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One Health and its Practical Implementation in Ethiopia

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Introduction

One Health is a modern global movement to promote collaborative efforts between different health related professionals, including medical doctors, veterinarians and many other scientific, health, environmental and other related disciplines. Although there is not an agreed One Health definition, a useful one is; "the collaborative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals and our environment. The importance of the program is increasing as the expansion of human and animal populations, ecological changes due to human impact and climate variations, and technological advancements facilitating global human, animal, and product movements have resulted in an increased risk of disease transmission between animals and people. It embraces the idea that a disease problem impacting the health of humans, animals, and the environment can only be solved through improved communication, cooperation, and collaboration across disciplines and institutions [1].

The aim of One Health is to improve health and well-being through the prevention of risks and the mitigation of effects of crises that originates at the interface between humans, animals and their various environments [2]. Cause of treatment failure in animals and humans attributable to antimicrobial resistance arising from the use of antimicrobial agents in food-producing animals or companion animals is a serious concern for public health [3].The areas of work in which a One Health approach is particularly relevant include food safety, the control of zoonosis (diseases that can spread between animals and humans, such as flu, rabies and Rift Valley Fever), and combating antibiotic resistance (when bacteria change after being exposed to antibiotics and become more difficult to treat. One Health for Central and Eastern Africa (OHCEA) is a network of universities in Central, West and Eastern Africa which are collaborating to build One Health capacity and academic partnerships in the region. OHCEA membership includes twenty-four Central, West and Eastern Africa Schools of Public Health, Veterinary Medicine and Environmental Science; and US partner institutions: University of Minnesota (UMN) and Tufts University. The current OHCEA membership spans eight countries: Kenya, Uganda, Tanzania, Rwanda, Ethiopia, Democratic Republic of Congo, Cameroon, and Senegal, working together to strengthen public health education, systems, emergency preparedness and response (www.ohcea.org)

The collaborative approach of One Health has even been suggested to alleviate poverty in the developing world through diminishing burden of illness associated with under-reported zoonotic disease and strengthening access to social services in rural settings [4]. In Ethiopia, even though the collaboration between disciplines was not new, One Health was officially launched in 2013. But, there is no still well documented information regarding one health program [5].

Therefore, the objectives of this seminar paper were:-

To review the principles of One Health program, its practice, challenges and future implications.

Objectives of One Health Program

Meeting new global challenges head-on through collaboration among multiple professions: Veterinary Medicine, human medicine, environmental, wildlife and public health [6]. Acting with professionalism in everything that they do, providing high quality education and participating in life-long learning; providing outstanding veterinary medical care, building interdisciplinary teams both within and outside the college to address the needs of students, college community, patients, and society; seeking partnerships to bring together individual knowledge and talents from across the college, university, and profession; actively participating in activities and university initiatives that impact our college, maintaining respect and appreciation for areas outside of our individual interests and expertise, creating a safe environment for engaging in candid and respectful discussion of differing opinions, recognizing that people matter, valuing the contributions that individuals, in different roles, bring to achieve the vision and missions [7].

Removing artificial boundaries that divide us, understanding and utilizing all of our strengths so that each person has the opportunity and tools to achieve their full potential, working to provide and accept honest and constructive feedback, maintaining an attitude of flexibility and adaptability, avoiding the 'it's always been done that way' trap, being open to having our opinions challenged in a constructive manner; looking for new opportunities to lead the profession in education, discovery, patient care, and public service, proactively responding to and providing creative solutions to address the needs of our society [8].

Application of One Health

Effective long-term public-private partnership (PPP) is necessary for the success and sustainability of the program. Monitoring, evaluation and implementation of this program will be a complex task, given the involvement of a large number of partners, wide geographical coverage and multidisciplinary approach. Successful adoption of the program would have the advantage of: Pooling and thus more efficient use of expertise and financial resources to address a common problem across the three health systems, synergy of different institutional perspectives and experiences. Coordinated multi-sectorial action that brings together those working on human, animal and ecosystems health is needed to address the impact of diseases occurring at the animal–human–ecosystems interface [9].

A conjoint effort from part of medical practitioners, veterinarians as well as ecologists and environmentalists is requisite in implementing the concept which still remains as a theoretical idea [10].The 5 C's (consensus, collaboration, cooperation, coordination and commitment) for implementing the one health includes consensus among stakeholders, collaboration among professionals, cooperation among inter–disciplinary groups, coordination among partner agencies and commitment (political and financial) by donors, partners, organizations and governments. A financial assistance of US $1.3 billion allocated for one health per year till 2020 for low and middle income nations [11].

One Health From Veterinary Perspective

The three strongly interlinked pillars of veterinary medicine are: Animal health, Public health and Animal welfare. The Core domains of Veterinary Public Health are diagnosis, monitoring, surveillance and epidemiology; control and prevention of zoonosis; food safety; biomedical research; management of wildlife populations and management of public health emergencies [12]. The following are veterinary perspectives in One Health Program

Zoonotic Disease

Any disease or infection that is naturally transmissible between animals and humans [13]. The current epidemic of Ebola virus in West Africa and the 2009 influenza A (H1N1) pandemic serve as stark reminders of the unpredictable nature of pathogens and the importance of animals in the ecology and emergence of viral strain [5]. Over 70 % human pathogens originate from animals for instances: Anthrax, Influenza, BSE, Brucellosis, Campylobacteriosis, Lyme Borreliosis, Rabies, Toxoplasmosis, Tuberculosis, Salmonellosis, Leishmaniasis, Echinococcosis [12]. About 75% of emerging infectious diseases over the past decades have been caused by pathogens originating from animals or their products. Veterinarians find themselves on the front lines in recognizing, diagnosing, and responding to these diseases [14].

Antimicrobial Resistance

The cause of treatment failure in animals and humans attributable to AMR arising from the use of antimicrobial agents in food-producing animals or companion animals is a serious concern. Internationally, it is estimated that the volumes of antimicrobials used in food animals exceeds the use in humans worldwide. Infections in humans with organisms that exhibit AMR are found most commonly among people who have been in hospital. However, people in community settings including overseas travellers and farmers also present with antimicrobial resistant infections, and the relative contributions of AMR acquired from community settings, food animals and companion animals is not known [3].

Disaster Preparedness

The challenge to be better prepared for natural and man-made disasters is a huge concern for all, but veterinarians are in a unique position to appreciate the implication of disasters on both human and animal communities. Currently, the overwhelming majority of disaster relief efforts are targeted only, but veterinarians understand an extricable link between humans and animals. Drawing on their knowledge of animal epidemiology, health husbandry and behaviour, veterinarians can uniquely contribute to improving quality of life for both animals and humans in the event of disaster [15].

Food Safety

The convergence of people, animals, and our environment has created a new dynamic one in which the health of each group is inextricably interconnected. The challenges associated with this dynamic are demanding, profound, and unprecedented. While the demand for animal-based protein is expected to increase by 50% by 2020, animal populations are under heightened pressure to survive, and further loss of biodiversity is highly probable [16]. It's increasing important to provide safe and adequate food and water for the world as the global population to the brink of seven billion consumers. Veterinarians have the expertise to address food production practices, ecosystem management and microbial contamination problems associated with food safety [17].

Public Health

Factors which contribute threats and degradation of environmental resources that sustain life are: changes inland and water use, over grazing, encroachment of farming and human activities in to wildlife habitat and toxins induced by sewage pollutants. Global trading mass transportation, industrialization of food processing, altered tropism (organism's natural response to stimuli) also contributes to the increasing and hygiene, the center for disease control prevention, pressure and spread of diseases and contamination. Veterinarians, their education in multi- and cross species biological interactions, clinical approaches, and preventive medicine make ideal and critical public health collaborators [18].

Wildlife Conservation

Over 60% of existing and emerging pathogens affecting humans originate from animals; of those, 75% came from wildlife [19].Human encroachment into wildlife habitats invites these infectious agents to become pathogen for human populations. It is important to identify the routes by which these agents find their way to the human host emerging health threats will create a culture of prevention among different constituent groups.

Environmental Health

The environment includes "all of the physical, chemical and biological factors and processes that determine the growth and survival of an organism or a community of organisms". Another concept, Ecosystem, is "comprised of all of the organisms and their physical and chemical environment within a specific area" [20]. Fundamentally, the environment affects how organisms live, thrive, and interact and must be considered in order to achieve optimal health for people and animals [21].

Human and animal well-being relies on the integrity of ecosystems. Ecosystems underpin processes essential to our survival, known as ecosystem services. These services include supporting services (nutrient cycling, soil formation, primary production); regulating services (climate and flood regulation, disease buffering, water purification);provisioning services (food, water, fuel); and cultural services (aesthetic, spiritual, mental health) that make the persistence of human and animal life possible [22]. Even though, ecosystems can maintain healthy populations, mismanagement or rapid alteration due to human pressure leads to increasing challenges to the maintenance of healthy ecosystems including climate change, deforestation and intensification of agricultural systems, freshwater depletion, and resultant biodiversity loss which can also be associated with disease emergence [23].

Future Implication and Opportunities of One Health Program

Adopting One Health

The need for One Health approaches is more important than ever although it is an old concept. The risks of not adopting a One Health approach were clearly evident in 1999 when a lack of coordination between veterinary and human diagnostic laboratory delayed recognition of the outbreak of West Nile fever in New York City [24]. The division of labour among public institutions makes for a segmented or vertical organization of work, in which institutions operate independently of one another and from the perspective of their discipline or sector. This unavoidably leads to gaps, and sometimes to overlaps. For practitioners working in this framework, the starting point for action tends to revolve around the question "What am I responsible for?" rather than "What needs to be done?" Changing the organization of work across disciplines to start with this latter question implies a substantial reorientation along horizontal lines in which regular communication takes place between practitioners at work in different disciplines and sectors. The followings are strategies to adopt the program that are communicating consistent messages, legislation that facilitates selective interaction between medical and veterinary services, strengthening education, providing an appropriate incentive and institutional framework and establishing trust among the different actors [25].

The value of One Health goes well beyond cooperation between veterinarians and physicians although a major trust for One Health has emerged from the veterinary community. Importantly, "in the past decade, the concept of One Health has expanded beyond an examination of the human-animal health interface to encompass the health and sustainability of the world's ecosystems" [26].

Major Challenges of One Health Program

There are many uncertainties that need to be assessed (both in terms of time and money) and entry points for actions to be determined with the inherent complexity and the stage of our understanding of OH issues. It is often difficult to know where to start and how to prioritize actions, many options arise out of analysis of problems, and solutions will tend to be highly context-specific. In fact, there is an enormous challenge in assessing benefit cost ratios where there are little comparable measures (different economists) for benefits across the health domains. The limits and costs of agency interaction cannot be under estimated: cash-strapped bureaucracies have different priorities and there are frequently inter-ministerial rivalries over budget allocations [27].

The legal barriers to interaction, or other structural barriers to cooperation, considerable uncertainties on who should pay for addressing the problems between sectors, between central and local, private and public, and between countries, high transaction costs for collaboration (example, for different ministries to come together for discussion and planning). There may also be cultural and perception issues to overcome. It often requires cultural shifts within agencies, and new systems and capacities to be built and changes in attitudinal relationships between professions (veterinarians, doctors, extension workers, biologists and workers in the area of the environment and natural resources)[9].

Humanity faces many challenges that require global solutions and one of these challenges is the spread of infectious diseases that emerge and re-emerge from the interfaces between animals, humans and the ecosystems in which they live. This is a result of several trends including the exponential growth in human and livestock populations, rapid urbanization, rapidly changing farming systems, closer integration between livestock and wildlife, forest encroachment, changes in ecosystems and globalization of trade in animal and animal products. Moreover, status thinking, education system, administrative structures and legislation hinder its future implementations [28].

One health approach is getting worldwide acceptance as strategic and holistic approach in combating global health problem which the connections between humans, animal and environment. In addition to this economic, cultural and physical factors that influence health also recognized by the approach. The emerging and re-emerging diseases were driven by several factors. Thus includes genetic and biological factors (microbial adaptation to macro- and micro environmental changes, changes in host susceptibility to infection) environmental factors (climatic change, ecosystems change and human and animal demography and densities changes) and socioeconomic and political factors (increasing international travel and trade, social inequality, poverty, famine, changes in economic development and land use). According to Institute of Medicine report, these factors were referred as driving forces for emergence of new zoonotic diseases and creates favourable condition for microbial population to be appeared [29].

Problem of Working Collaboratively

One Health approach should emphasize interdisciplinary collaboration, involving different disciplines both within and beyond the health sciences to address transnational health issues and solutions. One Health approach offers an even broader multi-systems perspective on health means and the inclusion of a wider range of expertise to include areas of academic specialization [30].

Conceptual and methodological differences between professionals of veterinary and human medicines are the most substantial challenges faced collaborative working across the globe [31]. Especially this challenge appears in determining the appropriate level of integration of different disciplinary methods and concepts, translating each discipline's terminology and concepts into the other participating and mediating different assumptions and views about what counts. As evidence, how it can be acquired and how it can be validated, incorporating stakeholder input in research topics and design, facilitating debates over objectivity versus social construction and combining preferences for reductionist or holistic approaches [32]. Scientific

knowledge and technical achievement is more important for successfulness of One Health approach. To develop more holistic and diverse understandings of health across cultures, species, ecosystems and local communities there are a lot of global challenges [31].

This is not consistent with the goals of global health effort which stresses the value and necessity of seeking participation from local communities and building interventions that draw on the capacities and resources of those communities [33]. Clearly involving community members in health projects is essential for planning interventions which do not inadvertently have negative health effects due to a failure to take into account the complexity and specificity of local conditions. Engaging communities in land-use decisions and approaches to disease control should be part of an integrated One Health approach [34].

Socio-Political Challenges

Application of one health concept will be challenged with socio-political issues because of people's belief and attachment with right and freedoms even though they cannot pay sacrifice for the concern of others. For this reason zoonotic disease control and prevention policy making depends on individual behaviour than factors that drive disease emergence/re-emergence [35]. Egoism, perceptions, short term solutions, populism and avoiding argument are characteristics of politics which result in challenges for emerging zoonotic disease prevention and control policy making and affect development of effective strategies for addressing EIDs [36].

Scientific evidence and societal perceptions proved that political intervention had role in zoonotic disease prevention and control. Indeed in the face of scientific uncertainty and ethical ambiguity, ideological perspectives and short-term political considerations often supplant effort to devise effective long-term interventions [36]. In the case of zoonotic and EID powerful interests dominated early government responses, leading policy makers to make decisions that avoided public controversy but had major economic consequence [37].

Ethical Concern

Effective zoonotic disease combating policy relays on its implementation context and especially on its alignment with stakeholder and public principles [38]. Like in modern liberalism there should be a few agreements over what is in the community interest and an understanding of the values which sustain it is required for the successful achievement of zoonotic disease prevention. However, this is in particular what has been missing in epidemics where fracture lines differences and value conflicts have become noticeable [36].

The situation of ethical concern is complex and resources are limited. But where decisions need to be made, its ethical differences are exposed to challenge of other occurrences that stakes are happening to be high evidences and the implications of actions are uncertain [39]. This discrepancy could be due to beliefs that deal with ecological and environmental issues can clash with the significant of people's connection to public goods, protection of individual and animal welfare [36]. This condition results adverse costs of public fear, doubt, misinformation and disobedience with public health directives [40].

Successful response of outbreaks in a One Health approach wants to address the above stated ethical concerns. To do this successful diverging values and logics must be negotiated to realize effective, sustainable and just solutions by considering the public interest as an apriority task [35].

Legal Challenges

The legal frame work that made for control and prevention of EIDs has its own set of challenges [37]. The laws that govern disease outbreak control mechanism in most jurisdictions are scattered, confusing and interpreted based on interest of individuals whose idea is dominant at the time of decision making [36]. The other complication and confusion appears to the epidemic regulatory structures rather than facilitating public health responses to EID (Emerging Infectious Diseases) [41]. The cost of laws restricts development of greater global health inequities with consequential effects for health outcomes. In order to simplify EID related legal complications in between economic development and health security, additional precise and clear cut recognition is needed of who are the principal beneficiaries and who bears the expenses of EIDs [42].

Challenge Of Managing Wildlife Ecosystem

The ecosystem changes due to driving forces can alter the state of well-being and leads change to the interaction between human and animal population [29]. It is important to identify the routes by which the wild animal reservoirs agent found their way to the human host and their impact on the animals that serve as the primary and intermediate hosts [43]. It is intrinsically more difficult to monitor diseases in wildlife due to afraid of aggressive wild animals, lack of knowledge and experience, inadequate financial recourse and lack of road. Wild animals are not constrained by boundaries and can extend over large distances. This is particularly for migratory birds or mammals which seasonally move across continents or vast oceans which they cause spreading of disease [39]. The declines and disappearances of different wild life species are due to disease of a certain pathogen. Practical difficulties can exist in determining the mortality rates because of dispersal after disease outbreak. It can also be difficult for many different reasons to find and count both sick and dead wild animals [43].

Zoonotic disease surveillance in wildlife clearly represents a great predictive modelling and known patterns in host range can be used to focus the effort on the species and pathogens that pose the greatest risk of zoonotic emergence. The surveillance and monitoring of disease outbreaks in wildlife populations are particularly relevant in these days of rapid human and animal translocation and the contact between wild and domestic animals is close and the threat of a bioterrorist attack is very real [37].

Neglected And Emerging EID

One Health is still applying itself to the disease problems it has addressed, and it is also very aware that there are large areas of what amounts to 'uncharted territory' of disease and situations yet to be addressed; the two main ones being

1. Neglected and endemic zoonosis and
2. Recent emerging or reemerging diseases.

1. Practices of One Health Approach In Developing Countries

Various opportunities have emerged to promote health in the continuously changing human, animal and environment interface even though there are obstacles and limitations to come to the mind set of One Health [5]. For example, ICONZ, which involves

21 European and African universities and research institutes is working on case studies of zoonotic disease clusters in seven African countries: Morocco, Mali, Nigeria, Uganda, Tanzania, Mozambique and Zambia. The need for organizational control programmes to consider both human and animal health factors, along with monetary and other benefits to society, can encourage participation from public health services in interventions that may otherwise never be cost-effective from a health sector point of view alone. This large collaborative project targeting the neglected zoonotic diseases is filling vital knowledge gaps particularly on the burden of neglected zoonosis, and provides a strong evidence base to support policy decisions at the international, regional and national levels in developing countries [4].

All representatives from governmental and private organizations furthermore appreciated OHCEA activities in Ethiopia so far and emphasized the need to consider the following points: focusing on advocacy of OH approach through creating more awareness forums to bring attitude change and get buy-in of policy makers, working on way of registering OHCEA in Ethiopia and formulating short and long term goals at national level, strengthening national committee and revising the existing membership to include all relevant OH stakeholders, soliciting funds or grants to make the present project sustainable after the current funding period expires, preparation of national strategic plan based on organized and well-designed assessment tool to know the gaps in various institutions/ organizations, documenting and sharing the lessons learnt from previous ways of fighting pandemic threats in the form of success stories, working on gender issue to address zoonotic diseases.

History of One Health in Ethiopia

One Health was launched in Ethiopia on March 16, 2013 at Harmony Hotel in collaboration of Jimma University with OHCEA Secretariat manager and various delegates from local and international organizations. Key note address was delivered through delegates of ministry of health and ministry of agriculture and both expressed the need for OH approach in the control and understanding of emerging diseases. The issue of collaboration was not new for the Ethiopian system since the two ministries in particular and other relevant disciplines were working together to address different health problems such as the case of unknown liver disease in Western part of Tigray region and the avian influenza. They also said that, the need for working together is timely approach not only to solve communicable diseases but also the non-communicable diseases which affects both livestock and human beings [5].

Practice and Challenges of One Health Approach in Ethiopian Context

Practice: The Ohio State University Health Science colleges established the "Ohio State University Health Sciences Ethiopia One Health Partnership task force" in August, 2012 aiming to create and develop a sustainable and mutually beneficial partnership with Ethiopian academic and service agencies in teaching, research and outreach by embracing the principles of One Health. The task force has been conducting activities such as: service learning, clinical, outreach and research projects that involved more than 300 Ethiopian and 100 Ohio State students, delivered more than 40 courses for more than 300 Ethiopians in Annual Summer Institutes, engaged in high impact societal problems such as Rabies and Cervical cancer, developed novel and rapid field-deployable diagnostic systems against key infectious diseases such as Bovine Tuberculosis, developed novel approaches for training and research delivery using electronic approaches such as iTunesU based courses, MAGPI(Mid-Atlantic GigaPop in Philadelphia for Internet2) and iPAD based data collection system and others [44].

One Health Central and Eastern Africa (OHCEA) network was established in 2011 as a network of seven public health and seven veterinary Higher Education Institutions that are located in 6 countries in the Eastern and Central African regions to address current and future global health challenges through the One Health approach. Ethiopia, being a member of OHCEA, has been sharing experiences, challenges and lessons to date from countries: Rwanda, Kenya, Uganda, Tanzania and Cameroon that have established on-going national One Health structure or "platform". This is because a national One Health platform provides government and

Stakeholders with a mechanism to improve multi-sectorial coordination and collaboration to strengthen the prediction, prevention, detection and response to emerging pandemic threats [7].

Challenges: The main focus of One Health is on the control of various infectious diseases that can be transmitted among and between animals, human and the environment [45]. As Ethiopia has a great coverage of pastoral area with inadequate veterinary and health infrastructures and facilities, low number of health professionals and less supply of medical inputs, the issue of OH is very critical. The livelihood of pastoral community of Ethiopia is mainly dependent on livestock production [46]. This condition made the people to have an intimate relationship with animals [47]. However, there is knowledge gap both in the community and health professionals about zoonotic infection in the rural areas. Apart from this, there is no trend of collaborative work between animal and human health professionals to create awareness about zoonosis to the community which demands policies and strategies that motivate professionals and disciplines to unite for human, animal and ecosystem health [48].

One Health Initiation in Ethiopia

One Health initiative in Ethiopia draws its national recognition. The team includes researchers, clinicians and students from the Ohio State colleges of Nursing, Public Health, Medicine, and Veterinary Medicine, who focus on health threats such as cervical cancer, rabies, neonatology, food and environmental quality in East Africa. The partnership has helped to install a capacity-building environment for faculty and students, created reciprocal adjunct faculty appointments, conducted workshops and field training through the One Health Summer Institute and increased opportunities for students. The partnership integrates academics and practitioners from Ohio State, Ethiopia and East African countries to leverage their knowledge, skills and resources to contribute to improving biologic and economic health in developed and underdeveloped countries

Benefits of a One Health Approach

American Veterinary Medical Association(AVMA) has noted the benefits of 'One health' which includes improving animal and human health globally through the collaboration among all health sciences, meeting new global challenges through interdisciplinary interactions, developing centers of excellence for education and

training in specific areas, increasing professional opportunities, and gaining scientific knowledge to create innovative programs to improve health [49,50]. 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 head-on through collaboration among multiple professions (veterinary medicine, human medicine, environmental, wildlife and public health), 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 [50].

The importance of one health is increasing as the expansion of human and animal populations, ecological changes due to human impact and climate variations, and technological advancements facilitating global human, animal, and product movements have resulted in an increased risk of disease transmission between animals and people. It embraces the idea that a disease problem impacting the health of humans, animals, and the environment can only be solved through improved communication, cooperation, and collaboration across disciplines and institutions.

Interdisciplinary programs more in education, training, research and established policy; more information sharing related to disease detection and diagnosis and as well as education and research; more prevention of diseases, both infectious and chronic disease; new therapies and approaches to treatment for unmet needs [51]. One Health can add value and reduce costs in five ways:

1. Sharing health resources between the medical and veterinary sectors,
2. Controlling zoonosis' in animal reservoirs,
3. Early detection and response to emerging diseases,
4. Prevention of pandemics and
5. Generating insights and adding value to health research development [52].

Joining Up Health Resources

One Health is synergistic, as it aims to shift the focus from single diseases to strengthening public and animal health systems, while also recognizing the environmental and social drivers of health [53]. To achieve this synergy, there must be a delicate balance between improving collaboration and cooperation while also acknowledging the distinct objectives and management principles of each discipline involved. If One Health is successfully implemented, there should be improved achievement and efficiency in logistics, the enhanced provisioning of services globally, and the strengthening of health systems [54].

Human health expenditure in developing countries was estimated at US$521 billion in 2012 [55] and veterinary health expenditures is less solid, but combining data from a number of studies suggest an expenditure of US$1bn – US$2bn on public animal health services [56]. Best available evidence suggests that shared laboratories, education and management of zoonosis can constitute 5% of the human health budget and 40% of the veterinary health budget implying that the total savings of joined-up services could be US$2.68bn per year [57].

Controlling Zoonosis In Animal Reservoirs

The convergence of human, animal and environment has made the routine disease prevention and control process difficult and unsuccessful creating a new concept, One Health, in which the health of each group is interconnected and dependent [58]. Studies estimate that around 14% of livestock in developing countries each year are infected with one or more zoonosis and that each infection reduces their productivity by around 10% [59]. In addition to morbidity, mortality is an important cause of loss for livestock. The annual mortality rate of livestock is high in developing countries particularly in Africa [60].

The human health costs of zoonosis are typically equal to or greater than the livestock sector losses, a trend which is becoming more pronounced with time [61]. To reduce such losses, One Health approach plays a significant role in the prevention and control of zoonoses [62].

Adding Value to Health Research And Development

One Health (OH) leads to better research and disease control program as well as ecosystems better able to provide health as a regulatory service. Evidence for the value of OH has been presented at major conferences with the most recent including: Addis Ababa, Arusha, Davos [30,59,63]. Important meetings have also been held where global health leaders endorsed the approach: these include gatherings in Winnipeg, Bellagio, London ,Stone Mountain. A recent review identified 41 major OH initiatives [64], another review showcased 31 OH projects [65] and a recent book sets out ecosystem health and practice [66].

Early Disease Outbreak Detection

It is estimated that outbreaks have cost on average US$6.7bn from 1997–2009 [67]. Human and animal health being investigated as a single social system makes control of diseases more cost effective (e.g.Rabies, Brucellosis; in comparison to looking at economic efficiency in one sector only) [64]. An integrated One Health system improves global health surveillance and preparedness. For example, it could ultimately reduce the lag time for detecting emerging diseases, as well as improve response and, importantly, prevention [68].

Pandemic Prevention

There is considerable concern over the possibility of a civilization-altering pandemic or plague in addition to the ongoing losses from disease outbreaks. These have occurred regularly but infrequently throughout history and pre-history. In a landmark study, the World Bank considers the possible impacts and costs of averting high impact but low probability pandemics. A severe pandemic costing US$3 trillion may occur, on average, once in a hundred years. If the investments in One Health systems are made and such a pandemic is prevented, the global expected benefits are US$30 billion per year. Every year, an investment of US$3.4 billion would produce an expected benefit of US$30 billion for the international community [69].

Conclusion and Recommendations

One Health approach in general promotes collaborative approaches to the collection, analysis and interpretation of a wide range of data to anticipate and respond to the rapidly changing environment and its impacts on the health of human and animal communities. This approach can only be successful if it maintains partnerships across various professional sectors and

engages stakeholders within the human, animal and environment categories. It stimulates more innovative collaborative intervention options for prevention and response to diseases. Despite the large and growing body of evidence supporting its usefulness, the great majority of medical education, clinical practice, development programs and research continue to operate within disciplinary boundaries. This lack of uptake of OH approach attributes to insufficient evidence to convince practitioners and decision makers. Moreover, it is apparent that complex public health challenges will continue to emerge which can only be tackled through application of One Health [70-73].

Therefore based on the above conclusion, the following recommendations are forwarded to encourage successful implementation of One Health approach

1. Educational curriculum has to be developed, in particular at the university level that integrate human, animal, and ecosystem health and familiarize the principles of One Health.
2. Legislation should be prepared and implemented to promote One Health approach through disease reporting and decision-making processes.
3. Institutional frameworks that facilitate enhanced cooperation and communication among human, animal and ecosystem health agencies have to be established.
4. Providing of an incentive framework, through the establishment of joint budgets of the services, and the provision of special grant mechanisms for One Health activities.
5. Therefore, capacity building by training health professionals, awareness creation to the community through health extension workers and promoting collaborative health programs in One Health approach.
6. Increase investment in the global human and animal health infrastructure commensurate with the serious nature of emerging and resurging disease threats to people, domestic animals and wildlife.

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