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A Critical Review on the Role of Climate Change in the Emergence and Re-Emergence of Zoonosis

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ABSTRACT

The role of climatic change on zoonotic disease epidemiology is evident by changes in reservoir and vector dynamics. Climatic variation creates new ecological niches for vectors hence altering temporal and spatial distribution of disease. The climate change has effect on distribution and occurrence of zoonotic disease such as West Nile fever, Rift valley fever and Japanese worse for the developing world where challenging socioeconomic encephalitis. It is considered as and political environments are exacerbated by a lack of epidemiological studies on the Emergence and Re-Emergence of zoonotic diseases.

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Introduction

In global climate change nitrous oxide is the largest climate driver and its rate of combustion of fossil fuels has resulted in a build-up of increase during the industrial era is very likely to have greenhouse gases within the atmosphere. These greenhouse gases also found to have come from several other sources traps heat and light from the sun in the earth's including tropospheric ozone changes due to atmosphere which increases the temperature. This process leads to the change in climate condition. The role of climatic change on zoonotic disease epidemiology is evident by changes in reservoir and vector dynamics. Climatic variation creates new ecological niches for vectors hence altering temporal and spatial distribution of disease.

It has been estimated that 60% of emerging and re –emerging human disease are zoonotic. In this review a zoonotic disease is defined as one that is transmitted from animals to humans, occurs naturally in animals and is not well adapted to human-to-human transmission The World Health Organization defines an emerging zoonosis as one that is "newly recognized or newly evolved, or that has occurred previously but shows an increase in incidence or expansion in geographical, host or vector range" [1]. The distribution and incidence of zoonotic diseases relate, in part, to their degree of climate sensitivity. So, this article aims to review the current literature on the role of climate change in the emergence and re-emergence of zoonosis.

Background

Climate Change

Climate change refers to any significant changes in climate through, temperature, precipitation, wind, etc., for an extended period, as a result of the natural processes, such as sun's intensity, ocean circulation, and human activities causing changes in the atmosphere's composition through burning fossil fuels and deforestation. The influence of climatic change on zoonotic disease epidemiology is evident by changes in reservoir and vector dynamics [2]. Climatic variation creates new ecological niches for vectors hence altering temporal and spatial distribution of disease

Land Temperatures

Global temperatures are rising at an unprecedented rate and this is mostly attributed to the anthropogenic emission of greenhouse gases. Temperature increases of 0.2°C per decade has been projected by the Intergovernmental Panel on Climate Change with a predicted mean temperature rise ranging between 1.8°C and 4°C by the end of the 21st century [1].

Due to the change in temperatures or Climate conditions of land, it is expected to increase the risk of vector-borne zoonotic diseases [1]. For example Arthropod vectors are the most sensitive to climatic temperature variability. Mosquitoes, ticks and sandflies are ectothermic and have life cycles that are dependent on ambient temperatures.

Risks due to Change in Climate

Climate change has a significant risk on human and animal health with regard to certain infectious diseases mainly transmitted through arthropod vectors. Climate change may affect disease by increasing the transmission cycles of vectors, and some regions, it may result in establishment of new diseases. The basic transmission cycle involves arthropod-animal host amplification, with humans acting as a dead-end host. Nearly half of the world's population is infected by vector borne diseases, resulting in high mortality and morbidity.

Zoonotic Disease

Zoonotic diseases are those disease passes from an animal or insect to man and vice versa. Some don't make the animal sick

but will sicken a human. Zoonosis ranges from minor short term illness to a major life changing illness. Certain one even causes death. Zoonosis can be caused by viruses, bacteria's, fungal and parasites [3]. They can also spread by different vectors. Especially zoonosis spread by mosquitos and ticks are most serious of disease

Emergence or Re-Emergence of Zoonotic Disease

The World Health Organization defines an emerging zoonosis as one that is "newly recognized or newly evolved, or that has occurred previously but shows an increase in incidence or expansion in geographical, host or vector range". Re-emerging diseases are known diseases that have reappeared after a significant decline in incidence. It is sign of the breakdown of public health measures.

Role of Climate Change in the Emergence and Re-Emergence of Zoonotic Disease

Climate change will alter the pattern of global infectious diseases. Climate exerts both direct and indirect effects on the appearance, and spread of many infectious diseases of humans, and animals.

The impact of climate change on the transmission and geographical distribution of vector-borne diseases, including zoonosis has been associated with changes in the replication rate, and dissemination of pathogen, vector, and animal host populations, which are sensitive to changing temperature and rainfall.

The available evidence indicates the potential for an increasing challenge to public health from arthropod-transmitted diseases such as tick borne encephalitis (TBE), West Nile fever (WNF), chikungunya fever, dirofilariasis and leishmaniasis. Climate change is also increasing the threat of infections, such as bluetongue virus (BTV) in domesticated animals [4].

Zoonotic pathogens such as Nipah virus, Hendra virus, Rift Valley fever virus, Hanta viruses, West Nile fever virus, Listeria monocytogenes, Campylobacter, Leptospira, Salmonella, Yersinia, Cryptosporidium, Giardia, Fasciola etc., are affected by climate change. Climate change have great role directly or indirectly on the occurrences or increase in number of most emergence and re-emergence of zoonotic disease. From those diseases only few of them discussed according to the next in this review

Rift Valley Fever

Rift Valley fever (RVF) is an acute febrile viral zoonotic disease caused by Rift Valley fever virus (RNA), which belongs to Bunyaviridae family Although human symptoms are usually mild, there can be hemorrhagic complications, and encephalitis. The role of climate change on RVF outbreaks might be anticipated to be mediated by the influence of increased rainfall on the habitat for vector mosquitoes. The outbreaks of RVF are usually associated with heavy rainfall, and warm temperature.

West Nile Fever

West Nile fever is an emerging viral zoonosis, and is caused by West Nile fever of genus Flavivirus and family Togavirdae is transmitted by the bite of mosquitoes of genus Culex.Climate warming will spread the infection.

Human African Trypanosomiasis

The African Trypanosomiasis (African sleeping sickness) is an important protozoan metazoonosis caused by Trypanosoma species. The infection occurs by the bites of infective tsetse fly of the genus Glossina. The climate changes in global and region temperature, humidity, and wind pattern will directly affect tsetse fly reproduction, development, and longevity as well as the vectorial capacity to transmit the protozoa [5].

Dirofilariasis

Dirifilariasis is a helminthic metazoonosis, and transmitted following the bite of infected mosquitoes. The changes in disease incidence are attributed to effects of temperature on the parasite itself, on the density of the vector population and to changes in human exposure.

Japanese Encephalitis

Japanese encephalitis (autumn encephalitis, brain fever) is an important arboviral zoonosis, which is affected by climate change, and is transmitted by the bite of infected mosquitoes of genus Culex, especially Cx. triataeniorhynchus [5].

So that, the changes in climate condition such as high rain fall, increase in global temperature, high humidity, andother extreme weather events Like El Niño has great role in the emergence and re-emergence of zoonosis. As example ENSO (El Niño -Southern Oscillation) cycle is a global climatic phenomenon consisting of hot and warm phases and contributing to increased extreme weather events. It has contributed to heavy rainfalls and Rift Valley fever outbreaks in East Africa [1].

Conclusion

Climate change occurs as a result of imbalance between incoming and outgoing radiation in the earth's atmosphere. The changes in climate condition such as high rain fall, increase in global temperature, high humidity, and other extreme weather events Like El Niño has great role in occurrence of emergence and re-emergence of zoonosis. So that giving special attention for the relationship between emergence and re-emergence of zoonosis and climate condition is very Public education on can be useful to decrease the important. climate change and zoonotic disease effects and risks, also additional studies should be conducted on role of climate changes in the emergence and re-emergence of zoonosis [6-13].

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