Climate Change and Disease Emergence

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Editorial

It is almost impossible to precisely forecast the next major disease outbreak. However, climate change plays an indelible role in amplifying the drivers of disease emergence. Global health is largely dependent on our ability to prevent, control, or eliminate diseases. To achieve these endpoints, an understanding of the intricate relationship between the ecosystem, climate change, and infectious diseases is essential. Climate change poses an unprecedented challenge with cascading effects, and it needs to be remediated at the earliest.

For instance, vector-borne diseases like malaria, dengue, and scrub typhus, once confined to the tropical zones of this world, can translocate to colder areas due to extreme weather events brought about by climate change. Such a transition could result in an increasing incidence of tropical diseases in previously unexposed populations. Climate change can also result in the loss of animal habitats and the dispersal of animal species. As 75% of infectious diseases are of animal origin, increased habitat loss and extreme weather events can proportionally increase the species jump of animal microbes [1]. Meanwhile, climate change can increase precipitation and flooding, which adversely affect aquatic ecosystems. Such disruptions in the environment can result in the redistribution of cholera bacteria, resulting in severe outbreaks due to contamination of drinking water sources. Global warming and increasing water temperatures provide preconditions for zooplankton blooms, which can trigger an overall abundance of cholera bacteria [2]. Such seasonal cholera surges pose a huge threat to the global population.

Meanwhile, the permafrost zones of this world are repositories of ice that have held several exotic pathogens frozen for a long time. Due to the melting of glaciers and defrosting of ice, such disease pathogens could percolate into the human population. Such a chain of events could trigger an epidemic in an immunologically naïve population that has never encountered such a microbe. The exotic pathogens could be mutated and...
pose symptoms previously unknown in the host population. Many of the ancient microbes frozen in the permafrost have not yet been discovered or characterized [3]. The thawing of permafrost as a result of global warming presents a formidable pathway for disease emergence.

Further, climate change can play an important role in the airborne transmission of viruses like SARS-CoV-2. For instance, increases in humidity and temperature ensure the longer perpetuation of virus particles in the air and environment [4]. Such weather changes can amplify the transmission of airborne pathogens and alter the reservoir species' density in a particular area. As most viruses are zoonotic in origin, such changes in reservoir concentration can enhance the transmission dynamics of the microbe to humans. One reservoir species, the bat, holds a unique place in the transmission of animal viruses to humans. In several biodiversity hotspots, there are several thousand animal viruses ready to spill over to the human population. Containing global warming, even under a 2 °C increase, will not significantly reduce the bat-based transmission of these viruses [5]. There is an urgent need to survey this looming threat of cross-species transmission facilitated by climate change.

Finally, addressing the climate change challenge could serve as a deterrent to disease outbreaks and spillovers [6]. As we formulate frameworks and responses to mitigate health threats due to biological agents, the impact of climate change and its accelerating effect on infectious disease emergence cannot be overlooked.

References: