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Influence of El Niño Southern Oscillation and Indian Ocean Dipole to Address the Fluctuation of Dengue in India

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Vector-borne diseases are well known for its widespread impact on illnesses of human and other animal populations caused by pathogens and parasites. It accounts over 17% of all infectious diseases, whereas, the mosquito is one of the important vector for transmitting disease.

Dengue is the most significant mosquito-borne, lethal flaviviral disease, deceptively intensifying as a global health issue. Dengue virus has been spread by the bite of infected Aedes mosquitoes. It causes a wide range of illness, among them dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) are common. The rapid growth of population change has increased the cumulative burden of dengue disease. It has recently estimated 390 million people are under threat for dengue [1], globally 50 million people are infected across 100 countries per year [2]. The worldwide surge in urbanization and sophisticated lifestyle of people has accelerated endemicity of dengue, specifically in Asia and parts of South Africa [3]. India is familiar with cyclical epidemics of dengue over the years and it is one of the main cause of hospitalization and death amongst children in the country [4]. Remarkably India reported a yearly average of 63,261 dengue cases and 188 deaths by the infection in 2010-2016 [5]. According to Indian Health Ministry, over 58 people died by the dengue virus among 36,000 cases recorded across the country, between the first 8 months of 2017. Conversely, the actual liability of dengue in India is profoundly flouted, because of the eclectic problem of lower reporting of dengue cases recently come into focus [6,7,8].

The anomaly of atmospheric pressure and sea surface temperature (SST) in the equatorial Pacific Ocean is known as El Niño and Southern Oscillation (ENSO). It is a huge supplier to Indian summer monsoon rainfall (ISMR) and effects world weather [9]. Indian continent experiences dry condition when the strong positive values of ENSO are related with El Niño episode [10]. Contemporary studies admitted that the ENSO acting as a vital role in the inter-mingle disparity of dengue transmission [11,12]. The Indian Ocean Dipole (IOD) is a combined ocean-atmosphere occurrence in the Indian Ocean, which is symbolized by divergent cooling of SST in the south-eastern equatorial Indian Ocean and divergent worming of SST in the western equatorial ocean [13]. At the time of positive IOD event, East African countries consume above normal rainfall, apparently reduced rainfall forms drought in Indonesia and Australia [14]. The IOD considerably rises the monsoon rainfall in India and decreases the effects of ENSO on ISMR [15].

There is emergent proof about the influences of climate change on dengue, and temperature enhances their vectorial capacity and the extrinsic incubation period (EIP) of pathogens [16, 17, 18]. ENSO and IOD related event increase the temperature of the concurrent year, whereas the heating can positively affect the proportion of dengue epidemics. Different statistical models like Pearson's product moment correlation coefficient, poison regression model, distributed lag non-linear statistical model (DLNM) are shows a strong positive relation between ENSO, IOD and dengue cases [19, 20]. Whereas, the spatial models are fruitful for assessing the correlation between climatic variable and dengue i.e. autoregressive integrated average model (ARIMA) [21], seasonal autoregressive integrated average model (SARIMA) [22], wavelet coherence analysis [23] etc. These models produces a strong correlation between ENSO and or IOD and dengue cases, which further used for an early warning system in different countries. Recently six countries (Brazil, Bolivia, Cambodia, Indonesia, Maldives, and Thailand) were evaluated routine dengue surveillance systems [24] and this continuous scientific reporting was considered beneficial for monitoring and national planning.

In India, correlation analysis between ENSO and dengue has been used for evaluating the influence of climatic phenomenon on this vector. But spatial models are still to be used in this concern, mainly because of the constraints of fine resolution spatio-temporal data (district wise and weekly) and unavailability of liable data on national level. Whereas spatial model for ENSO, IOD and dengue surveillance helps to incorporate the interoperable platform for collecting basic information for problematic judgment and develop forthcoming planning for controlling the disease. This kind of web-based, electronic data management, and data sharing platform can be adapted by India for avoiding poorer reporting of cases by effective surveillance of dengue in the country.

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