Agenda

08.30-08.45 Welcome and introduction by Jaap Boes

08.45-09.15 Short presentation from each participant (current project)

09.15-09.30 DUHC status and future plans by Michael Farre

09.30-09.45 Break

09.45-10.15 Presentations, WP new project 2019-2021 by Tariq Halasa, Michael Farre and Lærke Boye Astrup

10.15-10.30 “Superior Udder Health and “ringtest” – current knowledge on microbiology” by Lærke Boye Astrup

10.30-10.45 STOPMAST and Mastitis Milking Parlor Diagnostic by Michael Farre

10.45-11.00 EMCoMAST by Carsten Kirkeby

11.00-11.15 Break

11.15-12.00 Highlighting key points in each WP Levy Fund Project 2019-2021

12.00-12.45 Lunch

12.45-13.45 Brainstorm: milestones, involvement of Scientific Committee, new applications

13.45-14.30 Discussion

14.30-15.00 Wrap up, refreshments and departure

STØTTET AF

Mælkeafgiftsfonden

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DUHC status and future plans

Merging people and knowledge

Axelborg 6 March 2019 Michael Farre DVM / MBA

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The Challenge

- Reduction in antimicrobial usage with 20 % compared to 2012
- Industry goal is Bulk tank SCC 150.000 in 2020
- At the moment 19 % fulfill this goal
- *Strep. agalactiae* 6,5 % of the herds

Structure – framing the Centre

- The participants work on their own institution
- Annual assessment workshop with international participation
- Industry advisory board
- Common goals

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”Brothers in arms”

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Activities

- Involved in all major projects and resource groups with regard to public bodies, commercial companies e.g.
- Organizing the IDF Mastitis Conference 2019
- Annual assessment workshop with international participation
- Industry advisory board

Current projects – SEGES LivestockInnovation

- IDF Mastitis Conference
- Pilot project implementing elements of the UK Mastitis Control Plan
- Recommendations on bulk tank SCC threshold

Current projects – Centre of Diagnostic

- Proficiency test
- Hands-on course in microbiological diagnostics
- Antibiotic resistance, national survelliance
- Research project on quality-control of diagnostics in veterinary practices
- Research project on *E. Coli* vaccination
- Research project on *S. agalactiae* culturing

Current projects – KU SUND

- EMCoMast
- STOPMAST
- World class Udder Health

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Project 2019-2021

Superior Udder Health

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Background

- The project is a 3 year project – supported by the Milk Levy Fund
- No current data to support baseline pathogen profile in DK
- The actual management procedures implemented at an average farm in DK is not known

Project headlines

- Baseline study – identify prevalence and distribution of mastitis pathogens I DK
- Develop and monitor efficiency of treatment protocols
- Implementation management measure and monitor
- Economic impact from implemented management

WP1. Baselines study

Protocol for freezing samples

Suggestions for maximum freezing time pros/cons.

1. Hazards of freezing (false negative results etc.)
2. Standardized protocol
3. Conflicting results in literature

Protocol for culturing samples

- Subclinical samples expected to be of low CFU
- Culturing of 10µl with 3-point plating as standard?

How to avoid false negative results?

1. If culture-negative one enrichment step…?
2. If culture-negative plating of 100µl by Drigalski spatula?
3. 1 vs 2 = increased chance of culture positive but loss of quantitation vs 10-fold increased detection limit
4. If culture-negative save sample for PCR/Whole genome sequencing?

WP2. Treatment of mild clinical mastitis

1. A field study will be conducted to investigate whether mild clinical mastitis cases should be treated.
2. Which cases should be treated and which cases should be left without treatment.

WP2. Treatment of mild clinical mastitis

- Challenges:
  - We need to:
    - Score the case
    - Determine it is a mild case
    - Clean and disinfect
    - Obtain a milk sample
    - Assign it to a treatment or control group
    - Take the action accordingly
    - After 7 days of end of treatment, observe and sample again
  - It is very time consuming if we have to go to a herd everytime there is a case. What to do?
    - Train the farm workers or
    - We must do it our selves

WP2. Treatment of mild clinical mastitis

- Challenges:
  - Which treatment protocol should be used for the treatment group?
    - 2 days tubes or
    - 3 days tubes or
    - Also including IM injections?
  - What about the control group (non-treated), which protocol should we use?
    - Nothing or
    - Empty the udder 2-3 times per day or
    - Supportive treatment or
    - Anything else?
    - What if the case progresses and becomes worse, should we just treat?
  - Other issues to think about?

WP3. Communication & Implementation

- 5-10 papers (Scientific and Danish papers)
- Protocol for treatment recommendations
- Workshops aiming for consultants and vets working with udder health

“Superior Udder Health, proficiency test and current knowledge on microbiology”

Lærke Boye Astrup

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Proficiency test

Structure:

- Offered on yearly basis.
- Volountary
- 15 diagnostic samples + 5 resistance samples
- Only relevant pathogens from real-life mastitis cases in Denmark

Experience

- Decreasing number of participants
- Decreasing level of diagnostic capability

Current knowledge on microbiology

Consistent low level of diagnostic accuracy across several quality-control projects 2016 – 2018.

Issues with both:

1. Contaminated samples used for diagnostics
2. Inaccurate/false diagnoses.
3. Lack of awareness of antibiotic resistance and apropriate analyses

Antibiotic resistance, status Denmark 2018

Lærke B. Astrup

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Background

Surveillance appointed by the Danish Government

Mastitis the topic for adult cattle

Also diarrhea and pneumonia in calves

Materials & Methods

MIC panels with CLSI breakpoints (whenever possible)

30 of each of:

S. aureus, *S. uberis*, *S. dysgalactiae*, *E. coli*, and *K. pneumoniae*

In addition 4 isolates of *S. agalactiae*.

Collected in authumn 2018 from 11 veterinary clinics across Denmark, from cases of acute clinical mastitis.

Preliminary results

Pattern similar to 2017 survey.

S. aureus: Highest levels of resistance are found to spectinomycin and sulphametoxazole.

S. uberis: All are resistant to sulphamethoxazole. The majority is resistant to streptomycin. Some are in the intermediary interval for penicillin.

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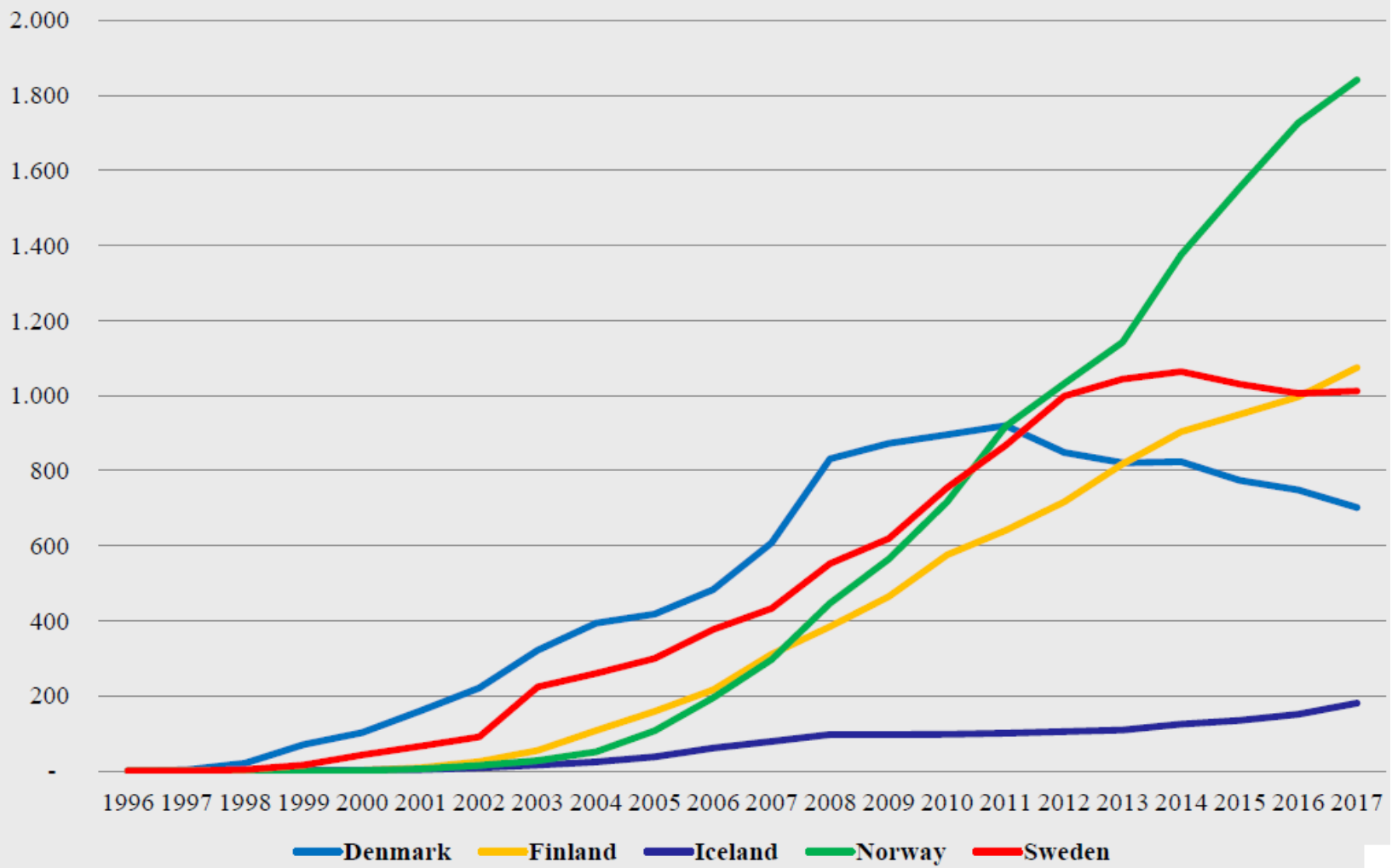
STOPMAST – focus on AMS herds

- WP1 develop method to detect and quantify contagious pathogens outside the udder and infectious dynamic
- WP2 Investigation of infectious dynamic and measure to reduce / control
- WP3 Decision support
- WP4 documentation and communication

AMS in the Scandinavia - NMSM

	Denmark	Finland	Iceland	Norway	Sweden	Nordic countries
Number of all dairy farms	2.978	6.806	573	8.154	3.614	**22.125**
Number of AMS farms	702	1.075	181	1.841	1.012	**4.811**
% of AMS farms, of total number of farms	23,6	15,8	31,6	22,6	28,0	**21,7**
Number of AMS boxes	2.055	1.593	222	1.957	1.926	**7.753**
Number of AMS boxes pr. farm	2,9	1,5	1,2	1,1	1,9	**1,6**
Total milk production, million kg	5.494	2.366	151	1.495	2.817	**12.323**
Estimated milk production with AMS, million kg	1.192	817	72	748	977	**3.806**
Estimated % of milk from AMS farms	21,7	34,5	47,7	50,0	34,7	**30,9**

Number of AMS farms within the Nordic countries



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WP1. Line Svennesen

- Accuracy of qPCR and bacterial culture for the diagnosis of bovine intramammary infections and teat skin colonization with *Streptococcus agalactiae* and *Staphylococcus aureus* using Bayesian analysis. Prev. Vet. Med. 161, 69–74

- Association between teat skin colonization and intramammary infection with *Staphylococcus aureus* and *Streptococcus agalactiae* in herds with automatic milking systems. J. Dairy Sci. 102: 629–639

WP3. Maya Gussmann

- Economic and epidemiological impact of different intervention strategies for clinical contagious mastitis. J. Dairy Sci. 102: 1–11

- A strain-, cow-, and herd-specific bio-economic simulation model of intramammary infections in dairy cattle herds. J. Theor. Biol. 449, 83-93.

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GUDP

Mastitis Milking Parlor Diagnostic

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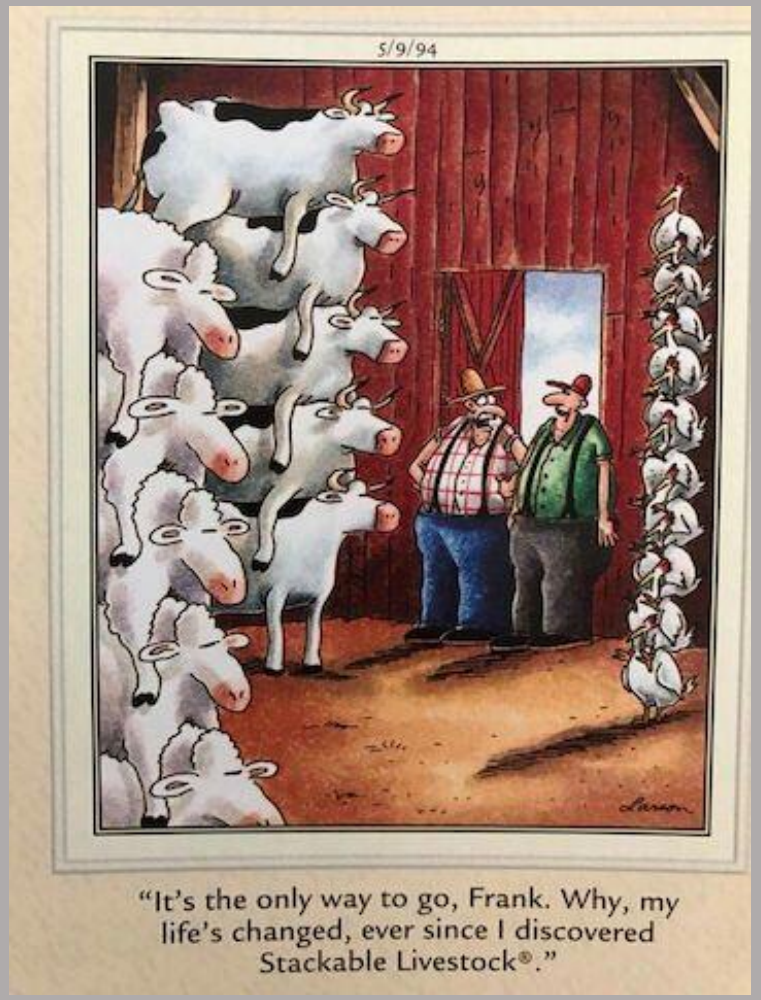
WP 1-7

- Development of assay and reagents
- Development of device /paperchip
- Development of reading app
- Data handling
- On farm test
- Communication

EMCoMAST: DSCC as indicator for IMI

Past, present and future research

Carsten Kirkeby, Michael Farre, Søren S. Nielsen,
Daniel Schwarz, Lisa Zervens, Tariq Halasa



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Overview

Purpose

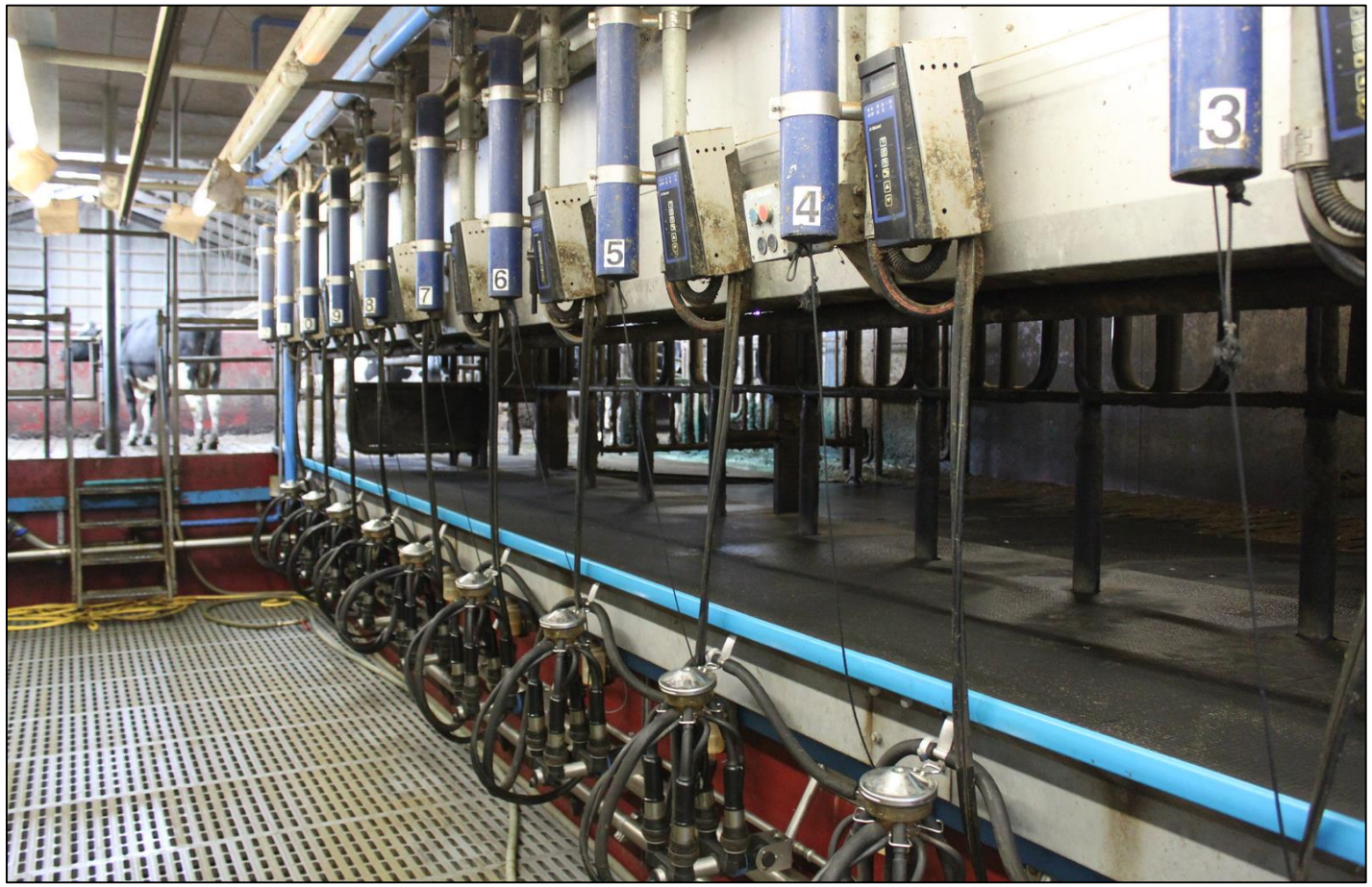
SCC vs. DSCC

Study design

Analysis

Results

Perspectives



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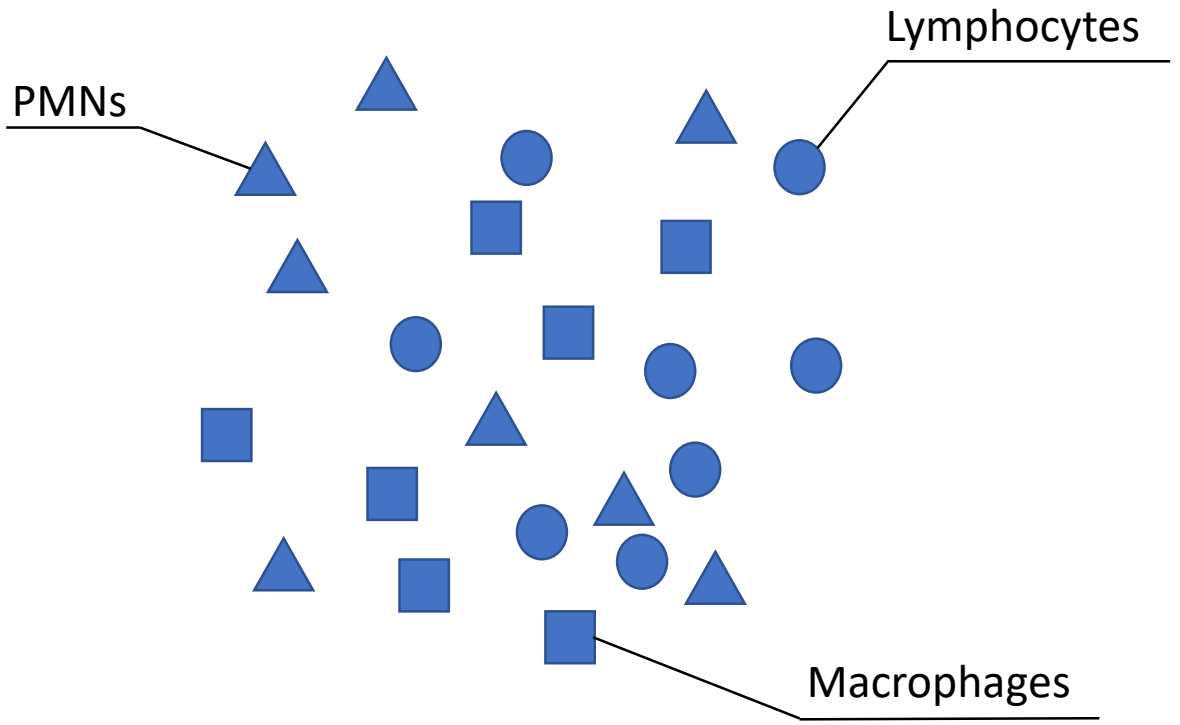
Purpose

Does DSCC add value to detect IMI when we already know SCC?

SCC vs. DSCC

SCC

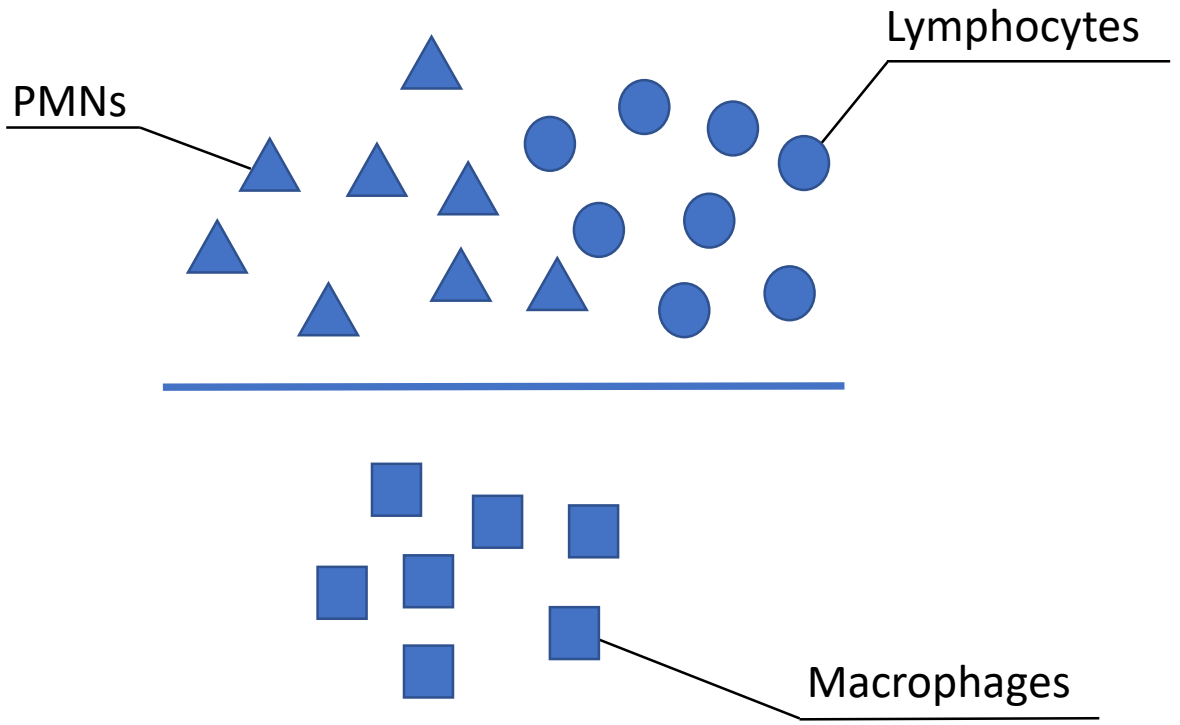
- Widely used
- Large variation



SCC vs. DSCC

DSCC

- Newly introduced by FOSS
- High throughput screening
- Differentiates cells



Study design

Two Danish dairy herds

Herd 1

- 180 cows
- Huge problems with mastitis
- Major pathogens

Herd 2

- 360 cows
- Few problems with mastitis
- Minor pathogens

Study design

12 samplings / herd

1 year

Cow level (PCR)

Quarter level (BC)

SCC + DSCC

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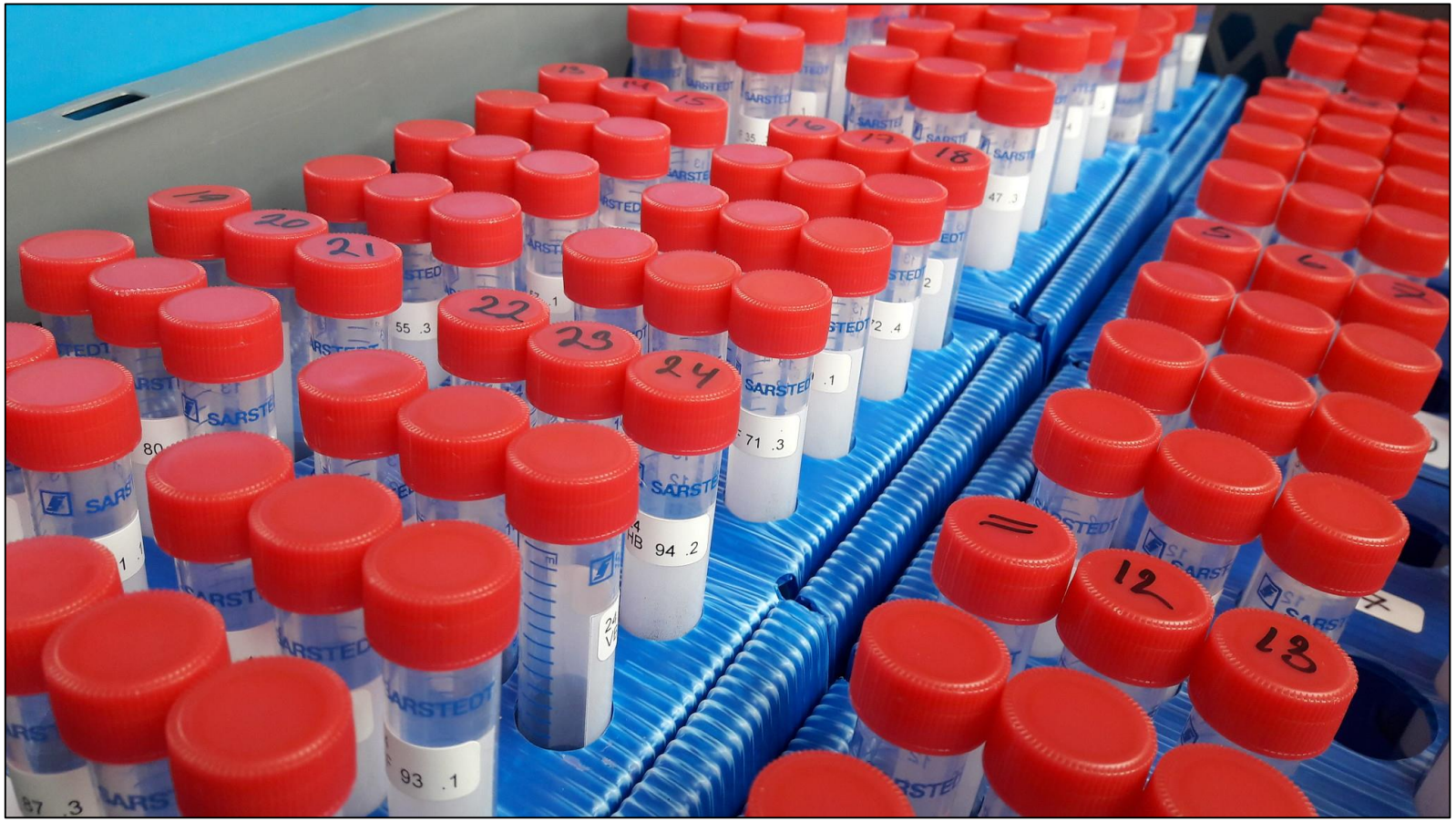
Study design

25.000 samples

Major / Minor /

Other pathogens

Infection in general

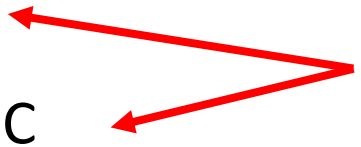


Analysis

- Cow level
- General linear mixed model
- Random effect of cow

Inf. ~ DIM + SCC

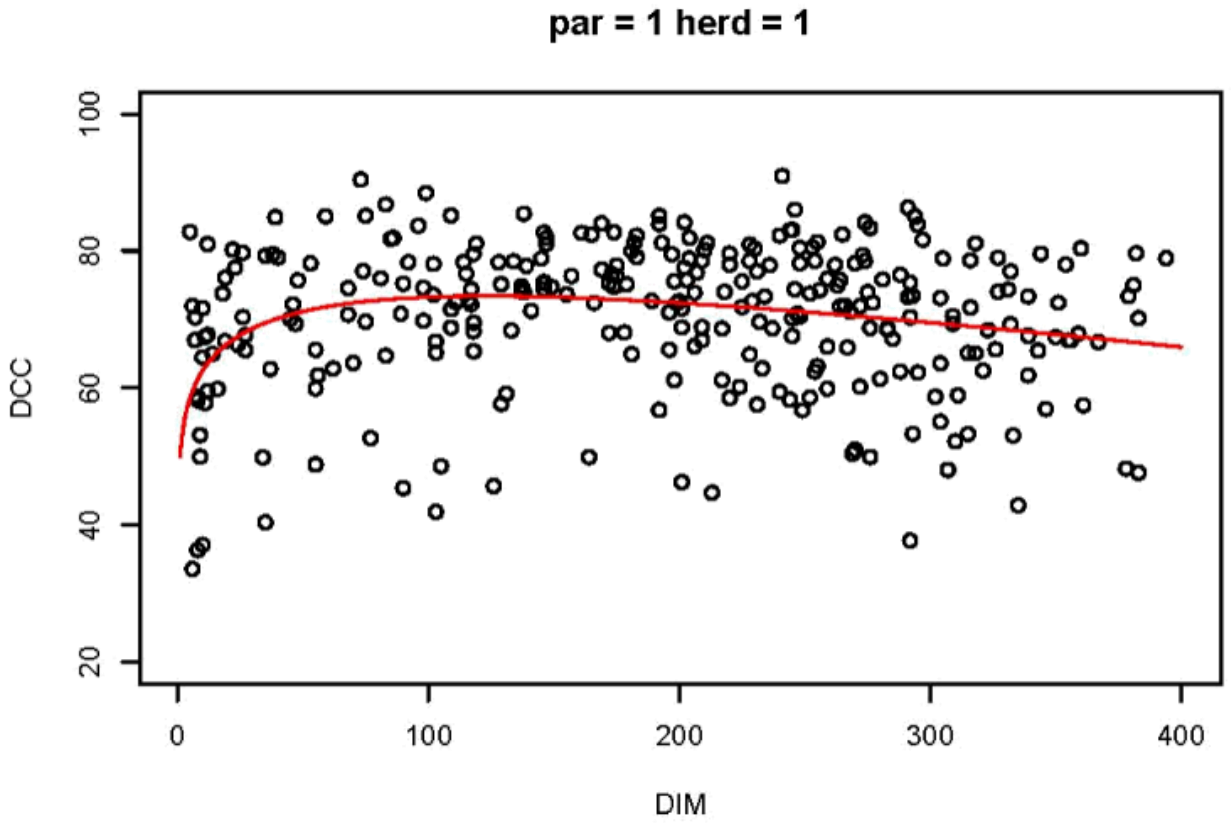
Inf. ~ DIM + SCC + DSCC

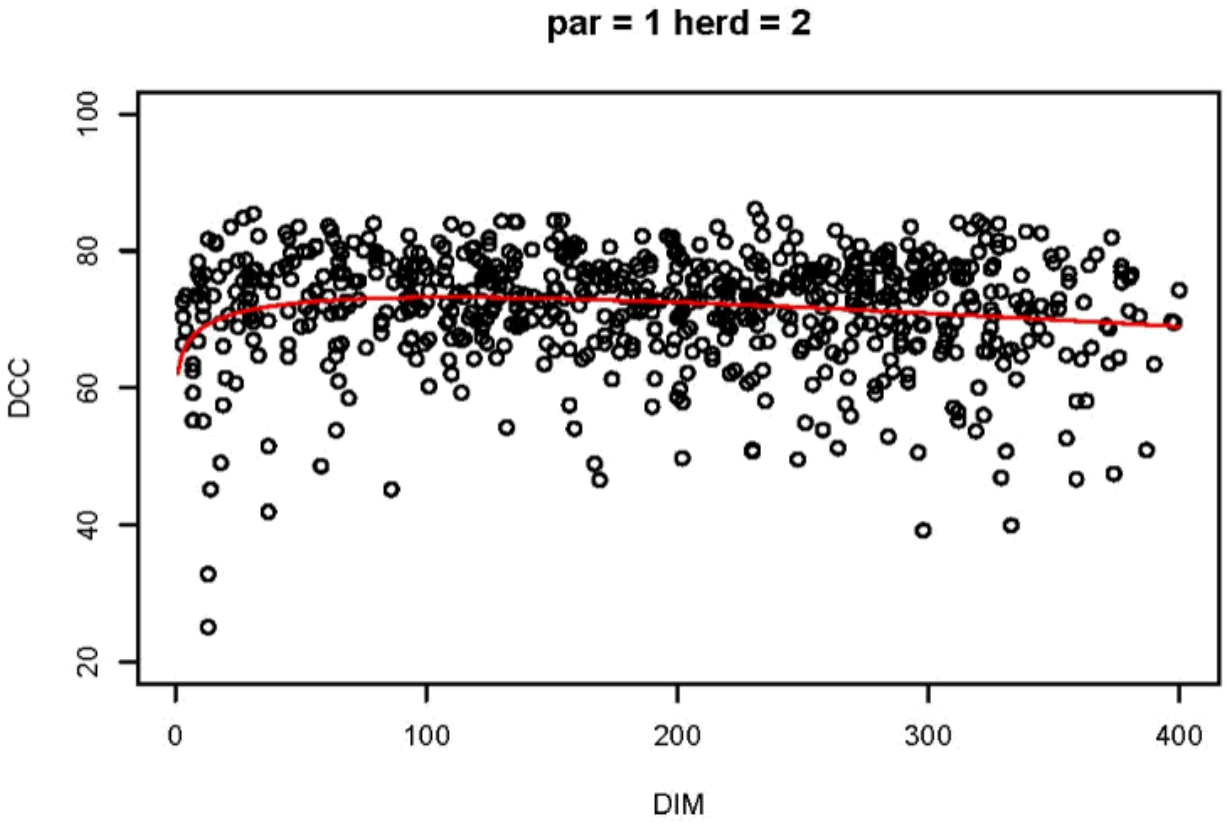


Significantly different?

Results

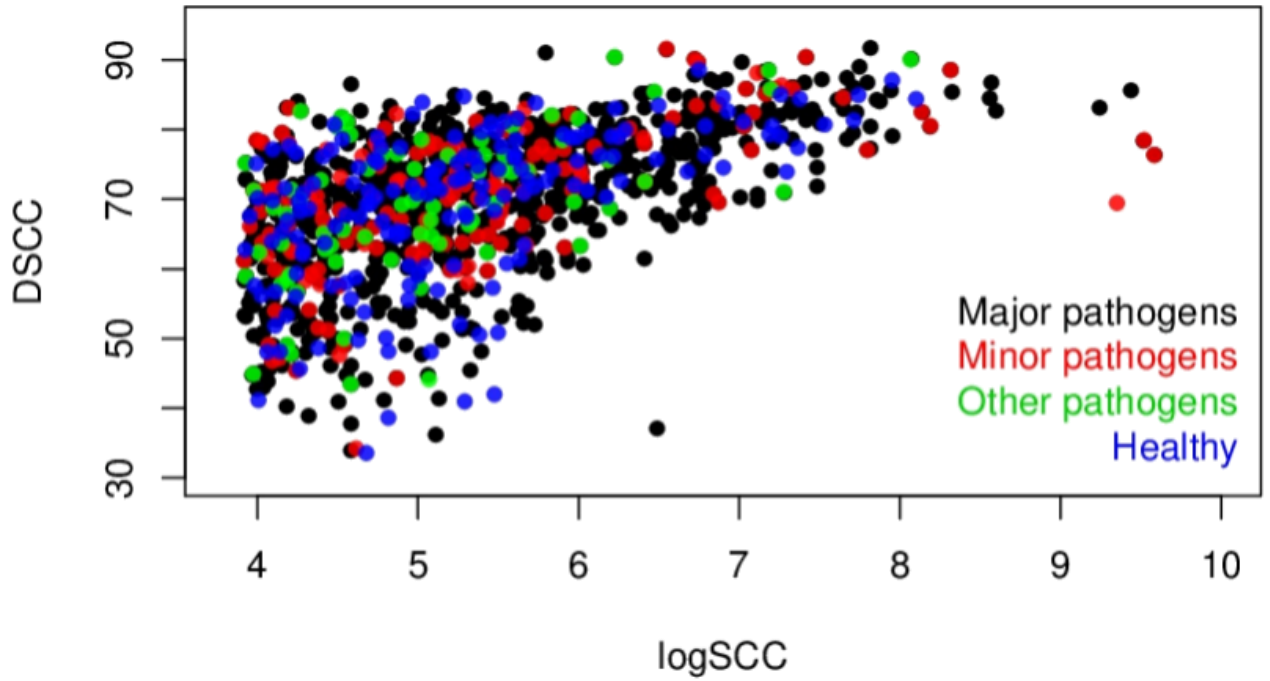
- Decrease over DIM

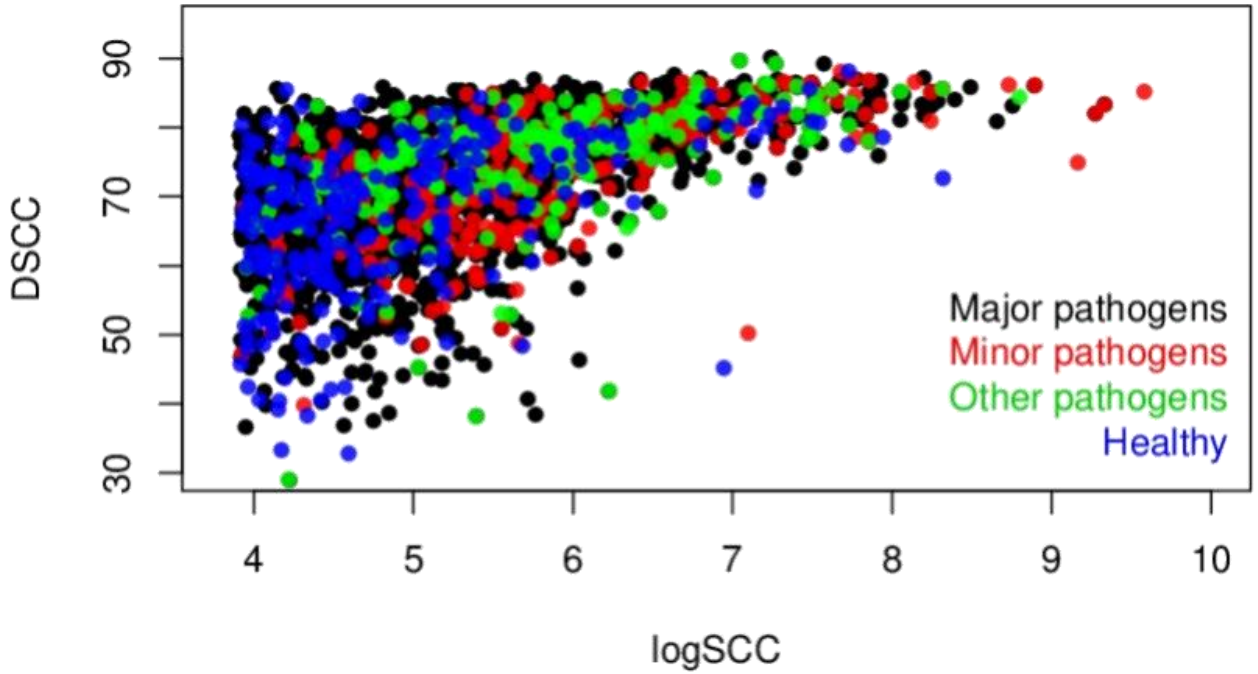




Results

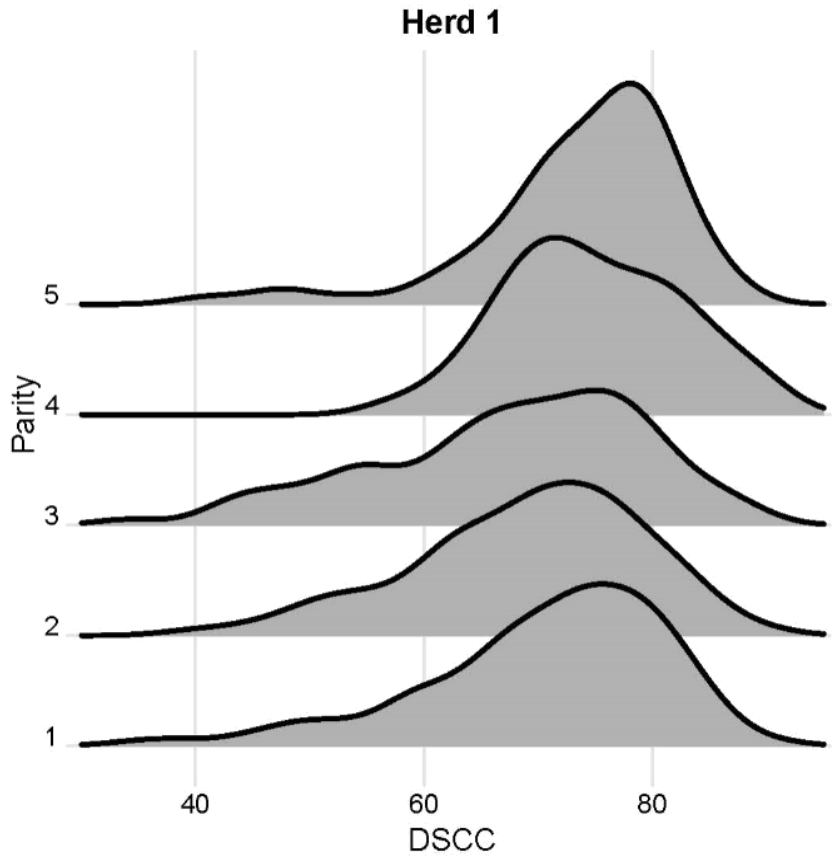
- Correlation

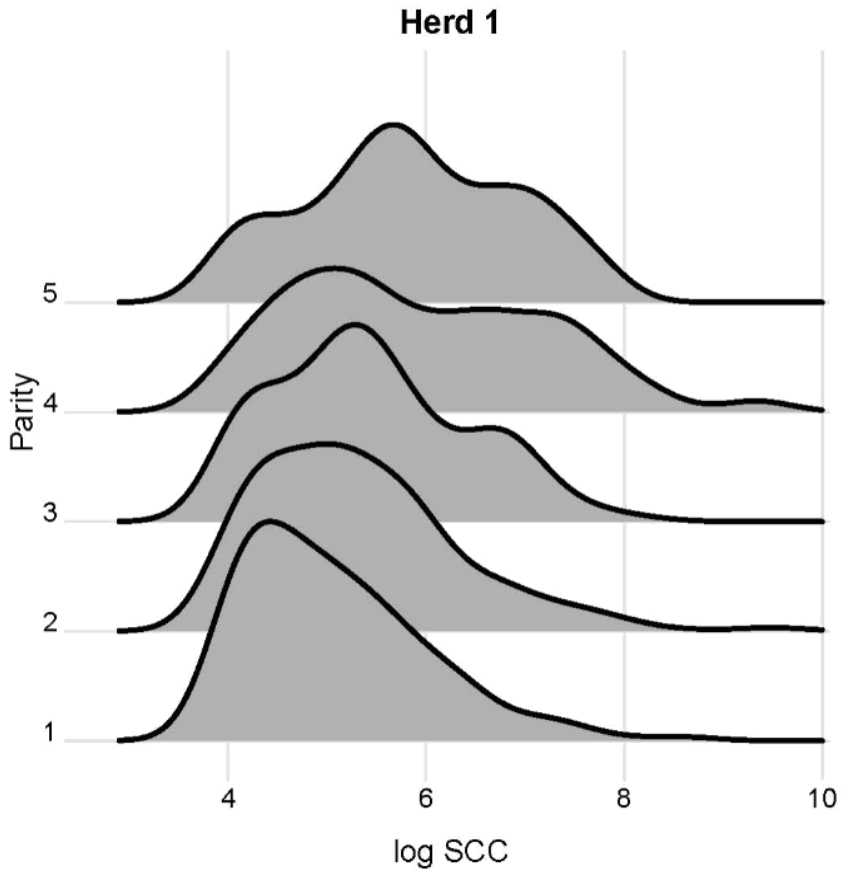




Results

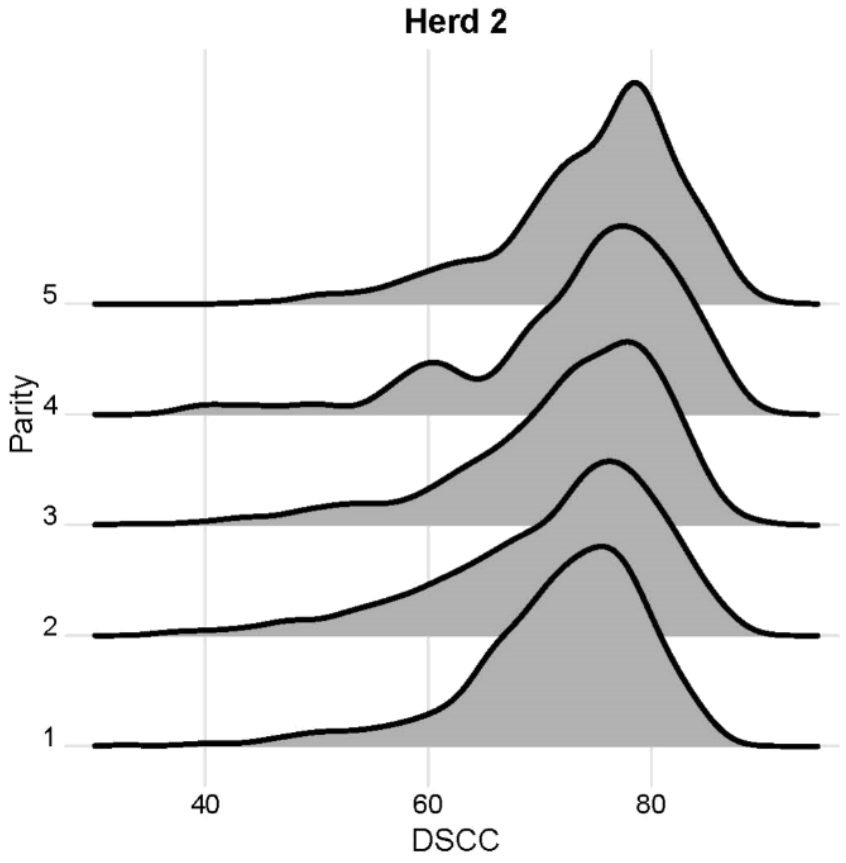
- Stable distribution

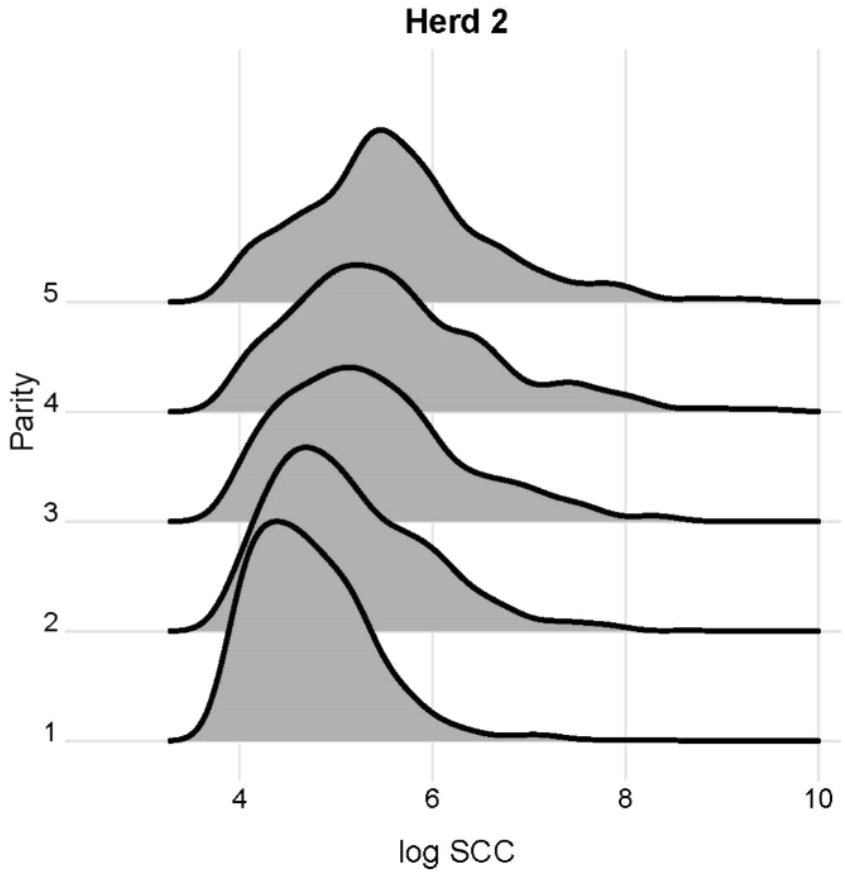




Results

- Stable distribution





Results

- Linear mixed model
- Significant contribution form DSCC

BC

- Infection in general: both herds
- Minor pathogens in Herd 2

PCR

- Other pathogens in Herd 1

Status

- Submitted to JDS

Perspectives

- New or chronic infections?
- Selection for dry cow therapy?
- ???

Study published

- February 2019

J. Dairy Sci. 102:1428–1442
https://doi.org/10.3168/jds.2018-15106

Transmission dynamics of *Staphylococcus aureus* within two Danish dairy cattle herds

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ABSTRACT

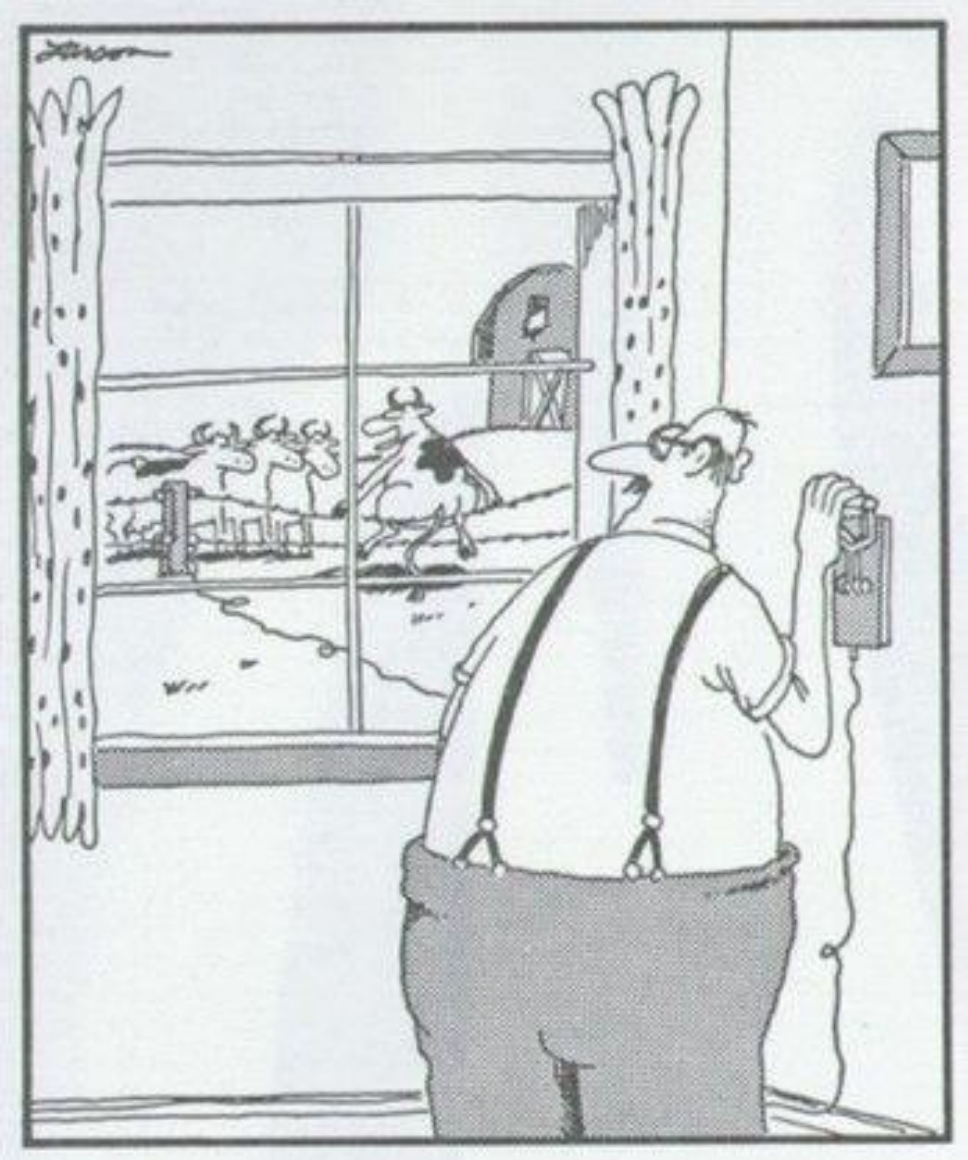
Staphylococcus aureus is a major pathogen causing intramammary infections (IMI) in dairy cattle herds worldwide. Simulation models can be used to investigate the epidemiologic and economic outcomes of different control strategies against IMI. The transmission rate parameter is one of the most influential parameters on the outcomes of these simulation models. Very few studies have estimated the transmission rate parameter and investigated the transmission dynamics of *Staph. aureus* IMI in dairy cattle herds. The objective of our study was therefore to analyze the transmission dynamics of *Staph. aureus* in 2 Danish dairy herds participating in a longitudinal study. The 2 herds had 180 and 360 milking cows, and animals were tested at quarter level once per month over a period of 1 yr. We estimated the quarter-level prevalence to be 34% for herd 1 and 2.57% for herd 2. The daily quarter-level transmission rate was estimated to be 0.0132 and 0.0077 cases/quarter-day for herds 1 and 2, respectively, and the median duration of infection was estimated to be 91 and 64 d for herds 1 and 2, respectively. We also estimated the reproductive ratio at 1.21 for herd 1 and 0.52 for herd 2. The results can provide valuable information for simulation models to aid decision-making in terms of the prevention and control of *Staph. aureus* IMI in dairy cattle herds.

have an increased SCC, decreased milk quality, and impaired performance. If cows develop clinical signs, they must be treated or culled and the milk must be discarded, with milk loss potentially continuing even after recovery (Gröhn et al., 2004; Hertl et al., 2014).

To prevent the spread of pathogens among cows, control of contagious IMI pathogens in dairy herds requires consistent management actions such as postmilking teat dipping, antibiotic treatment, and culling of infected animals (Hillerton et al., 1995). These management strategies can be simulated in prediction models to investigate the epidemiological and economic effects of the actions against IMI (Lam et al., 1996; Seegers et al., 2003; van den Borne et al., 2010; Halasa, 2012; Gussmann et al., 2018). The spread of pathogens can be simulated based on knowledge of the transmission dynamics in a herd (Kirkeby et al., 2017).

Contagious pathogens that cause IMI (such as *Staphylococcus aureus*) are believed to be transmitted between lactating cows primarily through milking equipment (Harmon, 1994). When modeling the spread of *Staph. aureus*, the transmission rate, number of infectious animals, and total number of lactating cows can be used to estimate the probability of infection (Halasa et al., 2009). The number of new IMI cases is therefore highly dependent on the transmission rate, which can have a considerable influence on the model predictions (Halasa et al., 2009; Down et al., 2013). Furthermore, variation in the estimated transmission rates may affect the cost-effectiveness of simulated control actions. In

Thank you



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Objective 1:

- Identify the current management strategies that are implemented in the Danish dairy cattle herds. Using a reference as the NMC 10. point plan, to evaluate the status at each farm.

- This activity will investigate which strategies are implemented in Danish dairy cattle herds in relation to udder health. The investigation will include a comparison of herds with high (> 250,000), medium (150,000 – 250,000) and low (< 150,000) BTSCC. It is expected that the procedures and strategy in each group will be different.

Objective 2:

- Conduct a herd analysis with the aim to:

1) Determine if the herd udder health control strategy and udder health status are compatible

2) Assess the effectiveness of the implemented strategy management procedures to support the strategy.

The activity will focus on conducting a survey to:

- Assess and analyze the udder health status within the herd based on observational data collected from the herd via a questionnaire, milk samples analysis, and data from the Cattle database.
- Identify the management routines for udder health within the herds based on the questionnaire and observations following herd visits.
- Assess how compatible these strategies are for the udder health status within the herd based on expert (our) assessment complemented by our experience, knowledge and the literature.
- Assess how well the strategies are implemented following farm visits.
- Analysis of relevant outcome variables based on the Danish cattle database.

Objective 3:

- Conduct an intervention study in order to assess the efficacy of herd-specific implementation of an udder health management program;
  - How good the herds are implementing the control program? This will be determined by a follow up herd visit.
  - Determine the effect of the control program in relation to different parameters obtained from the Danish Cattle database, such as, BTSCC, New infection rate, number of clinical cases, number of dry-off and lactational treatments.
  - Expected sample size 25-30 herds.

Objective 4:

- Cost-effectiveness of herd-specific management of udder health
- Based on the results from objective 3, the cost-effectiveness of the developed herd-specific control programs will be examined using an existing bio-economic model of mastitis in Danish dairy cattle herds.

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Lunchbreak!

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Brainstorm

- Milestones
- Scientific Committee

Handling dry cow treatment in the future

Current selection of cows for DCT demands a positive sample. This is not optimal because;

- The sample is contaminated.
- The sample is based on a composite which reduces the sensitivity.
- Easy to treat... intended positive sample.

Our proposal is a targeted treatment protocol

- History of the cow including SCC and Mastitis
- Probability to cure when treated compared to no treatment.
- Pathogen problem of the herd
- Cow characteristics including age and production.
- A sample might be needed in some situations....