



Developing Global Capacity in Conservation Medicine: Predicting and Preventing the Next Epidemic from Wildlife

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**Developing Global Capacity in
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Conservation medicine examines the interactions between pathogens and disease and their linkages with the interactions that occur between species and ecosystems. Thus, it focuses on the study of the ecological context of health and the remediation of ecological health problems. In response to the growing health implications of environmental degradation, conservation medicine includes examining the linkages among (a) change in climate, habitat quality, and contaminants; and (b) maintenance of biodiversity and ecosystem functions as they sustain land use; (c) emergence and re-emergence of infectious agents, parasites, and the environmental health of plant and animal communities, including humans (Aguirre *et al.* 2012). A conservation Medicine approach involving many parties including human and animal health professionals, ecologists, modelers and others would help provide comprehensive, coordinated, and cohesive strategies in addressing this immense threat.

KEY WORDS: *conservation medicine, ecohealth, emerging infectious diseases, wildlife health, transdisciplinarity.*

In recent years, the term *Conservation Medicine* has been used in several contexts within different scientific communities, national/international organizations, and research groups (Meffe, 1999; Osofsky *et al.*, 2000; Speare, 2000; Dierauf *et al.*, 2001; Norris, 2001; Lafferty and Gerber, 2002; Deem *et al.*, 2006). In 2002, the book *Conservation Medicine: Ecological Health in Practice* (Aguirre *et al.*, 2002) was published in an attempt to define a new discipline that links human and animal health with ecosystem health and global environmental change. This novel approach in the protection of biological diversity challenged scientists and practitioners in the health, natural, and social sciences to think about new, collaborative, transdisciplinary ways (Rapport, 1995) to address ecological health concerns in a deteriorating world.

The global loss of biological diversity affects the well being of both animals and people. Human impact on ecosystems and ecological processes is well documented. Habitat destruction and species loss have led to ecosystem disruptions that include, among other impacts, the alteration of disease transmission patterns (i.e., emerging diseases), the accumulation of toxic pollutants, and the invasion of alien species and pathogens (Colborn *et al.*, 1996; Epstein, 1999; McMichael *et al.*, 1999). Ecological perturbations are creating a medium for new disease patterns and health manifestations. For example, in the marine environment, new variants of *Vibrio cholerae* have been identified within red tide algal blooms. These toxic blooms are occurring in greater frequency and size throughout the temperate coastal zones of the world. In arid zones of the

Southwestern United States, Brazil, and Argentina, *Hantavirus* epidemics have emerged in ecosystems that exhibit habitat degradation and climatic disturbances (Epstein, 1993; Mills *et al.*, 1999).

These brief examples illustrate our growing awareness of the interrelationship between health and the environment. When the natural resilience of ecosystems is stressed and barriers to disease transmission are reduced, the emergence, resurgence, and redistribution of infectious diseases are obvious symptoms of a deteriorating planet. Over 300 new emerging diseases have been described in the past 50 years. Diseases like tuberculosis, temperate-zone malaria, hemorrhagic dengue fever, and diphtheria are also re-emerging as threats (Taylor *et al.*, 2001; Jones *et al.*, 2008).

Emerging zoonotic diseases are a major threat to public health globally. These diseases emerge from wildlife or livestock, and include HIV/AIDS, SARS, Ebola, Nipah, and H5N1 avian influenza. Zoonotic diseases “emerge” when environmental changes and/or changes in human activities alter the relationship between people and animals and provide new opportunities for pathogens to spread to people (Taylor *et al.*, 2001; Jones *et al.*, 2008). Rather than respond to the disastrous effects after they have emerged, our collaborations attempt to prevent these diseases from *spilling over* from animals to humans or to halt them rapidly after that spillover by understanding what factors induce emergence and rapidly identifying ways of prevention, control, and mitigation. Our One Health approach that we call the practice of Conservation Medicine, brings together an understanding of human and wildlife health and the environmental changes that cause diseases to emerge and spread. It is evident that the world’s pandemic prevention strategy is only beginning to take this broader view, as it has traditionally focused on the machinations of each pathogen strain and on the politics of surveillance, reporting, and trade regulation. The key factors that drive the emergence of new zoonotic diseases are related to a combination of human changes to the environment, agriculture, healthcare, and changes in demography, all against a background of a large pool of potential new zoonoses. We are fostering the growth of a collaborative initiative across Bangladesh and India among both ministry officials and scientists. To bring mid-career decision-makers in the relevant ministries (Wildlife/Forestry, Health, Agriculture), the 1st South Asian Transboundary Conservation Medicine Network meeting in West Bengal, India was organized and drafted the One Health Alliance of South Asia (OHASA) Bengal Declaration.

The U.S. Agency for International Development (USAID) has been a major leader in the global response to the emergence and spread of Highly Pathogenic Avian Influenza (HPAI). Since mid-2005, it has supported local capacities in more than 50 countries for monitoring the spread of HPAI among wild bird populations, domestic poultry, and humans, and to mount a rapid and effective containment of the virus when it is found. Recent analyses indicate that these efforts have contributed to significant downturns in reported poultry outbreaks and human infections and a dramatic reduction in the number of countries affected. The Global Avian Influenza Network for Surveillance (GAINS)

conducted active surveillance of highly pathogenic avian influenza in wild bird populations. Sponsored by USAID and the CDC, GAINS was begun in 2006 and administered by the Wildlife Conservation Society. Partner institutions, such as non-governmental organizations, universities, and foreign governments, collaborated in the GAINS network to collect and analyze laboratory samples from wild birds, which were captured and released. This early warning system intended for health officials to track viral spread in the natural hosts of the disease.

The USAID Bureau for Global Health, Office of Health, Infectious Disease and Nutrition (GH/HIDN) recently created an Emerging Pandemic Threats Program (www.usaid.gov/press/releases/2009/pr091103.html). Based on this, it granted two cooperative agreements, PREDICT and RESPOND, under its Avian and Pandemic Influenza and Zoonotic Disease Program to continue and expand this work. The goal of PREDICT is to establish a global early warning system for zoonotic disease emergence that is capable of detecting, tracking, and predicting the emergence of new infectious diseases in high-risk wildlife (e.g., bats, rodents, and non-human primates) that could pose a major threat to human health. The goal of RESPOND is to improve the capacity of countries in high risk areas to respond to outbreaks of emergent zoonotic diseases that pose a serious threat to human health. The intent is to respond to outbreaks while they are still within the animal community or to rapidly identify spillover to humans in the early stages of emergence. The geographic scope of this expanded effort is directed to those zoonotic “hotspots” of wildlife and domestic animal origins (Jones *et al.*, 2008). Much more should be done to monitor diseases in wildlife and domestic animals. There is no one international governmental agency that conducts comprehensive ecological surveillance and monitoring of diseases in animals. Even worse, many wild animals are exported to countries that conduct little or no surveillance of the pathogens that they might harbor. A One Health/Conservation Medicine approach involving many parties including human and animal health professionals, scientists, ecologists, and others would help provide comprehensive, coordinated, and cohesive strategies in addressing this immense threat (Tabor *et al.*, 2001, Aguirre *et al.*, 2012).

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