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Evaluating SCC and DSCC as Indicators for Intramammary Infections in Dairy Cattle

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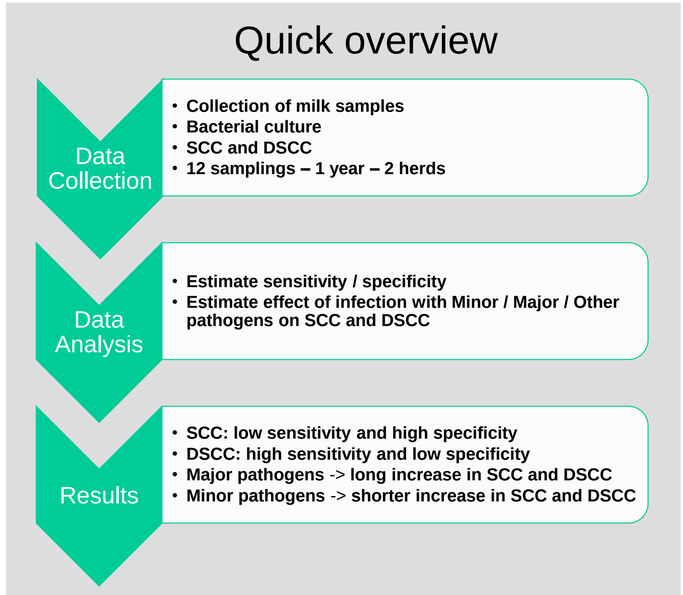
Introduction

Somatic cell count (SCC) measures the number of total immune cells in milk and is used worldwide to indicate (subclinical) mastitis in dairy cows. **A new indicator, the differential SCC (DSCC)** was recently introduced for routine measurements, describing the proportion of **polymorphonuclear neutrophils** (PMNs) and **lymphocytes** in relation to **total somatic cells** present in the milk.

In this study, we assessed the **sensitivity (Se)** and **specificity (Sp)** of SCC and DSCC for detecting Major, Minor and Other pathogens causing intramammary infection (IMI) in two Danish dairy herds. Furthermore, we investigated the **dynamics of SCC and DSCC** after infection with each pathogen group.

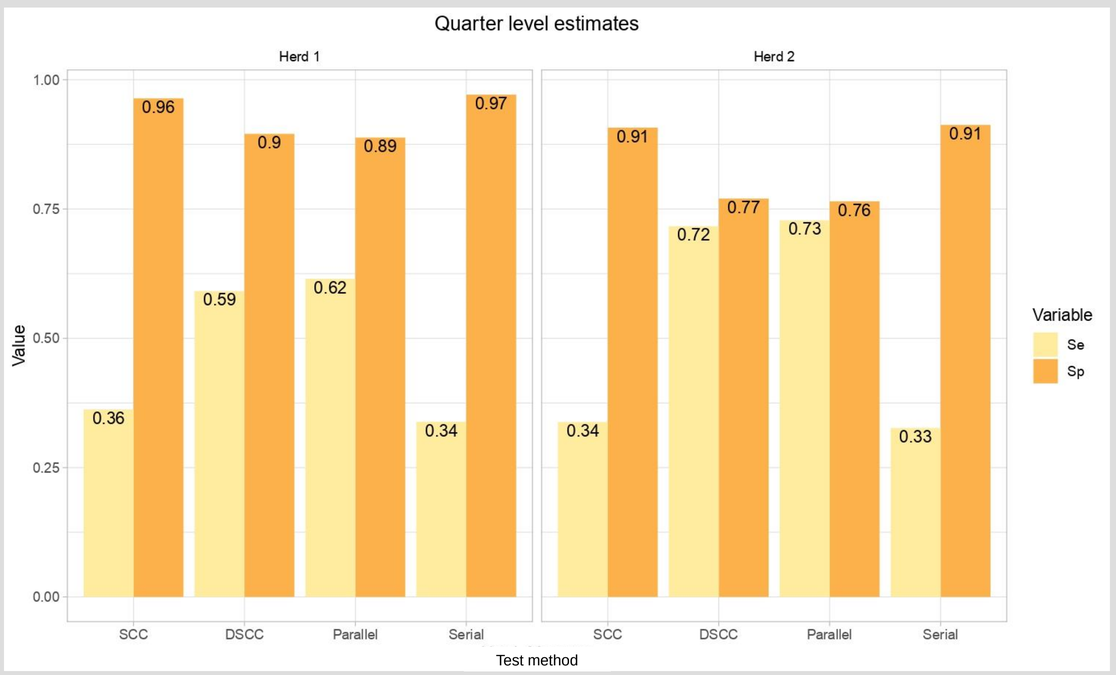
Materials and methods

- Monthly quarter samples were collected from two Danish dairy herds with **180 and 360 cows** throughout one year.
- **SCC**, **DSCC** and **bacterial culture** (BC) results were obtained from quarter foremilk samples.
- Pathogens were separated into groups of **Major, Minor** and **Other** IMI causing **pathogens**.
- Performance of SCC and DSCC was evaluated by estimating sensitivity and specificity (Se and Sp) for SCC and DSCC, assuming **BC as gold standard**.
- Mixed effects models were used to **estimate effect of infection** with different pathogens on SCC and DSCC



Performance assessment

We calculated the Se and Sp using BC as gold standard using standard threshold values of **200,000** for SCC and **62%** for DSCC (see figure below). We also calculated Se and Sp combining SCC and DSCC in serial testing, meaning that both tests had to be positive to indicate infection (see below).



Sensitivity and Specificity estimates for SCC and DSCC in the two study herds. Additional parallel and serial testing are shown, using both SCC and DSCC for indication of IMI on quarter level

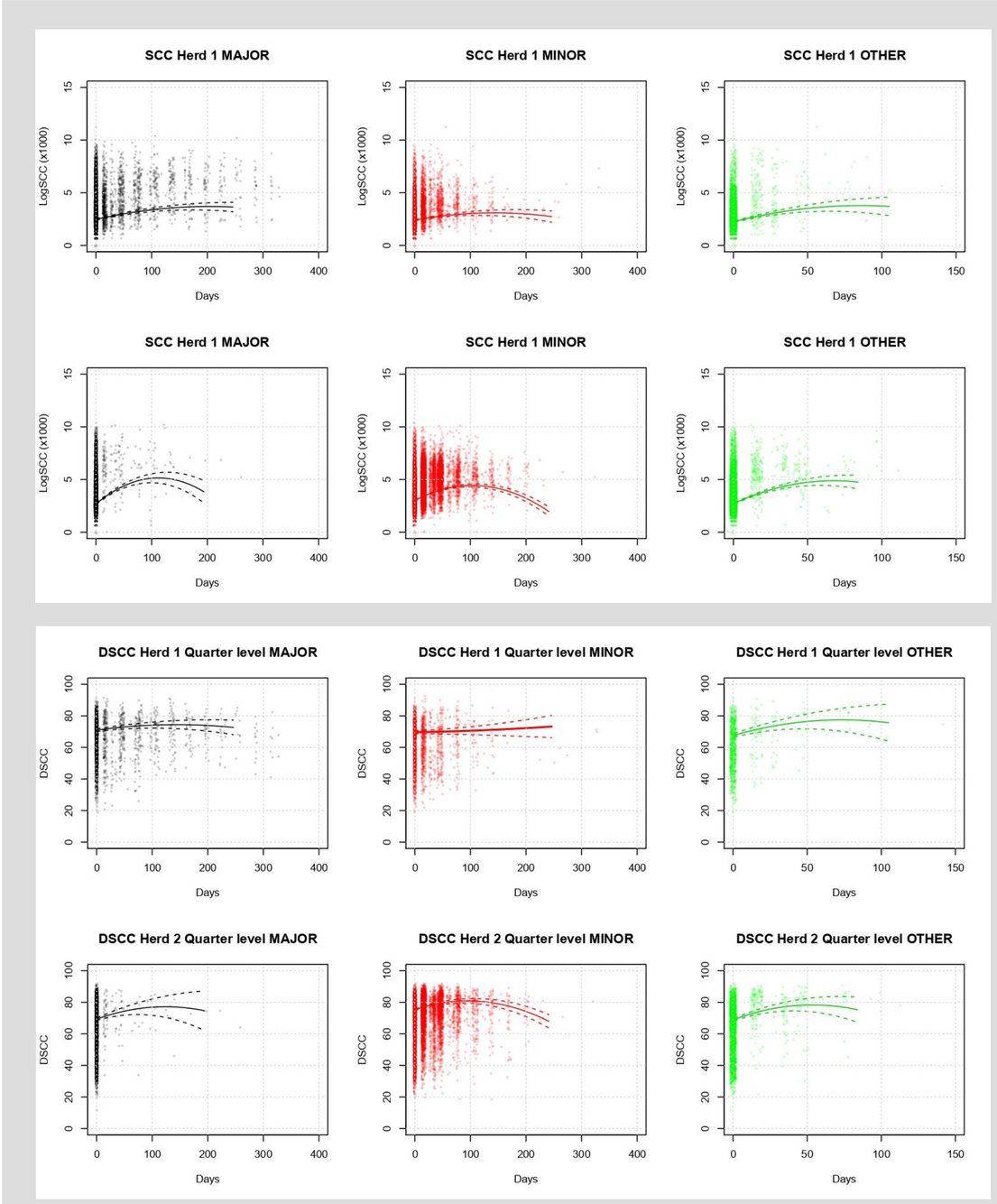
Bacterial culture was used as gold standard to calculate Se and Sp

Effect of infection

To assess the effect of time since infection on SCC and DSCC, we calculated the time since natural occurring infection events during the study for Major, Minor and Other pathogens. We then used linear mixed regression modeling to estimate the effect of time since infection.

Results

Using a cutoff at 200.000 cells/mL, we estimated the Se and Sp for SCC to be **0.35** and **0.94** for Herd 1, and **0.44** and **0.88** for Herd 2, respectively. A DSCC threshold at 62 resulted in Se and Sp at **0.42** and **0.89** for Herd 1, and **0.64** and **0.80** for Herd 2, respectively. When combining SCC and DSCC in parallel testing, the Se and Sp reached **0.48** and **0.87** for Herd 1, and **0.70** and **0.77** for Herd 2. Serial testing resulted in Se and Sp at 0.29 and 0.96 for Herd 1 and 0.38 and 0.91 for Herd 2. Thus, **parallel testing increased the sensitivity more than it decreased the specificity**. **Serial testing showed the highest specificity at the expense of a lower sensitivity**.



SCC and DSCC measurements after infection with Major, Minor or Other pathogens

Points show the data, and the mean effects from the mixed model are shown with interquartile range limits (dashed lines)

From the mixed effect models, we estimated the change in SCC and DSCC after infection events. For both SCC and DSCC, we found a **significant increase.** This **increase in SCC peaked after 204 and 112 days for Major pathogens** in Herd 1 and 2, respectively, **after 144 and 104 days for Minor pathogens**, and **after 86 and 68 days for Other pathogens**. For DSCC, the increase peaked after **144 and 124 days** for Major pathogens in Herd 1 and 2, respectively, after **95 days** in Herd 2 for Minor pathogens, and after **73 and 54 days for Other pathogens** in Herd 1 and 2, respectively.

Conclusions

DSCC showed a **higher sensitivity** and a **lower specificity** compared to SCC. Parallel testing showed promising results for improving the diagnostic performance, with **increased sensitivity at the expense of decreased specificity** compared to only using SCC**. Nevertheless, the estimates were herd-specific.**

Both SCC and DSCC increased after infection. In both herds, infection with the **Other pathogens** group lead to the shortest lasting increase whereas **Minor pathogens caused a longer increase**, and the increase after infection with **Major pathogens lasted longest**.

These results show that both SCC and DSCC are affected by the quarter infection status, and that they can be combined to used diagnostic testing and optimize decision support tools.

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