

Surveillance, detection and response: managing emerging diseases at national and international levels

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Summary

Globalisation is leading to a rise in the emergence of diseases and the author describes the new challenges that this brings for individual countries and the international community. The paper describes the existing international early warning systems and response mechanisms, discusses the role of international organisations in managing diseases that have the potential for cross-border spread, and underlines the importance of disease surveillance, detection and response at national level. While international collaboration exists in dealing with disease emergency situations, there is a need to develop regional and international contingency plans that can be launched as soon as an emergency situation arises. This will only be possible if there is the political will to tackle problems wherever they occur. The Global Early Warning System, which is a system currently being developed jointly by the Food and Agriculture Organization of the United Nations, the World Organisation for Animal Health and the World Health Organization, could provide an effective framework in which to achieve a higher level of international emergency preparedness.

Keywords

Contingency plan – Disease management – Early warning and rapid response – Emerging diseases surveillance – Food and Agriculture Organization Emergency Prevention System – Global Early Warning System – Global Outbreak Alert and Response Network – World Organisation for Animal Health international animal disease information system.

Introduction

Each new era of human history brings with it a fresh crop of diseases. Today, in the age of information and communication, as a consequence of globalisation, with the increasing and faster movement of people and goods between countries that this entails, there is a rise in the emergence and re-emergence of diseases, including zoonoses.

The World Organisation for Animal Health (OIE) defines an emerging disease as a new infection resulting from the evolution or change of an existing pathogenic agent, a known infection spreading to a new geographic area or population, or a previously unrecognised pathogenic agent or disease diagnosed for the first time (4).

Recent experience has shown that no country, however economically well-developed it may be, is capable of ensuring 100% security of its borders by imposing quarantine measures or import bans on animals and animal products, nor can it totally prevent the illegal flow of migrant human populations. Humans and commodities, including live animals, may illegally enter any country in the world. In addition, economically developed countries have witnessed major changes in consumer habits that have increased the risks of disease exposure and spread. The majority of consumers live in urban areas, and often want to spend their weekends and holidays in the countryside 'getting back to nature'. This exposes them to diseases that are not present in their home environment. A good example is Lyme disease,

which is caused by *Borrelia burgdorferi* bacterium and transmitted to humans by the bite of infected deer ticks in tick-infested woods. Similarly, they want to experience other types of cuisine and eat exotic foods that do not necessarily exist in their own country.

Changes in population distribution and behaviour have also been occurring in economically less well-developed countries. Recent phenomena include a rural exodus to peri-urban areas, a higher consumption of animal protein and changes in traditional livestock production systems, and the displacement of large numbers of people when there are problems of civil unrest, political instability, etc. Budgetary restrictions observed in developing countries in the last two decades have led to a decline in public services, while the private sector has remained generally weak. The purchasing power of the majority of the population in these countries is still very low and does not allow them to pay for the necessary services. All these changes constitute important risk factors for maintaining and developing diseases, which could at any moment spread to other populations and regions.

It is clear, therefore, that no country, rich or poor, is immune from the risk of disease. The conditions that encourage the emergence of disease may be different, but the challenge of managing disease spread is the same. However, not all countries have the same capacity to respond to this challenge. Within the so-called global village, different countries have different priorities, varying amounts of financial resources and contrasting levels of infrastructure. As there is an unprecedented amount of movement of humans, animals and animal products between these countries this presents a challenge not only to individual countries, but to the international community as a whole.

Surveillance, detection and response needs to be well managed at national level in the country where an event occurs. For this reason, the key elements of effective early warning systems that make it possible to respond rapidly to the occurrence of disease, including emerging disease, will be described first. This will be followed by a description of existing international early warning systems and response mechanisms, with the emphasis on what could be done to improve the rapid response at international level.

Surveillance, detection, and response: managing emerging diseases at national level

There is now unanimous agreement on the importance of having an efficient national surveillance and monitoring

system for animal diseases and zoonoses in domestic and wild animals, capable of generating reliable information on the disease situation within the country and rapidly detecting diseases introduced accidentally or deliberately. Each country should have a central epidemiology unit, with trained epidemiologists responsible for coordinating the system. This unit should be responsible for collecting information from different sources (field veterinarians, laboratories, etc.) and analysing it for the purposes of decision making. The use of computerised tools such as databases, mapping software and geographical information systems for data processing and analysis is recommended, particularly now that these tools are becoming affordable to most countries.

In addition to routine missions, the disease surveillance and monitoring system should be able to detect animal health events whenever they occur. It is important to make sure that the system is able to detect and identify emerging phenomena or diseases, rapidly evaluate the situation and if necessary sound the alarm and trigger the appropriate measures to control the situation. The ultimate objective is of course to bring the situation under control as quickly as possible while minimising the damage. While these principles are logical and easy to understand, their application in the field remains difficult. Problems can stem from a lack of understanding of the pathogenic agent itself or its complexity, in which case the involvement of research institutes and national and international laboratories will be required. Problems can also occur as a result of difficulties in efficiently managing the individuals that comprise the system; a system is composed of individuals and institutions with motivations and interests that could well be different and even contradictory. Thus, leadership of the partners within the system, and coordination between them, is of the utmost importance for ensuring that it functions at an optimal level. One has only to analyse the experience of countries, both rich and poor, in controlling the introduction of exotic diseases, to notice weaknesses in coordination and in making the necessary expertise rapidly available. The avian influenza episode in Southeast Asia that started in late 2003 was a good example of this, with weak coordination between stakeholders and between public health and animal health professionals in many of the affected countries.

In addition, a growing involvement of consumers in influencing animal health policy has been observed in many countries. To a certain extent consumers have become the evaluators of this policy as risk perceivers. In these countries, consumers are replacing producers as the principal clients of Veterinary Services. This fact, together with an environment dominated by the privatisation of veterinary services, complicates the task of the official veterinary authorities. The problem is complicated still further when the disease is a zoonosis and where other institutions, notably those in the public health field, are

involved. Without good coordination and prior concerted actions it becomes much more difficult to master the situation rapidly and with minimal damage.

One does not need to be a graduate of a military academy to guess that it is more difficult to keep soldiers alert in times of peace than in times of war. For this reason, it is inadvisable to have a specific system to detect emerging diseases. The national animal disease surveillance and monitoring system should have the capacity to detect any emerging events that might occur. It should be able to detect, identify and evaluate these phenomena rapidly. Mechanisms with a clear chain of command should be determined in advance to enable an early response to be taken so that the situation can be brought under control as quickly as possible. This aspect will be dealt with later.

Importance of national surveillance and monitoring systems

The chapter on the evaluation of Veterinary Services in the OIE *Terrestrial Animal Health Code* (5) states that: 'The Veterinary Services shall have at their disposal effective systems for animal disease surveillance and for notification of disease problems wherever they occur, in accordance with the provisions of the *Terrestrial Code*. Adequate coverage of animal populations should also be demonstrated. They shall at all times endeavour to improve their performance in terms of animal health information systems and animal disease control'.

Each country should design specific disease surveillance programmes in advance, taking into consideration who will be involved and what actions it will be necessary to take. It is of the utmost importance that the system in place is able to detect and notify unusual events. Operational diagnostic laboratories should be involved as full partners of the disease surveillance and monitoring system at national level, and if needed, international reference laboratories can also be used to support surveillance activities by carrying out the necessary diagnostic tests (1). The use of molecular epidemiology by the application of molecular characterisation tools is also recommended. For example, the determination of the phylogenetic relatedness of a virus assists in tracing back the origin of the infection. Research institutions and universities should also take part in the disease surveillance and monitoring system. They might help in the design and in the implementation of surveillance activities. They could play a major role in developing research programmes aimed at answering specific questions, especially when no or scarce scientific information is available.

The implementation of disease surveillance programmes should be accompanied by training programmes for private and public veterinarians, para-veterinarians,

laboratory staff, livestock producers and their associations, etc. Depending on the disease, other partners should also be involved. For zoonotic diseases, for example, public health professionals obviously need to be involved in the surveillance programme and in the preparation and implementation of contingency plans. This collaboration is essential in order to ensure that all the necessary information can be collected and that a coordinated and efficient response can be implemented should the need arise.

The system cannot function properly if the key people and institutions are not properly identified in advance and if they are not involved in a structured manner. It is also very important to define the objectives of the animal disease surveillance and monitoring system and to make sure that its objectives are fully understood by all the partners at all levels. While it does not fall under the scope of this paper to address the role of wildlife in emerging diseases (7), each country should be aware of the endemic diseases that exist in their wild animal populations and have the necessary veterinary infrastructure in place to be able to diagnose the whole spectrum of wildlife diseases.

How to define priority diseases for early warning purposes

The *Manual on the Preparation of National Animal Disease Emergency Preparedness Plans* of the Food and Agriculture Organization of the United Nations (FAO) (3), stipulates that each country should, as part of its early warning system, carry out risk analyses to determine the likelihood of exotic diseases being introduced. The risk of disease or pathogen introduction should be analysed in relation to the country's geographical location and the disease situations of neighbouring countries or trading partners. Other risk factors for the introduction of diseases (e.g. climate change or global warming, both of which lead to an increased risk of exotic vector-borne diseases) should be analysed and dealt with if the risk is deemed high. Risk analyses should frequently be updated to take into account changes in the disease situations of neighbouring countries or trading partners.

Contingency planning and rapid response

Each country should develop the capacity to respond rapidly to an animal health emergency. This requires advance preparation of a generic contingency plan for any potential disease or event. The generic contingency plan should describe in detail what should be done during an emergency situation and by whom, including the roles of the various partners and their responsibilities, with a clear chain of command (3).

Detailed arrangements for managing a crisis should be worked out in advance, describing the various committees and their composition, identifying national and international expertise and infrastructure (laboratories, faculties of veterinary medicine, research institutes, etc.) and the logistics available in the different localities and regions (communication tools, transportation vehicles, etc.). The involvement of the police and armed forces should be foreseen in case there is a need to put checkpoints in place or impose movement restrictions on animals or animal products in the country or a part of the country. As already mentioned, the choice and the prioritisation of diseases for which specific contingency plans should be designed must be based on risk analysis.

As part of the contingency plan, it is important to determine where and how quarantine procedures and border controls should be strengthened, to ensure that the necessary laboratory diagnostic capabilities are in place, and to define how and where active disease surveillance needs to be strengthened. According to the nature of the disease, it is important to determine the existing control measures that could be implemented if the disease were to be introduced. For example, one could check whether vaccination against the disease exists and, if so, establish the necessary contacts to determine the availability of vaccine stocks or decide to maintain a vaccine bank for use in the event of an emergency.

Simulation exercises should be regularly carried out to make sure that the contingency plan is fully understood by all partners (public and private veterinarians, livestock producers, police, army, customs, etc.) and to identify and correct any weaknesses. This is essential in order to ensure that the plan will work successfully in the event of a disease being introduced or the occurrence of an emerging disease.

Surveillance, detection, and response: managing emerging diseases at international level

World Organisation for Animal Health

The OIE manages the international animal disease reporting system for the main animal diseases, including zoonoses. This system, which started in the early 1980s, is based on official animal disease information that the veterinary authorities of OIE Member Countries have an obligation to report to the OIE and is divided into two components:

a) The international early warning system, with an alert procedure to warn of exceptional epidemiological events, whether natural or intentional, that occur in Member

Countries. Information is aimed at decision-makers and other stakeholders to enable them to take any necessary preventive measures. Under this system, the occurrence of any exceptional epidemiological event must be reported as soon as possible to OIE headquarters, which then redistributes the information through various channels. Follow-up reports are provided weekly to allow end-users to follow the epidemiological situation as it develops.

b) The international monitoring system, with procedures for gathering monthly and annual animal health data from around the world. Monthly information is collected on fifteen diseases that have the potential for very rapid spread, while annual information is collected for more than a hundred animal diseases, including zoonoses.

In terms of response, the OIE has a limited source of emergency funds that could be used rapidly to assist a Member Country faced with an exceptional epidemiological situation. However, experts from OIE Reference Laboratories or Collaborating Centres can immediately be sent to assess the epidemiological situation in the field, advise on actions to be taken by the national authorities and prepare for the intervention of other international bodies.

Food and Agriculture Organization Emergency Prevention System

The FAO Emergency Prevention System-Livestock (EMPRES-livestock) programme promotes the containment and control of transboundary animal diseases, and their progressive elimination on a regional and ultimately a global basis (2). It focuses primarily on rinderpest, but also includes other epidemic diseases (contagious bovine pleuropneumonia, foot and mouth disease, peste des petits ruminants, Rift Valley fever, Newcastle disease, lumpy skin disease, African swine fever and, most recently, avian influenza). Early warning messages are posted on the Web and distributed via the EMPRES-livestock mailing list. The EMPRES provides assistance in training national epidemiologists and advises on the establishment of surveillance programmes in the least developed countries. In the event of a disease emergency, EMPRES can also intervene at the request of an FAO Member Country to assist in combating diseases by means of FAO technical cooperation programmes. While efforts are being made to build capacity in some of the least developed countries, what has been achieved so far has not been enough to meet the real needs of many countries for assistance in strengthening their national surveillance and monitoring systems and bringing their contingency plans up to an acceptable level. Furthermore, the available resources for tackling emergency situations and avoiding the spread of transboundary diseases to other countries are far from sufficient.

World Health Organization

For diseases of public health concern, the International Health Regulations (IHR) of the United Nations World Health Organization (WHO) require Member Countries to notify the WHO of any human cases of three infectious diseases, namely, cholera, plague and yellow fever. The IHR are being amended to place greater emphasis on emerging human diseases. In April 2000, the WHO launched the Global Outbreak Alert and Response Network (GOARN) (8), the objective of which is to gather epidemic intelligence from informal sources. It uses a multilingual application called the global public health intelligence network, developed in partnership with Health Canada, which searches key Websites, alert networks, newswire services and on-line media sites, public health email services, and Websites of national governments, public health institutions, non-governmental organisations and specialised discussion groups to identify early warning information about epidemic threats and rumours of unusual disease events. The network has also organised actions in the field to combat diseases by ensuring that appropriate technical assistance reaches affected countries rapidly.

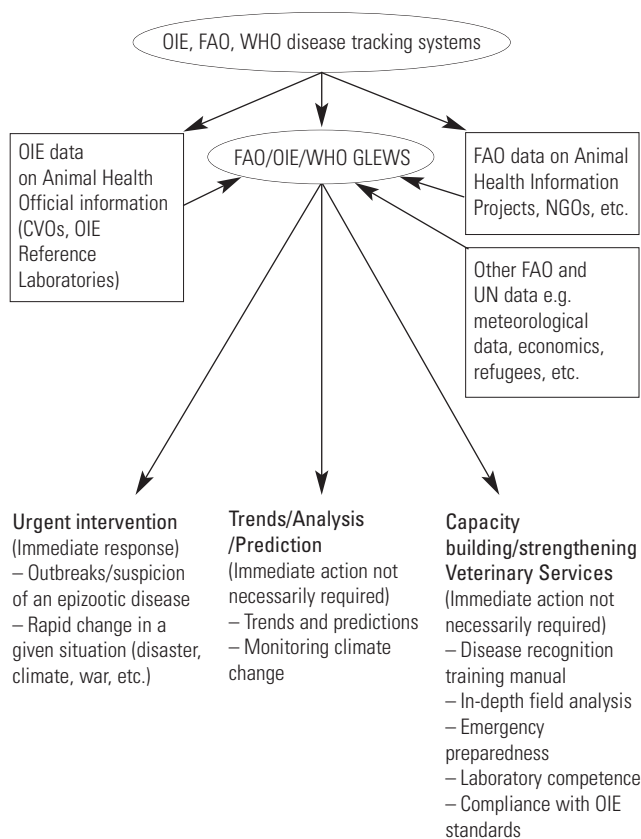
Global Early Warning System: a joint Food and Agriculture Organization/World Organisation for Animal Health/World Health Organization initiative

In order to improve the efficiency of their early warning systems for the benefit of the international community, the FAO, the OIE and the WHO have embarked on the development of a Global Early Warning System (GLEWS) (6). The main objectives of GLEWS (Fig. 1) are to share the results of disease tracking systems between the three sister organisations and to improve the information verification processes. Another important objective of GLEWS is to develop a tool for the benefit of the international community and stakeholders alike to assist in predicting livestock animal disease threats through epidemiological analysis and the examination of additional factors that might also have an impact on the occurrence and spread of such diseases (e.g. economic factors, civil unrest, and climate changes).

Another planned component of GLEWS is the development of a coordinated response among the three sister organisations to animal health emergencies, coupled with an international contingency plan. This would help to provide a more efficient response to emergency situations.

Conclusion

Globalisation and the rapid movement of humans, animals and animal products increase the risk of a local event



CVO: Chief Veterinary Officer
 FAO: Food and Agriculture Organization
 GLEWS: Global Early Warning System
 NGO: Non-governmental organisation
 OIE: World Organisation for Animal Health
 UN: United Nations
 WHO: World Health Organization

Fig. 1
Inputs and foreseen outputs of the Food and Agriculture Organization/World Organisation for Animal Health/World Health Organization Global Early Warning System

quickly developing an international dimension. The heterogeneity of countries in terms of wealth, priorities and infrastructure makes it very difficult to manage disease situations properly in many parts of the world.

For the poorest and least developed countries, substantial additional resources are an absolute necessity both for their general development and more particularly to strengthen their Veterinary Services, thereby helping them to improve their knowledge of the animal health situation in the country and prevent the potential spread of diseases by combating them immediately whenever they occur. These additional resources would not only benefit the poor countries themselves but would also constitute a kind of insurance policy for those more highly developed countries that have invested substantial resources in improving the public and animal health situations of their own countries. The international community has a major role to play at field level in strengthening national Veterinary Services.

It is important for international organisations to play a more proactive role in managing emerging disease situations with potential for international spread wherever they occur. This can be achieved only if efforts and actions are better coordinated so as to respond appropriately, each organisation building on its strengths.

While collaboration exists between international organisations such as the OIE and the FAO in dealing with animal disease emergency situations, there is also a need to develop regional and international contingency plans for animal diseases that can be activated as soon as an

emergency situation arises, with predefined mechanisms for rapid deployment of the necessary human and financial resources. This cannot be achieved without a general consensus and the international political will to tackle problems where they occur. The FAO/OIE/WHO GLEWS initiative could be the most effective means of coordinating this work if the necessary resources are allocated for its development.



La gestion des maladies émergentes par la surveillance, la détection et l'intervention au niveau national et international

K. Ben Jebara

Résumé

La mondialisation entraîne un accroissement de l'émergence de maladies. L'auteur explique les nouveaux défis que les différents pays et la communauté internationale ont à relever. Il décrit les systèmes internationaux d'alerte et les mécanismes d'intervention qui existent actuellement, précise le rôle des organisations internationales dans la gestion des maladies qui ont la capacité de se propager par-delà les frontières, et souligne l'importance des capacités de surveillance, dépistage et intervention à l'échelle nationale. Certes, la collaboration internationale existe en matière d'interventions sanitaires d'urgence, mais il faudrait la renforcer par la mise en place de plans d'intervention dans les différentes régions du globe et à l'échelle mondiale afin de pouvoir les mettre en œuvre dès l'apparition d'une situation d'urgence ; or ceci n'est possible que s'il existe la volonté politique de s'attaquer aux problèmes quel que soit l'endroit où ils surgissent. L'Organisation des Nations unies pour l'alimentation et l'agriculture, l'Organisation mondiale de la santé animale et l'Organisation mondiale de la santé travaillent actuellement à l'élaboration d'un Système mondial d'alerte précoce qui pourrait fournir des bases solides sur lesquelles on parviendrait à élever le niveau de préparation aux situations d'urgence à l'échelle internationale.

Mots-clés

Alerte précoce et intervention rapide – Gestion des maladies – Plan d'intervention d'urgence – Réseau mondial d'alerte et d'action en cas d'épidémie – Surveillance des maladies émergentes – Système de prévention des urgences de l'Organisation des Nations unies pour l'alimentation et l'agriculture – Système international d'information sanitaire de l'Organisation mondiale de la santé animale – Système mondial d'alerte précoce.



Vigilancia, detección y respuesta: lucha contra las enfermedades emergentes en los planos nacional e internacional

K. Ben Jebara

Resumen

El autor describe los nuevos problemas que afrontan los países como la comunidad internacional debido a la proliferación de enfermedades emergentes que la globalización trae consigo. El autor describe los sistemas de alerta rápida y los mecanismos de respuesta existentes a escala internacional, y reflexiona sobre el papel que deberían desempeñar los organismos internacionales para contener enfermedades que amenazan con propagarse atravesando fronteras. También insiste en la importancia de la vigilancia, la detección y la respuesta sanitaria en cada país. Pese a la existencia de mecanismos de colaboración internacional para hacer frente a situaciones de emergencia sanitaria, es menester elaborar planes de contingencia a situaciones imprevistas de alcance regional e internacional que puedan ser activados al menor indicio de crisis sanitaria. Pero ello no será posible si existe una falta de voluntad política internacional para afrontar los problemas en cuanto éstos surjan. El Sistema Mundial de Alerta Precoz que están preparando ahora conjuntamente la Organización Mundial de Sanidad Animal, la Organización Mundial de la Salud y la Organización de las Naciones Unidas para la Agricultura y la Alimentación brindará un marco de referencia útil para mejorar el nivel de preparación para emergencias en el plano internacional.

Palabras clave

Alerta y respuesta precoz – Control de enfermedades – Plan de contingencia a situaciones imprevistas – Red Mundial de Alerta y Respuesta ante Brotes Epidémicos – Sistema Mundial de Alerta Precoz – Sistema mundial de información zoonosológica de la Organización Mundial de Sanidad Animal – Sistema de Prevención de Emergencias de la Organización para la Agricultura y la Alimentación – Vigilancia de enfermedades emergentes.



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