Brief for GSDR 2015

Anthropogenic Drivers of Emerging Infectious Diseases

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The Ebola crisis in West Africa highlighted critical deficiencies in global health infrastructure, as well as the impact of disease outbreaks to developing economies. *The recent emergence of other diseases, including SARS, H7N9 and Marburg virus, has been linked to human practices, many which also correlate with the leading drivers of biodiversity loss.* The following science brief provides an overview of findings to support a more proactive, integrated and preventive approaches to disease emergence, which emphasize the need for a more coherent set of sustainable development goals and targets that better reflect the interconnected nature of the tripartite health, conservation and development challenges that we face.

Introduction

The highly fatal Ebola outbreak in West Africa had caused 21,000 reported cases as of mid-January 2015, with ongoing transmission more than a year into the outbreak (WHO, 2015). Efforts to contain the outbreak showcased a heavy reliance on response, with few preventive safeguards in place. Although the exact source of this particular outbreak was not definitively determined, previous outbreaks of Ebola have been linked to the hunting or handling of infected wildlife, with certain species of bats thought to harbor the virus (Olival & Hayman 2014), In many such cases including the current outbreak, ecological and socioeconomic realities have combined to exacerbate and define disease outcomes (Bausch & Schwarz, 2014).

Public health systems have conventionally focused on disease surveillance in humans, rather than the source of new pathogens. Yet, the majority of human pathogens have originated from animals ("zoonotic" diseases) (Taylor *et al.* 2001), with 70% of emerging infectious diseases coming from wildlife (Jones *et al.* 2008). Recent outbreaks such as H7N9 avian influenza, Middle East Respiratory Syndrome, Marburg virus, Nipah virus, and HIV/AIDS showcase the catastrophic health and economic effects of emerging diseases.

Analyses of recently-emerging infectious diseases show that anthropogenic factors including land use change (e.g. deforestation, mining, oil extraction, etc.), food production changes, and global trade and travel are among the leading causes of disease emergence (Karesh *et al.* 2012). Many of these underlying drivers also overlap with the leading drivers of biodiversity loss and ecosystem disruption (CBD and WHO, 2015; CBD, 2014). *These practices are causing fundamental changes in the environment and facilitating increased human-animal contact.*

Zoonotic diseases that are established or periodically circulate in certain populations are responsible for a billion cases and millions of human deaths annually (Karesh *et al.* 2012). Emerging diseases, which may become established, can have severe financial outcomes, with the 2003 outbreak of SARS causing upwards of US$30-50 billion in economic losses (The World Bank 2012).

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Facts and Figures

- The majority of human infectious diseases originated from animals, with nearly ¾ of recently-emerging diseases originating from wildlife.
- Single outbreaks have been responsible for billions of dollars in economic losses.
- Land use change, food production practices, and trade and travel are among the leading causes of disease emergence, several of which are shared drivers of biodiversity loss.
- Most public health systems currently lack integrated mechanisms to adequately detect and respond to viral threats.

Source: Authors' compilation.

Scientific debate

Emerging diseases are increasingly recognized as a global threat, with major concerns around rapid spread. Gaps in surveillance systems and research exist that hinder knowledge and analysis of disease risks. Not knowing which pathogens are circulating in wildlife and resulting human exposure risks poses great threat, preventing prioritization of risk-reducing actions.

Integrated health and environmental impact assessments are not typically conducted prior to implementation of development projects. *Establishing policies to require assessments can help anticipate risks and emphasize practices that prevent or reduce the threat of disease transmission between animals and humans.* For example, mining companies operating in remote areas could be required to provide a food supply to reduce hunting of wildlife by employees for subsistence purposes. Such practices are advantageous to industry, local communities and governments, which all may face health, social and financial burden from outbreaks.

More robust information from pathogen surveillance activities in wildlife can inform more precise risk prioritization. Surveillance can be targeted to high-risk interfaces to feed into predictive analyses (Morse *et al.* 2012). Collaboration on surveillance and information sharing between human health, agriculture, and environment sectors helps promote a "One Health" approach that better understands disease transmission dynamics. One Health also provides a valuable framework for the development of policies and interventions to maximize co-benefits at the nexus between health and biodiversity (Romanelli *et al.* 2014).

While enhanced surveillance will require upfront investments in sampling and screening capacity, these are expected to yield significant cost savings if outbreaks can be prevented or detected at an earlier stage. A recent study suggested that 85% of global mammal viral diversity could be captured with investments of US$1.4 billion over ten years (Anthony *et al.* 2013). This amount represents a small fraction of the costs borne to local and potentially global economies from each outbreak. Zoonotic diseases have cost hundreds of billions of dollars over the past two decades (Karesh *et al.* 2012).

In addition to human health risks, emerging diseases pose threats to food safety and biodiversity (Daszak *et al.* 2000; Nabarro & Wannous 2012). For example, much of the baseline knowledge on Ebola stems from major declines seen in endangered great apes from the disease. Outbreaks in these populations appear to precede human outbreaks, providing a possible sentinel value for public health (Leroy *et al.* 2004; Rouquet *et al.* 2005).

The notion of co-benefits at the juncture of biodiversity and health and the critical need for further integration of biodiversity-health linkages in sustainable development goals and targets has been extensively reviewed in a recent volume of the Convention on Biological Diversity and World Health Organization (CBD-WHO, 2015). The scientific underpinnings described throughout the volume make clear that the success of the global agenda for sustainable development can only be achieved through a truly *integrated* and coherent vision of health and environment.

Food for Thought

- Emerging diseases also pose threats to food security and endangered species.
- Outbreaks may disproportionately affect poverty reduction progress in middle-to-low income countries, and may reduce capacity for fighting other diseases.
- Knowledge of pathogens circulating in wildlife can inform risk prioritization and predictive modeling of outbreaks, helping to prevent or detect them earlier.
- Multisectoral collaboration and policies to promote risk anticipation and mitigation can help move us into a new era for fighting emerging diseases.

Source: Authors' compilation

Key issues for further consideration

Practices that can help anticipate and prevent risk of disease emergence and provide guidance for the development of more robust Sustainable Development Goals and targets include:

- Building on the findings of *Connecting Global Priorities: Biodiversity and Human Health, a State of Knowledge Review* (CBD-WHO-2015) to identify research priorities and maximize public health, conservation and development outcomes.
- Evaluating synergistic and antagonistic effects of complementary sustainable development goals and targets including those addressing health, food and freshwater security, biodiversity loss and climate change, and evaluate the long-term impacts of trade-offs;
- Requiring *integrated* impact assessments (e.g. health, environmental assessments), participatory appraisal methodologies and risk mitigation strategies, prior to approval of development projects.
- Adopting policies that are precautionary, place a value on ecosystem services to health, and make positive use of these connections. For example, for integrated disease surveillance in wildlife, livestock and human populations as a cost-effective measure to promote early detection.
- Incorporating pathogen surveillance, monitoring, control and mitigation in wildlife as routine public health activities and facilitate information exchange with other relevant sectors and stakeholders.
- Promoting "One Health" investments that encourage cross-disciplinary collaboration on human, animal and environmental health issues.

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