

ROLE OF PUBLIC HEALTH PROFESSIONALS IN TACKLING PANDEMIC SITUATIONS

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ABSTRACT

A pandemic of a disease occurs in many countries and so on continents at a time and affects its huge population physically, mentally, socially and economically. In order to minimize or eliminate the burden of pandemic, it is required to plan and implement effective strategies promptly. The rapid emergence and spread of these pandemic diseases raise severe public health, economic, and development implications. Additionally, it underlines how crucial it is to build comprehensive disease diagnosis and response skills, especially in "hot spot" zones where a wide range of factors may combine to bring about the manifestation of disease. As the entire planet attempts to slow the spread of pandemics from the time of occurrence, public health is now more significant than ever before. Public health professionals are individuals who fight epidemics for the population through disease identification and prevention, conducting research and promoting healthy lifestyles. Recognizing symptoms, such as unusual disease, that indicate a developing outbreak requires public health initiatives, particularly those incorporated in conventional health service provision. Once an unusual disease has been recognized and an outbreak has been established, core health care facilities work to identify individuals and their ties, as well as dismantle transmission chains in communities. This paper will try to present the responsibilities of public health professionals in tackling pandemic situations briefly. In the first section, a short overview of pandemic will be mentioned, then it will structurally discuss what public health experts particularly do during a pandemic.

Keywords: Pandemic, Public Health Professionals, Outbreak.

Introduction:

A pandemic, according to the Centres for Disease Control and Prevention (CDC), is a disease outbreak that has expanded several geographic and cultural boundaries and has impacted a substantial amount of people ("Principles of Epidemiology | Lesson 1 - Section 11," 2012). In the occurrence of a global pandemic, the World Health Organization (WHO), in partnership with national and international stakeholders and public health professionals, has a crucial impact in controlling and suppressing its propagation. Pandemics with higher prevalence may affect a substantial proportion of the world's population and lasts over a period of months (Wolfe et al., 2007). Majority of the disease with pandemic severity are frequently caused by fast-spreading infectious organisms (bacteria or viruses). Research shows that over the past century, pandemics have become more likely as a result of increased global tourism and inclusion, urbanization, drug resistance, impoverished healthcare systems, strenuous forms of agriculture, changing land uses, and greater destruction of natural eco system (Madhav et al., 2017; O'dowd 2007). The massive outbreaks of pandemic infectious diseases that are appearing and cropping up in any region occur without prior planning and development of disease control techniques. The lack of preparedness for the outbreak, as well as a lack of understanding of the potential cause, make the problem more difficult and complicated to address (Tekalign,2020). Finally, pandemics inflict enormous economic, social, and political disruption in addition to increasing morbidity and mortality across a broad range of geographic arena (Madhav et al., 2017). There have been a number of notable pandemics that have affected the world, including the Spanish flu, the E. coli O157:H7 (E. coli) pandemic, the Zika virus pandemic, and the HIV/AIDS pandemic [Table-1] (Madhav et al., 2017).

Table 1: Remarkable pandemic events since middle ages and impact on the economy and society (Madhav et al., 2017).

Event	Starting Year	Impact on the economy, society
Bubonic plague (Black Death) pandemic	1347	Likely hastened end of the feudal system in Europe
Introduction of smallpox	Early 1500s	Demolished native communities, allowing Europe to assume dominance
Fifth cholera pandemic	1817	Prompted strikes on the Russian tsarist administration and hospital professionals
Spanish flu influenza pandemic	1918	Australia's GDP decreased by 3%, Canada's by 15%, the United Kingdom's by 17%, and the United States' by 11%.
Asian flu influenza pandemic	1957	Canada, Japan, the UK, and the US all had a 3% GDP decline.
Hong Kong flu influenza pandemic	1968	Direct and indirect costs in the US range from US\$23 to US\$26 billion.
HIV/AIDS pandemic	1981	GDP growth in Africa is lost by 2-4 percent annually.

SARS pandemic	2003	Hong Kong SAR, China experienced a US\$4 billion GDP loss, US\$3 billion to US\$6 billion in Canada while Singapore suffered a US\$5 billion GDP loss.
Swine flu influenza pandemic	2009	Republic of Korea's GDP decreased by \$1 billion.
MERS epidemic	2012	Republic of Korea suffered a US\$2 billion loss, which led to US\$14 billion in government stimulus spending.
West Africa Ebola virus disease epidemic	2013	Loss in Guinea, Liberia, and Sierra Leone of US\$2 billion
Zika virus pandemic	2015	Loss in Latin America and the Caribbean of US\$7–US\$18 billion

Emergence and spread of infectious diseases with pandemic potential:

Throughout history, infectious disease with pandemic potential have frequently emerged and spread. As a result of increased interaction with animals due to breeding, hunting, and international commerce activities, zoonotic microorganisms, which are infectious diseases that can spread to people, are to blame for many infectious diseases that trigger pandemics (Boyce & Katz, 2019). Five sequential steps make up the process of cross-species transmission by which an animal pathogen becomes a competent pathogen in humans (Boyce & Katz, 2019; Piret & Boivin 2020; Pike et al., 2010).

- (1) Under natural conditions, the pathogens are exclusively infecting animals such as most malarial plasmodia.;
- (2) The pathogen transforms once it has been transferred to people but without enduring human-to-human transmission.; such pathogens include tularemia bacilli, Nipah, rabies, and West Nile viruses.;
- (3) Like the viruses that cause Ebola, Marburg, and human monkey pox, the pathogen only passes through a few rounds of secondary human transmission.;
- (4) Although the disease affects animals, protracted sequences of secondary human-to-human transmission, like that of influenza A, *Vibrio cholerae*, and the dengue virus, happen without the involvement of animal hosts.; and
- (5) the disease affects humans exclusively, such as human immunodeficiency virus (HIV) infection, smallpox, and tuberculosis.

The likelihood of zoonotic transmission is probably modulated by the pathogen-carrying animal species, the type of human connection with that animal, and the frequency of these encounters.

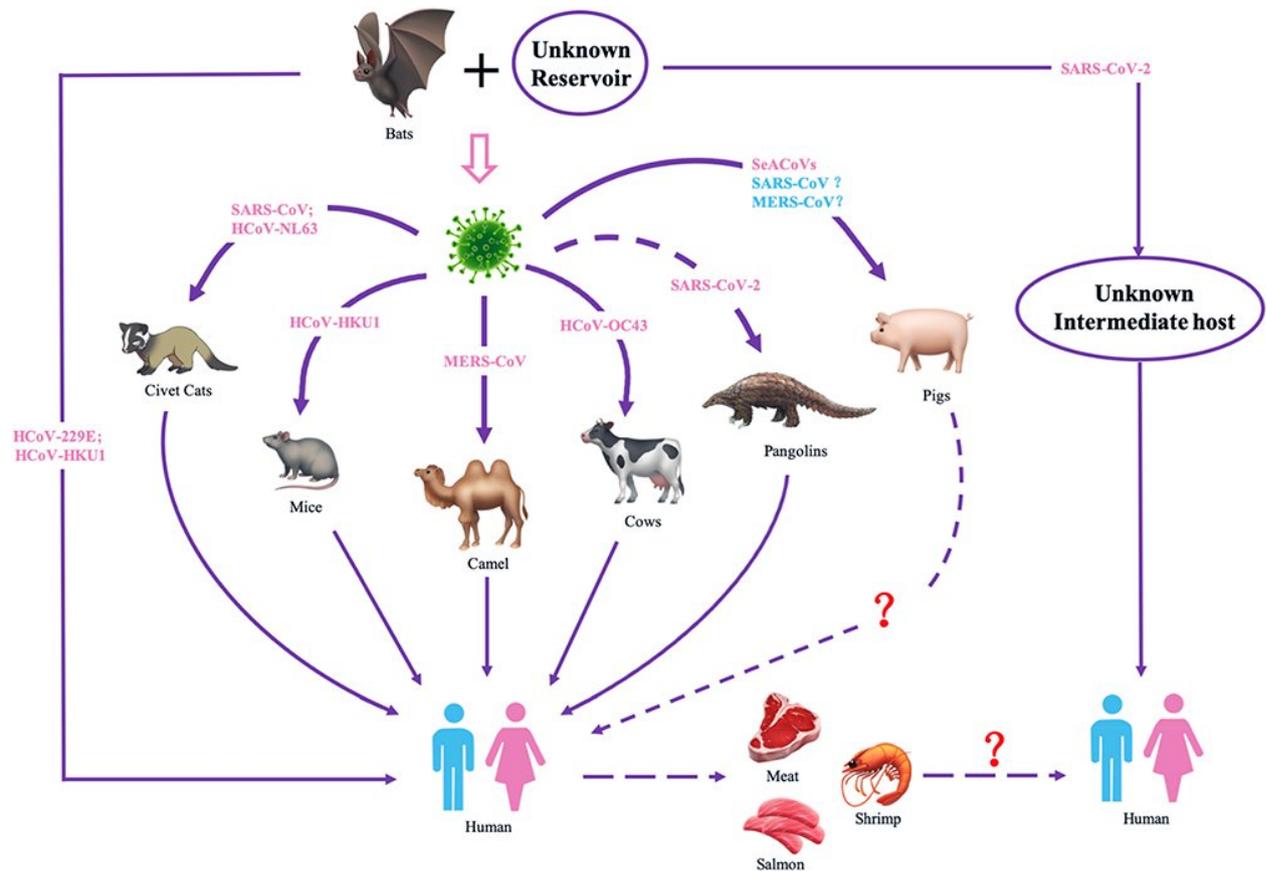


Figure 1: Cross-species transmission of pandemic diseases to human (Gan et al., 2020).

Every pandemic starts off as a small-scale disease episode that spreads fast over the world. In the case of the COVID-19 pandemic, in late 2019, healthcare professionals in Wuhan, China, began reporting a cluster of uncommon double lung infections with no known explanation to the WHO headquarters in China. The Huanan Seafood Market in Wuhan was the source of all COVID-19 cases in the beginning. These marketplaces sell live fish, meat, and wild animals, which brings a wide variety of animal species together in close proximity. As a result, viruses might easily switch between species. The genetic code of the viruses alters as a result of this, and a new animal viral strain emerges. When the infected animal was butchered, the virus infected a human by coming into contact with the mouths, eyes, nose, or blood. And because it was a new virus, humans had very little immunity to it. Globally, as of 16 June 2022, there have been 542,529,476 confirmed cases of COVID-19, including 6,336,651 deaths, reported to WHO (“WHO Coronavirus (COVID-19) Dashboard,” n.d.). To evaluate the effects of a pandemic, it is important to consider two key variables. The first is clinical severity, or the severity of the infection-related disease. The second factor is the pandemic virus's transmissibility, or how quickly it spreads from individual to individual. These two characteristics are used to help the CDC decide which activities to propose at any particular point during the pandemic (Branswell, 2009).

Classification and phases of pandemic

The classification of “pandemic” comes when a disease affects the global population. The stages of an outbreak that result in the proclamation of a pandemic have been established by the World Health Organization (WHO) (“The WHO pandemic phases”,2009). In 1999, the WHO created its pandemic phases, which were updated in 2005. The phases offer a universal framework to assist nations in pandemic preparedness and response planning and are relevant to the entire world. For ease of integration of new recommendations and methodologies into already-existing national preparedness and response plans, the WHO has retained the use of a six-phased strategy in this iteration. Phases 1-3 relate to preparedness, including activities for building capacity and reaction planning, whereas Phases 4-6 indisputably indicate the need for response and mitigation measures (Branswell,2009).

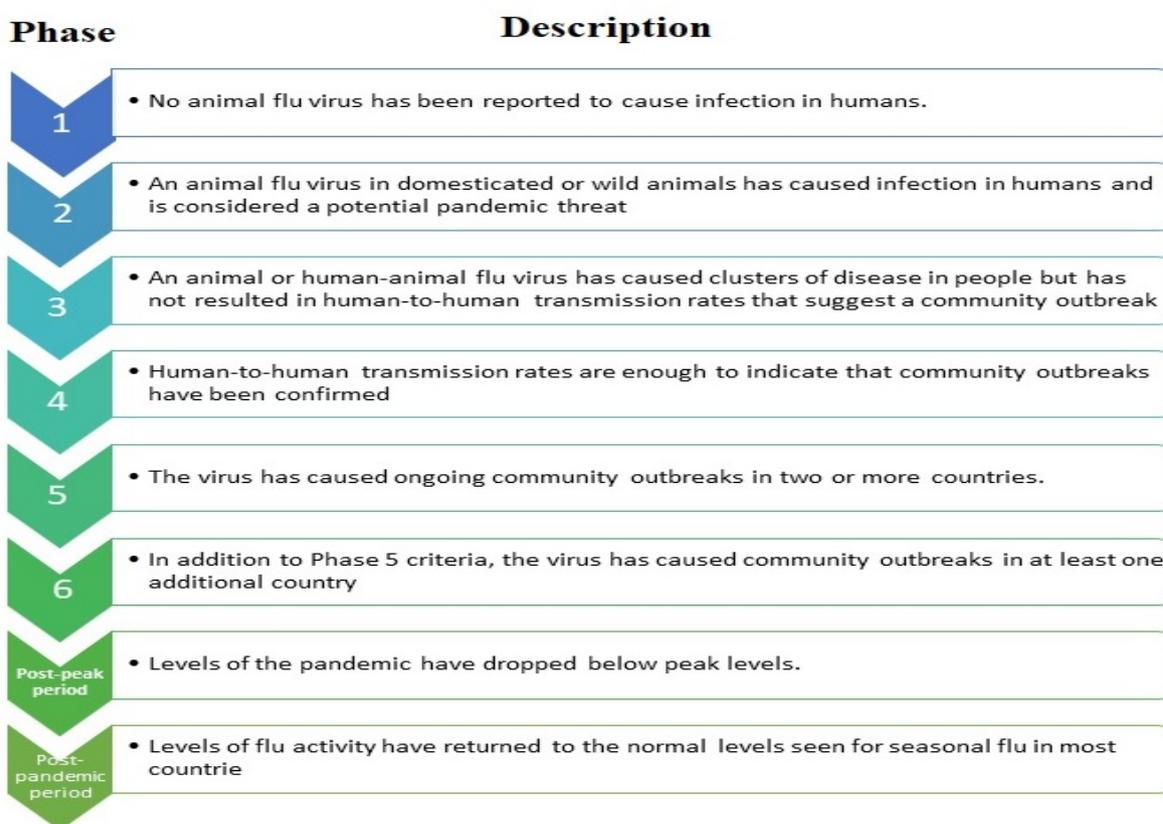


Figure 2: Phases for the declaration of pandemic (Riley, 2021)

This following staggered strategy is designed by the WHO to assist countries and other stakeholders in anticipating when certain conditions would necessitate decisions and determining when major actions should be implemented (Table-2) (Branswell,2009). This approach allows nations to establish additional global inequalities based on their unique circumstances in addition to the pandemic phase that has been declared globally. It is advised that governments investigate whether the potential pandemic virus is spreading disease within their borders, in neighbouring countries, or in countries that are in close proximity to them in this situation (Fraser, 2020). It is critical to emphasize that the phases were developed to provide guidance to countries on the implementation of activities, not as an epidemiological prediction. Although global influenza surveillance and monitoring systems have

significantly enhanced, it is still possible that the first outbreaks of a pandemic will go completely unnoticed. For example, if symptoms are mild and non-specific, an influenza virus with pandemic potential may achieve relatively widespread circulation before being detected, causing the global phase to shift from Phase 3 to Phases 5 or 6. If the rapid containment operations are successful, Phase 4 may be reverted to Phase 3 (“World Health Organization” 2009).

Table 2: WHO pandemic Influenza phase descriptions and main actions by phase (Branswell,2009)

	Estimated probability of pandemic	Summary	Main actions in affected countries	Main actions in nations that have not yet been impacted
Phase 1	Uncertain	No animal influenza virus circulating among animals has been reported to cause infection in humans.	Designing, executing out, practicing, and coordinating national pandemic influenza preparedness and response plans with national emergency preparedness and response plans.	
Phase 2		Since it is known that an animal influenza virus that is present in farmed or wild animals may infect people, it is recognized as a specific potential pandemic danger.		
Phase 3		There have been isolated cases or small clusters of disease in humans brought on by an animal or human-animal influenza reassortant virus, but there hasn't been enough human-to-human transmission to support widespread epidemics.		
Phase 4	Medium to high	It has been proven that an animal or human-animal influenza reassortant virus capable of sustaining community-level outbreaks can	Rapid containment.	Readiness for pandemic response.

		be transmitted from person to person.		
Phase 5	High to certain	The same identified virus has caused sustained community-level outbreaks in at least two countries in one WHO region.	Pandemic response: each country to implement actions as called for in their national plans.	Readiness for imminent response.
Phase 6	Pandemic in progress	The same virus has produced persistent community-level outbreaks in at least one additional nation in a different WHO region, in addition to the requirements specified in Phase 5 of the assessment process.		
Post-peak period		Most countries with effective surveillance have seen a decline in pandemic influenza levels from their peaks.	Evaluation of response; recovery; preparation for possible second wave.	-
Possible new wave		In most countries with effective surveillance, the level of pandemic influenza activity is once more on the rise.	Response	
Post-pandemic period		Throughout most countries that have effective surveillance, influenza levels have restored to those seen during the seasonal influenza season.	Evaluation of response; revision of plans; recovery.	

Role of public health professionals at the time of pandemic:

Public health workers are those who are in charge of delivering vital public health services, such as monitoring health status to identify community health problems, diagnosing and investigating community health problems and hazards, informing, educating, and empowering people about public health issues, mobilizing community partnerships to identify and solve health issues, and developing policies and plans that support individual and community health efforts; ensure a competitive environment for all (Rogers,2022). Like other health professionals, public health professionals endeavor to advance the general public's health and wellbeing by offering pertinent information on healthy behaviors and self-care ("Pandemic Severity Assessment Framework (PSAF) | Pandemic Influenza (Flu) | CDC," 2016). As a result, public health workers at all levels must be involved in all stages of the planning and implementation process for public health crisis management.

In the case of pandemic situation, public health measures play a significant role since public health works for protecting and improving the health of people and their communities in a scientific and artistic way (McGAVRAN, 1953). Public health efforts include encouraging healthy lifestyles, researching disease and its prevention, and identifying, preventing, and combating infectious diseases. Protecting the health of large populations, ranging in size from a single neighborhood to an entire nation or part of the world, is the overarching purpose of public health. Public health experts include people who conduct study on topics relating to community health, educate and promote healthy lifestyles in communities, set health standards and initiatives, etc. dedicate their knowledge, proficiency and experiences for protecting the health of populations (Kemppainen, 2017). The health of the poor during pandemic is totally dependent on government measures.

In the pandemic, public health professionals aid in protecting the health of populations by taking several actions. At the first place, public health professionals work to identify the sources of pandemic, developing models predicting the number of cases, then stop it to spread through planning and implementing control measure and keep communities as healthy as possible. Public health professionals do field investigations, door to door survey, interviews, observations, situation and lab analysis for coming into a scientific and evidence based point to ascertain the causation of disease transmission. On the basis of these evidences, action plans are prepared to find out the current number of cases and to predict potential population who are at risk of pandemic. In addition, public health specialists play important role to prepare strategic framework and guidelines to prevent disease for spreading and refraining to get from further complications of diseases, to promote healthy lifestyles and to prolong wellbeing (McGAVRAN, 1953; Kemppainen, 2017).

Public health professionals who execute such policies and programs safeguard the public. The majority of the time, ignorance is to blame for the spread of several deadly diseases. Raising public awareness is the main duty of public health professionals. They inform people on the gravity of illnesses and the best ways to stop the spread of disease or defend themselves from it in a pandemic. Increasing awareness is a crucial component of the public health strategy to enhance the standard of care for families and communities (“10 Essential Functions of Public Health Professionals | Texila,” 2021) Social marketing or “mass media” campaigns and eHealth interventions are effective techniques for promoting engagement in general health issues and raising public awareness (Gebbie et al., 2002). Public health practitioners also encourage those with whom they work to be healthy and happy. They advocate for healthy behaviors and instruct individuals or groups on how to engage in self-care and healthy behaviors. Examples of this include educating people about the importance of having excellent mental health or working with them to develop nourishing and healthy eating habits.

Identify the source of pandemic:

Identification of the source of diseases is the first and foremost responsibilities of a public health professional. Public health professional such as epidemiologists begin to search for the causation of diseases as soon as a public health concern occurred in a place. The field investigation is a widely practiced method using by the public health professionals for identifying the sources of diseases on urgent basis (Goodman et al., 1990). They conducted surveys in the surrounding and at medical facilities, and they collected nose and throat samples for laboratory investigation. These studies identified the afflicted individuals as well as the times and locations of their illnesses (“Coronavirus Disease 2019 (COVID-19),” 2020). To help Hubei province and Wuhan city health officials with their epidemiological and etiological investigations in response to the COVID 19 incident, the Chinese Center for Disease Control and Prevention (China CDC) established a rapid reaction team. Although no specific animal linkage was discovered, the WHO attributed the coronavirus epidemic spread to the Huanan South China Seafood Marketplace. The novel coronavirus, COVID-19, was discovered to be its source by a research team led by Prof. Yong-Zhen Zhang, and its first genome was made public on January 10 of 2020. The virus rapidly spread throughout China in less than a month during the Chinese New Year, a time of significant human mobility among Chinese people (Adhikari et al., 2020). Although it is still too early to determine who will be infected, early patterns resemble the coronaviruses that caused the Middle East Respiratory Syndrome and the severe acute respiratory syndrome (SARS) (MERS). Susceptibility appears to be correlated with aging, biological sex, and other health parameters (Fehr et al., 2017). COVID-19 has been formally designated as a Public Health Emergency of International Concern by the WHO (“Statement on the Second Meeting of the International Health Regulations (2005) Emergency Committee Regarding the Outbreak of Novel Coronavirus (2019-nCoV),” 2020).

Developing models predicting the number of cases

The most convenient way to model pandemic diseases is to use deterministic compartmental models. Epidemiologists and other public health professionals strive to anticipate the number of cases involved in disease pandemics around the world. Adjusting the equations' parameters allows for better simulation of environmental variables like social constraints. These models are named SEIR, SIT, SIRS, etc., since they are based on flow patterns between compartments such as susceptible (S), exposed (E), infected (I), and recovered (R). The most popular paradigm for modelling the global pandemic effects of diseases like COVID-19 is the conventional susceptible, expose, infectious, and recovered (SEIR) model. The SEIR model, which looks to be a difficult problem for general statistical approaches, can be used to evaluate the effectiveness of various activities taken after the epidemic. A common model for describing how humans move through three mutually exclusive stages of infection—prone, contaminated, and recovered—is the SIR (susceptible, infected, recovered) model for human-to-human transmission (Šušteršič et al., 2021).

Planning and implementing control measure

Public health experts and decision-makers take appropriate planning and control measures into account in order to prevent the rapid spread of pandemic diseases and protect everyone, especially those who are more likely to suffer severe illnesses, disproportionately impacted groups, and essential workers. The objective of using control measure strategies in nations where community transmission is common is to decrease overall transmission while minimizing the unfavourable social and economic effects of tactics like isolation, quarantine, or the closure of establishments like businesses, schools, and other public gathering places (Šušteršič et al., 2021).

COVID-19 and public health professional:

Health professionals are exposed to dangers that could result in infection with an outbreak pathogen like COVID-19 since they are on the front lines of any outbreak response. Potential risks include pathogen exposure, long work hours, psychological discomfort, weariness, occupational burnout, stigma, and physical and mental violence (“Coronavirus disease (covid-19) outbreak: Rights, roles and responsibilities of health workers, including key considerations for occupational safety and health”, n.d.) Public health professionals are starting to think about the future and how society may be better prepared for future pandemics based on what has been learnt from this coronavirus and global health care responses while the COVID-19 pandemic continues to affect the global population (Hussain et al., 2021).

Public health workers (PHWs) are critical in combating the pandemic, particularly in low-income nations with weak health systems. Immediate investment in health systems, as well as the involvement of health experts, may aid in the achievement of the following objectives: a. PROTECT healthcare workers, b. INTERRUPT the virus, c. MAINTAIN current healthcare services while expanding capacity, and d. PROTECT the most vulnerable from socioeconomic shocks. Examples of pandemic public health measures include monitoring disease progression, creating models to estimate the number of cases, creating and testing novel vaccines, screening and testing for COVID-19, public health messaging, public health prevention guidelines, contact tracing, and establishing standards for work, school, and other social activities (“What Do Public Health Professionals Do? | Goodwin College,” 2019).

PHWs play an important role in providing health services, and because they often volunteer, their personal happiness and motivation are important factors in their participation in health treatments. For instance, Public health worker’s programs in the Central African Republic demonstrated that they could provide some level of care at all times, reach the most vulnerable populations, and maintain disease surveillance activities even in conflict zones (Boyce & Katz, 2019). Given the COVID-19’s zoonotic roots, the emergence of new infectious illnesses, and PHWs’ aptitude for sensitively and culturally appropriate communication of key health themes, PHWs could be utilized to construct and promote One Health messaging initiatives. Inherent resilience could be strengthened by environmental incursion, bush meat consumption, and other factors that cause infectious disease spill over occurrences by encouraging more effective behavioral change initiatives and raising knowledge of the dangers posed by these

factors. PHWs may be used as a reserve health corp during a public health emergency to develop adaptive resilience. PHWs are frequently involved in developing national risk communication strategies, as well as communication networks that increase the perception of the information's credibility. During an outbreak response, this helps to limit the possibility of disinformation and rumours, which can lead to fear, social unrest, and violence (Seymour, 2018).

Conclusion:

In conclusion, it can be stated that public health experts play an important role during pandemic which is ranged from identifying, tracking, and preventing disease to research conducting for saving the future pandemic. In addition, they provide evidence-based suggestions and recommendation to the policy makers to plan and implement provisions for ensuring population health.

Conflicts of Interest

The author declares no conflicts of interest.

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