

Dairy Split Session I

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Developing Workable Calf Management Programs

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Introduction: Defining The Problem

The rearing of dairy calves, like the rearing of children, or like global politics or religion, is a subject which has been debated for many years, usually on the basis of strong opinions and not much evidence. Dairy farmers have been subjected to alternate waves of euphoria, as some new product or program is thrown out at them, and then despair, as yet another panacea fails. Some of the confusion with regard to the value of different calf rearing systems arises because not everyone is using the same standard for evaluation. Calf morbidity, mortality and welfare, economic efficiency and farmer satisfaction are all valid, and different, endpoints to consider. The idea, of course, is to optimize all of these. At the least, we need to be **aware** of all of these in our evaluations.

Another source of confusion in the debate, however, is the misconception that no one has made any progress in this field. Part of the reason for this is that we, as veterinarians, tend to pay most attention to farms which are having problems. Indeed, most dairy farmers prefer to leave well enough alone when the calves seem to be healthy, and only bring in the "experts" after the dead stock truck has been called for the third time in a week. The fact is that, within any given time period, a few farms have serious calf morbidity and mortality problems, and most farms are problem-free (1,2). Super-imposed on this pattern we have one of "problem years" or at least "problem seasons", again, often with respect to specific farms (3, 4). Nevertheless, to a very great extent we are scientifically ignorant as to why these differences occur.

Given a good set of records and an alert set of five senses, a practitioner can often evaluate why, within a farm, some calves get sick and some don't. He can even run individual-animal-level experiments. The effectiveness of a particular vaccine, or of navel dipping, within a farm can be tested by randomly assigning each animal to one or another treatment

group. Statistically sound random assignment methods are as close as the nearest nickel, or telephone book (5).

Evaluating over-all calf management programs to determine why some farmers are having fewer calf problems than others, or to look for time- or region-related patterns, is another matter. If we ask various experts why calves are dying at one particular time on one particular place, we are quickly faced with a series of differing opinions. A pathologist might suggest that the calves are dying from certain lung or intestinal lesions, a microbiologist would offer a list of pathogenic infectious agents, and an epidemiologist give a computer print-out of inappropriate husbandry and management practices. To determine how all of these factors fit together, to suggest other possibilities, and to assign relative importance to each component, requires well-designed, large scale survey work. A review of the current literature makes it quite clear that the gaps in our knowledge on this subject are large, and that a great deal remains to be done.

If calf mortality is taken as a measure of the success of a calf rearing program, it is worthwhile to begin by subdividing the mortality into two groups, stillbirths, and neonatal deaths, each of which is potentially affected by a different set of management techniques.

Stillbirths can be defined in various ways, none of them entirely satisfactory, but many of them useful. For purposes of evaluating management practices, we can call any calf which dies within the first 24 hours a stillbirth, and anything thereafter until 28 days of age a neonatal death (6). Stillbirths, defined in this way, are primarily influenced by breeding practices, prenatal care of the dam, and calving management. Neonatal deaths, on the other hand, are more likely to result from problems in the immediate post-natal period, and in the replacement management program.

Stillbirth Problems

Prenatal Care

A detailed examination of the effects of prenatal care of the dam on calf livability is beyond the scope of this article. Recent reviews on the subject indicate that, in general, deleterious effects are only associated with gross over-conditioning, starvation, and specific nutritional deficiencies or excesses (7, 8). Since such extremes of management occur only sporadically in the dairy industry, the over-all impact of dry cow management on calf survival, though unknown, is probably not great.

Breeding and Calving

The effects of dystocia on calf survival are well documented (9, 10, 11). A recent large scale survey carried out among Ontario Holstein cows provides results which are typical of those found by other researchers throughout North America. (9, Table 1). The 24-hour calf survival rate decreases as calving difficulty increases, and dystocia problems occur with greater frequency in heifer calving than in mature cow calvings.

TABLE 1. Calving Ease and Mortality.

Parity	1	2	3
Ease			
Unassisted or unobserved	8.9	5.0	5.1
Easy pull	5.8	3.4	4.6
Hard pull	27.1	24.1	25.2
Surgery	50.8	50.0	43.3

8.1% of Ontario Holstein dairy calves are dead within 24 hrs. of birth Cady and Burnside, 1980.

Dystocia involving a calf in normal presentation can occur for at least two reasons. A calving may be made unnecessarily difficult if the calf is pulled too soon or too quickly. This is a management problem, best remedied by a good dose of medicine new veterinary graduates often forget to include in their kits: patience. Many cases of dystocia, however, respond not to patience, but ultimately to a hard pull, or to surgery. In these cases, prevention is the only program worth pursuing. In recent years, programs have been developed in both Canada and the United States to rate bulls on the ease with which their calves are born (12, 13). In the U.S., the program is coordinated by the National Association of Animal Breeders out of Iowa State University, and results are available through local artificial insemination organizations. In Canada, ratings have been based on herds in Ontario and Quebec, which comprise the bulk of the Canadian dairy cattle population. These ratings are available from the Holstein-Friesian Association of Canada offices in Brantford, Ontario. Both organizations recommend that first calf heifers be bred to bulls whose progeny are born with the least difficulty.

The value of these programs in reducing dystocia problems and, ultimately, increasing newborn calf survival

rates, remains to be seen. Martinez, Berger and Freeman have reviewed much of the U.S. information available through the NAAB program, and have concluded that "response to calf livability can be expected to be 41% greater when it results from selection on dystocia than from direct selection on calf livability" (11). They have also added a note of caution, pointing out that those calves which are easily born may not themselves grow up to be easy calvers. In other words, the direct and indirect effects of sire on calf livability appear to be different and perhaps opposite in direction (14).

Neonatal Calf Problems

Management Factors

The various management components of a dairy calf rearing program were succinctly and ably outlined by Dr. Hancock at the 1982 A.A.B.P. sessions (15), and several aspects, such as the role of colostrum, feeding, housing and pathogenic agents will receive detailed examination in the remainder of this session. This would appear to leave very little material to be covered.

One might ask if vitamin or selenium injections, or navel treatments, to newborn calves enhance the probability of survival of the calf, or increase its sense of well-being, or decrease its probability of succumbing to disease. There is no published scientific evidence in the literature that navel treatment of the newborn calf is beneficial to that calf (16, 17, 18). In fact, initial results from a large observational study in Ontario indicate that both these procedures may be doing more to enhance the well-being of a certain type of treatment—happy farmer than to help preserve the health of the calf (2).

One study in Quebec suggested that dehorning calves at less than one month of age was associated with lower calf mortality rates than dehorning calves at later stages (19, Table 2). These results did not take into account other, possibly confounding, factors, nor have they been repeated elsewhere.

If all of the various management techniques of which we are aware are put into a statistical model, how much of the farm to farm variation in calf mortality can we explain? How much do we really know about why some farms have problems and others don't? Surprisingly, the appropriate multivariate statistical techniques have rarely been applied to this problem. Perhaps more surprising, however, and certainly more disconcerting, is that when the techniques are applied, we discover that we are swimming a vast sea of ignorance. Bowman, in Quebec (19) found that 17 management factors explained only 6.3% of the variation in mortality of calves up to three months of age. Simensen, in a review of Norwegian dairy calf mortality (6), discovered that 19 management factors explained 1.3% of the variation in mortality of liveborn calves to 30 days of age. In other words, well over 90% of the farm to farm variation in calf mortality remains unexplained.

Yo

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TABLE 2. Dehorning

Age of Calf	CMR (%)
1 month	11.9
1-3 months	13.3
3 months-2 yrs.	14.7
Never	16.1

Bowman, et al, 1977

Meteorological Factors

We must be missing something, but what? Certainly seasonal changes, with attendant meteorological variations, have not been given due attention. That calf mortality and morbidity vary over time does not appear to be in doubt, nor does the fact that climatological variations can “explain” a large proportion of that variation (3, 4). One of the reasons this area has been neglected is that no biologically plausible explanation, open to human manipulation and hence preventive measures, comes immediately to mind. The move to total confinement housing of calves a decade or two ago did not seem to provide a solution. Nevertheless, I believe we have backed away from this issue too quickly; at the very least, careful scientific study of this seasonal phenomenon may provide us with a residual, unmodifiable level of calf loss which can provide a goal for management programs. At best, we may discover clues to the ecology of some of the more important pathogens in calves.

The Human Factor

Another, perhaps more important missing ingredient in the calf management program, the human factor, is suggested by both a thorough reading of the survey literature, and a consideration of calf management models. In fact, any good practicing veterinarian could have told us this years ago. One can have all the most sophisticated management programs in the world, but they won't be of any benefit unless the right person is there to make them go. Management cannot exist without the manager.

While this knowledge has been floating around at an intuitive level, we have never, scientifically, come fully to grips with it. Over the last ten years, three calf management surveys have concluded that the person who takes care of the calves is important in determining calf outcome. From a design or analysis point of view, all of these surveys have serious flaws.

In 1973, a survey by Speicher and Hepp in Michigan (20) rated calf rearers in decreasing order of disaster-proneness, with hired help at the top and the farm wife or mother comfortably at the bottom. However, these conclusions were based on a mailed questionnaire for which the return rate was less than 50%, and hence may be seriously biased. As well, the workers noted that herd size was correlated with type of calf rearer, that is, that hired help were working on larger farms and that farmers and their family were caring for the calves on smaller herds. Having noted this association, no attempt was made to control for the effects of farm size by using appropriate multivariate statistical

techniques. Thus, one could with equal justification conclude that some other factors also associated with herd size, such as levels of crowding or contamination, were the direct cause of the increased calf mortality, rather than the calf rearer.

From an analytic point of view, a 1975 survey by Martin, Schwabe and Franti in California (17) provides firmer footing for the conclusion that farm owners are more beneficent as calf raisers than hired helpers. In that particular study, once calf management personnel was accounted for, no other management factors were significantly associated with mortality rate. These results differed from those in Michigan in that farm owners were considerably more effective in preventing calf losses than their wives or children. The most sophisticated analytical techniques, nevertheless, cannot make up for the fact that only 16 farms, 10 of which were randomly selected, were used in this study. This constituted, numerically, too weak a foundation on which to build any lasting calf rearing recommendations, or to discriminate between characteristics of problem farms and non-problem farms.

Jenny, Gramling and Glaze, in a 1978-79 survey of dairy calf management in South Carolina (21) found the highest calf mortality rates associated with farms that used hired help, the lowest on farms where the owner cared for the calves, and an intermediate level where wives or family were involved. This survey suffered from design and analysis problems similar to those of the Michigan study. If a factor by factor analysis is used, as it was in these studies, then at a p-value of .05, one in every 20 management factors considered can achieve the honour of “statistical significance” by virtue of chance alone.

Taken singly, none of these studies alone provides convincing evidence of the importance of the calf raising personnel. Taken together, however, and combined with evidence from other types of surveys, they should, at the very least, make us curious. A recent Ontario survey examining characteristics of successful and unsuccessful small farms noted that the behaviour of the farmer was more important in determining his success than the physical resources at his disposal (22). Aversion to risk, they concluded, was the chief behavioural constraint to successful farming. Another survey, also in Ontario, concluded that socio-psychological and management factors **together** could explain about twice as much of the farm to farm variation in reproductive problems, culling practices, and milk and fat BCA as management techniques alone (23). We have no reason to believe that similar effects are not at work in calf rearing programs.

It would appear, then, that one of the primary tasks of the veterinarian wishing to improve the morbidity and survival rates of the calves on his clients' farms is to motivate the farmer to really care about those calves.

Incentives and Motivations

Many individuals and businesses respond well to economic incentives—Chrysler Corporation being a prime

recent example. Unfortunately, very few thorough studies have been carried out in the area of economic evaluation of calf rearing programs. Martin and Wiggins, using a simplified model which included building, labor, feed, veterinary and drug costs, concluded that a 20% calf mortality rate resulted in 38% reduction in net profit to the farmer (24). This model has also been applied, with some success, to ascertain the costs incurred from respiratory diseases in Danish veal calves (25).

Another kind of incentive related directly to calf losses might be termed the "genetic incentive" or perhaps for publicity purposes, the "greater-freedom" incentive. A farm which experiences high calf losses has a smaller number of calves from which replacements can be chosen than a farm which loses few of its calves. Calf losses thus narrow the herd's potential genetic pool and restrict the farmer's freedom to choose replacements.

Not all farmers will respond to economic or genetic incentives, however. Dr. Blood, in his 1973 presentation at the A.A.B.P. (26), outlined at least three personality characteristics which he believed were related to the successful implementation of herd health programs: risk aversion, economic value orientation, and what might be called achievement orientation, that is, what the farmer really **wants** to accomplish. In a 1930 study of dairy farmers in Minnesota, Pond and Wilcox (27) had them list, in order of decreasing importance, those factors which they considered to be important to success. Included in the top ten items were factors such as farm experience, wife's cooperation, ambition to succeed, and liking for farm work (Table 3). By and large, insofar as these items were measurable, the farmers were proven to be right. While this information is interesting, however, it fails to provide many clues for what kinds of incentives might motivate a calf raiser to become a more effective calf care provider.

TABLE 3. Factors Listed by Farmers as Being Important to Success. (By Decreasing Importance)

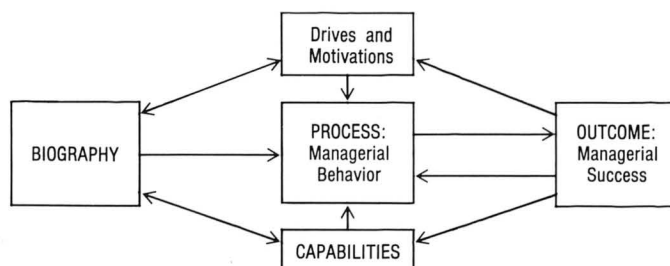
1. Farm experience
2. Wife's cooperation
3. Ambition to succeed
4. Liking for farm work
5. Getting work done on time
6. Hard work
7. County agent's help
8. Production management
9. Farm papers
10. Father having been a good farmer

Pond and Wilcox, 1930.

In a 1969 review of human factors and farm management, Muggen (28) suggests a simple model of the management process which clarifies some of the issues we are considering (Fig. 1). A farmer's management decisions are influenced not only by his personal biography, his drives and motivations, and his capabilities, but by the outcomes of his

previous decisions. If he has been using a scour vaccine which turns out to be useless, he is less likely to turn to vaccination as a solution in the future, even if an effective vaccine is developed. The recommendation to build large, expensive total confinement calf houses before a solid scientific and economic rationale for their use was available has probably tarnished the reputation of veterinary advice in that area, especially in light of the recent moves toward minimal housing strategies.

FIGURE 1. A model of the farm manager.



Muggen, 1969

Basic Starting Rules

We are a very long way from understanding, scientifically, why certain calf raisers are more successful than others, and what kinds of motivations and/or tailor-made programs could be developed for "problem" farms. Nevertheless, a few basic rules of thumb can be suggested.

1. Work with the calf management personnel. All management success is conditional on the active participation of the manager. Know whom you are working with and what they are willing and/or able to do.
2. Work within the given constraints. A dairy farmer has only a finite amount of time and money. If he is spending money to buy our latest injectable concoction and his time chasing heifers with a needle, then he may **not** be spending his money on good quality calf feed, and **not** spending more time paying attention to his calves. We need to ask which will benefit his farm more in the long run.
3. Find out where you are starting from. No calf management changes should be implemented until the farmer or calf raiser has been keeping good calf records for at least half a year. You will never know if changes are for the better or worse unless you know what your base line is, and farmers' memories are no different from anyone else's. They are notoriously unreliable indicators of the real state of affairs.
4. Start with basics and when you do, have a complete rationale for doing so. There is no doubt that newborn calves need that first colostrum as soon as possible. One might also think that a clean calving environment is an

indisputable asset. As some researchers in Ireland unintentionally discovered however, calves born into a clean environment and then moved into contaminated calf rearing area are no healthier or more likely to live than those born into a contaminated environment and moved into the same contaminated calf rearing facility (29). The moral of this is **not** that calving pens shouldn't be cleaned, but that there is little point in disinfecting the maternity pens if the calf pens are left dirty.

5. Finally, introduce any changes gradually, and be willing to experiment as you go. If you need advice on how to get up a scientifically sound on-farm trial, phone the closest veterinary college and ask to speak to an epidemiologist or a statistician. Dairy farmers, I have found, are very receptive to on-farm trials if they can look forward to the time, say, six months down the road, when they can have an answer as to whether a particular preventive treatment or management technique is useful on their farm. If management changes and treatments are introduced across-the-board, without a scientifically designed trial period, the farmer is no futher ahead, six months later, in terms of knowing whether a change in his level of calf morbidity or mortality is due to a new product, a change in the weather, or a daughter going off to college. We owe it to the farmers and the animals we serve to be not just scientists, not just practitioners but, as we were trained and intended to be, **scientific veterinary practitioners**.

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