Environmental Health: The Most Neglected Part of One Health

Sonali Dash1, Adya Prakash Rath2

1Assistant Professor, Centurion University of Technology and Management, Odisha, India.
2Additional Veterinary Officer, Fisheries & Animal Resources Development (FARD) Department, Govt. of Odisha, Sundargarh, Odisha, India.

Abstract

One health concept and perspective have gained momentum in the past few years in the global health sector. Keeping in view the increased popularity of “one health” American Veterinary & Medical Association has defined it as the emerging interdisciplinary field that inherently collaborates human, animal, and environmental aspects to combat emerging global health problems especially related to zoonotic public health emergencies. According to key findings of “One Health Networks (OHNs),” environmental factor is the most neglected part of one health triad that consists of the human-animal-environment interface. Currently, human and animal health has been constantly threatened by the rise of novel challenges like antimicrobial resistance, environmental pollution, epizootics, pandemics, development of multifactorial chronic ailments, etc which need interdisciplinary and intersectoral expertise. Ecosystem health and its adverse effects on human and animal health have gained the greatest attention over recent years as it serves as a melting pot for all infectious diseases. Despite achieving global success in the field of “One health” it is still in the embryonic stage in our country. So, the success of one health requires breaking down the shackles that still separate human and veterinary medicine from environmental, evolutionary, and ecological sciences that will ultimately lead to desired equilibrium and dynamics in maintaining healthy ecosystems.

Keywords: Most Neglected, One Health, Environmental Pollution, Environment Interface.

Mini Review Article

Author for Correspondence

Dr. Adya Prakash Rath; Additional Veterinary Officer, Fisheries & Animal Resources Development (FARD), Department, Govt. of Odisha, Sundargarh, Odisha, India.

E-Mail: rathadya10@gmail.com


Crossref doi: https://doi.org/10.36437/ijmvs.2020.1.2.B

Received: 28-7-2020 Revision: 2-9-2020 Accepted: 14-9-2020

License: This open access article is licensed under Creative Commons Attribution 4.0 International (CC BY 4.0).

http://creativecommons.org/

Introduction

New challenges always demand new approaches. Over the past few decades, human civilisation has been threatened by the rise and spread of certain infectious agents that lead to a significant increase in global mortality and morbidity rate. The emergence of epizootics, epidemics, zoonoses at a regular interval in the past few years has led to the outburst of a global pandemic in the form of COVID-19 in 2020 which made human life more critical. Apart from that, some of the greatest advances and holistic scientific approach in the human and animal health care sector has also been threatened by the emergence of antimicrobial resistance, environmental pollution, the occurrence of various multifactorial and chronic diseases, etc.(Destoumieux-Garzón et al., 2018). The exponential rise in the global human
population and its associated problems like industrialisation and various geopolitical issues like habitat destruction, bidirectional migratory movements of mankind, and behaviours in an ecosystem has led to a better understanding of different emerging and remerging disease dynamics. Therefore from a global health security perspective which includes an integration of human health, animal health, plant health, ecosystem, and biodiversity, the “One Health” concept was enforced in 2004 by breaking down all the interdisciplinary barriers between human and veterinary medicine (Zinsstag et al., 2011).

Keeping in view the above hindrances in the pathway of scientific development, “One Health” was formulated from the “One Medicine” concept in 2004 that assembles human and veterinary medicine in response to zoonoses (Davis and Sharp, 2020). It is defined by the American Veterinary Medical Association as “the collaborative, multisectorial, coordinated and transdisciplinary approach of working locally, nationally and globally in order to attain optimal health of people, animals, and our environment” (Lee and Brumme, 2013). The “One Health” concept got substantial attention in the past 15 – 20 years due to the occurrence of various emerging and remerging zoonotic diseases like SARS, MERS, H1N1 influenza, Ebola, and Zika, Nipah, Marburg, etc. (Evans and Leighton, 2014). Apart from that, “One Health” recognises the connecting link between human, animal, and environmental factors that leads to epidemics and pandemics as it was promoted by several international agencies like WHO, World Organisation for Animal Health (OIE), the Food and Agriculture Organization (FAO) of the United Nations (UN), the World Bank since 2010 in order to monitor global activities that ultimately hampers global health (Khan et al., 2018).

Overview of One Health

One Health triad consists of 3 components viz. human health, animal health, and environmental health but the latter part is ignored in most of the times which was identified as a key finding of systemic analysis of various One Health Networks (OHNs) (Essack, 2018). When European health and environmental ministers met World Health Organization (WHO) regional director for Europe on June 15, 2017, in Ostrava, Czech Republic for the sixth ministerial conference on Environment and Health they recognised that the holistic approach of the welfare of the human population could not be achieved with negligence of Ecohealth (Khan et al., 2018). The environment acts as the most dynamic and astounding sector of one health as it’s quite evident from the evolution of antimicrobial resistance and climate change. Antimicrobial resistance is defined as a complex and versatile problem that grasps human and animal health thereby threatening the global economy and security (White and Hughes, 2019). Recently, the emergence and rapid geographical dissemination of 2 antimicrobial resistance genes shook the entire world. An enzyme New Delhi Metallo-beta-lactamase 1 (NDM-1) that offers resistance to almost all antibiotics was detected from the tap water samples and the environment in India and Bangladesh respectively in 2010 (Islam et al. 2017). Similarly, MCR-1 (mobilized colistin resistance-1) gene, a plasmid-borne gene conferring colistin resistance, was detected from the pig’s population in China in 2014 and has eventually moved to other countries later on (Liu et al. 2016). According to a WHO report in 2019, antimicrobial resistance is regarded as the top ten threats to global health thereby suggesting the need for coordinated integration of environmental, aquatic, and wildlife issues for better AMR surveillance (White and Hughes, 2019).

Unless and until we have a complete comprehensive understanding of ecosystem dynamics it is impossible to assess the degree of alteration and adulteration caused by various anthropogenic factors in the direction of evolution, occurrence, and dissemination of infectious agents. The genotype of all
microorganisms originate in their natural environment through various genetic alterations like mutation, recombination, transduction, hybridisation and express their phenotypic traits by colonising different hosts at different points of time (Destoumieux-Garzón et al., 2018). Currently, the majority of infectious diseases are zoonotic in origin and among them, three-fourth originate in wild animals. The mechanism underlying the emergence of disease in the human population directly links to the domestication of wild animals and the transgression of the species barrier. Basically, vector-borne transmission agents develop due to the above transgression mechanism along with some other factors which include environmental perseverance, host diversity, community interaction, etc. (Kelly et al., 2020).

The devastation of natural habitat and climate change adds more misery to the terrible degradation of eco-health. All these environmental issues act as a confirmed catalyst in the process of occurrence and reoccurrence of various infectious agents that flare up the adverse effects on the health of humans, animals, and the environment (Levy, 2015). In the recent past, global climate change-induced certain alterations in the life cycle of pathogens, vectors, and reservoirs thereby assisted in the development of various destructive epidemics like H1N1, H5N1, coronavirus, Ebola, Zika, dengue, chikungunya, Nipah, etc. Global warming is solely responsible for the appearance of new diseases in plants and animals in a particular area that had never appeared before by altering the synchrony between interacting species thereby modifying their natural habitat. Example – schistosomiasis and chikungunya emergence in the European continent, Ebola epidemic in Western Africa (Gebreyes et al., 2014).

Similarly, trade globalisation and industrialisation of agricultural practices have occurred in a short span of evolutionary time scale. These trends are accompanied by ecological, behavioural and a socio-economic change induces loss of biodiversity that leads to colonisation of new territories by infectious agents. The intensive farming and breeding practices like offensive use of pesticides, fertilisers, and antibiotics lead to the generation of a new variant of insecticide-resistant mosquito species (etiological agent of malaria, arboviruses, filariasis, dengue, etc.) which is also resistant to certain antibiotics in bacteria (Stoate et al., 2009).

Environmental pollution is acknowledged as another major factor responsible for the degradation of the ecosystem. The human and animal population are vulnerable to several pollutants resulted due to increased anthropogenic releases in the environment, certain emerging pollutants like micro and nanoplastics, along with the emission of certain natural toxins like shellfish poisoning due to microalgae. Due to urbanisation, wildlife and domestic animals are on the verge of extinction due to continuous exposure to natural contaminants thereby reducing their chances of survivability and reproducing ability (Essack, 2018).

**Control Measures**

In this rapidly developing world, where anthropogenic activities have a devastating effect on the ecosystem, it has also created a loophole in the "One Health" framework. Therefore the concept of "resilience" emerged as a fruitful opinion to describe the response to ecosystem disturbances. Resilience is defined as the ability of the socio-ecosystem to absorb disturbances created by external force in order to maintain a dynamic equilibrium state (Destoumieux-Garzón et al., 2018). All the natural phenomenon of biological diversity like predation, competition, host-symbiotic relationship are required to maintain the fitness of the ecosystem as it helps in diluting the spread of infectious agents and disease...
transmission. Sometimes nature provides the best possible solution to restore its natural integrity. Bacteriophages are regarded as natural predators of bacteria that help in the reduction of the bacterial population in the environment (Argov et al., 2017). Similarly, the use of anti-microbial peptides opens up a new direction in pathogen dynamics. Being a part of the innate immune response, it acts by destabilising the biological membranes by forming transmembrane channels and thereby enhance immunity by working as immunomodulators (Destoumieux-Garzón et al., 2016). Another important aspect regarding the control of pathogens at the human-animal-environmental interface is the development and implementation of certain management policies that uphold the transboundary regulations. Therefore, a tripartite initiative has been taken jointly by OIE, WHO, and FAO that aims to work in close connection with various intergovernmental organisations, research institutes, private sector firms, and other stakeholders in order to write another glorious chapter of “One Health” (Herten et al., 2018).

Conclusion
Despite the worldwide support and commitment by various international organizations in the direction of one health concept has increased manifold but seems to be a daunting task in its implementation. Development of one health platform at the grass-root level is the most challenging task as some activities might not be feasible without external funding. Political invasion from various sectors proves to be a major challenge in front of scientific communities to implement the “One Health” concept thereby limiting the development of trans-disciplinary approaches and integrated operational actions (Aggarwal and Ramchandran, 2020). In the book Zoobiquity: what animals can teach us about health and the science of healing, the authors remark, ‘In a world where no creatures are truly isolated and diseases spread as fast as jets can fly, we are all canaries and the entire planet is our coal mine. So, before any species comes under the sentinel of danger, it’s the duty of everyone to understand the scientific basis and rich heritage of the “One Health” concept before it’s become too late. Famous Russian writer Leo Tolstoy quoted some beautiful lines regarding the environment that is “one of the first conditions of happiness is that the link between man and nature shall not be broken” which illustrates the importance of environmental health in safeguarding the “One Health”.

References