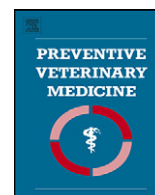




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The role of veterinary epidemiology in combating infectious animal diseases on a global scale: The impact of training and outreach programs

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ABSTRACT

The effectiveness of detection and control of highly contagious animal diseases is dependent on a solid understanding of their nature and implementation of scientifically sound methods by people who are well trained. The implementation of specific detection methods and tools requires training and application in natural as well as field conditions. The aim of this paper is to present the design and implementation of training in disease investigation and basic veterinary epidemiology in selected countries using the Highly Pathogenic Avian Influenza (HPAI) H5N1 Asia strain as a disease detection model. Indonesia, Egypt, Nigeria, Turkey, and Vietnam were each identified as either a priority country where AI was spreading rapidly or a country at risk for infection. In each of these countries, a training program on epidemiological concepts, field investigation methodology, and detection of H5N1 Asia strain cases was conducted. This report includes the impact of these training sessions on national animal health programs, including follow-up activities of animal health officers who went through these training sessions.

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“The veterinary profession as an agent for demonstration and promotion in a community of such badly needed humane values as compassion, kindness, empathy and love in an often inhumane world is an area highly worthy of serious study.”

Calvin Schwabe

1. Introduction

During the last two decades, there have been several emerging and new health events in humans that have received heightened attention from society in general. Most of these health events were linked to animal diseases or originated in animal products, including Highly Pathogenic Avian Influenza (H5N1), Bovine Spongiform Encephalopathy, West Nile Virus, and Severe Acute

Respiratory Syndrome. Due to the extensive involvement of animals and their products in these events, animal health authorities have been involved in measures to minimize the spread and impact of these diseases. However, it has been the public health sector, particularly within central government or international agencies, that led the effort to control or eradicate these diseases. Nevertheless, the prevention effort requires major involvement of animal health officers and others in related industries since the roots of most of these diseases are found in animal populations, particularly food-producing animals and wildlife species.

The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) was finalized as part of the Uruguay Round of Multilateral Trade Negotiations General Agreement on Tariff and Trade (GATT), signed in Marrakesh on 15 April 1994. Subsequent to its approval, the World Trade Organization (WTO) was established in January of 1995. The SPS Agreement's main intent is to provide guidelines and provisions to member countries to facilitate trade while taking measures to protect human,

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animal and plant life or health. The Agreement advocates the use of international standards from the World Organization for Animal Health (OIE), Codex Alimentarius (CAC) and the International Plant Protection Organizations (IPPC) as the basis for recommended standards. It has therefore become obvious that the health status of animals and their products plays a major role in import and export regulations. This type of requirement for trade has placed pressure on the animal health program both nationally and internationally. Veterinary professionals throughout the world, mainly through their animal health services, are faced with having to fulfill a crucial role in protecting their country's animal health status, providing sound surveillance information on the occurrence of diseases within their territories, and conducting scientifically valid risk analyses to establish justified import requirements. The majority of these tasks and activities require sound epidemiological approaches. Veterinary epidemiology as a discipline has therefore become the main focus of the scientific community for effectively combating infectious animal diseases nationally and internationally.

This paper presents the value and role of veterinary epidemiology in combating infectious animal diseases on a global scale, emphasizing the importance of training and outreach programs. Three main topics will be addressed:

- Veterinary epidemiology and its relation to the general discipline of epidemiology.
- Global aspects of infectious animal diseases and their impact on trade and public health.
- Training in veterinary epidemiology and its impact on constraining the spread of infectious diseases.

Particular examples and demonstrations are also presented in this paper.

2. Micro- vs. macro-veterinary epidemiology

In late 1960s the discipline of veterinary epidemiology began to be recognized as an important contributing discipline for animal production and public health aspects of veterinary medicine (Schwabe, 1982). Modern veterinary epidemiology was established in response to demands by veterinary and public health professionals to aid them in handling health events, including suboptimal production, within highly intensive livestock operations. In the 1960s and 1970s, quantitative veterinary epidemiology was attractive to intensive livestock producers, practitioners and, to a certain extent, central and local governments (Schwabe et al., 1977). The term “herd health” was used interchangeably with modern veterinary epidemiology. The tools and techniques were mainly borrowed and modified from several other disciplines such as clinical medicine, quantitative sociology, statistics, pathology, ecology, animal sciences, and microbiology, among others and the approaches were mainly applied at the individual herd or farm level. The term “micro-veterinary epidemiology” was used to reflect the unit of interest/study as individual animals (Schwabe, 1982; Dohoo et al., 2001; Martin et al., 1987; Meek, 1993; Schwabe, 1993). The dairy sector pioneered this effort and was later followed by the poultry,

swine and, to a certain extent, small ruminant and equine sectors. Epidemiologic techniques were also later adapted by animal shelters, laboratory animal colonies, and in the management of free-ranging wildlife species.

As a consequence to opening trade and the signing of the GATT agreement, the world started to take a different shape, especially in the early 1980s. Animal health programs were in the spotlight since the primary issue that would facilitate or impede the trade of animals and their products was their effect on the safety and health of humans, animals, and plants. Comprehensive surveillance, quantitative disease indices, and science-based risk analysis were a few of the new terms that emerged during this critical time. Veterinary epidemiologists, animal scientists, and agricultural economists started to apply some of the herd health tools on a larger scale within regions, zones, or countries. The term “macro-veterinary epidemiology” emerged as an important discipline in shaping animal health strategies and policies in several parts of the world. This term is actually not new to scientists and policy makers since economists have used it when the unit of interest is country based. Nevertheless, not all the tools and techniques used in micro-veterinary epidemiology can be applied directly to macro-veterinary epidemiology. Modifications and adjustments to some of these tools are required and these modifications have evolved out of necessity. The discipline of veterinary epidemiology so far has not addressed methods and techniques to differentiate between these two categories of its function.

3. National Public Health Program vs. National Animal Health Program

A National Public Health Program (NPHP) oversees the well-being of the people/society in the country with particular emphasis on community health quality including issues of food security, social health, and environmental contamination. Activities related to this type of national program therefore include detection, response, prevention, and treatment of specific diseases such as tuberculosis, salmonellosis, West Nile virus, and others.

A National Animal Health Program (NAHP) monitors the well-being of animal populations in the country with particular differentiation between those associated with food production, pleasure animals and, to a limited extent, with companion animals. Activities related to this type of national program are almost the same as those associated with a NPHP with the focus on targeted animal populations.

In addition, there are several overlapping activities between NPHP and NAHP particularly when adverse health events involve animals or their products.

In the USA, for example, it seems that the NAHP generally responds to the aftermath of specific adverse public health events that are initially recognized by NPHP. The response from animal health authorities during the *E. coli* O157:H7 outbreak, for instance, occurred after several fatal human cases were reported. The role of animal contamination in the salmonellosis outbreak in California via sewage was not investigated until the media made the issue public. The investigators, however, identified

properly the link to human sewage contamination as the source of *Salmonella* bacteria in this outbreak (Kinde et al., 1996). In the majority of cases the NPHP reacts to emerging issues brought to the public attention by the media. An exception to this is the new initiative through national surveillance in which health events are monitored and analyzed for their impact on the community. Regardless, the NAHP is almost considered to be a secondary resource for managing adverse public health events instead of working side by side with NPHP. Although the media should not be ignored, their role in identifying an emerging disease event should be evaluated carefully.

Historically one activity of the NAHP in the USA has been in disease-specific programs that were initiated as a result of the public health impact of zoonotic diseases. In the USA, the NAHP has been successful in reducing the impact of diseases such as bovine brucellosis, bovine tuberculosis, salmonellosis in poultry products, rabies, etc. Nevertheless, the interaction with the NPHP has been limited because of inadequate administrative connection or, as in the case of brucellosis, a lack of interest from the public health sector when there are few human cases because of the success of the eradication effort of this disease from the cattle population. Therefore, there has been limited knowledge about or appreciation for the accomplishments or progress of the NAHP. Consequently, the majority of methods and approaches used by the NAHP have not been recognized or valued by public health agencies.

Since its inception, the NPHP has by nature been proactive and dynamic. Society and public decision makers have paid more attention to the public health aspect especially in regard to community-based diseases. Limited attention has been paid to positive impacts of NAHP disease prevention activities on public health in USA. For instance, decision makers rarely acknowledge the value of consistently safe and high quality food of animal origin. The success of the NAHP has also contributed to better and more efficient animal production systems regardless of the zoonotic implications.

Since most of the public attention is given to the NPHP it receives the bulk of the resources, while NAHP components receive little attention and few resources. Furthermore the NAHP has many mandates and also is woefully underfunded. A good example of the imbalance of resource allocation is evident in the current activities related to the global occurrence of Highly Pathogenic Avian Influenza (HPAI). Far more resources have been given to the detection and control of spread of HPAI H5N1 in human populations with relatively limited resources dedicated to the animal side, even though the spread of the infection can be prevented in human side if the focus is on the animal side.

In a country such as the USA, there is the need for a parallel and sound relationship between NPHP and NAHP. An awareness system indicating the link between these two national systems must be shared with decision makers. This system would require animal health authorities and other interested parties such as the animal industries to have intensive and effective communications with decision makers and the public. The livestock

industry, veterinary professionals, animal health authorities and other related sectors should attempt to build bridges with their public health counterparts by explaining the value of NAHP for the well-being of society. The form of such collaboration requires comprehensive understanding of the role of each of these sectors in building a reliable, effective, and practical NAHP. Unfortunately, there is limited understanding of the role of each of these sectors with their counterparts. Therefore, records of successful past and current accomplishments of NAHP should be collected and presented to appropriate professional societies and authorities. The broad aspect of public health and preventive measures should also be emphasized. Any focus on selected zoonotic diseases coupled with a speculative and less scientific approach should be avoided as much as possible.

4. Field training in veterinary epidemiology

The discipline of veterinary epidemiology can be effective only if it is based on a solid understanding of its scientific principles and implemented by people who are well trained. Understanding the concepts of veterinary epidemiology and its tools are mainly a result of research and education. The implementation of specific approaches and tools requires training and application in natural as well as field conditions. Most of the graduate programs currently available require substantial on-campus residency periods which often make it difficult for public sector veterinarians to undertake them. Therefore, it would seem appropriate to explore the possibility of establishing training programs which require short intensive periods with the focus on animal health events of contemporary importance that are of interest to the audience. Distance education and working in the field with selected 'mentor' epidemiologists can enhance this type of training. This type of approach to training has several advantages for building a sound infrastructure for animal health programs. It allows opportunities for training in a way that more fully utilizes the talents of the veterinary epidemiologists already employed by the public sector. It will build a cadre of veterinary epidemiologists who can contribute a harmonized approach to national, regional, and global animal health programs. The training program will also be a major contributor in solving the most current emerging disease since it can deal directly with that disease. In addition, the field activities associated with this training program can be part of the regular public sector activities and thus serve ongoing needs.

5. Control of Avian Influenza is an example of the impact of veterinary epidemiology

Highly Pathogenic Avian Influenza (HPAI) H5N1 Asia strain is a growing problem in animal industries throughout the world, and there is the added threat to human health in the case of a human-adapted strain which might cause a pandemic. Worldwide, countries are preparing and implementing response plans (EFSA, 2008). The U.S. government through the Department of State, Department of Human Health Services, and Department of Agriculture

has contributed to several initiatives and projects to combat this disease in both humans and animals. For example, USDA-Animal Plant Health Inspection Services-Veterinary Services has been engaged in the delivery of technical capacity to various countries. Traditionally, APHIS has supported the training of epidemiologists within the domestic service because it recognizes the value of these scientists in the development of strategies to combat diseases, to evaluate risk, and in many cases to form the basis for field veterinarians to detect, control and eradicate outbreaks of disease. To these same ends, APHIS conducted a series of four regional epidemiology workshops in 2006 and 2007 for working-level epidemiologists of national veterinary services. These workshops were regionally convened: in Bangkok for countries of Asia; in Vienna for the countries of Eastern Europe, the Middle East and countries of the former Soviet Union; in Cairo for the countries of North and East Africa; and in Dakar for the countries of West Africa and Southern Africa.

The criteria for selection of these countries were based on greatest need, greatest number of human cases, lack of veterinary infrastructure, and possibly additional criteria. Indonesia, Egypt, Nigeria, Turkey, and Vietnam were identified as either a priority country, or a country at risk for infection where an opportunity existed to train epidemiologists. In each of these countries, a training program on epidemiological concepts, field investigation and detection of HPAI cases was conducted.

In addition, two sessions for selected participants were held in Fort Collins, CO, USA with an emphasis on the national surveillance system and implementation of a comprehensive national plan for the detection of HPAI, emergency planning, geographic information systems, and incident command system (ICS) application to HPAI control.

The value and effectiveness of these training sessions have already been observed. Animal health officers who have gone through these sessions have already been engaged in several of the following activities as a result of their training and exposure to alternative approaches:

- Revision of a national surveillance plan to better reflect sound epidemiological approaches (FAO-Egypt plan).
- Establishment of a more reliable case definition for investigating and reporting AI cases (FAO report).
- Establishment of a national professional network for the purpose of consolidating efforts to constrain the extent of AI (Nigeria experience).
- Change of the concept of biosecurity from the presence or absence to a continuum of efforts to prevent the introduction of the infection into premises or regions (Indonesia experience).
- Revitalization of epidemiological units as part of the government veterinary services (Egypt experience).

6. Conclusion

During the last two decades, the largest hurdle facing animal health has been the lack of resources available to combat several emerging and re-emerging infectious diseases. Due to recent events, particularly those with public health implications, more resources than ever are

currently being directed toward pressing animal health challenges. The available funds, however, are mainly directed at specific high-profile infectious diseases instead of animal diseases in general. Nevertheless, these resources provide an excellent opportunity to improve the infrastructure of organizations involved in national and global animal health programs.

The emergence of diseases that receive the attention of the public and of policy makers requires technically reliable disease investigation and case findings. There also are requirements for a science-based approach to trade and assessment of risk (i.e., no longer zero risk). Furthermore, international financial institutions have more involvement in shaping government veterinary services and have several requirements to justify plans of action.

Veterinary epidemiology has been a major discipline in supporting and improving national as well as global animal health programs. This discipline, however, should not be considered as an extension of the human public health sector or human epidemiology. Veterinary epidemiology is unique in its approaches and anticipated issues to be solved. The discipline's contribution to reducing the impact of global infectious animal diseases is significant but has had limited recognition. Veterinary epidemiologists are faced with several challenging questions in determining their role at the macro-level of animal health programs. Answering these questions requires a detailed assessment of approaches for designing scientifically sound national animal health programs that include surveillance, prevention strategies, and response plans. The planning of training and outreach sessions is an essential component for the promotion and implementation of sound animal health programs. Veterinary epidemiology is currently in its golden age in terms of its growth and encouragement of scientific approaches.

Conflict of interest statement

Dr. M.D. Salman does not have any conflict of interest.

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