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How to Stop the Next Pandemic; Approach that Aims to Prevent the Emergence and Spread of Novel Pathogens

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Infectious diseases, COVID-19, Pandemic, Emerging.

Introduction and Origin of Emerging Infections
Forty (40) years ago, the World Health Organization officially declared the smallpox eradicated at the 33rd World health assembly in May 1980 [1]. The lessons learnt from that victory such as the use of new technology and international cooperation amongst others have aided in the fight against other infectious diseases and can also help us in the fight against emerging infections. Infectious diseases remain amongst the leading causes of death worldwide and particularly in sub-Saharan Africa [2]. New infections emerge periodically and contribute significantly to the global burden of disease morbidity and mortality [3,4]. Majority of these emerging infections are especially of viral but also bacterial origin [5]. About half of pathogenic microorganisms found in wildlife and livestock are zoonotic [5-7]. Most pandemics known to humans originated from animal species, wildlife, domestic animals and livestock [5]. Animal species thus serve as reservoirs of pathogens that can potentially threaten the existence of the human race [8].

Over the course of human history, we have had the black plague, Italian plague, cholera, Spanish flu, Asian flu, Swine flu, HIV/AIDS, amongst others [9]. All these pandemics have helped public health experts to prepare for future pandemics even though each pandemic presents differently.

Route and Reasons for Spread
Emergence of novel pathogens such as the severe acute respiratory syndrome (SARS), Human Immunodeficiency Virus (HIV) and influenza were mostly influenced by human population dynamics and socioeconomic behaviors [10]. These occurred and spread as a result of increased population size [6], poverty, climate change and weather [11], disruption of natural ecosystems [11], international travel [6], increased trade routes, expansion of agriculture [12], and increased interactions between humans and the natural world [10].

Most pandemics originate from areas where humans interact with wildlife [7]. Microorganisms found naturally in animal reservoirs can spillover to humans as a result of interactions such as migration of humans, agricultural expansion and wildlife trade to name a few [7,10]. This spillover has actually accounted for a number of pandemics [6,13-15]. Spillover of pathogens from one animal species to another are known to occur, however, the mechanisms responsible for this are poorly understood.

Person to person transmission and global spread is aided by advancements in local and international travel, appropriate weather conditions, poor hygiene and cultural practices such as shaking of hand, hugging or kissing.

The Way Forward
Collaboration between scientists from all over the world can play an integral part in the fight against novel pandemics. The cooperation between the Union of Soviet Socialist Republics (USSR) and the United States of America (USA) was vital to the eradication of small pox some 40 years ago. COVID 19 has also led to a high level of international partnerships and sharing of medical and scientific data as the world unites to fight a common enemy.

Research and Surveillance amongst Wildlife and People in Contact with Wildlife

To prevent the next pandemic, we call on international organizations and governments to create a coordinated response. This should be centered on improving research and surveillance amongst wildlife and those who frequently have contact with wildlife so as to identify high risk pathogens and early outbreaks. This starts with identifying high-risk areas and adequately supporting them with human and technical aid. This will require the agricultural, public health and healthcare sectors working together to quickly identify groups living in areas of great wildlife diversity where an outbreak of a novel pathogen can easily occur [6,16,17]. Recent advancements in diagnostic medicine makes it possible to quickly identify novel pathogens and cost effectively screen mass populations. Local and international public health groups will need to develop surveillance programs amongst such highrisk groups in order to quickly identify and contain outbreaks [16]. We can also take advantage of technological advancements such as artificial intelligence to map out high risk areas and areas of possible spillover of infections [11].

Regulation of Wildlife Trade

Human activities that increase contact between humans and wildlife can potentially lead to outbreaks. Such activities include hunting of wild game, deforestation and increasing agricultural activities into forest areas. These activities need to be properly regulated or stopped. However, reducing the contact between humans and the microorganisms that some wild game carry can reduce the odds of the emergence on a novel pathogen [6,8]. The mechanism of spillover of microorganisms from animals to humans is not completely known and that is why we need to further invest into research works that delve into the mechanisms of spillover of infection from animals to humans.

Capacity Building and Infrastructural Development

Early laboratory identification can halt the spread of novel pathogens only if coupled with mass screening and isolation of infected people [7]. Appropriate human resource empowerment can involve the training of more infectious disease experts in all fields, including public health specialists, infectious disease physician specialists, virologists and bacteriologist and laboratory scientists. These personnel will serve as a reserve force in times of a pandemic. We advocate for governments to stockpile personal protective equipment and other needed logistics for use in critical times. This coupled with adequate and well distributed infrastructure such as testing, isolation and treatment centers can effectively manage a crisis of any magnitude.

Vaccine Banks and Treatment Modalities

Stocks of immunogenic materials that can readily be formulated into vaccines in times of need will better prepare the world for the next pandemic. The setting up of vaccine banks in strategic areas around the world will greatly increase capacity to supply the rest of the world with the much-needed vaccines in the shortest possible time to deal with novel pathogens. Infectious disease experts can store antigen strains of various viruses for use in case of emergency vaccinations and to help in the development of new vaccines for similar strains.

Conclusion

In a coordinated and concerted effort encompassing contact tracing, case finding, continuous surveillance, regulation of wildlife trade, capacity building of health workers and vaccination we can be better prepared to fight the next inevitable pandemic.

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