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One health in India: Time to act together

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ABSTRACT

The emerging public health issues of 21st century have clearly warned us that the efficient tackling of these threats need to be done in collaborative manner between relevant public health professionals under the umbrella of One Health. The concept of One Health is longstanding; however, it is gaining due momentum across the globe, especially in context of tackling emerging zoonoses. India remains vulnerable to many of emerging health threats due to demographic, socio-economic and other factors related with globalization, climate change and related biodiversity losses. In India, the various public health agencies which includes human, animal and environmental health professionals have contributed joint efforts in recent past to confront the One Health related issues. However, the bridging of professional silos to act more synergistically need further sustained efforts from all the stakeholders, including policy makers.

Keywords: Antimicrobial resistance, India, One health, Zoonoses

The concept of One Health is a key global public health strategy that recognizes that the public health is intensively connected with animal health and the environment through an integrative, interdisciplinary and transdisciplinary approach. It advocates multidisciplinary collaboration between human medical professionals, veterinarians, ecologists, public health professionals, wildlife experts, sociologist, anthropologists and many others as per the need of the public health related challenges (Hinchliffe 2015). The framework for One Health is the need of the hour, where collaborative synergistic efforts are advocated among the various public health professionals, working locally, nationally, and globally to attain optimal health for people, domestic animals, wildlife, plants, and our environment (Zinsstag *et al.* 2011). The various health problems across the globe including, emerging and re-emerging zoonoses, antimicrobial resistance, emerging vector borne diseases, food safety and food security related problems, and environmental pollutants, soil health, and biodiversity loss pose a great risk to the humanity (Ryu *et al.* 2017). The past experience has provided enough evidence that successful application of efforts in the framework of One Health have yielded positive synergistic outcomes to combat problems emanating at the human–animal–environment interface (Okello *et al.* 2011, Wielinga *et al.* 2012).

The endemic as well as emerging and re-emerging zoonotic diseases have huge socio-economic impact on the public health, especially in the developing world where the human-animal interface is quite porous due to agricultural and animal husbandry related activities (Bhatia and Narain 2010). Of the total of 1,415 species of infectious organisms known to be pathogenic to humans, zoonoses constitute 868 (61%) of these infectious diseases (Taylor *et al.* 2001). During the last 3 decades, approximately 75% of the emerging infectious diseases among humans have been zoonotic, i.e. diseases that can be transmitted from animals to people (Taylor *et al.* 2001).

The various factors for these zoonoses can vary from region to region; however, the commonly listed ones are: globalisation associated high levels of human interconnectivity and global trade; intensification of animal farming; human intrusion related biodiversity losses; breakdown of public health infrastructure especially during natural calamities, political conflicts and wars. However, the contribution of scientific diagnostic advancement in the healthcare sector in the form of nucleic-acid-based methods, immunological methods, and biosensor-based methods, and 'omics' technologies, to the increase in the list of these pathogens in developing countries cannot be denied, that allows rapid and reliable detection of pathogens than the conventional methods (Wang 2011, Bird and Mazet 2018). The evolving better healthcare facilities in developing countries also contribute to the rise of immunocompromised and elderly group of population, who are generally considered as more susceptible to many of the zoonotic infections (Trevejo *et al.* 2005).

Mechanism to generate One Health framework

The sustainable framework of One Health comprises of interactions and associated dependencies in complex professional silos which is characterized by evidence-

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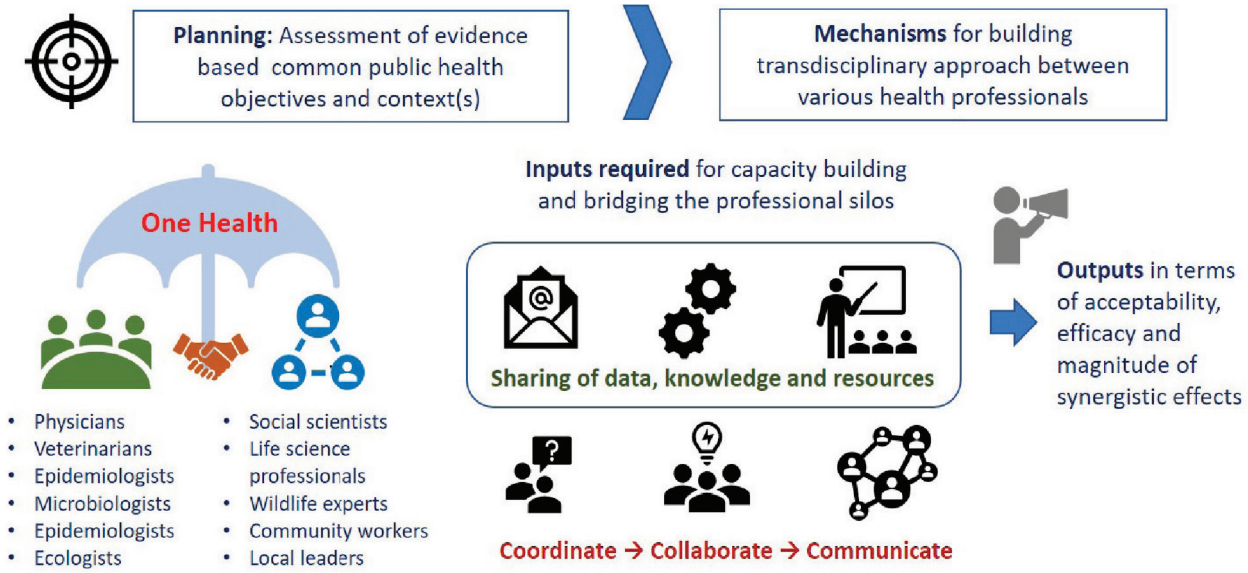

Fig. 1. Essential components and mechanism of One Health framework.

oriented collaboration, participation, sharing and exchange of data, knowledge and resources among different stakeholders to achieve a sustainability-oriented solutions of public health issues. The key feature of one health taskforce includes shared responsibility to manage complex problems across multiple stakeholders with diverse but complementary perspectives to generate robust solution-oriented systems. An outline of various features of one health framework is depicted in Fig. 1.

Emerging public health issues in India

India is facing multifaceted challenges for the sustainable development of its burgeoning population. The huge population of 1.38 billion (World Bank 2020) of the country is posing tremendous pressure on food security and biodiversity. The manifestations include the high animal protein demand to secure the nutritional security, which results in intensive animal farming and loss of biodiversity due to deforestation to occupy new habitats. The recent global emergence of zoonoses, viz. COVID-19, Nipah, Middle East respiratory syndrome (MERS), Ebola, Crimean-Congo haemorrhagic fever (CCHF), severe acute respiratory syndrome (SARS), etc., exhibited that even the slight imbalances to the ecosystem may result in deadly public health related consequences (Morand *et al.* 2014).

Apart from these emerging threats, India is also putting all efforts to manage the prevalent zoonoses, viz. rabies, anthrax, brucellosis, Japanese encephalitis, leptospirosis, Avian Influenza (H5N1), toxoplasmosis, plague, Kala azar, Kyasanur forest disease, spotted fever caused by Rickettsiae, cysticercosis, hydatid disease, trypanosomiasis, cryptosporidiosis, bovine tuberculosis, coxiellosis, etc., in various regions of the country (Sekar *et al.* 2011). Moreover, the predominant unorganized and poorly regulated food supply chains of animal foods and their products also pose high risk for food safety related issues, and results in periodic outbreaks of zoonotic foodborne pathogens, viz. salmonellosis, campylobacteriosis, *Clostridium sp., E. Coli*, *Bacillus* sp., etc (Bisht *et al.* 2021). In addition to existing zoonoses, the country faces potential threat of exotic zoonotic infection, viz. yellow fever, Hanta virus infection, Rift valley fever, West Nile fever, Ebola and Marburg disease, through the global trade as well as unchecked illegal wet animal markets across the borders. The wildlife trade and birds' migrations are also remaining a great hazard for spillover of the infectious agents (Chomel *et al.* 2007, Nagarajan *et al.* 2017).

Though the existing magnitude of endemic diseases and possible risk of spillover of exotic zoonoses is high; however, still there is limited awareness among the general public as well as public health professionals regarding the epidemiology and transmission dynamics of many of these emerging zoonoses (Kakkar *et al.* 2011).

In addition to infectious diseases, the issue of antimicrobial resistance (AMR) has become an inter-domain global public health challenge due to the rapid emergence and dissemination of resistant bacteria and genes among humans, animals and the environment (McEwen and Collignon 2018). It is projected that antimicrobial consumption will rise by 67% by 2030, and nearly double in India and few other countries (Van Boeckel *et al.* 2015). Antimicrobials used to treat various infectious diseases in animals may be the same or similar to those used for humans. Resistant bacteria arising in humans, animals or the environment may spread from one to the other, and from one country to another. AMR does not recognize geographic or human–animal borders. These resistance gene reservoirs are augmented by the influx of resistance genes from livestock and human waste into the environment. They are further augmented by the entry of antibiotic residues from pharmaceutical industries, intensive livestock farming, and hospitals, which disrupt the soil and water microflora in

addition to exerting selection pressure for the development of resistance (Lammie and Hughes 2016). Therefore, multidisciplinary and holistic studies employing 'One Health' approach are required to address the complexity of the problem, especially, in low-resource settings.

With this background, it is pertinent to equip the public health workforce with diverse professional skills and flexibility in order to tackle this array of public health challenge(s) with swiftness. Incorporating a One Health approach into public health policy is widely expected to increase the efficiency and cost-effectiveness by reducing the void among public health, animal health and ecosystem health sectors (Okello *et al.* 2021).

Efforts for One Health capacity building in India

In past, India's response has been largely remaining reactive where the country has been bouncing from one outbreak to the next. Some of the collaborative frameworks have been attempted to provide equitable healthcare or making the health sector more robust at the national level. One of the major milestones for controlling infectious diseases in India were launching of the Integrated Disease Surveillance Project (IDSP) in 2004. Currently, the IDSP-Integrated Health Information Platform (IHIP) captures syndromic, passively reported and laboratory-confirmed cases and also predicts disease trends through its state and district surveillance units. To address the food safety concerns and food borne illnesses, the Food Safety and Standards Authority of India (FSSAI) has taken several steps to collaborate with regional laboratories and carried out various capacity building approaches to ensure food safety and improve nutritional quality by way of launching safe and nutritious food (SNF) initiatives in India. To tackle the antimicrobial resistance, India's National Action Plan (NAP) for AMR was released in April 2017 by the Union Ministry of Health and Family Welfare with objectives of improving awareness, enhancing surveillance measures, strengthening infection prevention and control, research and development, promoting investments, and collaborative activities to control AMR.

In framing the One Health platform at national level, during 2010 in Nagpur, the professionals from medical and veterinary sciences participated in national conference organized by National Association of Welfare of Animals and Research in collaboration with Indian Medical Association (Nagpur Chapter), where the foundation of the idea of establishment of "National Institute for Zoonoses" (NIZ) was laid out to tackle the zoonotic diseases in the country. Since then, many deliberations were held between the officials of Indian Council of Medical Research (ICMR) and Indian Council of Agricultural Research (ICAR) and the discussions have resulted into the establishment of 'Centre for One Health'—a satellite Centre under National Institute of Virology in Nagpur in 2019. It is anticipated that gradually the institute will be converted into an independent research facility as National Institute for One Health (NIOH). This can be an inspiring approach for the future coordinated professional efforts in the country, where the exemplified public health response for COVID-19 in India is one of the best examples of the utility of One Health teamwork in resource-limited countries. Both the human professionals as well as veterinary professionals have put their shoulders together, especially in diagnostic as well as awareness front for successfully combating the pandemic. In this light, the country needs more coordinated approaches to tackle the public health issues. The proposed institute will serve as national leader and think-tank in framing the 'One Health' concept involving livestock, human, wildlife, agriculture and environment health by providing inter-sectoral and inter-disciplinary approach for surveillance, response, research, capacity building and advocacy/ communication for prevention and control of important public health issues. Further, the institute will bring sensitization and awareness about infectious diseases among the public. It will create database for disease forecasting and fill the knowledge gap by encouraging the health professionals to fulfill the objectives of the human-animal-environmental health.

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