

REGISTRATION OF HEALTH TRAITS – STRATEGIES OF PHENOTYPING, ASPECTS OF DATA QUALITY AND POSSIBLE BENEFITS



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OVERVIEW

- Registration of direct health data
 - Standardisation
 - Data security and recording
 - Validation
- Benefits
 - Herdmanagement
 - Genetic evaluation
 - Others
- Challenges and important measures for successs
- Conclusions



Farmers:
Increase productivity
and use existing
potentials

International image:
marketing
advantages

Ministries:
Operating figures on
animal health status

Consumer:
Food safety

**Breeding
Organisations:**
Genetic evaluation for
health traits

**Performance Recording
Organisations:**
Additional information
to support herd
management

Veterinarians:
Support for health
management

**Animal Health
Organisations:** Support
for evaluation and
preventive measures

BENEFIT

Benefit for stakeholders is precondition
for registration!



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BACKGROUND/NECESSITIES

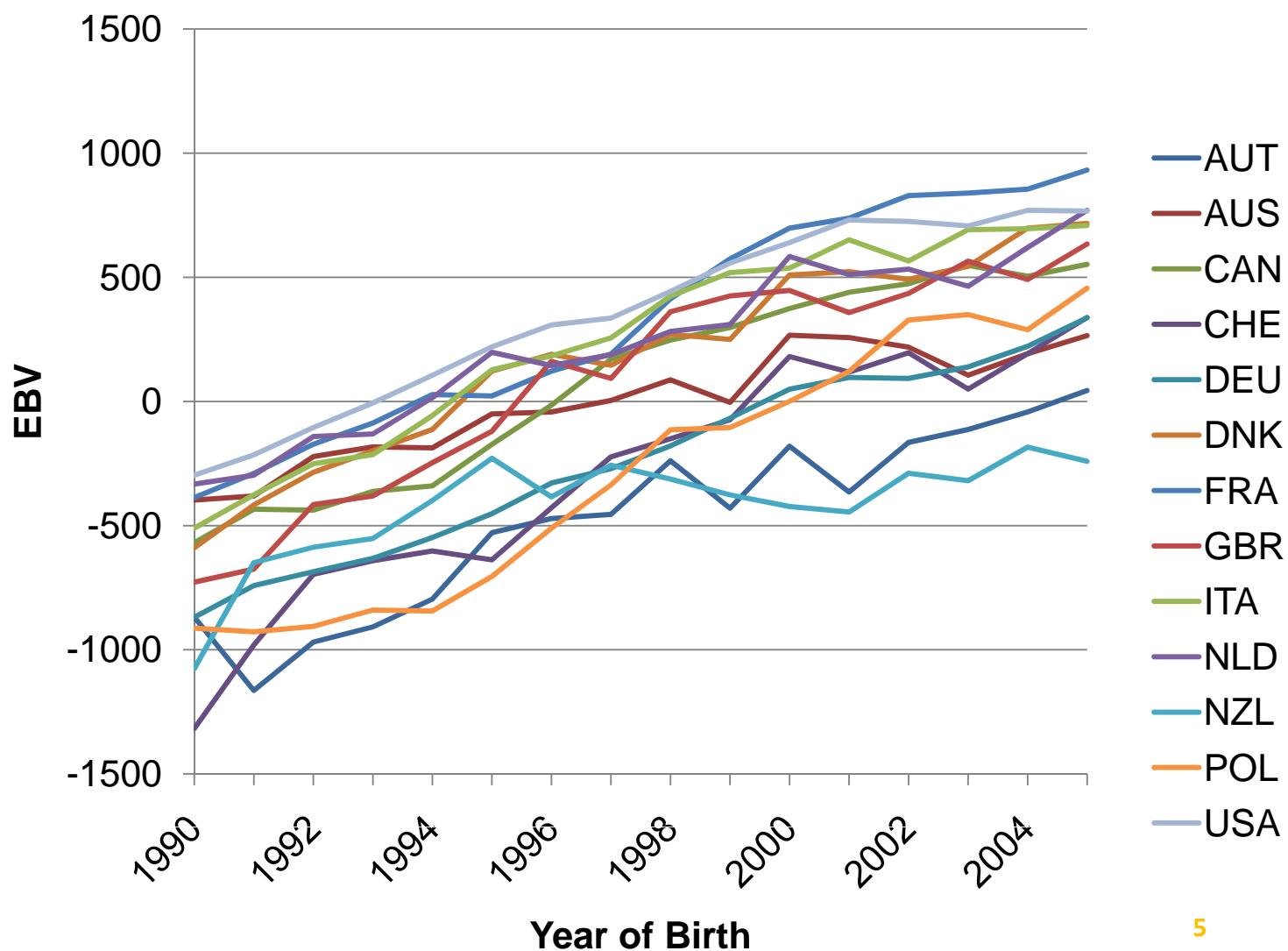
- Food safety:
 - consumer acceptance and confidence.
 - concerns about risks connected to the use of antibiotics
- Animal welfare aspects severe issue.
- Production efficiency: efficient use of feed, longevity, but also health aspects essential.
- Functional traits economically important.
- Genetic gains for functional traits not satisfactory.

**Emphasis on measures
to improve animal health!**

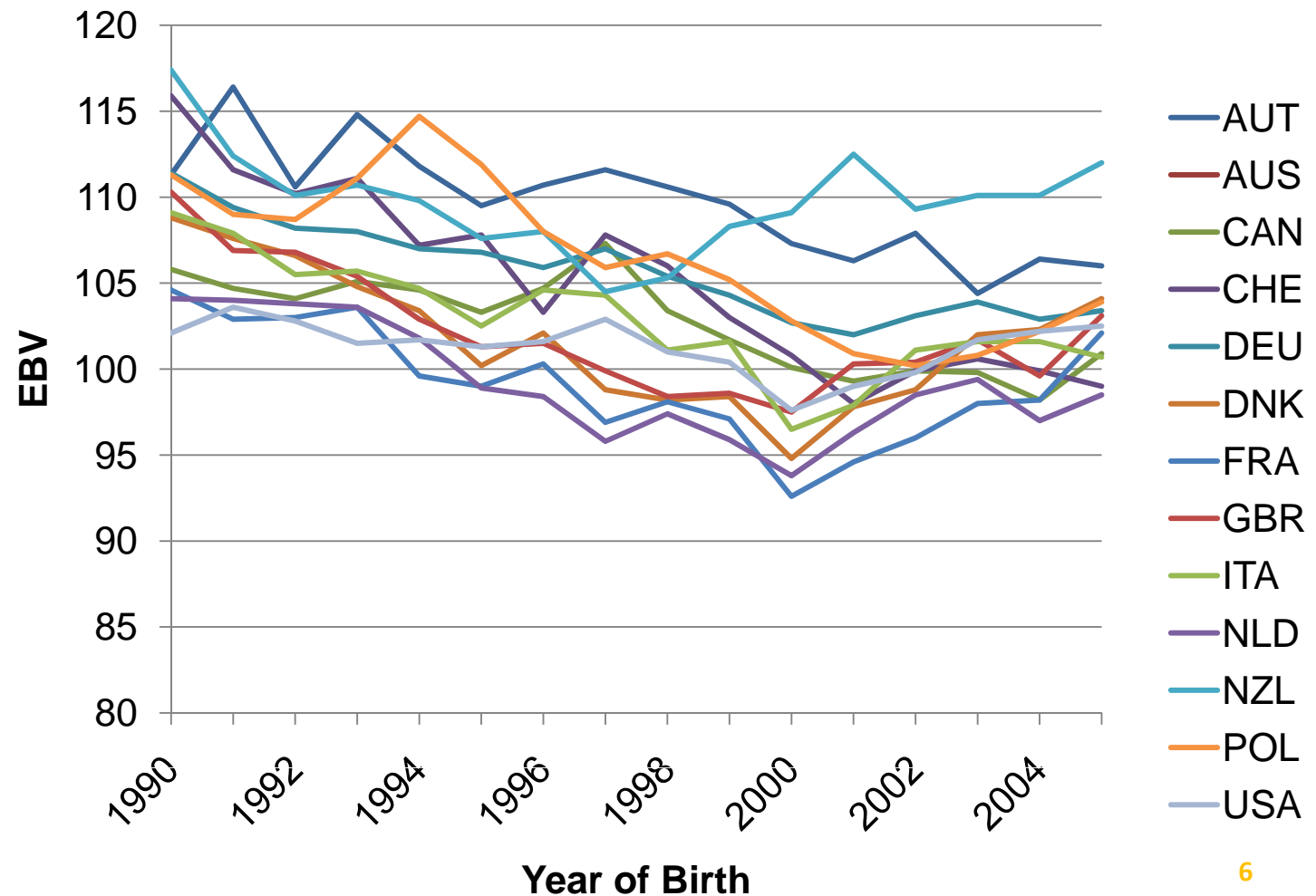


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GENETIC TREND MILK KG (HOLSTEIN; FUERST, 2011)



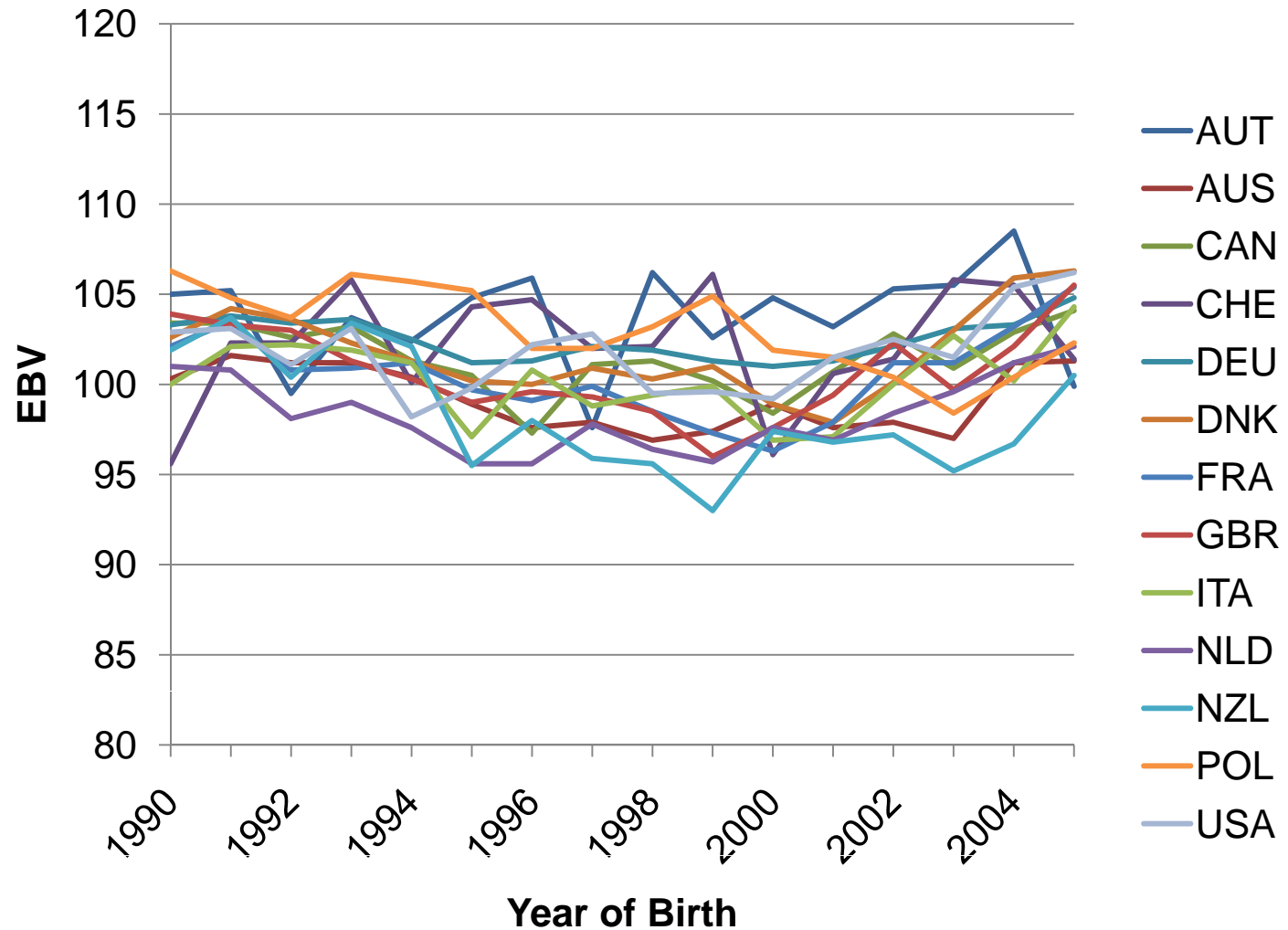
GENETIC TREND - TIME BETWEEN FIRST AND LAST INSEMINATION (HOLSTEIN; FUERST, 2011)





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GENETIC TREND – SOMATIC CELL COUNT(SCC) (HOLSTEIN; FUERST, 2011)



Trends SCC stable, but potential for economic improvement!



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SOLUTIONS/APPROACHES

- Direct selection for health traits more effective than indirect selection (Heringstad et al., 2007).
- Improvement of herdmanagement by integration of direct health data.
- Preventive measures within veterinarian approaches (EU-Animal Health Strategy (2007-2013) - Prevention is better than cure).
- Close cooperation between farmers and veterinarians.

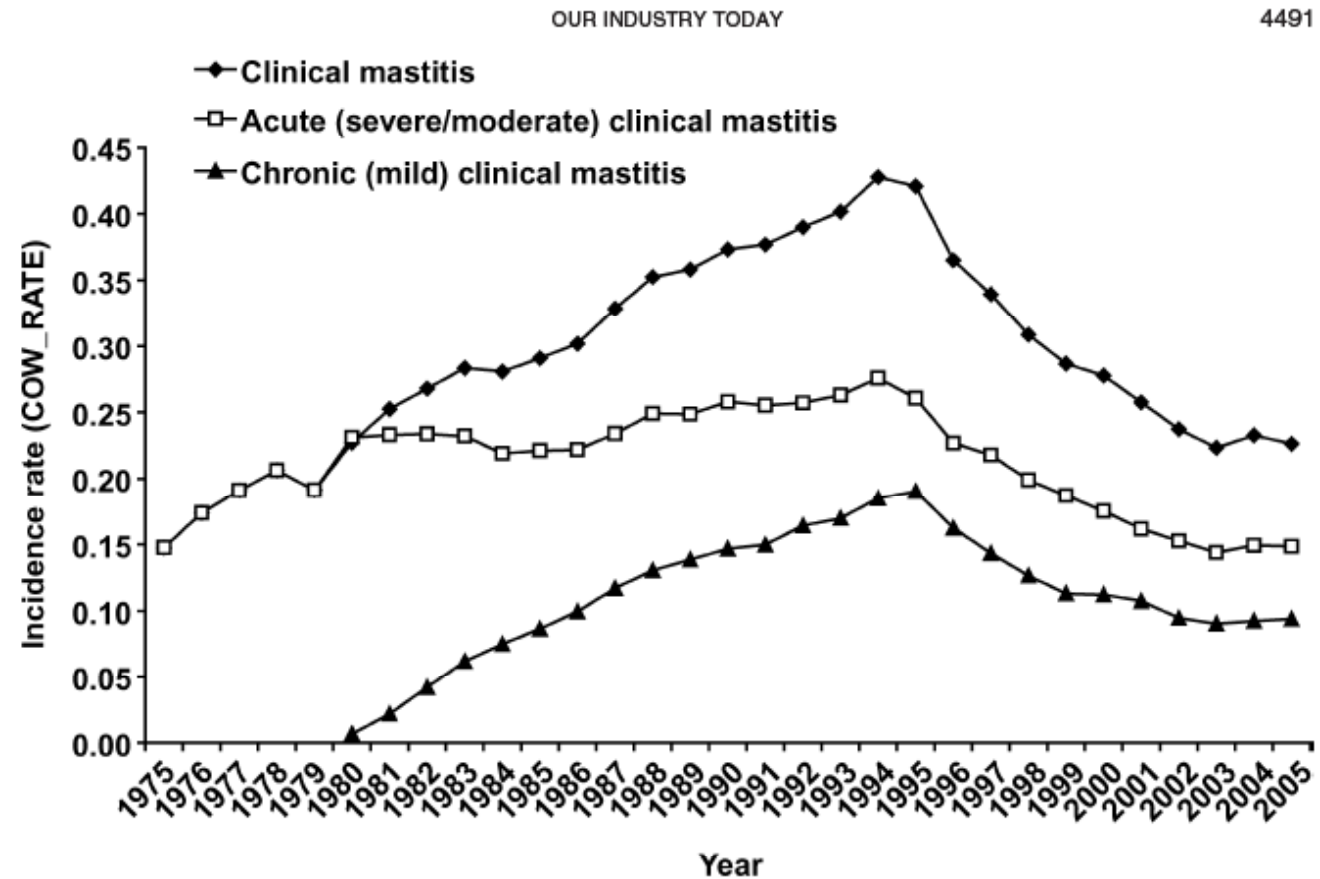
Availability of direct health data
precondition!



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EXAMPLE NORWAY

(NORWEGIAN CATTLE HEALTH SERVICES, 2005)





SOURCES OF DIRECT HEALTH DATA

Veterinarians	+	High quality data, allows joint use of data between producers and veterinarians.
	-	Motivation! If based on documentation of use of drugs only, it might not be complete.
Producers	+	Early recognition of disorders; comprehensive recording possible; possible use of already established data flow (routine performance testing, reporting of calving, documentation of inseminations).
	-	Consistency of data; risk of misinterpretation; attention/focus might change.
Expert groups (claw trimmer, nutritionist, .)	+	Specific and detailed information on a range of health traits important for the producer (high quality data)
	-	Motivation; business interests may interfere with objective documentation.
Others (laboratories, on-farm technical equipment, ...)	+	Automated or semi-automated recording systems; objective measurements.
	-	Lab: might only be from preselected animals.

DIRECT HEALTH DATA

PRESENT SITUATION

Veterinarian diagnoses:

- Norway, Sweden, Finland, Denmark – long history
- Austria – started 2006, Baden-Württemberg und Bavaria 2010,...
 - Routine genetic evaluation for direct health traits in Scandinavian countries and Austria/Germany

Producer recorded health data:

- US, Canada, Germany, France, UK, .. (Cole et al., 2006; Neuschwandner et al., 2008;..)
- Other projects and initiatives...



FREQUENCY OF THE MOST COMMON HEALTH DISORDERS (LACTATION INCIDENCE RATE (LIC))

Breed / Trait	Time period	LIC %	Reference
Danish Holstein			
Udder diseases	-10 to 100 dpp (1 st lactation)	21	Nielsen et al., 2000
Reproductive disturbances		10	
Digestive and metabolic diseases		3	
Feet and legs disorders		6	
Fleckvieh (Simmental)			
Clinical mastitis	-10 to 150 dpp	10	Koeck et al. 2010a,b
Early reproductive disorders	0 to 30 dpp	7	
Late reproductive disorders	30 to 150 dpp	14	

4 main complexes: udder, reproduction, digestive and metabolic disorders and feet and legs.



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RECOMMENDATION ON REGISTRATION

- Additional effort and expected benefit has to be in good balance.
- Priority to use of existing data sources and infrastructure for recording.
- Use of legal documentation requirements.
- Clear definitions of health incidents to be recorded, without options of diverse interpretation.
- Standardisation understandable by all parties involved. Different levels of detail should be permitted (very specific diagnoses of veterinarian compared to very general diagnoses or observations of producers).

STANDARDISATION

DIRECT HEALTH DATA

	Comprehensive key of diagnoses	Reduced key of diagnoses	Simple key of diagnoses
Nr. of diag.	> 600	60-100	10-15
Source	veterinarian	veterinarian	producer
Recording	electronic submission (vet)	vet, performance record., producer	producer
Example	Staufenbiel: mastitis catarrhalis acute and subacuta, mastitis parenchymatosa acuta and subacuta, ...	E.g. AUT: acute mastitis chronical mastitis;	mastitis

Coding of diagnoses precondition of use!
For harmonisation it is important how different keys of diagnoses can be linked!



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DATA RECORDING

- Examples: Denmark (Aamand, 2006):
 - Transfer from different invoicing systems (vets).
 - Registrations by the herd manager and vets by use of a pencil in a standard system (e.g. calving, sale).
 - Direct registration in the central database (data processing centres for milk recording, farmers, advisors and veterinarians).
- Scand./Austria:
 - By employees of performance recording organisations and/or direct electronic submission by vets. Additional possibilities by farmers.

Combine information from different sources! Store information about type of recording! Differences in completeness might exist!



DATA STORAGE – ACCESS TO DATA

- Complex national database with other relevant information is of advantage (plausibility checks easier,..)
- Enable extra gain – chance to link different information easily (electronic interfaces,..)
- Further information:
http://www.eadgene.info/Portals/0/WP10_1_Public_Downloads/EADGENE_Annex_VF.pdf
 - Construction and maintenance of animal health data collections (Definitions and storage of data)
 - Facilitation of exchange of data
 - Facilitation of analysis of data (for investigation of specific data, benchmarking etc.)
 - Level of harmonization (Following ISO principles)



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DATA SECURITY - ISSUES

- Ownership and use of data – consent of farmer needed!
- Access rights of (original) health data and results from health data analyses.
- Rights to edit the health data are provided very restrictively (use for control purposes dangerous!)
- If information about veterinarian is recorded - anonymisation of veterinarian advisable.

Data security – crucial – farmers and veterinarian have to build up trust into the system!



DATA VALIDATION

- Plausibility checks before storage in data base (e.g.:
http://www.bmg.gv.at/cms/home/attachments/9/7/3/CH1141/CMS1271936439807/tgdkundm74200_46-ii-b-10-10gesundheitsprogramm_rindprogramm.pdf)
 - provision of health reports and use within animal health programmes (farmers/veterinarians)
- Validation concerning completeness of recording:
„Farm with low incidence of disorders or farm with incomplete recording?“
 - DK: MIN 0.3 diagnoses/cow and year;
AUT: MIN 0.1 first diagnoses/cow and year
 - continuous recording of diagnoses
 - definition of the time under observation



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BENEFITS

- Improvement of management (farm level)
 - a. Farmers
 - b. Veterinarians
 - Immediate reactions (action lists, internet based information,..)
 - Long term adjustments (benchmarks, yearly reports,..)
- Monitoring of the health status (population level)
- Genetic evaluation (population level)

Rapid feedback is essential for motivation of farmers and veterinarians! Increase of economic efficiency!



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GENETIC EVALUATION

- Genetic differences exist although heritabilities are low (0.01-0.15).
- Direct health traits are an important additional information (e.g. Koeck et al. 2010a: ($r_g \approx -0.4$ Early fertility disorder and NR56), CM and SCC $r_g \approx 0.5-0.7$ (Heringstad et al. 2004; Zwald et al. 2006; Koeck et al. 2010b)).
- Combination of direct and indirect health traits is of advantage (fertility index, udder index).
- Combination of single diagnoses is of advantage due to low frequencies (Koeck et al. 2010: e.g. Early fertility disorders more stable than single traits retained placenta, puerperal disorders and metritis,...).



HEALTH DATA AND GENOMIC SELECTION

- Huge amount of data needed– reliable phenotypes and genotypes!
- Reference population of 3,000 bulls comparable with 21,000 cows at heritability of 0.1 (de Roos, 2011).
- Important to record complete herds!

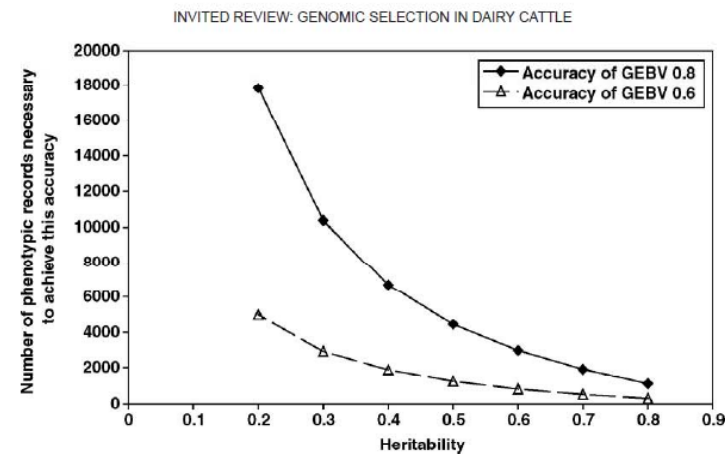


Figure 2. Number of phenotypic records required to achieve a desired accuracy of genomic breeding value (GEBV), 0.5 or 0.7, given the heritability of the trait. Effective population size (N_e) = 1,000 and a normal distribution of QTL effects is assumed. Derived from the formula of Goddard (2008).

(Hayes et al, 2009)



CHALLENGES

SUFFICIENT DATA FOR BREEDING PURPOSES

- Coverage of data recording has to be comparable with other functional traits
 - Due to low heritabilities a big amount of data needed.
- Possibilities:
 - All farms under performance recording are participating (advantage also for herd management use).
 - Contract herds with comprehensive recording: expensive, but higher heritabilities possible (Swalve, 2010); eventually phenotypes and genotypes (Pryce and Daetwyler, 2011).

IMPORTANT MEASURES

- Participative approach for veterinarian diagnoses.
- Benefit for key players: motivation for support depends on expected benefit and additional effort.
- Technical implementation with emphasis on data security and data quality (validation!).
- Continuous information and motivation: essential, more challenge than technical aspects. Opinion leaders important!
- Legal frameworks: continuous recording of health data on a high level of participation is a big challenge - legal frameworks are very valuable.





CONCLUSIONS

- Registration of direct health traits needed, but challenging.
- No standardised recommendation – only best practices adjusted to regional circumstances.
- Possibilities based on new technologies in future.
- Emphasis on data security and data validation.
- Benefit, information and motivation crucial issues.
- Harmonisation: key for standardisation of diagnoses, protocols for conversion of data between systems.

ICAR-working group on functional traits: presently working on guidelines for direct health data.

Feedback, recommendations, .. welcome.

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REFERENCE

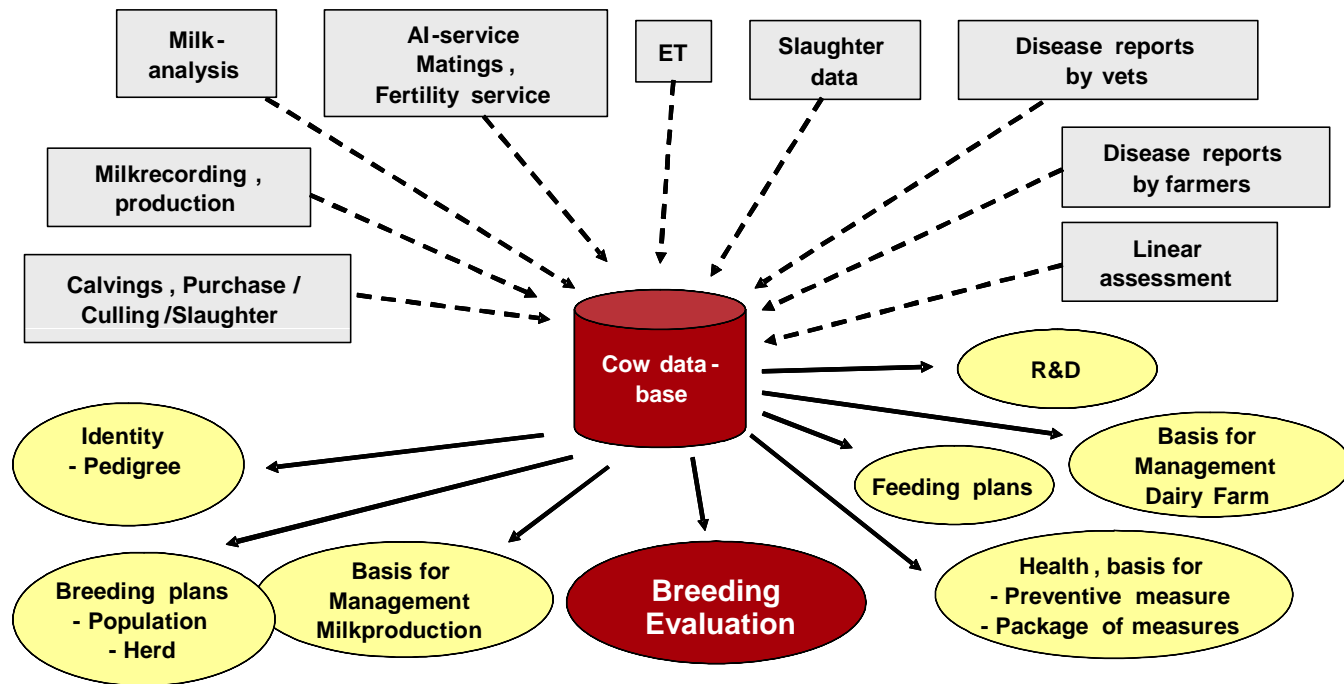
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Thank you for your attention

COMPLEX CATTLE DATA BASE (AAMAND, 2006)

Cow database

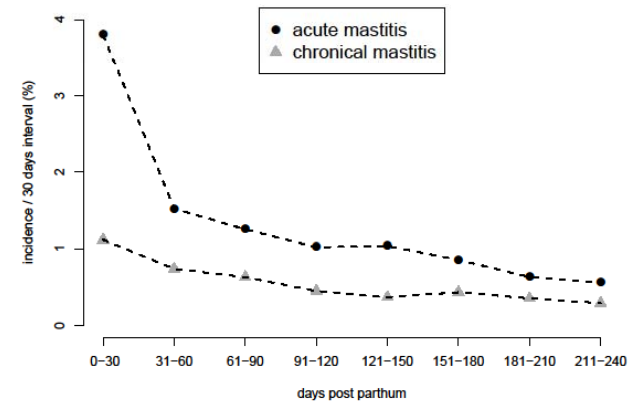
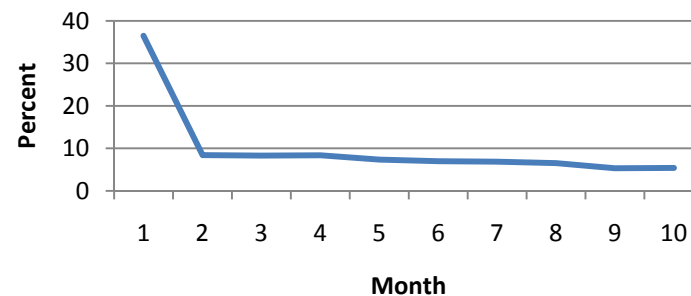




OCCURANCE OF MASTITIS

- Mastitis accumulated at the beginning of the lactation.

MASTITIS (Appuhamy et al. 2009)

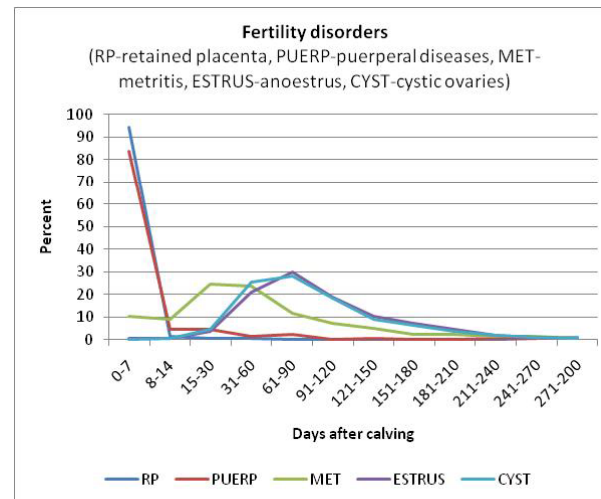


Schwarzenbacher et al. 2010

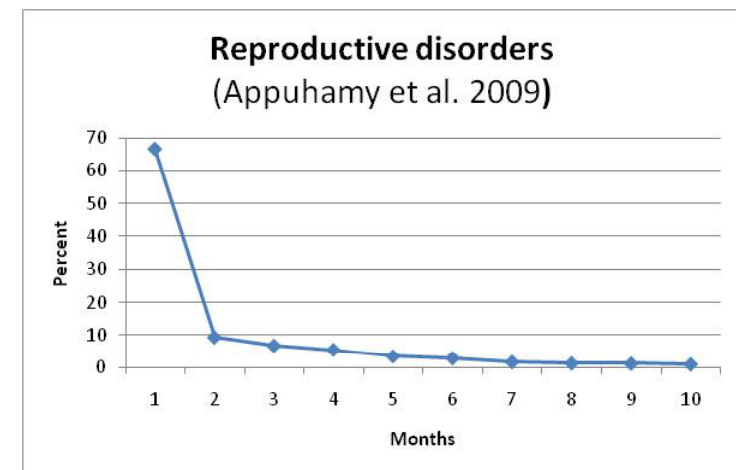


OCCURANCE OF FERTILITY DISORDERS

- Retained placenta, puerperal diseases after calving
- Disturbances of cycle mainly between 30 – 150 days.
- Disturbances of cycle could be recorded with inseminations, early fertility disorders with calving ease.



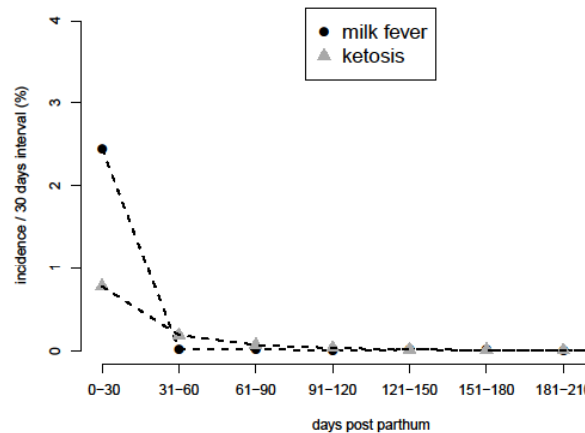
Koeck et al. 2010





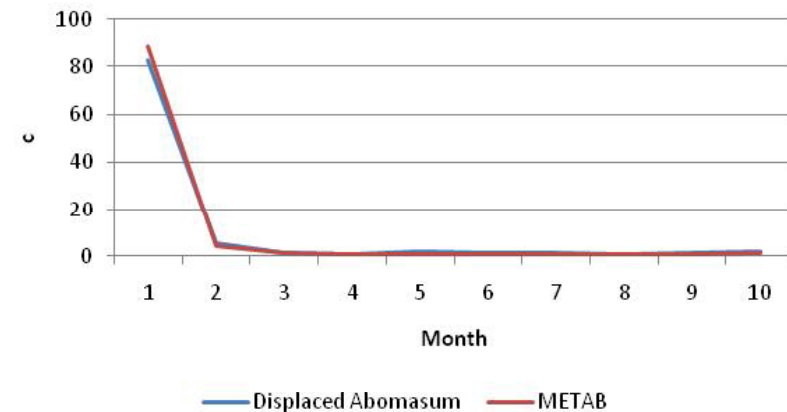
OCCURANCE OF METABOLIC DISORDERS

- Milk fever occurs to more than 90% till 10 days after calving.
- Higher incidence in higher lactations (Heringstad et al. 2005).



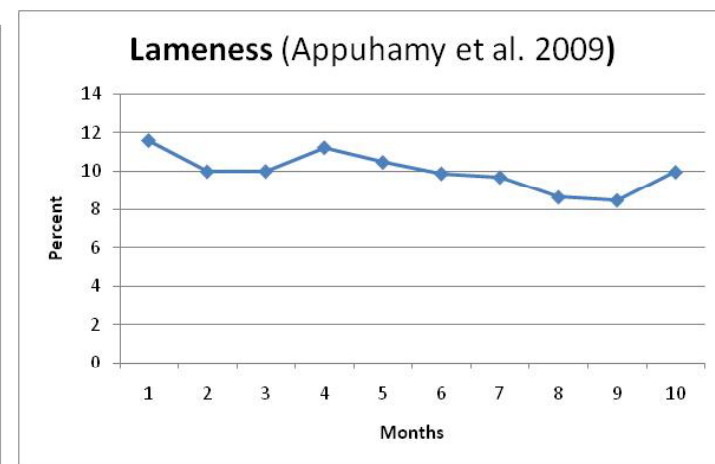
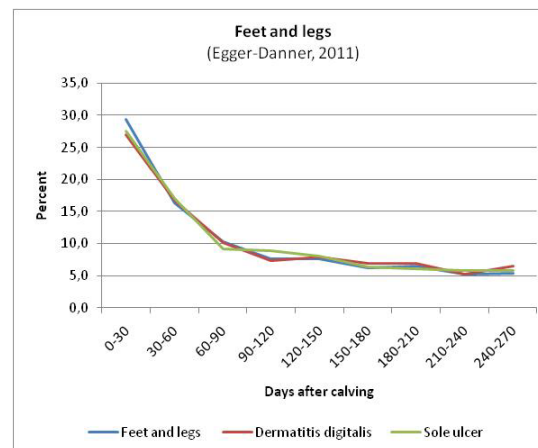
Schwarzenbacher et al. 2010

Metabolic disorders
(Appuhamy et al. 2009)



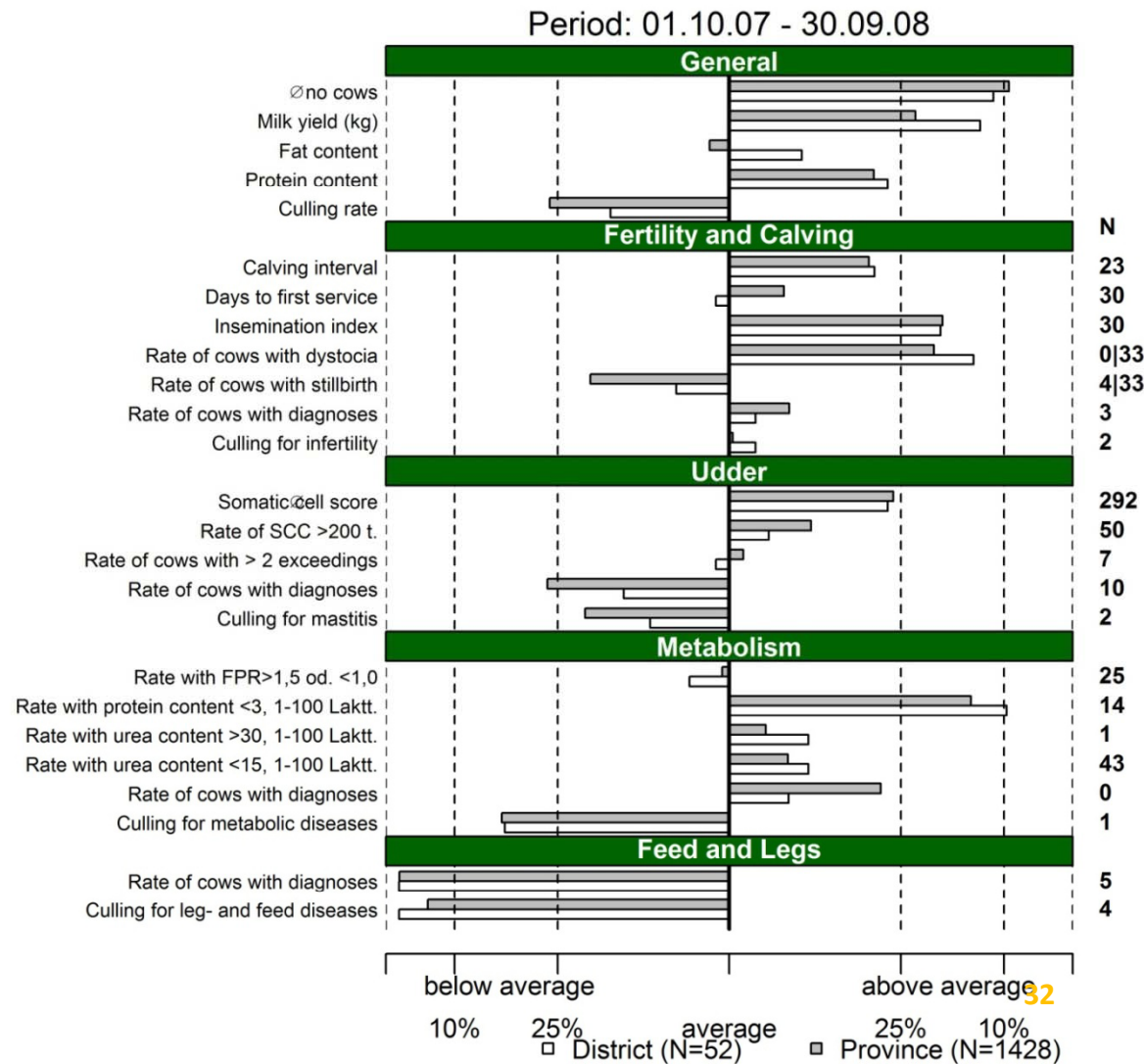
OCCURANCE OF FEET AND LEG PROBLEMS

- Feet and leg problems occur during the whole lactation.
- Diagnoses related with metabolic disorders mainly at the beginning of the lactation.
- For comprehensive information about feet and legs – information from claw trimmers needed!
- Veterinarian diagnoses cover only severe cases.



UTILIZATION OF INCIDENCE DATA (SCHWARZENBACHER ET AL. 2010)

Visual Health Reports



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