



Perspective

Need for integrated surveillance at human-animal interface for rapid detection & response to emerging coronavirus infections using One Health approach

The World Health Organization (WHO) on January 30, 2020 declared the coronavirus disease (COVID-19) event as the Public Health Emergency of International Concern. The event that commenced in Wuhan, Peoples' Republic of China, in December 2019, continues to spread relentlessly. Till February 28, 2020, the WHO has reported 85,403 confirmed cases of COVID-19. Of these cases, spread over 53 countries, 2,924 have died¹. The causative agent of COVID-19 has been designated by the International Committee on Taxonomy of Viruses² as severe acute respiratory syndrome- coronavirus-2 (SARS-CoV-2) because of genetic similarities of this virus with the corona virus (SARS-CoV-1) that caused SARS.

The United Nations had earlier linked national security with pandemics³. COVID-19 has also assumed immense global implications for human health, economy and development. The spread of the virus seems to be unstoppable. Swift international travel seeds the virus in hitherto virgin areas. Explosive human-to-human transmission becomes a possibility because of non-immune status of almost the entire population. The inherent characteristic of the coronavirus further fuels rapid transmission. Several other factors such as overcrowding, lack of awareness on proper use of non-pharmaceutical measures, weak health system and inadequate resources for isolation of patients and contacts and infection prevention and control practices in health facilities further facilitate the spread of the virus.

Recent pandemics

The past four decades have seen emergence and spread of several new viral diseases. These have transformed the microbial landscape of global public health. A large number of human infectious diseases arise from animals; 60 per cent of these are transmitted from animals, and 75 per cent of emerging infectious

diseases originate from animals⁴. Many of the viruses originated from animals have caused pandemics associated with substantial mortality, misery, social chaos and colossal economic losses. Non-availability of specific antivirals or vaccines during these crisis periods made it extremely difficult to provide pharmaceutical interventions to combat these emerging viruses.

During current millennium itself, apart from Influenza H1N1 pandemic of 2009 due to Influenza H1N1 pdm 2009 virus, avian flu (Influenza H5N1), SARS (SARS-Cov-1), Middle East respiratory syndrome (MERS)-CoV and COVID-19 (SARS-CoV-2) have severely hit the world⁵. Nipah virus outbreak in Kerala, India, is yet another example of a zoonotic infection causing social upheaval requiring emergency public health actions⁶. One of the major reasons for these epidemics to spread rapidly is the delay in early detection of appearance of viruses because of weak surveillance at human-animal interface.

Three major events during the current millennium (SARS, MERS and COVID-19) have been due to coronaviruses. There are many more corona and other viruses lurking among wild animals. Most of these have the potential to jump the species and cause novel infection in human beings, which may explode into uncontrollable pandemic. It has been estimated that "there are over 1.6 million unknown viral species in mammalian and avian populations, of which approximately 700,000 have the potential to infect and cause disease in humans"⁷. Compared to just over 260 viruses that are currently known to cause diseases in humans, the unknown viruses represent 99.9 per cent of potential zoonoses⁸. We need to be better prepared to detect these viruses through an efficient surveillance and characterize such significant viral threats available for spillover from animal reservoirs.

Strong surveillance of these viruses for early detection is critical to contain these viruses during initial phase of emergence of virus only.

Need for a sensitive surveillance system at human-animal interface

The recent events have reinforced the need for a global sensitive surveillance system that can detect these viruses during early phase of outbreak and facilitate mounting of appropriate non-pharmaceutical interventions to prevent their spread and amplification. Since these viruses have originated from human-animal interface, a system that integrates surveillance by human health and animal health sectors needs to be evolved in true spirit of One Health for early detection and efficient response to spillover of such viruses. The WHO in cooperation with international animal health agencies (Food and Agriculture Organization of the United Nations and OIE-World Organisation for Animal Health) has been encouraging “collaboration, networking and technical consultation for the purpose of jointly analyzing epidemiological, virological and human-animal interfaces and promptly sharing and distributing public health information”⁹.

The Global Virome Project (GVP), an innovative 10 years partnership, is striving to detect the majority of the unknown viral threats. GVP discoveries can catalyze activities that facilitate proactive preparations for them. It may be the beginning of the end of the pandemic era⁷.

Surveillance is a core capacity agreed to under legally binding International Health Regulation (IHR) (2005)

In 2005, the International Health Regulations (IHR 2005) were adopted as WHA Resolution 58.3¹⁰. The scope and purpose of IHR (2005) has been to prevent, protect against, control and provide a public health response to the international spread of diseases in ways that are commensurate with and restricted to public health risks. Since its entry into force in 2007, signatory States have been working, individually and collectively, to meet their core capacity requirements under the new framework. Surveillance is one of the important core capacities within the framework of IHR (2005)¹⁰.

The WHO and the international organizations in charge of animal health are working together to strengthen the contribution of the veterinary sector in

the implementation of the IHR (2005) and surveillance of zoonotic infections¹⁰. Tools have been developed through joint efforts and assessments in countries have been undertaken. The results of these assessments have unequivocally demonstrated the need for a greater interface between human and animal health sectors to benefit global health security¹¹.

International Health Regulation (2005) and One Health approach

In consonance with IHR (2005), One Health approach that is a validated, integrated and holistic concept is being advocated by the WHO, the Food and Agriculture Organization of the United Nations (FAO)¹² and the World Organisation for Animal Health (OIE)¹³ for combating health threats to humans and animals through human-animal-plant-environment interface. A tripartite agreement¹⁴ between these three organizations has been in vogue since 2010 to apply One Health approach. This needs to be percolated down to the field level where surveillance at human-animal interface should take place.

One Health concept warrants multi-sectoral, multi-disciplinary, multi-institutional and multi-specialty coordination, in all aspects of response to outbreaks. Joint surveillance by the human health and animal health can detect emergence of new viruses from animals at initial phase thus helping in early containment¹⁵.

There have been several barriers to successful implementation of One Health approach including fragmented and disconnected governance of health, animal health and environment, lack of clarity about the definition, concept and scope of One Health approach, under-recognition of its economic benefits, absence of an agreement between professionals on way forward and inadequate training activities. At the same time, successful outcomes have been observed in implementation of One Health in developing countries, namely, Rwanda and Zambia^{16,17}.

It is imperative that all those working in the fields of human, animal and ecological health with focus on surveillance must agree on operational aspects which are coordinated through a governance mechanism run by senior policy makers. Interdisciplinary training on surveillance may encourage cross-disciplinary collaboration¹⁸.

Countries may consider adopting the framework for effective implementation of One Health that

incorporates political commitment, policy formulation, sustainable financing, programme development, knowledge sharing, institutional collaboration, capacity enhancement, research to generate evidence, engagement of civil society and active participation of the communities^{19,20}. A beginning can be made with integrated surveillance.

Animal and public health authorities should collaborate to develop protocols for surveillance, and capacity building for responding to zoonotic infections. In addition, appropriate research needs to be undertaken and results of national and international research be integrated into surveillance and response protocols²¹, so that evidence-based surveillance and response be undertaken. Data and science should be the cornerstones of planning, implementation and monitoring epidemiology of pandemic-prone diseases.

Conclusions and way forward

In the early phase of future emergence (early warning) of coronaviruses from animals, veterinarians and stakeholders play an important role in early detection at the human-animal interface. Principles of one health must be applied in these settings. Although One Health is a simple and powerful concept, it has an extremely complex implementation process which has to overcome well-established silo approaches in all countries. It is imperative to bring about a change in the narrative in national response to zoonoses, especially integrated surveillance. The success of One Health implementation shall depend on the extent of attainment of institutional collaboration, joint planning and coordinated comprehensive surveillance for the early detection and prevention of zoonoses, especially coronaviruses to mitigate any future outbreaks due to these viruses.

Conflicts of Interest: None.

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