



Research Report

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Global Public Health and Transboundary Animal Diseases: Issues and Options, Approaches and Concerns

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SUMMARY

Transboundary animal diseases will continue to emerge around the globe, with human-to-human spread potential, and multiple associated costs to societies and governments. These emerging threats can be addressed and reduced through the application of holistic and proactive disease risk management approaches that build on disease intelligence, multidisciplinary collaborations, public-private partnerships, international commitments, and scientific progress. Although a focus on biosecurity measures along the production and marketing chain have proved beneficial so far, there is need to broaden measures geared to increase awareness among at-risk populations and targeted educational campaigns at vulnerable communities with the goal of changing, or at least influencing, the demeanours, habits and behaviours of people in such a way that the risks of disease contraction and transmission are decreased. For instance, the United States and the European Union are addressing the emergence and intensification of emerging biological threats across diverse ecological landscapes through identification and early tackling of critical disease drivers and risk factors. A key aspect of the approaches proposed is that they rely on working with economic actors and that they aims to develop with them sets of safe practices in production, processing, transportation, marketing and handling that are seen as coherent, applicable, practical, and in line with the realities in the ground. Further issues that need to be considered are cost-effectiveness, conflicts of interests, and sustainability.

1. Introduction

The world has experienced in the last twenty years the emergence of some insidious diseases affecting humans that are at least partially of animal origin, such as Bovine Spongiform Encephalopathy (BSE), Hendra Virus (HV), Nipah Virus (NV), Highly Pathogenic Avian Influenza (HPAI), and most recently Pandemic Influenza A (H1N1). The advent of these novel diseases pushes global public health emphasis away from the exclusive control and prevention of 'classical' animal and human infectious diseases known to mankind. Attention now also focuses on 'novel' transboundary animal diseases (TADs), as well as the very basic drivers of change in local and global socio-ecological environments. These contemporary concerns are not limited to narrow or specific niches at research communities, but have been further brought into the public spotlight by recent scientific consultations that build upon national and international expertise. Experts, practitioners and scientists have emphatically noted that human health protection against animal-borne pathogens is at the heart of local and global interests, and this protection, if consensually decided, should first start at the ecological loci from which they arise, rather than engaging in reactive responses. This research report briefly examines several of the issues surrounding TADs, the options to manage the risks of disease emergence, two examples of approaches used, and some concerns that arise from them.

2. Issues: Social, Political, Economic, and Fiscal

As the abovementioned diseases emerged and infected countries dealt with their impacts, it became rapidly evident that more attention was needed on how emerging public health threats – and their accompanying fears – impact social order, economic progress, human development, and national security. Herewith, we examine some relevant issues.

Social issues – Developed and developing countries are now more receptive to the notion of how debilitating diseases originating in domestic animals and wildlife can easily infect humans and also to how they can rapidly spread around the globe. TADs are not limited to unregulated, developing countries in tropical settings. In fact, diseases emerge everywhere: BSE or Mad Cow disease in the United Kingdom, HV in Australia, NV in Malaysia, Severe Acute Respiratory Syndrome (SARS) in China, HPAI or Bird Flu in Southeast Asia, and most recently H1N1, which was initially detected in Mexico and has now spread globally (Cáceres and Otte, 2009). This resurgence is not limited to novel diseases. Classical diseases such as Rabies, Foot-and-Mouth Disease, Classical Swine and Rift Valley Fevers have also been on the rise in Eastern Europe, the Horn of Africa, and the Pacific Rim. All these diseases share something in common: they are caused by micro-organisms that have been able to pass from their original animal hosts to humans. The looming risk is that once they have accomplished this first step, they may further

evolve and develop the capacity to sustain person-to-person transmission. In human populations that have had no prior exposure to these pathogens, such ‘invasions’ cause fear and can potentially lead to pandemics.

Political issues – Given that the pre-eminent roles of governments are to maintain social order, provide basic security, and the protection of property, then it is clear that new TADs need to be factored in equations that shape domestic and international policies, especially those concerned with safeguarding the global commons of public health. The implications of TADs in international economic affairs now span far beyond their potential impacts on retail commerce and trade. For instance, when TADs are deemed highly contagious, importing and neighbouring countries react with enactment of trade bans that tend to impact national budgets, social structures and, at times, even geopolitical positions. Moreover, in agriculture-based economies, lack of commitment to controlling emerging disease, dramatic revenue shortfalls due to export prohibition or significant losses accruing in rural areas during election years could have a high political price. Most importantly, from a political standpoint, is the fact that these novel biological threats are rapidly flourishing against a background of security and economic challenges: climate change, the proliferation of weapons of mass destruction, international terrorism, concerns about energy security, and high levels of unemployment.

Economic issues – Precise quantification of the full economic costs of TADs on livestock industries is complicated by the fact that impacts propagate up- and downstream through supply and distribution networks, and that short term reactions are likely to be followed by longer term adjustments. For instance, it has been estimated that Mad Cow disease resulted in losses amounting to US\$10–\$13 billion in the UK alone. In Canada, the discovery of one case of Mad Cow disease in cattle (and not a single human case) in May 2003 was sufficient to cause losses in the order of US\$1.5 billion. For 2009, Mexican authorities estimate that Pandemic H1N1 Influenza cost their economy over US\$2 billion, much of which comes from foregone revenues in trade and tourism. It is estimated that for the U.S. a severe influenza pandemic might cause economic losses between US\$71 and US\$167 billion, excluding disruptions to commerce and society. The World Bank predicts that a highly fatal HPAI pandemic could cost the world economy as much as US\$800 billion a year (Baumuller and Heymann, 2010; Meltzer *et al.*, 1999). Furthermore, even when human morbidity and mortality remain comparatively low, the extended economic impacts of these novel diseases are enormous. For example, in 2003, globally SARS involved some 8,500 cases and killed less than one thousand people, yet it represented an economic loss of approximately two percent of East Asia regional GDP for the second quarter of that year. Moreover, during SARS, infection minimization efforts resulted in a dramatic supply shock due to workplace absenteeism, disruption of production processes and shifts to more costly procedures, as well as severe demand shocks for service sectors such as restaurants, hotels, stores, supermarkets, tourism, and mass transportation (Brahmbhatt, 2005).

Fiscal issues – Animal and human health responses against TADs carry an expenditure component that oftentimes is largely assumed by national governments, i.e. ultimately borne by tax-payers. The extent of fiscal obligations is normally aligned to the magnitude of responses implemented. Around most of the globe, responses to emerging infectious diseases have been clearly dominated by public fears of an epidemic, possibly reaching pandemic proportions. Mass reaching media outlets disseminated ghastly images of uncountable human illnesses and fatalities. Fuelled by populist concerns, Governments voiced their apprehensions in terms of how biological threats might impact public health, social stability, and homeland security. Early worrisome narratives quickly reached the highest echelons of political power, which, at the high time of bioterrorism, prompted foremost defensive responses to keep disease away from ‘home’ (Cáceres and Otte, 2009; Scoones and Forster, 2008). Some of the defensive response measures included, among many others, stockpiling of disinfectants, medications and Tamiflu, airport passenger scanning, increased import inspections, public awareness campaigns, etc. In the case of bird flu, for instance, it has been estimated that by the end of 2008 the U.S. and European countries, including the European Commission, spent approximately US\$2.8 billion ‘at home’ versus US\$950 million ‘abroad’ for disease control ‘at source’ (Jonas, 2008). The heavy budgetary burdens of alarmist and uncontrolled responses can result, in many cases, in unnecessary layouts that could be best allocated elsewhere.

These ‘knee-jerk’, reactive, and defensive responses –and their associated social and monetary costs– have created a growing awareness among public and animal health agencies for the need to systematically and proactively address the risks of emerging diseases in today’s interconnected world, rather than relying on fear-driven *ad hoc* reactions.

3. Options: Proactive Disease Risk Management

Faced with uncertainty and imperfect information in many areas, national and international animal health agencies have primarily focused their efforts on prediction, identification, and prevention of emerging animal diseases followed by contingency preparations and emergency responses to what is actually found. Here, we propose a holistic and proactive approach to manage emerging disease risks that combine a number of old and new elements that interlock in a structured and logical way to deliver best possible outcomes: (i) foresight, (ii) prevention, (iii) impact mitigation, (iv) early detection, and (v) swift and effective reaction.

Foresight capacity builds on visioning exercises that systematically scan the horizons to identify sources of pathogens as well as pathways and drivers of emergence, leading to the identification of geographic ‘hotspots’ and ‘risky practices’. A profound understanding of the demographic, cultural, economic, environmental, climatic, evolutionary, and social factors that contribute to the

emergence and intensification of infectious diseases is required for this process. Foresight exercises require intimate interdisciplinary collaboration and build on mining and fusion of data from a broad array of sources (for related arguments, see: Shuman, 2010).

The second element utilizes insights gained from foresight exercises to propose preventive actions aimed at reducing the likelihood of pathogen emergence by specifically tackling significantly influential drivers, and to devise interventions that increase institutional, economic, and environmental resilience against novel pathogens. Unfortunately, investments in prevention and preparedness face major incentive problems as: **(a)** today's investment costs have to be justified against the uncertainty of disease-related losses avoided at some time in the future, and **(b)** sources and targets of investment funding will have to diverge to achieve the highest possible global protection from emerging diseases (Sproul *et al.*, 2009).

Given the stochastic element of infectious disease emergence and spread, even the most massive investment in disease intelligence cannot perfectly predict or entirely prevent pathogen emergence. A second line of defence is therefore needed. The third element of disease risk management couples early detection systems with early reaction capacity to swiftly and determinately tackle diseases at, or close to, source before spread has surpassed a critical threshold. Early detection of potential pathogens needs to combine active scanning of a multitude of host species, which include wildlife, food and companion animals, and humans with the rapid 'connection' of passively obtained information on unusual health events in the socio-ecological interface that link livestock, wildlife, and humans. Advances in high throughput screening, traceability, and information technology systems offer the possibility of 'real-time epidemiology' for early detection of emerging disease events.

Lastly, due to the possibility of rapid, long-distance spread, it is imperative to complement previous elements with emergency preparedness plans at national, regional and international levels, which are underpinned by repeated local capacity building exercises [i.e. training, simulations, workshops, stakeholder consultations, etc.] and rapid un-bureaucratic mobilization of international support when alarm bells start ringing (Burgos and Otte, 2010).

Regardless of the disease risk management approach chosen, it must not be forgotten that preventive interventions at ecosystem and livestock production systems level are required to complement emergency preparedness plans and relief responses. This is particularly relevant given that prevention is often not only cheaper than correction, but also because the potential benefits reaped far outweigh the costs implied. Moreover, in view of the economic dimensions of emerging infectious diseases, the efficiency gains that could be obtained through synergies between animal and human health sectors are substantial and accretive.

A complementary approach that has been heralded as priority is the creation and support of expertise networks to more narrowly address specific issues that arise from pre-emptive research. This, it is said, should be a global collaboration of individual and institutional brainpower that chiefly seeks to minimize potential damage while in parallel seeking for quick, affordable solutions to problems as they arise. In light of the open source format proposed, some nation-states have expressed their reservations in sharing biologic and genetic information fearing that this so-called 'selfless camaraderie' may come back to haunt them in the form of naming and shaming, or simply by suffering selective marginalization. For this specific reason, these expertise and information sharing platforms require full international collaboration, with clear delineations of roles, responsibilities, and boundaries (Capua and Cattoli, 2010).

4. Approaches: USA and EU

Despite the existing institutional capacity at national, regional, and international levels to address animal health issues, only recently attention is being placed on understanding the most influential underlying drivers that contribute to the emergence and intensification of emerging biological threats across diverse ecological landscapes. This section looks briefly into the approaches used by the United States and the European Union.

The U.S. approach

After witnessing BSE, SARS, HPAI and H1N1 it seems that North American epidemiologists, lawmakers, physicians and veterinarians believe that a few basic questions warrant close examination: What is out there waiting to come out? When? How bad will it be? Is there anything we can do today to be more effective tomorrow? In response, the U.S. is launching the Emerging Pandemic Threats program (EPT). The roughly 400 million dollar initiative is being led by the U.S. Agency for International Development (USAID) through a five-pronged approach that builds on functional existing programmes in an attempt to minimize the potential impacts of societies worldwide. At its core, the EPT programme will combat newly emerging animal diseases that could threaten human health at their originating source. This approach implies multidisciplinary institutional collaborations with five complementary themes: predict, identify, prevent, prepare, and respond. Each theme implements specific tasks, some of which include disease surveillance (monitor and tracking) in domestic and wildlife species, developing of diagnostic laboratory networks, increasing and strengthening local capacities, elaborating context-based pandemic preparedness plans, and designing behavioural-change interventions, coupled with risk communication strategies (USAID, 2009; AVMA, 2009).

The EU approach

For its part, the European Union recognizes that diverse factors are in a constant state of flux in rapidly evolving multidimensional environments in every nation-state, where health security can no longer rely only on traditional disease reporting mechanisms that at first were not designed to recognise sudden emergence of novel hazards. The EU designed a framework within which countries may adapt animal and human health surveillance systems to meet the new challenges emerging on short notice. Known as Epidemic Intelligence (EI), and based on contemporary epidemiological notions, it encompasses activities related to early identification of potential health hazards, verification, assessment, investigation and responses to suggest control measures aimed at upholding public health. In short, EI integrates two complementary components: an indicator-based element referring to structured data collected through routine surveillance systems, and an event-based element referring to unstructured data gathered from sources of intelligence of any nature. This information is carefully filtered, processed, summarised and analyzed to generate disease foresight (Paquet *et al.*, 2006). The European Centre for Disease Prevention and Control (ECDC) monitors potential public health threats under the principle of subsidiarity and builds on the expertise of pertinent units dealing with health threats. For its member countries, it produces weekly bulletins, electronic alerts, emergency notification, information databases, and journal articles (ECDC, 2010).

5. Concerns: Cost-effectiveness and Conflicts of Interests

Despite repeated efforts to get the most benefit for the least money, institutional initiatives have turned out onerous. There is fear that in an effort to uphold public health, taxpayers could end up paying for the costliest ideas. International commentators note that cost-benefit analyses should impinge plans before they are rolled out to consensually select the best option(s) available.

In relation to public-private partnerships proposed, there are numerous conflicts of interests; however, ample opportunities and benefits abound. For example, close collaborations between industry and academia have facilitated the development of new solutions, technologies and drugs (Lo and Fields, 2009). This is an area in which market incentives and key motivational interests are aligned: the public seeks effective new therapies, academia works to translate basic discoveries into treatments, and industry wishes to develop new products (Lo, 2010). It should be noted, however, that close relationships between public and private sectors have both benefits and risks. For instance, while national and international public organizations seek to improve public health as an end in itself, privately-owned companies tend to undertake public health work only if it enhances their revenues or reputation. Similarly, problems could arise in relation to their driving agendas. A for-profit pharmaceutical company can decide to exclusively focus on promising new markets that can guarantee sustained sales to justify research and development

expenditures, while on the other hand discouraging the development of unprofitable vaccines and drugs. National health agencies or intergovernmental organizations involved in such alliances or partnerships may be solely committed to reducing the socio-ecological determinants of poor health and minimising the global burden of animal and human diseases. The divergence of agendas based on institutional mandates can create procedural problems and conflicts of interests that need to be considered prior to engaging in strategic collaborations.

It is important to stress that the public-at-large has granted the medical and veterinary professions considerable latitude and discretion in setting its own ethical and moral standards because it trusts that physicians and veterinarians will place animal and human patients' interests ahead of their own or those of profit-seeking parties. Aware of this fact, to maintain and enhance this trust, national and international public organizations should take the lead in proactively addressing divergences of interests in animal and human medicine, rather than responding belatedly to international health regulations, government requirements, and adverse publicity about troubling incidents. In view of the abovementioned, conflict-of-interest policies require peer-reviewed and robust analysis of the actual and potential benefits and risks of strategic partnerships and working relationships between public and private sectors (Lo, 2010).

6. Final Thoughts

A holistic and proactive approach to emerging disease risk management can only be implemented with the appropriate support from pertinent national and international actors in line with their strengths and core competencies. 'Foresight capacity' should rest in the hands of already established centres of disease control and prevention in close collaboration with academic centres of excellence and the respective disease foreknowledge units at the Food and Agriculture Organization (FAO), and the World Health Organization (WHO). Preventive actions aimed to deal with influential drivers must be developed and jointly moved forward by intergovernmental organizations and national public and private animal health systems. These recommendations need tight alignment with international standards dealing with animal and plant health. Most importantly, 'early reaction capacity' to tackle diseases as they arise falls into the remit of national governments and their public and private animal and human health systems, according to the geographic location of disease emergence. These domestic institutions must be ready with the required financial, technical and human resources to support the first and second line of defence. Similarly, the private sector needs to play an important role as catalyst of change by embracing enhanced biosecurity and fostering collaboration with national public entities (Burgos and Otte, 2010; Capua and Cattoli, 2010).

Civil society organizations and animal health networks that are in closer proximity to the realities in the ground should frequently liaise with other national and international agencies to deliver grassroots animal and human health programmes and services after careful identification of operational gaps and overlaps. Global partnerships are needed to address the most pressing questions arising against a background of contemporary challenges. This colossal endeavour requires true champions as the driving force to move forward this holistic and proactive approach to disease risk management from rhetoric to tangible actions. As global public health leadership, agenda-setting and funding shifts more towards multilateral organizations, where clout remains primarily in the hands of influential nation-states, it is important to repeatedly stress to influential policymakers and opinion leaders that animal diseases threaten the health status of individuals and populations, and consequently hamper development, security and order. Decision makers therefore have to very seriously advocate surveillance, identification and control of animal diseases to uphold global public health.

Finally, in view of the rather relentless push by the international animal and human health community for a 'One Health' approach, there is still an urgent need to clearly formulate a coherent and comprehensive vision and plan based on a doable roadmap, as well as developing a sound and effective communication strategy to market and sell the plan to opinion leaders, policymakers, donors and funding agencies. Above all, and most critically, the depth, breadth and scope of the 'One Health' approach must provide guidance on how far the boundaries are to be stretched given the existence of emerging pandemic threats, communicable zoonoses, highly contagious animal infectious diseases, food-borne hazards, land-use related health threats, and anthropogenic-induced impacts, among many others.

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