Added value of data integration to reduce the use of antimicrobials on dairy farms

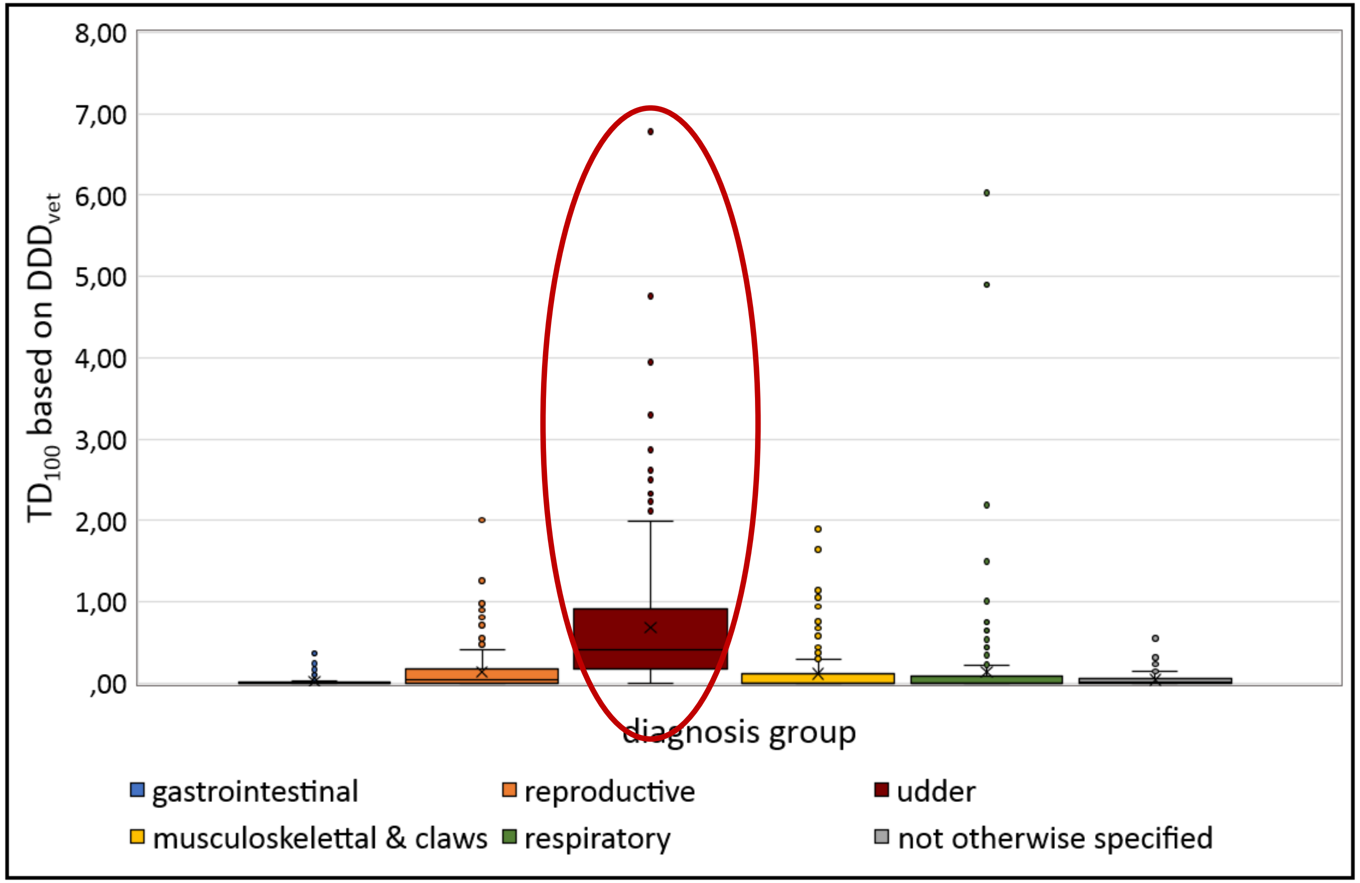
C. Firth[1], C. Egger-Danner[2], K. Fuchs[3], M. Suntinger[1], A. Käsbohrer[1], T. Wittek[4], B. Fuerst-Waltl[5], Walter Obritzhauser[1]

[1]Institute of Food Safety, Food Technology and Veterinary Public Health, University of Veterinary Medicine, 1210 Vienna, Austria
[2]ZuchtData EDV-Dienstleistungen GmbH, 1200 Vienna, Austria
[3]Data, Statistics and Risk Assessment, Austrian Agency for Health and Food Safety (AGES), 8010 Graz, Austria
[4]University Clinic for Ruminants, University of Veterinary Medicine Vienna, 1210 Vienna, Austria
[5]Department of Sustainable Agricultural Systems, University of Natural Resources and Life Sciences, 1180 Vienna, Austria

Background

- Animal health, welfare and food safety (antimicrobial resistance,…) of increasing concern
- Improvement of udder health important measure
  - genetics, herd management, targeted treatment,…
- Various data sources of importance
  - somatic cell count, diagnoses, treatment data,…
- Bacteriological milk samples (pathogens)
  - pathogen-specific treatments
  - relevant in the context of prudent use of antimicrobials
- Linkage of data and advanced technologies offer new possibilities

Use of antimicrobials in dairy cows in Austria



Observational study
Firth et al. 2018

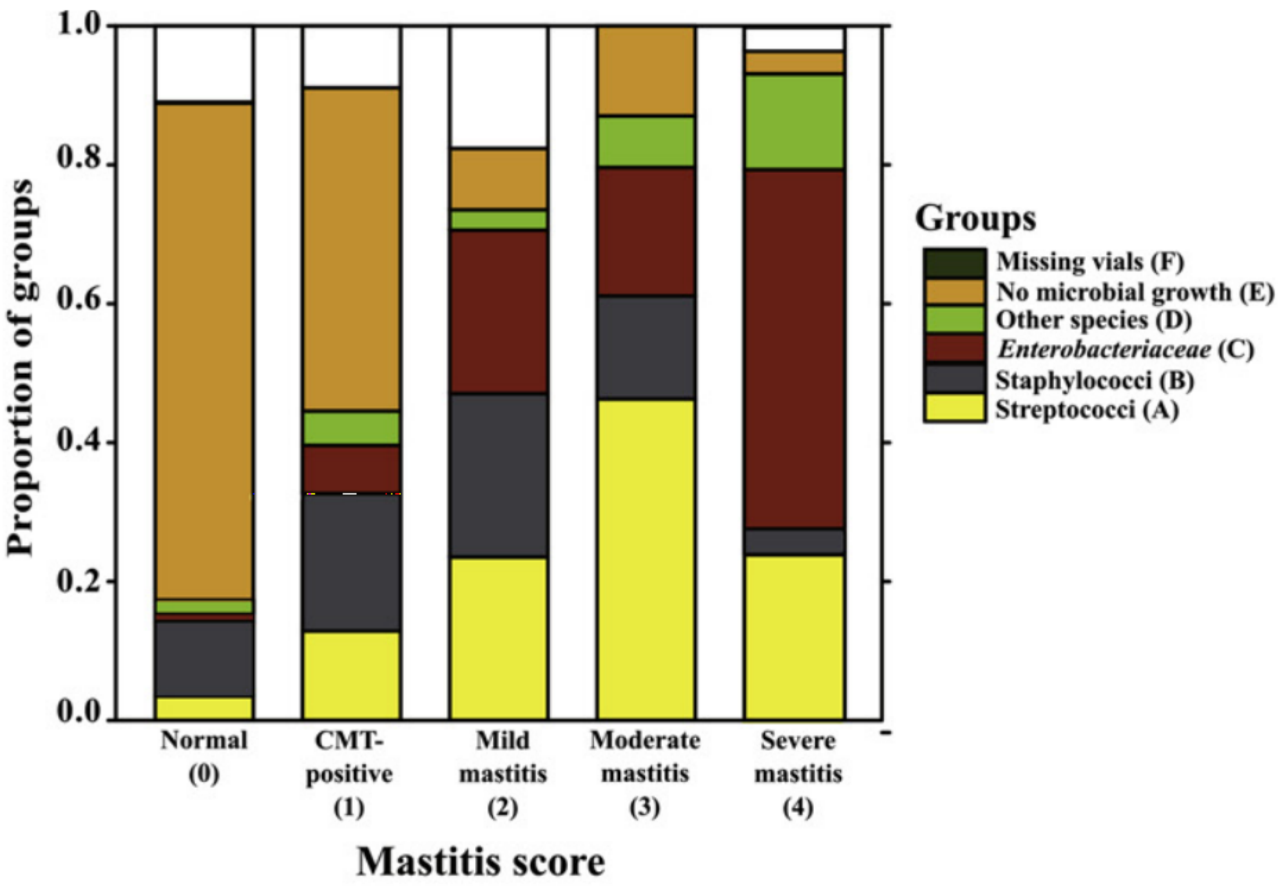
Dataset:
249 farms
17 veterinarians
6,700 cows and 16,000+cattle
7,867 antimicrobial treatments

Observation period:
Oct 2015-Sep 2016

Low level but potential especially concerning udder health!
Dry-Off strategies potential for reduction!

Bacteriological milk analyses

Distribution of pathogen groups stratified by mastitis score



Resistance testing done (Schabauer et al. 2018):

55% of Enterobacteriacae isolates restistant to least one antibiotic agent

Benzylpenicillin and tetracycline most common resistance in Staph. aureus (14% and 11% resistant isolates).

Schabauer et al., Veterinary Microbiology 227 (2018): The relationship between clinical signs and microbiological species, spa type, and antimicrobial resistance in bovine mastitis cases in Austria.

Various data sources

More detailed information
(deep phenotype)

Environment

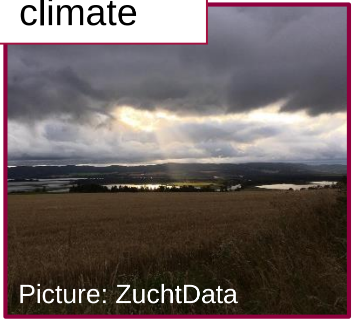
Farm

Animal

Udder quarter

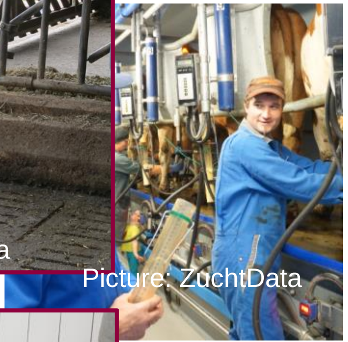

Picture: Pessl Instruments

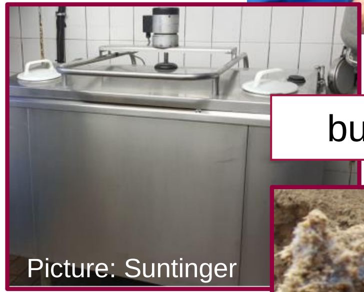
risk factors


Picture: ZuchtData

climate


Picture: ZuchtData


Picture: ZuchtData

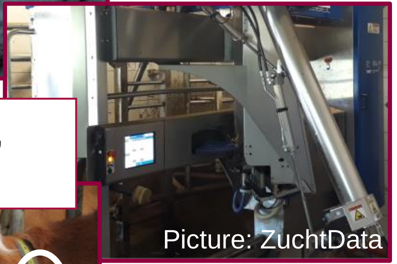

Picture: Suntinger

bulk milk

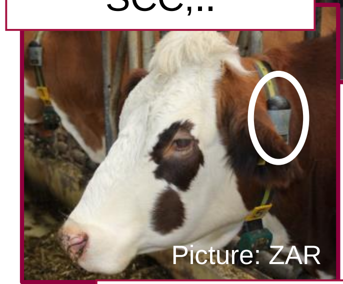

Picture: Biomin


Picture: ADDA

acute mastitis


Picture: ZuchtData

milk yield,
SCC,..


Picture: ZAR

conductivity, rumination,
activity, ph-value,.


Picture: ZAR


Picture: Priewasser

SCC


Picture: Obritzhauser

pathogen

resistance

treatment


Picture: ZAR

Data integration is important for farmers and vet

(Survey: participation – farmer: LW 19.1%, vets 20.8%)

Importance of integration of data into one platform:

% very important and important

	Farmer	Veterinarian
Bacteriological milk sample	81	87
Bulk milk samples	78	70
Diagnoses and treatment data	73/72	72
Disease status	72	83
Findings from labs	63	88-89
Services of performance recording	-	79
Results of feed analyses	-	78

Perner et al. 2016; Weissensteiner et al. 2018

80 % of the farmers want integrated communication of systems on farm

Current status of data integration in central cattle database in Austria

- Veterinary diagnoses integrated in herd management and genetics
- Bacteriological findings (p… …n information)
- Medical treatment based on anim… …iagnoses level

  → Extended health reports for farmers and veterinarians

Standardisation!

Data protection issues

Compliance with legal aspects

OBER-ÖSTERREICHISCHER tgd

vet Österreichische Tierärztekammer

Gesundheitsdienst für Nutztiere für Kärnten

ZAR RINDERZUCHT AUSTRIA

ZuchtData EDV-DIENSTLEISTUNGEN GMBH

Tiroler T-TGD Tiergesundheitsdienst

RDV GmbH Rinder Daten Verbund

Qualitätslabor Niederösterreich

TGD Verein Steirischer Tiergesundheitsdienst

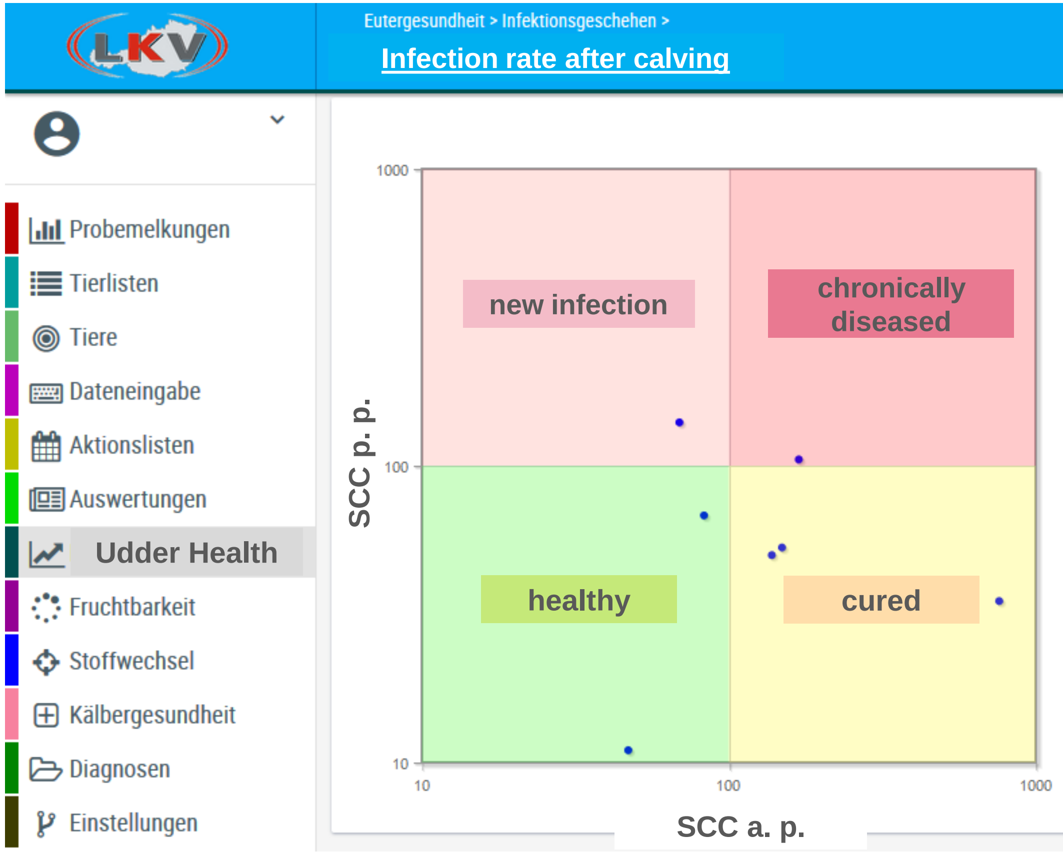
tgd NÖ TIERGESUNDHEITSDIENST

TIERGESUNDHEITSDIENST TGD Salzburg

LKV AUSTRIA

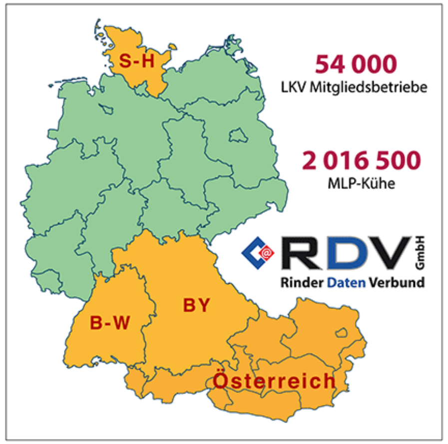
Detailed herd management reports

e.g. new udder infection rate after calving (RDV, LKV-Austria)



Statistik			
Quadrant	Anzahl Kühe	% Kühe	% Ziel
Euter gesund	3	37,5	> 65
geheilt	3	75	>25
Neuinfektion	1	25	< 15
chronisch krank	1	12,5	< 5

Example from
“LKV-herd manager”



Example for data integration

Results of bacteriological milk samples in herd management tool

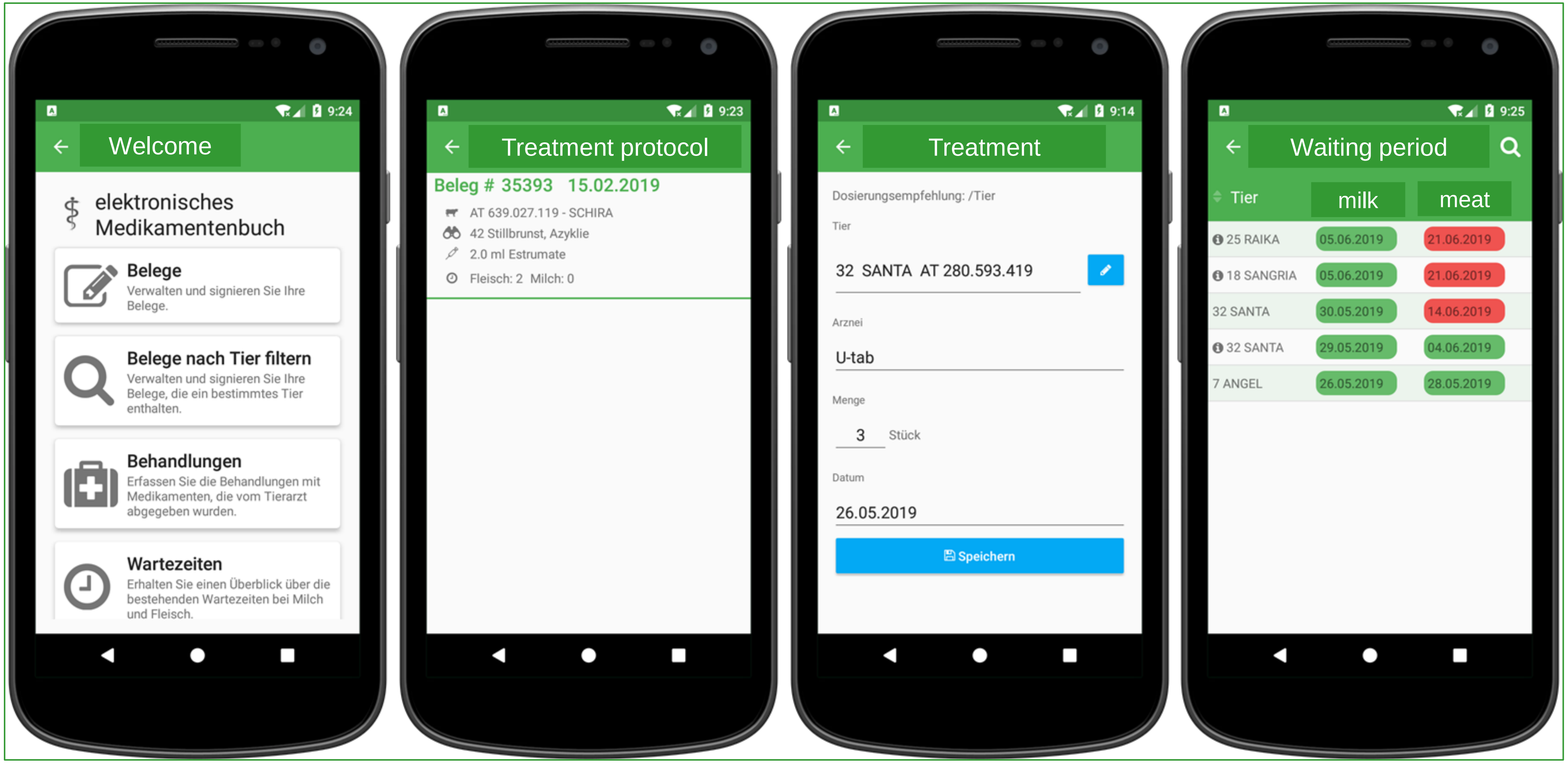
(Project ADDA 2014-2017)

Picture: Suntinger

- Standards of analyses in lab and definition of findings harmonised (guideline developed)√
- Data protection issues investigated and solved √
- Development of analyses and benchmarks for herd management tools (Suntinger et al. 2019; Obritzhauser et al. 2019) √

Mobile documentation of treatment data (EMED)

D4Dairy



Calculation of treatment days per farm

Calculation of the number of treatment days over 365 production days per farm (*#TD365*):

$$\#TD365 = \sum_{i=1}^{n} \frac{amount\ AS_i\ in\ period\ P\ (mg)}{DDDvet_i\ (mg/kg/day)\ x\ \#production\ days\ in\ period\ P\ (days) \times standardised\ weight\ (kg)}\ x\ 365$$

 # TD365 = number of treatment days per year that an animal is present on the farm

amount AS_i = amount (in mg) of active substance i used in period P; i = 1, 2, …, n

$DDDvet_i$ = Defined Daily Dose of active substance i (in mg/kg/day); i = 1, 2, …, n (EMA 2016)

 # production days in period P = number of animals present daily during period P (in days)

standardised weight = standard animal weight at treatment (in kg)

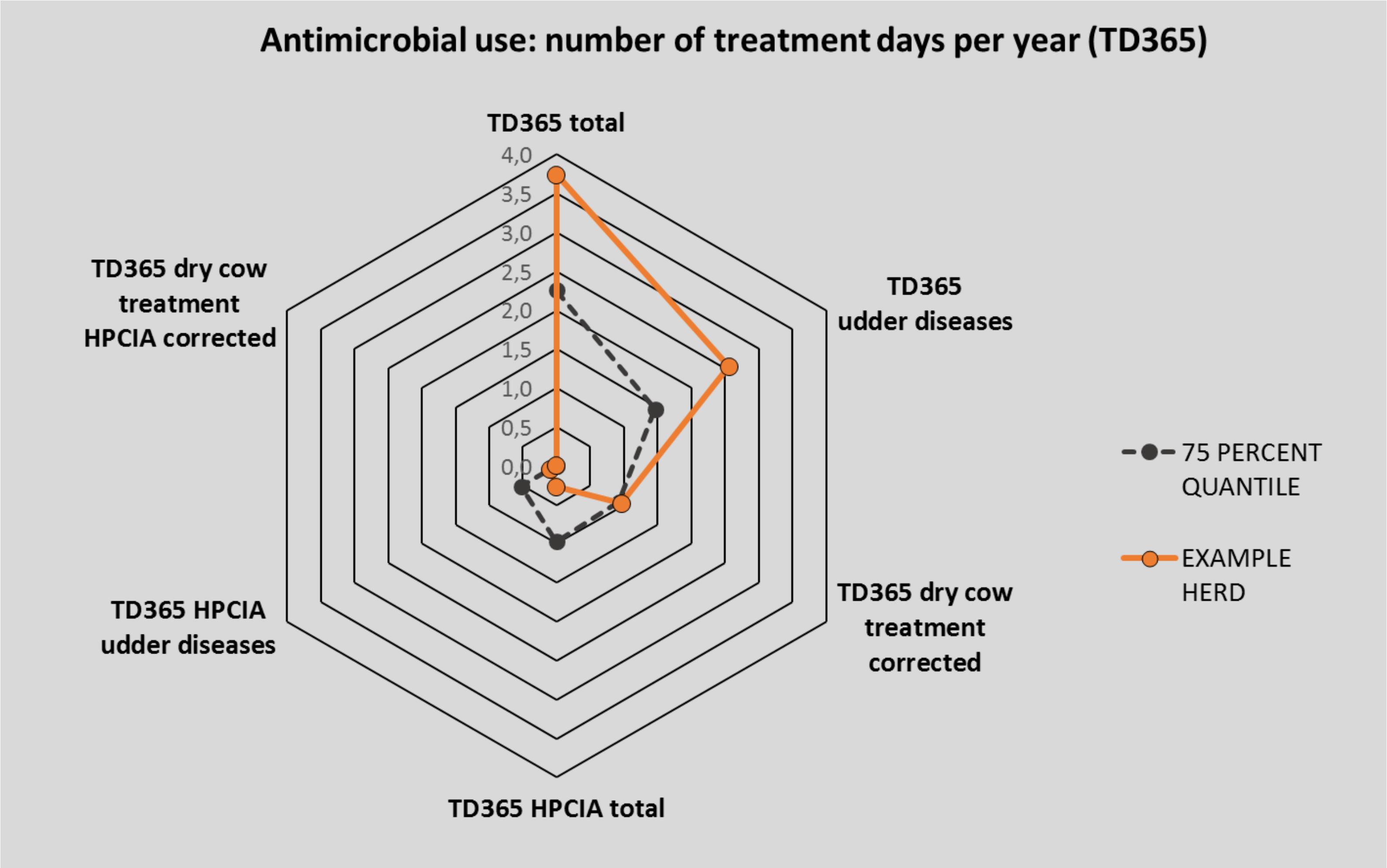
Correction #TD365 for dry cow treatment:

$$\#TD365\ dry\ cow\ treatment\ corrected = \#TD365\ dry\ cow\ treatment * (CI/365 * (100/100 - PR))$$

CI = calving interval of the herd (days)

PR = percentage of cows replaced

Herd specific antimicrobial use (EMED)



Next steps - current research topics within D4Dairy

- Further **data communication and integration** – focus on automation (milking systems, sensor and feeding systems)
- Analyses of risk factors and network for occurrence of mastitis
- Mid-Infra-red spectra for mastitis prediction
- **Harmonisation of antimicrobial resistance testing**
- **Elaboration of strategy for targeted dry-off (pilot study)**
- **Decision support tool** for dry-off strategy

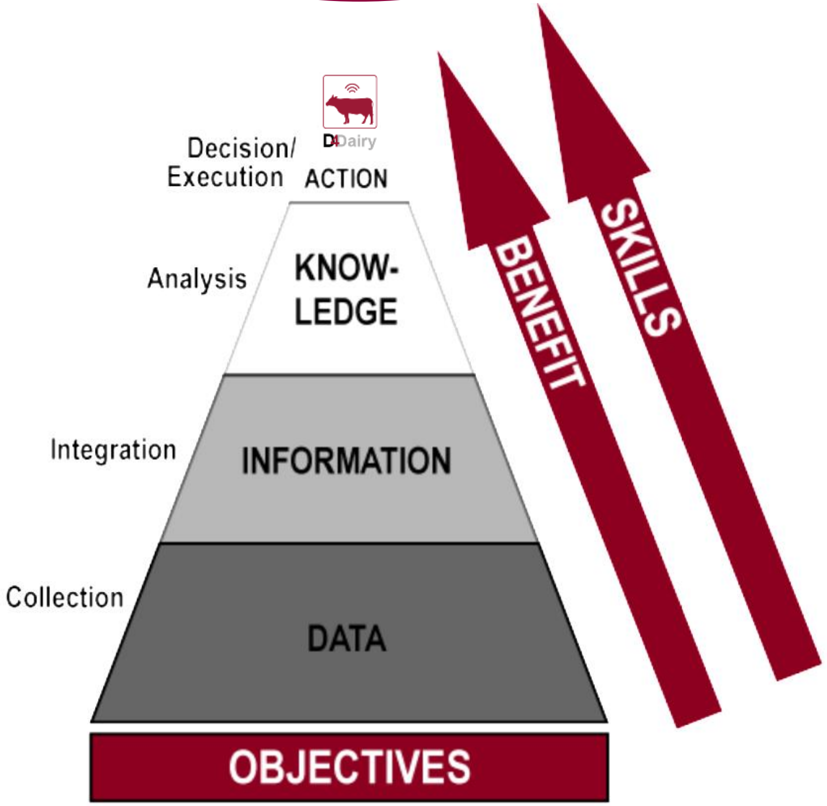
D4Dairy should achieve…

Decision support for improvement of udder health e.g. targeted treatment, dry-off strategy

- better decision support tools by …
  - collection
  - integration
  - analysis
  - …

Improved value and benefit

less mastitis,
less use of
antibiotics

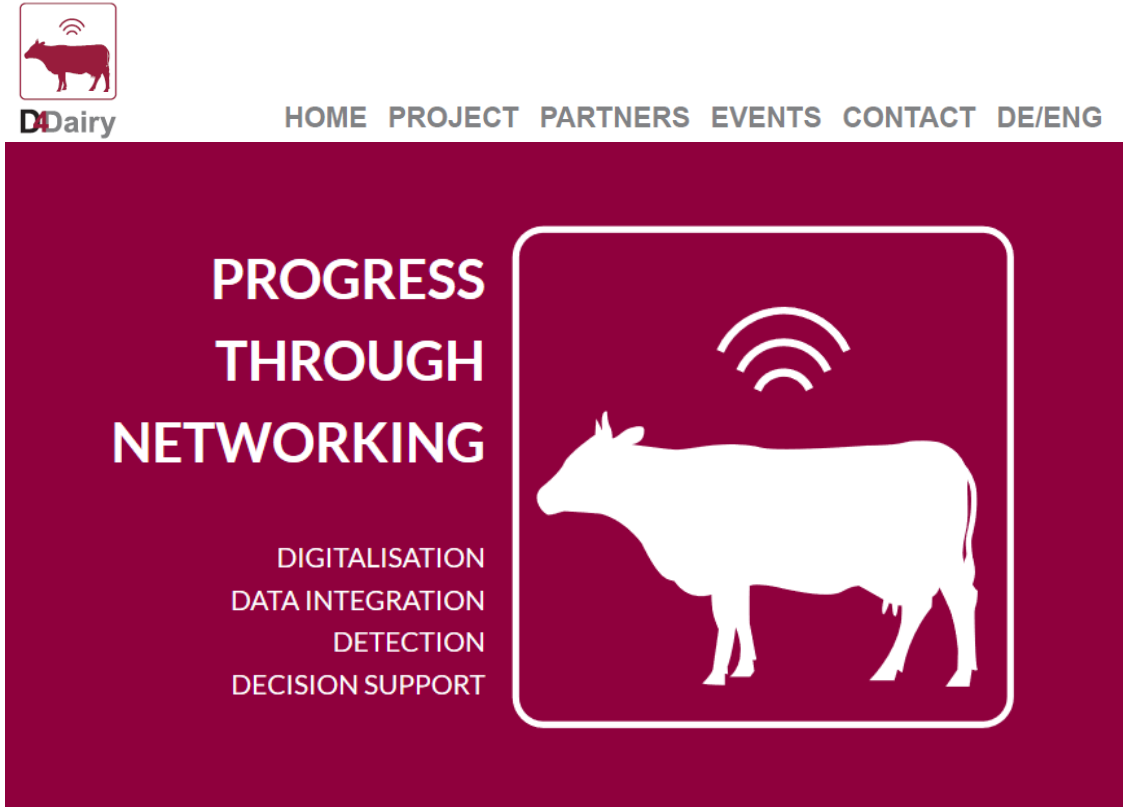


Acknowledgement

Many thanks to farmers, veterinarians and colleagues from the respective project partners within **ADDA**, within the project **Electronic herdbook** and the partners from project **Promoting Action to a reduced Antimicrobial Resistance (P1.3.1/P1.3.2)** within D4Dairy

This work was conducted within the **COMET-Projects ADDA, D4Dairy** (Digitalisation, Data integration, Detection and Decision support in Dairying) and the project **Electronic herdbook**. That is supported by BMVIT, BMDW and the provinces of Lower Austria and Vienna in the framework of COMET-Competence Centers for Excellent Technologies. The COMET program is handled by the FFG.

D4Dairy – Digitalisation, Data integration, Detection and Decision support in Dairying



Duration: 10/2018 – 09/2022

www.d4dairy.com

Research Partners

Company Partners

Cooperation partners for specific topics:

Thank you for your attention

Antimicrobial use in dairy herds – results of the observational study (Firth et al. 2018)

	MIN	25 PERCENT QUANTILE	MEAN	MEDIAN	75 PERCENT QUANTILE	MAX
TD_{365} total	0.00	0.58	1.69	1.20	2.26	10.70
TD_{365} udder diseases	0.00	0.25	1.10	0.65	1.46	10.01
TD_{365} dry cow treatment corrected	0.00	0.25	0.61	0.55	0.93	2.14
TD_{365} HPCIA total	0.00	0.15	0.78	0.39	0.98	9.81
TD_{365} HPCIA udder diseases	0.00	0.00	0.51	0.18	0.53	9.55
TD_{365} HPCIA dry cow treatment corrected	0.00	0.00	0.03	0.00	0.00	0.68

Bacteriological milk analyses

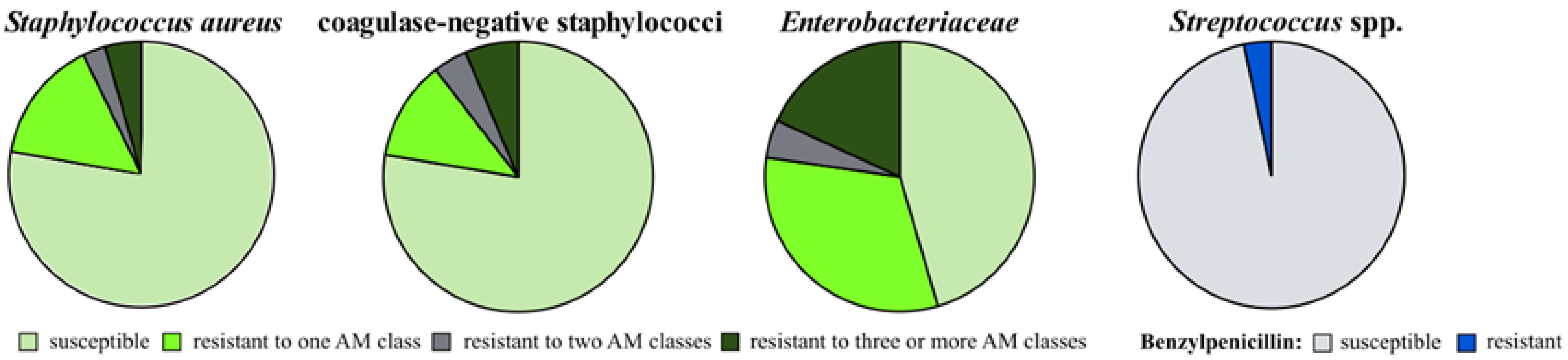
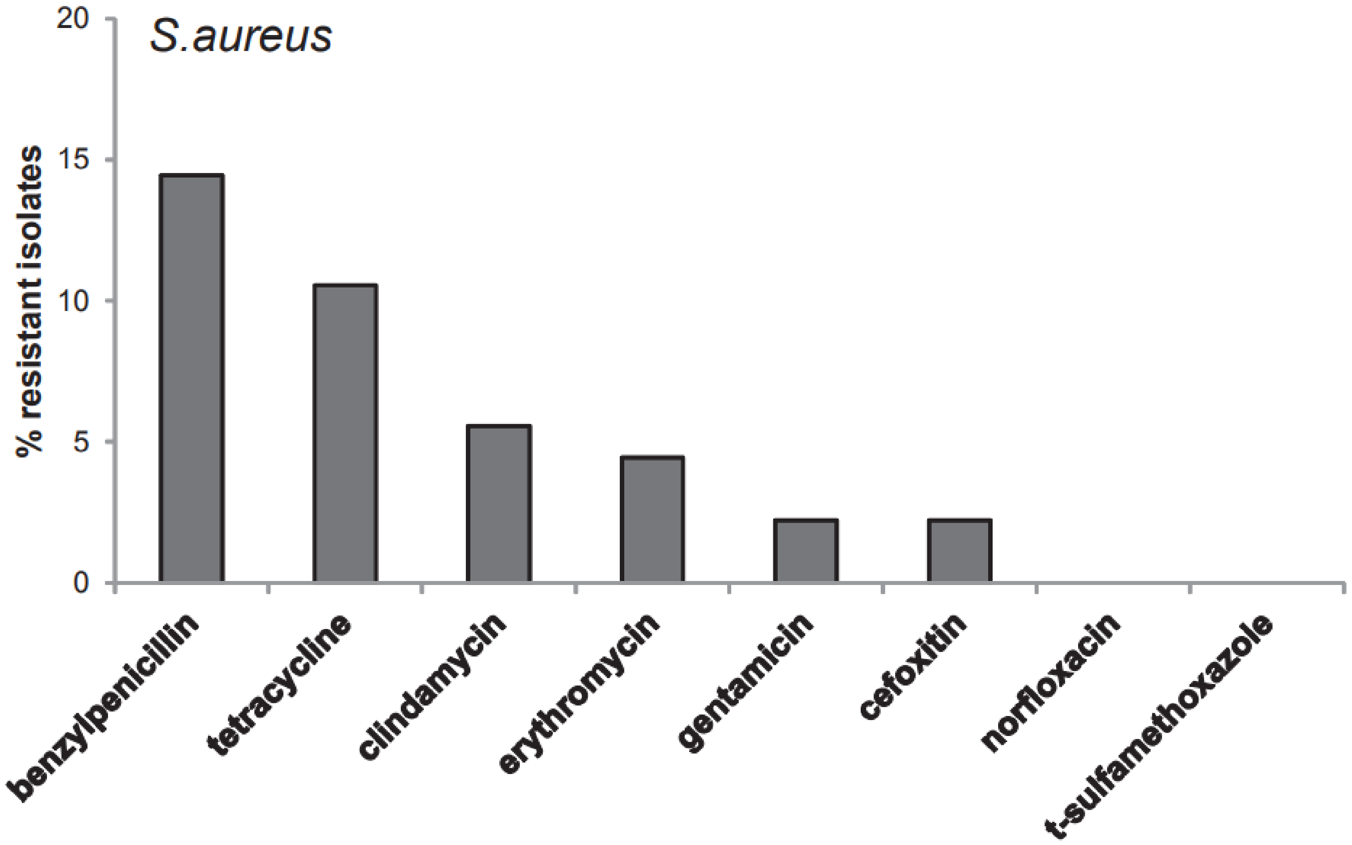


Figure 2. Antimicrobial susceptibility (distribution of isolates) in *Staphylococcus aureus* (n = 180), coagulase-negative staphylococci (n = 219) and *Enterobacteriaceae* (n = 132) and *Streptococcus* spp. (n = 241) isolates. AM class = antimicrobial class. N.B. that for streptococci isolates (group B) only susceptibility to benzylpenicillin was determined.

Schabauer et al., 2018

Bacteriological milk analyses

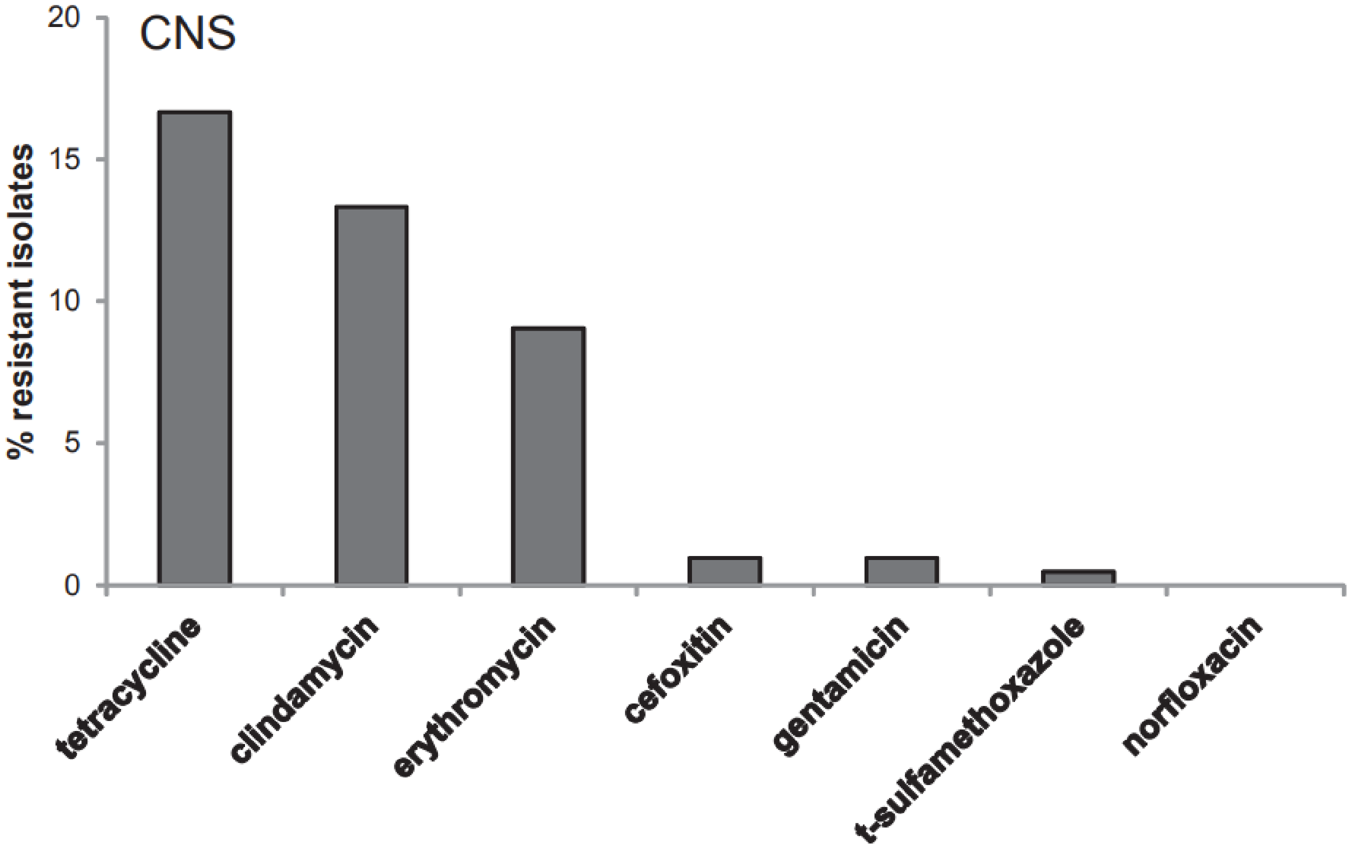
Antimicrobial resistance (%) of *S. aureus* (n = 180) to the particular antimicrobial reagents.



Schabauer et al., Veterinary Microbiology 227 (2018)

Bacteriological milk analyses

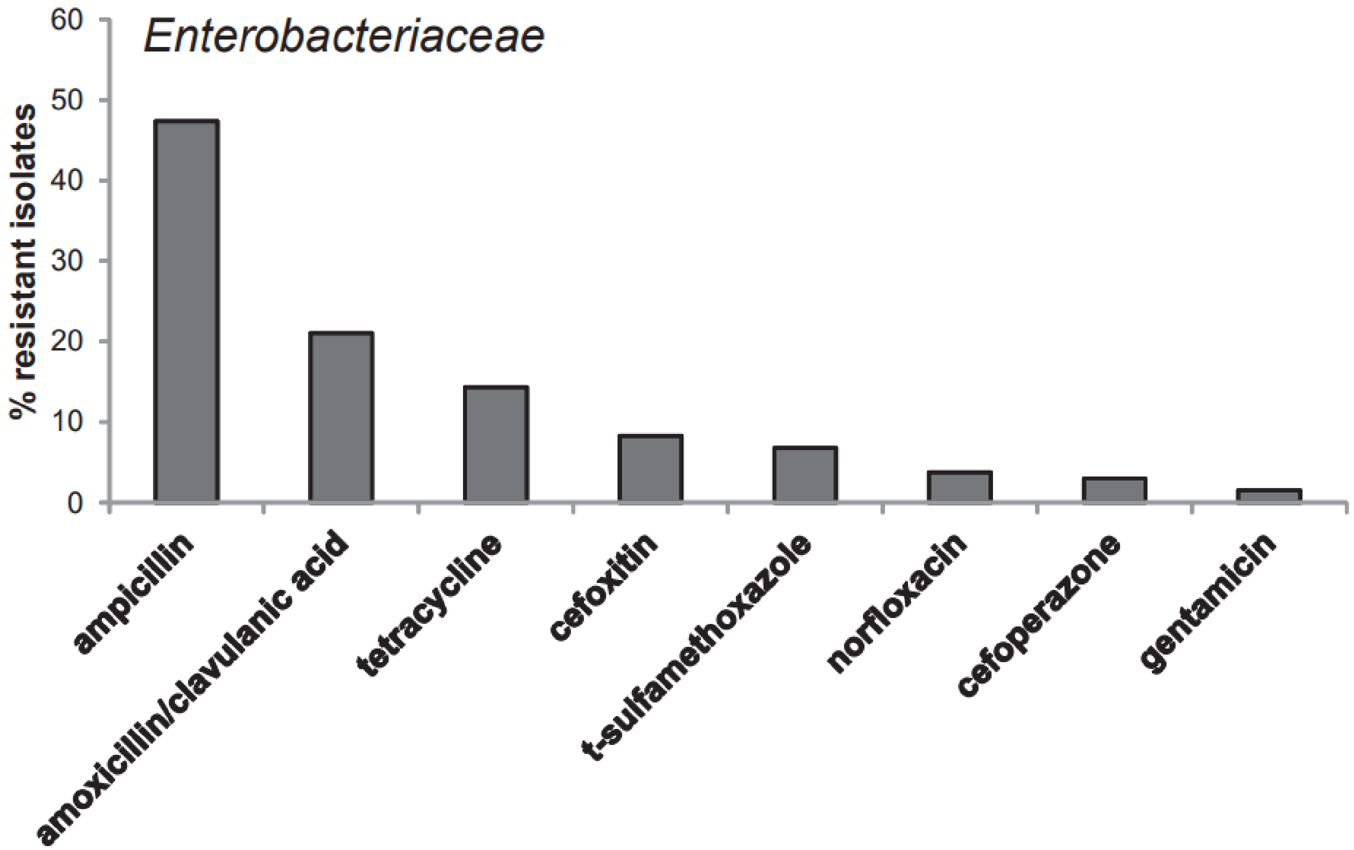
Antimicrobial resistance (%) of coagulase-negative staphylococci (n = 219) to the particular antimicrobial reagents.



Schabauer et al., Veterinary Microbiology 227 (2018)

Bacteriological milk analyses

Antimicrobial resistance (%) of *Enterobacteriaceae* isolates (n = 133) to the particular antimicrobial reagents.



Schabauer et al., Veterinary Microbiology 227 (2018)