Managing the Risk of Emerging Diseases

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In the last fifteen years the world witnessed the emergence of Bovine Spongiform Encephalopathy (BSE) or Mad Cow disease in the United Kingdom, Hendra virus in Australia, Nipah virus in Malaysia, Severe Acute Respiratory Syndrome (SARS) in China, Highly Pathogenic Avian Influenza (HPAI) or Bird Flu in Southeast Asia, and most recently Pandemic H1N1 Influenza, which was initially detected in Mexico and has now spread throughout the globe.

These events share something in common: the associated diseases are caused by micro-organisms that have been able to pass from their original animal host 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. Arguably, in human populations that have had no prior exposure to these pathogens, such 'invasions' cause fear and can potentially lead to severe pandemics.

Economic Impacts

The economic impacts of these novel diseases are enormous, even when human morbidity and mortality remain comparatively low. 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).

Precise quantification of the full costs of emerging zoonotic diseases 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. However, some estimates indicating the order of magnitude of losses can be found. 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).

Responses

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).

It goes without saying that pharmaceuticals reaped the most economic benefits by selling supplies that, in the case of bird flu, were never used and had to be disposed of. These reactive, 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.

Proactive Disease Risk Management

A proactive approach to disease risk management combines a number of interlocking elements: (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.

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: (i) today's investment costs have to be justified against the uncertainty of disease related losses avoided at some time in the future, and (ii) 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 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 ring.

Actors and Forces

The abovementioned approach to 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 biosecuirty and fostering collaboration with national public entities.

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. Without a doubt, however, an endeavour of the envisaged magnitude requires true champions as the driving force to move forward this holistic and proactive approach to disease risk management from rhetoric to tangible actions.

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