

# Chapter 8

## One Health: From Concept to Practice

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**Abstract** One Health (OH) is an approach, focusing on emergent infectious diseases, which looks at health in the context of human, animal and environment relationships. Governments worldwide through the International Ministerial Conferences on Avian and Pandemic Influenza (IMCAPI) meetings have made a commitment to OH. There is unanimous agreement from the international organizations to the community level that this is a necessary approach in an increasingly populous world. It is a world, however, in which professions have moved to specialization and expertise within their own realm rather than in collaboration and cross discipline. This chapter reports on the operationalization of OH to date and consideration of the forward path in examination of the key areas of: leadership, relationships, infrastructure, skills and capacity, communication and technology, and resources.

**Keywords** Cross-species transmission • Food and Agriculture Organization • Food safety and security • Human-animal-ecosystem interfaces • One Health • One Health Global Network • One Health Initiative • World Health Organization • World Organization of Animal Health • Zoonoses

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## 8.1 Introducing and Defining the Scope and Concept of One Health (OH)

### 8.1.1 *Development of the OH Paradigm: The Decade Since SARS*

The past two decades have been a momentous period for extending our knowledge of the origin and emergence of novel diseases, and in particular, our recognition of the role of wildlife reservoirs as the source of potential pathogens. It has clearly delineated the importance of the interface between humans and domestic and wild animals in cross-species transmission of zoonotic diseases.

It is now 10 years since the world was faced with the first severe and readily transmissible new disease to emerge in the twenty-first century, Severe Acute Respiratory Syndrome (SARS). Caused by a previously unrecognized coronavirus associated with the animal markets of southern China, the disease spread across the world via major air routes, reaching 29 countries on five continents (Guan et al. 2003). Later evidence strongly implicated insectivorous bats as the probable natural reservoir of the virus (Lau et al. 2005; Li et al. 2005; Ge et al. 2013). This discovery stimulated further investigations into a variety of wildlife species which revealed a plethora of new viruses carried by fruit and insectivorous bats, rodents and other species of wildlife from around the globe (Mackenzie and Jeggo 2013). Thus the SARS outbreak led to a number of important observations. It demonstrated that:

- a previously unknown pathogen could emerge from a wildlife source at any time and in any place and, without warning, threaten the health, well-being and economies of all societies;
- there was a clear need for countries to have the capability and capacity to maintain an effective alert and response system to detect and quickly react to outbreaks of international concern, and to share information about such outbreaks rapidly and transparently; and
- responding to pandemic threats requires global cooperation and global participation.

International concerns about novel zoonotic diseases were subsequently heightened by the spread of virulence of highly pathogenic avian influenza (HPAI) H5N1 and its potential to become the next worldwide pandemic. The H5N1 avian influenza threat persists (World Health Organization 2014a), but the more immediate concerns are the possible global spread of two novel viruses, avian influenza H7N9 and the Middle East Respiratory Syndrome coronavirus (MERS-CoV). At the time of writing, there have been 432 human cases of avian influenza H7N9, most of which have occurred in mainland China with a few cases from China Taiwan and Hong Kong SAR (ProMED 2014; World Health Organization 2014b; Centre for Health Protection 2014). Surveillance at the animal-human interface is proving difficult because of the avirulence of the virus in domestic poultry (Chen

et al. 2013). With MERS-CoV, 253 laboratory-confirmed cases have been reported at the time of writing, most of which have occurred in the Middle East (particularly in Saudi Arabia, but also including Jordan, Kuwait, Oman, Qatar, and United Arab Emirates), but with sporadic cases in travellers from the Middle East to Europe (France, Germany, Greece, Italy and the United Kingdom), North Africa (Tunisia) and Asia (Malaysia and Philippines) (World Health Organization 2014c). Recent data has suggested that dromedary camels are the spill-over hosts of MERS-CoV and the source of most human infections (Alagaili et al. 2014; Meyer et al. 2014), although bats have been suggested as a possible reservoir (Memish et al. 2013).

Many emergent pathogens are not only linked to increasing contact between humans and animals, both domestic and wild, but to intensification and integration of food production, to the need for clean drinking water, to climate, and to the expansion of international travel and trade. The role of the wildlife-livestock-human-ecosystem interfaces has been fundamental to the development of the OH paradigm over the past decade, a concept that recognizes that the health of humans, animals, and ecosystems are interconnected, and that to better understand and respond to zoonotic diseases requires coordinated, collaborative, multidisciplinary and cross-sectoral approaches.

The concept of OH is not new; the recognition that the health of people, animals and the ecosystems of which we are part, are inextricably woven together and is as old as human culture (Veterinarians Without Borders 2010). Over 2,500 years ago Hippocrates urged physicians that all aspects of their patients' lives need to be considered including their environment. However, the concept has been more commonly associated with the nineteenth century physician Rudolf Virchow, who acknowledged the similarities between human and animal medicine, and who first used the term 'zoonosis' for infections acquired from animals. Much more recently in the mid-1960s, the eminent American veterinary epidemiologist, Calvin Schwabe, also recognized that the health of humans, animals and ecosystems are interconnected, which he referred to as "One Medicine" in his textbook "Veterinary Medicine and Human Health" (Schwabe 1984).

The significance of zoonoses in the emergence of human infectious diseases was also recognized in the 1992 Institute of Medicine Report 'Emerging Infections: Microbial Threats to Health in the United States (IOM 1992), and the subsequent 2003 Report "Microbial Threats to Health: Emergence, Detection, and Response (IOM 2003). These and a number of subsequent meetings and events have been instrumental in further developing and defining the OH paradigm. They have been listed in Table 8.1 as a series of milestones.

The current momentum associated with the OH concept during the past decade was driven initially by a series of strategic goals, known as the 'Manhattan Principles' which were derived during a 'One World, One Health™' meeting of the Wildlife Conservation Society entitled *Building Interdisciplinary Bridges to Health in a "Globalized World"* held in September 2004 in New York (Wildlife Conservation Society 2004). These goals, developed for combating threats to life on Earth, clearly recognized the link between human health and animal health, and the threats that diseases pose to food supplies and economies, and called for the

**Table 8.1** A timeline of major milestones in the development and implementation of the One Health concept

Time	Event
Approximately 400 BCE	Hippocrates urged physicians that all aspects of their patient's lives need to be considered including their environment
1855	Rudolph Virchow first used the term 'zoonosis' for infections acquired from animals
1971	An international group, Wildlife Trust, formed by naturalist Gerald Durrell. The Wildlife Trust is now known as EcoHealth Alliance
1984	Calvin Schwabe, veterinary epidemiologist coined the term 'One Medicine'
1992	Institute Of Medicine release the report, 'Emerging infections: Microbial Threats to Health in the United States.'
1993	Federation of American Scientists and WHO sponsored a meeting in Geneva to discuss the potential threat of biological warfare
1994	Launch of the Program for Monitoring Emerging Diseases (ProMED) (Morse et al. 1996)
2000	The Global Outbreak Alert and Response Network (GOARN) conceived and development begun
2003	'Microbial Threats to Health: Emergence, Detection and Response' Report released by IOM
2004	Human Animal Infections and Risk Surveillance (HAIRS) begins operation in the UK
2004 September	Manhattan Principles are defined in a meeting on 'One World One Health' convened by the Wildlife Conservation Society
2005	International Health Regulations agreed by the World Health Assembly (WHO), and implemented in 2007
2005 September	United Nations Systems for Influenza Coordination formed (UNSIC)
2005	The Asia Pacific Strategy for Emerging Diseases (APSED) implemented
2006 January	First International Ministerial Conference on Avian Influenza and Pandemic Influenza (IMCAPI) Beijing, PR China
2006	The Global Early Warning System for major Animal Diseases (GLEWS) developed and implemented by FAO, OIE and WHO
2006 December	Second IMCAPI Bamako, Mali
2007	American Veterinary Medicine Association (AVMA) was instrumental in forming the One Health Initiative Taskforce (OHITF) (King et al. 2008)
2007 December	Third IMCAPI New Delhi, India
2008 January	The South Africa Centre for Infectious Disease Surveillance (SACIDS) established as a One Health Virtual Centre linking research institutions in Tanzania, DRC, Mozambique, Zambia and South Africa
2008	The One Health Initiative (OHI) <a href="http://www.onehealthinitiative.com">www.onehealthinitiative.com</a> , a major internet based communications resource launched
2008 October	Fourth IMCAPI Sharm el-Sheikh, Egypt
2008 October	FAO, OIE, WHO, UNICEF, World Bank and UNSIC produce collaborative document 'Contributing to One World, One Health. A Strategic Framework for Reducing Risks of Infectious Disease at the Animal-Human-Ecosystem Interface' endorsed by IMCAPI at Sharm el-Sheikh

(continued)

**Table 8.1** (continued)

Time	Event
2009 March	Expert international consultation held in Winnipeg ‘One World One Health: from Ideas to Action’
2009	A national (USA) One Health Commission ( <a href="http://www.onehealthcommission.org">http://www.onehealthcommission.org</a> ) formed following recommendations of the OHITF, with AVMA, the American Medical Association, the American Public Health Association, the Association of American Medical Colleges, the Association of American Veterinary Medical Colleges, the American Society for Microbiology, and the Infectious Diseases Society of America as partners, and funded by the Rockefeller Foundation
2009	Afrique One, an African Research Consortium on Ecosystem and Population Health, launched with members from West and East Africa with three European partners
2009	One Health Alliance of South Asia (OHASA) formed as a network of scientists in Bangladesh, India, Nepal, and Pakistan
2010 April	Fifth IMCAPI Hanoi
2010 April	Tripartite Concept Strategy—An FAO-OIE-WHO collaboration to address health risks at the animal-human-ecosystems interface’ is endorsed
2010 May	Centers for Disease Control (CDC) Stone Mountain meeting initiates seven international working groups to progress aspects of One Health
2010	World Bank publishes ‘People, Pathogens and Our Planet: Vol 1. Toward a One Health Approach for Controlling Zoonotic Disease.’
2010	‘Connecting Organizations for Regional Disease Surveillance (CORDS)’, a non-government platform connects global regional surveillance systems
2011 February	First International One Health Congress Melbourne, Australia
2011	One Health Central and Eastern Africa (OHCEA) formed as a network of 14 public health and veterinary institutions in Ethiopia, Uganda, Kenya, Tanzania, DR Congo and Rwanda
2012	One Health Global Network, an information clearing house, is launched
2012	World Bank publishes ‘People, Pathogens and Our Planet: Vol 2. The Economics of One Health’
2012 February	Global Risk Forum One Health Summit ‘One Health, One Planet, One Future’ held in Davos, Switzerland
2013 January	Second International One Health Congress Bangkok, Thailand
2013	The Gates Foundation calls for One Health research through the Grand Challenge program
2014	One Health Summer Schools available in Denmark, England and Australia. Masters in One Health offered in USA and UK, and a doctorate in the USA

inclusion of wildlife health as an essential component of global disease prevention, surveillance, monitoring, control and mitigation. The goals also recognized the need to devise holistic and forward-looking approaches for responding to emerging and resurging diseases.

Support for OH continued to grow at different levels through workshops, meetings and discussion groups, and with government agencies advancing the

agenda, and the paradigm broadened as it became clearer that OH extends beyond an examination of the human–animal health interface to encompass the health and sustainability of the world’s ecosystems. This has led to the recognition that the environment profoundly influences both human and animal health, especially through effects on the water and food supply and through global climate and air quality (Shomaker et al. 2013).

### 8.1.2 *Definitions and Scope*

There is no single, accepted definition of OH, but the most frequently used definition is that developed by the AVMA:

The integrative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals and the environment. (King et al. 2008).

The breadth and scope of OH, however, makes it difficult to find a definition that covers all aspects, and indeed the lack of consensus in definition gives the OH approach much greater flexibility. Increasingly OH is considered to be systemic-based with its scope of practice broad and growing, ranging from a specific zoonosis focus to a wide multidisciplinary ecosystem approach with a very broad canvas. However, the price for flexibility even in the field of emerging infectious disease (EID) has been diffusion, fragmentation and duplication of effort, and there is a strong argument put forward that it is timely for a unified international voice and structure to counteract these impacts (Lee and Brumme 2012).

There is a general agreement, especially in national OH programs, of the need to focus on the animal–human infectious disease interface as ‘doable’ whilst extending activities to develop infrastructure and capacity to a broader approach. Many of the important zoonoses relate to animals in the food production chain. Food, therefore, becomes an important vehicle for a substantial number of these zoonotic pathogens (Wielinga and Schlundt 2013), and food safety and food security are major OH issues, as clearly envisaged by the Food and Agriculture Organization (FAO) (Lubroth 2013; FAO 2011), the United Nations (Nabarro 2012) and WHO. Indeed, within WHO, OH is located in the Food Safety and Food Security Division of the Health, Security and Environment cluster. Globalization of the food supply has increased the risks for outbreaks and spread of food-borne pathogens, and also for the emergence and spread of novel antibiotic resistance genes (IOM 2012; Wielinga and Schlundt 2013). The International Food Safety Authorities Network (INFOSAN), a joint program of FAO and WHO, with the Secretariat in WHO, links national authorities responsible for managing food safety emergencies (INFOSAN 2013).

Food security is potentially one of the biggest global issues facing the planet. Kelly et al. (2013) argue that increasing livestock numbers without increasing productivity is a recipe for ecosystem disaster and eventual protein scarcity. The authors call on OH practitioners to “develop a vision for veterinary education that

sees livestock disease control and productivity as a continuum, going beyond disease control to include production efficiencies, economically based agricultural development, the potential impact on the food system of changes in technology, ecosystem health, urbanization, public health and the multidisciplinary collaborations necessary to generate food policies”. Sadly there has not been a similar passionate cry expressed from the medical world.

### ***8.1.3 Recent Drivers of the One Health Paradigm***

#### **8.1.3.1 Concerns About Pandemic Risks from Highly Pathogenic Avian Influenza**

After the SARS epidemic, international attention and concern focused on the potential of the HPAI H5N1 virus to mutate and become transmissible from person-to-person. This was the catalyst that led to President George W Bush to announce the International Partnership on Avian and Pandemic Influenza at a high-level Plenary Meeting of the United Nations General Assembly in September 2005. The goals of the partnership were to improve global readiness by elevating the issue on national agendas, leveraging resources, and building capacity to identify, contain and respond to pandemic influenza. The Secretary-General of the United Nations, Kofi Annan, subsequently announced that the UN family would do all it could to ensure all countries—rich and poor—were protected and prepared for a pandemic caused by avian influenza, and appointed a UN Systems Coordinator for Avian and Human Influenza (UNSIC). This proved to be a major leap forward in advancing One Health through bringing about collaboration between international organizations, regions and nations to discuss the ongoing pandemic threat posed by HPAI H5N1, and provided an excellent example of what can be done when specifically targeting collaborations between leaders in order to bring about change and action. This collaboration brought together international organizations, including FAO, WHO, the World Organization for Animal Health (OIE), the United Nations Children’s Fund (UNICEF), the World Bank, and the EU, with various country representatives, and was the force behind the development of the International Ministerial Conferences on Avian and Pandemic Influenza (IMCAPI).

IMCAPI have clearly been major drivers of OH over the past decade, and may provide a blueprint for future directions and leadership of OH. The early conferences were concerned with pledging of funds and resources for an international preparedness and response effort, but subsequent IMCAPI have considered the wider impact and cause of EIDs. In 2008, the four international organizations (FAO, OIE, WHO and UNICEF), together with the World Bank and UNSIC, collaborated on developing strategies primarily focused on influenza yet clearly intended to extend to the wider context of disease emergence. The strategies were outlined in a document entitled *‘Contributing to One World, One Health. A Strategic Framework for Reducing Risks of Infectious Diseases at the*

*Animal-Human-Ecosystems Interface*' which focused on how best to diminish the risk and minimize the global impact of epidemics and pandemics due to EID by enhancing disease intelligence, surveillance and emergency response systems at national, regional and international levels, and by supporting them through strong and stable public and animal health services and effective national communication strategies (UNSIC 2008).

The IMCAPI meeting in Hanoi in 2010 concluded with the Hanoi Declaration which proposed a multi-sector array of national measures to detect new diseases that may cross from animals to humans. There was an agreement to promote international surveillance, diagnosis and rapid response, and a clearly stated recognition of the need for community participation, increased capacity particularly in least developed countries, and consideration of societal and cultural elements. It also noted that country strategies should be aligned nationally and regionally to address "One Health" challenges (UNSIC 2010). In addition, FAO, OIE and WHO distributed their Strategy Framework to work more closely together to address the animal-human-ecosystem interfaces. This Tripartite Concept Note, 'The FAO-OIE-WHO Collaboration—sharing responsibilities and coordinating global activities to address health risks at the animal–human-ecosystems interfaces' aligned strategies and resource streamlining and commitment (World Health Organization 2010). Several areas have been advanced through the Tripartite Concept including identification of elements for joint plans, development and implementation of integrated risk assessment projects at country level in Egypt and Vietnam, OH assessment missions in Costa Rica and Kenya, table top exercises, collaboration in surveillance systems, strengthening awareness in food safety, jointly agreed food standards and the development of a tripartite road map to tackle neglected zoonotic diseases (Landford and Nunn 2012).

Early detection and response to outbreaks of emerging infectious diseases were greatly assisted by the introduction of the International Health Regulations (2005) (IHR) which provided a policy infrastructure for OH in keeping with the awareness, prevention, shared data and response. The IHR, developed and implemented by WHO, is a global instrument agreed to by all 194 member States to plan for and respond to public health threats to the international community. The IHR set out the basic public health core capacities that States must develop in order to detect, report and respond to public health risks and public health emergencies of international concern (World Health Organization 2008a). The new regulations offer a new global health governance framework that promotes collective interests above national interests, and is radically transforming the international law applicable to identifying and responding to the international spread of diseases.

### **8.1.3.2 Developing Plans to Put One Health Concepts into Practice**

Two seminal meetings were held in 2009 and 2010 that were directed at developing ways to put the concepts of OH into practice. The first of these was an expert consultation entitled "One World, One Health: From Ideas to Action", sponsored by



the Public Health Agency of Canada and bringing together scientific experts, international organizations and government officials to seek ways to advance the concept and build a framework for future activities. The meeting made a number of recommendations including to: (a) foster political will; (b) support partnerships and collaborations; (c) encourage data sharing and integration; (d) build capacity; (e) develop communication strategies (include the media); (f) provide incentives for reporting adverse events; (g) encourage stakeholder and community engagement; and (h) develop ‘supra country’ (trans-border) approaches (Public Health Agency of Canada 2009).

This meeting was followed a year later in 2010 by a second strategy meeting convened by the US Centers for Disease Control and Prevention (CDC) and the major international organizations at Stone Mountain, entitled ‘Operationalizing One Health: a Policy Perspective—Taking Stock and Shaping an Implementation Roadmap’ (CDC 2010). The specific aim of the meeting was to identify clear and concrete actions to move the concept of OH from vision to implementation. Seven working groups were identified as being crucial steps in attaining the 3–5 year vision. These were: (1) ‘Training’ to develop and build skills, expertise and competencies through a OH curriculum; (2) a ‘One Health Global Network’ as a means of gaining international support and as a vehicle to stimulate further global collaboration; (3) an ‘Information Clearing House’ to promote advocacy through providing information on success stories and lessons learned; (4) ‘Needs Assessment’, by developing country-level self-assessment methods to identify activities which could benefit from a OH approach; (5) ‘Capacity Building’, by identifying ways to leverage existing programs and capacity-building efforts to have a major impact at minimal cost; (6) ‘Proof of Concept’, through demonstrating a retrospective and prospective evidence base that the use of OH interventions and/or concepts leads to better cross-species health outcomes; and (7) a ‘Business Plan’, by articulating the concept of and rationale for OH more clearly and presenting this information to policymakers and donors worldwide (Centers for Disease Control and Prevention 2010). Outcomes from the working groups are, with some exceptions, still progressing (Stone Mountain Workgroups 2011; 2012; Rubin 2013). The workgroup to develop an ‘Information Clearing House’ was subsequently combined with the ‘One Health Global Network workgroup and, led by the group chair Dr Vandersmissen, the One Health Global Network ([www.onehealthglobal.net](http://www.onehealthglobal.net)) was successfully launched in 2012. The Proof of Concept working group has also reviewed and assembled evidence to demonstrate that proof of concept for a OH approach to EID threats is feasible through cross-sectoral integration between human, animal and environmental health sectors. It concluded that bigger and more controlled comparative studies of OH disease prediction and control strategies are needed, such as larger implementation of surveillance systems integrating human, animal and environmental data, and larger controlled intervention trials (Rabinowitz et al. 2013).

## 8.2 Implementation of One Health Activities

UNSIC clearly demonstrated the significant impact that an organization dedicated to forming effective international relationships can achieve in the pursuit of determined goals. UNSIC's role and authority have diminished since the influenza H1N1 pandemic and it has not, as many wished, evolved into a collaborating organization to promote a global OH approach. The effectiveness of UNSIC might also suggest that the Tripartite Collaboration of FAO, OIE and WHO should take the lead in implementing OH internationally. While the argument that a global governance approach is needed to oversee implementation of an effective and strong OH agenda, there are currently many important activities happening internationally, regionally, nationally and even locally.

### 8.2.1 *The Involvement of the International Organizations in One Health*

Each of the three major international organizations has instituted OH approaches or units within their organizations. The different scope, priorities and resources of the three international organizations however, have proved a challenge for ongoing collaboration and maximizing synergies. The OIE, which has a narrower remit and far less resources than FAO and WHO, has moved to ensure implementation of OH approaches in global animal health policies, reflecting also the activity of veterinary services regionally. FAO's approach aims to strengthen veterinary-public health systems to more clearly encompass disease prevention, with greater emphasis on food production, distribution and marketing practices, and adoption of sustainable animal agriculture and natural resource management. It established the Emergency Center for Transboundary Animal Diseases to assist member countries in responding to threats from transboundary animal diseases, initially HPAI, but subsequently for all transboundary diseases with probable consequences for human and animal health (FAO 2014). WHO has aligned One Health activities to food safety and food security in the Department of Food Safety and Zoonoses in the Health Security and Environment cluster, and despite its close involvement with OIE and FAO in the Tripartite Concept Note for sharing responsibilities in addressing health risks at the animal-human-ecosystems interfaces, makes no mention of the concept of OH at any place on its website. Joint OH programs and policies are limited between the three organizations, although they have made considerable effort to develop collaboration in surveillance and laboratory networks, and FAO, WHO and OIE are strong promoters of OH forums internationally and regionally. These collaborations are described in more detail below.

The World Bank has grasped the value of OH and taken a leadership role, especially with respect to economic evaluation. It has produced two volumes in the series 'People, Pathogens and Our Planet', the first volume entitled 'Toward a

One Health Approach for Controlling Zoonotic Diseases’ (World Bank 2010) and the second entitled ‘The Economics of One Health’ (World Bank 2012). They provide advice not only for economists in determining funding arrangements and effectiveness evaluation but also for project planners and policy makers on understanding a rigorous economic framework for OH. These documents are a significant step forward in developing economic policy in considering the multidisciplinary nature and multiple outcomes of the OH approach. The importance of the application of the principles to least developed country funding cannot be under-estimated. Furthermore, in taking this forward, the World Bank is now supporting projects in individual countries to progress this approach at the nation level e.g. Mongolia ((South Asia Regional One Health Symposium, 2–6 December, 2013 Paro, Bhutan; personal communication, M Jeggo).

International regional instrumentalities have also supported OH approaches with respect to potential threats from zoonoses. In Europe, the European Union has been a key supporter of the IMCAPI and, since 2008, has promoted the OH approach and integrated it into certain EU strategy documents (European Union 2013). In Asia the Association of South East Asian Nations (ASEAN) and the Asia Pacific Economic Cooperation (APEC) have played active roles in capacity building and preparedness for influenza pandemic response, and developed and strengthened cross-sectoral networks and operations against the threat of emerging and zoonotic infectious diseases (ASEAN 2008; APEC 2011).

### ***8.2.2 National, Multidisciplinary and Cross-Border Activities***

Many regions and nations, particularly developing nations, have now taken up the principles of One Health and are applying them to the extent that their own capabilities and capacities permit. As examples, nations as diverse as the United Kingdom (UK), France, Sweden, Laos, Thailand, Mongolia, Canada and Tanzania, to name but a few, have set up national OH entities within or supported by government and varying in scope and resources. France has endorsed support for the Tripartite Collaboration and has committed to align its strategies and activities with the Tripartite Collaboration (French Government 2011; Hall and Coghlan 2011). In the UK, a cross-government approach chaired by Public Health England entitled ‘Human Animal Infections and Risk Surveillance (HAIRS) group’ provides a One Health approach to zoonoses and emerging infections across Government, and has been operating since 2004. It acts as a horizon-scanning group to identify emerging zoonoses which may pose a future threat, and brings together representatives from human and animal health from the Departments and Agencies across the UK (Public Health England 2014). Developing countries appear to be more successful in implementing OH programs than developed countries, due in large part to the fact that limited resources make it necessary for different sectors to work closely together, whereas more developed nations have older, established and more

rigid public health structures with well-defined responsibilities met using a fairly narrow range of disciplines.

OH programs include elements of field epidemiology, the sharing of laboratory resources and health information, the use of multi-sectoral teams and the application of an evaluation framework. A good example of how this is working in practice can be seen in Mongolia. Coordination mechanisms established between veterinary and public health sectors in Mongolia are proving crucial in addressing issues of food safety, emergency disease management and the impact of climate change on disease emergence. Tuberculosis, anthrax, rabies and brucellosis are managed through the National Emergency Management Agency (NEMA) which adopts the OH approach involving both veterinarians and medical professionals. It is proposed to establish a “Centre” or “National Hub” for the further development of coordination mechanisms between relevant sectors, including animal and human sectors, food safety authorities, wildlife management authorities, border quarantine services and environmental health personnel, at all levels (sub-national, national, sub-regional, regional). This Centre will deal not only with the immediate threats but longer time risk reduction strategies. Increased and improved national surveillance, more comprehensive risk assessment, and the development of a broader based response capability will be further developed based on multilevel, multidisciplinary and multi-sectoral coordination through this national Center. This example in Mongolia provides a snapshot of what is being developed in countries in both Asia and Africa (Batsukh et al. 2013; Mazet et al. 2009; Hall and Coghlan 2011; Hueston et al. 2013).

Laos presents another example of a nationally operating One Health framework. Laos has an ideal platform for the spread of trans-boundary and emerging zoonotic pathogens through a complex web of wildlife, livestock and human interfaces, extending from remote protected areas to the center of the capital city, Vientiane. Wildlife is still widely hunted across the country, eaten by villagers for subsistence, traded locally in wet and medicinal markets, and transported widely for domestic and international trade. The extensive and often geographically rugged borders of land-locked Laos are extremely porous and movement of wildlife products, livestock, and other items are pervasive, both into and out of the country, representing a potentially significant conduit for the movement of novel pathogens. Bovine cysticercosis, tuberculosis, Q fever, brucellosis and leptospirosis are of particular concern (Vongxay et al. 2012). Laos has seen high levels of economic growth in the last decade and along with this growth have come new roads, many extractive and hydroelectric industries, and an increase in intensive farming resulting in large swathes of deforestation and dramatic land-use changes. All of these activities have the potential to alter disease ecology and in order to respond effectively to these challenges, Laos has reorganized to ensure effective collaboration between the animal and human health sectors. With support from a number of international agencies and NGOs, there is a significant shift towards a whole of Government and OH approach to tackling health issues, whether it be human, livestock or the environment.

The impact of these events, although often difficult to quantify, is at the community and environmental level. The European Union in the document '*Implementation of a One Health Approach in Asia and Europe*' (Hall and Coghlan 2011), noted over 90 OH programs and over 750 dedicated OH practitioners in Europe and Asia involved in emerging infectious diseases. In detailing ten diverse case studies ranging from the Swiss national antibiotic research program to controlling hydatid disease in Nepal, they noted firstly the need to take a systems approach when dealing with so many diverse players; secondly, that a One Health team must be trans-disciplinary; and thirdly, that there must be involvement of the community.

This trend is reflected in the changing face of health funding with large philanthropic donors such as the Bill and Melinda Gates Foundation leaning away from the more conservative vertical programs aimed at diseases which affect humans primarily, HIV, AIDS and malaria (Liden 2013) to ones involving a OH approach. The recent One Health call by the Gates Foundation through the Grand Challenge program (Gates Foundation 2013) espouses many One Health principles of multidiscipline cross-sectoral activity and in particular looks to fund innovations that benefit health but are developed in a non-health sector and vice versa.

Innovative OH partnerships have been set up in Africa in collaboration with various institutions in industrialized countries. These include the South African Centre for infectious Disease Surveillance (SACIDS) with the remit to increase capacity in zoonotic disease surveillance and to strengthen Africa's capacity to detect, identify and monitor infectious diseases of humans and animals (Rweyemamu et al. 2013a, b; SACID 2011); the One Health Central and East Africa (OHCEA 2013), which brings together 14 institutions of public health and veterinary medicine in Ethiopia, Democratic Republic of Congo, Kenya, Tanzania and Uganda; and East African Integrated Disease Surveillance Network (EAIDNet) which brings together government departments, academic institutions, and health organizations in Kenya, Tanzania and Uganda (Ope et al. 2013); and Afrique One, the African Research Consortium on Ecosystem and Population Health, which brings together organizations in Côte D'Ivoire, Senegal, Chad, Ghana, Tanzania, and Uganda (Afrique One 2013). All of these organizations have demonstrated the ability to work across borders in a transparent and collaborative way.

Similarly, in southern Asia, the One Health Alliance of South Asia (OHASA) was launched initially by the Wildlife Trust to form a cohesive regional network of scientists and policy makers from Ministries of Health, Agriculture and Environment, as well as NGOs and universities in India, Bangladesh, Pakistan and Nepal to address zoonotic diseases (EcoHealth Alliance 2013).

There are a many other national and regional initiatives similar to those described above, some for specific diseases and some much broader to encompass zoonoses generally, as reflected in presentations at the First and Second International One Health Congresses. These range from dealing with the direct interface of animal and human disease such as the collaboration in regard to Hendra virus in Australia (Crawford et al. 2012) to looking comprehensively at food security through the development of Animal Health clubs in Sub Saharan Africa (One

Health Congress 2011; Prince Mahidol Conference 2013). The increased reporting of such initiatives through the One Health websites, the One Health Newsletter, and in journals dedicating issues to One Health such as Microbiology Australia (Volume 33, No 4; available on download from: <http://www.theasm.org.au>) and the EcoHealth Journal (Volume 7 Supp 1) reflects a gradual but increasing global diffusion of the One Health philosophy and approach,

### ***8.2.3 Surveillance, Detection and Response***

Surveillance is an essential component of the OH approach, especially for the early detection of novel threats arising at the human-animal interface. Key international surveillance networks are the Global Early Warning System for Major Animal Diseases (GLEWS), developed by FAO, OIE and WHO (GLEWS 2013), and also the Global Alert and Response Operations (GAR) of WHO. Coordinated rapid outbreak response is provided by WHO's Global Outbreak Alert and Response Network (GOARN), a network of technical institutions, research institutes, universities, international health organizations and technical networks willing to contribute and participate in international coordinated responses to infectious disease outbreaks (Mackenzie et al. 2014). FAO and OIE have also collaborated to develop a network of Expertise on Animal Influenza (OFFLU 2013). While there is no mechanism presently available to permit early and rapid detection of potential human pathogens at the human-animal interface, the PREDICT program of the USAID's Emerging Pandemic Threats has the potential to do this by detecting spillovers of pathogens from wildlife using their SMART (Strategic, Measurable, Adaptive, Responsive, and Targeted) surveillance method (Morse et al. 2012; PREDICT 2013). Animal disease surveillance or outbreak investigation is, in general, fragmentary, and tends to be highly focused on domestic livestock and supporting trade in livestock and livestock products. New platforms for pathogen discovery integrated with new surveillance procedures targeted at the animal-human interface are needed. In response to these needs, innovative molecular diagnostic platforms have been developed which have changed the face of pathogen discovery and detection with enormous sensitivity and specificity (Lipkin 2013), and novel procedures for targeted surveillance have been generated through the PREDICT program (Morse et al. 2012). For non OIE-listed emerging and reemerging diseases, the very recently launched OIE web application named WAHIS-wild interface will potentially assist in surveillance of wild animal diseases (OIE 2014).

The PREDICT project of the USAID's Emerging Pandemic Threats program is an exciting and far-reaching development with the aim of detecting the transmission of novel infectious agents from wildlife to humans. Coordinated by Dr. Jonna Mazet at the University of California at Davis and Dr. Stephen Morse at Columbia University, and with a number of partners including the EcoHealth Alliance and Metabiota, it supports and coordinates projects in countries in Asia, Africa and

South America. The SMART surveillance method developed by PREDICT is designed to detect novel diseases with pandemic potential early, giving health professionals the best opportunity to prevent emergence and spread. It also targets sentinel animal species at active human interfaces in specific hotspots to increase potential of success (PREDICT 2013). The Emerging Pandemic Threats program has additional projects linked to PREDICT, which are PREVENT, IDENTIFY, and RESPOND (USAID 2013). Importantly, the PREDICT project builds on a broad coalition of partners and thus provides a capacity building component in a collaborative framework. These surveillance systems are now established and improving and to date have received dedicated funding.

Regional surveillance networks, a key strategy of the Tripartite Collaboration, have been set up and progressively improved in Europe, Southern Africa, South and South East Asia, and in the Pacific Islands. A non-government platform for connecting and sharing information between regional disease surveillance networks was established in 2010 entitled ‘Connecting Organizations for Regional Disease Surveillance (CORDS: <http://www.cordsnetwork.org>). Surveillance networks included are the Mekong Basin Surveillance Network, Middle East Consortium on Infectious Disease Surveillance, South-Eastern European Health Network, Asian Partnership on Emerging Infectious Disease Research, Southern Africa Centre for Infectious Disease Surveillance, and East African Integrated Disease Surveillance Network (Gresham et al. 2011, 2013). The regional networks are generally staffed by national governments with assistance from WHO and philanthropic organizations such as the Rockefeller Institute. The networks are more than surveillance agencies, with the four key aims being: improving capacity, advancing One Health, promoting innovation and building sustainable networks. CORDS is currently undergoing an evaluation which includes assessing the value of community activity, knowledge capital, and the sustainability and value of change in practices.

In South–East Asia and Western Pacific, a plan known as the Asia-Pacific Strategy for Emerging Diseases (APSED) was developed to assist member states with achieving their core capacities for compliance with the new IHR, and to reduce the risk of emerging diseases by strengthening early detection and response to outbreaks, including zoonoses. This included a ‘Guide to Establishing Collaboration between Animal and Human Health Sectors at the Country Level’ as a joint collaboration between WHO, FAO and OIE covering surveillance and information sharing, response, and risk reduction (World Health Organization 2008b). The countries report back to a technical group on an annual basis.

### **8.2.4 Wildlife Interface**

The wildlife-human interface is a crucial and pivotal step in the emergence of zoonotic diseases, and being able to detect a novel pathogen before or shortly after a spillover event and then to respond early would be a ‘game-changing’ development

in the OH paradigm. As described previously, the emergence of new infectious diseases is increasing, as is the pathogenicity and distribution of re-emergent infectious diseases, with zoonotic infections predominating and primarily from wildlife. McFarlane et al. (2012) note the association of land conversion and global decline in diversity is associated with a rise of EIDs of wildlife origin. Underscoring this is that ‘synanthropic’ mammal species, those wildlife species which adapt well in human-modified environments, are 15 times more likely to be the source of EIDs. This would strongly argue that surveillance and control of diseases in wildlife should be at the same level as that for in farm animals as exchange of pathogens within and between the two populations are increasing.

General surveillance for diseases in wildlife that can impact on trade, human health and biodiversity occurs in most countries. However, the approach is often ad hoc, uncoordinated, or with lines of reporting that do not recognize the broad impact that diseases with wildlife as part of their ecology may have across different sectors. Different circumstances in different countries have led to a variety of different approaches, with some countries being more organized than others. Wild animals are of high social and economic importance to human societies. It is important to consider the value of wildlife in terms of ecology, species diversity, and, many would argue, the contribution to mankind’s art and spirituality. Diseases of wildlife threatening whole species include: plague, chytrid fungus, avian cholera chronic wasting disease, mycoplasma spp., West Nile virus and avian malaria.

In many countries, however, wildlife surveillance is non-existent, and even where some ad hoc surveillance occurs, resources are extremely poor or unavailable. Systems often cited as being useful include those adopted by Australia (the Australian Wildlife Health Network; AWHN 2013), Canada (the Canadian Cooperative Wildlife Health Centre; CCWHC 2013), and France (The SAGIR Network; LaMarque and Artois 1997). In an effort to identify and respond to new zoonotic diseases before they spread to humans, partners in the PREDICT program, described above, locate their research in geographic “hotspots” and focus on wildlife that is most likely to carry zoonotic diseases—animals such as bats, rodents, and nonhuman primates. The USAID PREDICT program with its focus on human population densities and wildlife sources of pathogens may be a useful model for individual countries.

In the last 5 years, OIE, WHO and FAO have all increased their interest and activities associated with wildlife disease surveillance in recognition of the impact that these disease can have on global trade, human health and biodiversity. The OIE has an information network supported since 1994 by its international working group composed of high level scientists with an expertise in wildlife. The network relies on national Focal Points appointed by Member Countries Delegates for relaying information to the working group and to the OIE. In response to the need for improved knowledge of diseases in wildlife as well as in domestic animals, OIE is introducing wildlife species of significance in each of the disease specific chapters in the Terrestrial Code (OIE 2013a) and has developed a training manual on wildlife diseases and surveillance (OIE 2013b). The latter points out that the components of a National Wildlife Health Program should contain the same



components as any population health program: prevention, including border management and environmental management to prevent emergence, early detection, timely decisions and responses, and effective pathogen management.

Despite increasing interest, wildlife programs remain poorly resourced even though the majority of emerging diseases arise from wildlife and spillovers from wildlife to domestic animals and humans continue to occur. The law of diminishing returns suggests that the greatest improvement in communicable disease control will occur from investment in important areas with the least resources. At the moment this is animal health, specifically wildlife health.

### ***8.2.5 One Health Research***

Research programs in OH are being developed and undertaken in various ways, however funding is precarious and if able to be summed up would easily be miniscule compared to agricultural and animal funding and non-existent to medical care funding. Most current funding organizations are targeted at specific disciplines or sciences and research projects on OH do not fit well into this model.

Recognition that a OH research methodology needs to be vastly different, including many more players and having different evaluation methods and indeed multiple hypotheses related not only to outcome but to processes and relationships.

Areas of excellence of OH research are nevertheless developing. The International Development Research Centre of Canada (IDRC) is one of the leaders in this field. The IDRC strives for a trans-disciplinary approach in all its research in developing countries and provides an excellent model not just for research but for intervention programs, education, and for strategy and policy development, arguably at all levels. The IDRC has methodology for measuring and evaluating relationships and the impact of relationship strength to project success (IDRC 2013). Much more work is needed in this field. A meeting held in 2012 to explore issues in the development of a research and education framework for OH identified two broad OH research issues: (1) the need to develop and evaluate interventions with the potential to provide economic benefits to human or animal health to demonstrate a return on investment; and (2) the need to engage behavioral science researchers and social marketers in conducting research to better understand consumer perspectives on OH issues. Other areas included the need to obtain longitudinal environmental data acquisition to support predictive modeling focused on the implications of changes at the human–animal–environment interfaces, and the development of rapid diagnostics for field and point of care use (Gargano et al. 2013).

### 8.3 Essential Issues and Challenges for Putting One Health into Practice

While there has been wide-ranging commitment to the One Health approach for addressing complex health problems by a large number of national and international organizations and professional bodies, its operationalization has so far proved to be challenging. Implementation is often a complex issue requiring collaboration between diverse and multi-disciplinary partnerships (Conrad et al. 2013). At a local or national level it often might be a matter of breaking down professional barriers through improved communication and incorporating information on OH and its benefits into professional training and university courses. At the international level it is usually much more difficult and can be hindered by dysfunctions which characterize current forms of global health governance (Lee and Brumme 2012).

#### 8.3.1 Leadership

Leadership is a crucial issue in the development of One Health approaches. It is essential for building relationships and trust, both vertically within an organization and from community to international levels but most importantly horizontally between disciplines and within communities. In many countries, the sectors and disciplines needed to collaborate for a OH approach are based in different institutes, departments or ministries. Offering leadership in this complex environment is often seen as threatening or “empire building”. On the contrary, the OH approach is alliance building, and leadership is crucial if the benefits of a One Health approach are to be realized.

Despite their divergent roles and resources the Tripartite collaboration between WHO, FAO and OIE is being looked at to provide international leadership. The history of international governance and leadership indicate that such collaboration needs dedicated resources and close attention to quality of key relationships (Fidler 2010), and this may be difficult in the absence of a crisis such as the influenza pandemic threat. There has been arguably a lull since the H1N1 pandemic with a false perception perhaps that sufficient preparation and infrastructure is in place for infectious disease crisis. The World Bank has continued to take a leadership role by stating that there are clear economic returns and benefits in driving a One Health Approach. There is also a swell of interest in OH from the professional and lay communities as evidenced by the burgeoning of national and international forums and collaborations. This is driven by the recognition that there are not yet enough mechanisms in place, nor are the wider drivers being given sufficient attention. There is also a demand for consideration of the wider scope of OH and a call for system thinking in all aspects of human, animal and environmental health. It may be that the global leadership required is in the form of a collaborating body such as

UNSIC formed for influenza. The demand for this is not clear, loud or certain enough.

Leadership within nations requires at least political agreement if not clear positioning such as public OH policies, strategies if not physical offices. The Canadian Food Protection Agency has delineated a key priority for the Office of the Chief Food Safety Officer to ‘steward’ OH nationally (Canadian Food Inspection Agency 2012). Thailand has emphasis on OH within its Public Health Ministry and has led the South East Asia region in promoting surveillance network and university OH networks.

### 8.3.2 *Building Strong Relationships*

*Multi-disciplinary* is defined as many disciplines being involved, *inter-disciplinary* as disciplines working very closely with one another and plans fully integrated, *trans-disciplinary* implies an exchange of knowledge and skills between disciplines in working together for a desired outcome. It is therefore important to recognize that OH requires a *trans-disciplinary* approach to be successful.

An examination of using a One Health approach to canine rabies control in Africa provides a good example of the need to build strong trans-disciplinary relationships. As considered by Landford and Nunn (2012), a broad and diverse number of entities were revealed to be important for success, involving in addition to Health and Agriculture Ministries, the Ministry of Justice (legal assistance, advice on laws and regulations) and non-governmental organizations (resources, programs), private sector (skills, capacity) and international organizations (guidelines, national, regional planning) to name a few.

The movement to true *trans-disciplinary* effort is seen mainly at a research level with this being one of the key drivers and outcomes of the research programs. Relationships have been developed at an international level through shared systems such as GOARN, GLEWS and OFFLU and through international law as with the IHR. Initiatives advanced through the Tripartite Concept rely on relationships, and to some extent good relationships are a by-product, but the strength of relationships needs to be recognized as an essential resource. Similarly while promising innovative partnerships have been set up, such as that between the southern African nations, London International Development Centre, Wellcome Trust, the Rockefeller Foundation and the Google Foundation forming the South African Centre for infectious Disease Surveillance (SACIDS), care needs to be taken to nurture relationships and in particular to develop *trans-disciplinary* capacity and skills.

The One Health movement in the last decade has been driven primarily by veterinarians. HIV, tuberculosis and malaria are some of the infectious disease priorities for physicians, and as a profession, medical leaders in some countries appear unconvinced that emerging infectious diseases and zoonoses have a large impact on human health. Engaging the human health profession, and the public health sector in particular in developed countries is one of the challenges facing

One Health. Veterinarians have generally been much more willing to embrace the concept and value of OH than their human medical colleagues.

Community is an integral part of OH, being both the informer and the beneficiary. Collaboration in developing countries is in many ways easier than in developed countries because of clear need and fewer administrative barriers, however often a lack of skills and knowledge has also to be addressed. Techniques that maximize the use of community knowledge, provide additional knowledge, and impart skills, are needed. Participatory epidemiology using participatory rural appraisal techniques (PRA) is based on the understanding that the local population usually have of prevailing diseases and also conditions that might give rise to diseases, and is used in concert with other surveillance methodology. The use of PRA had contributed importantly to the successful eradication of rinderpest disease (Marcotty et al. 2013).

Success in OH also needs cultural and societal values to be an integral part of the process. Calvin Schwabe in his book *Veterinary Medicine and Human Health* (1984) stated that ‘the critical needs of man include the combating of diseases, ensuring enough food, adequate environmental quality, and a society in which humane values prevail’ (Schwabe 1984). This was supported by Dr Suwit Wibulpolprasert, senior advisor in disease control to the Ministry of Health, Thailand, who emphasized the need for social equity and justice in his keynote speech at the International Congress for One Health in Melbourne in 2011. He stated that a more sustainable world is a more just world (Wibulpolprasert 2011). Some of the ways in which One Health approaches can learn from many tenets of the paradigm of social-ecological systems was discussed by Ross (2013).

The effectiveness of relationships in OH endeavors is a key aspect but is not fully recognized as such. A methodology for assessing effectiveness of relationships in OH is sorely needed.

### **8.3.3 Infrastructure**

Infrastructure for OH has developed pragmatically around surveillance and laboratory systems and networks of expertise, but infrastructure also implies dedicated services for development of skills and capacity, communication and information channels and organizational and policy frameworks to support OH. There is much to do in this area as we operationalize the concepts.

Most attention to date has been in the development of surveillance and laboratory systems, and those of expert networks. Monitoring of environmental health occurs separately to human and animal health activities, and there are very few linkages. This is the area that remains least well developed in terms of a OH approach. On the positive side, environmental perturbations are now being incorporated into risk predictions, as seen for example in temperature and humidity trends reflecting potential spread of mosquitos, and in floods indicating a possible increase in leptospirosis in infected areas. Complex predictive models are being

developed for human health—for example Healthscape in King County, Washington, which takes into account land use, transport, air quality and potential climate change to predict impact on public health (King County HealthScape 2009).

### ***8.3.4 Education and Training***

It is essential to recognize that One Health requires thinking and acting across disciplines as a basic tenant. Ideally skills are ‘trans-disciplinary’ that is, not just to know how other disciplines work but sharing skills and agreed goals. One of the ways to demonstrate the necessary skills and benefits is to use examples and case studies of success stories, such as those described in the ‘One Health for One World: a Compendium of Case Studies’ assembled by Veterinarians Without Borders (Veterinarians Without Borders 2010). A number of other case studies have been reported, including those in Asia and Europe described by Hall and Coghlan (2011), Africa (Rweyemamu et al. 2013a), and various studies in One Health Talk (2013).

Practitioners working in resource poor countries see a clear benefit in trans-disciplinary training being introduced at an undergraduate level (Marcotty et al. 2013). As yet it seems that ‘western society’ veterinary and medical faculties have not recognized the benefit of pre-graduate training—but this is changing. Global health is now reported to be included in 40 % of US and Canadian medical schools either as mandatory or elective programs. Many of the Masters and graduate training courses, and other professional training modules available in support of OH are listed on One Health Global Network website (see below).

There are currently no standardized guidelines for competencies or curricula for OH, or accreditation across professions.

### ***8.3.5 Communication and Technology***

Communication channels and networks are numerous, with many websites and informal and formal reporting tools concerned with OH and other arenas relevant to the animal–human–ecosystems interfaces such as disease emergence. The two dedicated OH websites, the One Health Global Network ([www.onehealthglobal.net](http://www.onehealthglobal.net)) and the One Health Initiative ([www.onehealthinitiative.com/index.php](http://www.onehealthinitiative.com/index.php)) have different emphases although they overlap in a number of areas. The objectives of the former are on developing collaborative international programs and projects, on the promotion of OH education, and on ensuring a coherence of messages regarding OH strategies, communication and advocacy, whereas the latter has a broader remit as a means of communication, news and advocacy for all and any OH activities, but with a special interest in educational efforts across the OH spectrum and

cross-species surveillance, transmission, prevention. A shared language is developing informally as is consensus definitions. One Health Sweden (formerly Infection Ecology and Epidemiology) has a focus on OH research but also works to provide open and transparent access to research articles, new methodologies and technological advances ([One Health Sweden 2013](#)). The EcoHealth Alliance, with an emphasis on holistic environmental concerns and ecosystem stability is a strong supporter of One Health and collaborates on language and definition ([Zinsstag 2012](#)).

The rapid growth and sophistication of new technologies, particularly information technology, has greatly assisted many areas underlying the One Health approach, including communication, data management, pathogen detection, risk analysis, and modelling. One such new technology has been the development of Geographic Information Systems (GIS) is an element in numerous projects enabling activities such as herd mobilization mapping, and research related to mixing of wildlife and livestock. On the ground easy to use Personal Digital Assistants (PDAs) and spreading availability of Wi-Fi are making collection and transfer of information easier and faster. In the world of molecular sciences, the availability of complex sequence data on a single pathogen is leading to the widespread use of molecular epidemiology to map and understand more closely the spread of viruses both within and between epidemics. All this science can be equally applied to human or animal health and the skills and knowledge to utilize these technologies have a clear One Health dimension.

## 8.4 The Way Forward

It is 10 years since the Manhattan Principles were promulgated and international concerns began to be raised about the risk posed by HPAI H5N1, and while the OH approach has been greeted widely with enthusiasm, it can also be argued that it has now reached a cross-road. To go forward, it is essential that professional silos are broken down to present a common, cross-disciplinary approach to health issues at the animal–human–ecosystems interfaces, and that the three major international organizations together with other international partners must begin to provide the global leadership which is presently lacking. This might best be done by a process similar to that taken by the United Nations Secretary-General in forming the UNSIC—that is by high-level international United Nations System coordination.

It is also essential that resources be made available to support research in the OH arena, and particularly in developing a better understanding of the human–animal–ecosystems interfaces including wildlife disease surveillance. The majority of emerging diseases arise from wildlife but the vast majority of funds are spent on understanding and controlling them in humans. There is an immediate need to invest in the frameworks, policies and processes required to better identify, articulate and manage risks posted to trade, human health and biodiversity by diseases with wildlife as part of their ecology.

Globally accepted frameworks and standards for research, education and accepted core competencies are required along with the need for an identified career path. However, there is little interest in any form of ‘global governance’: OH is a concept or approach not an association or society. Identifying a body that can lead relationship development between major disciplines and foster a true trans-disciplinary approach, develop global guidelines and strategies, and ensure sustainable funding is needed, probably in an advisory capacity. The recent establishments of groups doing this at the regional level in developing countries (e.g. SACID) do seem to be achieving success in operationalizing OH at the national level and a similar approach could be emulated at the international level. In its most recent guise, OH is still just an approach for detecting and managing global health at the animal–human–environment interfaces, albeit relatively recent, and requires nurturing and further development to realize its full potential. It has been suggested that there should be a One Health Global Guidance Group as one of the outcomes of Stone Mountain, but this has still to be widely accepted. To some, this should be part of the leadership devolved to FAO, OIE and WHO, with an invitation list of international experts added to form an ‘oversight’ group. The importance of food safety and security is reason enough to support their leadership. However, there is no doubt that there is increasing global support for the usefulness and value of the OH approach for the detection and response to diseases at the animal–human–ecosystems interfaces in a transparent, collaborative, and multi-disciplinary way, and that this approach will become an essential component to future global health, and to the provision of safe food and water for an increasingly hungry world.

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