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SUSTAINING GLOBAL SURVEILLANCE AND RESPONSE TO EMERGING ZOO NOTIC DISEASES

Outbreaks in the past decade of avian influenza H5N1 (“bird flu”), severe acute respiratory syndrome (SARS), and pandemic H1N1 2009 (so called “swine flu”) are examples of how zoonotic diseases—those caused by bacteria, viruses, parasites, or unconventional agents and are transmissible between humans and animals—can threaten health and economies around the world. Unfortunately, for several reasons, disease surveillance in the United States and abroad is not very effective in alerting officials to emerging zoonotic diseases. This report calls for the United States to take the lead, working with global health organizations, to establish a global zoonotic disease surveillance system that better integrates the human and animal health sectors for improved early detection and response.

Zoonotic pathogens have caused more than 65 percent of emerging infectious disease events in the past six decades. Zoonotic diseases are often novel and ones societies are medically unprepared to treat, as was the case when HIV/AIDS and variant Creutzfeldt-Jakob Disease (the human form of “mad cow disease”) emerged. Moreover, the severity of illness in different species is unpredictable and widely variable. For example, the 1918 influenza pandemic (“Spanish flu”) was a particularly virulent strain of H1N1 that killed millions of people worldwide. Although mortality from recent human avian influenza outbreaks has been relatively low—notably just 257 reported deaths worldwide from the ongoing highly pathogenic avian influenza H5N1 (HPAI H5N1) outbreak—there is still much cause for concern.

In response to this concern, the U.S. Agency for International Development (USAID) approached the Institute of Medicine and the National Research Council for advice about how to achieve more sustainable global capacity for surveillance and response to emerging zoonotic diseases. A committee was convened to examine several infectious disease surveillance systems already in operation, identify effective systems, uncover gaps in efforts, and recommend improvements toward the goal of an effective global disease surveillance system. Experts in human and animal disease surveillance provided input to the committee at a workshop held in June 2008 in Washington, D.C.

In addition to human and animal illness and potential loss of lives, the economic losses due to zoonotic disease outbreaks can be staggering. Economic consequences can include trade sanctions, travel warnings or restrictions, animal disease control efforts such as animal culling (intentional slaughter), and declining public confidence in animals products, as was the case with pork



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products and the influenza A(H1N1) 2009 outbreak. The economic cost of HPAI H5N1 between 2003 and 2006 was estimated to equal nearly 2 percent of the regional gross domestic product of China, Taiwan, Hong Kong, and Singapore. In the United States, the beef industry experienced a total loss of \$11 billion over 3 years after the detection of one Bovine Spongiform Encephalopathy-infected cow in December 2003.

The occurrence of zoonotic disease outbreaks is increasing as the world becomes more interconnected. Humans, animals, and animal products can now circumnavigate the globe within 24 hours, making virtually all locations vulnerable to diseases they may carry. In the first half of 2003, the United States saw concurrent outbreaks of SARS and human monkeypox, as well as new geographical niches for West Nile virus—zoonotic pathogens never before found within U.S. borders. Several factors also lead to disease emergence and increase opportunities for exposure including increased food-animal production and the associated challenges in proper management to meet the growing global demand for meat, the expansion of housing into existing wildlife habitats, a rise in trade of exotic pets, and the effects of climate change on animal migration patterns.

EXISTING SURVEILLANCE AND RESPONSE CAPACITY

Several global disease surveillance systems and networks have been established to detect human outbreaks of emerging zoonotic diseases or outbreaks of animal diseases. Some of these were described in the committee's *Achieving Global Capacity for Surveillance and Response to Emerging Diseases of Zoonotic Origin: Workshop Summary* published in 2008. However, the efforts to conduct human and animal disease surveillance in these populations have been limited. Such surveillance activities may not only be conducted by, but also inform several international players which have varying responsibilities for human and animal health or international trade (see Box 1). The committee concluded that there is no single example, in the United States or elsewhere, of a well-functioning zoonotic disease surveillance system integrated across human and animal health sectors. Non-integration increases the possibility that human health officials might not be alerted to an animal disease syndrome that could pose a threat in humans or vice versa. Circumstances of the 1999 outbreak of West Nile virus in the United States demonstrate the need to integrate human and animal surveillance: despite a common diagnosis of encephalitis in both humans and birds in the vicinity of the Bronx and Queens, separate investigations by and inefficient communication between the Centers for Disease Control and Prevention and veterinary organizations delayed linking the two. The delay in identifying the correct etiologic cause of outbreaks allowed time for the virus to establish and spread.

A critical element of robust disease surveillance capability includes laboratory capacity and capability for zoonotic diseases. The committee concluded from available data that existing disease diagnostic laboratory capacity (represented by green and white dots in Figure 1) is poorly matched to areas where it may be most needed— red and orange shaded areas on the map suspected to be ideal for pathogen emergence or adaptation. The committee further concluded that the industrialized world has the most robust surveillance systems for both humans and animals; however surveillance systems are weaker in the developing world where most recent zoonotic diseases have emerged.

STRENGTHENING SURVEILLANCE AND RESPONSE CAPACITY

The committee concluded that because the U.S. government is among the world leaders in disease surveillance and has a considerable stake in the emergence and spread of zoonotic diseases, it should lead efforts to coordinate a global, integrated, and sustainable zoonotic disease surveillance system.

The report recommends that the U.S. Departments of Health and Human Services, Agriculture, Homeland Security, and the Interior should collaborate with the private sector and nongovernmental organizations to achieve an integrated surveillance and response system for emerging zoonotic diseases in the United States. These agencies should also collaborate with USAID and international organizations to spearhead efforts for achieving a more effective global surveillance and response system, learning from and informing the experiences of other nations.

Strategic approaches to strengthen surveillance and response should include:

1. Working with researchers to develop science-based criteria to determine the magnitude and distribution of disease drivers.
2. Immediately strengthening surveillance in human populations at high-risk for zoonotic diseases (for example, livestock and poultry workers) in countries where disease surveillance in animal populations is weak.
3. Developing and strengthening surveillance systems in animal populations so that outbreaks are detected early in animal populations rather than discovered later through secondary human outbreaks.
4. Synchronizing and sharing surveillance information from both human and animal populations in an integrated system, in as close to real time as possible.
5. Engaging science-based nongovernmental organizations as valuable partners that provide the wide geographic reach and field-expertise needed for more comprehensive surveillance and response activities.

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FINANCING AND INCENTIVES FOR SURVEILLANCE AND RESPONSE

Funding needs for the development and sustainability of a global disease surveillance system for emerging and reemerging zoonotic diseases will be significant. Existing international aid architecture is fragmented and donor funding is unpredictable, especially during a global economic crisis. USAID—in partnership with international finance institutions and other bilateral assistance agencies—should lead an effort to generate sustainable financial resources to adequately support the development, implementation, and operation of integrated zoonotic disease surveillance and response systems. Several options are reviewed in the report, including one that specifically considers a tax on traded meat and meat products as a potential source of revenue.

GOVERNANCE OF GLOBAL EFFORTS TO IMPROVE SURVEILLANCE AND RESPONSE CAPABILITIES

Recent concerns about the potential for a highly-virulent avian influenza pandemic in humans resulted in coordinated international action to help countries improve their ability to detect disease outbreaks. A streamlined architecture for global health governance related to zoonotic diseases would benefit from structured coordination

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of critical intergovernmental bodies. USAID, in cooperation with the United Nations (UN) and other stakeholders from human and animal health sectors, should promote the establishment of a coordinating body to develop and implement harmonized, long-term strategies for integrated surveillance and response to zoonotic diseases. This body could be modeled after the UN's System Influenza Coordinator (UNSIC) (see Box 2). Because of the success of the UNSIC in handling highly pathogenic avian influenza, this role could be broadened and made permanent to encompass all zoonotic diseases, not just influenza, but it is currently expected to end in December 2010 without further action.

ADDITIONAL RECOMMENDATIONS

The report makes the following additional recommendations towards the goal of achieving an effective zoonotic disease surveillance system.

- Establish and sustain open source information and communication technology platforms that facilitate data acquisition, management, and sharing for even the most remote and resource-challenged countries.
- Strengthen global laboratory network infrastructure with integrated human and animal health components for zoonotic disease diagnosis and reporting.
- Develop new and improve existing interdisciplinary educational and training programs to build human capacity to plan, conduct, and evaluate integrated zoonotic disease surveillance.
- Establish a technical multi-disciplinary panel to review current scientific information on drivers of zoonotic disease emergence and propose modifying policy and governance strategies.
- Create an independent mechanism to audit and rate national surveillance capacities for detecting and responding to emerging zoonotic disease outbreaks in humans and animals.
- Reduce incentives for disease concealment at the country and local levels and reduce the social and economic repercussions for early reporting.
- Convene representatives from the public, private, and civil sectors to help build trust towards useful information for effective evidence-based decision making and coordinated actions.
- Revise OIE governance strategies to better protect animal health and international trade.
- Undertake steps to mitigate disease threats from the legal and illegal trade in wildlife and wildlife products.

BOX 2: UNITED NATIONS SYSTEM INFLUENZA COORDINATOR

Appointed by the UN Secretary General in September 2005, the UNSIC has developed strong partnerships between technical agencies such as WHO, FAO, OIE and UNICEF. As a result, communication and cooperation among the various agencies has significantly improved. Pointed examples include cooperation to prepare strategy updates and joint preparation of integrated national action plans. While these are evidence of joint strategy development and planning, it is noted that little effort has been made on joint activities for implementing disease surveillance and control.

FOR MORE INFORMATION . . .

Copies of *Sustaining Global Surveillance and Response to Emerging Zoonotic Diseases* are available from the National Academies Press, 500 Fifth Street, N.W., Lockbox 285, Washington, DC 20055; (800) 624-6242 or (202) 334-3313 (in the Washington metropolitan area); Internet, www.nap.edu. The full text of this report is available at www.nap.edu. A related report, *Achieving Sustainable Global Capacity for Surveillance and Response to Emerging Diseases of Zoonotic Origin: Workshop Summary*, was published in December 2008 (IOM and NRC, 2008) and is available online through National Academies Press; www.nap.edu.

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COMMITTEE ON ACHIEVING SUSTAINABLE GLOBAL CAPACITY FOR SURVEILLANCE AND RESPONSE TO EMERGING DISEASES OF ZOOONOTIC ORIGIN

GERALD T. KEUSCH (Co-Chair), Boston University, MA; **MARGUERITE PAPPAIOANOU** (Co-Chair), Association of American Veterinary Medical Colleges, Washington, D.C.; **CORRIE BROWN**, University of Georgia, Athens; **JOHN S. BROWNSTEIN**, Harvard Medical School, Cambridge, MA; **PETER DASZAK**, Wildlife Trust, New York, NY; **CORNELIS DE HAAN**, The World Bank (retired), Washington, D.C.; **CHRISTL A. DONNELLY**, Imperial College London, United Kingdom; **DAVID P. FIDLER**, Indiana University, Bloomington; **KENNETH H. HILL**, Harvard University, Cambridge, MA; **ANN MARIE KIMBALL**, University of Washington, Seattle; **RAMANAN LAXMINARAYAN**, Resources for the Future, Washington, D.C.; **TERRY F. McELWAIN**, Washington State University, Pullman; **MARK NICTER**, University of Arizona, Tucson; **MO SALMAN**, Colorado State University, Fort Collins; **OYEWALE TOMORI**, Redeemer's University, Ogun State, Nigeria; **KEVIN D. WALKER**, Michigan State University, East Lansing; **MARK WOOLHOUSE**, University of Edinburgh, United Kingdom

STUDY STAFF

KIMBERLY A. SCOTT, Study Director; **PEGGY TSAI**, Program Officer; **MILA C. GONZÁLEZ**, Research Associate; **SARAH JANE BROWN**, Senior Program Assistant; **JULIE WILTSHIRE**, Financial Officer; **PATRICK KELLEY**, Director, Board on Global Health; **ROBIN A. SCHOEN**, Director, Board on Agriculture and Natural Resources