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An Analytical Review on Inter-relationships Between Climate Change and Malaria Transmission

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ABSTRACT

Prolong changes in climatic parameters may affect not only the geographical distribution of various vector borne diseases, but also is projected to have adverse effects on human health with regard to infectious diseases, particularly malaria. Malaria is perceived as the world's most devastating infectious disease, and is responsible for very high morbidity and mortality. A number of socioeconomic, environmental and behavioral factors affect the disease prevalence. Despite these factors, the impact of climate on probability of malaria transmission remains contentious.

Keywords: Malaria, transmission, climate change, health, geographical distribution

1. INTRODUCTION

Major physical consequences of changing climatic conditions are rise in earth's average temperature and spurt full changes in water cycles. Global warming is a steady process that may result in serious consequences including raised sea levels, famine, floods, changes in rainfall patterns, flora and fauna distribution, and serious health hazards. With advancement of scientific knowledge in recent years, awareness has also increased about influence of climate change on human health [1].

Climatic features, such as rainfall, humidity and seasonal temperature variations, are predominant factors in explaining the geographical distribution of the disease. Variations in thermal and weather extremities affect the health in terms of prevalence and intensity of various vector borne diseases- such as salmonellosis, cholera, giardiasis and malaria, which can thrive under these circumstances. Dynamics of such diseases depends on the mutual interaction between the regional climate and population. Thus, global warming may result in a considerable shift of the spectrum of infectious diseases [1].

The range as well as distribution of vectors is affected by even a little variation in temperature, precipitation and vegetation. A number of studies were carried out to simulate the potential consequence of climate change on malaria distribution in different geo-climatic zones [2, 3].

These models were based on selective studies on factors affecting the climate suitability and vulnerable populations, and data were analyzed by different statistical and biological parameters. Both population size and global warming are inter-related because human activities increase production of greenhouse gases. This effect culminates in global warming. The observed rise in global temperature over the 20th century was 0.3 to 0.6 °C and this rise is predicted to accelerate [4]. Altered environmental influences would also mean courting environmental disasters such as famines and floods.

2. MALARIA

Malaria, the most prevalent and the most pernicious parasitic disease of humans, is a major cause of morbidity and mortality. It is responsible for about 300-500 million clinical cases and up to 1.5- 2.7 million deaths every year [5]. Ninety percent of malaria-related deaths occur in sub-Saharan Africa, majority of whom are young children below the age of five years [6]. Malaria is also a cause of poverty and a major hindrance to economic development. The malaria burden is not evenly distributed. The global pattern of malarial transmission suggests a disease centered in the tropics but with a reach into subtropical regions in five continents [7].

3. CLIMATE CHANGE AND MALARIA TRANSMISSION

It is a well-known fact that vector borne infectious diseases, such as trypanosomiasis, giardiasis, leishmaniasis and malaria can thrive very well under such circumstances, but the consequences of climate change on malaria transmission is still ambiguous. The dynamics and distribution of malaria are strongly determined by climatic factors [8]. There is always a possibility of malaria transmission in novel regions, where it was non-endemic otherwise, due to changing climatic conditions.

Incidence of malaria depends upon various factors; mainly the abundance of *Anopheles spp.*, anthropogenic factors, and the presence of *Plasmodium* parasites [2]. Malaria transmission is commonly associated with lack of disease awareness, poverty, sanitation and also changing environmental conditions, particularly climate alterations. An alteration in climate may unswervingly affect the life-cycle of *Plasmodium* parasite, geographical distribution and behavior of the mosquitoes directly, and influencing other environmental factors such as vegetation and the availability of breeding sites indirectly. All these factors affect the dynamics and distribution of malaria [2].

4. IMPACT ON DISTRIBUTION OF MALARIA VECTORS

The major consequence of climate change is the distribution of malaria vectors and hence emergence of malaria in previously non-endemic regions [9]. In this way, climate change may result in a substantial shift of the malaria spectrum. Survival of mosquito vectors is an important aspect for malaria transmission; hence malaria cannot persist in climates, which are unsuitable for mosuitoes. Warm, moist climates are most conducive to mosquito propagation and survival. Survival of mosquitoes require warm, humid conditions and hence they most common around human populations and in deciduous and mixed forests [10]. Mosquito larvae are found in small pools of water. Various factors, which affect the mosquito breeding and larval persistence are, food availability, larval population and water quality [11]. The development of aquatic stages of mosquito vectors is enhanced under conditions of raised temperature with optimal larval development at 28 °C and optimal adult development between 28 and 32 °C [12]. Thus, global warming provides conditions favorable to the spread of malaria [1]. Sporogony of *Plasmodium* in mosuitoes needs temperatures between 16 and 33 °C, and hence malaria transmission is not possible beyond this range.

5. CONCLUSIONS

Climatic effects are predicted to include crowding, famine, water contamination, human migration, and alterations in vector ecology, all of which increase the risk of new infections in society. Malaria is likely to spread easily to novel areas, especially that are adjacent to current endemic area, because of the change in mosquito vector distribution. Effective strategies to combat malaria include better vector control measures, more effective chemotherapeutic agents and effective vaccines. Appropriate provisions and investigations can reduce adverse effects of climate change especially in terms of disease transmission.

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