



ICAR 2013 Health Data Conference, Aarhus / DK (May 31, 2013)

# Standardization of health data

## – ICAR guidelines including health key

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# Background

- worldwide increased interest in animal health and welfare in the livestock sector
- recent survey: remarkable R&D activities to consider health traits in future breeding programs \*
  - (projected) systems for health data collection in many countries
  - few countries with settled routines for work with disease information
- new traits for targeted improvement of dairy health
  - appropriate quality
  - sufficient quantity
- standardization & harmonization of phenotype data collection as basis of reliable genetic and genomic evaluations

\* ICAR 2012: Survey on the recording and use of functional traits in dairy cattle management and breeding

# Functional traits WG

ICAR working group on "recording, evaluation and genetic improvement of functional traits in dairy cattle" (FTWG; ICAR 2000)

- supply member organizations of ICAR with recommendations (standards and guidelines) on recording schemes, evaluation procedures and genetic improvement schemes for functional traits
  - portfolio of recommendation sheets on recording, evaluation and genetic improvement for functional traits in dairy cattle
- broader view: functional traits in cattle, i.e. dairy + beef



# Health guidelines

- focus of work of FTWG in 2010/2011: health traits  
 → **ICAR guidelines for Recording, Evaluation and Genetic Improvement of Health Traits** (approved in 2012)
- starting point
  - existing health data recording systems with different approaches  
 → heterogeneity of recording schemes (broad range of number of traits with 1 to > 900 documentation options)
  - worldwide distributed experience with little exchange, sparse interdisciplinary collaboration

**Who is documenting?** → veterinarians, farmers, staff of performance recording agencies, claw trimmers, ...

**What is documented in which context?** → veterinary diagnoses (reasons for drug use), disease observations during routine work on farm, ...

**Specific challenges of the recording approach** → legal framework (obligatory vs. facultative documentation),  
 motivation / personal interests of thorough documentation, ...

# Outline of guidelines (I)

- best practices for working with health data (standardized recording, data processing and analyses)
- basics
  - definition of data types
    - indirect health data (health indicators correlated with health/disease like *somatic cell score*) and
    - direct health data (disease diagnoses or observations of disease like *sole ulcer*, clinical signs / findings indicative of disease like *lameness*)
  - sources of data
    - veterinarians
    - producers / farmers
    - expert groups (e.g. claw trimmers)
    - others

# Outline of guidelines (II)

- data security
- standardized recording of direct health data
- data quality
- use of data
- ...

# Data security

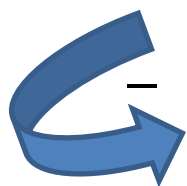
- central role of health in the context of animal welfare and consumer protection
  - obligation (farmers, veterinarians) to maintain high-quality records on animal health
  - ⇒ particular sensitivity of health data
- legal framework for working with health data
  - national requirements & data privacy standards
  - type of information to be stored in the health database
  - data ownership & authority to permit transfer and use of data
  - institutions authorized to administer database & analyze data
  - access rights of (original) data & results from data analyses

trust → acceptance & support of the health monitoring system



# Recording of direct health data

- in connection with obligatory base information, i.e. animal-ID, date and place/herd, data source: type of health incident (standardized code for recording)
- requirements for reference health key:
  - clear trait definitions
  - compatibility with existing recording systems
  - broad usability across user groups



- hierarchical structure
- comprehensive



# Health key: structure (I)

- multiple levels of detail: category / disease group (N=9)  
 → sub-category → individual items with low to high specificity

**TAB. 1: CATEGORIES / DISEASE GROUPS**

Code	Technical term	No. of items
1.	Organ diseases	539
2.	Reproduction disorders in females	116
3.	Reproduction disorders in males	44
4.	Infectious disease and other microbe-related diseases *	103
5.	Parasitoses (parasite infestations)	42
6.	Metabolic diseases and deficiencies	73
7.	Poisoning	35
8.	Behavioral disorders and general findings	14
9.	Health-related information not representing diagnoses	45

\* except local infections of udder and caws

# Health key: structure (II)

- multiple levels of detail: category / disease group (N=9)  
 → sub-category → individual items with low to high specificity

**TAB. 2: SELECTED CATEGORIES / DISEASE GROUPS & SUBCATEGORIES**

Code	Technical term	No. of items	Code	Technical term	No. of items
<b>1.</b>	Organ diseases	539	<b>2.</b>	Reproduction disorders in females	116
<b>1.01.</b>	Diseases of skin, subcutis and coat	27	<b>2.01.</b>	Diseases of the female reproductive system	23
<b>1.02.</b>	Diseases of the trunk	22	<b>2.02.</b>	Pregnancy disorders	17
<b>1.03.</b>	Horn diseases	11	<b>2.03.</b>	Diseases related to calving	24
<b>1.04.</b>	Diseases of the lymphoid system	8	<b>2.04.</b>	Disorders in the postpartal period	16
<b>1.05.</b>	Diseases of the cardiovascular system	49	<b>2.05.</b>	Female infertility	30
<b>1.06.</b>	Diseases of the respiratory tract	46			
<b>1.07.</b>	Diseases of the digestive tract	108			
<b>1.08.</b>	Diseases of the urinary tract	23			
<b>1.09.</b>	Diseases of the locomotory apparatus	63			
<b>1.10.</b>	Claw diseases	56			
<b>1.11.</b>	Diseases of the central nervous system and the sensory organs	40			
<b>1.12.</b>	Diseases of the udder (other than mastitis)	37			
<b>1.13.</b>	Mastitis (inflammation of the mammary gland)	36			

# Health key: structure (III)

- multiple levels of detail: category / disease group (N=9)  
 → sub-category → individual items with low to high specificity

**Case 1: comatose cow with severe milk fever**

**TAB. 3: EXAMPLES FOR INDIVIDUAL ITEMS**

Code	Technical term
6.03.	Disturbances of mineral balance
6.03.01.	Disturbances of calcium and phosphorus balance
6.03.01.01.	Parturient paresis (milk fever)
6.03.01.01.01.	Typical parturient paresis / Stages 1 and 2 of parturient paresis
6.03.01.01.02.	Parturient coma / Stage 3 of parturient paresis
6.03.01.01.03.	Atypical parturient paresis
6.03.01.01.04.	Downer cow syndrome
6.03.01.01.05.	Lactation paresis
6.03.01.02.	Osteopathies (bone diseases) due to disturbances of calcium and phosphorus balance
6.03.02.	Disturbances of magnesium balance
6.03.03.	Disturbances of sodium balance
6.03.04.	Disturbances of chloride balance
6.03.05.	Disturbances of sulfur balance
6.03.06.	Disturbances of potassium balance
6.03.99.	Other disturbances of mineral balance

Code	Technical term
2.05.	Female infertility
2.05.00.	Control of oestrus cycle with no abnormality detected
2.05.01.	Uterine infertility
2.05.02.	Ovarial infertility
2.05.02.01.	Disturbance of the ovarian reproductive cycle
2.05.02.02.	Nymphomania
2.05.02.03.	Virilism
2.05.02.04.	Ovarial cysts
2.05.02.04.01.	Follicular cystic ovary disease
2.05.02.04.02.	Luteal cystic ovary disease
2.05.02.04.03.	Cystic ovarian degeneration
2.05.02.05.	Corpus luteum persistens (persisting corpus luteum)
2.05.02.06.	Atrophy of the ovaries
2.05.02.07.	Dystrophy of the ovaries
2.05.03.	Examination due to infertility
2.05.04.	Treatment due to infertility
2.99.	Other disturbances of female fertility

# Health key: structure (III)

- multiple levels of detail: category / disease group (N=9)  
 → sub-category → individual items with low to high specificity

## Case 2: cyst detection at infertility-related cycle control

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6.03.01.01.01.	Typical parturient paresis / Stages 1 and 2 of parturient paresis
6.03.01.01.02.	Parturient coma / Stage 3 of parturient paresis
6.03.01.01.03.	Atypical parturient paresis
6.03.01.01.04.	Downer cow syndrome
6.03.01.01.05.	Lactation paresis
6.03.01.02.	Osteopathies (bone diseases) due to disturbances of calcium and phosphorus balance
6.03.02.	Disturbances of magnesium balance
6.03.03.	Disturbances of sodium balance
6.03.04.	Disturbances of chloride balance
6.03.05.	Disturbances of sulfur balance
6.03.06.	Disturbances of potassium balance
6.03.99.	Other disturbances of mineral balance

Code	Technical term
2.05.	Female infertility
2.05.00.	Control of oestrus cycle with no abnormality detected
2.05.01.	Uterine infertility
2.05.02.	Ovarial infertility
2.05.02.01.	Disturbance of the ovarian reproductive cycle
2.05.02.02.	Nymphomania
2.05.02.03.	Virilism
2.05.02.04.	Ovarial cysts
2.05.02.04.01.	Follicular cystic ovary disease
2.05.02.04.02.	Luteal cystic ovary disease
2.05.02.04.03.	Cystic ovarian degeneration
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2.05.04.	Treatment due to infertility
2.99.	Other disturbances of female fertility

# Health key: structure (IV)

- multiple levels of detail: category / disease group (N=9)  
→ sub-category → individual items with low to high specificity
- user-dependent implementation
  - manageable subset of 'simple' diagnoses for farmers
  - specific subset of diagnoses for expert groups (claw diseases for claw trimmers, metabolic diseases for nutritionists, ...)
  - (possibly) comprehensive set of diagnoses for veterinarians
- user-friendly implementation  
minimizing the risk of confusion and recording errors caused by too many input options presented at a time ('multiple-level strategy')

hierarchical → flexible & user-friendly implementation

# Health key: content

- broad spectrum of cattle diagnoses
  - all organ systems
  - all types of diseases (inherited disorders, malformations, tumors, injuries, inflammations, degenerative changes, ...)
- (some) additional health-related information
  - few clinical signs / findings (e.g. lameness, fever)
  - relevant measures (biotechnical measures like estrus induction, prophylactic measures like vaccination or drying-off)

comprehensive → compatible with existing keys (general reference)

# Health key: use

- superiority of integrative systems of health monitoring \*  
→ common and favorable course of development from single- to multiple-source systems with diversified infrastructure
- increasing need to combine health data from different sources
  - national (information from veterinarians, claw trimmers, farmers, ...)
  - international (share of phenotype information for genomic evaluations)→ comprehensive key as universal reference

\* ICAR 2012: Survey on the recording and use of functional traits in dairy cattle management and breeding





## EXAMPLE

### Joint use of data / Cross referencing

Wolff, 2012. Validation of the Nordic disease recording systems for dairy cattle with special reference to clinical mastitis. Doctoral thesis, Uppsala, Sweden.

Table 1. The country-specific diagnostic codes for CM in 2008.

DK	FI	NO	SE
11 Mastitis	301 Acute clinical mastitis	303 Clinical mastitis, severe or moderate	2101 and 2102 Acute mastitis
12 Mastitis during dry period	303 Chronic mastitis	304 Clinical mastitis, mild	2103 Mastitis
14 Mastitis following teat lesion	610 Owners notes: Mastitis during lactation		2104 and 9765 Reoccurring mastitis
15 Acute mastitis			2116 Chronic mastitis
72 Summer mastitis			2117 and 9779 Exacerbating clinical mastitis
94 Toxic mastitis			2147 Teat lesion with mastitis
179 Mastitis with paresis			9764 Acute clinical mastitis
			9766 Mastitis with gangrene
			9767 Mastitis with sepsis
			9769 Chronic clinical mastitis
			9789 Teat lesion with clinical mastitis

Scandinavian  
countries

Norway

Code before 1989	Code after 1989	Disease name
— Diseases of the mammary gland —		
	300	Agalactiae (absence of milk)
10	301	Agalactiae (failure of milk ejection)
52	302	Extirpation of supernumerary teats
08	303	Acute clinical mastitis
50	304	Chronic clinical mastitis
56	305	Subclinical mastitis
06	306	Teat injuries
07		Narrow teat
54		Congenital deficiency
	308	Udder edema
	309	Wound between the udder and thigh
	310	Dry cow therapy
	319	Other diseases

Østeras et al., 2007. Results and Evaluation of Thirty Years of Health Recordings in the Norwegian Dairy Cattle Population. *J. Dairy Sci.* 90: 4483-4497

### ICAR Central Health Key

Code	Technical Term
1.13.	Mastitis (inflammation of the mammary gland)
1.13.01.	Mastitis - descriptive
1.13.01.01.	Disturbance of milk secretion
1.13.01.02.	Mastitis catarrhalis acuta (acute catarrhal mastitis)
1.13.01.03.	Mastitis catarrhalis chronica (chronic catarrhal mastitis)
1.13.01.04.	Mastitis haemorrhagica (hemorrhagic mastitis)
1.13.01.05.	Mastitis necrotica (necrotizing mastitis)
1.13.01.06.	Mastitis apostematosa (purulent mastitis)
1.13.01.07.	Mastitis interstitialis non purulenta (non-purulent interstitial mastitis)
1.13.01.08.	Mastitis granulomatosa (granulomatous mastitis)
1.13.01.09.	Mastitis phlegmonosa / Mastitis acuta gravis (phlegmonous mastitis)
1.13.01.10.	Mastitis catarrhalis subclinica (subclinical mastitis)

# EXAMPLE

## Joint use of data / Cross referencing



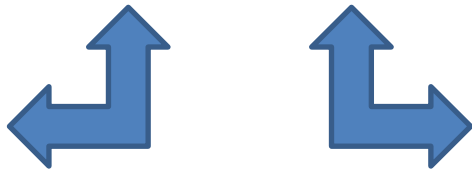
### Standarddiagnoseschlüssel

#### 2. Eutererkrankungen (EU)

- 2.1. Euterabszess
  - 2.2. Euterekzem
  - 2.3. Mastitis nach Ursachen, Erregern (ätiologisch)
    - 2.3.1. Streptokokken
      - 2.3.1.1 Sc. agalactiae (Gelber Galt)
      - 2.3.1.2. Sc. dysgalactiae
      - 2.3.1.3 Sc. uberis
      - 2.3.1.4. Andere Streptokokken
    - 2.3.2. Mikrokokken
      - 2.3.2.1. S. aureus
    - 2.3.2.2. CNS / koagulasenegative Staphylokokken
    - 2.3.2.3. Andere Staphylokokken
  - 2.3.3. Enterobakterien
    - 2.3.3.1. coliforme Keime
    - 2.3.3.2. Klebsiellen
    - 2.3.3.3. Andere Enterobakterien
  - 2.3.4. Andere Bakterien
    - 2.3.4.1. A. pyogenes
    - 2.3.4.2. Mykoplasmen
    - 2.3.4.3. Hefen
    - 2.3.4.4. Prototheken
  - 2.3.5. Sonstige
- 2.4. Mastitis nach Ausbreitung, Umfang (deskriptiv)
  - 2.4.1. Mastitis-chronisch
  - 2.4.2. Mastitis-akut
  - 2.4.3. Mastitis-phlegmonosa
  - 2.4.4. Mastitis-apostematosa
  - 2.4.5. Mastitis-gangraenosa
  - 2.4.6. Mastitis granulomatosa
  - 2.4.7. Mastitis subklinisch

Northern Germany

Code	Technical Term
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1.13.01.06.	Mastitis apostematosa (purulent mastitis)
1.13.01.07.	Mastitis interstitialis non purulenta (non-purulent interstitial mastitis)
1.13.01.08.	Mastitis granulomatosa (granulomatous mastitis)
1.13.01.09.	Mastitis phlegmonosa / Mastitis acuta gravis (phlegmonous mastitis)
1.13.01.10.	Mastitis catarrhalis subclinica (subclinical mastitis)



Item
Diagnosis
Reproductive disorder
Metritis (MET)
Anoestrus (ESTR)
Cystic ovaries (CYST)
Retained placenta (RP)
Puerperal disorder (PUERP)
Udder disorder
Acute mastitis (AcM)
Chronic mastitis (CrM)
Digestive disorder
Milk fever (MF)
Ketosis (KET)
Hoof and claw disorder
Panaritium/dermatitis digitalis (PAN/DD)
Hoof ulcer (HU)
Other

Egger-Danner et al., 2012. Recording of direct health traits in Austria – Experience report with emphasis on aspects of availability for breeding purposes. J. Dairy Sci. 95: 2765-2777.

PRO GESUND Januar 2013	
2 Eutererkrankungen	
21	Euterekzem, Euterabszß, Euterschenkelekzem
22	Mastitis – chronisch (Mastitis catarrhalis chronica)
23	Mastitis – akut (Mastitis catarrhalis acuta)
24	Mastitis phlegmonosa (Colimastitis)
26	Mastitis – subklinisch
27	Zitzenverletzungen und Euterverletzungen
283	Zitzenstenose
29	Sonstige
291	Euterhämatom
292	Blutmelken
293	Euterödem
294	Papillomatose (Euterwarzen)

Austria + Southern Germany

21	Euterabszess
22	Mastitis-chronisch
23	Mastitis-akut
24	Mastitis-phlegmonosa (Colimastitis)
25	Mastitis-apostematosa (Pyogenes-Keime)
26	Mastitis-subklinisch
27	Zitzen-/Euterverletzungen
28	Melkbarkeitstörungen- Schwer-, Langmelker
29	Sonstige (Euterkrankheiten)

# Prospects

- ICAR health guidelines as up-to-date international standard
  - importance of health traits in dairy cattle
  - internationality of dairy breeding
- international & interdisciplinary health data conference as opportunity for more targeted improvement of dairy health
  - exchange of experiences
  - basis for intensified collaboration



- harmonization & broadening of routine health monitoring
- improved selection for healthy and durable cows
- future conferences / workshops on special topics







# EXAMPLE

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Northern Germany

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1.13.01.10.	Mastitis catarrhalis subclinica (subclinical mastitis)

- Mastitis catarrhalis acuta
- Mastitis catarrhalis subacuta
- Mastitis parenchymatosa acuta
- Mastitis parenchymatosa subacuta
- Mastitis catarrhalis chronica
- Mastitis parenchymatosa chronica
- Mastitis apostematosa
- Mastitis subclinica
- Sekretionsstörung
- Erkrankung der Euter- und Zitzenhaut
- infektiös bedingte Erkrankung der Euter- und Zitzenhaut
- Virusinfektion der Euter- und Zitzenhaut
- Euterpocken
- bovine Herpesvirus-Mammilitis
- Papillomatose



Januar 2013




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294	Papillomatose (Euterwarzen)



Austria + Southern Germany



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27	Zitzen-/Euterverletzungen
28	Melkbarkeitstörungen-Schwer-, Langmelker
29	Sonstige (Euterkrankheiten)