Predicting mastitis resistance breeding values from somatic cell count indicator traits

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Outline

- Introduction
- Model and traits
- New Udder Health index
- Test run results
- Conclusions and implications

Introduction

- Improving the Dutch udder health index
  - Making better use of cell count records in the breeding value estimation
  - Using direct clinical mastitis records in the breeding value estimation

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  - Making smarter use of cell count records in the breeding value estimation
  - Using direct clinical mastitis records in the breeding value estimation
- Research collaboration
  - Animal Science Group - Lelystad
  - CRV - Arnhem
  - Udder Health Centre Netherlands - Deventer
  - Animal Health Service - Deventer

Model and traits

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  - Subclinical mastitis (SCM)
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- Five indicator traits:
  - Mean 2log(somatic cell count) day 5 - 150 lactation
  - Mean 2log(somatic cell count) day 151 - 400 lactation
  - Absence/presence of SCC > 150,000 cells/ml
  - Fraction of test days with SCC > 150,000 cells/ml
  - Total number of peaks in SCC

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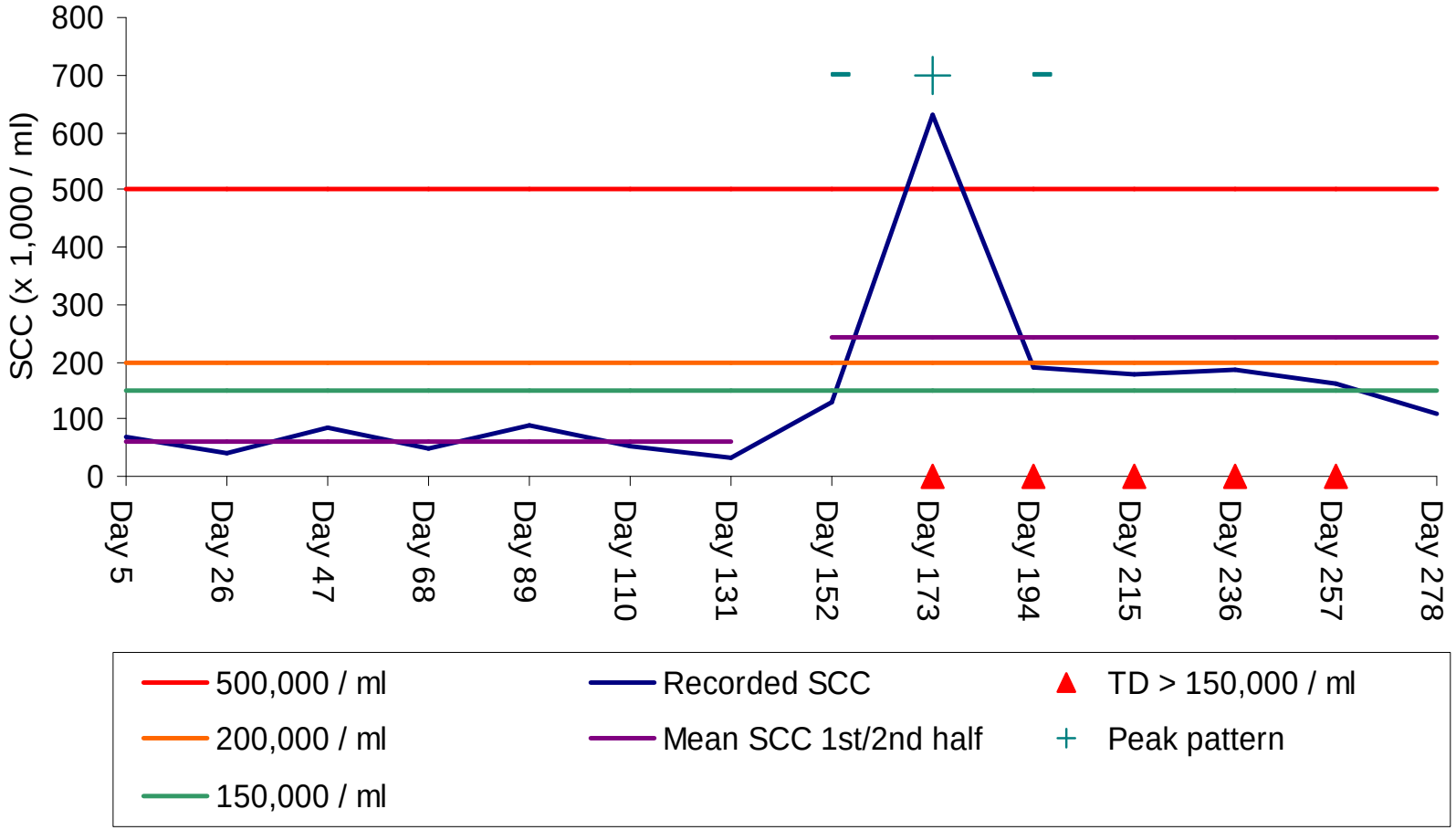
  - Proportion SCC > 150,000 cells/ml
  - Total number of peaks in SCC

Example indicator traits



SCS150 : $^{2}\log(57{,}000)$ = 15.7

SCC400 : $^{2}\log(243{,}000)$ = 17.9

Peaks : 1

Infection : Yes

Severity : 5/14 = 0.36

Model and traits II

- Multitrait animal model
  - $Y_{i(=1\ ..\ 7)} = \mu + HY + YM + NTD + DAR + animal + error$
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- Data from 1990 to 2008

New Udder Health Index

- Index of SCM and CM
  - Based on economic damage of 1 case of each
  - SCM : € 83 per case
  - CM :€ 196 per case
  - *Average* damages
    - Depending on stage of lactation

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- Index : UDH = - 83 * SCM - 196 * CM
  - But presentation on relative scale 100 +/- 4
  - $FW_{UDH} = 100 + \mathbf{0{,}477} * [FW_{SCM} - 100] + \mathbf{0{,}641} * [FW_{CM} - 100]$

Mastitis heritabilities and correlations

	SCM1	CM1	SCM2	CM2	SCM3	CM3
SCM1	**0.02**					
CM1	0.59	**0.02**				
SCM2	0.69	0.54	**0.03**			
CM2	0.61	0.68	0.55	**0.02**		
SCM3	0.69	0.36	0.82	0.37	**0.04**	
CM3	0.52	0.67	0.50	0.81	0.26	**0.03**

- Combined over lactations:
  - SCM => 5.6%, CM => 6.0%, UDH => 8.9%

Overall heritabilities

- Realized heritabilities (overall traits)

Trait	h^2	σ_g
SCS150	0.165	43.255
SCS400	0.173	38.794
Infection	0.120	0.110
Severity	0.158	8.864
Peaks	0.112	0.113
SCM	0.056	0.068
CM	0.060	0.039
UDH	**0.089**	**0.051**

Reliabilities

	Number of daughters			Reliability		
	lactation 1	lactation 2	lactation 3	SCM	CM	UDH
young 1	**80-120**	**0**	**0**	69	67	70
young 2	**150-250**	74	**0**	79	76	80
proven 1	**150-250**	139	93	87	83	87
proven 2	**900-1,100**	766	526	95	94	95
proven 3	**8,000 - 12,000**	7,436	5,452	95	95	95
proven 4	**>12,000**	23,133	**>6,000**	98	98	98

Breeding value range

- Top and bottom 5 sires

Bull	SCM	CM	UDH	UGZ
0001	113	111	113	111
0002	112	110	112	109
0003	114	109	112	109
0004	109	112	112	106
0005	112	109	111	110
9995	86	86	83	87
9996	85	84	82	86
9997	84	85	82	85
9998	85	80	80	87
9999	84	77	77	82

Response

- Expectations for daughters

Bull	SCM	CM	UDH
0001	113	111	113
	-9.9%	**-4.7%**	**17.07 euro**
5423	104	105	105
	-3.0%	**-2.1%**	**6.57 euro**
9999	84	77	77
	12.1%	**9.8%**	**-30.21 euro**

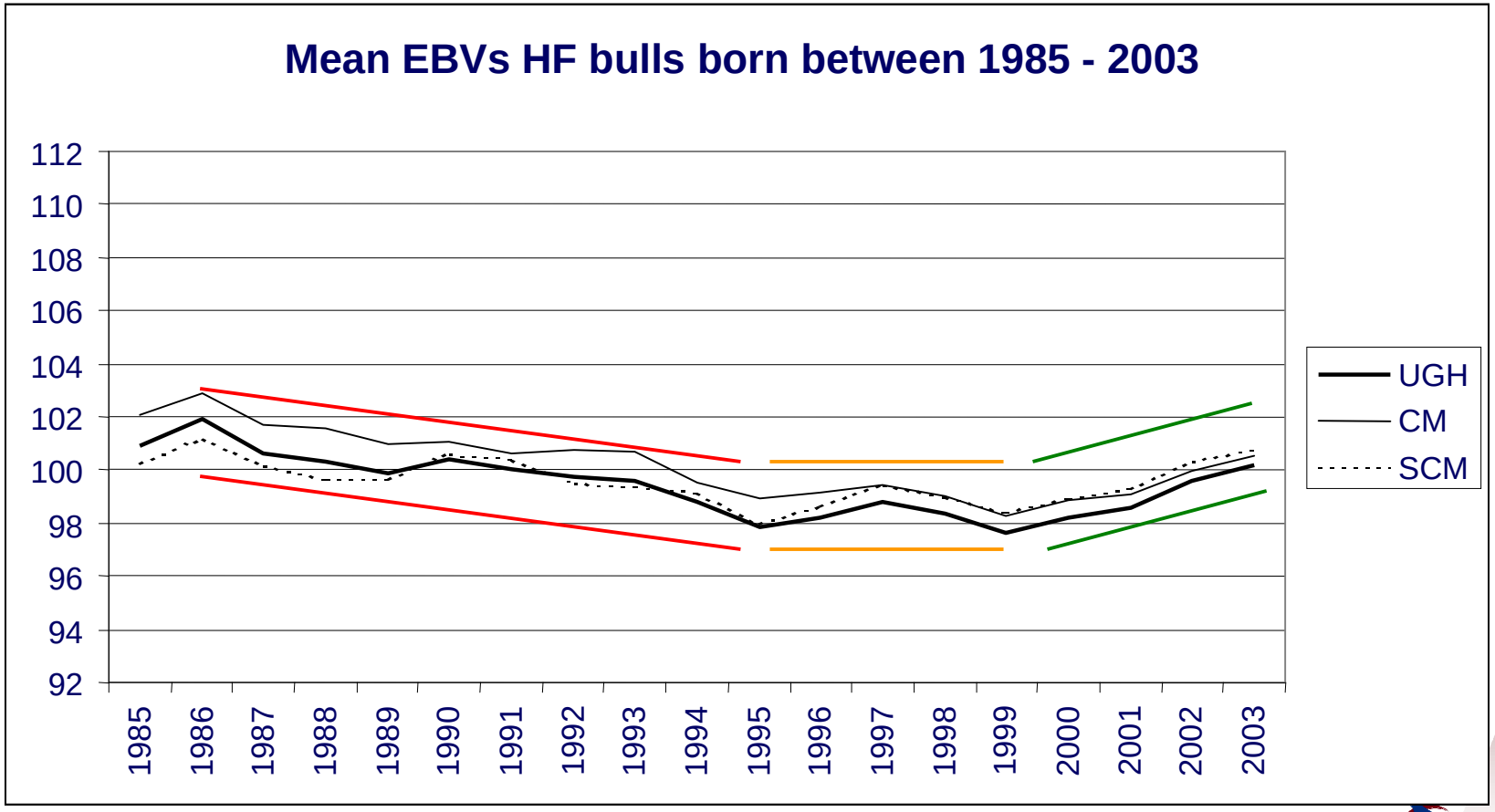
Correlations II

- Correlation between new and old index

	CM	SCM	SCC	(old) UGZ
BV $_{sires}$				
UDH	0.945	0.912	0.898	0.890
CM		0.750	0.781	**0.777**
SCM			0.922	0.912

  - UDH ~ CM + SCM
  - SCC/UGZ ~ SCM, not CM (so much)

Genetic trend



Conclusions and implications

- New udderhealth index
  - More reliable
  - Better heritability
  - Broader breeding goal (CM + SCM vs SCM only)

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- New udder health index
  - more reliable
  - better heritability
  - broader breeding goal (CM + SCM vs CM only)
- Bulls show more variation
  - more accurate selection of superior bulls
- Direct breeding on mastitis resistance
  - Less mastitis => lower SCC, NTOWA

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