Antibiotics and resistance in Dairy Cattle

Senior Specialist DVM / MBA Michael Farre

Seges Livestock Innovation

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Agenda

- Danish milk production
- Historic perspective in handling antibiotics
- Consumption of antibiotics
- Treatment of clinical mastitis and DCT
- Resistance







Key statistic Danish Milk Production*

- 515.000 cows in milk recording (95%)
- Average herd size 210 cows (range 5 3700 cows), 2752 farms shipping milk to about 23 processors
- Average Holstein 11.626 Kg Energy Corrected Milk
- Bulk tank SCC average 199.000

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Management trends

- 25 % of the cows are milked by robots the number are status quo
 - SCC and Bactoscan are higher in AMS / VMS herds
- Labor cost milking about 20 €/hour
- "Keep it simple stupid" less automatization is correlated to herd size
- Foreign labor Central Europe, Ukraine and East Asia
- 3X in about 1/3 of the herds







Danish milkproduction – health status

- Historically we have been eradicating diseases,
 - IBR, BVD, Leukosis e.g.
- Current issues;
 - Salmonella Dublin, Strep. agalactia, (Jones Disease)









Handling antibiotic in historic perspective









The Danish Dairy Vet prior 1995

- All income was based on fire engine work + medicine
- The profit on distributing medicine was at the practitioner
- Little incentive for improving herd health

Calves < 1 year

- Medicine for re-treatments of cases within 5 days
- Diagnosis and treatment started by a veterinarian







The Danish Dairy Vet later then 1995

- Overall handling of antibiotics and profit moved to the pharmacy
- Profit on medicine used by vet 10%
- Profit on medicine distributed by the vet 5%
- Herd Health Contract became an option, but mandatory if you wanted to treat cows and calves







The intention with the regulation

- No veterinary incentive for selling antibiotics
- No preventive use of antibiotics
- Close herd vet relationship and acquaintance
- More focus on preventive medicine as part of the business model







Dairy Vet behavior

- When the main income is profit on medicine the incentive for reduction the consumption = profit is very limited
- The dairy vet will spend his time on routine tech work and distribute medicine and vaccines







Herd health regulation in Denmark 1995

- Mandatory 12 visits every year 20-40 days apart focus on preventive measure
- The dairy farmer could then have;
- Medicine for re-treatment for 5 days (Cows older then 12 month)
- Youngstock less than 12 month prescription of medicine for 35 days period based on "herd diagnosis" respiratory disease e.g.







Present status – herd health contracts

- Mandatory > 100 adult dairy cows
- 3 different options
 - Basic gives no privileges
 - Module 1. follow up treatment after the vet diagnosed the cow
 - Module 2. diagnosing and treatment of adult cows







The Vet perspective

- Just think about it what do many dairy veterinarians do?
 - Study veterinary medicine 5-6 years
 - After graduation do technician work (rectal palpation, ultrasound scanning and dehorning calves)
 - Pharmacy on wheels
 - C-sections at uncomfortable times at night ${\ensuremath{\mathfrak{S}}}$







Catastrophe – the vet will die of starvation!

- In perspective this didn't really happened ③
- Today a Danish dairy vet can only sell his time and knowledge;
 - Monitoring risk group cows
 - Proactive often based on data from DMS
 - Limited fire engine work (organic and small herds)







From the Dairy Vet perspective

- You will be measured on you ability to implement preventive measure by the farmer
- You need to work with the farmer to achieve his goal
- There is no longer the same quick fix for problems
- Share knowledge with the producer next time he will challenge you at a higher level, will you be ready for this?









Prescribing medicine for dairy cattle









Prescribing medicine in 2019

- Amphenicol's
- Aminoglycosides
- Cephalosporines (1. generation)
- Lincomycin
- Penicillin (simple)
- Penicillin (advanced)
- Sulfa TMP
- Tetracyclines









Pharmacy and Seges

- The farmer decide which pharmacy the vet should send the prescription to
- He can get medicine for disease which is defined as "herd diagnosis" by the vet
 - Must follow the protocol from the vet
 - Must record treatments in Dairy Management Software (Seges developed)









Recording medicine and treatment in DMS

- The vet will record treatments and transfer data to Seges from basis and module 1
- Recording in DMS is mandatory in module 2









Following prescription data











Industry goal is 20 % reduction in consumption in 2020 – compared to 2012!







Some key point to limit consumption

- Close cooperation between all stakeholders
- Strong industry goals
- Research projects to support the strategy
- Mutually binding cooperation dairy producer herd vet







Key numbers on consumption at country level

- The consumption in 2018 across all production animals (fish, pigs, poultry, mink and cows)was 100 ton antimicrobials, with 75 % of the active compound in pigs
- The consumption for cows the last four years have fluctuated between 12-13 tons with roughly 500 kg for intramammary use









Distribution biomass











Quantity at species level

Therapeutic group	Aminoglycosides	Amphenicols	Cephalosporins	Fluoroquinolones	Lincosamides	Macrolides	Other AB	Other quinolones	Penicillins, b-lactamase sensitive	Penicillins, others(a)	Pleuromutilins	Sulfonamides and trimethoprim	Tetracyclines	Total 2017	Total 2018
Pigs	8296	388	<1	0	1978	12056	<1	0	16551	8715	7627	6080	12965	74935	74658
Sows and piglets	1854	279	<1	0	441	624	<1	0	8764	3605	937	4654	1174	21752	22331
Finishers	173	9	<1	0	701	3457	0	0	5867	734	3827	236	3475	19354	18479
Weaners	6270	100	<1	0	837	7976	<1	0	1920	4376	2863	1190	8316	33828	33848
Cattle	901	837	79	<1	11	245	3	0	7627	730	0	879	1553	12370	12865
Intramammaries	38	0	68	0	9	0	<1	0	287	131	0	<1	0	502	533
Cows and bulls	215	12	10	<1	<1	97	<1	0	6627	470	0	767	894	9056	9093
Calves <12 months	614	803	<1	<1	<1	145	3	0	574	118	0	105	615	2557	2978
Heifers and steers	34	22	<1	0	<1	3	0	0	139	11	0	7	44	255	261









Quantity by disease









We have a "low" consumption – then we must have superior protocol??









Handling DCT and lactation mastitis in practice

And here we need to change direction – but not on the DCT!









General recommendation DCT

- Sampling all cows in *Strep. agalactiae* herds
- All other herds;
 - Clinical mastitis during lactation
 - One of the last three DHI before dry-off is > 100.000
- Treatment in general if identification of one of the major pathogens(Staph.

aureus, Strep. uberis, dysgalactiae and agalactiae) are present









Product range for DCT

- Short answer this is very limited!
 - Orbenin[®] (Cloxacillin)
 - Cefagold[®] (1.generation cephalsporine)
- Add teat seal to treated and non treated cows







Legal requirement for DCT - PCR

- PCR test within 42 days prior dry off and Ct value < 37 on one parameter
- At the moment the PathoProff[®] from Thermo Fisher Scientific, Finland is the assey used
- Because of carry over, you need to consider the milking order*
- The only pathogen with recommendation for Ct value is *staph. aureus*

*(Mahmmod et al., 2017 J. Dairy Sci. 100:1–8)









Applying PCR testing*

- Ct-value <32;
 - "very likely to be infected with Staph. aureus,"
- Ct-value in the range 32–37;
 - "uncertain Staph. aureus status"
- Ct-values of >37;
 - "likely to be negative for Staph. aureus"

*(Mahmmod et al., 2017 J. Dairy Sci. 100:1-8)







Legal requirement for DCT - culture

- Positive culture typically composite sample collected by the farmer
- The sampling is with the intention of using antibiotics
- "Seek, and ye shall find"*

*Matthew 7:7-8 The Holy Bible









Data from the national cattle database

	2014	2015	2016	2017	2018
Milk Samples microbiology	189.918	193.491	182.624	183.310	185.519
Sensitivity at culture	99 %	99 %	99,2 %	99,3 %	99,3 %
Contaminated	4 %	4 %	4,3 %	4 %	4 %









Clinical mastitis treatment recommendations

- Grading all cases*
- Sample and wait for result in grade 1-(2)
- Treatment with narrow spectrum penicillin
- Treatment IMM + NSAID

Oliveira et al., 2013







Clinical mastitis treatment in practice

- Grading cases are very limited
- Sample and wait for result in grade 1-(2) if the herd vet is keen on mastitis!
- Treatment with narrow spectrum penicillin yes doing this
- Treatment IMM + IM + (NSAID)









Surveillance of antimicrobial resistance in Denmark









Organization of the DANMAP collaboration regarding resistance data and data flow











Monitoring at different levels

- National level "Danmap"
- SEGES through the surveillance program
- Mandatory monitoring when applying broad-spectrum antibiotics for

clinical mastitis and screening of all dry cow samples









LA-MRSA CC398 in Denmark

- Nasal swaps from 17 weal farms (620 calves)
- 2 slaughterhouses
- Bulk Tank Samples 286 Herds

LA-MRSA CC398 in Dairy Cattle and Veal Calf Farms Indicates Spillover From Pig Production

Julie E. Hansen¹, Troels Ronco¹, Marc Stegger², Raphael N. Sieber², Mette E. Fertner¹, Henrik L. Martin³, Michael Farre³, Nils Toft¹, Anders R. Larsen² and Karl Pedersen^{4*}

¹ National Veterinary Institute, Technical University of Denmark, Lyngby, Denmark, ² Department of Bacteria, Parasites and Fungi, Statens Serum Institut, Copenhagen, Denmark, ³ SEGES P/S, Livestock Innovation, Aarhus, Denmark, ⁴ National Veterinary Institute, Uppsala, Sweden









Main results from the project

- Two weal farms were positive with 1 and 3 calves each
- 286 Bulk Tank Samples 2,8 % positive
- Spillover from pig production identified based on phylogenetic analysis
- Danish cattle represent a low prevalence reservoir of LA-MRSA CC398, which at present, is not of major human health concern.







The method applied

- National level based on MIC panels
- SEGES follow up with bulk tank samples from farms with low Ct PCR value on beta lactam and *Staph. aureus* bulk tank then cultured
- The veterinary practitioner; blodagar with 0,1 / 1.0 % penicillin
- PCR dry cow samples beta lactam reaction







Surveillance based on microbiology

- Originally the surveillance for antimicrobial resistance has been part of microbiology in practice, but the methods is questionable
 - No uniform protocol
 - No regulatory monitoring / quality assessment
 - The PCR test doesn't detect resistance, but needs a follow up culture







Take home message

- Involve all stakeholders if you want to progress in reducing consumption of antibiotics in dairy cows
- Separate distribution of antibiotics from the practitioner
- Diagnostic prior to treatment is KING!





