THE USES OF EPIDEMIOLOGY IN
FOOD ANIMAL VETERINARY MEDICINE

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This presentation can also be entitled "the growth and maturation of an academic clinical veterinarian." Or, perhaps "the chronological development from one who originally though that epidemiology was the science by which staph food poisoning was differentiated from salmonella food poisoning to a clinical veterinarian who now wishes he were an epidemiologist."

The thesis for this presentation is that current and future food animal medicine practice can be facilitated by the technology of the science of epidemiology.

Food animal medicine is changing.

My job is a pig production specialist. Similar veterinary production specialists exist in the poultry and beef industries. More are needed in the swine industry. Our role is not to diagnose diseases, but rather to improve production efficiency. On every farm, there exists a difference between the owner's expectations of animal productivity and the actual animal productivity. Our job is to quantitate this difference and to help eliminate the constraints that cause this difference. Our major limitation is an inability to convince clients that both they and we need epidemiological information to make many of the necessary judgments and changes.

This difference between actual and expected productivity is called sub-clinical disease, sub-optimal performance, production disease or inefficiency. It needs a more succinct name to give it the importance and impact it deserves. The science and art of increasing animal productivity is variously called herd health maintenance, production medicine, preventive medicine, health and production maintenance, or just herd health.

Clinical veterinary medicine for production specialists is changing. Problem solving is the major challenge; it usually precedes the establishment of confirmed diagnosis. Swine abortion problems provide an excellent example. The probability of finding an in-
fectious agent is less than 0.25. Even when a pathogenic microbe is isolated, no true causal relationship can be ascertained. Therefore, the investigating veterinarian must expect that an infectious cause will not be found; he must turn instead to a broader approach. By using the standard epidemiologic questions of what, where, when, why, and how, clinical veterinarians have found and reported that abortions are most common in September through December in the northern hemisphere. They are also most common in very thin, cold, sows. A retrospective view of diagnostic laboratory records has confirmed the seasonality of the problem. Without the systematic epidemiologic approach and looking beyond infectious causes, the potential solutions to the abortion problem would not have arisen. More feed, more light, and higher ambient temperatures are being tried to solve the seasonal abortion problem.

The above example is just one of many where a specific diagnosis is not reached. More commonly veterinarians must solve problems without the aid of a specific diagnosis. Increasingly, we rely on an epidemiologic approach to point to possible solutions.

Veterinary production specialists have had an awkward transition to make. They started with the same training that all U.S. veterinarians now receive -- the germ theory of disease. Pathogenic microbes = disease = reduced production efficiency. This formula has deceived many veterinarians. It has kept many from making the transitions necessary to provide profitable service to livestock and poultry farms. Wayne Martin called this "the one ill, one pill, and one bill syndrome."

In the broad sense, pathogenic microbes and infectious diseases have no innate importance to animal production. They may not even be important as a cause of sub-optimal performance. Atrophic rhinitis in swine is a useful example. Veterinarians have long believed that crooked noses in pigs is a cause of poor growth and it leads to more severe pneumonia. Some recent research has found that neither conclusion is true. Using the standard epidemiologic tool of multiple regression analysis, Dr. Straw of our laboratory has studied about 1500 pigs in the National Barrow Show Test Station. Pigs with atrophic rhinitis grew as well as those that had none. Atrophic rhinitis was not associated with pneumonia. In the same study she also destroyed other myths by epidemiologic techniques. Pigs that travelled long distances to the Test Station had the same mortality rate and average daily gain as those that travelled only short distances. The examples are growing more numerous; when traditional veterinary thinking is put to the test of real farm situations, myths are destroyed. In the case of atrophic rhinitis, it now appears that this disease is just as likely to be the effect of slow growth rather than the cause. Is the same true for other infectious diseases?
Production specialists are existing by their ability to gather, process, and analyze data. The data base is coming less from traditional veterinary sources and more from USDA statistical reporting services, farm management record systems (usually tax-based systems), organizations like Dairy Herd Improvement Association (DHIA) and from on-farm recordings. These skills were not taught in veterinary school.

Production specialists are existing by their ability to establish innovative methods of gathering even more information. Routine serum banks, slaughter inspections, farm trials, chemistry profiles are just a few examples.

Production specialists need some new technology advances. There is need for better animal identification both on the farm and through the marketing channels. There is need for better monitoring and recording of environmental conditions, food and water consumption, and daily growth and production information. Getting the information from the animal to the farm management must be made easier.

Production specialists need some new techniques for on-farm testing and for benefit-cost analysis. Models would be useful learning devices and decision aids.

Production specialists are passing from the age where microbiology and pathology dominated veterinary thinking to a current stage of looking for new leadership or a philosophic basis. This transition has been largely intuitive and unstructured. This presentation is an appeal to you, professional epidemiologists, to help us; you have some tools and skills that we need.

I have reached this conclusion largely through my experience with applied research and clinical teaching. In an attempt, for example, to understand the seasonal breeding pattern of pigs, which was obvious to the reasonably trained clinical eye, several research projects were started. Without realizing what we were doing, we conducted a retrospective epidemiological survey of 50 farm-years. Interestingly, this epidemiological definition of the problem offered part of the solution. The research and the five publications that resulted cost about $10,000.00. As knowledge on seasonable infertility increased, we turned our attention to potential infectious causes of this problem. We spent well over $100,000.00 in an attempt to identify organisms that might be associated with seasonal infertility and found none.

I had stumbled into the science of epidemiology without bothering to consult with an epidemiologist on the appropriate tools to be used. Obviously some of the techniques were flawed; the research could have yielded substantially more information and could have been presented more effectively. I am indebted to R.K. Anderson...
of the University of Minnesota for admonishing me one day at the copy machine. He said that epidemiologists could help. He was right.

Over the past seven years, the swine medicine group at the University of Minnesota has attempted to provide primary veterinary services to several large swine farms. When we began on two farms, the owners thought that their growing pig mortality rate was the major problem to be solved. We agreed. We conducted necropsy examinations and slaughter inspections and made some obvious diagnoses. But the treatments did not change the rates. The next obvious step was to establish on-farm trials of new treatments and combinations of old treatments. Vaccines, bacterins, and therapeutic antibacterials in the feed and water and injected were tested. We even consulted the statisticians and economists prior to the trials. We wanted to record not only biologic changes but also to determine the economic benefits. The results of the eight trials were striking; they changed my entire veterinary perspective. None of these veterinary interventions produced any measurable biologic effects. Economic studies were completely unnecessary. Our poor judgment had cost both producers considerable money and lost time and opportunity in solving their real problems. I have become a medical agnostic. Until proven otherwise, I do not believe that these "standard" veterinary interventions are likely to be successful.

Epidemiology can help

Regardless of its name, form, or species involved, production oriented veterinarians are intuitively using more and more of the skills of the science of epidemiology. I make the conclusion for several reasons.

1. Farm problems almost always involve herds and flocks and large populations of animals; data gathering and processing from these populations is becoming more essential to veterinary practice.

2. Most current veterinary problems involve sub-optimal rates of gain, feed conversion, reproductive efficiency or milk production in large populations. They do not lend themselves to the classical veterinary format of animal examination, diagnosis, and treatment.

3. Diagnoses are often based upon prevalence and incidence data.

4. Prognoses are based upon previous epidemiological observation of the same disease in similar circumstances.
5. Diagnoses and judgments are more often made from computer printouts than from traditional pathological testing.

6. Finally, self assessment of veterinary intervention and benefit/cost analysis of the intervention is dependent on continuing epidemiologic information.

Having attempted to praise the science of epidemiology and suggest that it has usefulness in food animal clinical medicine, I offer some suggestions that would be helpful to veterinary clinicians. 1) U.S. veterinary epidemiologists should become more involved in solving animal production problems. This is not to deny the value of your previous and current efforts. There is, however, a need for your services in the production of meat, milk and animal fiber. 2) Suggest collaboration to your clinical colleagues. Of course, many clinical faculty are paranoid about the sharing of case material, but the marriage is needed. Give it a try. Very few clinicians know a retrospective study from a prospective study. Very few know anything about a case control or cohort study. These are well established epidemiologic techniques that grease the path to publication, a path that clinicians especially are seeking. 3) Interact regularly with food animal practitioners. They form the basis of most new innovation. They collect and process high volumes of data and therefore have many potential answers to real problems. Help them to authenticate their observations; help unleash the practitioners into legitimate research.

The message that epidemiologic procedures can solve real farm problems has made a big splash in some circles and just a little plop in others. For example, at Boyne Mountain, Michigan in 1980, scientists from many disciplines gathered to discuss and chart the future direction of food animal research. There was great enthusiasm about using epidemiologic studies to make research and delivery of animal agricultural sciences more efficient. And yet in the subsequent years of U.S.D.A. funding there has been an even greater turning away from this applied approach and concurrent increase in funding of very basic agricultural research; the spirit and agreement of the Boyne Mountain Conference has certainly not been manifested. Basic researchers, not epidemiologists or clinicians are still manning the peer review committees. Changes are needed! The message that epidemiologic research is productive, efficient, and legitimate has not been told.

And finally, perhaps most importantly, veterinary epidemiology is a potential solution to a growing dilemma. Veterinary clinicians and practitioners everywhere are being asked to authenticate or evaluate their services. Are veterinarians worth their fee? Heretofore, tools for making this evaluation have been poor. Epidemiologic and economic tools can bring
into focus the actual value of veterinary service, and in doing so, provide a powerful self-assessment tool and an equally powerful tool for promotion of veterinary service.

To summarize, veterinary epidemiology is a valuable and potentially useful science to the entire veterinary community, especially for the production of meat, milk and animal fiber. I challenge you to at least meet the clinical veterinarians halfway in extending the tools of your science for the benefit of all of us.