

# Climate Change and Infectious Diseases in India: Implications for Healthcare Providers

## Authors

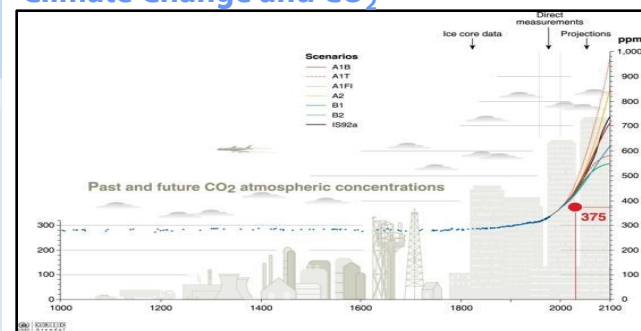
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## Summary

While climate change has the potential to influence Earth's biological systems, its effect on human health is not well defined. A developing nation such as India may face a host of health effects due to climate change, including vector-borne and water-borne diseases such as malaria, cholera, and dengue. This poster gives a broad overview of common and prevalent infectious diseases in India, their links to climate change, and how health-care providers might discuss preventive health-care strategies with their patients.

## Climate Change and CO<sub>2</sub>



## Climate Change and Disease in India

- Infectious disease distribution involves complex social and demographic factors, as well as meteorological factors including temperature, humidity, and rainfall patterns.
- In South Asia, scientists predict an increased frequency of floods due to greater intensity of rainfall. Previous floods in India have been linked with outbreaks of diarrheal diseases, respiratory infections, and rodent-borne and other infectious diseases.
- Rising sea-surface temperatures are expected to increase tropical cyclone intensity and the height of storm surges, which could lead to diseases and illnesses associated with the loss of clean water, hygiene, and sanitation.

## Water-borne diseases

- A warmer climate could cause water-borne diseases to become more frequent in India, including cholera and diarrheal diseases such as giardiasis, salmonellosis, and cryptosporidiosis.
- Diarrheal diseases are already a major cause of morbidity and mortality in South Asia, particularly among children.
- As rising ambient temperatures increase, bacterial survival time and proliferation and thus the incidence of diarrheal diseases might further increase.
- Diarrheal diseases are largely attributable to unsafe drinking water and the lack of basic sanitation; thus, reductions in the availability of freshwater are likely to increase the incidence of such diseases.
- Outbreaks of cholera have occurred in India. A relationship has been observed between increases in sea-surface temperature and the onset of cholera epidemics.

## Malaria

- Currently, all of India's population is at risk for contracting malaria except for those in the areas above 1700m.
- More than 973 million persons are exposed to vector-borne malarial parasites in India, and in 1998 an estimated 577,000 Disability Adjusted Life Years (DALYs) were lost due to malaria.
- Changes in temperature, rainfall, and humidity can all affect malaria transmission, and have the potential to expand the geographical range of malaria into temperate and arid parts of South Asia.
- In India malaria distribution is expected to expand to higher latitudes and altitudes, while in some areas increasing temperatures may restrict malaria transmission.
- To determine the role of climate change in malaria transmission, research efforts will be required that incorporate a disease surveillance system combining trend analyses from multiple sites to account for local factors.
- By the 2050s, the range of malaria vectors is projected to shift away from central regions toward southwestern and northern states.
- Duration of the transmission window is likely to widen in northern and western states and shorten in southern states.
- Malaria is likely to persist in Orissa, West Bengal, and southern parts of Assam.



## Other Vector-borne and Zoonotic Diseases

- Climate change might affect other diseases endemic to South Asia, such as chikungunya and dengue, parasitic diseases such as leishmaniasis, lymphatic filariasis and onchocerciasis, and tick-borne diseases.
- Some of these disease may exhibit changes in transmission intensity or shifts in their geographical ranges due to the impact of climate on the relevant vector populations.
- Climatic factors might also influence human plague.
- Temperature and rainfall are important determinants of rodent population abundance and distribution. Combined with the influence of temperature and humidity on flea survival and development, changes in any of these climatic components may result in changes in plague incidence.
- Murine typhus, a rickettsial disease, is also transmitted by fleas and thus may exhibit similar climate sensitivity.
- The arboviral diseases chikungunya and dengue may also be influenced by climate, as both are transmitted by the common vector *Aedes aegypti*. The first reported outbreak of chikungunya in India was in 1963 in Calcutta, with transmission continuing until 1973. The virus reemerged in 2005, and has since spread rapidly, with more than one million cases reported—despite no standardized surveillance system for the disease. This reemergence has been associated with weather extremes.
- Dengue has also been a significant problem, with more than 50 dengue outbreaks reported in India since 1960.

## Conclusions and Implications

As a developing coastal country with high population density, India might experience myriad human health effects because of climate change. These effects could include infectious diseases such as malaria, chikungunya, and water-borne illnesses. Healthcare providers should be aware of these possible threats. They may also be able to indirectly discuss climate change with their patients by focusing on activities which have mitigation co-benefits, such as healthy diet and exercise.

## What Clinicians Might Expect

- Increased illnesses and deaths from more severe heat waves
- Increased injury, death, and post-traumatic stress disorders from increases in storms, cyclones, and floods
- Increased risks of diarrheal disease
- Change in the range, distribution, and incidence of outbreaks of vector-borne diseases (e.g. dengue, chikungunya)
- Adverse health effects of more severe drought and long-term drying conditions on rural and remote communities:
  - Exposure to extremes of heat, dust, and smoke
  - Fresh water shortages (hygiene and sanitation)
  - Mental health (depression and suicide)
  - Childhood emotional and developmental experiences
- Increase in flow of environmental refugees

## Discussing climate change with patients

- Healthy diet
  - eating more plant foods with vegetables, fruit, and grains will reduce your risk of obesity, diabetes, hypertension, heart disease and some types of cancer
  - buy fresh, organic and locally grown food
  - consume less meat
- Healthy exercise
  - walk or cycle wherever you can
  - use public transport