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Emerging and reemerging diseases in the environment of the Free Trade Agreement

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Introduction

Not all emerging and reemerging pathogens that infect animals have been detected, studied and subsequently controlled. As a result, we have been surprised in the past and continue to be surprised when they suddenly appear. The question then becomes, who is responsible to diagnose them, determine their epidemiologies and intervene to control or eliminate them -- the government? Veterinarians in practice? Producers themselves? We are now in a new environment with the signing of the Free Trade Agreement (FTA) between the governments of Colombia and the United States of America. This is the time to begin thinking seriously about the implications that the FTA has for veterinary medicine and animal production in an environment of emerging and reemerging diseases. A current example of the risks that animal production faces is the sudden appearance of high pathogenicty avian influenza virus H7N3 in Jalisco, Mexico that resulted in the culling of over 2 million chickens. In this interconnected world, we should think about what we should do to prevent the spread of this virus into the southern USA, perhaps through illegal movement of fighting cocks, then to the domestic poultry industry, and on to Colombia through legal trade in poultry and poultry products. This is pure speculation, but represents the kind of unexpected series of events for which we should be prepared.

Facing Realities

In developing contingency plans for dealing with emerging diseases, some realities need to be faced (Yuill, 1981, 1987, 1991):

- Pathogenic organisms are components of ecosystems, and are already present but may be unrecognized.
- Humans are components of ecosystems, too, and subject to natural forces.
- Changes in ecosystems may promote or inhibit the emergence of pathogenic organisms.
- Human activity is the major cause of ecological change.

These realities must be incorporated into planning for disease surveillance and control. These plans must take into consideration biological, ecological, economic, social and cultural factors.

Why Diseases Emerge and Reemerge

Pathogens move. They can be transported in infected hematophagous arthropods, as was probably the case with West Nile virus where

the most likely cause of the 1999 spread to New York City by mosquitoes carried by commercial aircraft from the Middle East or southern Europe. The sudden appearance of bluetongue-3 virus, previously known only in Africa, into the Caribbean and Central America was probably via wind-blown infected Culicoides biting midges. Pathogens can be transported by infected domestic and wild animals. Introduction of Newcastle disease virus into California and Texas by infected pet wild birds or illegally transported fighting cocks are examples. The appearance of foot and mouth disease (FMD) in Europe on various occasions has been due to movement of animal products. Movement of FMD in animals and animal products is of concern to Colombia, given its May 2012 declaration of FMD-free with vaccination status. The extensive borders with Venezuela and Ecuador, countries not free of the virus, requires constant surveillance to detect cases should the virus cross into Colombia, with resulting loss of disease-free status. This situation is illustrated by a statement by Hiroyuki Konuma, FAO representative for Asia and the Pacific, who said, "Recent outbreaks of foot and mouth disease throughout the world demonstrate that domestic animals diseases do not have international borders, can have a devastating effect and require a global response." (Kanuma, 2012). The international movement of prions that cause bovine spongiform encephalopathy ("mad cow disease") occurred recently in Europe. With anticipated increased trade in animals and their products between Colombia and the USA, as a response to the free trade agreement, the words of Hiroyuki Konuma must be taken seriously.

Environmental and ecological changes favor appearance of diseases. Many of these pathogens have always been present, but have persisted at such low levels that they have gone undetected. Natural or human-induced ecological changes can accelerate transmission of infectious and parasitic agents among wild or domestic animal hosts with spill-over into humans or domestic animals. An example is the occurrence of Leptospires in rats in the fresh produce market in Medellín (Agudelo-Flórez *et al*., 2009), or hantaviruses and arenaviruses harbored by wild rodents in many countries of the Americas.

Pathogens change. Pathogenic organisms can mutate. Viruses with segmented RNA genomes can reassort their segments. Influenza virus provides a good example of both types of change, increasing pathogenicity of the resulting viruses.

System Requirements

Response to Emerging Diseases Requires an Integrated System. The system requires multiple disciplines working together meet the following challenges:

- Surveillance in rural and urban areas involves monitoring of both domestic and wild animals, and requires the expertise of veterinarians, animal scientists, ecologists and field biologists. The challenges are that many domestic animal populations and most wildlife populations do not have reliable census data. Their disease histories are often unknown. It may be difficult to find fresh carcasses, especially of wild animals. Ongoing, continuous surveillance labor intensive and costly, and often adequate funding is not available.
- Competent and comprehensive laboratory diagnosis is needed. This requires the services of veterinary pathologists, pathogen specialists and technical laboratory staff working in well equipped laboratories. Often, it is necessary to adapt tests developed for one species to another species. This can be especially challenging for diagnosis of diseases of wild animals. Costs for a comprehensive diagnostic service can be high.
- Data from surveillance and diagnosis must be interpreted by veterinary epidemiologists, statisticians and ecologists.
- Intervention for control or elimination of emerging diseases requires planning utilizing the expertise of veterinary epidemiologists, animal scientists, field biologists, economists (to predict costs), and scientists who understand cultural and social factors. Once the planning is in place, there needs to be constant monitoring of progress and adjustments made to field efforts. The eradication of smallpox in the human population and rinderpest in cattle are outstanding examples of how this integrated system can work successfully.

- Research is needed to support the integrated system, such as determining the pathogenicity of agents of emerging diseases in various species, both sexes, and a range of ages. Determination of immune responses of hosts to the pathogen is a key component understanding pathogenesis. Assessment of the influence of population dynamics of hosts and vectors is important to understand transmission and maintenance of the pathogen in nature. Adaptation of newer technology such as GIS, radiotelemetry to determine movement, DNA and RNA analysis provide useful new tools for epidemiological studies.

Future Needs

In an interconnected world involving emerging and reemerging diseases, it would be a mistake to focus narrowly on just one disease in one species of animal. Zoonotic diseases are of concern for public health. Some 75% of emerging diseases of humans are of animal origin. Of these, 65% involve wild vertebrate animals. Domestic and wild animals do not live in isolation from each other, and exchange pathogens, presenting risk of economic loss of domestic animals and complicate management of wildlife, especially those species threatened with extinction. The conclusion is that we need to break down the barriers between public health, animal health and wildlife management and conservation. That will necessitate breaking down the barriers between professions and their specialties, so that all can be brought together to understand and solve problems.

Recognizing these needs is not enough. Action is required. One example that relates to this celebration of 50 years since the establishment of the Faculty of Veterinary Medicine and Animal Science is the Universidad de Antioquia (U de A) – University of Wisconsin (UW) Program for Research and Training in Zoonoses. The program involved both field and laboratory components in Antioquia, Wisconsin and Alberta, Canada. It provided students and professors the opportunity to work with pathogens in ecosystems far different from the ones in their home areas. During the 43 years of the Program, studies were carried out on diseases of several wild mammals (Tobon *et al.*, 1976; Osorio, Godsy *et al.*; 1996, Osorio, Schoepp *et al.*, 1996; Osorio and Yuill, 1996), Venezuelan equine encephalitis (Zuluaga and Yuill 1978, 1979), on vesicular stomatitis (Zuluaga and Yuill, 1979), bluetonge (Homan, Zuluaga *et al.,* 1985; Homan , Lorbacher *et al*.; 1985, Homan, Taylor *et al*., 1985) and most recently avian influenza, West Nile virus and dengue viruses and vaccines. (Jorge Osorio personal communication, various occasions, 2011-2012). Young U de A professors were provided fellowships for graduate study at UW to increase research capability. UW students and professors were provided opportunities to conduct tropical field studies in Antioquia. The long life of the program is due to the benefits accrued to both Universities and to the participants in the program.

The free trade agreement raises new challenges and opportunities for collaboration in other areas as well. The future Pacific Alliance between Colombia, Peru, Chile and Mexico will increase those challenges and opportunities.

Dr. Jaime Estupiñán Árias, a consultant for World Bank projects in Latin America, said that there is a need for more active involvement of veterinarians and animal scientists in insuring safety and quality of products of animal origin in the food chain (personal communication 23 June 2012). Currently, there are often gaps in the system from farm to consumer. Movement of animal products in international trade, as promoted by free trade agreements, requires a seamless system of food production from producers to processors to the ultimate consumers. Too often, the emphasis is on the processing component, without regard to problems that may occur on the farm. But solution of on-farm problems requires a comprehensive understanding of the entire system. Often, there is a gap in this understanding on the part of veterinarians and animal scientists so that animals and their products arrive at the processing plant in safe, optimal condition. Pathogens such as brucellosis, tuberculosis, *Salmonella*, *E. coli* and a variety of parasites must not reach processing plants. Veterinarians and animal scientists also need to understand the demands that consumers place upon the animal products that they consume, so that herd and flock health factors are incorporated into

management practices. This suggests that consumer demands for products free of pathogens and toxicants, processing problems and their relationship to herd/flock health and management needs to be incorporated into university curricula and in technical assistance programs. Free trade agreements bring with them regulations for food safety and quality. The OIE has stated that strong veterinary systems must protect the safety of sources of food, health, trade, and animals, and as such is a global public good.

Conclusion

Emerging and reemerging pathogens are an iceberg. Only the tip is visible, and many surprises are waiting to emerge beneath the surface. Their emergence will have impacts on the health of domestic and wild animals and of humans. They must be viewed through a one health perspective, because in reality there is no separation between the factors that influence human and animal health. One health requires the active collaboration between professions and specialties. We must work as teams, and train our students to do so as well, if we are to be ready to confront the next problems that will surely appear.

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