

# One Health Approach to Prevent Emergence and Spread of Emerging Zoonoses

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## Abstract

We are now with an increased global trade, expanding agricultural systems, deforestation and urbanization which are predisposing factors to the emergence of many zoonoses. The concept of one health approach is broad and has much a potential to prevent emergence and spread of emerging zoonoses. The review was gird with the objectives: to raise awareness of the rationale about One Health and indicate the ways in which we veterinarians can participate in improving animal, public, and environmental health; and to indicate the power of One Health approach in tackling the emergence and spread of emerging zoonoses. Many emerging zoonoses have animal origins before their appearance in humans. Traditionally, approaches to health have focused on interventions such as human-based clinical treatment, emergency response, or vaccines. Most of health concerned sectors had been and are working fragmentally which would not be effective in prevention and control of the disease battles of the 21<sup>st</sup> century. Even though there are many countries and organizations that are trying to implement and operationalize the concept of one health approach, in different parts of the world; still there are lack of awareness about one health and mistrust between the responsible bodies in animal, human, and environmental health sectors. In this era, there are increasing risks of zoonoses emergence and spread globally which need collaborative efforts to be taken into action. Continuous awareness creations and educations focused on the integrative approach should be given for the responsible bodies in; animal, human, and environmental health sectors; and notable emphasis should be given to risks of emerging zoonoses have on developing countries like our country, Ethiopia and one health should be implemented in different localities of these countries.

**Keywords:** One health, emerging zoonoses, disease emergence

## INTRODUCTION

An emerging infection is one that is newly recognized, newly appearing in a different population than previously affected, newly affecting many more individuals, or has evolved new attributes (Fineberg and Wilson, 2010). A re-emerging disease is considered a known or endemic disease that either shifts its geographical setting or expands its host range, or significantly increases its prevalence (OIE, 2004). The emergence of many zoonoses can be attributed to predisposing factors such as global travel, trade, agricultural expansion, deforestation and urbanization (FAO, 2011).

Approaches to zoonotic disease management were fragmented. Meanwhile, separate groups work on disease management and disease eradication (IDS, 2013). In 1960s, Schwabe coined the term “One Medicine” (Schwabe, 1984) and he renewed the basic principle that a more holistic approach to human, animal and environmental health was needed to better protect the health of all (Lee and Brumme, 2012).

The concept of One Health was later broadened to encompass the health of ecosystems as well as human, domestic animal, and wildlife health. The One Health idea is a paradigm shift in the way we think about human and animal health in the world (Bousfield and Brown, 2011). A new network- One Health Central and Eastern Africa (OHCEA) was established in which Ethiopia is one of the six founding member countries (OHCEA, 2013). Objectives of thee review:

- ✓ To raise awareness of the rationale about One Health and the ways in which we veterinarians can participate in improving animal, public, and environmental health.
- ✓ To indicate the potential of One Health approach in tackling the emergence and spread of emerging infectious zoonoses.

## LITERATURE REVIEW

### One Health Approach

One Health is the collaborative effort of multiple disciplines-working locally, nationally, and globally to attain optimal health for people, animals and our environment. The concept of One Health is very much a strategy with a long-overdue bias towards health promotion and disease prevention across the human, animal, and environmental domains (AVMA, 2008). Events would bear out the arguments for greater collaboration between public and veterinary health (World Bank, 2010).

The One Health idea is a paradigm shift in the way we think about human and animal health in the world. The agents of change giving rise to One Health are a complex set of multi-factorial circumstances such as population growth, changes in nutritional, agricultural and trade practices, globalization, shifts in land use,

accelerated urbanization, deforestation, encroachment on wildlife and climate change. Population growth and the globalization of economic networks have resulted in a rapidly changing, highly interconnected world (UN, 2011). One Health has no set of laws: it has many concepts, which are formed by consensual agreement by all the relevant “actors”. It concerns all human and animal diseases and all related ecologies. It is not owned by anyone: all are welcome to contribute if they can help the One Health aims (Bousfield and Brown, 2011).

### **The need for collaborative approach**

A critical difference in the response to emerging and reemerging zoonoses will be the need for partnerships and collaboration. The complexity of human-animal relationships illustrates that our future will be characterized by a new interdependence, and true progress on the prevention and control of zoonotic diseases can only be achieved through collaborative ventures between animal health and public health and a new global strategy of cooperation (OIE, 2004). Physicians are less inclined to analyze the role of animals in the transmission of zoonotic diseases, and it is important to regard that analysis as being properly within the purview of veterinarians (Kahn, 2006). Substantial consensus among informed human and animal health authorities, scientists, and policy makers for effective prevention and control measures against emerging and re-emerging infectious diseases will require multisectoral strategies and active collaboration across professional disciplines (Lindenmayer, 2007).

Zoonotic diseases are threats to the global health of animals and humans and so as to mount an effective response to such global threats, it is necessary to coordinate the knowledge, expertise, and experience of a multi-disciplinary force of physicians, veterinarians, and allied health professionals. The key success factor will be the extension of One Health to the local and community levels worldwide. Partnership is critical to success. By working together, more can be accomplished to improve health (AVMA, 2008).

It is clear that no one discipline or sector of society has enough knowledge and resources to prevent the emergence or resurgence of diseases in today’s globalized world. Only by breaking down the barriers among agencies, individuals, specialties and sectors can we unleash the innovation and expertise needed to meet the many serious challenges to the health of people, domestic animals, and wildlife and to the integrity of ecosystems. Solving today’s threats and tomorrow’s problems cannot be accomplished with yesterday’s approaches since we are in an era of One World, One Health (Bousfield and Brown, 2011).

Current approaches to zoonotic disease management are fragmented. Veterinarians deal with livestock disease, wildlife specialists with wild animal populations, ecologists with ecosystem biodiversity and public health experts with human disease. Meanwhile, separate groups work on disease management and disease eradication. There is evidently a need and a demand for a new approach (IDS, 2013). A broader understanding of health and disease demands a unity of approach achievable only through a consilience of human, domestic animal and wildlife health - One Health. To win the disease battles of the 21<sup>st</sup> Century while ensuring the biological integrity of the earth for future generations requires interdisciplinary and cross-sectoral approaches to disease prevention, surveillance, monitoring, control and mitigation as well as to environmental conservation more broadly (Leboeuf, 2011).

### **Responsible institutions**

Responsibility for human health is mostly under the sole purview of ministries of health, while that for livestock and poultry and international trade lies with ministries of agriculture, and increasingly with agricultural companies in the private sector. Ministries of natural resources/environment are responsible for wildlife and environmental health and ecotourism (Pappaioanou, 2010). An alliance of a few international organizations including the FAO, OIE, WHO, World Bank, United Nations System Influenza Coordination (UNSIC), etc. has mobilized to develop One Health. Organizations that promote One Health include organizations as different as the World Small Animal Veterinary Association (WSAVA), the Federation of Veterinarians of Europe (FVE), the surveillance organization ProMED, the British Royal Society (through the concept ‘One Medicine’), the US Army Medical Department, the American Society of Toxicological Pathology and others (Bousfield and Brown, 2011).

### **Its scope, focus areas and areas of integration**

The scope of One Health is impressive, broad, and growing; which may include agro-and bio-terrorism, animal agriculture and animal sciences, antimicrobial resistance, basic and translational research, biomedical research, clinical medicine, combating existing and emerging diseases and zoonoses, comparative medicine, conservation medicine, consumer support; diagnosis, surveillance, control, response and recovery directed at natural or intentional threats that are chemical, toxicological, or radiological in nature; entomology, ethics, food safety and security, global food and water systems, global trade and commerce, health communications, health of the environment and environmental preservation, implications of climate change, infectious disease ecology, integrated systems for detection, land use and production systems and practice, mental health, microbiology education, occupational health, public awareness and public communications, public health and public policy,

regulatory enforcement, scientific discovery and knowledge creation, support of biodiversity, training, veterinary and environment health professionals and organizations, Wildlife promotion and protection (AVMA, 2008).

The sum total of needs that prevail within the human, livestock, and wildlife health domains is beyond the scope of any one discipline. The focus of One Health, then, is on areas of convergence and which therefore generally excludes diseases that lack the potential to jump species, from animals to humans. Improved coordination among public, veterinary, and ecosystems health agents will rely on: consultation on priority setting, joint preparedness planning, and providing an appropriate institutional framework with their respective benefits (World Bank, 2010). Emergency preparedness, both locally and nationally, is much better coordinated today but can still benefit from further integration (AVMA, 2008).

### **Challenges in implementing one health approach**

The OHIF in (2008) had articulated the presence of significant barriers to the adoption of the One Health concept, perhaps the most important being the need for key leadership to embrace the concept of One Health, to obtain buy-in from medical, veterinary, industrial, and environmental partners, and to execute a change program on a global basis. Success in adopting the One Health concept will require overcoming many other barriers, including difficulty in changing the mindset of health care providers from one of “disease care” to one of preventive medicine, the bias towards clinical care, increasing specialization and fragmentation of the field, as well as a general lack of awareness and education of physicians, and difficulty getting busy practitioners on board. Additional barriers identified were differences in organizational cultures, competing priorities, and a lack of resources to promote and further develop One Health; the need for a communication plan that could effectively influence public awareness and motivate a campaign to help influence congress and key policy makers (AVMA, 2008).

Even though there are many challenges to achieving effective inter-sectoral collaboration, to list a few of them may be: lack of appreciation that a stronger veterinary infrastructure could prevent the emergence of zoonotic diseases in animal populations and their spread to humans, presence of differences in international authorities, a lack of mutual understanding and trust between sectors, the news media frequently relaying confusing public health messages with respect to risks of exposures, and exacerbating misunderstanding and mistrust between sectors (Pappaioanou, 2010).

### **Earlier and current situations of one health approach**

*At the global level:* Cooperation at the international level is generally good. In 1975, the FAO and WHO published a joint report titled “The Veterinary Contribution to Public Health Practice”, and the WHO developed a program on veterinary skills in what has been called “veterinary public health,” which was further defined by WHO in 1999 as “the sum of all contributions to the physical, mental and social wellbeing of humans through an understanding and application of veterinary science” (WHO, 2009).

Zoonotic diseases are the core domain of veterinary public health, which provides a valuable channel between the WHO, FAO and OIE. The three organizations are also partners in the Codex Alimentarius Committee, which sets food safety standards, and in the Global Early Warning System for Major Animal Diseases, including Zoonoses (FAO, 2007).

In April of 2007 the American Veterinary Medical Association (AVMA) took official action to establish the One Health Initiative by forming the AVMA One Health Initiative Task Force (OHITF). This OHITF was comprised of thirteen visionary individuals from various health science professions, academia, including two student representatives, government, and industry. In June of 2007 the AMA House of Delegates approved a policy resolution which called for the AMA to engage in collaboration with the AVMA to discuss strategies for enhancing collaboration between the human and veterinary medical professions. The OHITF completed its charge in June of 2008 by presenting its final report and recommendations to the AVMA Executive Board (AVMA, 2008).

The OHC was officially chartered in Washington, D.C. on June 29, 2009 with eight institutional members. In October of 2010 the OHC issued a Request for Proposal (RFP) to secure an institutional leading partner(s) to provide needed capacity of support to fully operationalize the OHC, including establishing permanency of location and staff. The RFP was sent to all accredited Colleges and Schools of Medicine, Public Health and Public Health Programs, and Veterinary Medicine in the U.S. On December 1, 2010 Iowa State University (ISU) and its One Health consortium was selected to become a leading partner with the OHC. A Memorandum of Understanding (MOU) between the OHC and ISU was finalized on January 31, 2011. Through the MOU the OHC office headquarters have been established within the Nutrition and Wellness Research Center at the ISU Research Park. Based on the OHC vision and goals, the MOU calls for the development and implementation of a joint strategic business plan between the OHC and the ISU One Health Consortium, and thereby, the Commission becomes fully operational. The mission of the One Health Commission is “the establishment of closer professional interactions, collaborations, and educational and research opportunities

across the health sciences professions, together with their related disciplines, to improve the health of people, animals, plants and our environment” (OHC, 2013).

*In Eastern and Central Africa:* USAID identified the health alliance, a network of seven Schools of Public Health in Eastern Africa, as a priority network to be targeted for immediate respond’s collaborative engagement to expand respond projects across the entire Congo basin. During a meeting of Deans of the seven Schools of Public Health and seven Veterinary Schools from six Central and Eastern Africa held in Kampala, Uganda; it was agreed that a new network- One Health Central and Eastern Africa (OHCEA) be established by the 14 founding members namely: Jimma University College of Public Health and Medical Sciences, Jimma University, College of Agriculture and Veterinary Medicine, School of Veterinary Medicine, College of Veterinary Medicine, Mekelle University, University of Kinshasa School of Public Health, Faculty of Veterinary Medicine University of Lubumbashi, University of Nairobi School of Public Health, University of Nairobi Faculty of Veterinary Medicine, Moi University School of Public Health, National University of Rwanda School of Public Health, Umutara Polytechnic Faculty of Veterinary Medicine, Muhimbili University of Health and Allied Sciences School of Public Health and Social Sciences, Sokoine University of Agriculture, Faculty of Veterinary Medicine, Makerere University, Faculty of Veterinary Medicine and Makerere University School of Public Health ( from 6 countries; Ethiopia, Democratic Republic of Congo, Kenya, Rwanda, Tanzania and Uganda). *OHCEA activities are coordinated at a regional level housed by Makerere School of Public Health.* OHCEA CCC includes; Uganda, Kenya, Tanzania, Rwanda, DRC Congo, and Ethiopia and members may include University Deans and Focal Persons belonging to different member countries (OHCEA, 2013).

### **Benefits of implementing one health approach**

There is every indication that infectious diseases will continue to have a significant impact on our health, and the emergence and reemergence of pathogens will threaten the health and well being of people and animals throughout the 21<sup>st</sup> century. Implementing a One Health approach may help in:

- Improving animal and human health globally through collaboration among all the health sciences, especially between the veterinary and human medical professions to address critical needs;
- Meeting new global challenges confrontational through collaboration among multiple professions;
- Developing centers of excellence for education and training in specific areas through enhanced collaboration among colleges and schools of veterinary medicine, human medicine, and public health;
- Increasing professional opportunities for veterinarians, and adding to our scientific knowledge to create innovative programs to improve health (AVMA, 2008).

One Health seeks to replace the disease centered approach to zoonoses with a system based one. One Health can play a role in catalyzing better preparedness and surveillance that are informed by cross-disciplinary approaches. It could also help accelerate research discoveries, enhance the efficacy of response and prevention efforts, and improve education and care (IDS, 2013).

### **EMERGING ZOOSES**

An emerging infection is one that is newly recognized as occurring, newly appearing in a different population than previously affected, is newly affecting many more individuals, or has evolved new attributes (e.g., resistance or virulence). The most prominent emerging pathogens globally have been viruses that spread from person to person, typically by inhalation, sexual exposure, or direct contact to mucous membranes. Emerging infections in humans tend to be caused by microbes that are established in vertebrate animals and have crossed the species barrier to infect humans. Such animal to human transmission is termed a zoonotic infection or zoonosis. Wildlife (e.g., bats, nonhuman primates) and food animals (e.g., poultry, swine, and cattle) have been sources of zoonoses (Fineberg and Wilson, 2010).

Interactions between animals and humans continue to evolve with changing human and animal demographics. Outbreaks of emerging zoonotic diseases and infections with increasing occurrence have had significant direct and indirect impacts on human and animal health, and on local, national and global economies (IOM/NRC, 2009). The consequences of these diseases for human populations not only illness or death, but also impacts on mental health from fear, misperceptions of exposure or from the loss of income from animal illness and death (from disease or control efforts), which can lead to poverty and other negative impacts on national economies (Pappaioanou, 2010).

Over two thirds of all human infectious diseases have their origins in animals. The rate at which these zoonotic diseases have appeared in people has increased over the past 40 years, with at least 43 newly identified outbreaks since 2004 (IDS, 2013).

### **Emergence of emerging zoonoses**

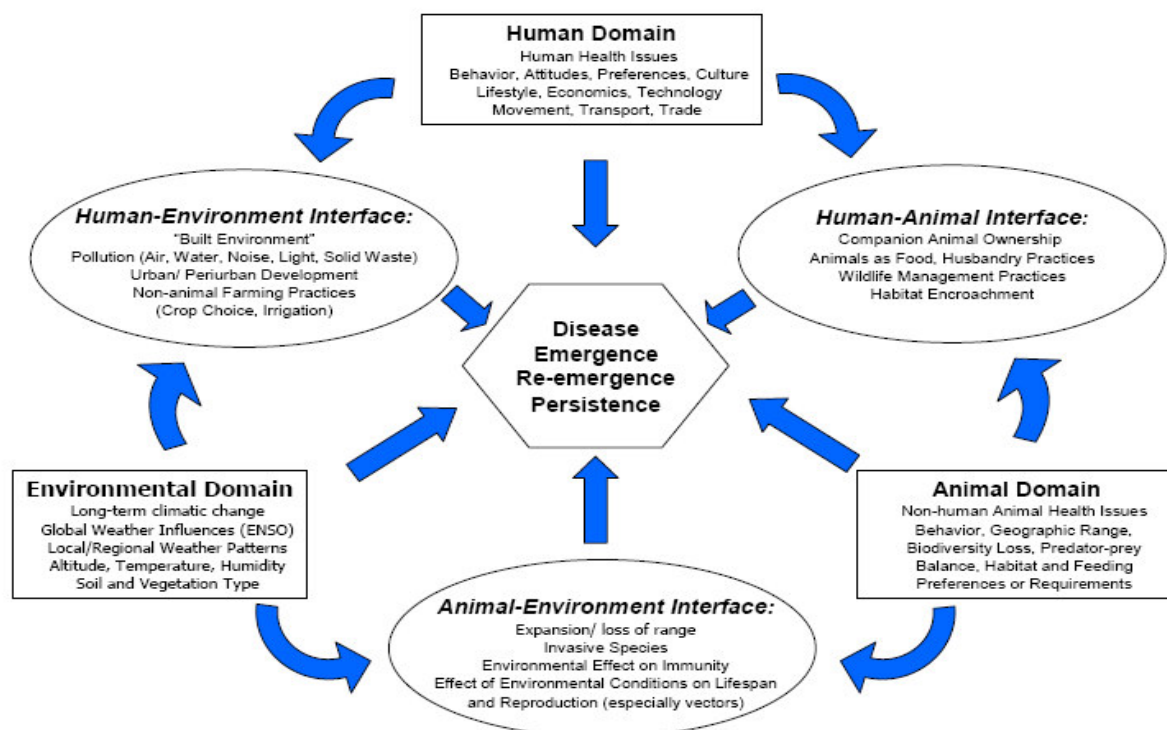
An emerging disease is defined as a new infection resulting from the evolution or change of an existing pathogen or parasite resulting in a change of host range, vector, pathogenicity or strain; or the occurrence of a previously

unrecognized infection or disease. A reemerging disease is considered a known or endemic disease that either shifts its geographical setting or expands its host range, or significantly increases its prevalence (OIE, 2004). As noted by the Institute of Medicine, the global interconnectedness that has evolved during the past several decades has caused infectious pathogens to emerge more frequently, spread greater distances, pass more easily between humans and animals, and evolve into new and more virulent strains (IOM/NRC, 2009).

For an infectious disease to emerge in the human population, something has to change in the ecological balance, and these changes constitute the principal contributing factors to risk emergence. In general, these factors deal, directly or indirectly, with changes in the relationships of humans, animals, and potential microbial pathogens (Fineberg and Wilson, 2010). The emergence of many zoonoses can be attributed to predisposing factors such as global travel, trade, agricultural expansion, deforestation and urbanization; such factors increase the interface and/or the rate of contact among human, domestic animal and wildlife populations, thereby creating increased opportunities for spill-over events to occur (FAO, 2011).

*Driving and contributing factors of emergence:* The emergence, reemergence, and spread of microbial threats are driven by a complex set of factors. The convergence of any number of these factors can create an environment in which infectious diseases can emerge and be maintained in society. The increasing interaction of domestic animals, wildlife, and humans is a critical and progressively important factor within the dynamic of emerging diseases and the transmission of zoonotic pathogens (OIE, 2004). The factors that drive the emergence of new diseases can be usefully classified into those that occur in one of three environments: (i) in human living environments: i.e. changing consumer demand and dietary habits, urbanization, human and animal population density, the proximity of humans and livestock, changing demographics, increasing mobility, rates of poverty, and the deteriorating state of public health and veterinary services all serve as drivers of emerging and reemerging zoonotic diseases. (ii) in food and agriculture systems: i.e. the number of livestock, the spatial concentration of livestock production, the existence of mixed biosecurity regimes, growth in the export of animal source products, inappropriate vaccination and drug use, and exploitative farming systems are prominent factors. (iii) in natural ecosystems: i.e. the effects of human encroachment and adverse land use such as deforestation, poaching, and trade in live animals and bushmeat carry considerable consequences in terms of habitat fragmentation, biodiversity loss, and climate change (World Bank, 2010).

The main drivers of emerging infection can be explained in a matrix of features and interactions among “human,” “animal,” and “environmental” dimensions (Figure 1).



**Figure 1:** Overview of the driver-pathogen interactions that contribute to the emergence of infectious zoonotic diseases. **Source:** (Fineberg and Wilson, 2010).

Human factors that contribute to emerging infection include such elements as behavior and lifestyle, mobility (travel and immigration), and economic and technologic conditions of living. Environmental factors range from soil and vegetation, weather and season, longer-term climate change, and local conditions such as

altitude, temperature, humidity that influence animal and vector populations. Animal factors include geographic range, legal and illegal trade in domesticated animals and wildlife, biodiversity, predator/prey balance, habitat, and animal health. At the human-environment interface appear such factors as urbanization and crowding, the nature of the built environment, water and waste management, and non-animal farming practices. At the animal-environment interface are such factors as conditions for reproduction and survival of disease vectors, and expansion or loss of species range (figure 1).

The social dynamics factor embraces many of the human, human-animal, and human-environmental factors that contribute to emerging infection. Growth in the number and size of urban centres, increases in international travel and trade, a growing migrant workforce, enormous rise in farm animal production, and proximity to live animals hunted or acquired for food, are among the most powerful contributing factors (Smolinski *et al.*, 2010).

**Table 1:** Selected attributes of illustrative emerging infectious diseases.

Infectious Disease	Organism	Transmission mode	contributing factors
vCJD (form of spongiform encephalopathy)	Prion	Ingestion of contaminated meat	Animal rendering and feeding practices; economic incentives and interests
Dengue	Virus	Vector-borne (mosquito)	Urbanization and population growth; International travel and trade; Poor infrastructure
HIV/AIDS	Virus	Person-to-person (sexual; mother-to-child; transfusion/injection)	Primate contact (bush meat); sexual practices; social stigma; travel and migratory workers; intravenous drug use and injection practices
Influenza	Virus	Person-to-person (respiratory)	Multiple zoonotic reservoirs; international travel
Monkeypox	Virus	Animal-human contact	International trade in wild animals
SARS	Virus	Person-to-person (respiratory)	Cultivation of wild animals (civet cats) for food; bat-civet cat interface; international travel

**Source:** (Fineberg and Wilson, 2010).

The speed and scale of both the growth in international travel and the growth in animal food production and agricultural trade has been significant (Wilson, 2010b). New farming equipment plus advanced networks of infrastructure, transportation and distribution have led to larger scale animal farming and increased trade (risk amplification). This can facilitate new routes and scale of exposure to infection. The extent to which the various contributors to emerging infection affect a population is highly related to the socio-economic status of the population at risk. Many tropical areas with climate and weather that favour emerging infections are also regions that are crowded, economically underdeveloped, and especially susceptible. Tropical areas are characterized by high biological diversity, including a greater array and abundance of potential pathogens. These areas coincide with large and growing populations in developing countries (Guernier *et al.*, 2004).

Other environmental forces of weather and climate, changes in vegetation and habitat, and shifts in ecological balance also affect microorganisms, vectors, animals, and human exposure (Wilson, 2010b). Scientific knowledge about microorganisms, vectors, and disease is an extremely strong contributor to averting and reducing the effects of emerging infections. Scientific understanding of the roles of microorganisms and vectors in disease has led to preventive strategies (behaviour adjustment, mosquito control, and vaccines) and effective treatment (antimicrobials) against many emerging and established infections. While not a primary driver of emerging infection, conflicts about interests and values can powerfully influence the response to certain diseases (Fineberg and Wilson, 2010).

### Spread of emerging zoonoses

For an infectious disease to emerge in the human population, something has to change in the ecological balance, and these changes constitute the principal contributing factors to risk emergence. In general, these factors deal, directly or indirectly, with changes in the relationships of humans, animals, and potential pathogens. Once an infection has occurred in a human, in order for the infection to be maintained or to spread in the population, the infectious organism must reproduce (in new hosts) faster than it dies out (in already infected hosts). Epidemiologists characterize this basic reproductive rate ( $R_0$ ) in numerical terms, where  $R_0$  must exceed a value of 1.0 for an infectious outbreak to spread (Anderson and May, 1991). In general, four features influence the value of  $R_0$ : (1) the intrinsic infectiousness of the organism; (2) the duration of the infectious period in an infected individual; (3) the number in the population who are susceptible to infection; and (4) the extent of mixing between those infected and those susceptible. These elements are useful in that they help characterize

what has changed to produce an emerging infection and point to opportunities to interdict the spread of disease, i.e., to prevent the risk (Fraser *et al.*, 2004).

*Factors of spread:* Rapid air travel, commerce and trade in domesticated and wild animals, demographic changes including urbanization, climate change, deforestation, and many other factors increase the potential spread of infectious diseases. Migratory birds and bats are capable of introducing infectious diseases across international borders (AVMA, 2008). The main drivers behind the transmission of animal infections to people (known as ‘spillovers’), and the subsequent spread of the infections, relate to where and how people live, and the contacts people have with animals, both wild and domestic. These drivers have intensified rapidly in recent decades as previously inaccessible natural habitat is converted into farmland or settlements and wildlife is exploited for food. The likelihood of disease spillover is also increasing as climate change affects habitats, wildlife populations and the distribution of the organisms that carry these diseases from one animal to another (‘vectors’). In addition, the massive growth of human populations in urban areas, combined with the greater connectedness of cities around the world, makes a global pandemic resulting from a geographically remote spillover event a real possibility (IDS, 2013).

### **Threats to animals and humans**

The rise of emerging and resurging infectious diseases threatens not only humans (and their food supplies and economies), but also the fauna and flora comprising the critically needed biodiversity that supports the living infrastructure of our world (Bousfield and Brown, 2011).

Emerging infectious diseases are a global phenomenon. They cannot be understood in less than a global context nor managed with less than a global strategy (Fineberg and Wilson, 2010). EIDs are a significant threat to global public health, particularly considering that more than 25 percent of annual deaths worldwide are estimated to be directly related to infectious diseases. Economic losses associated with livestock morbidity and mortality threaten not only agricultural industries, but also wildlife-based economies such as wildlife tourism or the bush meat trade. EIDs are also a significant threat to species conservation and biodiversity. While wildlife species can be considered reservoirs of pathogens with the potential to infect humans and livestock, wildlife populations are themselves also threatened by introduced pathogens. Spill-over of infectious agents to wildlife populations is a particular threat to endangered species, where the presence of infected reservoir hosts can lower the pathogen’s threshold density and lead to local population extinction (FAO, 2011).

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 21<sup>st</sup> century (AVMA, 2008).

*Threats to underdeveloped, developing, and developed countries:* Zoonotic diseases have a huge impact and a disproportionate one on the poorest people in the poorest countries. In low-income countries, 20% of human sickness and death is due to zoonoses. Poor people suffer further when development implications are not factored into disease planning and response strategies (IDS, 2013). With almost 90% of future human population increases occurring in developing countries, unprecedented animal production is also increasing in these areas of the world. Unfortunately, these countries often do not have adequate human and animal infrastructures in place to control and address current disease, much less the emergence and detection of the next group of microbial threats. Emerging disease events have been progressively increasing over the decades, and, except for emerging antimicrobial resistant organisms, most have originated in developing regions of the world and will likely continue this pattern well into the future. Yet existing surveillance systems have been developed and implemented with a bias toward richer and developed countries and thus, fail to consider those areas of world at greatest risk and with the highest probability of incubating the next emerging infection. The need to create and establish good surveillance and monitoring systems in developing countries as an integrated strategy and across domains is lacking at a time that is most needed (AVMA, 2008).

Many tropical areas with climate and weather that favour emerging infections, are regions that are crowded, economically underdeveloped, and especially susceptible (Fineberg and Wilson, 2010). Low latitude (tropical) areas are characterized by high biological diversity, including a greater array and abundance of potential pathogens. These areas coincide with large and growing populations in developing countries (Guernier *et al.*, 2004). A new, integrated ‘One Health’ approach to zoonoses that moves away from top-down disease-focused intervention is urgently needed. With this, it would be possible to put people first by factoring development implications into disease preparation and response strategies and so move from panic to planning (IDS, 2013).

### **Measures to prevent emergence and spread**

Emerging zoonotic infectious diseases represent a growing threat. Improved real-time surveillance through integrated human, veterinary and wildlife disease systems will reduce time to recognition and enhance disease control (AVMA, 2008).

In many countries, irrespective of the status of their veterinary services infrastructure, zoonotic diseases with epidemic potential are frequently detected following human illness and/or death. As human infections are traced back to their animal source, massive control efforts are implemented to stem further spread to or among humans. There are numerous opportunities to prevent, detect, respond to and control zoonotic infections and diseases in animal populations before human exposures occur, or, should transmission have already occurred, to detect and respond to human infections earlier, thereby reducing risks of further human exposures. Early detection and response wherever infection is first identified is becoming better understood as a true global public good, and this is an important first step to building the political will that will be needed to address these problems (Pappaioanou, 2010).

The emergence and spread of infectious diseases in recent years has resulted in a major awakening of public health services. The involvement of veterinarians and other wildlife specialists has highlighted the role that they can play in the surveillance, control and prevention of emerging zoonoses. Current strategies for disease prevention and control in the spill-over host are directed towards minimizing direct or indirect contact with the natural host, improving farm-gate and on-farm biosecurity, and rapid disease detection and diagnosis. Effective management strategies in the natural host are predicated on an understanding of the ecology of the disease in the natural host, and the identification and avoidance of factors putatively associated with emergence, such as habitat loss, land-use change and demographic shifts. A possible future management strategy in reservoir populations is immunization using bait or plant-derived vaccinations (FAO, 2011).

*Implementing one health approach:* In a well functioning, effective system comprising a strong and coordinated human, animal and environmental health infrastructure, the emergence of and response to emerging infectious zoonoses would be more likely to be prevented or contained early. Interventions to prevent zoonotic disease emergence in animal populations would be implemented. Should prevention efforts fail, veterinary infrastructure would be sufficiently strong to detect emergence early. Risk communication would be instituted in such a way as to not cause panic, but to guide people on how to avoid exposure and when and where they should seek care should symptoms occur. Occupational surveillance systems would detect infections early in people at greatest risk of first exposure (e.g. people working closely with animals) (Pappaioanou, 2010).

The opportunity to meet continuing challenges to health through the concept and implementation of new strategies is both exciting and troubling. One Health has the potential to meet critical societal needs and demands. Veterinarians are well grounded in population health, comparative medicine, and preventive medicine. The profession has the potential to take a major leadership role in the efforts of One Health. However, this is not a given, and a reluctance by our profession or by the other health sciences to take this step, will, without question, be a lost opportunity that will be picked up by other groups (AVMA, 2008).

To win the disease battles of the 21<sup>st</sup> Century while ensuring the biological integrity of the earth for future generations requires interdisciplinary and cross-sectoral approaches to disease prevention, surveillance, monitoring, control and mitigation as well as to environmental conservation more broadly. "It is clear that no one discipline or sector of society has enough knowledge and resources to prevent the emergence or resurgence of diseases in today's globalized world. Only by breaking down the barriers among agencies, individuals, specialties and sectors can we unleash the innovation and expertise needed to meet the many serious challenges to the health of people, domestic animals, and wildlife and to the integrity of ecosystems. We are in an era of One World, One Health and we must devise adaptive, forward-looking and multidisciplinary solutions to the challenges that undoubtedly lie ahead" (Bousfield and Brown, 2011).

*Prevention, detection, and response measures:* Prevention, detection, and response measures to tackle emergence and spread of emerging infectious zoonoses would include: preventing the emergence of zoonotic diseases in animal populations; detection of zoonotic diseases in animals; response to control disease transmission in animal populations; detection of zoonotic diseases in human populations; preventing the transmission of zoonotic disease agents to human populations; and response to control zoonotic disease in human populations (Pappaioanou, 2010).

The NCEZID was established in 2010, with a mission, "to reduce illness and death associated with emerging and zoonoses and to protect against the spread of infectious diseases", and scientific activities that trace back to the earliest days of the CDC (NCEZID, 2011). Continued funding for public and animal health systems, complete with clearly defined reportable infectious disease surveillance, will ensure the existence of infrastructure required for future EZD surveillance (Roth, 2011).

*Response and surveillance:* The heart of a global "early warning system" to cope with emerging zoonoses rests on global surveillance that must include animal as well as human pathogens and diseases (IOM, 2010). With regard to emerging zoonoses control, three related imperatives require explicit action. First, a stronger global awareness program is needed that emphasizes the risks of emerging zoonotic diseases. Second, the low-income developing countries need financial and technical assistance to strengthen their health systems in the context of the One Health approach. Third, the provision of improved international research capacity for the control of zoonotic diseases is needed, that creates an active interface between medical and veterinary science.



This research agenda needs to emphasize efforts to develop and operate an efficient and effective global surveillance system and to anticipate technical challenges to controlling disease outbreaks (AVMA, 2008).

## CONCLUSION AND RECOMMENDATIONS

One Health Approach is a new, interdisciplinary, and cost effective disease prevention strategy and the concept is very much a strategy with a long-overdue bias towards health promotion and disease prevention across the human, animal, and environmental domains. It is mentioned that, no one discipline or sector of society has enough knowledge and resources to prevent the emergence or resurgence of diseases in today's globalized world. Emerging infectious diseases have a huge impact and a disproportionate one on the poorest people in the poorest countries but show a global phenomenon. Despite these facts; still there are lack of awareness and education of physicians, lack of appreciation that a stronger veterinary infrastructure could prevent the emergence of zoonotic diseases in animal populations and their spread to humans, presence of differences in international authorities, and a lack of mutual understanding and trust between sectors, that may challenge the implementation of the integrative approach. But in a well functioning, collaborative approach such as in one health; the emergence of and response to emerging infectious zoonoses would be more likely to be prevented or contained early. Therefore, implementing the one health approach principles would provide ease opportunities to prevent and control emergence and spread of emerging zoonoses and it will allow collaborative efforts to be applied.

Generally, some aspects of one health approach, with especial concern given to prevent the emergence and spread of emerging infectious zoonoses had been reviewed and the following recommendations were forwarded:

- Continuous awareness creations and educations focused on the integrative approach should be given for the responsible bodies in; animal, human, and environmental health sectors.
- Especial emphasis should be given to risks of emerging infectious zoonoses have on developing countries like our country, Ethiopia and one health should be implemented in different localities of these countries.

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