



The Role of Veterinarian in One Health Approach

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Abstract: One health is the integrative effort of multiple disciplines working locally, nationally and globally to attain optimal health for people, animals and the environment. As the human population continues to increase across the world, the interface of people, animals and the environment becomes more significant and impactful. For the past few years, the one health concept has brought together experts in the areas of animal and human health. It has provided a new synthesis for public health and veterinary communities across the world. This paper is aimed to provide information on major roles of veterinarian in one health approach and challenges and opportunities of one health. The introduction of the concept of one health emphasizes the role of a veterinarian as a leader in present society by addressing the risk and emergence of zoonotic diseases and promoting basic health care needs of the world. Veterinarian protect the human health and well-being by ensuring food security and safety, preventing and controlling emerging infectious zoonoses, protecting environment and ecosystem, assisting in bioterrorism and agro-terrorism preparedness, and contributing to public health. Even though veterinarians have a leadership role, they face challenges to collaborate with other professionals for the success of one health approach. Therefore, veterinarian should overcome their tendency to communicate solely within their professions rather than to communicate across disciplines. [*Rep Opinion* 2021;13(3):15-22]. ISSN 1553-9873 (print); ISSN 2375-7205 (online). <http://www.sciencepub.net/report>. 3. doi:[10.7537/marsroj130321.03](https://doi.org/10.7537/marsroj130321.03).

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1. Introduction

One health is multidisciplinary approach involving veterinarian, physician and environmental health professionals to ensure well-being within human, animal, and ecosystem interfaces (Papadopoulou and Wilmer, 2011). Due to urbanization, globalization, deforestation, changes in human ecology and behavior, animal has come more closely and close to people resulting transmission and emergence of infections in both directions. Faced with these complexes, it is crucial for Physicians, Veterinarians and the Environmental Health Practitioners (EHPs) to work more closely together for better animal, human and environmental health (Zinsstag *et al.*, 2011).

The concept of one health represents a unique and significant opportunity for veterinarian to be in a leadership role and to work collaboratively for ecosystem health (a community of humans, animals, and plants interacting with one another and with their physical environment) for the greater good of society. Of the 1,461 diseases now recognized as affecting humans, approximately 60% are due to multi-host pathogens characterized by movement across species lines; and over the last three decades, approximately 75% of new emerging human infectious diseases have been zoonotic (American Veterinary Medical Association, 2008).

The veterinarian is the only health care professional likely to see both people and their animals. So he or she therefore has awareness of the potential threat of zoonotic diseases and has the ability and responsibility for detections of zoonotic or emerging diseases. Fortunately, veterinarians have considerable training in comparative medicine, zoonoses, and public health. Physicians on the other hand do not receive extensive training in comparative medicine and zoonoses. Therefore veterinarians are in a better position to discover public health threats than are physicians. They are also in ideal position for in establishing a disease surveillance system using pets as sentinels of disease exposure in the home environment and in the world (AVMA and World Veterinary Congress, 2008).

Veterinarians, regardless of their field of practice, all play a significant role in human health and environmental health. The future will most likely bring more collaboration of veterinarians from all fields with multiple professionals such as public health, human medicine, bio-engineering, animal science, environmental science, and wild life. Together, we are strong to fight disease and we are indeed, wiser (Michael, 2010). People readily associate the role of veterinarians with private veterinary practice focused on pets and farm animals, but the true dimensions and

contributions of veterinary medicine are much broader and reflect expanding societal needs and contemporary challenges to animal and human health and to the environment (Hoblet *et al.*, 2003).

Therefore, the major objective of this seminar paper is to provide information on major roles of veterinarian in one health approach, challenges and opportunities of one health.

2. One health

The approach of One Health stems from the original theory of 'One Medicine', developed in 1984 by Calvin Schwabe who is a veterinary epidemiologist in his book "Veterinary Medicine and Human Health" (Schwabe, 1984) advocating a combined medical and veterinary approach for preventing and controlling zoonotic disease that are communicable between animals and humans naturally (Schwabe, 1984; Kahn *et al.*, 2007). One Medicine is integrated approach of veterinary and human medicine to prevent and control diseases of animal origin. It embodies the view that human and veterinary medicine is dependent on an overlapping collection of biological characteristics, technologies and research discoveries. Scientific advances have demonstrated striking commonalities among the genomes of humans, animals and the importance of emerging zoonoses, public health and food safety, bio-defense, wildlife disease and conservation. The interrelationships between human and animal health is at the core of the discipline of Comparative Medicine; it is the basis of the "One Medicine" concepts that evolved to One Health (National Research Council, 2005a).

The One Health concept recognizes that the health of humans is connected to the health of animals and the environment. The collaborative effort of multiple health science professions together with related disciplines and institutions working locally, nationally and globally to attain optimal health for people, domestic animals, wild life and our environments (AVMA, 2008). It is a concept that becomes an approach and then a movement and rapidly becoming international movements based on inter disciplinary collaborations. The major difference between One Medicine and One Health is the addition of ecosystem health into the interface. Ecosystem health is included to incorporate the environment as well as wildlife populations and recognizes that sustainable development and continued human and animal health are dependent on healthy surrounding ecosystems (Lebel, 2003).

One Health is very much an overarching concept that spans many disciplines, professions, and areas of interest that includes the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge. Close

cooperation and interaction between veterinarians, occupational health physicians and public health operators is thus necessary, for a worldwide strategy to expand interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment. This is what the one health Approach is intended to be (Rabozzi *et al.*, 2012).

The concept of One Health represents a unique and significant opportunity for veterinary medicine to be in a leadership role and to work collaboratively for ecosystem health (a community of humans, animals, and plants interacting with one another and with their physical environment) for the greater good of society (Chaddock, 2012).

3. Veterinarian in the past and present society and their role in one health approach

In contrast with human medicine, the role of the veterinarian in society has greatly expanded since the founding of the first veterinary school in Lyon in 1761. The school was primarily established to combat an epidemic of rinderpest, the most feared disease of cattle in that era that was ravaging France. Following the establishment of the Lyon veterinary school, veterinary schools were soon opened in other countries in Europe and later in other countries around the world. Throughout the nineteenth century and the early part of the twentieth century, the focus of veterinary education in these schools were training of veterinarians to control disease in food producing animals, to prevent the transmission of zoonotic diseases, and, importantly, on the clinical care of riding, draft, and warfare horses (Gibbs and Gibbs, 2012).

The introduction of motorized vehicles in the industrialized nations after World War I resulted in a dramatic decline in the number of draft and riding horses and this changed the role of the profession in these countries. Most veterinarians employed prior to World War II were in rural practice and predominantly involved with livestock. After World War II, the demand for veterinarians specializing in small animal medicine arose in response to the growing status of companion animals in society (Smith, 2011).

Today in the USA, approximately 77 % of clinical veterinarians work on companion animals, either exclusively or predominantly; those working on food animals, exclusively or predominantly, represent approximately 8 % (Gibbs and Gibbs, 2012). Although the majority of the profession is now employed in companion animal practice, until recently, interest in the one health concept has focused mainly on disease interactions between people and production animals. That is now changing (Day, 2010; Anonymous, 2012).

Significant involvement of veterinarians in wildlife and ecosystem health has occurred relatively recently

within the history of the profession. In industrialized countries, veterinarians began to be employed to care for zoo animals in the nineteenth century, and wildlife species serving as reservoirs of infectious agricultural diseases attracted the attention of veterinarians during disease control campaigns throughout the twentieth century (E.g. foot-and-mouth disease in Cape buffalo in South Africa). Until fairly recently, however, work with zoo animals and wildlife reservoirs was motivated more by entertainment and disease eradication goals than a concern for wildlife or ecosystem health (Fowler, 2006).

In lesser developed areas of the world, livestock continue to be extremely important to the immediate welfare of individuals and society for food, fiber, and transportation. As a result, veterinary medicine is still focused on food animal health, zoonotic diseases, and, in some areas, diseases that pass between livestock and wildlife. For example, in most parts of sub-Saharan Africa, with the republic of South Africa serving as the exception, agriculture is still the major emphasis of veterinary training and practice (Swan and Kriek, 2009).

Veterinarians play incredible role to One Health even the concept evolved from One Medicine concept, developed in 1984 by Calvin Schwabe who is a veterinary epidemiologist in his book “Veterinary Medicine and Human Health” (Schwabe, 1984) advocating a combined medical and veterinary approach for preventing and controlling zoonotic disease that are communicable between animals and humans naturally (Kahn *et al.*, 2007).

Veterinarians practice One Health every day from clinical treatment of individual animals using the appropriate antibiotic on the farm to zoonotic disease surveillance activities in free ranging wildlife. Even the daily activity of a veterinarian vaccinating a dog against rabies is One Health in action (Pappaioanou, 2004). Veterinarians contributes to human health by promoting the health of animals, which provide necessary income, food, transport, draught power and the raw materials for clothing throughout the world. By promoting animal health, the quality and quantity of animal products is enhanced. This is especially important in developing countries, where foods of animal origin help to improve the nutritional status of malnourished people by providing high quality protein and micronutrients. In all countries, improved animal health and quality assurance of foods of animal origin contributes to food security at local and national levels (WHO, 2002).

Veterinarians in all aspects of the profession have opportunity and responsibility to protect the health and well-being of people in all that they do including; protecting food security and safety, addressing threats to antibiotic sensitivity, preventing and controlling

zoonotic emerging infectious diseases, protecting environments and ecosystems, participating in bio and agro-terrorism preparedness and response (Pappaioanou, 2004).

Recently, due to the increased incidence of emerging infectious diseases (Avian influenza, Severe Acute Respiratory Syndrome (SARS), Ebola etc), veterinarians focused on surveillance, prevention and control of these disease (Cipolla *et al.*, 2015). In addition to that a number of practicing veterinarians in developed countries mainly involved in pet animal practice through education of pet owners about the risks of acquiring zoonotic diseases. They also reduce transmission risks by vaccinating pets against zoonotic diseases and by reducing pets’ burden of parasites that may infest the animals’ owners. Apart from zoonotic disease control and prevention Pet animal practice is important for the mental health of pet owners via the human-animal bond phenomenon (Monath *et al.*, 2010).

4. Major one health issues of veterinarian concern

4.1. Bioterrorism

Bioterrorism is the use of microorganisms (bacteria, viruses and fungi) or toxins by terrorist or extremists’ groups to produce weapons which cause death and disease among humans, animals and plants. The use of biological agents on populations to cause harm or death is not a new concept; countries have been conducting bioterrorism for hundreds of years (CDC, 2013). Bioterrorism dates back to the 14th century, when cadavers were dropped into enemy wells to poison the drinking water. Similarly, bioterrorism occurred during the French and Indian wars, when Native Americans were given smallpox laden blankets. This action is believed to have initiated smallpox in this previously unexposed population and resulted in a 40% mortality rate. More recently, bioterrorism events have been noted, one is the intentional contamination of salad bars in the Dallas, Oregon, using *Salmonella* and the other, the 2001 attack using anthrax laden letters mailed to media organizations and politicians (Texas Department of State Health Service, 2011).

Some zoonotic diseases are unfamiliar to the general medical community and exist as potential agents of bioterrorism against human populations because of their virulence, lack of treatment options, and ease of production, transmission, and infection. Zoonotic bioterrorism agents can also target agriculture, causing economic disruptions and undermining consumer confidence in food supplies. Outbreaks of livestock diseases can result in mass culling of animals, import and export restrictions on livestock, and fears of human contagion and pandemics (Osburn *et al.*, 2009).

Veterinarians play a significant role in surveillance for bioterrorism agents, controlling disease, in the

treatment of the ill and early warning system for bioterrorism that usually targets humans and indirectly animals because most of bioterrorism agents are zoonotic. Of the six major bioterrorism threats identified by CDC; Anthrax, small pox, botulism, plague, tularemia and hemorrhagic fever all but small pox virus are agents with which veterinarians are already familiar (Pal *et al.*, 2017).

4.2. Public health

Graduating veterinarians swear that among other obligations, they will use their scientific knowledge and skills for the benefit of society through the promotion of public health (AVMA, 2003). Some have commented on the natural tension which seems to exist in the oath where “protecting animal health” and “conservation of animal resources” are perceived to conflict in some circumstances with the “promotion of public health”. But in an increasingly human dominated world the health and well-being of humans will take precedence. Thus, as Schwabe suggested so many years ago, human health indeed provides the most logical unifying or apical cause in veterinary medicine’s hierarchy of values and provides an important pathway for veterinary medicine to evolve successfully in the future (Schwabe, 1984).

Veterinarians contributes to improvement of human and public health by improving agriculture and food systems, advancing biomedical and comparative medical research, preventing and addressing zoonotic diseases, enhancing environmental and ecosystem health, and helping manage 21st century public health challenges (Walsh *et al.*, 2003).

4.3. Food safety

Food safety challenges are complex both in the developed and developing world. Food is the fundamental fuel for human health but also a potential vehicle for disease transmission. In addition to the traditional food borne disease species such as *Escherichia*, *Salmonella*, *Campylobacter*, and *Listeria* new pathogens are emerging and more foods can now transmit potential food borne pathogens. Central to food safety is the occurrence of food borne diseases many of which are complex and thus require diverse stakeholder participation such as the one health approach to combat (Institute of medicine, 2012). Food borne diseases have taken on new dimensions due to international transport of foodstuffs, increasing demands for animal protein, and opportunities for spread of infectious diseases (Kahn, 2011).

With the ever growing global population, it is vital to provide safe and adequate food and water. The movement of people, animals, and agricultural products can quickly spread disease pathogens around the world. Globalization of the food supply has spread livestock and agricultural crop diseases into previously

unaffected areas. Several emerging infectious zoonotic diseases threaten the safety of our food supply and the control of these diseases requires the collaborative efforts of various health workers. Veterinarians have the expertise to address food production practices from “farm to fork”, ecosystem management and microbial contamination problems associated with food safety (Osburn *et al.*, 2009).

4.4. Environmental pollution

Environmental pollution is the introduction of contaminants into the environment that cause harm or discomfort to humans or other living organisms, or that damage the environment which can come in the form of chemical substances or energy such as noise, heat and light (Gray, 2014).

Pollution and contamination has greatly reduced the health and sustainability of our environment. Such degradation of the environment will continue to create favorable settings for the expansion of existing infectious diseases, as well as increase the number of acute and chronic non-infectious disease events detrimental to both human and animal health (AVMA, 2008). A study by the World Health Organization (WHO) determined that an estimated 24% of the global burden of disease and 23% of all global deaths can be attributed to environmental factors (Barrett *et al.*, 2011). WHO estimates that about a quarter of the diseases facing mankind today occur due to prolonged exposure to environmental pollution (Kimani, 2007).

The One Health approach considers the health of the environment, humans and animals are interrelated. Indeed, both animals and humans live in the same environment, sharing air, water and food. If there is a poor health for the environment, there is a poor health for people and animals. Veterinarians can contribute to the health of the environment because agricultural contamination may lead to contamination of foods of animal origin. Moreover, these foods can be used as sentinel for monitoring contamination in the environment. For example, pesticide contamination of honey can be related to the contamination source and could reflect the specific pollution of an environment (Panseri *et al.*, 2014). The use of animal sentinel for health hazards is very helpful to detect and manage more quickly and efficiently shared health risks (Rabinowitz *et al.*, 2009).

Because veterinarians work at the interface of human, animal, and environmental health, they are uniquely positioned to view this dynamic through the lens of public health impact. Significant changes in land use, expansion of large and intensified animal production units, and microbial and chemical pollution of land and water sources have created new threats to the health of both animals and humans (Zinsstag *et al.*, 2005).

4.5. Emerging infectious diseases

An emerging infectious diseases (EID) are diseases that have never been seen before or some are previously documented but without known etiology and one that has developed new attributes (like, resistance or virulence) or a disease of which true incidence increases in a significant way in a given population, in a given geographic area and during a given period, in comparison with the usual epidemiological situation of this disease (Claude *et al.*, 2012).

There is a strong link between emerging infectious zoonotic diseases and increasingly greater interaction among humans, livestock, and wildlife (Daszak *et al.*, 2000). Infectious diseases globally cause over 13 million deaths per year, affecting all people regardless of age, gender, lifestyle, ethnicity, economic status, and causing suffering, poverty, and challenges to development in poor countries (WHO, 1999). Approximately 75% of emerging diseases are zoonotic (Taylor *et al.*, 2001).

WHO has tracked many zoonotic infectious disease outbreaks between 1996 to present, including Ebola virus outbreaks in Central Africa, Nipah Virus in Malaysia and Singapore, avian influenza in Hong Kong, and Hantavirus and West Nile virus (WNV) in the US. Each outbreak has helped the human medical and public health communities recognize that the links between human and animal disease are real. Moreover, it is becoming better understood among public health officials that preventing and controlling diseases in animals can be an important component of preventing and controlling disease in humans. Veterinarians can play significant role in the identification of source of infection, means of transmission and about the nature of EIDs (King and Khabbaz, 2003).

4.6. Antimicrobial resistance

Antimicrobial drugs have undoubtedly saved the lives of millions of people. However, the widespread use of such drugs in hospitals, health centers, the community and agriculture has led to the emergence of resistance among pathogens (WHO, 2000). Antimicrobials are commonly used in food producing animals for treatment, prophylaxis and growth promotion. However, such use can also lead to the development of drug resistant pathogens, which may be transmitted to humans through the food supply. Veterinary Public Health leadership is therefore essential to evaluate and respond to the human health consequences of using antimicrobials in food producing animals (WHO, 2002). Today, the emergence and spread of antimicrobial resistance (AMR) is believed to be threatening the success of infectious disease treatment and prevention around the world (WHO, 2001).

The activity of veterinarians related to pharmacology and drugs is often cross-disciplinary, covering companion and food producing animal practice, food security, and official drugs residue controls. However, the rising importance of prudent use of antibiotics makes this topic suitable to become a specific area under the one health approach. Indeed, the concern on AMR increased in recent years; it is considered a major public health threat, due to misuse of antibiotics in both human and animal therapy. Therefore, it is a cross-disciplinary issue, engaging veterinarians to reduce and monitor antimicrobial usage in livestock (WHO, 2015).

Veterinarians and colleagues at the CDC, Food and Drug Administration (FDA), United States Department of Agriculture (USDA) and selected state health departments have established a key sentinel surveillance system called the “National Antimicrobial Resistance Monitoring System (NARMS) for enteric bacteria. NARMS monitors and reports on antimicrobial resistance of six pathogens (obtained from human infections) to 17 different antimicrobials in 27 sites covering 158 million people in the US (56% of the US population). USDA and FDA coordinate testing for antimicrobial resistance of *Salmonella*, *Campylobacter*, and *E. coli* isolates from infections in a number of food and companion animals (CDC, 2000).

4.7. Companion animals

Veterinarians also have contributed to public health through the care of companion animals. Fifty seven percent of all U.S. households own a dog, cat, or both. In addition, millions of exotic animals, birds, and reptiles are kept as pets (Brown and Silverman, 1999). Although pets enrich the lives of humans, they also potentially can threaten public health. Veterinarians help educate the public about prevention of zoonoses; vaccinate large numbers of pets for zoonotic diseases, such as rabies and leptospirosis; and reduce the level of ectoparasites that can transmit human diseases and intestinal worms, such as roundworms, which can cause serious health problems in humans. The 60,000 private practice veterinarians in the United States form a valuable front line for detecting adverse health events, reducing zoonotic diseases, and delivering public health education (NRC, 2005b).

4.8. Global climate change

Projected climatic changes are expected to increase the risks of vector borne and other diseases in humans and animals. Many of the potential impacts of climatic change will take years or even decades to become obvious. Consequently, there is a need for greater integration of data collecting efforts by all concerned. Much of the burden of global climatic change will fall on developing countries with few monitoring capabilities (WHO, 2002).

Vector borne zoonotic diseases such as yellow fever and certain encephalitides may become more widespread as the geographic range of their mosquito vectors increases. Warming temperatures and shorter winters played a part in the establishment of the tropical diseases dengue and malaria in more temperate areas of the world during the 1980s and 1990s (Daszak *et al.*, 2000). In addition to widespread of vector born diseases climate change has predicted impact on the supply of food to the rapidly increasing human population and the increased incidence of food borne diseases. Veterinarians are involved in awareness creation about the effect of climate change on animal health as well as zoonoses and public health; surveillance and response to diseases occurred due to climate change (Australian Veterinary Association, 2017).

5. Challenges and Opportunities

5.1. Challenges

There are several challenges ahead that need to be addressed carefully to ensure the implementation of One Health concept. Professionals within the One Health field argue that there is a problem of collaboration between professions working within the framework, specifically those from veterinary and medical communities. The inability to effectively coordinate professional services could jeopardize communication and surveillance regarding emerging zoonotic disease and curb the opportunity for collaboration in other interconnected matters of public health concern. In addition to the inability to collaborate effectively across disciplines the challenge of capacity can be an issue for government bodies as not all countries have the ability to support a one health agenda. This lack of resources and informed personnel may prove difficult in establishing networks between animal, human, and environmental health professionals (Papadopoulos and Wilmer, 2011).

5.2. Opportunities

One Health approach provides the opportunity for the veterinarian to collaborate intimately with the physician, public health officials, wildlife and environmental health professionals for better understanding of diseases affection in human being and animals. One Health also enables creation of disease free ecosystem (Pal *et al.*, 2014).

South Africa reduce reported canine cases of rabies from nearly 500 with high number of human cases in 2007 to 37 canine rabies cases per year with no human cases reported by 2014 through the implementation of a centralized program involving large-scale dog vaccination aligned with public health dog bite management centers, this was among the opportunities gained from one health (University of Minnesota, 2015). In 2004, highly pathogenic Avian Influenza (H5N1) outbreaks were occurred in many parts of the

world and this outbreak was successfully controlled through adoption of One Health approach (FAO, 2008). The response to the introduction of West Nile virus into North America was another example of a reactive multidisciplinary response in which physicians and veterinarians around the world jointly worked to determine its cause and source (Lanciotti *et al.*, 1999).

6. Conclusion and recommendations

Veterinarians play an important role in major issues of One Health including bio terrorism preparedness, food safety, environmental pollution, public health, control and prevention of emerging infectious diseases, anti-microbial resistance, global climate change and companion animal practice. In addition to this veterinarians are well grounded in population health, comparative medicine and preventive medicine. So they can play a leadership role in one health approach. Even though veterinarians can play a leadership role, an integrated (multi disciplinary) approach is the key to promoting One Health.

Based on the above conclusion the following recommendations are forwarded:-

- ❖ Overcome a tendency for veterinarians to communicate solely within their professions rather than to communicate across disciplines.
- ❖ Veterinarians should be involved as stakeholders in local, national and global One Health initiatives to contribute towards protecting animal and human health, and the environment.
- ❖ Ensure that veterinarians are part of planning, implementation, management and advisory processes of One Health activities at all levels locally and globally.
- ❖ Veterinarians should not only be restricted to animal practice rather they should be involved in public health, environmental health, and food safety control.

Conflict of Interest

None

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