National Animal Health Monitoring System in the USA: a model information system for international animal health *

L.J. KING **

Summary: The National Animal Health Monitoring System (NAHMS) has been set up in the United States to measure the incidence, prevalence, trends and economic burden of diseases in food-producing animals. The system is envisaged as a distributive network of microcomputers, with each state responsible for its own data base, and a core of information used from each state for national and regional summaries. Information can be oriented toward production or in-depth diagnostic profiles. The major attributes of an information system and suggestions for application in other countries are described.

KEYWORDS: Animal diseases - Animal production - Data bases - Epidemiological surveillance - Information systems - International cooperation - USA - Veterinary services.

The food animal industries, those associated with them, and those attempting to serve them, are becoming increasingly aware of the need for valid information concerning the occurrences, trends and economic impact of diseases. The availability of such data is essential for improving the health and productivity of animal populations everywhere.

Because of the tremendous need to quantify diseases and production losses, the Animal and Plant Health Inspection Service (APHIS) of the US Department of Agriculture (USDA) has accepted the lead in developing, coordinating and implementing a National Animal Health Monitoring System (NAHMS). The perfection of a comprehensive animal health monitoring system is one of the most important tasks facing animal health officials in any country in the near future.

**DEFINITION**

The objective of NAHMS is to develop the methods to measure the incidence, prevalence, trends and economic burden of diseases in food-producing animals on a state, local and national basis. Results are to be used to improve the efficiency of

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** Animal Health Information Staff, Program Planning & Development, Animal and Plant Health Inspection Service, United States Department of Agriculture, P.O. Box 96464, Washington D.C. 20250, USA.
production of food animals. Some of the NAHMS methods and techniques that are being used for the collection, analysis and dissemination of NAHMS data are applicable to other countries which are interested in establishing their own monitoring or surveillance systems.

This is a most opportune time to implement a national monitoring system. Not only will such a system meet the needs of the rapidly changing livestock and poultry industries; information technology has now become available to support the effort. Computer technologies have become inexpensive and flexible enough to be relevant to most organisational tasks. Information services will quickly become the most rapid growth areas in animal health and will require changes in organisational structure and activities to ensure their efficient and effective use. The ability and necessity to undertake animal health surveillance will take on a new meaning in the future, both domestically and internationally.

Herds and flocks are randomly selected by probability proportion to size, production type and herd/flock size so that results can be leveraged to much larger populations at risk. Producers track and record all health-related events and costs for twelve months. Each month, Veterinary Medical Officers (VMO's) interview the producers, consolidate all the data and submit monthly reports which serve as the foundation for the NAHMS data base (DB). The system is envisaged as a distributive network of microcomputers, with each state responsible for its own DB, and a core of information used from each state DB for national and regional summaries. A basic "core" or first level of NAHMS data is producer-oriented and generic in scope. A second level DB is being incorporated whereby a sample within the original random sample is selected, termed a subsample and followed by in-depth diagnostic workups. Bacteriological, virological, serological and necropsy results are incorporated with the basic NAHMS subset data to add specificity to the information.

**TYPES OF SURVEILLANCE**

Animal health surveillance activities can be divided into two major categories: (1) detecting the foci of diseases and (2) estimating levels of disease in populations. Most of our activities in APHIS, USDA, use disease-detection methods. These call for non-random samples that usually involve large numbers of animals being screened in order to find individual cases of diseases and thus to support eradication or control programmes.

NAHMS is a system which estimates the level of disease in large populations where the sample is random, stratified and involving relatively few animals or herds. Results are leveraged and extrapolated to much larger populations at risk. The methods and objectives are quite different from those in disease-detection activities.

Monitoring or surveillance is considered an umbrella effect covering an entire spectrum of animal health events. Other surveillance systems initiated and maintained by diagnostic laboratories, private practitioners, universities and meat inspection services are useful, and all have a necessary place under the umbrella. NAHMS is coordinating its findings with other systems but seeks to define health problems continuously at the farm level; this has been an area of surveillance which has escaped other systems. In order to get a total picture of animal health, including the costs and complexities of both infectious and non-infectious diseases, it is necessary to
establish a long-term, continuous study that monitors daily events as NAHMS does. In the past, we have taken "snapshots" of health problems at various, unrelated points in time and have incorrectly attempted to use these data to define the status of animal health. This procedure has led to a bias flow of information.

ATTRIBUTES

There are eight attributes to measure the quality of a system such as NAHMS. These attributes, however, can be applied to any type of surveillance activity. Sensitivity, specificity, timeliness and representativeness can be considered quantitative attributes since they can be defined numerically. Simplicity, flexibility, relevance and acceptability are more subjective measurements.

**Sensitivity** is the system's ability to detect true health-related events. This attribute is a function of case definition and the completeness of the reporting system. Diagnostic workups and testing greatly assist this area.

**Specificity** deals with false identification of a health-related event. False positives are a problem in surveillance systems and are adjusted through diagnostic testing and careful definition of the population at risk. Both sensitivity and specificity rely on the accurate classification of numerators and denominators.

**Representativeness** must be planned in the early stages of designing a surveillance system. Because the NAHMS sample is randomised and stratified and collects reports of all health-related occurrences, it is, by definition, representative. **Timeliness** is truly a reflection of the user. There is a need to know information and a period of time when it is useable. In some cases, results may require immediate action. In others, the time between the occurrence of an event and its report may not be critical.

**Simplicity** – a surveillance system should be easily understood and implemented while providing meaningful and useful data. Data collection must be complete but not a burden on participants. Likewise, data quality should not be compromised by the need to have it well-received by producers.

**Flexibility** is a measure of the system's ability to adapt easily to new reporting needs in response to changes in health-related events. New diagnostic tests, special interests of producer groups or states, or emerging problems may require flexibility in a system. Microcomputers and off-the-shelf software packages lend themselves to flexible data handling and retrieval.

**Acceptability** is a measure of the willingness of persons conducting surveillance and those providing data to generate accurate, consistent and timely information. In a voluntary system such as NAHMS, participants must perceive the system to have public value and benefit.

**Relevance** – the system must be applicable to current needs and problems.

The interaction between health and production often involves a very complex system of many events and factors reacting with each other over a variable time frame. The complexities are multiplied by the degree of variability of each of these factors. Yet many of these variations are measurable. Certainly clinical disease can be quantified, and the costs of treatment and direct losses associated with these events
can be tracked. Morbidity and subclinical problems will require special studies, but with in-depth diagnostic workups in selected herds/flocks and the collection of production parameters, the economic burden of these events can be reasonably estimated. Animal health and production are synonymous; to measure one is to measure the other.

The past aim of veterinary medicine was to reduce the occurrence of disease causing mortality. As producers become more sophisticated and competitive, they are now increasingly concerned with significant losses associated with problems that reduce the efficiency of production. Monitoring thus takes on a new significance, as will our ability to relate and convert traditional biological measurements into economic production parameters. The emphasis will be on production functions such as herd/flock feed efficiency rather than on disease as such. Host, environment and management factors may be more significant events than classical infectious disease problems. Objective measurements will be used as a basis for planned improvement, production projections and performance optimisation. In countries such as the US, where epidemic diseases have been controlled, production diseases (often producing no recognisable clinical signs) are the most important contributors to reduced productivity. Knowledge in this area, however, is on a precariously thin foundation. The major barrier impeding our understanding of production diseases is methodological. The NAHMS project is developing and refining the methods necessary to bring about the successful implementation of this system. Much of this methodology has application to any country interested in animal health surveillance.

It is the intent of NAHMS, in concert with specialised animal health research, to develop and implement methods that detect production losses and inefficiencies and assess causal influence of important factors contributing to production diseases. These diseases are epidemiologically complex and are the result of multiple factors working together over time, such as infectious, toxic, genetic, metabolic, environmental and management causes. NAHMS encourages and even demands an interdisciplinary or team approach to identify and quantify these factors and interactions as well as in constructing practical strategies for their control.

The ultimate objectives of NAHMS and disease research are to develop methods to prevent, eliminate or control health hazards in food animal production, which result from existing and emerging diseases. A synthesis of these efforts should lead to the development of new knowledge and technology whose application will benefit both producers and consumers in terms of the quantity, wholesomeness and safety of our protein supply, and also in regard to its efficient production and enhanced marketability, both domestically and internationally. The emphasis should be on the efficiency of production rather than on increasing production.

Our concept of animal health will be an expanded one. The NAHMS project is a strategic effort to improve our capacity to adapt to the new services that are being demanded by the industry. We are building bridges of cooperation as we develop and implement information systems.

**INTERNATIONAL IMPLICATIONS**

Not only are rapid changes taking place in the structure and needs of the US food animal industry; there are also many changing international trends which have
important implications for surveillance activities and information systems. There is a greater diversification of trading patterns with an increased volume of animals and products being moved. Market access is truly an international animal health issue. Concurrently, patterns of disease movement are less predictable and the need for rapid exchange of accurate information has never been greater. Countries will need to strengthen animal health monitoring capabilities and solidify that epidemiologic basis to demonstrate animal health status. Finally, systems such as NAHMS will be vital in countries having minimal resources available for animal health programmes. NAHMS has the ability to translate animal disease information into economic terms; therefore, measurements of the economic impact of diseases and health-related events will be available. This “core” data base will ensure that scarce funds will truly be allocated in the most cost-effective manner.

The core NAHMS system in which descriptive epidemiologic data is collected and analysed has direct application and can serve as a model for almost any country or any animal production system. Direct losses and costs can be estimated and if a minimal amount of diagnostic support is provided, losses due to specific diseases can be estimated as well. The core system with minimal lab support would seem to be the most useful and feasible model for new systems to initiate.

There are two compelling benefits from a NAHMS-like system which truly warrant and justify the activity for animal health officials in any country:

1. The findings of the surveillance process contribute to the continuous redefinition of animal health priorities as past problems are resolved and new needs arise.

2. Decisions are only as good as the information available to make them. Thus a factual data base with statistical reliability serves as the cornerstone upon which planning, resource allocation and effective decision-making is based.

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LE SYSTÈME NATIONAL DE SURVEILLANCE DE LA SANTÉ ANIMALE AUX ETATS-UNIS, MODÈLE DE SYSTÈME D'INFORMATION ZOO-SANITAIRE AU PLAN INTERNATIONAL. – L.J. King.

Résumé : Aux Etats-Unis, le Système national de surveillance de la santé animale, connu sous son sigle NAHMS, a été mis en place pour mesurer l’incidence, la prévalence, les tendances et l’impact économique des maladies des animaux d’élevage. Le système est conçu sous la forme d’un réseau distributif de micro-ordinateurs, dans lequel chaque État est responsable de sa propre base de données et les informations essentielles provenant des différents États sont utilisées pour établir des récapitulations aux niveaux national et régional. Les informations produites peuvent être orientées en direction de la production ou d’études diagnostiques approfondies. L’auteur présente les principales qualités que doit avoir un système d’information et fait des suggestions pour l’application dans d'autres pays des méthodes du NAHMS.

MOTS-CLÉS : Bases de données - Coopération internationale - Etats-Unis - Maladies animales - Production animale - Services vétérinaires - Surveillance épidémiologique - Systèmes d’information.
Resumen: En los Estados Unidos, el Sistema nacional de vigilancia de sanidad animal (NAHMS) se ha establecido para medir la incidencia, la prevalencia, las tendencias y el impacto económico de las enfermedades de los animales de cría. Este sistema se concibió en forma de una red distributiva de microordenadores en la que cada Estado es responsable de su propia base de datos y las informaciones esenciales procedentes de los diferentes Estados son utilizados para establecer recapitulaciones tanto a nivel nacional como regional. Las informaciones producidas se pueden orientar ya sea hacia la producción o hacia estudios de diagnóstico detenidos. El autor presenta las principales cualidades que debe tener un sistema de información y hace sugerencias para la aplicación de los métodos del NAHMS en otros países.

PALABRAS CLAVE: Bases de datos - Cooperación internacional - Enfermedades de animales - Estados Unidos - Producción animal - Servicios veterinarios - Sistemas de información - Vigilancia epidemiológica.