Northern NY Agricultural Development Program
2017 Project Report

Assessing the Risk of Subclinical (SC) Infections in Cows With Clinical Mastitis

Project Leader(s):

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Cooperating Producers:

- Clinton County: Miner Institute
- Jefferson County: Deer Run Farm
- Lewis County: Moserdale Farm
- St. Lawrence County: Greenwood Dairy Farm

Background:

Clinical mastitis (CM) is an expensive disease, with an estimated cost of $400 (Rollin, 2015) per case. A common approach to treatment and management of cows with CM is to focus efforts on the quarter(s) with abnormal milk and signs of inflammation, disregarding quarters with visibly normal milk.

Current recommendations for pathogen-based mastitis treatment protocols result in a decrease in antibiotic use and increase in saleable milk. However, when we compare the estimated percentages of CM (Barkema, 1998) to all infected quarters in a herd (Eberhart, et al, 1982) based on bulk tank somatic cell count (SCC), we observe that CM infections can be "the tip of the iceberg." Subclinical mastitis (SCM) can negatively impact milk

quality and production (Huijps, et al., 2008) and may go undiagnosed in cows with clinically normal quarters. Previous research has reported that 67% of cows with CM also had SCM in a nonclinical quarter (Lago and Silva-del-Rio, 2014).

This research in 2017 continued to report that sampling nonclinical quarters increased the percentage of cows with identifiable intramammary pathogens from 52% to 82%.

Objectives:

The objective of this Northern New York Agricultural Development Program project was to evaluate the risk of SCM in quarters of cows with CM in visibly normal quarters in comparison to animals with normal milk in NNY dairy herds. Our hypothesis is that cows with CM in one quarter are at a higher risk of SCM in otherwise normal quarters when compared to low and high somatic cell count (SCC) control groups. This research evaluates the incidence of SCM in otherwise normal quarters in cows in selected NNY dairy herd to compare clinical cows with those with high and low SCC with no visible mastitis.

Materials & Methods:

Four collaborating herds in Northern New York sampled all cows with CM, taking individual aseptic samples from all four quarters at the time of CM identification. The farmers used Dairy Comp 305 for electronic submission so that severity score could be recorded and to ensure accurate cow identification in records. Samples were picked up daily to weekly based on farm location and proximity to Canton, NY. Samples not picked up daily were frozen until submission

Samples were cultured using standard microbiological methods (NMC, 1999) by Quality Milk Production Services, Canton, NY. Somatic cell count (SCC) was determined by using a DeLaval Cell Counter.

The farm appropriately managed clinical quarters, using either blanket treatment or pathogen-based mastitis treatment protocols.

Control cows were matched on days in milk (DIM) and lactation number to CM cows. Control cows were classified as low SCC (<200,000 cells/ml) or high SCC (>200,000 cells/ml) based on DHIA SCC or decrease in milk production and conductivity. Control cows were quarter sampled aseptically to further determine SCC, and aerobic culture. All quarters with positive intramammary infections (IMI) control and clinical were re-sampled within 2-4 weeks for aerobic culture and SCC.

The MEANS procedure for statistical analysis (SAS 9.2; SAS Institute, 2008) was used to determine variable means of the whole data set as well as means for reason sampled.

The SAS FREQ procedure was used to determine count and percentages of samples in various categories, as well as to determine the relative risk of infection based on reason sampled.

Epidemiological diagnostic test characteristics (sensitivity, specificity, and predictive values) for SCC were subsequently calculated using PROC FREQ of SAS. Sensitivity was defined as the probability of a test result (SCC >200,000) indicative of IMI for a sample with a positive aerobic culture. Specificity was defined as the probability of a test result (SCC <200,000) indicative of a negative aerobic culture. Positive predictive values (PPV) and negative predictive values (NPV) were calculated using the prevalence of samples with or without a positive aerobic culture and a somatic cell count above or below the 200,000 cut-point, respectively. Significance was determined at $P \leq 0.05$.

Results:

A total of 1698 quarters (CM =246, nonclinical = 575, low SCC = 486, high SCC = 391) were included in the study. Average days in milk (mean = 150.7; range = 1 to 484) and lactation number (mean = 2.7; range = 1 to 9) did not vary across CM and control cow groups (Table 1).

Overall, 25.7% of all quarters sampled (n = 1698) were positive for IMIs (Table 2). Positive culture results occurred in 55.3% of samples from CM quarters, an additional 24.63% of NCQ had an IMI.

High SCC cows had an IMI in 26.6% of the quarters sampled, while low SCC cows had an IMI in 11.5% of the quarters sampled. Samples from NCQ and quarters from a high SCC cow (HSCC) were at a greater risk of having an IMI as compared to samples from low SCC (LSCC) cows.

The most common pathogens present in initial samples (Table 3) included:

- Staphylococcus spp. (n = 177)
- Gram negative organisms (n = 119), and
- Streptococcus spp. (n = 95).

Overall, 38.9% of follow-up samples showed a persistent IMI. Samples from high SCC quarters were most likely to have a positive follow-up culture result (57.4%) as compared to CM quarters (28.3%), low SCC (29.8%) and non-clinical quarters (38.9%).

A total of 437 quarters had a positive initial sample, however, only 357 were re-sampled (Table 2). This number discrepancy is due to animals leaving the herd before the resampling period. A total of 139 (38.9%) of follow-up samples had a positive culture result. In contrast to initial sampling, follow-up samples from high SCC cows had a greater percentage of positive samples as compared to all other groups.

A total of 30 quarters (12% of entire data set) were classified as having a persistent infection defined as a positive culture result at initial and follow-up sampling (Table 4).

Clinical and LSCC quarters had a greater percentage of negative culture results at follow-up compared to NCQ and HSCC quarters. LSCC quarters had the lowest percentage of persistent infections.

Similar to initial samples, the most common pathogen present was Staphylococcus spp. (n = 73), followed by Streptococcus spp. (Table 5). Also similar, samples from HSCC quarters were more likely to have a positive culture on the follow-up sample (57.4%) as compared to CM quarters (28.3%), LSCC (29.8%), and non-clinical quarters (37.3%).

Using a SCC of >200,000 cells/mL, at time of quarter sampling, as an indicator of IMI was accurate 72.6% of the time in initial samples and ~~only~~ 67.37% of the time in follow-up samples (Table 6).

Conclusions/Outcomes/Impacts:

The objective of this project was to evaluate the risk of subclinical mastitis (SCM) in quarters of cows with clinical mastitis (CM) in visibly normal quarters in comparison to animals with normal milk.

Based on the data, nonclinical quarters in a cow with CM had an increased risk of infection as compared to quarters from a low SCC cow, the risk was similar to that in a quarter from a cow with a high SCC and visibly normal milk.

Clinical mastitis quarters and high SCC quarters had a greater percentage of persistent infections as compared to non-clinical quarters and low SCC quarters.

Additionally, data from this study indicates that only 55.3% of CM quarters had a positive culture result, displaying the importance of using a pathogen-based treatment protocol to more accurately diagnose.

Additional data collected from this study including previous and post–infection DHI test day data is being analyzed to determine risk of follow-up infection by group. That analysis is expected to be available in 2018.

Outreach: The results of this project were presented at the Franklin County Dairy Summit, St. Lawrence County Dairy Summit, Lewis County Dairy Day, and the National Mastitis Council Annual Meeting in Tucson, AZ. This research will also be presented at the American Dairy Science Association annual meeting in Knoxville, TN, in 2018.

An article discussing the impact of subclinical mastitis will be published in the North Country Ag Advisor in the March 2018 edition and will be available online. This research will be written into a fact sheet for farmer distribution and an article for the Journal of Dairy Science.

Reports and/or articles in which results of this project have been published:

National Mastitis Council Annual Meeting Proceedings, 2018.

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