COSTS AND EFFICACY OF MANAGEMENT MEASURES TO IMPROVE UDDER HEALTH AT DUTCH DAIRY FARMS. THE USE OF EXPERTISE

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Introduction

Mastitis is an endemic disease in the dairy sector worldwide and causes, amongst others, serious economic consequences (Halasa et al., 2007). Mastitis expresses itself in two ways: subclinical mastitis and clinical mastitis. To measure the mastitis situation at a farm, bulk tank somatic cell count (BTSCC) is often used as parameter for subclinical mastitis and clinical mastitis (CM) is often expressed as the incidence rate of CM (Barnouin et al., 2005). It is difficult to control mastitis, because it is a multi-factorial disease, has numerous causative bacteria and can be transmitted from cow to cow (contagious mastitis) and from environment to cow (environmental mastitis). The multifactorial nature of mastitis means that there are many risk factors for mastitis, requiring a number of different management measures to control.

Literature on the efficacy of management measures mostly gives general information which is not applicable in a farm specific situation, especially when the effects need to be quantified for economic calculations. Quantitative data on continuous variables are usually a prerequisite for sound decision making. Preferably, such data are derived from field studies and experiments. However, these data often are not (yet) available or, if available, incomprehensive, unreliable, only indirectly applicable or a combination of these factors. This results in decisions being made without correct and complete information. In such situations, expert judgement is the only way to gain the required knowledge (Seabrook, 1984).

Previous research

One of the objectives of previous research by Huijps et al. (2009a, 2009b) was to analyze the efficacies of management measures regarding mastitis. The determined efficacies were used to calculate costs and benefits of different management measures.

As a first step, the management measures were selected for which information is needed about efficacies for a mastitis problem, varying from 100% environmental to 100% contagious. Efficacies were needed specified on BTSCC and on the incidence of CM. These management measures came from the 10 point plan of the NMC (www.nmconline.org), which was the base of the more specified management measures as advised by the Dutch Udder Health Centre (Table 1).

Table 1. Management measures included in the study based on the NMC 10 point plan and the Dutch Udder Health Centre (Huijps et al., 2009b).

	Management measure description	Short description
1	All cows with clinical signs are milked last	Milking clinical cases last
2	All cows with an elevated SCC (>250,000 cells/ml) are milked last	Milking subclinical cases last

3	For all cows a separate cloth is used to clean the udder before attaching the cluster	Separate cloth
4	Clean udders are washed with water and are dried before attaching the cluster	Wash dirty udder
5	All cows are prestripped	Prestripping
6	During every milking milkers' gloves are worn	Milkers' gloves
7	All cows are treated with a good teat disinfectant after milking	Post milking teat disinfection
8	After milking a cow with clinical signs of mastitis the cluster is rinsed with hot water before another cows is milked	Rinse clusters clinical
9	After milking a cow with subclinical mastitis the cluster is rinsed with hot water before another cows is milked	Rinse clusters subclinical
10	Teat liners are replaced according to the manufacturer's norm	Replace teat cup liners
11	A treatment protocol is set up together with a veterinarian and every month the therapies are evaluated together	Treatment protocol
12	All cows are dried of with an appropriate antibiotic	Drying off
13	After milking, cows are kept standing for at least 30 minutes	Keep cows standing
14	Add appropriate minerals to the feed of dry cows	Dry cow minerals
15	Decrease the number of cows to prevent overcrowding	Prevent overcrowding
16	Clean the stalls twice every day and make sure enough and clean bedding material is present	Clean stalls
17	Manually clean the yards twice every day	Clean yards
18	Optimize the feed according to farm specific needs	Optimize feed

Two kinds of inputs were used to determine the efficacy of different management measures. First, an extensive literature search was carried out. All peer-reviewed papers in scientific journals from 1996 to 2006, and papers describing field experiments from 1986 to 2006, were searched. Results as described in these papers had to be quantified as a percentage decrease in BTSCC or in incidence of CM related to one of the management measures. Selected papers were valued from 0 (not relevant) to 3 (very relevant), based on availability of data, country, materials and methods, and the potential to recalculate the data from the paper to a percentage decrease in BTSCC or incidence of CM. Because literature was incomplete, expert opinions were additionally included based on a questionnaire. To reach experts from different fields, three expert sessions were organized: one with dairy farmers, one with veterinarians, and one with experts from different milk and feed industries. The experts were asked to indicate a minimum, most likely and maximum effect for every management measure, specified for a 100% environmental mastitis problem and a 100% contagious mastitis problem, and specified for three udder health situations. The different udder health situations were: 1) good (BTSCC < 150,000 cells/ml and CM incidence < 20 cases per 100 cows per year)), 2) average (BTSCC > 150,000 and < 300,000 cells/ml and CM incidence between 20-30 cases per 100 cows per year), and 3) bad (BTSCC > 300,000 cells/ml and CM > 30 cases per 100 cows per year). Efficacy is defined as the percentage decrease in BTSCC and the percentage decrease in incidence of CM. Efficacies were based on the situation in which the management measure is

a new measure on the farm, it is not yet implemented. They were asked to indicate these effects for a default farm, defined as a farm under Dutch circumstances, with 65 milking cows and a milking parlor with 12 places. The results of the expert sessions and the literature search were combined to determine the efficacy of the management measures using Monte Carlo expert evaluation analysis. Analysis was carried out using @Risk (Palisade Corporation, Ithaca, NY). This resulted in a minimum, most likely, and maximum value of efficacy for all management measures in different farm situations.
For all management measures in all situations, a large variance (min; max) was found, indicating the uncertainty and/or variation of the efficacies. The efficacies for the different situations are presented in Table 2. Further results on efficacies, costs and benefits of the different measures can be found in Huijps et al. (2009a, 2009b).
The efficacies of the management measures were an important input of the calculations of the costs and benefits of those measures. It is therefore important to have accurate and reliable data. Efficacies were based on a combination of literature and expertise. On average, expert values were lower than literature values (when literature was available). This can be caused by the fact that the experts were cautious in their answers. (Huijps et al., 2009a, Huijps et al., 2009b).
Further research on efficacies of the different management measures is needed.

Further research

Objectives

The first objective of the future research is to determine efficacies of the 18 management measures on BTSCC and CM with larger accuracy. The second objective is to analyze the use of expertise in estimating efficacies.

Survey design

Two groups of experts will be asked to estimate the efficacies of the 18 management measures as described in Huijps et al. (2009a) with the use of a new designed questionnaire. Efficacy is defined as the percentage decrease in BTSCC and the percentage decrease in incidence of CM. Efficacies are based on the situation in which the management measure is not yet implemented on the farm. In this new questionnaire the experts will be asked to indicate a minimum, most likely and maximum effect for every management measure, specified for a 100% environmental mastitis problem and a 100% contagious mastitis problem for a default farm. A default farm is defined as a farm with 65 milking cows, a milking parlor with 12 places, a BTSCC of 200,000 cells/mL and a clinical mastitis incidence of 25 cases per 100 cows per year (thus, 20 cases for the default herd). No distinctions will be made in different udder health situations. The first group of experts (group A) will fill in the questionnaire with two management measures (drying off and post milking teat disinfection) given as reference measures. The efficacies of these two measures are well known from clinical trials from literature and the values will be given in the questionnaire. The experts can estimate the efficacies of the 16 remaining management measures by using the two given reference measures. Because two efficacies are given, not only the absolute values can be used, but also the ratio between the two reference measures. Finally, the experts will be asked how their own perspective of the reference measures matches the given values. The second group of experts (group B) will be asked to fill in the exact same questionnaire, but without the values of the two reference measures given.

Table 2. Efficacies of 18 management measures indicated as a percentage decrease in BTSCC and CM (where 1= milking clinical cases last, 2= milking subclinical cases last, 3= use a separate cloth, 4= wash dirty udders, 5= prestripping, 6= wear milkers' gloves, 7= post milking teat disinfection, 8= rinse clusters clinical, 9= rinse clusters subclinical, 10= replace teat cup liners, 11= treatment protocol, 12= drying off, 13= keep cows standing, 14= dry cow minerals, 15= prevent overcrowding, 16= clean stalls, 17= clean yards, and 18= optimize feed) (Huijps et al., 2009b).

Effect	BTSCC						CM					
Pathogen	Environmental			Contagious			Environmental			Contagious		
Udder health situation	good	average	bad	good	average	bad	good	average	bad	good	average	bad
1	15.7	12.9	14.5	17.8	16.5	18.2	3.6	4.45	6.3	7.1	9.2	12.5
2	24.5	18.3	19.9	27.1	24.6	26.3	1.6	2.1	4.3	8.3	11.4	16.5
3	1.6	2.8	3.5	4.4	5.7	6.3	3.3	6.1	8.8	6.0	9.4	13.5
4	5.7	5.9	6.2	5.0	5.3	5.6	4.9	6.3	8.8	3.2	4.9	5.7
5	12.5	13.7	14.6	12.6	14.3	15.5	1.7	3.0	4.3	1.6	2.9	4.4
6	1.8	3.4	4.3	4.8	6.4	7.5	-8.9	3.6	6.1	-8.9	5.4	8.6
7	33.4	33.9	34.3	33.8	34.4	40.3	32.0	38.3	39.2	32.4	39.0	40.0
8	6.0	8.5	9.3	11.7	13.5	13.1	1.1	5.7	8.3	1.9	9.5	14.2
9	6.0	8.5	9.3	11.7	13.5	13.1	1.1	5.7	8.3	1.9	9.5	14.2
10	6.2	8.4	8.8	6.3	8.7	9.3	8.4	4.1	5.6	8.8	6.1	8.6
11	4.4	7.8	11.9	6.8	10.5	12.6	2.6	4.7	7.8	3.6	5.7	8.7
12	14.2	19.8	22.1	15.9	22.4	25.0	7.9	11.5	15.8	9.7	13.4	19.0
13	5.1	7.3	8.6	2.9	4.9	5.2	6.8	9.3	12.4	3.3	5.2	7.0
14	20.1	21.5	21.1	20.3	20.5	19.8	12.7	14.7	17.6	11.6	14.5	16.7
15	9.6	14.5	16.4	6.7	10.2	12.1	8.7	12.1	15.5	6.4	8.5	11.3
16	9.5	13.7	14.7	5.5	8.0	8.2	9.3	11.1	14.3	3.7	5.4	7.5
17	5.6	9.2	9.7	2.2	3.4	4.0	5.5	8.0	11.0	2.6	4.2	6.1
18	12.7	14.3	13.4	14.0	15.5	13.9	14.5	16.8	19.7	14.0	16.3	19.2

Participants
In total, two groups of experts (group A and group B) will participate in this survey and data of the group of experts (group C) as described in the previous research by Huijps et al. (2009a) will also be used for analysis. Group A exists of the same 15 experts (veterinarians, dairy farmers and experts from different milk and feed industries) as described by Huijps et al. (2009a). Group A will fill in the questionnaire with the given values of the two reference measures. The veterinarians and dairy farmers will estimate the efficacies of all the management measures. The experts from different milk and feed industries will estimate only the management measures related to their own field of expertise. Group B exists of 8 newly acquired experts (only veterinarians). Group B will fill in the whole questionnaire without the given values of the reference measures. The existing data of group C will be used for further analysis.

Analysis
The results of the three groups will be compared with reality based on a chosen control reference measure. This is an a priori chosen third management measure of which the efficacy is also known from literature. The value of the effect of this control reference measure will not be shown to the participants in the questionnaire. The differences between the estimated efficacy of the control reference measure and the true value of the control reference measure will also be compared to each other. Probably the most reliable method is the one which has the smallest difference between the estimated efficacy of the control reference measure and the true value of the control reference measure. Furthermore, the absolute values of the different efficacies found in the different groups will be compared to each other by using pair wise comparisons. The results of group A and group C will also be compared by analyzing the variation within persons. Further analysis will be performed when the new results are more equal to the control reference measure or big differences are found compared to group C. New efficacies will be determined by using Monte Carlo expert evaluation analysis, as described in Huijps et al. (2009a). The ratio's between the different efficacies for the different management measures in different farm situations known from the research by Huijps et al. (2009b) can be used for transformation of the efficacies found in the present research to the different farm situations.

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