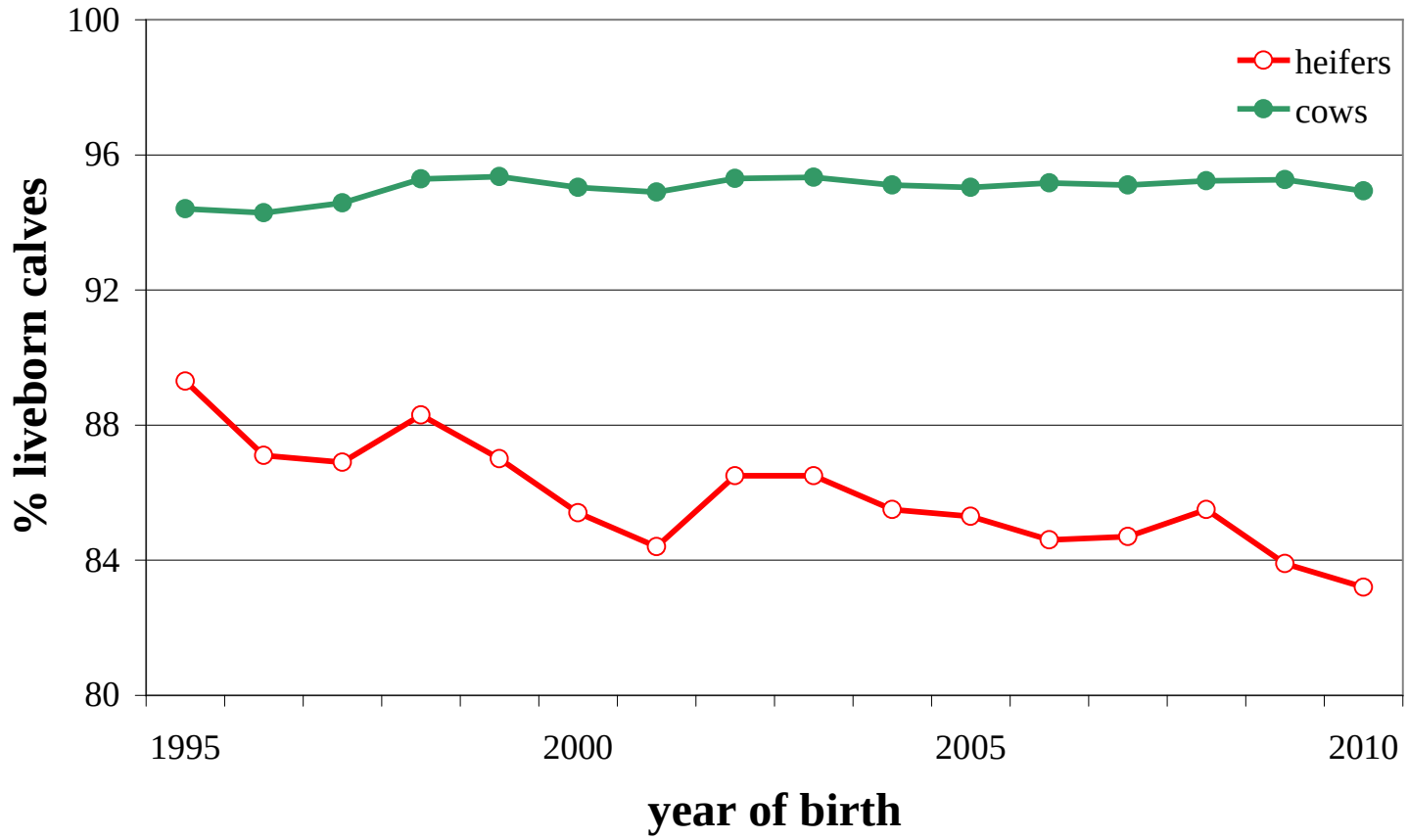
- **Introduction**
- Aim of study
- Material & Methods
- Results
- Conclusions

Introduction

- **Definition of livability**
  - a live-born calf is a calf that is still alive 24 hours after birth
  - a stillborn calf is a calf that dies before, during or within 24 hours after birth
  - livability or calf vitality = 1 - stillbirth

- **Phenotypic trend for livability**
  - stable for cows
  - negative for heifers

Phenotypic trend livability - Holstein



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Aim of study

- **Investigation which factors are causing the decline of heifer livability**
  - **with focus on genetics**

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Material & Methods

- **Analysis I**
  - genetic analysis to estimate variance components
- **Analysis II**
  - use results analysis I in a breeding value estimation
  - investigate effects in model

Data recording

- All live-born calves are eartagged and registered in the Dutch identification & registration system (I&R)
- A calf is considered stillborn if the dam has a calving date, but no calf is registered with the I&R system

I. Data selection

- Calvings from 2003 until 2008
- Herdbook registered calves with at least 75%HF (for dam as well)
- Gestation length between 260-300 days
- No multiple births
- No ET-calves

- On farm level
  - at least 80 births for heifers and 200 births for cows
  - 1 out 3 herds selected at random

- Total dataset 790,643 records
  - 266,578 calvings of heifers
  - 656,801 calvings of cows

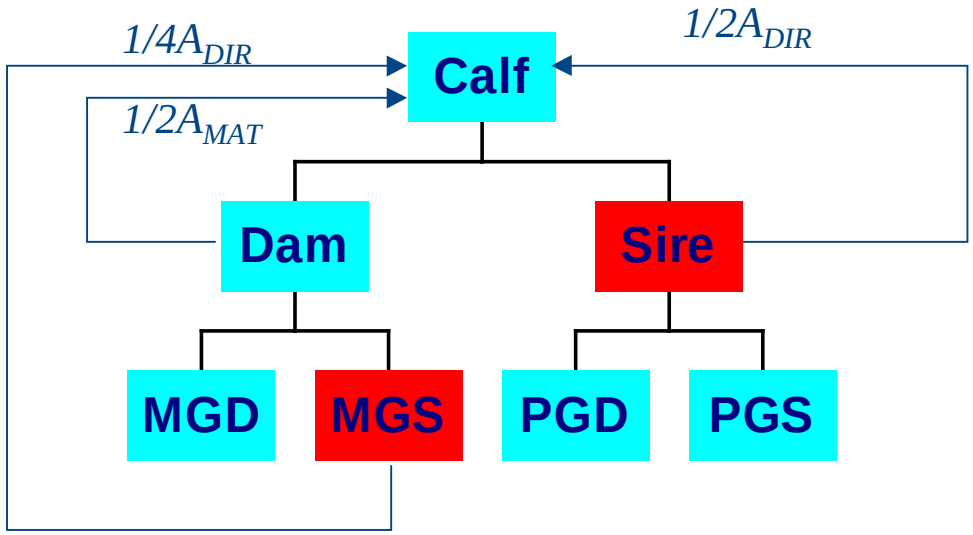
I. Statistical model

Heifers: Y = A + M + H + sire + mgs + e

Cows: Y = P + M + H + sire + mgs + perm + e

• Y	= observation for livability	
• A	= age at calving	fixed
• P	= parity number	fixed
• M	= year x month of calving	fixed
• H	= herd	fixed
• sire	= sire of the calf	random
• mgs	= sire of the dam	random
• perm	= permanent environment	random
• e	= residual	random

From sire and mgs variances to direct and maternal variances



$$\sigma^2_{A_{DIR}} = 4 * \sigma^2_{A_{SIRE}}$$

$$MGS = \frac{1}{2} A_{MAT} + \frac{1}{4} A_{DIR} \Longrightarrow A_{MAT} = 2 * MGS - SIRE$$

$$\sigma^2_{A_{MAT}} = 4 * \sigma^2_{A_{MGS}} + \sigma^2_{A_{SIRE}} - 4 * \sigma_{A_{S,MGS}}$$

II. Analysis decline heifer livability

- Breeding value estimation
  - Multi Trait Animal Model
  - correlated direct and maternal effect

- Effects in model for heifers
  - HYS - management group
  - YM - year x month
  - age - age at calving
  - cow - maternal effect
  - calf - direct effect

- Calculation of average solution per year x month

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I. Genetic parameters

	Mat. Liv. Heifers	Mat. Liv. Cows	Dir. Liv. Heifers	Dir. Liv. Cows	Genetic SD (%)
Mat. Liv. Heifers	**0.085**				10.79
Mat. Liv. Cows	0.524	**0.005**			1.53
Dir. Liv. Heifers	-0.156	0.214	**0.038**		7.20
Dir. Liv. Cows	0.090	0.358	0.570	**0.005**	1.48

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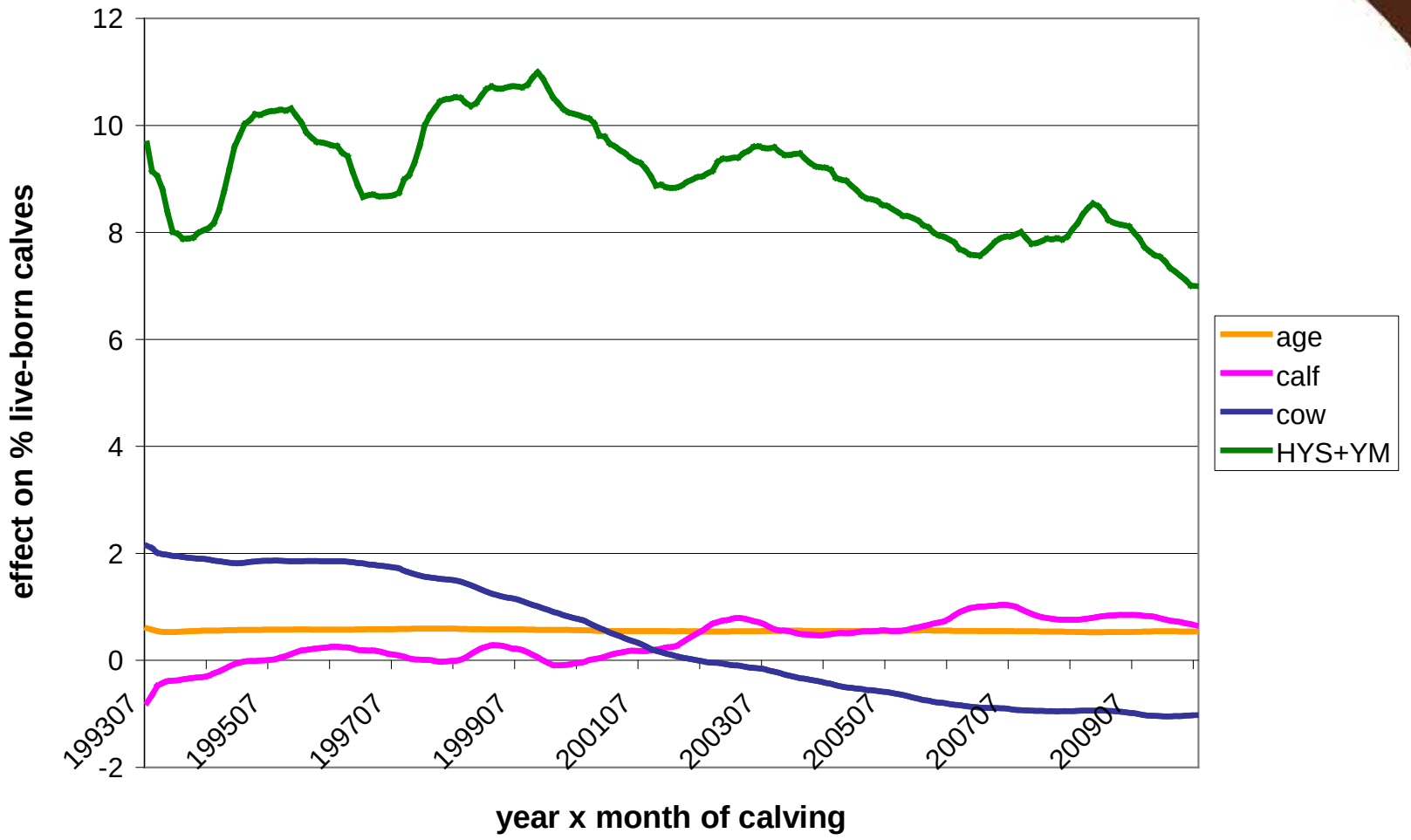
II. Decline of heifer livability



II. Decline of heifer livability

- Age at calving has no impact on the decline
- Calf has a slighty positive effect of around 1% on the decline
- Cow has a negative effect of 3% on the decline and seems to stabilise
- HYS+YM has a negative effect of 4% on the decline since 2000

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Conclusions

- **I. Role of genetics**
  - possible to estimate genetic parameters with sire model
    - multi trait
    - correlated direct and maternal effect
  - livability from heifers and cows are different traits
    - heritabilities
    - genetic correlations
    - genetic standard deviation

- **II. Decline of heifer livability caused by**
  - genetic ability of the maternal effect
  - herd + time effects

Conclusions

- **Change of breeding goal**
  - improving heifer livability
  - change negative phenotypic trend

- **Further research**
  - other effects
    - genetics; inbreeding
    - management; …