Dairy farmers can change: results of a 5-year national mastitis control program in the Netherlands

J Jansen[1], G Van Schaik[2], RJ Renes[1], and TJGM Lam[2,3]

[1] Communication Science, Wageningen University, Wageningen, The Netherlands

[2] GD Animal Health Service Ltd., Deventer, The Netherlands

[3] Dutch Udder Health Centre (UGCN), Deventer, The Netherlands

Abstract

Over the years, much effort has been put into mastitis control programs. To further improve such programs, we need to understand farmers' knowledge, attitude and behavior regarding udder health, and the way this can be influenced by mastitis control programs. This study aimed to explore the effect of a Dutch national mastitis control program on farmers' knowledge, attitude and behavior regarding mastitis.

In this study, 204 randomly selected dairy farmers completed a survey on attitude, knowledge and behavior regarding mastitis before the start of the national mastitis control program (2004) and in the final year of the program (2009). Statistical analyses show that, compared to 2004, the attitude, knowledge and behavior of the participating farmers changed significantly.

Farmers' satisfaction level and problem level of BMSCC changed; farmers were satisfied with on average 156,000 cells/ml in 2004 compared to 150,000 cells/ml in 2009, and perceived a problem at 285,000 cells/ml in 2004 compared to 271,000 cells/ml in 2009. More farmers perceived that they had sufficient knowledge about the control of mastitis (34% in 2004 vs. 53% in 2009), and they focused more often on udder health characteristics when selecting bulls (46% vs. 61%).

Specific mastitis control measures have increased significantly during the program. The use of milking gloves increased from 15% to 46%, the use of a standardized mastitis treatment protocol increased from 7% to 34% and cubicles are cleaned more often (2.28 vs. 2.51 times/day).

The results of this study show that a national mastitis control program can affect farmers' knowledge, attitude and behavior regarding mastitis.

Keywords: mastitis control program, attitude, behavior, knowledge, communication

Introduction

Over the years, much effort has been put into mastitis control programs. Evaluation of such extension education programs is necessary to optimize future campaigns (Chase *et al.* 2006). The aim of a mastitis control program is to improve management practices by influencing farmers' attitude and knowledge to reduce mastitis incidence and to improve milk quality (Barkema *et al.* 1998, 1999; Jansen *et al.* 2009). Consequently, to improve mastitis control programs we need to understand farmers' knowledge, attitude and behavior regarding udder health, and the way this can be influenced.

In 2005, a project was initiated to improve udder health in The Netherlands: the 5-year mastitis control program of the Dutch Udder Health Centre (UGCN). The communication strategies of the udder health project consist of two main routes to reach as many farmers as possible: a direct approach through articles in farm magazines, presentations at agricultural fairs and mailings to all dairy farmers, and an indirect approach through veterinarians as intermediaries between UGCN and farmers. In 2008, almost 200 out of 326 veterinary practices participated in the program including 17,000 dairy farmers (approximately 85% of all Dutch dairy farmers) of which 3,169 farmers (approximately 16% of all Dutch dairy farmers) participated in on-farm study groups organized by their veterinarian on udder health issues.

The aim of the present study was to determine whether farmers' knowledge, attitude and behavior had changed since the Dutch udder health program started, and whether this change differs between farmers who had different udder health situations at the start of the program.

Materials and methods

Participants

Between April and July 2004, an extensive baseline survey was conducted on farmers' knowledge, attitude and behavior, in which 378 Dutch dairy farmers cooperated (response rate 69.6%), as described by Jansen *et al.* (2009). Between April and July 2009, the same farmers were asked to participate again in a similar survey, resulting in a data set of 207 dairy farmers that participated in both surveys. Reasons for 171 farmers not participating in the 2009 survey were: 1) farmers had quit farming, reorganized the farm or could not be reached (30%), 2) farmers had neither the time nor the inclination to fill in the forms (24%), 3) farmers perceived surveys as useless, not relevant or had a bad experience when participating in other studies (21%), 4) personal circumstances (9%) or 5) other reasons (16%). These non-responders did not differ significantly from farmers who did participate in the 2009 survey regarding their average BMSCC from July 2004 to July 2005 ($p=0.59$).

Questionnaire

The data on farmers' knowledge, attitude and behavior were collected using a structured questionnaire in 2004 and 2009 containing 50 items regarding behavior and farm demographics, and 76 items about farmers' attitude, knowledge and information sources (Jansen *et al.* 2009). The attitude and behavior items were measured using various methods such as binominal dummy variables, open questions and statements that the farmers rated on a 5-point Likert scale according to how much they agreed or disagreed with the statements (Likert, 1932). When frequencies are presented in the results section, scores 1 (disagree) and 2 (partly disagree) are combined, as well as scores 4 (partly agree) and 5 (agree).

Statistical analyses

To compare farmers' answers between 2004 and 2009 in general, Wilcoxon signed rank tests ($p\leq0.05$) were performed. In addition, for each survey variable, gain scores were calculated by subtracting the value in 2004 from the value in 2009. A positive gain score means an increased

score on that question. To compare differences in gain scores between farmers with different levels of self-reported geometric bulk milk somatic cell count (BMSCC) level in 2004, the following threshold values were used (Barkema *et al.* 1998): low BMSCC (≤150,000 cells/ml), medium BMSCC (>150,000 and ≤250,000 cells/ml) and high BMSCC (>250,000 cells/ml). The BMSCC value of 18 farms in 2004 was unknown; they were excluded from this specific analysis. To compare differences between these three groups regarding their change over time, non parametric Kruskal-Wallis analyses ($p \leq 0.05$) were performed. Furthermore, Wilcoxon signed rank tests ($p \leq 0.05$) were performed to determine if the gain scores within a group deviated significantly from zero. All data were analyzed using SPSS (SPSS 15.0.1 for Windows, SPSS Inc. Chicago, IL, USA).

Results

Overall differences between 2004 and 2009

The results show that compared to 2004, attitude, knowledge and behavior of the participating farmers changed significantly ($p \leq 0.05$). In general, farmers increased the number of milking cows over the period (78 vs. 88 cows) even though their total manpower stayed the same, at approximately 1.65 fulltime equivalents. This change was also manifested in their attitude towards mastitis. The extra work was more often perceived as the most annoying aspect of mastitis (26% vs. 49%), and more farmers stated that it was important to keep the farm management simple (79% vs. 88%). With regard to farmers' attitudes, their satisfaction level and problem level of BMSCC changed; farmers were satisfied with on average 156,000 cells/ml in 2004 compared to 150,000 cells/ml in 2009, and perceived a problem at 285,000 cells/ml in 2004 compared to 271,000 cells/ml in 2009. Farmers' perceptions on how to decrease the national BMSCC also changed between the baseline and the end survey. More farmers mentioned that they would prefer a bonus for a low BMSCC (71% vs. 86%), and fewer farmers' stated that they would prefer an increase in fines (19% vs. 11%).

In the 2009 survey, farmers perceived that they had more knowledge about controlling mastitis

problems than in 2004 (34% vs. 53%) and they stated that they more often knew the causes when a mastitis problem occurred (25% vs. 37%). Compared to 2004, more farmers claimed to have sufficient knowledge about the influence of nutrition on mastitis (24% vs. 29%), and more claimed to know that they had to focus on the hygiene of milking procedures when there were *S. aureus* problems (76% vs. 84%). Farmers reported that they more often used the internet as an information source (8% vs. 25%), whereas other information sources such as farm magazines, independent consultants and the Dutch Animal Health Service had decreased in importance.

With regard to farmers' behavior, farmers now focus more often on udder health characteristics when selecting bulls (46% vs. 61%). The use of milking gloves increased from 15% to 46%, the use of a standardized mastitis treatment protocol increased from 7% to 34% and cubicles are more often cleaned (2.28 vs. 2.51 times/day). More farmers use blanket dry-cow therapy with antibiotics (85% vs. 94%), and automatic measurements of milk quality during milking are more often used to diagnose clinical (4% vs. 13%) and subclinical mastitis (4% vs. 10%). The percentage of farmers who engage in foremilk stripping on all cows decreased (33% vs. 27%) as well as the percentage of farmers who prevent cows from lying down after milking (56% vs. 46%).

Comparing low, medium, and high BMSCC farmers

Table 1 shows the significant differences in gain scores between farmers who had a low, medium and high self-reported BMSCC at the baseline survey in 2004 ($p \leq 0.05$). Although the self-reported geometric BMSCC did not change significantly between 2004 and 2009, it did change within the different groups of farmers. The low BMSCC farmers significantly increased their self-reported BMSCC (118,000 cells/ml vs. 145,000 cells/ml), the medium BMSCC farmers more or less maintained the same level (191,000 cells/ml vs. 188,000 cells/ml), and the high BMSCC farmers significantly decreased their BMSCC (282,000 cells/ml vs. 206,000 cells/ml in 2009). Comparison of the gain scores of the high BMSCC group with the low BMSCC group reveals that they sometimes changed their opinions during the years in opposite directions. The gain scores of the high BMSCC group indicate that during the five years, they paid less attention to the number of

attention cows in the DHIA reports and they thought less often that a standardized treatment plan was useful. They also talked less with their veterinarian about mastitis and did not want more mastitis articles in their farm magazines. No significant differences could be found between groups regarding their gain scores on problem and satisfaction levels of mastitis, or the perception of their knowledge.

Table 1. Low, medium and high BMSCC farmers' changes in attitude, knowledge and behavior between 2004 and 2009 (n=189).

Survey variable	Overall gain score	Gain scores per BMSCC group			P-value between groups
		Low (n=71)	Medium (n=91)	High (n=27)	
Self-reported geometric BMSCC (1,000 cells/ml)	-2.01	**27.24**	-2.94	**-75.82**	***
Most annoying aspect of mastitis: uncertainty about cow's recovery[2]	**-0.17**	-0.09	**-0.13**	**-0.38**	*
Importance of getting external income as farm goal[1]	-0.13	**-0.24**	0.05	**-0.41**	*
I always watch the number of attention cows on the DHI reports carefully[1]	-0.05	0.13	0.07	**-0.67**	*
Standardized treatment plan for mastitis is useful [2]	0.07	**0.23**	0.01	-0.15	**
Bacterial culturing is useful because it gives a direction to the treatment that follows[1]	**-0.28**	-0.22	-0.12	**-0.88**	*
I diagnose clinical mastitis by forestripping only high cell count cows[2]	0.05	0.01	**0.10**	-0.15	*
I discover subclinical mastitis by automatic measurement of milk quality during milking[2]	**0.06**	0.03	0.02	**0.26**	**
I only treat a subclinical mastitis case when the cell count is really high[2]	0.01	0.12	-0.11	0.11	*
The best way to decrease the national BMSCC is to decrease the penalty level[2]	-0.01	0.11	**-0.10**	0.00	*
The best way to decrease the national BMSCC is to increase the fines[2]	**-0.09**	**-0.18**	0.00	-0.12	*
The veterinarian is the first person I go to when I have questions about mastitis[1]	-0.10	-0.04	0.01	**-0.52**	**
I often talk about mastitis with my veterinarian[1]	0.00	0.02	0.11	**-0.33**	*
I would like to see more mastitis articles in my farm magazine[1]	**-0.18**	0.19	-0.23	**-0.74**	**

Significant results of Kruskal-Wallis analyses comparing gain scores (2009-2004) between groups with a low (<150,000), medium (151,000-250,000) or high (>251,000) self-reported geometric BMSCC in 2004
* $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$. Values in bold are gain scores within a group that are significantly different from zero (Wilcoxon signed-rank test ($p \leq 0.05$)).
[1] Scored from 1 (disagree) to 5 (agree)
[2] Dummy variable: 0= no, 1=yes

Discussion

The results of this survey show that over the course of a national mastitis control program farmers have changed their attitude, knowledge and behavior. In particular, their attitude towards problem and satisfaction levels of BMSCC changed favorably; this is important because these normative values influence their BMSCC and are expected to influence the farms' udder health status in the long term (Jansen *et al.* 2009). Also, farmers' behavior change seems to be quite profound, and it can be expected that these values will influence mastitis incidence in the future. Interestingly, on some questions there were no overall changes between 2009 and 2004, whereas changes did occur in relation to the initial BMSCC level of farms. It appears that a distinction in BMSCC groups can be important when evaluating mastitis control programs. The group of farmers with a high BMSCC in 2004 reported a lower BMSCC in 2009. For mastitis control programs, it seems important to be successful in reaching this group of farmers.

Even though the farmers in the high BMSCC group were successful in decreasing their BMSCC, they had different opinions compared to the low BMSCC group on e.g., the need for mastitis information, the usefulness of bacterial culturing of milk, and concern about the number of attention cows. Further statistical analyses are needed to determine which attitudinal and behavioral variables explain the change in BMSCC during the years, taking into account that the maximum explained variance in BMSCC by farmers' self reported attitudes and behavior is 48% (Jansen *et al*, 2009).

It is debatable whether the changes in farmers' attitude and behavior have been caused by the national mastitis control program, because changes in farm management are a long-term process and also depend on contextual factors (Leeuwis, 2004), such as milk price, quota regulations or infectious disease outbreaks. Although the study herds were initially randomly sampled from the Dutch dairy herd population, the 207 participants may not be representative of the whole population. These farmers were willing to participate in the survey, and thus may have been more interested in udder health management and/or had a better udder health. Also herds that ceased farming may have had a worse udder health than herds that continued farming and were

participating in the last questionnaire. However, the responders' BMSCC in 2004 did not differ from that of the non-responders. Nonetheless, the selection biases may have led to an overestimation of the success of the national udder health program.

As this study uses farmers' self-reported BMSCC, it would be interesting to study the effect of farmers' attitude and behavioral change on their real BMSCC and mastitis incidence. In conclusion though, the results of this study show that, over the course of a national mastitis control program, farmers' knowledge, attitude and behavior regarding mastitis can change.

Acknowledgements

This study is part of the 5-year mastitis program of the Dutch Udder Health Centre and was financially supported by the Dutch Dairy Board. The authors would like to acknowledge the dairy farmers for their participation in these studies.

References

Barkema HW, Schukken YH, Lam TJGM, *et al*. Management practices associated with low, medium and high somatic cell counts in bulk milk. J. Dairy Sci. 81, 1917–27, 1998

Barkema HW, Van der Ploeg JD, Schukken YH, *et al*. Management style and its association with bulk milk somatic cell count and incidence rate of clinical mastitis. J. Dairy Sci. 82, 1655–63, 1999

Chase LE, Ely OL, Hutjens MF. Major advances in extension education programs in dairy production. J. Dairy Sci. 89, 1147–54, 2006

Jansen J, Van den Borne BHP, Renes RJ, *et al.* Explaining mastitis incidence in Dutch dairy farming: the influence of farmers' attitudes and behavior. Prev. Vet. Med. 92, 210-223, 2009

Leeuwis C. Communication for Rural Innovation. Rethinking Agricultural Extension, 3rd edition. Blackwell Science Ltd, Oxford, UK, 2004.

Likert R. A technique for the measurement of attitudes. Arch. of Psychol. 140, 1-55. 1932.