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CURRENT AND FUTURE PROJECTIONS OF RISE IN VECTOR BORNE DISEASES DUE TO CLIMATE CHANGE IN INDIA

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ABSTRACT

Climate change is one of the greatest threats to human health in the 21st century. Climate directly impacts health through climatic extremes, air quality, sea-level rise,food production systems and water resources. Climate also affects infectious diseases,which have played a significant role in human history, impacting the rise and fall of civilizations. The world is witnessing Climate change. Vector-borne diseases account for over 17% of all infectious diseases. There is increasing evidence about the impactof climate change on Vector Borne Diseases. In this paper, I have collected secondarydata from published articles, journals, reports, and books on this major issue to discussthe effects of climate change on VBDs in India through this article. This paper will briefly review the changing epidemiology of the most important vector-borne diseasesin India.

Keywords: *Climate change, infectious diseases, temperature changes and vector- borne disease.*

INTRODUCTION

Climate change refers to any change in climate over time, whether due to natural variability or asa result of human activity.1 Climate change occurs in hundreds or even millions of years. Climatechange may result from both natural and human causes though the human causes appear to be increasingly responsible for climate change over the past few decades. Naturally occurring Greenhouse Gases (GHG) include water vapour, carbon dioxide, ozone, methane, chlorofluoro carbon (cfc) and nitrous oxide, together create a natural greenhouse effect. Human activities are increasing GHG levels in the atmosphere and thus causing Global Warming.2 Atmospheric carbondioxide levels, which have remained steady at 180-220 ppm for the past 420,000 years, are now close to 370 ppm and rising.3 Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. According to Intergovernmental Panel on Climate Change (IPCC) 2013- The globally averaged combined land and ocean surface temperature data as calculated by a linear trend, show a warming of 0.85 [0.65 to 1.06] °C, over the period 1880 to 2012.

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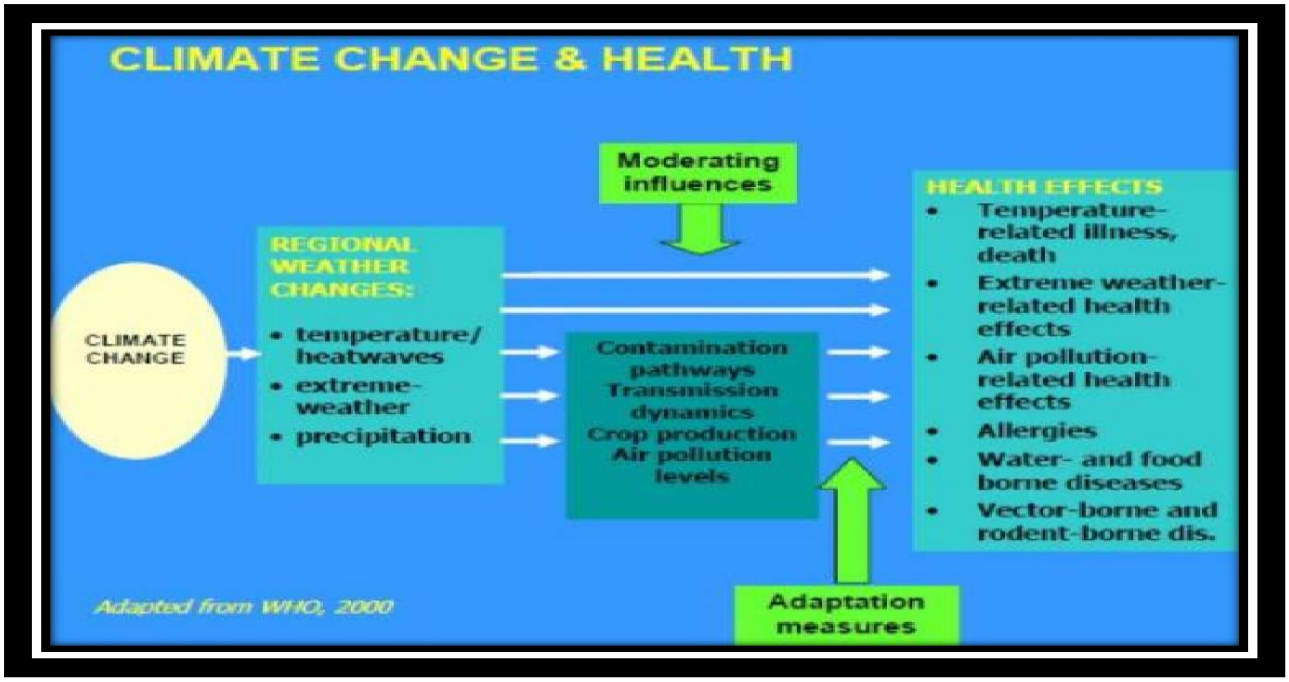

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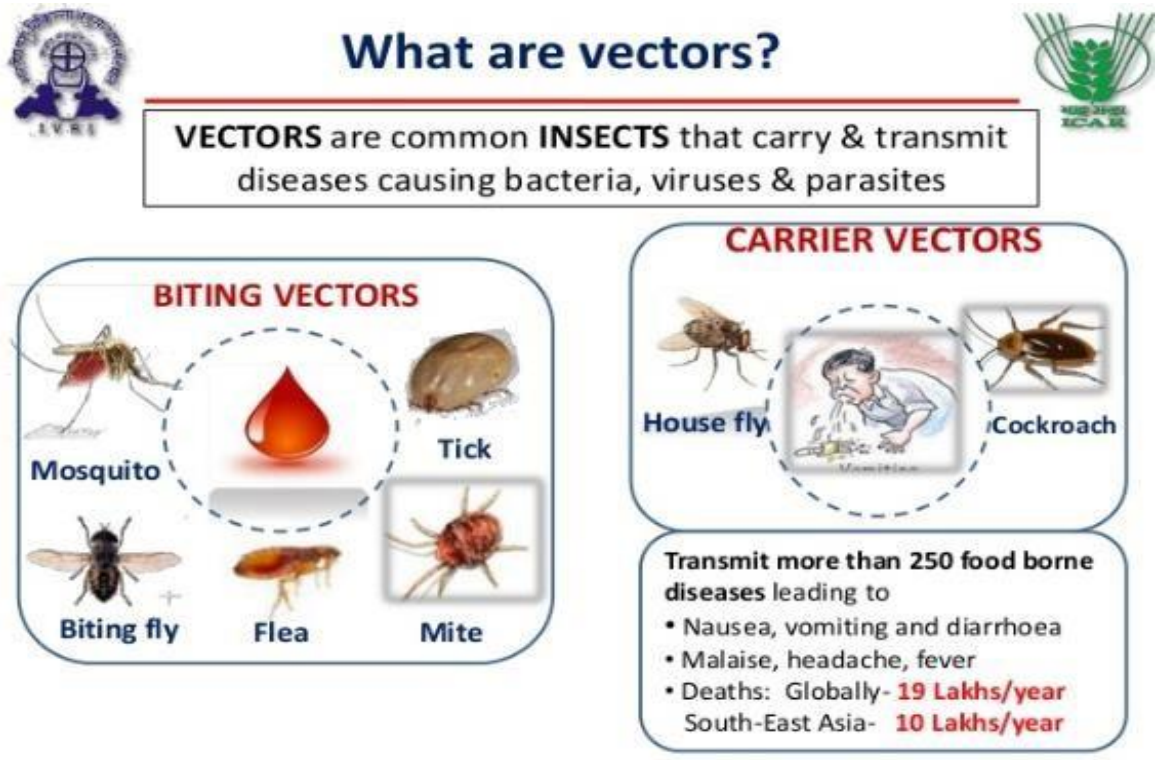

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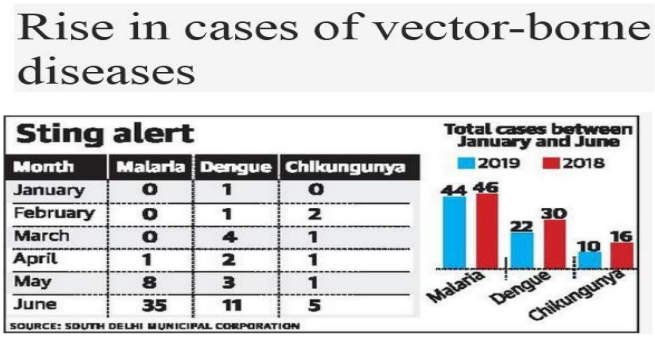
Major Vector-borne diseases (VBDs) in India

Vector-borne diseases are illnesses caused by pathogens and parasites in human populations. Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans. TABLE -1. There is increasing evidence about the impact of climate change on Vector Borne Diseases, and some of it can be explained by the fact that the insect vectors of these diseases are ectothermic and hence temperature affects their

vectorial capacityand the extrinsic incubation period (EIP) of pathogens.9 The main VBDs in India are Malaria, Kala-azar (Visceral Leishmaniasis), Japanese Encephalitis, Lymphatic



Filariasis (LF),Chikungunya and Dengue.

Table 1.Vector Borne Diseases – their Pathogens and Vectors

Disease	Pathogen	Vector	Transmission
Protozoan			
Malaria	Plasmodium falciparum, vivax, ovale, malariae	Anopheles spp. Mosquitoes	Anthroponotic
Kala azar/ Leishmaniasis *	Leishmania spp.	Lutzomyia & Phlebotomus spp. Sandflies	Zoonotic Reservoir: Domestic animals - cow, buffalo, goat, dog
Trypanosomiasis *	Trypanosoma brucei gambiense, rhodesiense	Glossina spp. (tsetse fly)	Zoonotic
Chagas disease *	Trypanosoma cruzi	Triatomine spp.	Zoonotic
Viral			
Dengue *	DEN-1,2,3,4 flaviviruses	Aedes aegypti mosquito	Anthroponotic
Yellow fever	Yellow fever flavivirus	Aedes aegypti mosquito	Anthroponotic
Encephalitis (West Nile, Lyme, etc.)	Flavi-,alpha- and bunyaviruses	Culex mosquitoes and ticks	Zoonotic Reservoir: Domestic pigs and wild birds
Filarial nematodes			
Lymphatic filariasis *	Wuchereria bancrofti Brugia malayi, timori,	Anopheles, Culex, Aedes mosquitoes	Anthroponotic
Onchocerciasis *	Onchocerca volvulus	Simulium spp. Blackflies	Anthroponotic

*WHO neglected tropical disease

Reference: slideshare.com

CLIMATE CHANGE AND ITS EFFECTS

Temperature Effects On Vector

1. Decrease/increase rate of vector population growth.

On Pathogen

1. Affecting its Vectorial Capacity.
2. changes in the transmission season, in geographical distribution of disease vectors and VBDs,for example, by rendering

previously endemic areas unsuitable and previously non-endemic areas suitable for their existence and reproduction.

Vector Survival

1. Direct effects of temperature on mortality rates.
2. At low temperatures, lifecycle lengthens and mortality outstrips fecundity.

Malaria

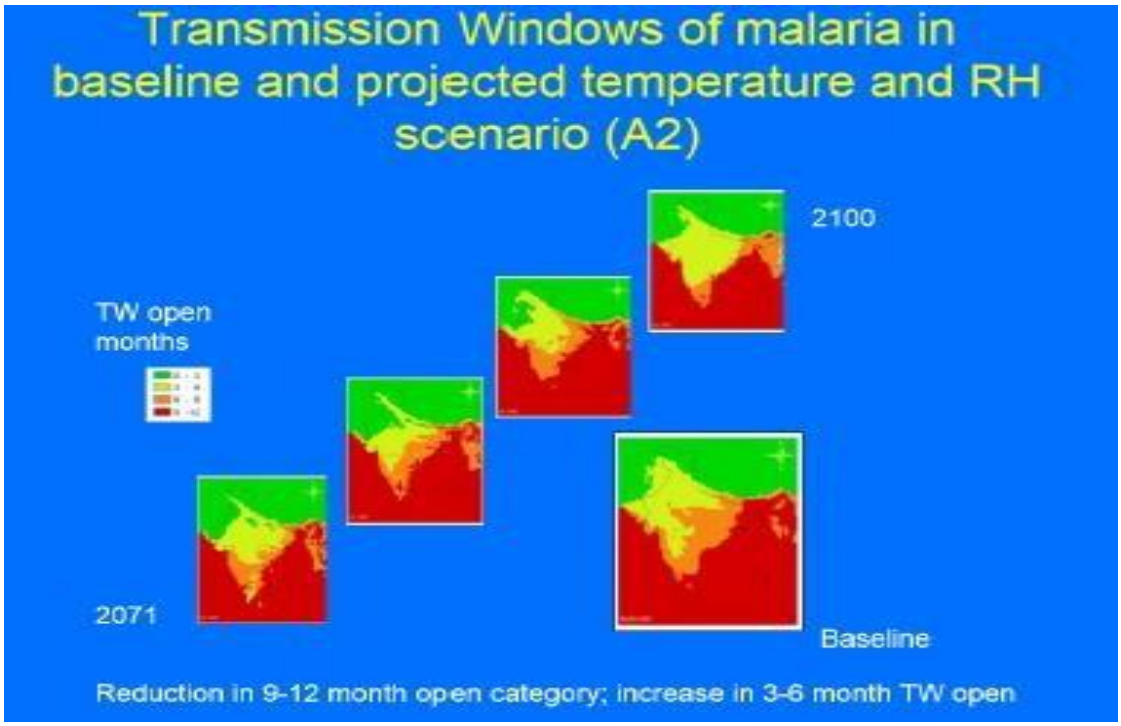
About 400-500 million cases of malaria and more than 1 million malaria-related deaths occur globally each year.

Several factors like including the emergence of insecticide and drug resistance, human population growth and movement, land-use change, and deteriorating public health infrastructure.

Over the past 15 years, Malaria burden has reduced in India. At lower temperatures, a small increase in temperature can greatly increase the risk of malaria transmission due to increased numbers of mosquitoes.

Changes in temperature and precipitation patterns have the potential to expand the geographical range of malaria into temperate and arid parts of South Asia. For example, in India malaria distribution is expected to expand to higher latitudes and altitudes. Rainfall alone accounted for about 45 per cent of the variation in malaria transmission.

Analysis of Baseline and projected climate parameters for Malaria and Dengue was done at national level using A2 and A1B Scenario of Providing Regional Climate for Impact Study (PRECIS) model. Studies undertaken in India with A2 scenario on malaria reveal that the transmission window in Punjab, Haryana, Jammu & Kashmir and northeastern states are likely toextend temporally by 2–3 months and in Odisha, Andhra Pradesh and Tamil Nadu there may be reduction in transmission windows. Thus, there will be reduction in 9-12-month open category andincrease in 3-6 months Transmission Window (TW) open.



Reference: Research Gate

Dengue

1. More than 50 dengue outbreaks reported in India since 1960.
2. 20 Impact of climate change on dengue also reveals increase in transmission with 2°C rise intemperature in northern India.
3. Temperature and relative humidity for indigenous transmission of dengue need to be redefined.
4. In a study using A2 scenario of PRECIS model, transmission windows for denguetransmission (12–40°C temperature) were projected, which show climatically whole country is suitable; water availability and Life style are the major determinants. Figure – 4

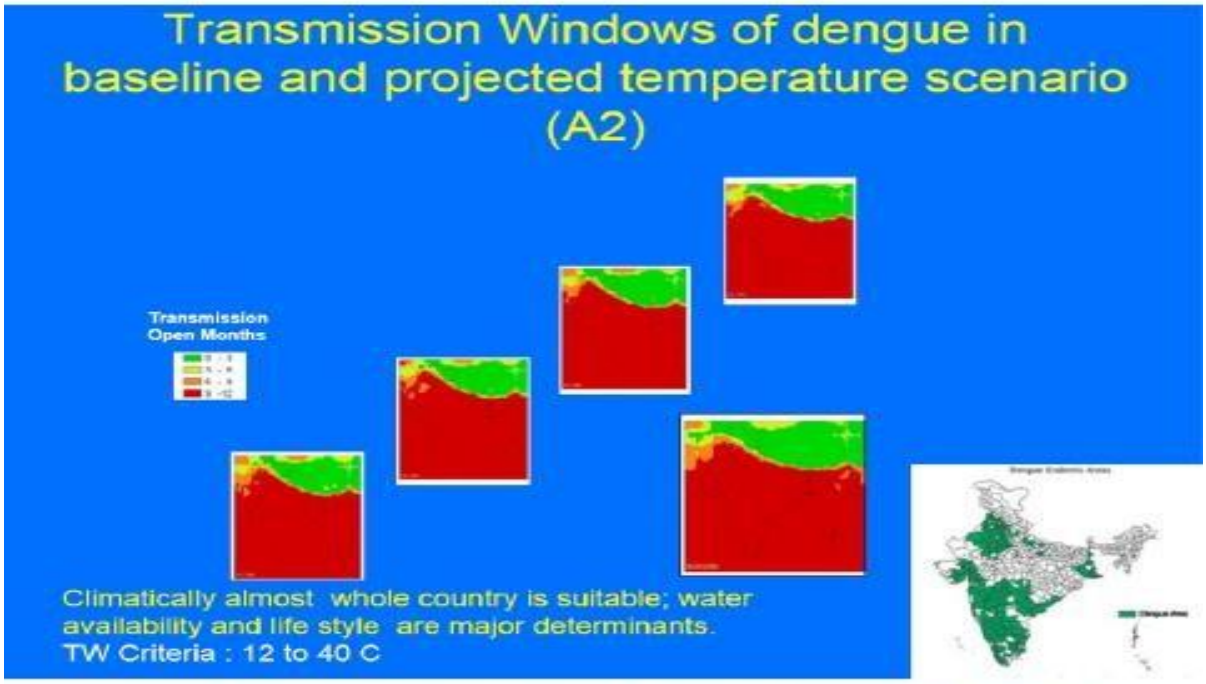


Figure 4.Transmission Windows of Dengue (Scenario A2), in India

Reference: Research Gate

Vector-borne diseases account for over 17% of all infectious diseases. The National Vector Borne Disease Control Programme (NVBDCP) data from 2007 to 2016 shows that there is a slight decrease in Malaria burden whereas the burden of Dengue and Chikungunya is on a rise.TABLE – 2.

Table 2.Climate change in India and rise of some VBDs - Dengue and Chickungunya

Disease	Year	Cases	Deaths
Malaria	2007	1.59 million	1023
	2016	1090724	331
	2017	486059	44
Kala azar	2007	28941	105
	2016	6245	Nil
	2017	2969	Nil
Japanese Encephalitis	2007	5149	677
	2016	1676	283
	2017	1066	115
Dengue	2007	28292	110
	2016	129166	245
	2017	36635	58
Chikungunya	2007	59535	Nil
	2016	64057	Nil
	2017	22828	Nil
Filariasis	2007	600 million (Toatl Burden)	Nil

Source NVBDCP (data for 2017 is only up to August 2017)

MEASURES TAKEN

- Spraying insecticides to prevent mosquito breeding.
- Cleanliness, Wear light colour, long sleeved shirts and long trousers tucked into socks and boots.
- Use Fogging machine, insect repellent on exposed skin are widely used and are also very effectivein curbing VBD.
- The number of cases of vector-borne diseases is expected to rise during the monsoon, which isexpected to arrive later this week.
- The three municipal corporations have been undertaking several measures such as door-to-door tosurveys and spraying insecticides to prevent mosquito breeding. The South Delhi Municipal

Corporation's report stated that 2,37,466 houses have been sprayed with insecticides. Around80,165 houses have been sprayed in north Delhi and only 12,542 in east Delhi.

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