

One health:

Concept, scope and relevance

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Global changes are accelerated by population explosion, industrialization and geopolitical unrest, which harm biodiversity, deteriorate the ecosystems, and drastically increase human, and animal species migration. Infectious as well as non-infectious diseases emerge and re-emerge as a result of these rapid environmental changes. In response, a transdisciplinary approach among human, animal, plant and environmental health, described as One Health (OH), has gained support and visibility because of its capacity to synergistically address these challenges. One Health introduces a concept embedded in the philosophy of 'co-existence' in which every other living being (and inanimate objects like air, water and soil) influences the health of the fellow being. In today's globalized world, no one discipline, or sector of society may have enough knowledge or resources to prevent the emergence or resurgence of threats like disease, deficiency, crisis, hazard, or disaster (DDCHD).

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ONE health recognises the interconnection between human health, animal health and the ecosystem health, which became globally evident in the recent years with the emergence of infectious diseases, particularly zoonotic infections such as avian influenza, Ebola, Zika, monkeypox, and the latest COVID-19 pandemic. One health has recently been re-defined by the One Health High-Level Expert Panel (OHHLEP) as 'an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems'. This concept admits that the health of humans, domestic and wild animals, plants and the wider environment (including ecosystems) are closely linked and interdependent. 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 and safe water, energy, air, nutritious food, taking action on climate change and contributing to sustainable development.

No one sector can address issues at the animal-human-environment interface alone such as antimicrobial resistance, food security, biosafety, biosecurity and emerging, and re-emerging infectious diseases associated with changes in land use, population growth, urbanization, global travel and trade, and climate

change. One Health approach offers a pragmatic solution to the present-day problems of the world, including the strategy to combat emerging public health issues. In the wake of a recent pandemic crisis, these words of wisdom are more relevant than ever before and likely to have attracted wide public health attention.

Together, the G20 nations account for around 80% of global economic output, nearly 75% of global exports, and about 60% of the world's population. The G20 countries are looking for guidance from the One Health Quadripartite in operationalizing One Health (OH) approaches. Amidst the surge of COVID-19 pandemic, the leaders from G20 nation during 2022 at Bali, Indonesia affirmed commitment to tackle global challenges and lay a foundation for strong, sustainable, balanced, and inclusive global economic growth. The Indonesian G20 Presidency was supported by the Quadripartite to develop the Lombok G20 One Health Policy brief. Multiple consultations with governments and input from the OHHLEP recommended to raise awareness and advocacy for OH priorities, to identify gaps and opportunities and also facilitate OH research, knowledge and capacity. The Bali declaration primarily thrust upon the protection and development of resilient economic responses and co-operation, reinforcing the dialogues to promote food

and energy security, and thereby a sustainable market growth, promoting innovative financing sources, and instruments, and eventually towards the faster accomplishment of sustainable development goals. The declaration reaffirmed facilitation of One Health research, knowledge sharing, capacity building and voluntary knowledge transfers by creating an enabling environment in which learning research and knowledge sharing can thrive. This involves investing in research and expert researchers to increase our collective understanding, and knowledge on One Health contexts.

With the influence of the G20 Presidency, India led a global call to action for AMR, zoonoses, climate change and One Health. The tag line “One Earth, One Family, One Future” itself embodies *Vasudhaiva Kutumbakam*. Whereas, the G20 Meeting of Agricultural Chief Scientists (MACS) held at Varanasi in 2023 urged the coordinated R&D efforts to provide nutrient rich varieties of food crops for the benefit of farmers and consumers. While reiterating the thrust areas of Bali declaration, the Varanasi meet also highlighted the need for resilient agriculture and food systems by providing solutions for climate change adaptation and mitigation without adverse effects on food security, protecting and enhancing biodiversity, and thereby helping to improve productivity and profitability sustainably in global agri-food value chains. Besides, co-operation for digital transformation of agriculture and digital technologies for food production and safety; climate resilience, circular economy principles for preventing food loss and waste, need to be considered. Further, the MACS meeting upheld the enhanced need of cooperation and research on transboundary diseases, antimicrobial resistance and prevention of zoonotic disease emergence among One Health issues, for identifying opportunities to undertake research through collaborations, without duplicating the efforts of existing international organizations.

Scope and relevance of One Health

Conjoint efforts from the part of medical practitioners, veterinarians, ecologists and environmentalists are requisite in implementing the concept which remains a theoretical idea. The five sectors for implementing one health includes consensus among stakeholders, collaboration among professionals, cooperation among inter-disciplinary groups, coordination among partner agencies and commitment (political and financial) by the donors, partners, organizations, and the governments.

Zoonoses: It has been identified that 868 (61%) of 1,415 species of infectious organisms are known to be pathogenic to humans, and more than two-thirds of these have originated in wildlife. A clear advantage of One Health is that interventions in animal populations can result in public health and societal benefits, more cost-effectively than just interventions in humans. The influence of global warming and the geo-climatic variations on zoonotic disease epidemiology is evident by alterations in the host, vector and pathogen dynamics, and their interactions. Many climate projections

revealed potential geographical expansion and the severity of vector-borne, water-borne, food-borne, rodent-borne, and air-borne zoonoses. The One Health concept is critical to attaining the vision of FAO, WOA and WHO of a world capable of, detecting, responding to, containing, eliminating, and preventing animal and public health risks attributable to zoonoses and animal diseases with an impact on food security through multi-sectoral cooperation and strong partnerships. Livestock may act as intermediate amplifying hosts, facilitating the transfer of pathogens from their normal ecological niche into humans such as Japanese encephalitis (JE), Nipah virus, and Crimean-Congo hemorrhagic fever (CCHF).

Historically, zoonotic diseases had a tremendous impact on the evolution of man, especially in those cultures and societies that domesticated and bred animals for food and clothing. Zoonoses occur throughout the world transcending the natural boundaries. Their important effect on the global economy and health is well known, extending from the international movement of animals and importation of diseases to bans on the importation of all animal products and restrictions on other international trade practices. So, zoonoses no longer are solely a national problem. It has been realized that several other diseases characterized as neglected diseases have tended to be increasingly overlooked in the shadow of these huge problems. These neglected diseases affect poor marginalized populations due to a lack of the health resources and research needed to control them effectively.

One of the most neglected areas of zoonoses research in our country is rodent-borne diseases. Rodents are seen as pests because of their gnawing habit, which can cause economic losses, spoilage of food and lead to structural damage. Rodents can transmit diseases directly or indirectly. Every year outbreaks of leptospirosis are reported in Mumbai, Thane, and Konkan regions during the monsoon season. The absolute numbers of infectious diseases associated with rodents are not known precisely. However, it has been said that rodents function as reservoirs for approximately 46% of all globally known zoonoses, and more people are considered to have died in the past because of rodent-borne infections than wars.

Effective surveillance and control of zoonotic diseases require multi-sectoral collaboration involving the human health, veterinary, agricultural, educational, wildlife and environment, and sanitation sectors. Disease surveillance is an important activity that provides basic data on the disease burden in a country for follow-up actions to control, prevent, and eventually eradicate the disease. To ensure this, a joint effort to utilize the existing surveillance system both in the animal and human sectors and plan to establish a new system for emerging zoonotic disease surveillance is the need of the hour. It is time to take the One Health approach and work on delineating the modalities to face such situations to protect the health of livestock and human.

The WHO has outlined four tactical factors for the

successful control of zoonoses, which includes– a legal framework, a policy framework, institutional structures, and a program implementation plan; but currently, there are gaps in each element. A strong legal and regulatory framework is essential to help enforce disease prevention and control laws and regulations. As differences exist in the policy, vision, and mission of the medical and veterinary sectors with each emphasizing their traditional divided constituencies of public health and livestock production, the policy frameworks and institutional mandates do not favour effective zoonoses control.

Antimicrobial resistance (AMR): Antimicrobial resistance is a global problem of complex epidemiology, suited to a broad, integrated One Health approach. Antibiotic resistance is a direct consequence of the selection pressure from antibiotic use in humans, animals, and the environment where they live, requiring a One Health approach towards its containment. Since antibiotics are used for humans and animals, only a One Health approach will identify solutions that address all of these sectors. There is a need of surveillance to quantify the burden of antibiotic resistance to implement measures for its containment on biomedical, clinical, socio-behavioural, drug discovery/diagnostics and policy grounds.

Environmental hazards and climate change: Effects of climate change on human health can be expected to be mediated through complex interactions of physical, ecological and social factors. These effects will undoubtedly have a greater impact on societies or individuals with scarce resources, where technologies are lacking, and where infrastructure and institutions (such as the health sector) are least able to adapt. Collaboration between veterinary, medical, environment specialists, anthropologists and public health professionals to understand the ecological interactions, and reactions to flux in a system can facilitate a clearer understanding of climate change impacts on environmental, animal, and human health. The global environment is rapidly changing and animals, and human beings are exposed to shared environmental health risks. Environmental disasters such as Hurricane Katrina wreak havoc on both human and animal populations. Now people are increasingly aware of the need for a more collective approach to tackle certain urgent environmental problems.

Food safety: Food-borne illness and food safety issues constitute an unmanageable enigma, especially in developing and underdeveloped countries which are generally lacking in better surveillance, modern traceability, and diagnostic methods to locate and report such outbreaks. With burgeoning incidences of food-borne illnesses, there is growing public awareness of food safety, food security and sustainability in food production practices. Adoption of an integrated approach for food safety throughout the food chain ‘farm-to-fork’ is critical for preventing food-borne diseases and other food safety hazards, and is the need

of the hour. Good Agricultural Practices (GAPs), Good Hygiene Practices (GHPs) and Good Manufacturing Practices (GMPs) lay the foundation for food safety systems. Preventive approaches such as the Hazard Analysis Critical Control Point (HACCP) system have resulted in the industry taking greater responsibility for the control of food safety risks.

Residues of pesticides from foods of plant origin and antibiotics residues from animal-sourced foods are some of the unaddressed issues that question the very foundation of our farming practices today. The livestock sector is an area in which One Health’s thinking and action can make a difference in human lives and livelihoods. Efforts to respond to food insecurity, food safety and food trade challenges have addressed all four dimensions of food security namely, availability, access, utilization, and stability.

Implementation of food safety as well as addressing the food safety challenges require a coordinated, interdisciplinary linkage between various sectors involving medical professionals (reporting of human illness), veterinarians (ensuring safe production as well as reporting of animal origin illness), food safety officers (implementing the regulatory practices and quality control), food safety laboratories (quality control of illness), regulatory authorities (implementing as well as updating the regulations/ guidelines) as well as food scientists and technologists (to foster the quality control practices, developing field-oriented tests and strengthen academia). Overall, the public shall be made aware of the issues of food safety and a strong political will is required to ensure food safety. In short, a coordinated well-focused effort by various allied sectors is required to ensure food safety.

Human-wildlife conflict and biodiversity conservation: Expansion of agriculture has promoted encroachment into wildlife habitats, leading to ecosystem changes and bringing humans and livestock into closer proximity to wildlife and vectors, and the sylvatic cycles of potentially zoonotic pathogens. This greater intensity of interaction creates opportunities for the spillover of previously unknown pathogens into livestock or humans and the establishment of new transmission cycles. As a result, more people live in close contact with wild and domestic animals, both livestock and pets. Animals play an important role in our lives, whether for food, fiber, livelihoods, travel, sport, education, or companionship. A holistic approach to mitigating human-wildlife conflict (HWC) inclusively and sustainably is guided and facilitated by the National Human-Wildlife Conflict Mitigation Strategy and Action Plan (HWC-NAP) (2021–26) for India. It envisages that the One Health approach will be engaged, especially when planning for HWC mitigation measures in the forest fringe areas, in close coordination with the public health and animal husbandry departments.

Pollution and wastes: Good health depends on a continuous supply of safe and pure water. The quality of water, whether used for drinking, domestic

purposes, food production or recreational purposes has an important impact on health. Initiatives to manage the safety of water do not only support public health but often promote socio-economic development and well-being as well. Millions of people are exposed to dangerous levels of biological contaminants and chemical pollutants in their drinking water due to inadequate management of urban, industrial or agricultural waste-water. Therefore, the environment-human-animal interface should be considered together when thinking of avoiding such catastrophes. Rapid urbanization, constant change in consumption patterns, and social behaviour have increased the generation of municipal solid waste beyond the assimilative capacity of our environment and the management capacity of the existing waste management systems. Therefore, there is an urgent necessity for improved planning and implementation of comprehensive waste management systems for upgrading the environmental scenario of the state.

Prophylactic vaccinations: There is a strong connection between the One Health concept, vaccination, and the development of improved vaccines. Vaccines have a key role to play within the One Health agenda since they can control disease transmission between humans and animals, and have a significant impact on their shared environments. As a prophylactic measure, vaccines can prevent the emergence of disease in the first place and as an intervention, they can restrict its spread. Undeniably, many new vaccine technologies find their first applications within veterinary medicine before being applied to human vaccines. Some examples of these novel technologies include adjuvants/delivery systems, recombinant vectors and stabilization know-how. For example, some vaccines can be given to both humans and economically valuable animals (West Nile Fever) to provide a similar level of disease control. There are several key areas of synergy between human and veterinary vaccinology that could be exploited for the development of effective vaccines against shared diseases such as tuberculosis, brucellosis, Q-fever, Rabies, Middle-East Respiratory Syndrome (MERS), Rift

Valley Fever, Creamian Congo Haemorrhagic Fever, etc, which cause mortality in humans and animals equally.

Future perspective

In recent years, with the unfolding of a series of zoonotic disease events, the One Health approach of bringing disciplines together not only for research but also for interventions has gained explicit recognition. There is a need to provide evidence on the added value of the “One Health” approach for governments, researchers, funding bodies, and stakeholders. Finally, promoting the integrative benefits expected of the One Health concept requires a new interface with human, social, and legal sciences that remains to be built. The OH framework must be conveyed by rich outcomes to avoid a reductionist One Health focus on zoonotic pathogens that forgo the benefits of the framework. It is to be emphasized here that the OH framework must be broadened to accommodate non-infectious diseases as prime health concerns and killers, in addition to infectious diseases including zoonoses, besides providing realistic eco-health solutions. It is important to define, develop, evaluate, improve and continue to refine One Health education, not only in One Health degree programmes but also in existing public health, environmental, veterinary and medical curricula.

SUMMARY

One Health approach can counteract the weakness of black-box approaches by bringing health experts together with specialists in behavioural sciences, ecology, wildlife, and vector populations, climate, geographic information systems, anthropology, mathematical modelling, toxicology, veterinary medicine, and public health to help to develop visualization tools that better inform the public about hazards. The multi-sectoral cooperation in the surveillance and control of emerging infectious diseases is challenging to achieve, due to the significant gap between the fields of animal and human health.

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