Health monitoring in Austria

Statistical models based on somatic cell count at cow level for early detection of udder health problems

P. Winter[1], J. Hofrichter[2], W. Obritzhauser[4], K. Zottl[5], C. Egger-Danner[3]

[1]Department for Farm Animals and Veterinary Public Health, University of Veterinary Medicine Vienna, Austria,
[2]Data, Statistics and Risk Assessment, Austrian Agency for Health and Food Safety, Austria,
[3]ZuchtData EDV-Services, Vienna, Austria,
[4]Chamber of Veterinaries, Vienna, Austria,
[5]Performance Recording for Lower Austria, Zwettl, Austria

Content

- Performance recording in Austria
- Udder health status
- New approach for early warning
  - Dataset
  - Statistics
  - Results
  - Implementation
- Conclusion

1. Performance recording in Austria (1)

Milk Recording	Austria	Lower Austria
Herds	23.676	3.996
Cows	390.031	79.206
Herd size	16,5	19,8
Recording associations	8	1
Health Monitoring	54 %	78 %

1. Performance recording in Austria (2)

Main Breeds	Austria	Lower Austria
Simmental Fleckvieh	275.782	70.636
Brown Swiss	57.771	3.306
Holstein	43.010	4.524
Pinzgauer	8.279	
Tirolean Grey	3.938	
Misc. / Genetic Conservation	1.251	740

2. Udder Health Reports

- **DHI Report**
  - **SCC highlighted over 200.000 cells**
  - **Section for udder health lists cows, that**
    - **exceeded 200.000 within the latest 3 recordings and/or**
    - **had a mastitis diagnoses within that time**

Eutergesundheit

Kühe mit Zellzahl über 200.000 oder mit Euterdiagnosen

Nr.	Name	Lebensnummer	L.	Tg.	17.09.07 Zellzahl		01.08.07 Zellzahl		18.06.07 Zellzahl	
	MICA	AT 999.117.842	5	103	625		164			
	UNIVERSUM	AT 999.942.245	4	168	30[illegible]	[illegible]	[illegible]			
	SILVI	AT 999.382.[illegible]47	4	[illegible]	[illegible]		25		T	
	SUPER	AT [illegible]	[illegible]	[illegible]	[illegible]		T		472	
	UN	AT 999.[illegible]	1	41	49	Ⓓ				
	UN	AT 999.268.707	1	113	23		67	Ⓓ	S	

Most actual data are yesterday's data ?!

3. New approach for early warning Dataset

- **Data set**
  - **Result of bacteriological examination + previous monthly dairy herd improvement data (- 6 months)**
    - **SCC, milk yield, milk contents, age, days in lactation, breed**
    - Logisitc Regression (n=7070)
    - Classication and Regression Trees (CART) (n=8509)
- **An infected cow is defined as**
  - **Isolation of a mastitis pathogen at least in one quarter**

3. New approach for early warning Statistics

Logistic Regession

- Response variable:
  - Result of bacteriological examination
- Explanatory variables:
  - Age
  - Days in lactation
  - DHI data from the last 6 months
    - Milk yield
    - Milk contents (SCC, fat, protein, urea)
- Model selection via analysis table of deviance
- Optimal cutpoint for logistic regression
  - ROC-Curve
  - Minimal distance to 100% sensitivity and 0% false positive rate

CART - Clustering

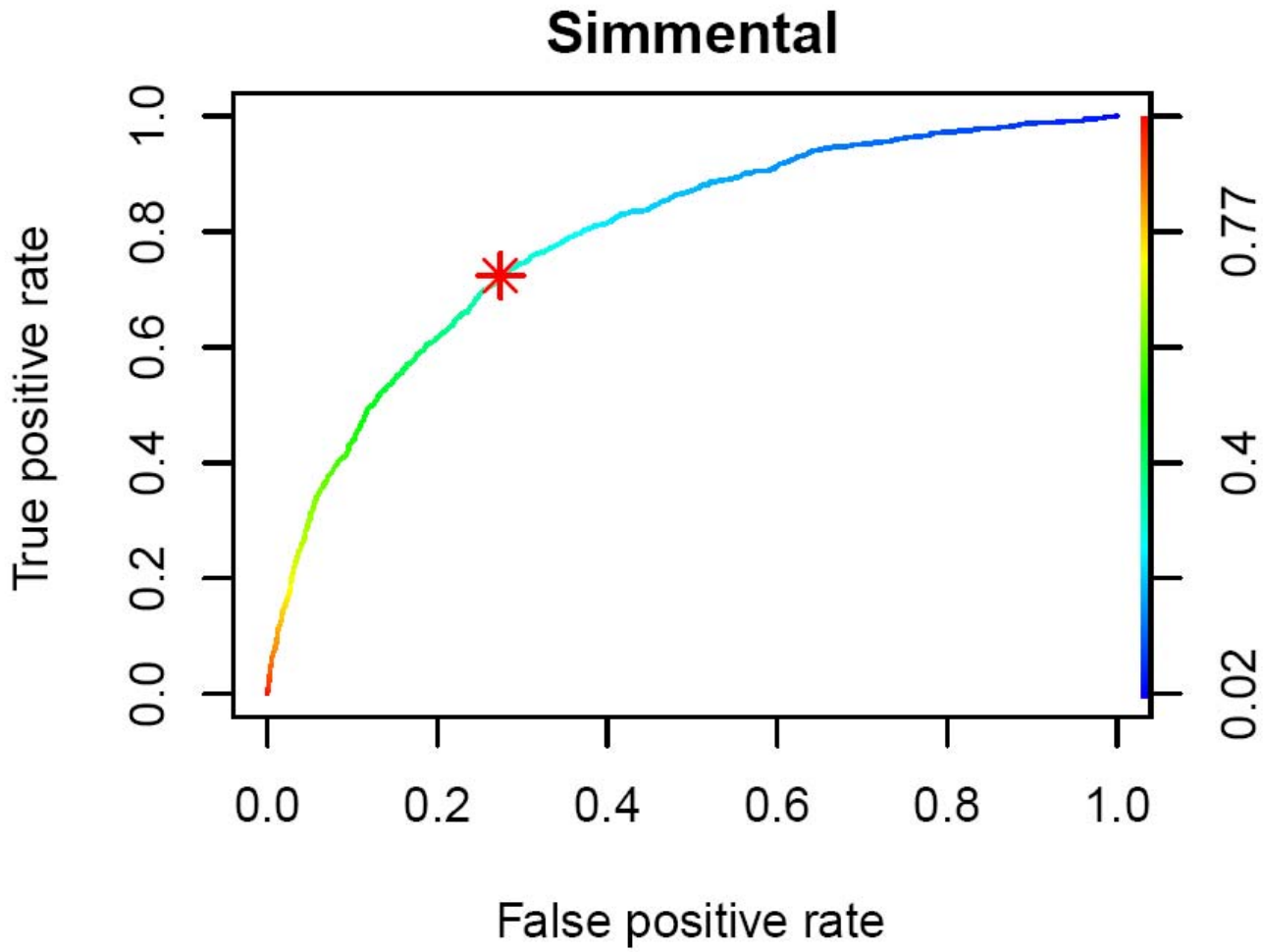
Phase I:

- Optimal splitting of SCC values using CART with respect to
  - Result of bacteriological examination
  - Monthly DHI data
- Cluster based on this CART

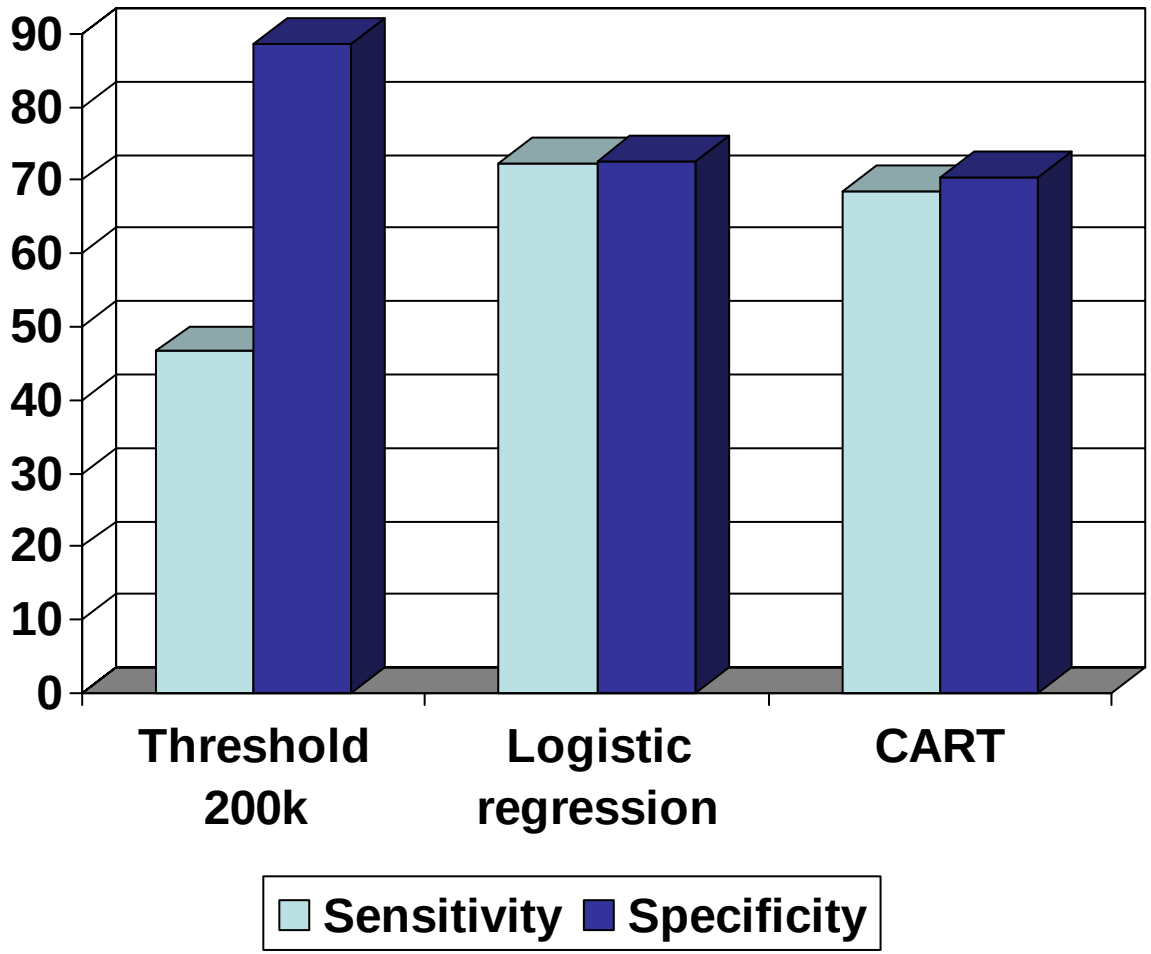
Phase II:

- SCC- Threshold within each cluster
- Based on ROC-Curve

Logistic Regression
Receiver Operating Characteristic (ROC)-Curve for Simmental Fleckvieh

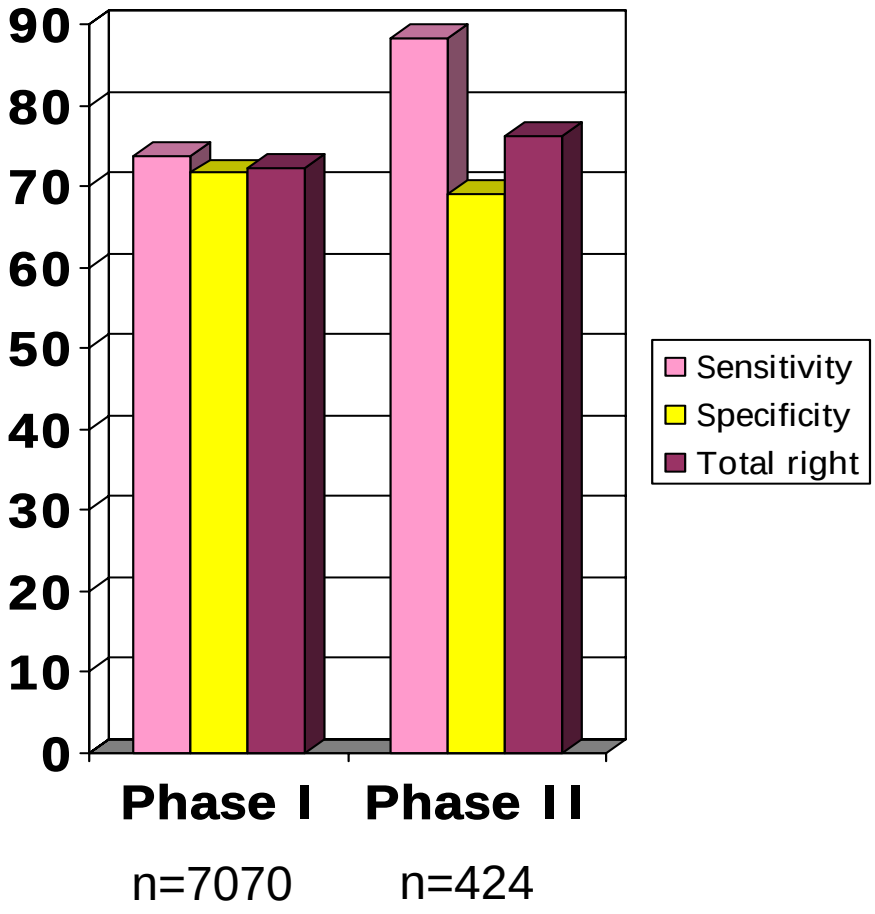


Sensitivity and Specificity comparing the models

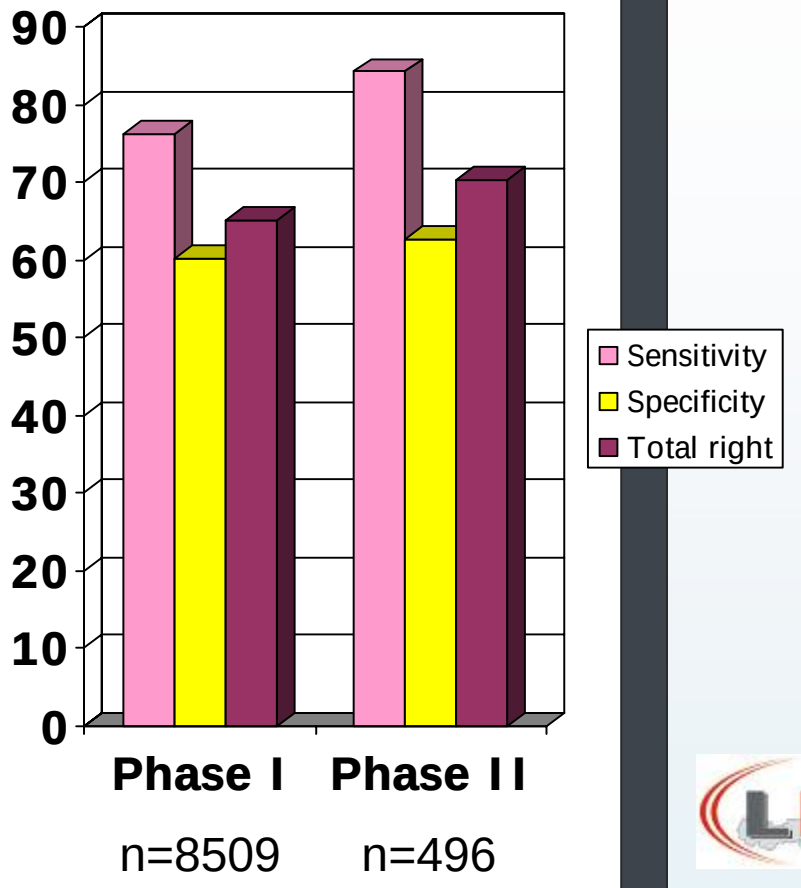


Performance indicators

Logistic Regression



CART



Results for Lower Austria logistic regression

SCC on day of milk recording	Nr MR	% suspicious at 200k	% suspicious with two consecutive warnings	% suspicious with one warning
<50	166,012		1.0	2.2
50 < 100	107,859		14.7	27.1
100 -< 150	56,127		43.0	73.4
150 -< 200	33,473		54.9	86.8
200 -< 250	21,537	100	59.6	89.1
250 -< 300	14,585		60.9	89.4
300 -< 350	10,293		61.6	89.0
350 -< 400	7,656		60.5	88.7
>= 400	45,242		57.5	85.8
Total	**462,784**	**21,5**	**25.7**	**41.1**

The results for 2009 show, that about 50 % of the recordings with an SCC between 100 and 200 seem to suspicious (with two consecutive warnings).

Implementation on the DHI report

Cows with high somatic cell counts and mastitis – further investigations recommended

Name	Animal-ID	L.	Days	BE*	21.08.2009 SCC		21.07.2009 SCC	12.06.2009 SCC
LISA	AT 999.444.972	2	283	BE*	568		205	132
SUMSI	AT 999.136.847	4	121		40	D	268	174
BIENE	AT 999.326.745	5	215	BE*	182		108	48
STRAUSSA	AT 999.327.845	4	28		31		T	T
LOLITA	AT 999.857.145	5	11		16		T	T

BE*: Bacterial examination recommended

- **Cows with 2 consecutive warnings will be highlighted in the Udder Health section of the Report as conspicious**
- **As further steps a California Mastits Test and/or a bacterial examination is recommended**

Conclusion

- **Logistic regression model is a potential tool for monitoring udder health at cow level**
- **Implementation in the DHI data reports helps to detect infections in a very early stage**
- **Farmers will be able to select potential infected cows for further interventions like**
  - **California Mastitis Test**
  - **Bacterial examination of quarter milk**
- **It is possible to provide an efficient early warning system for udder health.**

Acknowledgements

- Austrian Federal Ministry of Health
- Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria
- The Austrian Breeding Association

Thanks for your attention