



Working Paper EERG/CGHS: 01/10

Achieving Effective Inter-Sectoral Collaboration to Prevent, Detect and Control the Emergence and Spread of Zoonotic Diseases

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April 2010

This paper was presented at the Chatham House policy seminar on 'Strengthening Collaboration between Wildlife, Livestock and Human Health Sectors', jointly organised by the Energy, Environment and Development Programme and the Centre on Global Health Security on 16-17 March 2010 in London. Further information, including the meeting report, agenda and presentations, can be found at www.chathamhouse.org.uk/events/view/-/id/1425

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Consider the following -

In Asia, many households raise poultry to sell in live bird markets to earn money that can keep a family out of poverty and cover expenses for shelter, food, education, health care and other important items. Poultry are also important in celebrating holidays and are considered to be good luck. Moreover, several Asian countries are becoming leaders in the international trade of poultry, eggs and other related products. In 1997, 18 people in Hong Kong became ill with highly pathogenic H5N1 avian influenza virus, and six of them (33%) died from their infections. It was the first time this poultry virus had been detected in people. Human exposures were found to occur from contact with infected poultry in Hong Kong's live bird markets, where wild aquatic waterfowl—the reservoir of influenza viruses—had been mixed with domesticated poultry.

Immediate control measures instituted in Hong Kong's live bird markets and depopulation of their entire poultry population stemmed further infections in Hong Kong, which remained free of H5N1 infected poultry. But the virus remained present in poultry populations outside Hong Kong, and in 2003 it began to spread in poultry throughout Asia, Eastern Europe, the Middle East and into Africa. In late 2003, the World Health Organization (WHO) was alerted to the possibility that a recent childhood illness of unknown origin detected in Viet Nam might be associated with outbreaks of this virus. Human infections continued to occur. Wild birds were found to be infected, and fears they would cause large-scale spread of the virus led policy makers in some countries to call for the elimination of wild birds. Reports that some countries started culling them prompted the UN to warn against such measures.

Human health authorities, alarmed over these events, recognised that the control of poultry infections—vital for reducing human exposures—rested with ministries of agriculture, veterinary services and natural resources. Yet there was little to no history of ministries of health and agriculture communicating and working together to address animal diseases with potential to infect humans. Veterinary services of countries across Asia were insufficiently resourced and organised to effectively detect and contain the spread of the virus in poultry. There was a dearth of veterinarians with expertise and experience in poultry diseases, basic sanitary and hygienic control measures, effective animal husbandry biosecurity practices and vaccination programmes.

As of 17 February 2010, 51 countries have reported poultry or wild bird outbreaks of H5N1 infection to the World Organization for Animal Health (OIE) and 478 laboratory confirmed human zoonotic infections from 15 countries have been reported to the WHO, with 286 (~60%) deaths. People working closely with infected poultry appear to be at greatest risk for infection. Billions of poultry have been culled across affected countries to contain the spread and reduce the risk for human exposure, leading to economic losses estimated to be in the billions of dollars. China, Vietnam, and Thailand instituted surveillance and national poultry vaccination campaigns, which were followed by drops in numbers of human infections. In the meantime, international trade of poultry and poultry products were negatively affected. In several countries, the demand for chicken and other poultry products crashed as the public incorrectly assumed that eating chicken carried the disease risk. Although there has been limited person-to-person spread, given the high case fatality rate and the potential for mutation, huge concern exists for a deadly human pandemic influenza virus to emerge. Infections among poultry and in people continue to occur.

INTRODUCTION

Animals benefit society in many important ways. Livestock, poultry, fish and other species are essential for providing animal protein in human diets, fibre for clothing, fertilizer for crops and fuel for heat and cooking. The international trade of livestock and poultry and their by-products is a significant component of many national economies and the global economy overall. Wildlife are an essential component of healthy, biodiverse ecosystems, which are important for sustaining a global environment that supports human and animal health, and for sustaining economic livelihoods in many developing countries (Osofsky 2009). Animals will continue to play an important role in helping countries achieve the Millennium Development Goals that address poverty, health and education (UN 2009).

However, humans can become ill from pathogens transmitted from animals (i.e., zoonotic infections). Such human outbreaks are increasing as a growing human population encroaches on animal habitat, as global climate change increases insect and rodent vectors and as people exhibit behaviours and food preferences that increase their contact with exotic, wild animals. Valuable opportunities for the prevention and early control of zoonotic infections and diseases are being missed, in large part because veterinary services infrastructure is under-resourced and weak and collaboration among the various sectors responsible for human, animal and environmental health is poor or nonexistent.

To inform this meeting, this paper outlines the connection between animal, human and environmental health, presents a vision for a well functioning, integrated inter-sectoral system for the prevention, early detection and control of zoonotic disease events, and proposes for discussion possible solutions to achieve increased collaboration among the sectors.

EMERGENCE, SPREAD AND CONTROL OF ZOOBOTIC DISEASES

Animal species can be reservoir hosts or become infected with pathogens that are transmissible to humans through multiple routes. Such human infections may or may not cause illness or death, and may or may not be transmitted from person-to-person and some have the potential to mutate in such a way as to increase or decrease their transmissibility or virulence. Interactions between animals and humans continue to evolve with changing human and animal demographics. Outbreaks of emerging zoonotic diseases and infections with increasing occurrence have had significant direct and indirect impacts on human and animal health, and on local, national and global economies. Examples include SARS, Rift Valley Fever, Ebola virus, pandemic H1N1 influenza, highly pathogenic H5N1 avian influenza virus, rabies, Bovine Spongiform Encephalopathy (BSE or mad cow disease), tuberculosis and brucellosis (NRC, 2001; IOM/NRC, 2009). The consequences of these diseases for human populations include not only illness or death, but also impacts on mental health—from fear, misperceptions of risks of exposure or from the loss of income from animal illness and death (from disease or control efforts), which can lead to poverty and other negative impacts on national economies.

In many countries, irrespective of the status of their veterinary services infrastructure, zoonotic diseases with epidemic potential are frequently detected following human illness and/or death. As human infections are traced back to their animal source, massive control efforts are implemented to stem further spread to or among humans. There are numerous opportunities to prevent, detect, respond to and control zoonotic infections and diseases in animal populations before human exposures occur, or, should transmission have already occurred, to detect and respond to human infections earlier, thereby reducing risks of further human exposures (see Appendix 1).

RESPONSIBILITIES FOR HUMAN, ANIMAL AND ENVIRONMENTAL HEALTH

Today, responsibility for human health is mostly under the sole purview of ministries of health/public health, while that for livestock and poultry and international trade lies with ministries of agriculture in the public sector, and increasingly with agricultural companies in the private sector. Ministries of natural resources/environment/interior are responsible for wildlife and environmental health and ecotourism. These sectors and agencies are guided by different missions. However, the drivers of zoonotic disease emergence and actions required to effectively prevent, detect or control them cross over the mandates of these and often other ministries. Over the last several decades, these entities, in virtually all countries, have been unable to undertake, integrate and/or coordinate their efforts effectively to prevent, detect and control emerging zoonotic infections early, either in animal or human populations.

At the international level, the WHO coordinates human health and oversees and implements the International Health Regulations (IHR), while the OIE is the intergovernmental organization responsible for establishing standards and recommendations for the regulation of trade in animals and products, and for animal health, including zoonoses. The Food and Agricultural Organization (FAO) provides country support and guidance on matters of animal health that affect food security and nutrition.

VISION FOR A WELL FUNCTIONING, EFFECTIVE, INTER-SECTORAL SYSTEM TO ADDRESS ZOOBOTIC DISEASES

In a well functioning, effective system comprising a strong and coordinated human, animal and environmental health infrastructure, the emergence of and response to zoonotic infectious diseases would be more likely to be prevented or contained early. In the event of either an animal or human outbreak, there would be regular meetings coordinated across sectors and disciplines, including communications and social science experts. Protocols clarifying roles for reporting and response and communications channels within and between local, national, and international levels, would be developed, tested, practiced and executed when appropriate. Sufficient resources would be allocated and distributed for ongoing training, education, supervision, operations and communication.

Interventions to prevent zoonotic disease emergence in animal populations would be implemented. Should prevention efforts fail, veterinary infrastructure would be sufficiently strong to detect emergence early. Protocols and resourced personnel would be in place to deploy veterinary investigation teams to collect and analyze clinical and epidemiologic information and to collect specimens for testing at a reference laboratory to confirm the cause of the outbreak. Veterinary services, using personal protective equipment (PPE) if required, would immediately implement interventions to stop or limit the spread of infection in animals. When a zoonotic disease is suspected, they would advise animal owners and local communities how best to prevent human exposure, and alert human health authorities so that investigations could be conducted in human populations. Risk communication would be instituted in such a way as to not cause panic, but to guide people on how to avoid exposure and when and where they should seek care should symptoms occur. Occupational surveillance systems would detect infections early in people at greatest risk of first exposure (e.g. people working closely with animals), while front-line human health care workers would wear PPE if necessary. Human and animal diagnostic laboratories would share information on an ongoing basis.

CHALLENGES TO ACHIEVING EFFECTIVE INTER-SECTORAL COLLABORATION

1. There is a lack of appreciation that a stronger veterinary infrastructure could prevent the emergence of zoonotic diseases in animal populations and their spread to humans,

which leads to weak, under-resourced departments of veterinary services and laboratories. There are substantive jurisdictional divisions that lead to important differences in levels of funding and programmes for the different ministries and sectors, with minimal to no opportunities for inter-sectoral funding. In general, resources allocated to human health surveillance, response and research programmes are magnitudes higher than those for veterinary services. Given already limited resources to address animal disease prevention and control, veterinary services are unable to devote the resources needed to address zoonotic infections or diseases that often do not carry significant health consequences for animals. In addition, the veterinary workforce is often significantly smaller than the human health workforce. In many countries there are no bodies of accreditation for veterinary medical schools, which means knowledge and competencies can vary greatly within and between countries. These shortcomings make it difficult to supply sufficient numbers of veterinary personnel with the right expertise and experience to lead and implement veterinary services programmes, or assign to or lead multidisciplinary teams. In addition, the incomes of animal health personnel often are much lower than those of their human health counterparts and this causes tensions among those working on teams doing similar work. Finally, there frequently is a lack of uniformity in regulation of veterinary medicines and vaccines, often leading to inconsistent quality and effectiveness.

2. There are differences in international authorities. As specified by the IHR, all member nations must notify the WHO “within 24 hours of assessment of public health information, of all events which may constitute a public health emergency of international concern within its territory”. The WHO is also required to develop core capacities in epidemiology and public health laboratory support that facilitates earlier detection and response to infectious disease outbreaks. Under the IHR, the WHO must provide guidance and facilitate collaboration with member countries in order to ensure compliance with detection, reporting and response to diseases of public health interest, including zoonotic infections or diseases. By comparison, a resolution passed by OIE member countries reminds them that they are obligated to make available to OIE all information on relevant animal diseases, including those that are of zoonotic potential, but does not legally bind obligations for development and maintenance of core surveillance and response capabilities, or authorize OIE to publicly disseminate information received from non-governmental sources in the event OIE member states fail to confirm or deny such information in a timely manner (IOM/NRC, 2009).

3. There is a lack of mutual understanding and trust between sectors. There is a lack of mutual understanding of and accounting for differences in sector missions, of objectives and methods of disease prevention, detection and control, and of the full range of impacts of disease control efforts in animal and human populations on human, animal and ecosystem health. And despite similarities in biomedical or other scientific training, there are important differences in the cultures of the human, animal and environmental health professions, including how professionals relate to and communicate with each other.

Frequently, animal health authorities feel that human health authorities under-appreciate the full range of health benefits that animals bring to society. They often feel that decisions on disease control by policymakers or human health authorities are made based on incomplete or inaccurate information on disease dynamics in animal populations. The food animal production industry has become concerned that identification of a zoonotic disease outbreak will lead to non-evidence based decisions for large scale animal depopulation and decreased public demand for their food products, with resulting economic loss, even if the products are not involved in disease transmission. This results in reluctance to report disease outbreaks early and this lack of transparency exacerbates distrust. There is also concern among human public health authorities about the use of antimicrobials in animals and the impact of this on antibiotic resistance in humans. Most animal authorities believe that the evidence linking use of antimicrobials in animals and antibiotic resistance in humans does not clearly establish cause and effect and that human health authorities do not understand how and for what purposes antibiotics are used in animals, or what changes in their use would mean for both the proliferation of food borne pathogens that cause human infection, and for the affordability of animal protein.

Meanwhile, human health authorities often feel that animal health authorities and the food animal production industry under-appreciate the full extent of public health consequences that can occur when zoonotic diseases go undetected, unreported or uncontrolled in animal populations. These perceptions are exacerbated when animal health personnel do not use infection control measures or personal protective equipment, which puts them and their human contacts at risk of infection.

The absence of efficient communication systems and platforms makes it difficult for leaders from different sectors to come together to analyze and act on health and disease problems with the benefit of the full spectrum of relevant perspective and expertise, which permits full consideration of potential outcomes of decisions taken. Moreover, in an environment of poor communication between sectors, human and animal health authorities frequently are unaware of the full scope of disease prevention and control strategies that are employed by different sectors for a given disease problem, and too often mistakenly assume that their sector is being targeted as the sole cause of emerging zoonotic disease outbreaks. This leads to greater levels of distrust.

4. The news media frequently relay confusing public health messages with respect to risk of exposures, exacerbating misunderstanding and mistrust between sectors. There is a practice in the news media of using names and headlines that capture attention. In some instances, animals are vilified and portrayed as frightening threats. Animal names are often used in the name of the infection or disease, irrespective of the animal's actual role in pathogen transmission. This causes worrying public health confusion among the general population and can lead to devastating economic consequences for food animal industries. For example, the emergence of novel 2009 influenza H1N1 (referred to by the media as "swine flu") in humans led to a sharp drop in demand for pork and pork products, leading to huge economic losses and closure of farms and pork-related industries—despite the fact that pigs and pork were not involved in human-to-human transmission. Likewise, the chicken industry suffered huge economic losses beginning in 2003, as outbreaks of highly pathogenic H5N1 avian influenza virus ("bird flu") spread across Asia and Eastern Europe, even though human infection has not resulted from consumption of chicken.

FACTORS FACILITATING THE DEVELOPMENT OF AN EFFECTIVE INTEGRATED INTER-SECTORAL SYSTEM

Despite the many challenges described in the section above, there is a growing appreciation that all sectors suffer severe health, economic, social and other consequences from the emergence of and actions taken to stem the spread of zoonotic infections and diseases. Early detection and response wherever infection is first identified is becoming better understood as a true global public good, and this is an important first step to building the political will that will be needed to address these problems.

PROPOSED SOLUTIONS TO DISCUSS

1. Implement the 12 recommendations of the US Institute of Medicine/National Research Council report "Sustaining Global Surveillance and Response to Emerging Zoonotic Diseases (IOM/NRC, 2009; Appendix 2), which address economic incentives for early detection and reporting, sustainable funding for prevention, detection and response of zoonotic diseases in animal and human populations, human and system capacity building, communications, and political/ governance strategies that are proposed to achieve an integrated system.

2. Build the political will to fund strengthened veterinary infrastructure for domesticated animals and wildlife, and environmental services, in all countries and regions.

3. Address workforce shortages and provide compensation that attracts and retains adequate numbers of professionals with requisite expertise and experience.

4. Bring leaders of multiple sectors together to develop a shared vision for an integrated, coordinated system in their respective countries and internationally. Develop a "One Health" workforce through training in leadership, education, clinical, epidemiologic, field, and laboratory protocols, and on the contributions that each sector has to make. Hold joint scientific conferences, and encourage publications in cross-disciplinary journals to help sectors understand what other sectors are doing.

5. Develop joint funding streams from human, animal and environmental health sectors to support integrated veterinary and public health disease detection, prevention, and response programs. Provide economic incentives, social support, and communication strategies that encourage early disease reporting and control efforts in animal populations. For example, provide appropriate compensation and important social support when animal populations must be culled, and offer vaccines and other veterinary services to reward early reporting.

6. Establish communication platforms and protocols for joint problem identification, outbreak investigations and analysis, reporting, response planning, implementation and evaluation, and for effective communication across sectors and with the public.

7. Identify and agree on a system for naming zoonotic disease events that does not result in confusing public health messages on risk and unnecessary negative impacts on agriculture and food systems.

8. Identify a research agenda and provide inter-sectoral funding to fill gaps in information on drivers of zoonotic infectious disease emergence, improved diagnostics for early detection of pathogens in animal species and human populations, and new interventions to control zoonotic diseases in animal and human populations.

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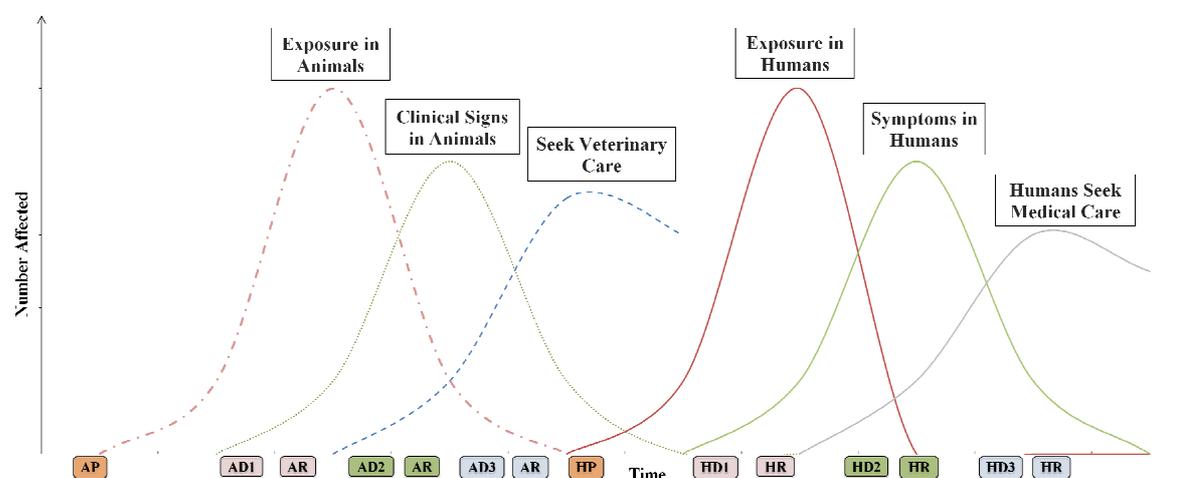
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APPENDIX 1: OPPORTUNITIES TO PREVENT, DETECT AND RESPOND TO THE EMERGENCE AND TRANSMISSION OF ZOOBOTIC DISEASES



NOTE: The graph is a stylized representation of a zoonotic disease outbreak and is not meant to represent any specific infectious agent. The timeline along the X-axis indicates when during the outbreak various opportunities to intervene in animal and human populations occur, and is expanded to facilitate illustration.

AP, Preventing the emergence of zoonotic diseases in animal populations. Examples would include vaccination programs (rabies, avian influenza, other), effective live animal market sanitation and other management policies to prevent mixing of species, sanitation including manure and rodent/pest management on farms, biosecurity measures, and testing and treatment programs of companion and stray animals for zoonotic diseases (e.g., *Echinococcus granulosus*); Hazards Analysis of Critical Control Points procedures in food systems; regular preventive visits to veterinarians for companion animals.

AD, Detection of zoonotic diseases in animals:

AD1, detection before clinical signs occur would result from testing animal specimens at diagnostic laboratories in ongoing serosurveillance programs, or in testing food animals at slaughter.

AD2, detection in animal populations after clinical signs occur at the local level, by farmers, food-animal production workers, household flock and companion animal owners, and the public (e.g., wild animal die-offs).

AD3, detection in animal populations after veterinary care is sought would occur with veterinarians and or animal health workers diagnosing and reporting disease.

AR, Response to control disease transmission in animal populations. This would include rapid outbreak investigation to determine etiologic agent, risk factors for spread, and points for control. Other response measures would include vaccination of animal populations in the face of an outbreak, testing and slaughter of food animal populations, mass depopulation programs, strengthening biosecurity programs, and treating and curing zoonotic disease infection in household animals.

HD, Detection of zoonotic diseases in human populations:

HD1, detection in humans before symptoms occur. This would include detection from screening programs, serosurveillance, etc.

HD2/HD3, detection in humans after symptoms occur and before or at the time medical care is sought. Detection would occur by patient report, findings by village health care workers, at local health clinics, at district hospitals, at tertiary hospitals, by health care providers, and through laboratory testing.

HP, Preventing the transmission of zoonotic disease agents to human populations. This would include effective use of hand washing, use of personal protective equipment in abattoir workers, animal disease control personnel, and other people in regular close contact with animal populations; use of universal precautions and personal protection equipment by health care workers; vaccination programs; safe food preparation at the household level; restrictions on the importation, movement, and ownership of exotic pets; and regular prevention check-ups of humans in close contact with animals and animal populations.

HR, Response to control zoonotic disease in human populations. This would include outbreak investigation to identify etiologic agent, risk factors, points for control, treatment at diagnosis, instituting isolation and quarantine measures, targeted disease surveillance and vaccination programs, mass vaccination programs, targeted antimicrobial administration, and mass antimicrobial administration.

Source: Institute of Medicine and National Resource Council (2009), Figure 2-8, Chapter 2, pp 48-49.

APPENDIX 2: RECOMMENDATIONS FOR IMPROVED ZOOBOTIC SURVEILLANCE AND RESPONSE BY PRIORITY AND CATEGORY AREAS

	Technical	Economic	Political
	Strengthen surveillance and response capacity	Financing and incentives for surveillance and response	Governance of global efforts to improve surveillance and response capacities
High Priority	Establish surveillance and response strategies	Establish sustainable funding strategies	Create a coordinating body for global zoonotic surveillance and response
Priority	<p>Improve use of information technology to support surveillance and response activities</p> <p>Strengthen the laboratory network to support surveillance and response activities</p> <p>Build human resources capacity to support surveillance and response efforts</p> <p>Establish a zoonotic disease drivers panel</p>	<p>Create an audit and rating framework for surveillance and response systems</p> <p>Strengthen incentives for country and local reporting</p>	<p>Deepen the engagement of stakeholders</p> <p>Revise OIE governance strategies</p> <p>Mitigate disease threats from wildlife and trade</p>

Source: Institute of Medicine and National Resource Council (2009), Table 8-1, Chapter 8, p 237. For details on the recommendations see the full report available at www.nap.edu/catalog.php?record_id=12625