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Problem Solving in Dairy Health Management

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Introduction

For veterinarians and dairymen cooperating in dairy health management programs, the most economically important conditions affecting the cattle are those which manifest themselves principally through impairment of production efficiency (1). Conditions such as subclinical mastitis, reproductive problems and suboptimal nutrition may cause very few clinical symptoms but can have a marked effect on productivity. The objective of a health management program is to minimize the losses from these subclinical conditions along with controlling clinically evident diseases.

The first step in problem solving in dairy health management is identifying the fact that a problem exists and determining in general terms what it is. This involves routinely monitoring production and other parameters which are indicators of the health of the herd. These parameters are then compared to pre-established goals or targets and problem areas identified.

The second step is to determine very specifically what the problem is and examine possible reasons as to why it is occurring. An analogy from individual animal medicine would be starting with a dog that was presented with a persistent occular discharge and by conducting a physical examination and appropriae diagnostic tests arriving at a diagnosis of keratoconjunctivitis sica due to inadequate tear production. Instead of a physical examination and diagnostic tests though, a veterinarian involved in health management must analyse the herd's health and productivity records (perhaps including records of multiple physical examinations) and evaluate the results of screening tests (such as somatic cell counts) in order to arrive at a herd diagnosis.

It has been stated that "a problem clearly defined is a problem half solved". One method of arriving at a clear definition of the problem is to follow the time honoured journalistic tradition of investigating the 5 W's: when, who, where, what and why. This paper discusses each of these in turn and then presents two examples in which this approach was used to solve economically important problems in dairy herds.

When

The time of occurrence of a condition can be measured on two scales. One scale (an absolute scale) describes the occurrence of events in actual or calendar time. Examination of short term variations in disease rates (i.e. daily or weekly variations) or changes over longer periods (seasonal or yearly fluctuations) can be very informative. As an example, if only 10% of all observed heats in a dairy herd are noted on Saturdays and Sundays, it would be reasonable to question the efficacy of heat detection on the weekend because one would expect 29% (2/7 = 29%) of heats to occur on those two days. It is also important to monitor long term trends in disease rates and measures of productivity and reproductive performance in order to determine whether or not the health management program is succeeding.

However, for solving herd problems, determining the time of occurrence of events on a relative time scale is one of the most important determinations to be made. For dairy cattle, this means: "when does the problem occur relative to calving?" For example, when investigating a mastitis problem it is important to determine whether most new infections occur during the dry period or in the early, middle or late stages of the lactation. For a problem of poor reproductive performance the reproductive process

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can be subdivided into a number of stages and each stage examined for evidence of inadequate performance. This would involve dividing the calving to conception interval into calving to first breeding and first breeding to conception intervals. The calving to first breeding interval could then be subdivided into the calving to first observed heat interval and the first observed heat to first breeding interval and so on. For each interval, either the herd's average or the percent of cows with an excessively long interval can be calculated to evaluate performance in that phase of the reproductive process. The use of a herd's averages is demonstrated in example #2.

Who

The question "who?" relates to which animals within a herd or which herds within your practice are affected. In order to determine which cows within a herd are affected, the veterinarian must have some way of defining an "affected animal". For a subclinical mastitis problem, affected cows could be defined as those with cell counts above a certain level or those cows with a positive milk culture. For reproductive problems affected cows may be defined as those with a calving to first observed heat interval over 40 days or those with more than three services.

Once the above criteria have been established, the severity of the problem in various groups of cows within the herd can be determined. It may be useful to compare heifers to mature cows, low producing cows to high producers, purebreds to grades, animals on different rations and so on. The objective is to pinpoint which cows are most commonly or most severely affected.

A comparison among herds can also be useful for determining average disease rates and measures of reproductive performance and productivity in your practice area. This is useful for establishing reasonable targets for health management programs. It also enables a dairyman to compare his results to either the average, or to the best results for the area. This can provide added incentive for him to work diligently on his health management program.

Where

The question "where is the problem most severe?" is addressed in much the same manner as the question "who is affected?" Animals are divided into groups according to their physical location and the severity of the problem in each group is determined. It can be useful to compare pastured to stabled animals (this may relate to seasonal patterns) or compare animals in different barns. Even noting the location of the affected animals within a barn and their relationship to factors such as milking order, feeding order, ventilation and other physical environment factors can provide much useful information.

As with "who?", it is also useful to compare herd disease rates and productivity parameters from various areas of your practice. For example, if you find that most herds in one area have a high rate of retained placenta, it would be worthwhile checking the soil selenium levels in that area.

What

The crux of problem-solving is the production of a clear definition of the problem at hand. Defining what the problem is requires that: a) the information obtained by answering the questions when, who and where be summarized, b) additional data be collected as required and c) an estimate of the magnitude of the problem in both biological and economic terms be made.

As an example of a situation where additional data may be required, consider the problem of a herd with a prolonged calving to conception interval. Through an analysis of the herd's records, the veterinarian determined that the problem was primarily one of a prolonged calving to first heat interval (i.e. "when") in the heifers (i.e. "who"). The herd is housed in a loose housing barn with the heifers in a pen near the back of the barn (i.e. "where") and they are fed a different ration than the mature cows. At this point additional data is required to determine if the problem is due to the heifers not cycling (perhaps due to sub-optimal nutrition) or due to poor heat detection. To answer this question, the veterinarian could rectally palpate a number of postpartum heifers and from those examinations assess their level of ovarian activity.

When answering the question "what?" it is important to attempt to estimate the magnitude of the problem in economic terms for two reasons. Firstly, a producer may have several impediments to optimal productivity. Assessing the loss associated with each problem, along with the costs involved in rectifying each can help establish which problem should be given the highest priority. Secondly, it may be impossible to convince a producer of the need for corrective action unless the problem is presented in economic terms. Estimating the loss due to some conditions can be a difficult process but a number of recent Canadian publications give some guidelines for losses associated with sub-clinical mastitis (2,3) and reproductive inefficiency (4,5).

Why

Once the problem has been clearly defined, the number of possible reasons "why?" which will require investigation will be greatly reduced. The questions to be answered in order to determine the reason why will be determined by the statement of the problem.

For example, if a herd has a high prevalence of subclinical mastitis, analysis of the somatic cell count records and culture data may indicate that most new infections are occurring during the dry period. If this is the case, the veterinarian would then vigorously investigate the dry cow therapy regimen and the housing and management of the dry cows. An evaluation of the milking system and milking procedures in this herd, while potentially beneficial, would receive less emphasis.

Answering the question "why?", calls on all of the observational powers and investigative skills of the clinician. If the answer is not apparent after a thorough investigation, the veterinarian should be prepared to conduct small, but well designed field trials to obtain additional information. For example, if the housing and management of the dry cows in the previous example are found to be adequate and the producer is diligent about treating all cows at drying off with a generally effective product, the veterinarian may want to consider several other dry cow preparations. The best way to accomplish this would be to use culture and sensitivity results to identify several potentially effective products. A field trial that compares the new infection rates in cows treated with those products should then be conducted. The essential features of the design of such a field trial have been reviewed elsewhere (6).

The utility of this "5-W's" approach is not restricted to situations where major disease or productivity problems exist. As the following two examples show, it can be used to help rectify problems which had previously been considered unimportant by the producer.

Example 1

A 90 cow Holstein-Friesian herd in Ontario, Canada had a rolling herd average of 147 BCA units and a daily production of 20.7 litres/cow/day. Both production parameters indicated a reasonable level of milk production but the bulk tank somatic cell count had averaged 409,000 cells/mL over the last six months. The producer was not particularly concerned but his veterinarian pointed out that with milk valued at $40.00/hL, he was losing in excess of $8,000/year in milk compared to what he would produce if his cell count averaged 150,000 cells/mL (2).

In order to investigate the problem further, the veterinarian classified all the cows as having "elevated SCC" if their most recent individual cow somatic cell count was over 200,000 cells/mL and "normal" if was less than that. While investigating when the problem occurred it was found that the distribution of counts according to the cows' stage of lactation (i.e. "when") was as follows:

Stage of Lactation

	Early	**Middle**	**Late**
Elevated SCC	11%	35%	79%
Normal	89%	65%	21%

The fact that, in general, counts were low early in lactation suggests that the dry cow therapy program on this farm was adequate and also that the majority of new infections were not occurring around the time of parturition. The dramatic rise in the prevalence of elevated counts throughout the lactation is suggestive of cow to cow transmission of the pathogenic agent.

In order to determine which cows were affected (i.e. "who") the cows were classified according to age and cell count status with the following results:

Age (yrs.)

	2	**3-5**	**6+**
Elevated SCC	25%	55%	75%
Normal	75%	45%	25%

It is quite evident that the prevalence of elevated counts increases with the age of the cows but since one expects very few elevated counts in first calf heifers, the 25% prevalence observed in this herd is certainly cause for concern. It is apparent that the herd has a high prevalence of elevated counts and all ages are affected.

At this point it was concluded that the herd had a high prevalence of infection with cow to cow spread during the lactation being the most likely mechanism of transmission. It was also concluded that most infections were eliminated by the dry cow therapy and that management at the time of calving was adequate since relatively few new infections occurred then.

In order to further characterize the problem, data about the incidence of clinical mastitis was collected and composite milk samples from the 75 cows milking were collected for culturing. The incidence of clinical mastitis was 2.7% per month (i.e. 2.7 cases/100 cows/month) which was deemed acceptable. Of the 31 samples which were culture postive, 26 (84%) yielded *Streptococcus agalactia.*

The "herd diagnosis" of this problem could now be stated as a high rate of cow to cow transmission of *Streptococcus agalactia* during lactation resulting in a high prevalence of subclinical mastitis with an attendant economic loss in excess of $8,000/year.

Resolution of the problem then depended on identifying those faults in the milking system and the operator's technique which related either to cow to cow transmission of the organism or to increasing the susceptibility of the cows to new infections.

Example 2

A 200 cow Holstein-Friesian herd in Ontario, Canada had a calving to conception interval of 121 days (based on cows calving during a 16 month period). The dairyman, in conjunction with his veterinarian, had set 90 days as the herd objective and based on an estimated loss of $2.50/cow/extra day open (5) it was estimated that suboptimal reproductive performance was resulting in a loss of approximately $15,000/year.

In order to identify when in the sequence of reproductive events the problem was occurring (i.e. "when") the veterinarian examined several diagnostic indices: (See below).

From these data it was apparent that of the total of 31 days that were being lost, all of the loss was occurring prior to the first breeding. A proportion of this loss appeared to occur between the first heat and first breeding but the greatest loss was due to failure to detect heat early in all cows (earlier due to the cows not cycling or to poor heat detection).

When further investigating the loss of time between first heat and first breeding, it must be recognized that since the producer had decided that cows would not be bred prior to 50 days postpartum, not all cows could be bred on their first detected heat. However, of the 210 cows calving, 26 (12.4%) had heats detected on or after day 50 at which they were not bred. An average of 47 days (called "deferral days") then elapsed before those cows were again detected in heat and bred. Although only affecting a small number of cows, these "deferral days" added substantially to the herd's overall calving to conception interval.

Interval	**Mean**	**Target**	**"Days Lost"**
calving to conception	121	90	31
first breeding to conception	27	30	0
calving to first breeding	94	60	34
calving to first heat	66	45	21
% in heat by day 45 postpartum	40%	100%	—
% bred by day 60 postpartum	19%	50%	—

In order to further investigate this problem of "deferral days" the veterinarian subdivided the herd into heifers and mature cows (i.e. "who") and it was found that 0% and 18.5% of each group respectively, were deferred. Heifers have a greater persistency of milk production than do cows so a longer calving to conception interval in heifers has less detrimental effect on overall productivity than one in cows. Consequently, it was with concern that it was noted that the deferrals were occurring in mature cows instead of in heifers. However, the veterinarian had been continually stressing the importance of early breeding and when the % of cows deferred during the first six, second six and last four months of the study period were calculated (i.e. "when — long term trends") the results were 17.0%, 12.8% and 0%. It appeared that the problem of deferrals had been solved.

The veterinarian then turned his attention to the problem of identifying which cows (i.e. "who") were not being seen in heat early in the postpartum period. A number of factors were examined and the results of several appear below:

Age did not appear to be a factor in the problem. However, the 26 cows which had a retained placenta had a substantially longer interval to first observed heat, suggesting that measures to reduce the incidence of retained placentas might be in order. The problem was also more serious in the higher producing cows which suggests that the nutrition program in the dry period and early lactation should be reviewed. Finally, the problem appears to be more serious during the winter. The veterinarian had noticed that the operators were less likely to be around the barn late in the evening during the winter and one possible consequence of this was a reduced level of heat detection.

These analyses were not a complete evaluation of all aspects of the reproduction program on the farm but they did serve to identify the major problem areas (i.e. "what"). The problem of "deferral days" was identified but it appeared that the producer had already rectified that situation. It was also determined that cows having a retained placenta and cows calving during the winter were more likely to have a prolonged calving to first heat interval. Steps to rectify those problems could be initiated immediately. Finally, the problem of failure to detect heats appeared more serious in high producing cows. A review of the nutritional program along with an evaluation of body condition scores would be required to answer the question "why?" before corrective measures for that problem could be undertaken.

Factor	**Calving to First Heat Interval**
Age — 2 years	64 days
— 3-5 years	62 "
— 6+ years	68 "
Retained placenta — present	86 days
— absent	61 "
Production — above herd average	71 days
— below herd average	58 "
Season — summer first year	56 days
— winter	77 "
— summer second year	61 "

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