J. Dairy Sci. 100:1–5
https://doi.org/10.3168/jds.2016-12384

Short communication: Weak associations between mastitis control measures and bulk milk somatic cell counts in Swedish dairy herds

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ABSTRACT

Despite the fact that control programs have been available for several decades, mastitis remains an important problem in dairy herds around the world. Possible reasons for this include poor uptake and application of recommended mastitis control measures; poor or variable compliance; or variability in the effects of these measures. The objective of this study was to evaluate the associations between implemented mastitis control measures and bulk milk somatic cell count (BMSCC) in Swedish dairy herds. Data for this study were collected primarily from an extensive self-administered postal questionnaire about the herds, the people responsible for udder health, and details of udder health and mastitis management. A total of 898 questionnaires were distributed, and 428 questionnaires were returned (overall response rate of 48%), but we used the information from only 395 herds in this study. For all herds, we collected data on herd size and geometric average calculated BMSCC from the Swedish Official Milk Recording Scheme. We used logistic regression to assess the association between mastitis control measures and BMSCC, dichotomized as low (<200,000 cells/mL) or high (>200,000 cells/mL). We investigated 21 measures that have been suggested for mastitis control, but found only 2 to be associated with udder health as measured by BMSCC. Not providing dry cows with a specialized mineral feed was significantly associated with increased risk of high BMSCC, and not using post-milking teat disinfectant tended to be associated with increased risk. The lack of association for all other measures was not likely due to low power (because most of these measures had variable implementation rates) but could be due to the relatively narrow range of BMSCC in our study (range 61,000–524,000 cells/mL). However, our results agreed well with those of other recent studies, supporting the call for a thorough review of the current knowledge of mastitis control and for wider application of intervention studies to verify the actual effects of suggested control measures.
Key words: dairy cow, management, bulk milk somatic cell count

Short Communication

Mastitis in dairy cows is a major problem around the world, and many have attempted to develop mastitis control measures, including the 5-point plan of Dodd and Neave (1970) and the 10-point plan of the National Mastitis Council (https://www.nmconline.org). Common to all such plans is that costs are incurred in terms of increased labor, equipment, and consumables, so measures must have a positive return on investment if they are to be adopted to an appreciable degree. Estimates of the effect of different measures on mastitis rates are essential for evaluating their return on investment. Intervention studies are needed to evaluate the actual and realized effects of implemented control measures, but such studies are costly, and only a few have been performed (Green et al., 2007). The alternative is to compare the udder health of herds with and without implemented control measures, and several such studies have been performed (Dufour et al., 2011). However, most of the studies cited by Dufour et al. (2011) were performed during the last century, with different general udder health status and herd structures compared to today; it is therefore imperative to re-estimate associations under current conditions.

The objective of the present study was to determine the associations between implemented mastitis control measures and bulk milk SCC (**BMSCC**) in Swedish dairy herds, adjusting for potential confounders.

Data for this study were collected primarily from an extensive self-administered postal questionnaire sent in May 2011 to a sample of Swedish dairy farmers. The sample was drawn from the database of the Swedish Official Milk Recording Scheme, which was run at that time by the Swedish Dairy Association. Data were

Received December 1, 2016.
Accepted April 25, 2017.
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stratified by housing and milking system. All herds in Sweden with freestalls and an automatic milking system (**AMS**; n = 298) were eligible for inclusion in the study, and samples of 300 herds with tie stalls and pipeline milking and 300 herds with freestalls and parlor milking were identified by randomization from farms in the respective populations. We collected information about the herds and the people responsible for udder health, and the questionnaire also contained detailed questions about udder health and mastitis management. In total, the questionnaire had 9 pages and 23 questions; several questions also had sub-questions. Completion of the questionnaire was estimated to take approximately 30 min. The question on applied mastitis control measures was “Which of the following measures are implemented in the herd?”, followed by 21 control measures related to stall hygiene, milking hygiene and milking routines, dry-cow management, and general management routines (Table 1). Mailing and collection of the questionnaires was managed by Statistics Sweden (Statistiska Centralbyrån, Örebro, Sweden; www.scb.se). Pre-testing of the questionnaire was done by 2 researchers, 1 with experience in designing questionnaires and 1 with experience in mastitis research, and the questionnaire content was also reviewed for clarity by Statistics Sweden. The instructions provided with the questionnaire specifically requested that the person responsible for udder health in the herd answer the questionnaire. Further details about the questionnaire can be found in Nielsen and Emanuelson (2013).

For all herds, we obtained data on herd size and the geometric average calculated BMSCC for 2010 (the year to which the questions in the questionnaire applied) from the Swedish Official Milk Recording Scheme. The BMSCC was based on individual cow test-day information on milk yield and SCC, rather than on milk delivered.

We used logistic regression to assess the association between mastitis control measures and BMSCC, where BMSCC was classified as low (<200,000 cells/mL) or high (>200,000 cells/mL). Associations were evaluated 1 measure at a time, and then all measures with a P-value <0.20 were included in a multivariable model. We derived a final model by backward elimination, using a significance level of 10%. Potentially confounding explanatory factors (i.e., milking system, herd size, sex of the individual responsible for udder health, and number of employees) were included in all models. We developed separate models as sensitivity analyses by (1) excluding herds with AMS, because some mastitis control measures could not be implemented in such herds, and (2) excluding the 10% of herds with the highest BMSCC (>349,000 cells/mL), because such herds might feel forced by dairy company restrictions to implement mastitis control measures so they could deliver milk.

The fit of the multivariable model was assessed with a Hosmer-Lemeshow goodness-of-fit test (Hosmer and Lemeshow, 2000), and the coefficient of determination with a generalized R^2 as suggested by Nagelkerke (1991). All statistical analyses were performed using SAS (version 9.4; SAS Institute Inc., Cary, NC).

A total of 898 questionnaires were distributed, and 428 usable questionnaires were obtained (overall response rate of 48%), but only 395 herds (i.e., herds with only 1 type of housing/milking system and with BMSCC available) were used in this study. A detailed description of the observations from the complete study can be found in Nielsen and Emanuelson (2013). The median (range) of BMSCC in herds classified as low was 176,000 (61,000–198,000) cells/mL and 265,000 (200,000–524,000) cells/mL in herds classified as high. The distribution of herds according to mastitis control measures and some potentially confounding variables is presented in Table 1, together with BMSCC for the subgroups. The median (range) BMSCC for quartiles of herd size were 221,000 (61,000–429,000), 240,000 (96,000–506,000), 241,000 (68,000–465,000), and 256,000 (127,000–524,000) cells/mL, respectively, and the corresponding percentages in each quartile with BMSCC <200,000 cells/mL were 32, 27, 25, and 20%. The most striking difference between herd types was the low proportion of low BMSCC among herds using AMS.

Results from the multivariable logistic regression model are presented in Table 2. Not providing dry cows with a specialized mineral feed was significantly associated with increased risk of the herd having a high BMSCC. Not using post-milking teat disinfectant tended to be associated with increased risk. The Hosmer-Lemeshow goodness-of-fit statistic was not significant (P = 0.11), indicating a reasonable fit, although the model explained only 8% of the variation as assessed by generalized R^2. When herds with AMS were excluded, the effect of the sex of the individual responsible for udder health became significant [odds ratio (**OR**) = 2.53, 95% CI: 1.36–4.71], the use of post-milking teat disinfectant became significant (OR 2.21, 95% CI: 1.00–4.85), the OR for dry-cow mineral feed increased a small amount (OR 2.33, 95% CI: 1.15–4.71), and the model fit improved (Hosmer-Lemeshow P = 0.75), but no additional mastitis control measures were significantly associated with the outcome.

The only mastitis control measure significantly associated with BMSCC for all herds was providing dry cows with a mineral feed that covered their needs. This control measure was implemented in the majority of the herds (290/395), so it might have an important effect