

Review Article

One Health – A holistic solution for sustainable management of globalization-driven public health challenges

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Summary

Globalization is an inevitable and extremely complex phenomenon that involves transnational integration of culture, economy, environment, politics, and other social interest. Globally, we are witnessing multitude changes such as a rapid population growth, urbanization, international trade and commerce, agricultural intensification, and encroachment into the natural ecosystem. Further mismatching of food demand and supply, growth disparities, increasing food prices, and over utilization of natural resources are among the challenges to the economic status of a nation and its health sector. The health impacts of globalization can be both positive and negative; of course, its impacts vary based on factors such as geographical location, gender, age, literacy, and socioeconomic status. Globalization has played pivotal role in health improvements via dissemination of new medical knowledge, low-cost health technologies, fast transactions of medical supply and improvement of human rights. Thus it has shown potential positive impacts by minimizing the gaps in health inequalities between rich and poor people in the global South and North and improved the idea of healthcare for all. On the other hand, there are also shortcomings of globalization to global health, such as the spread of infectious diseases due to rapid mobility, which is emerging as the greatest threat to all. The interconnectedness of globalization and One Health is complex. Whereas, globalization is one of the main challenges to ensure global health security. One Health is a remedy to manage the negative health consequences of globalization, especially in least developed world. It is undeniable that the connection between humans, animals, and the environment calls for the attention of multi-sectorial institutes to collaborate to closely monitor and reduce the risks and consequences on health and wellbeing. One Health approach is increasingly recognized and streamlined into national and international plans and strat-

egies for effective management of zoonotic diseases, food safety, antimicrobial resistance, and climate change. Human practices such as, changes in land use and how food is produced are driving ecological and evolutionary conditions that facilitate disease spillover events and contribute to antimicrobial resistance. These changes are occurring rapidly on a large scale, both locally and globally. The pursuit of understanding human, veterinary and environmental health issues separately leads to an incomplete understanding of disease dynamics and, therefore, missed synergy for a joint mitigation of the problems. One Health actions support the primary prevention of such problems, enabling more timely and effective containment and response to public health threats at the human-animal-environment interface. In short, systematic and sustained One Health approach becomes more important than ever in order to promote and ensure health security and avert the negative impacts of globalization. Therefore, there is a need to focus on the creation of socially and environmentally sustainable forms of globalization that provide the greatest benefits and least costs, shared more equitably than the status quo.

Keywords: *Globalization, One Health, Impacts, Opportunities.*

Introduction

Though there is no universally agreed definition of globalization; economists typically use the term to refer to international integration in commodity, capital, and labor markets (Bordo *et al.*, 2003). Globalization has revealed itself in the 19th century and the second half of the 20th century. It has often been marked by periods of accelerated integration and by periods of dramatic reversals (as in the inter-war period) sometimes with devastating outcomes. The two most recent episodes of globalization were characterized by increased integration in trade, capital flows, and movement of labor, although there are differences in the importance that each of these elements played in the two episodes (World Trade Organization, 2007a).

The increasing interconnectedness and interdependence of nations, peoples, and economies are described by globalization. It has played its role in the improvement of health via the dissemination of new health-related research findings, affordable health technologies, and human rights (Labonté, 2015). Globalization is believed to impact a wider range of public health both positive and negative. Globalization plays its role in the creation, exchange, and application of knowledge, ideas, norms, beliefs, values, cultural identities, and other

thought processes as its consequence. In recent decades, the rapid spread of communication and information technologies resulting in a more widespread and intense flow of information across national boundaries via the mass media, advertising agencies, think tanks, consultancy firms, public relations bodies, educational institutions, scientists, and religious groups (Lee, 2000). Globalization also influences lifestyles (for example, diet, and smoking) and health-seeking behavior. Less directly is the impact on knowledge creation and dissemination concerning health and health care through scientific research, policy ideas, training, and business and management practices (Evans and Newnham, 1998). To supplement these principles of state security, analysts have argued, “globalization has made individual human suffering an irrevocable universal concern. While governments continue to be important, global integration of world markets and instant communication have given a role and a profile to those in business, civil society, NGOs, and intergovernmental organizations” (Axworthy, 2001).

Since the patterns of global change are complex, the complicated interconnection of humans, pet animals, livestock, and wildlife and their social and ecological environment is obvious and integrated approaches to human and animal health and their respective social and environmental contexts are required. Zinsstag *et al.*, (2012) also noted that from early historical times, the history of integrative thinking of human and animal health is briefly reviewed and ended with the establishment of universities in Europe and followed by the beginning of comparative medicine at the end of the 19th century. It is well established that humans do not live in isolation, are a part of the large living ecosystem, and are regarded to be interconnected to the inhabiting ecosystem (Scott, 2008) and that is why it is said everything is designed to become interconnected.

Like globalization, One Health is not a new concept and of course, the outcomes of the interaction that exist between ecosystems, animals, and people have modified, and continue to modify in the course of human events and history. A rational and evidence-based argument of the history of One Health should first be established on consensuses of the accepted definition of the term. However, given the many disciplines and sciences involved, coming up with a clear definition is not an easy task. Furthermore, some visionary scholars have, over a long period, tried to create awareness and advance the concept to improve the mitigation of risks and outcomes that arise at the interface between animal, human, and ecosystem health. The One Health concepts and approach of the current century encompass a re-conceptualization of disease mitigation

efforts in response to the increasing ecosystem changes over the past 100 and more years. Changes that is associated with the parallel exponential growth and concentration of the global human population. Therefore, the idea of One Health should have to be recognized as the continuously growing association between animals, humans, and the ecosystem they share (Evans *et al.*, 2014). In conditions in which vaccines and other pharmaceutical resources are unobtainable, some governments are fighting against the pandemic disease tempted to equate biosecurity with border security. Such an approach was taken to the extreme when Ebola struck West Africa in 2014, and it may have seemed at first to be better than allowing freedom of international movement to continue in the face of contagion. Therefore, the objective of this review paper is to assess the interconnectedness and impact of Globalization on One health.

Globalization

The definition of globalization is described in many ways; some define globalization in the way that it has intensified the integration of national economies in the global market through trade, investment, and financial impact. This means there is a strong and complex global exchange of goods, services, finance, productivity, and people. Others define it as the “process of denationalization of markets, laws, and politics in the sense of connecting peoples and individuals for the sake of the common good (Delbrück, 1999). Furthermore, some researchers define globalization as a free, comprehensive, and fast movement, exchange, and transfer of information, knowledge, finances, goods, services, and people between national economies globally. However, globalization is not just a simple phenomenon, and not just an economic process, it contains new trends in the economy, leading to significant changes in the allocations of workforces, reorganization, and relocation of corporations. There is a growing agreement that globalization is a form of accelerated international economic activities that require rapid movement of information, capital, goods, and services, leading to the establishment of transnational structures and the global integration of cultural, economic, environmental, political, and social processes, and global interdependency. This is a more dynamic process than a phenomenon that in itself involves and transfers many aspects of financial, technological, economic, social, cultural, and geopolitical activities. This process is institutionalized in openness and the strengthening of international understanding in trade, technology, and financial flow that affect the price and allocation of resources, including manpower in a way that reduces the impact of national policies (Frankel and Romer, 1999).

Globalization and human health

For almost 200 years, globalization has been perceived as a positive development, albeit with costs and benefits, and as progress and modernization, a broadening of humanity's scope from the local and parochial to the cosmopolitan and international levels. This attitude has changed dramatically with the Great Recession of 2008, the waves of migration of the last decade, and the emergence of global pandemics (e.g. COVID-19, Swine /Bird flu, SARS, MERS-CoV). For many, globalization is now being viewed as economic dislocation, increasing inequality, unwanted immigration, and being a vehicle for the transmission of disease (Kobrin, 2020). Globalization is a key challenge to public health, especially in developing countries, but the linkages between globalization and health are complex. Although a growing amount of literature has appeared on the subject, it is piecemeal and suffers from a lack of an agreed framework for assessing the direct and indirect health effects of different aspects of globalization (Woodward *et al.*, 2001). As borders disappear, people and goods are increasingly free to move, creating new challenges to global health. These cannot be met by national governments alone but must be dealt with instead by international organizations and agreements (Pang and Guindon, 2004). Woodward *et al.*, (2015) state that the links between globalization and health are complex and globalization is a multifaceted phenomenon that can affect health in many ways. Some of the effects of globalization are, high mobility and emerging infectious diseases, illegal trading of drugs and biomedical with potential health risks, and 'brain-drain' in the health sector as a result of labor migration from developing to developed regions. The novel coronavirus (COVID-19) is challenging the world. When there was no vaccine and limited medical capacity to treat the disease, non-pharmaceutical interventions (NPI) is the main strategy to contain the pandemic. Unprecedented global travel restrictions and stay-at-home orders are causing the most severe disruption of the global economy since World War II. With international travel bans affecting over 90% of the world population and widespread restrictions on public gatherings and community mobility, tourism largely ceased in March 2020. Early evidence on impacts on air travel, cruises, and accommodations have been devastating. While highly uncertain, early projections from UNWTO for 2020 suggested international arrivals could decline by 20 to 30% relative to 2019. Tourism is especially susceptible to measures to counteract pandemics because of restricted mobility and social distancing. The WHO has estimated that by the year 2020, non-communicable diseases, such as cancers, diabetes, obesity, and cardiovascular diseases, will cause about two-thirds of the global

disease burden. This rapid increase again illustrates the globalized risks for conditions that are mainly caused by diet, even in less developed countries that have coexistent under-nutrition. There were 151 million cases of diabetes worldwide in 2001, and this was estimated to increase by 46% to 221 million cases in 2010, with the steepest growth in the developing world (Zimmet *et al.*, 2001). The same holds for obesity (Shell, 2001). The global spread of antibiotic-resistant *Pneumococcus* was first identified in Spain in the early 1980s and rapidly jumped to South Africa and USA before spreading to all other parts of the world. Each year, approximately two million children die in developing countries as a result of lower respiratory infections, mostly pneumonia. The exact origin of this *Pneumococcus* strain is still unknown but is likely to come from the Far East (McGee *et al.*, 2001). Perhaps the most profound changes that have taken place during the past 10 years have come through the globalization of ideas and information, facilitated through the revolution in information technology. The internet, satellite television broadcasting, and high-speed data links across the globe have dramatically increased access to all kinds of information, even in the most remote corners of the world. Despite early concerns about a 'digital divide' that would further disadvantage the poor, these fears have been overestimated. The reality is that this divide is narrowing between rich and poor countries that have increased access to cell phone communication and the internet (The Economist, 2004).

Globalization is likely to affect many aspects of public health, one of which is vaccine-preventable communicable diseases. Important forces include increased funding initiatives supporting immunization at the global by WHO & FAO level; regulatory harmonization; widespread intellectual property rights provisions through the World Trade Organization agreements; the emergence of developing-country manufacturers as major players in vaccine supply; and the appearance of new communicable disease threats, including those potentially linked to bioterrorism. All of these forces can affect, either positively or negatively, the development and availability of vaccines. Harnessing these will be a challenge for policymakers and immunization stakeholders (Scheffler and Pathania, 2005). There are many studies on the consequences of globalization on the availability of pharmaceutical products (Huynen *et al.*, 2005).

Globalization is causing profound and complex changes in the very nature of our society, bringing new opportunities as well as risks. In addition, the effects of globalization are causing a growing concern for our health, and the inter-generational equity implied by 'sustainable development' forces us to think

about the right of future generations to a healthy environment and a healthy life (Martens *et al.*, 200). As the world around us is becoming progressively interconnected and complex, human health is increasingly perceived as the integrated outcome of its ecological, social-cultural, economic, and institutional determinants. Therefore, it can be seen as an important high-level integrating index that reflects the state and, in the long term, the sustainability of our natural and socio-economic environments (World Bank, 2020a).

It is important to note that global tourism has been exposed to a wide range of crises in the past years (Figure 1). Between 2000 and 2015, major disruptive events including the September 11 terrorist attacks (2001), the severe acute respiratory syndrome (SARS) outbreak (2003), the global economic crisis unfolded in 2008/2009, and the 2015 Middle East Respiratory Syndrome (MERS) outbreak (Gössling *et al.*, 2020, World Bank, 2020a, 2020b). None of them led to a longer-term decline in the global development of tourism, and some of them are not even notable in Figure 1, with only SARS (-0.4%) and the global economic crisis (-4.0%) leading to declines in international arrivals (Frederick, 2005). This would suggest that tourism, as a system has been resilient to external shocks. However, there is much evidence that the impact and recovery from the COVID-19 pandemic is unprecedented. The relationships between pandemics and travel are central to understanding health security and global change (Brown *et al.*, 2016). Although tourism research has developed at least a cursory realization of the potential systemic effects of global climate change, there has not been the same appreciation of the systemic effects of pandemics, with studies tending to focus on individual country impacts, rather than the system-level challenges and vulnerability. Several studies have demonstrated the important role of air travel in accelerating and amplifying propagating influenza and coronaviruses (Gössling *et al.*, 2016).

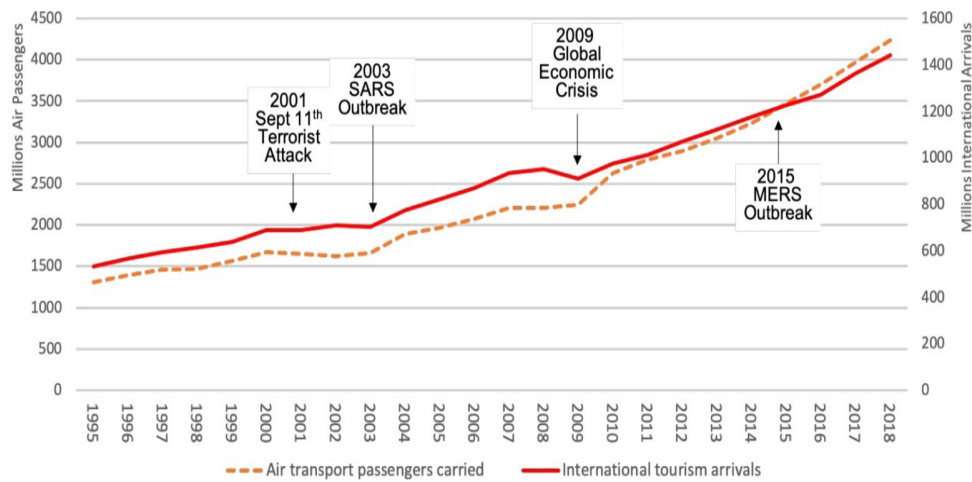


Figure 1. Impact of major crisis events on global tourism (World Bank, 2020a, 2020b).

Most importantly, there have been several warnings that pandemics posed a major threat to society and tourism from both tourism (Scott *et al.*, 2015, Bloom, and Cadarette, 2019) and health researchers (Fauci and Morens, 2012, NASEM, 2018), as well as government agencies (Jonas, 2013) and institutions (Labonte *et al.*, 2014). The main reasons for the increasing pandemic threat in the 21st century are: a rapidly growing and mobile world population; urbanization trends and the concentration of people; industrialized food production in global value chains; increased consumption of higher-order foods including meat; and, the development of global transport networks acting as vectors in the spread of pathogens (Hon, 2013). One of the central realizations of research on pandemics is that travel is central to epidemiology and disease surveillance (Nicolaidis *et al.*, 2019). Recognizing that travel and tourism is both a contributor to disease spread and its economic consequences and is dramatically affected by it because of Non-pharmaceutical Interventions (NPIs) (Bai *et al.*, 2020).

The world has experienced several major epidemics/pandemics in the last 40 years, yet none had similar implications for the global economy as the COVID-19 pandemic. COVID-19 is not as contagious as measles and not as likely to kill an infected person as Ebola, but people can start shedding the virus several days in advance of symptoms so that spread rapidly (Rothe *et al.*, 2020, Li *et al.*, 2020). As a result, asymptomatic people transmit COVID-19 before they

know to self-isolate or take another measure like physical distancing in public or wearing mouth/nose coverings to prevent the spread of the virus through speaking, coughing, or sneezing. With very limited testing in many countries, also due to the unavailability of tests, unknowingly asymptomatic transmission is thought to be substantive (ECDC, 2020). There is also a rapid increase in and spread of confirmed COVID-19 cases from its epicenter (Shrestha *et al.*, 2018).

Globalization and animal health

The containment of pandemic threats such as avian influenza and severe acute respiratory syndrome within months of the outbreak is a few examples of successful applications of the One Health paradigm (McMichael, 2004). Understanding this versatile human-animal interface is crucial for characterizing the permanent yet continuously evolving risks of cross-species transmission of pathogens between animals and humans. Humans and microbes are engaged in a moral, self-interested, co-evolutionary struggle (Reperant *et al.*, 2013). The inextricable connectivity between animals, humans, and the environment has been recognized for centuries. Diamond and Ford, (2000) have put forth ‘Questions of the animal origins of human disease lie behind the broadest pattern of human history and some of the most important issues of human health today.’ The complex relationships between humans and animals have resulted in a human-animal interface since pre-historical times (Mackenzie *et al.*, 2013). There are various emerging and reemerging infections, which are mainly originated from wild, and domestic animals. The incidence or a spread of a pathogen into new areas or a new host species is called “disease emergence” (Hubálek, 2003). Yet, majorities of Zoonoses are not prioritized by health systems and are labeled as “neglected” or “endemic” (Gebreyes *et al.*, 2014).

In recent decades, many infectious diseases have emerged with often devastating consequences for global health and impacts on trade and economies. These include SARS, Nipah virus, avian influenza, pandemic H1N1, and MRSA. Systematic reviews have determined that ~75% of emerging infections in the past two decades are zoonotic in origin (Woolhouse and Gowtage-Sequeria, 2005). Therefore, human-animal linkages play a key role in infectious-disease emergence. Changing agricultural practices and the spillover of pathogens from wildlife reservoirs are both driving the emergence of infectious diseases from animals (Burroughs *et al.*, 2002). Many pathogens exist in wildlife reservoirs often without causing significant morbidity or mortality in the reservoir spe-

cies. As human development encroaches on wildlife habitats, and humans continue to make contact with wildlife through hunting or trading in wild animals, there is an increased risk of pathogen spillover into human populations (Daszak *et al.*, 2000)]. One public health response to changing environmental health risks is to be vigilant for the occurrence of sentinel events that can signal the appearance of a new hazard or a breakdown in ongoing control efforts for a recognized health threat. Animals have served in numerous cases as “sentinels” for environmental threats near where humans are living or working (Van der *et al.*, 1999). A classic example of this is the historical use of canaries by coal miners to detect the presence of toxic gas in coalmines (Burrell and Seibert, 1916). An example of animals serving as sentinels for infectious pathogen hazards in the environment occurred with the 1979 outbreak of anthrax in Sverdlovsk, Russia (Meselson *et al.*, 1994). Climate change is also expected to affect the distribution of vector species and other animals. One predicted effect is an increase in malaria-prone habitats in Africa (Ermer *et al.*, 2011). The same changes may also make formerly habitable areas less hospitable and alter the overall range distribution of a particular arthropod vector (Ahlenius, 2005).

Infectious diseases share common pathophysiology between domestic and wildlife animals. These diseases are not only one of the largest sources of non-tariff barriers to international trade, but also, affect the dynamism and fluidity of the agronomic input markets, either by creating higher costs of production in industries directly dependent on these inputs or generating commercial levies to the export country on certain animal products as a direct consequence of a disease epidemic. As a result, an increase in the complexity of the patterns of consumption and access to competitive global markets is generated. Additionally, affect the monumental annual costs that several countries worldwide spend on control and eradication programs of TADs, as well as, the resilient and compensatory payments by governments to the livestock sector after a disease outbreak (Vandeputte *et al.*, 2011). According to the Organization of the United Nations Food and Agriculture Organization (FAO), pests and animal diseases cause the loss of more than 40% of the global food supply. This is a clear threat to the residual economies of developing countries and the food security of its inhabitants. In general livestock products have increased their international trade by 4% only in the last two decades. However, as a result of the emergence and re-emergence of various animal diseases, such as bovine spongiform encephalopathy (BSE), the annual growth of meat products decreased by 2% in the late 1990s (Morgan, and Prakash, 2006). There-

fore, the cost of trans-boundary animal diseases (TADs) related to agricultural products, the country's economy, and international markets are monumental. Thus, it is very important to create public policies focused to assure countries' food security (especially in developing nations) to avoid negative economic impacts caused by TADs, especially on the more susceptible social stratus.

The globalization era starting in full in the 1990s brought entirely new conditions for epizootic disease spread and control at the global level. Significantly, intensified global trade in animals and their products without any effective sanitary filter has facilitated the mass worldwide spreading of pathogens. The huge daily flow of exported nonpathogenfree animal commodities has led to the rapid deterioration of the global epidemiological situation. The international animal health information system covers only a very small part of animal infections and provides insufficient data on their occurrence. The importing countries have minimal or zero information for objective risk assessment to avoid pathogen introduction (Václav, 2017).

Swanepoel *et al.* (1999) described that Rabies and Marburg are zoonotic diseases with serious health implications for humans and both have a common reservoir, the bat. These two diseases are very good examples for the application of the One Health approach. Globalization also favors the international trade of domestic and wild animals, some of which include illegal trade and importation of wildlife. The magnitude of the global movement of animals is staggering. In terms of sheer numbers, 37,858,179 individually counted live amphibians, birds, mammals including rodents, and reptiles were legally imported to the United States from 163 countries from 2000–to 2004 (Jenkins *et al.*, 2007). There are several unfortunate examples of the failure of partners across these areas to work together. They include governmental decisions in the People's Republic of China to kill dogs as a control measure for rabies and advocating the extermination of storks as a control measure for avian influenza in Thailand (Wildlife Conservation Society, 2007). In the case of the dogs, an integrated team of animal and public health professionals might have implemented alternate control measures, such as leash laws and rabies vaccination of dogs. The storks were luckier in which wildlife conservationists and other partners in the animal health sector eventually intervened to convince governmental authorities that the killings of storks was not an appropriate control measure for avian influenza. Prevention efforts should include reducing both the supply and the demand for exotic animals. However, navigating the myriad responsibilities of the different sectors for human, livestock, companion

animal and wildlife health continues to be a challenge. Guidelines addressing the infectious disease risks associated with exotic animals that may help raise awareness of the risks and decrease the demand for exotic animals have been published (NAPHV, 2006). However, no single agency can solve this problem alone; it is only through partnership with other federal agencies, wildlife associations, veterinary medical associations, and private industry that we will be able to better control the global movement of animals and reduce the risk of introducing emerging infectious diseases into new locations. The “One Medicine Initiative” announced by Roger Mahr, the 2006 President of the American Veterinary Medical Association, has led to the 2007 formation in the United States of a “One Health Task Force” to bring wildlife, environmental, human, and domestic animal sectors together for a coordinated approach to improving and protecting human and animal health (Enserink, 2007). This coordinated approach, actively supported by multiple stakeholders, takes into account the larger ecologic context of infectious diseases and improves our ability to prevent disease rather than simply reacting to new outbreaks as they emerge. The close collaboration of cross-disciplinary initiatives, as well as the efforts of the informed readership of *Emerging Infectious Diseases (EID)* to make important contributions in stemming the magnitude of live animal trade that poses risks to human, animal, and ecosystem health, is very important (Marano *et al.*, 2007).

Globalization and environmental health

Globalization affects the socio-economic and political aspects of human life and connects world economies via trade, capital flows, innovative opportunities, and cultural ties. It heightens global changes in population size, distribution, mobility, scales, and types of economic activity, all of which have consequences for the environment. Intensified economic and agricultural activities have already resulted in a rapid increase in greenhouse-gas emissions, degradation of land, and depletion of natural resources in addition to environmental pollutions. The emissions of pollutants have further adverse implications for global climate change and ecological imbalance. Moreover, the effects of these emissions may result in lower sustainable economic growth and development through welfare retarding channels (Ganguly, 2003).

Globalization brings new environmental health risks such as the rise of non-communicable diseases (coronary heart disease, cancers) and forms of substance abuse such as alcoholism, and tobacco-related diseases (Feachem,

2001). It is also time that globalization is changing the nature of the infectious disease. Infectious diseases such as tuberculosis, malaria, plague, and cholera are interpreted as re-emerging. For example, the re-emergence of malaria is seen in areas (developed and developing countries) where it had been thought it was eradicated (Baum, 2001). In addition, there are other newly emerging diseases like HIV, Ebola, SARS, and Avian Flu (Lee, 2000). However, with the increase in global travel, tourism, population migration, and displacement, other diseases like malaria and cholera, HIV is proving to be a public and environmental health threat (World Health Organization, 1997). The increase and intensification of worldwide mobility in both people and trade also have key public health risks and implications for the transportation of food (expired/contaminated) and the increased incidence of trans-border food-borne diseases (Reperant and Osterhaus, 2017). The global environmental changes have brought about the intensity of modern consumer driven economics and holding risks for public health. These changes to the earth's basic life-supporting processes pose long-term risks to the health of populations (McMichael, 2004).

Gold mining operations are often associated with spectacular fish kills and consequences to aquatic resources. Most aquatic organisms were killed along the main stem of the Tisza River in Hungary, and most water supplies were closed when a dam failure at a tailing pond in Romania triggered the release of about 100,000 m³ of cyanide-containing waste in January 2000 (Roggla, 2000). More sustainable mining practices require mitigation measures for existing tailings and improved processes and safety procedures for ongoing activities (Dudka and Adriano, 1997). Highly toxic chemicals, such as cyanide or mercury, should be replaced by less harmful extraction agents, such as halogens, or a zero-emission policy should be enforced (Akcil, 2003). Such technical measures should be supplemented by clear international regulations (Hamor, 2004) and corporate social responsibility in the mining industry, which is based on open information policies (Jenkins and Yakovleva, 2006).

Contamination of groundwater from municipal solid waste landfills, hazardous waste sites, accidental spills, and abandoned production facilities is a prominent cause of water pollution. Several hundred thousand sites can be found throughout the world, where 100 million tons of waste have been and still are discarded. Many of them contain large amounts of hazardous or radioactive material (Giusti, 2009). Even though many of the official contaminated sites are under control, the large majority of them are expected to release chemicals into the environment. In addition, thousands of oil, gasoline, and other chemi-

cal spills occur each year on the land and in water from a variety of types of incidents, including transportation and facility releases. Estimating the number and fluxes of toxic chemicals from such contaminated sites to the groundwater is difficult (Baun and Christensen, 2004). In many cases of spills, waste disposal sites, and abandoned facilities, their primary contaminants are chlorinated ethane, PCBs and polychlorinated dibenzo-p-dioxins (PCDDs) from wastes of pesticide manufacturing (Engelhaupt, 2008), methyl mercury from contaminated soils and wastewater (Selin, 2009), radionuclides from former nuclear weapons test sites (Kersting *et al.*, 1999) and radioactive waste repositories (Ewing, 2006), and nitro aromatic explosives from ammunition plants (Eighmy *et al.*, 1995), to name just a few. Discarded materials are, however, often not well characterized and heterogeneous (Baun and Christensen, 2004]. Apart from some predominant contaminant species, the leachate composition from the landfill materials cannot be predicted in detail (Eighmy *et al.*, 1995).

One Health approach as a remedy to globalization driven health challenges

Earlier healers, religious persons, and pioneer physicians have been devoted to the health care of both people and animals until the 18th century when Health Science evolved into veterinary and human medicines (Schwabe, 1984; Driesch and Peters, 2003). A Chinese text by Xu Dachun ('on the origin and development of medicine') from the 18th century states that 'The foundations of veterinary medicine are as comprehensive and subtle as those of human medicine and it is not possible to place one above the other' (Driesch and Peters, 2003). Medical science reached a climax point towards the end of the first millennium with specific hippiatric texts like the Kitab al Baytara in the sphere of Arab influence. Here, veterinary medicine has remained largely in the hands of equeerries until the 18th century, whereas, human medicine was integrated into the medieval Universities (Rüegg, 2004). Claude Bourgelat, the founder of the first veterinary school in Lyon in 1762, was heavily criticized when he recommended human clinical training for the veterinary curriculum (Driesch and Peters, 2003). In the 19th century, German Pathologist Dr. Rudolf Virchow developed a strong interest in linking human and veterinary medicine as a form of comparative medicine based on the discovery of similar disease processes in humans and animals with the advent of cellular pathology (Saunders, 2000). The German scientist, Rudolf Virchow proposed the term zoonosis in 1855 (Cardiff *et al.*, 2008), and he was also the first to suggest the term One Health, stressing the need and interconnectedness between human and

veterinary medicine in all aspects (Osburn *et al.*, 2009). Calvin Schwabe (Herbold, 2005) and William Osler (Kahn *et al.*, 2007) have subsequently promoted the one health concept internationally. Globally, the term one health has re-emerged as an innovative solution to combat zoonoses, AMR, food safety issues under the premise that international animal health is a public good. More importantly, some animal diseases, for instance, Rinderpest, rather than human epidemics, were the stimulus for medical research in South Africa, and tsetse fly control was motivated primarily by cattle trypanosomiasis (Dukes, 2000).

The term one health has emerged as a front-runner as an innovative solution to combat trans-boundary animal diseases (TADs) under the premise that international animal health is a public good. The definition of the One Health approach adopted by the European Union as “The improvement of health and well-being via (a) the prevention of risks and the mitigation of effects of crises that originate at the interface between humans, animals, and their shared environments, and (b) promoting a cross-sectoral, collaborative, “whole of society” approach to health hazards, as a systemic change of perspective in the management of risks” (Okello *et al.*, 2017). Furthermore, the Executive Summary of the American Veterinary Medical Association (AVMA) One Health Initiative Task Force (OHITF) defines One Health as “The collaborative effort of multiple institutes working at the local, national, and international level to provide the best health service for their people, animals, and the environment” (King *et al.*, 2008). Globalization has intensified the links and connectivity among human, animal and environmental health within an ecological setting, aggressively working to assess the effects of leading to the emergence of contagious diseases of animals origins that have impacts on human health and animal health, (Tabor, 2002).

According to WHO (2021), The Food and Agriculture Organization of the United Nations (FAO), the World Organization for Animal Health (WOAH), the United Nations Environment Programme (UNEP) and the World Health Organization (WHO) welcome the newly formed operational definition of One Health from their advisory panel, the One Health High Level Expert Panel (OHHLEP), whose members represent a broad range of disciplines in science and policy-related sectors relevant to One Health from around the world. The four organizations are working together to mainstream One Health so that they are better prepared to prevent, predict, detect, and respond to global health threats and promote sustainable development. The One Health definition developed by the OHHLEP states: ***One Health is an integrated, uni-***

fyng approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development (Figure 2).

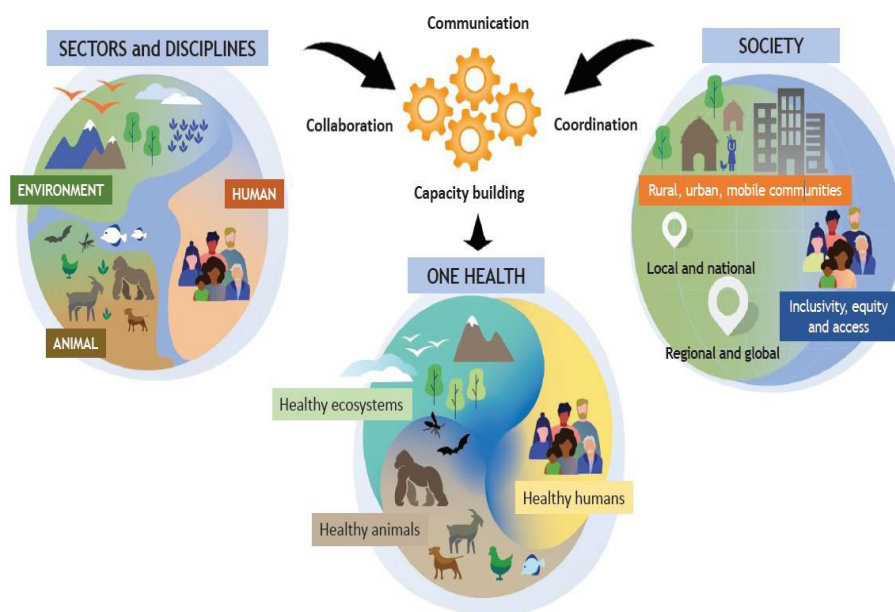


Figure 2. Tripartite and UNEP support OHHLEP's definition of "One Health" (WHO, 2021).

In the increasing globalized world the exponential growth in both human and animal populations, rapidly changing farming systems and urbanization. These have encouraged increased forest encroachment, marked changes in ecosystem. Moreover, this closer interface among humans, animals, and wildlife resulted in the increase of globalization of trade animals and animal products. These characteristics of the present globalized world provide sustained exposure of humanity to myriads of challenges that will require sustainable global

governance and solutions. Among these challenges is the spread of emerging and/or re-emerging infectious diseases in the animal-human-environment interface. These diseases are medically, socially, economically, and environmentally expensive, with their wide consequences requiring interdisciplinary solutions. The “One Health” approach can proffer such solutions, which can be harnessed as a global strategy by health organizations and policy makers worldwide in response to global needs (Bolajoko *et al.*, 2022).

Regarding One Health in Ethiopia, it is at its infant stage to implement the approach to mitigate the existing, emerging and, reemerging infectious diseases. So far, encouraging achievements have been made to advocate for and implement the One Health approach. Some of the developments achieved so far include the establishment of the National One Health Steering Committee and Technical Working Groups, prioritization of infectious diseases of human and animal health importance, the development of prevention and control strategies for prioritized zoonotic diseases, joint disease surveillance and outbreak investigation, capacity building and other One Health promotions. Despite these key achievements made so far, there are still challenges that require additional investments and efforts. Some of the challenges include poor collaboration and cooperation among institutes in data sharing and communication, institutionalization of the One Health, inadequate and sustained advocacy for One Health among health practitioners and stakeholders, shortage of funds to support One Health joint actions including research, etc. Hence, it is critical to continue raising awareness on One Health approach and foster collaboration across disciplines and sectors (Erkyihun *et al.*, 2022).

Conclusions

Globalization is rather a complex phenomenon, which goes beyond economic, socio-cultural, and political integration. It is the interactive co-evolution of multiple technological, cultural, economic, institutional, social, and environmental trends. Globalization is associated with several flows that have direct and indirect effects on health, environment, food safety, biosecurity, and tourism. Some argue that globalization has positive effects on development as it gives rise to exposure to new technologies and skills as well as new industries and more jobs in developing countries. Conversely, globalization is also believed to have a downside in that it will force poorer countries to be dependent on developed countries and follow their directions. The risk of spreading drug-resistant in-

fectious agents or pandemic diseases has been heightened with globalization. As the movement of people continues to increase, the circulations of pathogens are also likely to rise. Hence, the trend of globalization has expanded from the impact on the individual to the impact on the community, from the technical health care problems to social problems.

Therefore, provided the fact that globalization has a huge impact (positive impacts of economic social developments, and/ or adverse consequences) on the health of humans, animals and the environment, a systematic and interdisciplinary collaboration through the ONE HEALTH approach is a remedy for reducing the global health challenges due to globalization.

Ethics approval and consent to participate

Not applicable

Availability of supporting data

The data used for this manuscript are available from the authors on request.

Conflict of interests

The authors declare that there is no conflict of interest.

Authors' contributions

FA conceived the concept of the preparation of the manuscript, collected all necessary data, and drafted the paper; while GM and BM are involved in the critical revision of the manuscript. All authors read and approved the final manuscript.

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