

## III. Introduction

The convergence of people, animals, and our environment has created a new dynamic—one in which the health of each group is inextricably interconnected. The challenges associated with this dynamic are demanding, profound, and unprecedented. While the demand for animal-based protein is expected to increase by 50% by 2020, animal populations are under heightened pressure to survive, and further loss of biodiversity is highly probable.<sup>2</sup>

Compounding that is the fact that, of the 1,461 diseases now recognized in humans, approximately 60% are due to multi-host pathogens characterized by their movement across species lines.<sup>3</sup> And, over the last three decades, approximately 75% of new emerging human infectious diseases are defined as zoonotic.<sup>4</sup> Our increasing interdependence with animals and their products may well be the single most critical risk factor to our own health and well-being with regard to infectious diseases.

### **Environmental degradation promotes expansion of infectious diseases and non-infectious threats**

At the same time, pollution and contamination of our environment has greatly reduced the health and sustainability of our environment. Such degradation of the environment will continue to create favorable settings for the expansion of existing infectious diseases, as well as an increasing number of acute and chronic non-infectious disease events detrimental to both human and animal health. In addition, non-infectious threats include toxins and chemical contaminants, such as endocrine-disrupting chemicals in the environment (Our Stolen Future, Theo Colborn, 1996).<sup>8</sup>

Other examples include the melamine contamination of pet foods, fire-retardant carpet chemicals causing adverse effects in pet cats, and marine toxins in manatees. While we have experienced remarkable medical advances, there is a growing concern that the world's youngest generation could be the first in history to experience a reduction in life expectancy and health in general, compared to prior generations. This is already being seen in SubSahara Africa and, most recently, in females in various parts of the US.

### **The need for a holistic approach to health**

Although new opportunities have emerged to promote health in the rapidly changing human, animal, and environment domains, our ability to protect, improve, and advance health cannot be based on strategies and mindsets in the past. Rather, we need to adopt an integrated, holistic approach that reflects both our profound interdependence and the realization that we are part of a larger ecological system—exquisitely and elaborately connected.

We suggest that the strategy to better understanding and addressing the contemporary health issues created by the convergence of human, animal, and environmental domains is the concept of One Health. The term One Health has been defined by the Task Force as the collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals, and our environment. Achieving the end point of One Health is truly one of the critical challenges facing humankind today.

### **Control of infectious diseases central to One Health**

Central to the concept of One Health is the control of infectious diseases which have helped shape the course of human history. There is every indication that infectious diseases will continue to have a significant impact on our health, and the emergence and re-emergence of pathogens will threaten the health and well being of people and animals throughout the 21st century.

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In addition, according to Jared Diamond, in his book, “Guns, Germs and Steel,”<sup>9</sup> microbes causing diseases such as measles, smallpox, influenza, and tuberculosis likely evolved from animal diseases as a result of the advent of agriculture and the domestication of animals approximately 8-10,000 years ago. Today, microbes pose an increasing threat.

In their article entitled “Microbial Threats to Health, Emergence, Detection, and Response”<sup>10</sup> (NAS, 2003), authors from the Institute of Medicine suggest that a group of factors have simultaneously converged to create a “perfect microbial storm.” The most important of these factors include:

- Adaptation of microbes
- Global travel and transportation
- Host susceptibility
- Intent to do harm
- Climate change
- Economic development and land use
- Human demographics and behavior
- A breakdown of both public and animal health infrastructures
- Poverty
- Social inequality

Most of these factors are man-made, and have produced a remarkable new milieu referred to as “the global mixing bowl,” in which microbes have much greater opportunities to create new niches, cross species boundaries, travel worldwide very quickly and establish new beachheads in the populations of people and animals. They are also invading our environment, where they are being uniquely maintained in nature outside of living hosts. The convergence of these domains is creating threats to the health of all three.

### **Threats to animal and human domains**

Numerous examples point to the critical need to address these threats, including:

- The spread of HIV-AIDS, a zoonotic disease with its origin in non-human primates, which has had a severe impact on life expectancy and human health, especially in Africa.<sup>10</sup>
- The incursion of West Nile Virus in 1999, and SARS and monkeypox in the US in 2003—although none of these had ever been found in the Western Hemisphere in prior years.
- The infection of over 1.5 million individuals in the US by West Nile Virus, as well as countless horses and birds, permanently changed the landscape of human and animal medicine in this country.
- The emergence of Bovine Spongiform Encephalopathy (BSE), now recognized as a disease produced by an aberrant protein, has changed the standards of global agricultural trade as well as how cattle are fed. This disease is also recognized as a food-borne human pathogen producing new variant Creutzfeld-Jakob Disease (VCJD) in humans.

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- The incidence in livestock of the highly contagious Foot and Mouth Disease (FMD). Trade consequences from an FMD introduction into the United States include projected losses at more than \$37 Billion to the US economy.<sup>b</sup> While it is typically not associated with human disease, the psychological consequences of introduction of FMD in the US could range from food safety fears by the public, to severe distress of livestock producers and other areas impacted directly or indirectly by an outbreak.
- Some disease conditions that affect only animals still have wide consequences on human health. For example, while Porcine Reproductive and Respiratory Syndrome (PRRS) affects only swine, the vast number of swine deaths caused by PRRS outbreaks has had major consequences on the food supply chain and on the economies of swine-producing countries.<sup>11</sup>
- The major decline in amphibian population worldwide being caused by the fungal disease chytridiomycosis that is threatening biodiversity and ecosystem sustainability.
- The death each year of 1.5 million people, mostly of whom are children, from diarrheal diseases—many of which are transmitted through water-borne and food-borne sources.

The words of Dr. Gro Harlem Brundtland, former director of the World Health Organization (WHO), were indeed prophetic. In her speech<sup>12</sup> at the United Nations Global Leadership Awards on April 19, 2001, she stated that in a modern world, bacteria and viruses travel almost as fast as money. With globalization, a single microbial sea washes over all humankind and there are no health sanctions.<sup>12</sup> In actuality, that sea washes not over just all humankind, but also across all animal and environmental domains.

Beyond infectious diseases, it is important to note that “noncommunicable” conditions and risks are crossing species and adversely affecting both animal and human health. Examples include obesity and exposure to secondhand tobacco smoke among pets, pet-owners, and their children.

There is nothing on the horizon to suggest that any of these factors are abating. In fact, these factors are likely to accelerate in intensity and complexity, and will surely create consequences and implications of unprecedented scope and scale and global economic devastation much greater than any previous time in history. By adopting the tenets of One Health, we can devise integrated strategies to control that sea and prevent these threats from crossing domains.

b. Newcomb J. Economic analysis of impacts of Avian Influenza, SARS, FMD and other infectious disease outbreaks (workshop presentation). Beyond Zoonoses: One World—One Health, Bangkok, Thailand, November 2004.

