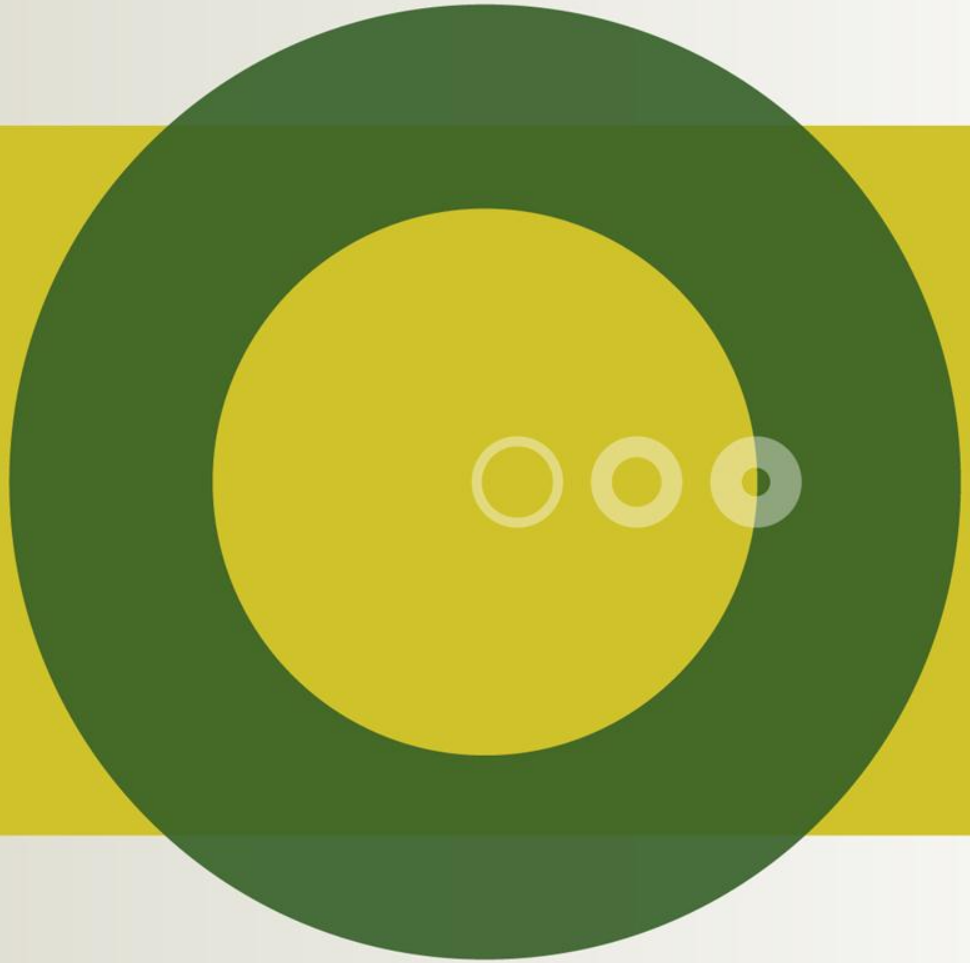
VIDENCENTRET FOR LANDBRUG

Genetic evaluation of calf vitality

Line Buch

VFL



PARTNER I DLBR DANSK LANDBRUGSRÅDGIVNING

Previous analyses

- Mortality among Holstein calves
  - 9.4 % among heifer calves from 1 day after birth to 1 day before first calving[1]
  - 9.3 and 5.1 % (first and later calvings, respectively) among heifer calves and bull calves < 24 hours[2]

- Mortality among Jersey calves
  - 12.5 % among heifer calves from 1 to 180 days after birth[3]
  - 7.2 and 3.5 % (first and later calvings, respectively) among heifer calves and bull calves < 24 hours[2]

[1] Fuerst-Waltl and Sørensen (2010); [2] Årsstatistik avl; [3] Norberg (2008)

Reasons for culling in percentage of dead heifer calves and heifers

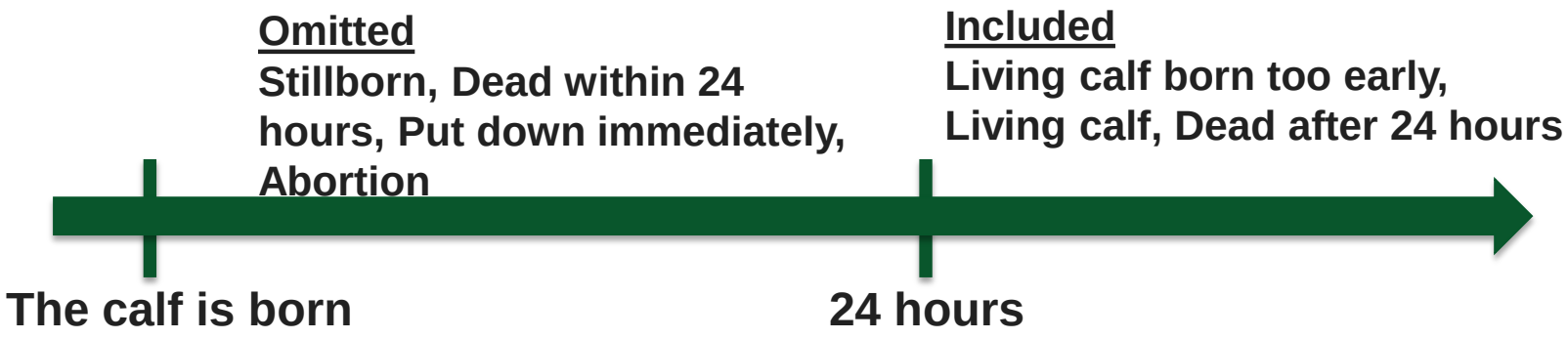
Reasons for culling	Holstein	RDC	Jersey
Diarrhoea, calves	29.7	30.5	47.5
Pneumonia, calves	20.5	24.6	21.8
Other reasons, calves	16.6	16.1	16.8
Accidents	12.0	9.1	4.2

Aim

- The aim of the project was to
  - Process data for bull and heifer calves at different age groups
  - Define traits
  - Estimate genetic parameters for calf mortality
  - Investigate the possibility of developing an index for calf vitality
  - Estimate correlations between EBVs for calf vitality, stillbirth and diseases other than mastitis

Data

- Data from 1998 onwards
- The dataset contains information on:
  - When the calf is born, moved, slaughtered, put down or dead
  - Parity of the cow
  - Size of the calf
  - Course of calving



Challenges

- Many calves are moved
  - Some heifers are gathered in herds specialised in raising heifers
  - Most bull calves are gathered in fattening herds until slaughter

Response variables

- Binary data structure
  - 0 = alive through the entire period
  - 1 = dead within the period

- Dead: Calves that die or are put down
  - Calves > 24 hours are put down as a result of serious illness (ethical concerns)
  - Healthy calves that are put down as a result of economical concerns are put down immediately after birth

Trait definition

- Period 1
  - From d 1 to 30 after birth (bulls and heifers)
    - Change in mortality rate
    - Calves are moved to other herds
    - Genes controlling survival may change over time
- Period 2
  - From d 31 to 458 after birth (15 months, heifers)
  - From d 31 to 183 after birth (6 months, bulls)
    - Heifers are not culled because of fertility problems
    - Bulls are not slaughtered yet

Missing information

- Information on calves was set to missing for this and the following period if the calves were
  - slaughtered or exported within that period
  - too young to theoretically reach the maximum age of that period
- However, their records were kept for preceding periods

Mortality and number of animals - Holstein

Mortality, %	Heifers	Bulls
P1	3.2	4.0
P2	3.7	4.5

Number of animals	Heifers	Bulls
P1	1,705,000	1,541,000
P2	1,496,000	1,430,000

Number of animals in total: 3,245,000

Mortality and number of animals - RDC

Mortality, %	Heifers	Bulls
P1	3.2	3.8
P2	4.6	6.5

Number of animals	Heifers	Bulls
P1	234,127	235,961
P2	207,442	220,150

Number of animals in total: 470,000

Mortality and number of animals - Jersey

Mortality, %	Heifers	Bulls
P1	7.2	11.5
P2	6.9	9.6

Number of animals	Heifers	Bulls
P1	305,000	110,000
P2	253,000	95,000

Number of animals in total: 416,000

Model

- Linear animal model
- Fixed effects
  - Herd × year at the beginning of the period
  - Year of calving × month of calving
  - Parity
  - Size of the calf
  - Calving ease
  - Calendar month where the calf is moved

Phenotypic differences between Holstein bulls

- Mortality in P1 for the best and the worst bull, respectively
  - Heifer calves: 1.9 – 5.5 %
  - Bull calves: 2.3 – 5.9 %

- Mortality in P2 for the best and the worst bull, respectively
  - Heifer calves: 2.0 – 6.0 %
  - Bull calves: 2.4 – 8.9 %

The bulls have more than 1500 offspring within each gender

Genetic standard deviations (σ_g)

Trait	σ_g - Holstein	σ_g – RDC	σ_g - Jersey
P1 heifer	0.016	0.015	0.033
P2 heifer	0.019	0.031	0.027
P1 bull	0.015	0.015	0.035
P2 bull	0.032	0.044	0.028
Stillbirth, < 24 hours	0.106	0.084	0.087

Genetic parameters – Holstein

	Heritability	P2 Heifer	P1 Bull	P2 Bull
P1 Heifer	**0.01 (0.001)**			
P2 Heifer	**0.01 (0.002)**			
P1 Bull	**0.01 (0.001)**			
P2 Bull	**0.03 (0.003)**			

- Low heritabilities
  - The heritabilities for still birth in connection with first and later calvings are 0.04 and 0.01, respectively

Genetic parameters – Holstein

	Heritability	P2 Heifer	P1 Bull	P2 Bull
P1 Heifer	**0.01 (0.001)**	**0.51 (0.13)**	**0.90 (0.13)**	**0.40 (0.15)**
P2 Heifer	**0.01 (0.002)**		**0.42 (0.21)**	**0.95 (0.04)**
P1 Bull	**0.01 (0.001)**			**0.44 (0.13)**
P2 Bull	**0.03 (0.003)**			

- High genetic correlations between traits within periods
- Moderate genetic correlations between traits across periods

Genetic parameters – RDC

	Heritability	P2 Heifer	P1 Bull	P2 Bull
P1 Heifer	**0.01 (0.001)**	**0.75 (0.08)**	**0.95 (0.10)**	**0.61 (0.14)**
P2 Heifer	**0.02 (0.003)**		**0.78 (0.12)**	**0.89 (0.05)**
P1 Bull	**0.01 (0.001)**			**0.58 (0.08)**
P2 Bull	**0.03 (0.004)**			

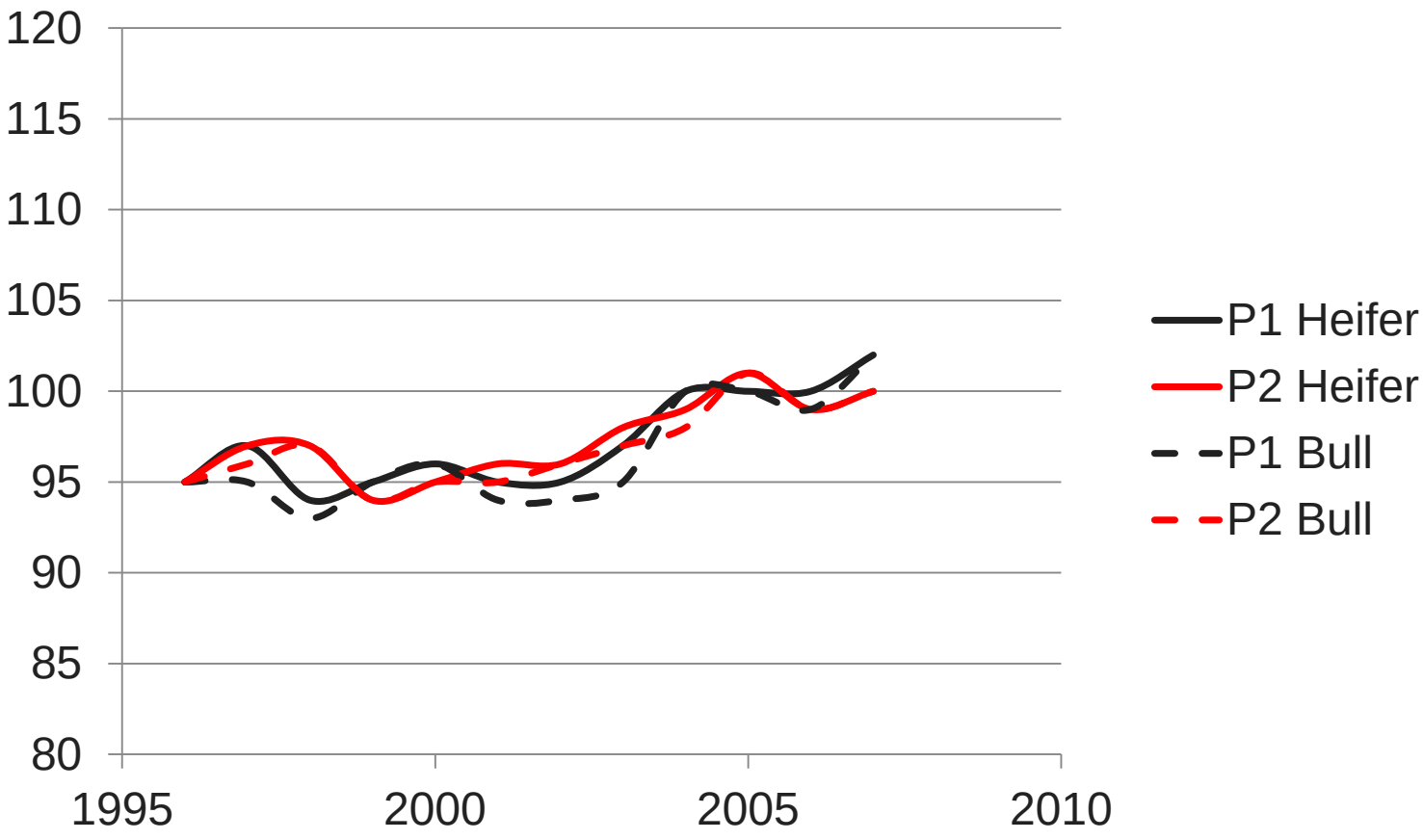
- The genetic correlations between traits across periods seem to be higher for RDC than for Holstein

Genetic parameters – Jersey

	Arvbarhed	P2 Heifer	P1 Bull	P2 Bull
P1 Heifer	**0.02 (0.002)**	**0.42 (0.12)**	**0.95 (0.05)**	**0.34 (0.18)**
P2 Heifer	**0.01 (0.002)**		**0.39 (0.18)**	**0.99 (0.06)**
P1 Bull	**0.01 (0.003)**			**0.39 (0.17)**
P2 Bull	**0.01 (0.003)**			

- The conclusions are the same as for Holstein
- Relatively large standard errors

Genetic trends for Holstein bulls



More than 100 daughters per bull

Correlations between breeding values for proven Holstein bulls

	NTM	Birth	Longe-vity	Other diseases	Yield	Growth
Calves	0.18					

Tyrene er født i perioden fra 2001 til 2006 og har mere end 50 døtre

Correlations between breeding values for proven Holstein bulls

	NTM	Birth	Longe-vity	Other diseases	Yield	Growth
Calves	0.18	0.18	0.17	0.13		

Tyrene er født i perioden fra 2001 til 2006 og har mere end 50 døtre

Correlations between breeding values for proven Holstein bulls

	NTM	Birth	Longe-vity	Other diseases	Yield	Growth
Calves	0.18	0.18	0.17	0.13	0.06	0.05

Tyrene er født i perioden fra 2001 til 2006 og har mere end 50 døtre