Bovine Herd Health Programmes—State of the Art and Science

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Summary

Bovine veterinary practice has changed and continues to change from emphasis on the diagnosis and treatment of the individual animal to increased emphasis on the health and production of the herd. However, herd health service is not yet a major component of most bovine practices. The knowledge and skills are available for the veterinarian to provide varying levels of planned animal health and production management. The factors which have impeded the delivery of a totally integrated herd health service to cattle producers include those related to the desire of the farmer to adopt a regularly scheduled herd health service, the economic viability of the herd, the market price for beef and milk, the enthusiasm and competence of the veterinarian and, the data recording system. The widespread use of the veterinarian in a herd health program will depend on the development of species-industry veterinary specialists. Veterinarians must show integrated animal health and production management service. Computers allow the collection and analysis of the animal health and production data required to identify problem areas and to make intelligent decisions about changes in management.

Introduction—Historical Background

A brief consideration of the historical aspects of rural large animal veterinary medicine may explain certain aspects of the state-of-the-art and science of bovine herd health (9).

In Phase I which began in the early part of this century, national and state governments were involved in the eradication of the zoonoses such as brucellosis and tuberculosis. These programs were successful because the diagnostic tests were reliable, the testing was compulsory, and the financial resources were made available from the public treasury.

In Phase II, between 1945 and 1965, there was a large growth in rural large animal practice. This period coincided with a sharp increase in the standard of living in the developed countries which created an unprecedented demand for meat and milk. Farm animals became valuable and when they became ill, it was economical to call the veterinarian to treat them on an individual basis. During this period, modern clinical veterinary education was also born, and veterinary graduates possessed the knowledge and skills to treat a variety of animal diseases with remarkable success. Antimicrobial agents were also introduced during this period, and veterinarians could treat common infectious diseases such as pneumonia and enteritis with spectacular results. Veterinarians learned how to perform aseptic surgery, and the caesarean section in cattle, for example, became a common surgical procedure in veterinary practice. The ever increasing demand for meat and milk created a large demand for veterinarians and their services. Veterinarians spent most of their time treating individual sick animals and "fire-engine practice" was common. Because of a lack of time there was little effort made to control or prevent diseases on a herd basis. The emphasis was on the individual animal. Efforts to control or prevent disease consisted mainly of large-scale testing and vaccination programs for diseases such as brucellosis.

In Phase III, beginning about 1965, veterinarians and farmers began to appreciate the value of taking positive action to maintain normal animal health and efficient production on a herd basis. Farmers themselves gradually learned how to recognize and treat the common diseases. Veterinarians began to make recommendations for the control of specific diseases in the herd by vaccination, for example, or by changes in management. As veterinarians became more involved and more familiar with the herd and the farmer on a regular basis, the presence of subclinical disease and inadequacies in management which resulted in suboptimal animal performance were recognized. Subclinical disease in its broadest sense was soon recognized as a major cause of economic loss in food-producing animal herds. During this phase, the use of the word *disease,* was expanded to include not only clinical and subclinical disease but also management inefficiency, all of which could result in suboptimal performance.

The recognition that economic benefits could be derived by taking positive action against subclinical disease was then followed by the development of planned herd health programs. Veterinarians began to make regularly scheduled visits to farms to examine the animal health and production status of the herd and to make recommendations for improvement. During this phase, farmers and veterinarians recognized the value and necessity of keeping good records of animal health and production so that an objective analysis of health and production, including the costs of production, could be made.

Phase IV is taking place in the 1980's. In this phase

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practicing veterinarians make regularly scheduled visits to the herds, examine animals and records for evidence of subclinical disease, and collect and analyze data in some cases with the assistance of the computer. Both the farmer and veterinarian agree on targets of health and production performance. The veterinarian regularly analyzes the animal health and production data, compares the actual performance with the targets of performance, and identifies the reasons for failure to achieve the targets of performance. In collaboration with agricultural advisors the veterinarian makes recommendations for improvement in animal health and production using the whole farm approach.

It is now generally recognized that subclinical disease or production inefficiencies, many of which cause no recognizable clinical signs, are the most important contributors to reduced productivity. The production inefficiencies, which result from factors that impair animal health, can be minimized in the forseeable future if present knowledge is applied, if animal health delivery systems are improved, and if new technology is developed through basic and applied research in areas where suitable measures are not presently available. The development of a totally integrated animal health and management system is the most important need. On a world wide basis the pressure is on the cattle producer to become more and more efficient. This requires an animal health management and production system which provides *constant surveillance* of what is happening so that a diagnosis can be made and corrective action taken as soon as possible.

Progress in Herd Health

What is the state-of-the-art and science of bovine herd health in 1986? *Objectives.* I am confident that the objectives of a herd health program are clear and valid. The primary objective should be to foster animal health and production of the whole herd in such a way as to achieve optimum production and maximum economic returns to the producer (17). Secondary objectives include the prevention of zoonoses and the production of wholesome meat and milk free from drug residues.

Target of Performance. The objectives of herd health are achieved by application of the concept of target of performance which is the level of animal health and production that is considered to be optimum and will yield the best economic returns on investment (17). The *targets of performance* are determined from the performance found on a sample of farms that are considered to be representative of the economically conscious commercial farm population. In a herd health program, the *actual performance* of various animal health and production parameters is determined on a regular basis from the records and compared with the targets of performance. The differences between the targets and actual performance are the shortfalls. The reasons for failure to achieve the targets of performance are then identified, which means making a diagnosis, followed by making recommendations for improvement and, then monitoring performace continuously to assess the effectiveness of the action taken. Target of performance will vary from area to area and from farm to farm dependent on specific objectives of the farmer and differences in production systems. The numerical value of the targets will also change as research results based on field experience indicate that a change is economical.

Veterinary Knowledge and Skills. The knowledge and skills necessary for the veterinarian to provide a totally integrated animal health management and production program to cattle producers are available. The knowledge and skills are well developed for dairy cattle and beef cow-calf herds but perhaps less so for beef feedlots. There is a large body of knowledge available on the veterinary aspects of the clinical and subclinical diseases of cattle and the inadequacies of management which interfere with optimum production. Examples include bovine mastitis and suboptimal reproductive performance in dairy cattle associated with failure to detect estrus. There is sufficient information on nutrition of dairy and beef cattle which allows the formulation of the most economical ration and thereby minimizes nutrition as a constraint to optimum production.

Veterinarians have the knowledge base and skills required to make an etiological diagnosis when confronted with clinical or subclinical disease, in most cases. They have the manipulative skills required to examine the reproductive tract of cattle for pregnancy diagnosis and abnormalities which may cause suboptimal reproductive performance.

The progress in bovine reproduction in the last 10 years has been remarkable and the veterinarian has had a major influence in improving herd performance (29). The detection of estrus is known to be a major factor affecting reproductive performance in dairy herds and reliable aids to detection have been developed (23, 31). The milk progesterone assay allows early pregnancy diagnosis (31). The potential for controlled breeding exists because of prostaglandins (22). The criteria for culling dairy cows are becoming more precise and cost-effective (27). Much more information is available on the ideal mean calving interval for a dairy herd and the cost of delayed conception (25, 26, 27). The techniques for embryo transfer in cattle are well established (24).

In other important areas of dairy cattle health and production the veterinarian has not been as influential even though there is a wealth of information available. These include feeding systems and their effect on the body condition of cows and milk production, mastitis control, calf health, lameness in cows and the control of infectious diseases.

The science of clinical epidemiology which deals with the determinants of disease, the frequency and distribution of disease in populations of animals has provided the veterinarian with powerful mathematical tools required to determine the cause and effect relationship of diseases or inadequacies of management which interfere with the problems for the practicing veterinarian.

The knowledge base in the agricultural sciences is likewise large and useful including such specialties as nutrition, housing, breeding, engineering, economics, crop and soil sciences, animal behavior, farm management, pasture and range management, milking machine technology, and even meteorology. The veterinarian uses varying levels of knowledge and skills from these sciences. However, obtaining the information from these large data bases and delivering and supplying the *useful* information on a regular basis are major problems for the practicing veterinarian.

Amount of Herd Health Being Delivered. There is very little documented information on the amount of herd health service being delivered by bovine practitioners. Informal discussions with bovine practitioners from different parts of the world reveal that a high percentage of practices offer some herd health services but few practices spend a major portion of their time in the activity.

In a Canadian survey of 550 practitioners in 1981, 333 (60%) indicated that they worked mainly with food animals and, 268 of the 333 (80%) reported that some of their service was health management (1). The mean percentage of their practice time devoted to herd health was dairy cattle 10-20%, cow-calf 2-10%, and feedlot 1.7-3.7%. Of the overall average of 30% of their time devoted to health management for all classes of cattle by far the greatest percentage was spent with dairy herds.

In Canada, the amount and type of herd health services provided by veterinary practices varies widely dependent on the number of veterinarians in the practice and the individual size and number of farms in the area served by the practice. *A multiple person practice is a prerequisite for a meaningful dairy herd health service.* In areas where dairy cattle herds predominate such as in Ontario, Quebec and the Fraser Valley of British Columbia and around major cities elsewhere, veterinarians are providing regularly scheduled herd health services with emphasis on reproductive performance. Individual veterinarians will visit 30 to 50 dairy herds, per month, each with an average of 35 to 50 cows.

In the more extensive less populated areas, the farms consist of cow-calf herds in which the average size ranges from 30 to 50 cows. Most of the veterinary service in these herds is emergency individual animal medicine. The herd health service consists primarily of the evaluation of bulls for breeding soundness and pregnancy diagnosis, and recommendations on vaccination schedules and the control of specific diseases as they may occur sporadically. Veterinarians also provide general advice on animal health and production to these producers usually on an ad hoc basis.

In the beef ranching areas of Canada where herds vary in size from 300 to 500 breeding cows, veterinarians will visit such ranches at least twice yearly. In the spring, the bulls are examined individually for breeding soundness and the females are examined as a group (target weights, nutritional status) to ensure an effective breeding program. In the fall of the year, the veterinarian is involved in pregnancy diagnosis and the selection of cows to be culled and in giving advice on the vaccination and nutritional schedule for the weaned calves. In some cases the veterinarian may provide advice on the winter feeding program for the pregnant animals.

There is almost no published validated information on the status of beef feedlot herd health. Some veterinarians provide emergency advice on the diagnosis, treatment and control of disease as it is requested by the feedlot, usually when there is an epidemic of undiagnosed disease or when the affected animals are not responding to conventional treatment. Only a small number of veterinarians are supplying a complete animal health service to feedlots. They visit the feedlots almost daily and perform necropsies, analyze the treatment and mortality records and make recommendations for changes in treatment, processing procedures, management, feeds and feeding and vaccination schedules. A retrospective study of 24 feedlots in Alberta revealed that the cost of veterinary fees was less than one-tenth of the cost for drugs and vaccines (18).

Benefits of Bovine Herd Health. Evidence continues to accumulate that a herd health program can be profitable to the farmer. Most of the documented evidence has been generated from dairy herds in which comparisons in animal health and production were made before and after a herd health program was initiated (5, 6, 7, 8, 19). Other important beneficial effects have been the development of aids to management, continuous assessment of the cattle herd, more efficient utilization of bovine practitioners during periods of the year which are traditionally not busy, the encouragement of veterinarians to become species specialists, namely dairy cattle or beef cattle veterinary specialists, increasing the veterinarians' involvement with subclinical disease and the agricultural sciences and, the opportunity to conduct clinical trials such as vaccine efficacy in the field.

Constraints to Herd Health

There are many factors which have appeared to slow progress to wisespread adoption of herd health activities. The question can be asked "If herd health is so good, why is there not greater use of the service by cattle producers?"

The three major requirements for a successful herd health program are:

1. A farmer who wishes to improve his current level or to maintain an optimum level of animal health and production. An economically viable farm and a market which will provide a fair economic return for his products are prerequisites.

2. An enthusiastic and competent veterinarian who has the *conviction* that animal health management is possible and cost-effective for the producer.

3. A simple and reliable system of recording and analyzing animal health events and production performance.

Accordingly, the factors which are constraints to the adoption of herd health programs can be related to the farmer, his herd, and the markets for milk and beef; the veterinarian and, the data recording and analytical system

from which information is obtained.

Cattle Producer (His management expertise, his farm and his markets). the success of a herd health program depends primarily on the level of management and the desire and ability of the farmer and his assistants to carry out the recommendations of the veterinarian and other agricultural advisors involved. The characteristics that identify farmers as likely to adopt a herd health program (the innovators) and to set an example for the farming community who will in turn adopt the program (the diffusion process) include the following: leaders in the community, successful businessmen, stable and efficient farmers who have good judgement and who are recognized as early innovators, knowledgeable farmers who keep up to date with the farm literature on animal health and production, farmers who have not overextended their limit of resources and are most likely to be able to make changes in management and, farmers whose inclination is to avoid taking risk are natural enlisters in herd health programs (10).

There is growing awareness that only a part, perhaps a very small part, of the differences in farm income and efficiency between farmers can be explained by differences in quality and quantity of land, labor and capital. The rest of the variation must be explained mainly by the management factor (11). The components of management which appear to be associated with successful farm management performance include: intelligence, education, farming experience, motivation, scientific orientation, use of information sources, planning and organization practices and interest in farming or preferences for certain enterprises.

The constraints to successful herd health which have been associated with the farmer have included the following:

1. The goals and values of the farmer may not be profit oriented. Rural sociological research indicates that farmers have a predominantly intrinsic orientation to work, valuing the way of life, independence and performance of work tasks above expressive instrumental or social aspects of their occupations (13).

2. Some farmers simply do not use reliable methods and techniques as part of their livestock management program. For example, in a survey of 1692 dairy farms in England and Wales in 1982 it was found that 42% of farms did not use veterinary pregnancy diagnosis (21). About 80% of those not using pregnancy diagnosis thought is was unnecessary and about 12% thought it was too expensive.

A recent survey of Ontario milk producers determined that many had not adopted practices that have been advocated for the integrated control of bovine mastitis (30). Futhermore, a great many dairymen were not familiar with mastitis in its subclinical form and did not appreciate the losses in production associated with it. These findings indicate that there is a need to increase the farmers awareness of subclinical mastitis both with regard to the effects on production and the rate of return of funds invested in its control. Those producers who depend on their farms for a primary income will be as efficient as possible and will add cost-effective animal health and production procedures.

A study of the attitudes and management practices of Ontario Dairy farm managers revealed a need for improvement in cow breeding, heat detection and record keeping (35). They delayed breeding until 60 days or more after calving, their efficiency of heat detection was low and they tended not to keep complete records.

3. Many farmers do not recognize the need for a coordinated herd health approach. They do not appreciate the interactions between reproduction, nutrition, mastitis, milk production and calf-health management.

4. The herd may be too small to support a cost-effective herd health program. In most parts of the world, livestock farms are small and it may be uneconomical to provide a regularly scheduled herd health service.

5. Many farmers do not keep useful and reliable health and production records or if they do, they do not use them (35). Some farmers, seemingly, do not want to know the true status of health and production in their herd. They may ignore inferior productivity until it becomes intolerable.

6. Failure to maintain a veterinary supervised herd health program for long enough to assess the results. The farmer may decide that the veterinarian is no longer required on a regular scheduled basis because progress could not be appreciated or that regular veterinary advice was no longer necessary because animal health and production were apparently adequate. The farmer may decide that a herd health program is no longer economical because of inadequate net returns for his products at the market. The current surplus of meat and milk and low world prices in the developed countries is a significant constraint to herd health.

7. The cattle producer may not recognize that veterinarians are capable of providing a herd health service. Veterinarians have been traditionally perceived as physicians who were called primarily for the diagnosis and treatment of clinical disease in individual animals and to perform routine tasks such as vaccination, castration and hoof-trimming (2, 3). In fact, not only livestock owners but agribusiness in general and also the banking industry, which has a major stake in the farmers' success, do not appreciate what veterinary medicine and veterinarians can do to improve efficiency of livestock production. Furthermore, some cattle producers may find it difficult to ask for professional advice on how to run their farm. Some of this resistance is due to pride.

8. Farmers can and do obtain animal health and production information and advice free of charge from many sources such as feed companies, animal health products companies, government sponsored agricultural advisory services and university faculty. The value of this advice is difficult to evaluate. It is usually fragmented and rarely evaluated by any follow-up procedure.

Enthusiasm and Competence of the Veterinarian. The factors which affect the enthusiasm and competence of the veterinarian to provide a herd health service include the following:

As described earlier, bovine practitioners did the work

which was most readily available. Most of their time and effort was spent on the diagnosis and treatment of individual animals which required primary care. Practitioners became proficient in clinical diagnosis, field pathology, surgery, therapeutics and the many manipulative skills required to do routine tasks. However, many of the tasks which once kept them busy are now considered to be technical and can be done by animal health technicians or a well informed farmer. Futhermore, the veterinarian is now being confronted with the difficult cases which did not respond to treatment given by the farmer (ie, incurable pneumonia, downer cows, chronic peritonitis). Bovine practitioners recognized that this "busy-work" was becoming a smaller part of their practices, and that the provision of herd health services was necessary and could be cost-effective. However, the transition has been slow. The veterinary profession has been slow to meet the challenge.

Concurrent with the emphasis on emergency veterinary medicine, practitioners, depended on the sales of drugs and vaccines and other animal health products for a major part of their income. The recent decline in net revenue from these sources has not been offset by an increase in revenue from herd health services particularly advisory services. Farmers appear willing to pay for the tangible aspects of herd health such as the skill associated with pregnancy diagnosis but are reluctant to pay for advice based on analyses and interpretation of observations of the animal health and production status of the herd. Unfortunately, the advice for the control of disease or for changes in management which could result in improved performance was often not well founded. It was usually based on clinical impressions, clinical experience and opinion rather than on reliable data collected from the performance of the herd. Futhermore, the advice has traditionally been dispensed verbally rather than by written report.

This situation may in part be due to the failure of veterinary colleges to respond to the changing needs of the livestock industry. The emphasis in the veterinary curricula has been on the individual animal. This combined with an increased consumer demand for veterinary care on companion animals, particularly small animals, resulted in more emphasis on sophisticated diagnostic and therapeutic techniques in individual animal medicine and less on the information, skills and techniques required to deliver a high standard of animal health management on a herd basis. The application of clinical epidemiology to the whole herd has not been emphasized as an important tool for herd health. Because of this lack of an effective system with clearly stated objectives, methods and standards of herd health practice, a multitude of fragmented programs have been developed. Undoubtedly each program is well intentioned but the real economic benefits to the farmer have been difficult to evaluate because of a lack of standards.

of which are very attractive to the undergraduate student who would like to contribute to agriculture. However, when the student graduates and goes into practice, he finds that he cannot deliver the service at the level he was taught, he soon realizes the farmer seems reluctant to pay for professional advice and, furthermore, there is little or no opportunity in most private practices for the new veterinary graduate to become qualified and experienced as a herd health specialist. This leads to discouragement and lack of the development of specialists. Contrast that to the education of a chartered accountant in Canada. The student graduates with a bachelor's degree in Commerce and enters a two-year postgraduate training program in accounting under strict daily supervision. During this on-the-job training period the candidate must study and pass several courses of study in accounting culminating in a difficult comprehensive final examination based on problem solving. Such a program produces well qualified chartered accountants for private practice. There are no similar programs in veterinary medicine. Veterinarians are expected to train themselves in a specialty; furthermore, it is not happening.

In general, veterinarians who are currently providing a herd health service are self-taught. They developed a certain level of herd health expertise in veterinary practice usually with little or no direct analytical supervision from an experienced veterinarian. There are few role models of practicing veterinarians who have established a totally integrated herd health service complete with an information system which critically analyzes health and production on the farm. As a result there are probably few, if any, veterinarians who are recognized as bovine herd health specialists who can in turn train new graduates. Where would one send an enthusiastic young veterinarian to obtain experience in a totally integrated bovine herd health service?

A major constraint for some veterinarians in less populated rural areas, particularly beef cattle areas in North America and Australia is the large amount of time and effort expended in travelling to the farms. Those veterinarians who desire to offer a herd health service to the larger economically viable herds must spend up to one-third or more of their time driving their motor vehicles to get to a sufficient number of farms.

There has been almost no financial or other incentive for bovine practitioners to become herd health specialists. It is unfortunate that experienced practicing veterinarians are not paid significantly more for their experience and expertise than the recent graduate. In other professions like medicine and law, the senior members of the practice are recognized as specialists and paid accordingly which is an incentive for junior members of the practice to pursue excellence. This kind of tradition does not exist in veterinary medicine.

Not enough veterinarians are delivering a totally integrated animal health management program which can be seen by the farming community. The service tends to be fragmented or incomplete. The monthly examination of the reproductive tracts of a dairy herd without regular surveillance and attention to the level of mastitis, the nutritional status, the cost of milk production, and calf health is not a complete service. Veterinarians would claim that farmers

are not willing to pay for a total program. Some farmers would say that their veterinarian is disinterested in providing a broadly based program.

The Information System. A prerequisite for a successful herd health program is a simple reliable animal health and production recording system which the farmer will adopt and use and, which the veterinarian can analyze and make cost-effective recommendations based on accurate data.

A major constraint to successful profitable herd health has been the failure of farmers to keep useful animal health and production records on a continuous basis. Most cattle producers keep some records such as calving and breeding dates but the quality of the records varies widely and it is usually difficult to extract the information necessary to calculate actual performance indices for comparison with targets of performance.

Many different manual recording systems are available from which actual performance can be calculated. However, the task is tedious because of the paperwork involved and usually does not get done and the records accumulate without any analysis being done.

The Challenges Ahead

The future of bovine herd health will depend on the veterinarian, the farmer and the data recording system.

The Veterinarian and the Service he Provides. The guiding light for the veterinarian must be the provision of a totally integrated animal health and management service to the cattle producer who needs and wants the service.

The provision of a totally integrated animal health and production management service requires *constant surveillance* which includes regularly scheduled farm visits and regular analysis of animal health and production data and, showing the farmer what is happening, why it is happening, both good and bad, and what needs to be done, or what should not be done. In other words, the veterinarian must become an indispensable part of the management team of the farm.

Veterinarians who wish to provide the service must adopt modern methods of marketing the concept to the farmer and begin to promote the service using the principles of selling a product or service. Innovation, leadership, creativity and adaptation will be required by the veterinarian who wishes to provide a broadly based bovine herd health service. There is a need for some innovative and creative ideas for persuading the farmer that herd health can be profitable. The veterinarian must show leadership which means monitoring all aspects of animal health and production on a regular basis. This may include the use of a predetermined check list which examines each animal health and production aspect on a regular basis (6, 7, 8). In this way many problems will be identified and can be examined before significant economic losses occur.

In a marketing survey of veterinary practices and farmers in England, one conclusion was that "veterinarians in rural areas, facing increased competition and changes in farming methods, will have to improve their business methods if their practices are to develop" (20). The survey found that farmers greatly appreciated the prompt action of veterinarians in dealing with emergency cases, but made insufficient use of their services for other matters such as participating in preventive medicine schemes. The survey found that the majority of practitioners had limited commercial experience and received no training in business methods before qualifying. Most learned the rudiments of commercial and management practices during their first job, but failed to develop them to an extent which would substantially improve the efficiency and scale of their operations. Most veterinarians were in favor of extending the coverage of preventive medicine but found it difficult to get farmers to accept it. Veterinarians surveyed, acknowledged the importance of marketing their services more effectively because they were increasingly faced with competition from other organizations in the agricultural industry. Most of the farmers had a high opinion of the veterinarians, particularly when dealing with emergency cases but many farmers were reluctant to call on their services too frequently because they were regarded as too expensive. However, there was a growing tendency for farmers to ask the veterinarian for advice on farm management and planning. Farmers also indicated that non-prescription drugs were too expensive when purchased from veterinarians and as a result 84% of farmers bought these drugs from agricultural cooperatives or merchants. Most veterinarians were opposed to advertising by individual practices but could see merit in central corporate advertising on a regional basis.

If a regularly scheduled herd health service is economically beneficial to the producer, the veterinary fees should not be a constraint to veterinary usage. There is no documented evidence that professional veterinary fees discourage producers from using veterinarians. Undoubtedly, producers may perceive that the veterinarian is an expense rather than an investment for future profit. Veterinarians will have to demonstrate their professional worth, in economic terms, to the producer. This is done in other sectors of agribusiness such as fertilizers, pesticides and herbicides where the results of treated and untreated plots of field crops are displayed to the farmers. The results are obvious and the economic returns from investing in the inputs are easily calculable. Similar methods are needed in the animal health field. For veterinarians to work effectively with their clients, animal health management advice must be based on information that assesses the risk of loss due to disease and the beneficial economic effects of coordinated animal health and production management.

The veterinarian must become knowledgeable about all aspects of farm management especially those which cause or contribute to clinical or subclinical disease which in turn impairs animal production. The knowledge base necessary will vary depending on the cattle enterprise served (dairy herd, cow-calf herd, feedlot) but will include the nutritional program which is always changing, milking and milking

machines, breeding systems, calf rearing systems, housing, and record-keeping systems.

The successful delivery of a totally integrated animal health and production management service by the veterinarian will depend primarily on the veterinarian becoming a species-industry specialist who can provide the needs of the dairy herd, the beef cow-calf herd or the beef feedlot (12). The veterinarian must understand the industry he works in. In dairy cattle practice this means knowing the component parts of the cost of milk production and how to identify the animal and management factors which affect the efficiency of production.

It is highly probably that a totally integrated animal health and production service will become a specialty practice within veterinary medicine. Given the expertise required to become a species specialist it is unlikely that a high quality herd health service will ever become a normal function of general rural large animal practice. The successful specialist will be a member of a multiple person practice which gives high priority to the delivery of a herd health service. The veterinarian delivering the service must be totally committed to that function and not be distracted by the demands of emergency service work. The practice must allow the veterinarian to develop the herd health service and, initially may have to provide the service for less than it is worth in order to get it started. Thus we must start thinking about a complete herd health service becoming a specialty practice delivered by a small number of veterinarians to livestock producers who are genuinely interested in improvement of animal health and productivity. General veterinary practitioners will continue to deliver emergency veterinary medical care and offer simple herd health programs such as advice on vaccinations and perform pregnancy diagnosis. In many geographical areas because of the extensive nature of small farms it will not be possible to provide an integrated regularly scheduled herd health program (14).

Veterinarians are now employing qualified animal health technicians to assist in herd health programs. They do an excellent job of collecting and collating data, the detection and treatment of sick animals in feedlots, the collection of samples for diagnosis and, assisting in a variety of routine procedures. Such assistance allows the veterinarian to spend the time necessary to examine specific problems.

The educational requirements necessary to become a bovine veterinary specialist will include the following:

1. Be educated in the specialty by a role model specialist at the post-graduate level either at a University or in private practice. Post-graduate programs leading to a Masters degree in Preventive Veterinary Medicine, Epidemiology and Species Specialization are currently available at the University of California, University of Melbourne, University of Saskatchewan and the other universities. These post-graduate qualifications can be used by the candidate to begin the development of a specialty practice. Veterinary curricula have traditionally emphasized the disciplines required to practice veterinary medicine on the individual animal. It is now time for veterinary education to reallocate the resources necessary to educate species specialists at the post-graduate level, who can handle herd problems.

2. Be knowledgable in all aspects of bovine practice particularly the diagnosis, treatment and control of the common clinical diseases of dairy cattle, beef breeding herds or beef feedlots. This includes the drug residue problem. He must ensure that the producer is properly advised about the use of drugs in cattle and to adhere to the stated withdrawal times. Appropriate testing of milk and urine for evidence of residues will become an important part of a herd health program.

3. Become competent in the examination of the herd in order to be able to identify the causes of suboptimal performance or epidemics of disease which the etiological diagnosis is not readily apparent. As herds become larger in size and as population density within herds increases, the control of infectious diseases becomes more complex and difficult. In fact, the etiological diagnosis and clinical management of epidemics of infectious diseases such as acute diarrhea in calves, environmental mastitis in dairy cattle (33), acute respiratory disease in weaned beef calves and feedlot cattle are major unsolved problems. These will require a multi-disciplinary approach which includes the science of epidemiology. Practicing veterinarians who provide herd health services to these problem herds will have to work with specialists from the agricultural sciences and with regional diagnostic veterinary laboratories and veterinary investigation centers. The declining support given by some governments for veterinary investigation centers is a major concern in this regard. It should be obvious that the investigation of epidemics of disease, particularly infectious disease, must be supported by both local and national governments. If they are not, epidemics of disease and their origin and epidemiology will simply not be examined by practitioners in the detail necessary to generate new information for future control and prevention. It is of paramount importance that we understand the pathogenesis and epidemiology of disease. Patterns of disease change with time and it is important that the descriptive epidemiology of these epidemic diseases be recorded. For example, little progress has been made in understanding outbreaks of pneumonia in feedlot cattle because the descriptive epidemiology has not been examined. There are many common diseases of cattle in which the etiology and pathogenesis are complex and not well understood. These are a constant source of frustration for the veterinarian who is attempting to provide total animal health management.

4. Become knowledgeable about the production aspects of the particular species or industry which means being able to recognize the farm management factors which contribute to the impairment of health and production. This includes knowledge of such subjects as nutrition, reproduction, housing and ventilation, genetics and breeding programs and the economics of production.

5. Be able to use and apply the fundamental principles and techniques of clinical epidemiology, clinical biostatistics, decision theory and decision analysis (15). As the economics of production continue to be more critical in livestock production, the veterinarian will be expected to become involved in risk assessment of disease. This means being able to predict the prevalence of disease based on the health status or origin of the animals and whether or not certain prophylactic measures should be instituted. This will require clinical research trials on the farm and the use of dicision theory to assess the economic outcomes of various options. It has been suggested that veterinary medicine will move towards a more mathematical approach to solve animal health problems (16).

In recent years, veterinary colleges have responded to the needs for more herd health education by creating faculty positions in clinical epidemiology. The science of epidemiology will provide the veterinary graduate with the additional tools required to mathematically analyze herd problems and to make an epidemiological diagnosis when diseases or problems are multifactorial in origin.

6. The development of a personal system to keep up-to-date with and to critically appraise the literature relevant to the species-industry which is being served. This includes the development of an effective filing system for the storage and retrieval of useful information. This information must in turn be transferred to the producer as appropriate. Veterinarians must become "information brokers." This is a major task because of the large number of scientific publications devoted to the many different aspects of bovine medicine, nutrition, reproduction, and production techniques and economics. The computer and electronic telecommunications now make this task simple and efficient.

The Farmer, His Farm and His Markets. Cattle producers who are in the cattle business as a primary source of income want a cost-effective animal health and production management program. Veterinarians should first seek out those producers who want such a service and work with them as thoroughly as possible. If the program is successful the farmer will advertise the success to the farming community. The success of the program is in the hands of the farmer. The veterinarian can make observations, analyze data and make recommendations but carrying out the recommendation is the primary responsibility of the farmer. The successful producer will be the one who keeps himself fully informed about the production indices and the causes of failure to reach targets of performance and who takes action to improve.

There is a need for some research into the attitudes of cattle producers towards their adoption of a herd health service. We should attempt to find out what the cattle industry perceives about bovine practitioners and why we are not being used more frequently and widely as herd health consultants. Unpublished observations indicate that many farmers do not have sufficient confidence in their veterinarians as someone who can improve health and production. Farmers feel that veterinarians have a vested interest in the sales of drugs and vaccines and therefore our recommendations for the control of specific diseases are biased towards the use of saleable animal health products. This is a major obstacle which must be overcome.

In general, farmers are not aware of the capabilities of the modern veterinarian. There is a need to expand the extension-educational programs which emphasize the role of veterinarian in animal health management. This can be done by holding regularly scheduled meetings of producers and presenting lectures and workshops on the economic benefits of mastitis control, and monitoring reproductive performance, calf health, and nutritional status. The more knowledgeable the producer is, the more he will consult with professionals about the application of his knowledge.

The farm (the herd) must be large enough to support the cost of a regularly scheduled herd health service. There is a need to determine the minimum size of a dairy herd, a cow-calf breeding herd or a feedlot, which is required to support a regularly scheduled herd health service. This could assist in determining which farms would consider the adoption of a herd health service. The farmer must also receive a profitable return for his product at the market so that he can afford to invest in a herd health program. The current surplus of beef and milk in the developed countries which results in low prices at the farm gate will have a negative effect on the attitudes of farmers towards investing in herd health programs.

The concept of government subsidized bovine herd health programs may deserve consideration. If the production of animal protein is important for the nutrition of man, it can be argued that government could be involved at least to initiate the programs and show the producer that a regularly scheduled herd health service will improve the efficiency of livestock production. National and state governments have traditionally assumed financial responsibility for regulatory veterinary medicine, diagnostic laboratory service, public health programs, and agriculture extension services. Some financial support for the cost of herd health programs for cattle herds are equally as justifiable and could be a major step forward in the improvement of animal health and production and help to make producers aware of the economic benefits of herd health.

In Canada, the Departments of Agriculture in the provinces of New Brunswick and Quebec have financially supported farm animal health schemes (36, 37). In New Brunswick, the dairy herd health program is delivered by veterinarians who are employed by the province (36). In Quebec, there exists a state-controlled animal health insurance scheme in which the province pays one-half of the veterinary costs, excluding drugs (37). For cattle, 79% of the visits were for pregnancy diagnosis and 10% for foot diseases. The most frequent problems were endometritis, acute mastitis, anestrus and milk fever. There are plans to consider expanding the scheme to include planned herd health programs.

The amount of money spent by cattle producers in the U.S.A. on veterinary care for agricultural animals has been estimated (34). In 1981, average per cow costs for veterinary care and medicine provided to beef-cow operations was $4.86 (U.S.) and $0.89 (U.S.) per hundred weight of beef feedlot sales. The average cost per head of dairy cattle by commercial dairy farms was $23.28 (U.S.). These amounts are very small as a percentage of gross income from sales of live cattle, beef and milk.

The Data Recording and Information System. The data recording and information system required for a comprehensive herd health program should no longer be a significant constraint. A large variety of health and production data recording systems now exists. With the introduction of the microcomputer on the farm or in the veterinary practice it is now possible to record important events for each animal and to obtain current herd performance indices. These will assist the producer and the veterinarian in determining how the herd is doing relative to the target of performance and where changes in animal health management and production are necessary. The information system is vital because it allows measurement of progress or failure of the herd health program.

The veterinarian should maintain a detailed record of the status of animal health and production of each herd and prepare and submit to the farmer a report following each herd health visit. The report should be simple and clear and contain a summary of actual performance and recommendations for improvement. An annual report which summarizes animal health and production and major disease and production problems which are causing economic losses should also be submitted. Farmers can be motivated to change when they see the performance of their herd analyzed in a written report. Microcomputers now allow the veterinarian to handle large amounts of data with ease and to prepare useful reports.

The potential impact of on-farm microcomputers of livestock management and veterinary practice has been described (4). The information systems are designed to support management decision making focused on identification of exceptional or problem cases (2) resource acquisition and control planning and (3) strategic planning, focused on decision making involving overall achievement of goals and objectives.

A computer-based data collection and analyzing system is an absolute necessity for a meaningful feedlot animal health management system. Some feedlots now have computer terminals situated in the treatment facility which allows entry of treatment data directly and immediately into the computer. On a daily basis the feedlot can obtain a print-out of morbidity, treatments used, the costs of treatment, treatment response, percentage of relapses and the problem pens. The computer assists in the daily management of problems such as the rational selection of antimicrobials for the treatment of pneumonia.

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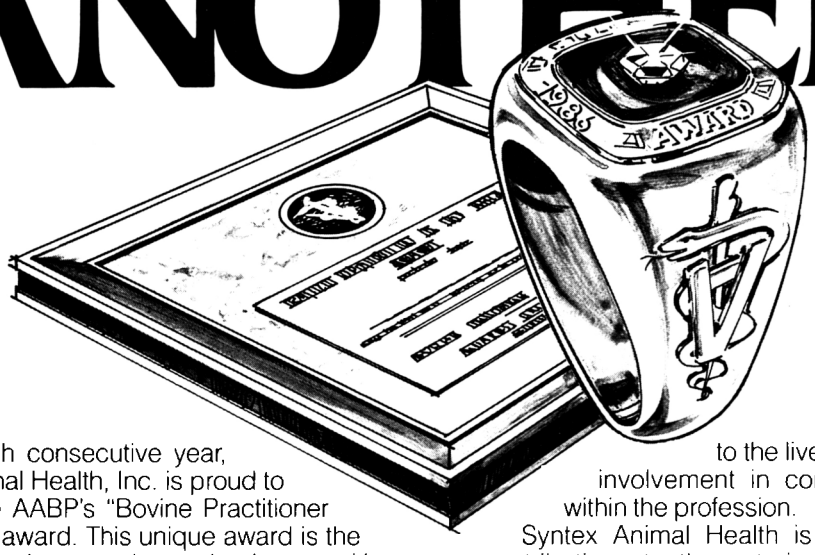

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