DOI: 10.21567/adhyayan.v7i1.8111

Vulnerability of Human-Beings to Changing Climatic Conditions: An In-depth Insight in the Indian Context

Nandita

Assistant Professor, Maharishi University of Information Technology, Lucknow

Abstract

The four most critical issues that homo-sapiens currently face are ─ peace, population, development and environment. All the issues are co-related. The anthropogenic activities leading to climate change can be linked to various diseases. Strong relations and evidences have been found between change in climate and health. The world is facing an increase in disease burden due to malaria. Malaria has been associated with highest morbidity and highest mortality in the world. The El Nino cycles and global warming can be attributed to the higher incidence of malaria.

This paper aims to review the relationships between future prediction of climate change and increasing health risks. Various issues like droughts and water scarcity, storms and cyclones, melting glaciers, heat and cold wave and its impact on human health have been discussed. All these have been discussed with reference to Indian context. It delves into what will be the impact of changing weather patterns on human beings. It provides an insight into the factors that can cause diseases, disability and death when the humans are directly or indirectly exposed to these factors.

Key Words: Climate change, Health risks, Disease

I. Introduction

Climate change is a serious and urgent issue. The anthropogenic activities since industrial revolution have led to unprecedented changes in climate. There is now significant evidence of the fact that human activity is causing global warming. While most of the experts view the effects of global warming to be more substantial and more rapidly occurring than others do, the scientific consensus on climatic changes related to global warming is that the average temperature of the Earth has risen between 0.4 and 0.8 °C over the past 100 years.

Global climate change is a phenomenon that is now considered strongly associated with human activities. Carbon dioxide levels in the atmosphere which had been steady at 180-220 ppm for the past 420,000 years are now close to 370 ppm and rising. Climate change will have a wide range of implications to human development. Even a minor change in climate can result in substantial change in risk. The effect will be significant in case of developing countries and especially those countries that are still dependent on primary production for their survival and major source of income. This impact is acute for India as it is still in development stage with huge population.

II. Objectives of Research

1. To assess the upcoming changes in climate in India.
2. To study the impact of climate change on human health with reference to India.
3. To suggest ways and means to adapt to the changing climate.

III. Literature Review

Increase in the frequency and intensity of extreme temperatures, will have both direct and indirect effects on health (Anil &Aline, 2008). The researchers have further established a link between extreme climate and weather events and higher levels of aggression. A 2013 study

(Solomon M. Hsiang, Marshall Burke, Edward Miguel) found that increase in temperature and extreme rainfall are associated with increased levels of conflict between individuals, and between groups as higher temperatures increase levels of adrenaline in the body, which can contribute to aggression. American Psychological Association has reported that when pregnant women are exposed to air pollutants, their children are more likely to have symptoms of anxiety and depression. The external forces (strong association with human activities) have led to emission of greenhouse gases in which electricity generation and transport are the major contributors (Stern 2006).Developing nations with limited resources are expected to face a host of health effects due to climate change, including vector-borne and water-borne diseases such as malaria, cholera, and dengue.

Majority of health-related risks posed by climate changes are preventable or curable through the scale-up of existing health programs and interventions. Intensive action to strengthen public health systems and to promote sustainable and healthy development choices can enhance current health conditions as well as can reduce vulnerability to future climate changes (Chandran & Sandhya, 2013).

Table 1: Health Impact of Climatic Changes in Developed and Developing Countries

Region	Health Impacts	Adaptive Capacity
Africa	- Changing in spatial and temporal distribution of malaria, dengue, diarrhea, cholera, meningitis, etc. - Increased deaths and injuries due to extreme weather events in new areas. - Malnutrition	Low adaptive capacity due to lack of financial and technological resources, low GDP per capita, poverty, limited infrastructure, weak primary health care, high infant mortality, low education levels, limited access to capital, armed conflicts.
Asia	Thermal stress due to heat waves in East Asia - Air pollution related diseases - Transmission of malaria to new areas - Increased morbidity and mortality due to diarrhea in South and Southeast Asia and cholera in South Asia - Increased deaths and injuries due to flooding and extreme events in East Asia, Southeast and South Asia - Malnutrition	Adaptive capacity varies among countries and is often constrained due to poor financial and technological resources, income inequalities and weak health care system
Latin America	- Thermal stresses due to heat waves in big cities - Transmission of vector-borne diseases to new areas, including malaria - Increased deaths and injuries due to tropical cyclones in the Caribbean basin - Rodent-borne infections after flooding and droughts	Limited adaptive capacity due to high infant mortality, income inequalities, weak health care system.
Small Island developing states	- Thermal stresses due to heat waves - Transmission of vector-borne diseases to new areas and increased morbidity and mortality due to diarrhea. - Increased deaths and injuries due to tropical cyclones	Low adaptive capacity, due to poor resources, weak health care system and high frequency of natural hazards.
Europe	Thermal stresses due to heat waves - Air pollution related diseases - Increased deaths and injuries due to extreme events and flooding - Expected increase in lyme disease and tick borne encephalitis in temperate regions - Expected increase in leishmaniasis in Mediterranean countries	Adaptive capacity is higher than in developing countries. Existing public health resources will allow to put in place curative and preventive measures to face at least part of the health impacts.
North America	Thermal stresses due to heat waves, mainly in North east and Mid-west - Injuries and mortality due to storms, floods, hurricanes, tornadoes and ice storms - Increased vector and water-borne diseases	Adaptive capacity higher than in developing countries. Existing public health resources will allow to put in place curative and preventive measures to face at least part of the health impacts.
Australia and New Zealand	Thermal stresses due to heat waves - Air pollution related diseases - Increased deaths and injuries due to tropical cyclones	Adaptive capacity higher than in developing countries. Existing public health resources will allow to put in place curative and preventive

	and floods - Increased transmission of vector-borne diseases (dengue)	measures to face at least part of the health impacts.
Source: As cited by Anil Markandya and Aline Chiabai (2008)		

IV. Implications of Climate Change in India

According to the projections given by the Inter-Governmental Panel on Climate Change (IPCC, third assessment), the global climate may warm by 1.4 to 5.8°C and precipitation may increase up to 7 per cent, and global sea level will rise from 0.09 to 0.88 m by the year 2100 (Bhattacharya et al 2006). Human population and countries with huge population will be impacted the most by this change.

World Bank Group engaged the Potsdam Institute for Climate Impact Research and Climate Analytics to assess the probable impacts of temperature increase i.e. from 2ºC to 4ºC in three regions. They studied the impact on agriculture, water resources, cities and coastal ecosystems in South Asia, South East Asia and Sub-Saharan Africa. Some of their findings for India have been summarized in table 2. Climate change may pose a threat to food security through erratic rainfall patterns and decreasing crop yields, contributing to increased hunger.

Table 2: Implications of Climate Change in India

Sl. No.	Expected changes in Climate	Probable impacts
1.	Extreme Heat Extremes in maximum and minimum temperatures are also predicted (Kumar et al; 2006)	The west coast and southern India are projected to shift to new, high-temperature climatic regimes with significant impacts on agriculture
2.	Changing rainfall patterns	Highly unpredictable summer monsoon , could trigger more frequent droughts as well as greater flooding in large parts of India, more than average rainfall in northwest and south east coastal regions
3.	Droughts	More frequent especially in north-western India, Jharkhand, Orissa and Chhattisgarh. Crop yields are expected to fall significantly because of extreme heat by the 2040s.
4.	Groundwater	15% of India's groundwater resources are overexploited. Falling ground water levels.
5.	Glacier Melt	At 2.5°C warming, melting glaciers and the loss of snow cover over the Himalayas are expected to threaten the stability and reliability of northern India's primarily glacier-fed rivers, particularly the Indus and the Brahmaputra. This could significantly impact irrigation, affecting the amount of food that can be produced in their basins as well as the livelihoods of millions of people.
6.	Sea level rise	Sea-level rise and storm surges would lead to saltwater intrusion in the coastal areas, impacting agriculture, degrading groundwater quality, contaminating drinking water, and possibly causing a rise in diarrhea cases and cholera outbreaks, as the cholera bacterium survives longer in saline water.
7.	Agriculture and food security	Recent studies shows that wheat yields peaked in India and Bangladesh around 2001 and have not increased since despite increasing fertilizer applications. Observations show that extremely high temperatures in northern India - above 34°C - have had a substantial negative effect on wheat yields, and rising temperatures can only aggravate the situation.
8.	Energy Security	Decreases in the availability of water and increases in temperature will pose major risk factors to thermal power generation.
9.	Water Security	Studies have found that the threat to water security is very high over Central India, along the mountain ranges of the Western Ghats, and

		in India's northeastern states.
10.	Health	Climate change is expected to have major health impacts in India- increasing malnutrition and related health disorders such as child stunting - with the poor likely to be affected most severely. Child stunting is projected to increase by 35% by 2050 compared to a scenario without climate change. Malaria and other vector-borne diseases, along with and diarrheal infections which are a major cause of child mortality, are likely to spread into areas where colder temperatures had previously limited transmission.
11.	Migration and conflict	Climate change impacts on agriculture and livelihoods can increase the number of climate refugees.

Source: World Bank

V. Adaptation options in the Climate Change Regime

With the given fact that climate projections and anticipated changes are highly unexpected; adaptation to climate change is a key concern now and the capacities to adapt to the adverse impacts of climate change may not be sufficient. However, amongst these uncertainties we need some preparedness.

Some of the measures that can be envisaged at this juncture which can help to reduce the vulnerability under climate change conditions may include:

- With increase in temperatures the urban planners are required to counteract these with unique designs which may include less consumption of energy and less emission of greenhouse gases. Many eco-friendly homes are coming up which need to be substantiated by government endorsements and promotions.
- Improvements in hydro-meteorological systems for weather forecasting and the installation of flood warning systems can help people move out of harm's way before a weather-related disaster strikes.
- The efficient use of ground water resources will need to be incentivized.
- Investments in water storage capacity are required to benefit from increased river flows in spring and compensate for lower flows later on.
- Crop diversification, efficient use of water, and improved soil management practices, along with the development and R&D of drought-resistant crops can help in reduction of negative impacts.
- Improvements in irrigation systems, water harvesting techniques, and more-efficient agricultural water management can mitigate some of the risks which climate change projections predict.
- Improvement and greater accessibility to medical health services, identification of vulnerable areas, development of robust predictive model linking climate and their implications and incidences may help in adapting to the climate change.
- Improved surveillance and monitoring systems, improved infrastructure, develop Integrated Environmental Management Plans to combat the upcoming challenges.
- Public education and incensitivization.

A combination of these options can be used to reduce the vulnerability of the population under the future climate projections.

VI. Discussion and Conclusion

The extent of vulnerability due to climate change depends on environmental factors, the vector population, and the prevailing socio-economic conditions and the adaptive capacity of the human population too. Climate change is

caused by greenhouse gas emissions from energy use, agriculture and deforestation. All the three sectors require attention and efforts to mitigate them. Climate impacts in India will not be uniform. Those of low socio-economic status are likely to be the most affected by the health impacts of climate change, as they have the least adaptive capacity. As India's economy continues to expand, the growing middle class presents a unique situation. The green agenda conflicts with the brown agenda. While rising out of poverty will improve sanitation levels and living conditions, thus increasing resilience to infectious diseases, it will also lead to higher consumption patterns that can initiate new health problems while leading to more carbon footprints. The level of preparedness will help in reducing the impacts and incidences of climate change in India. Proper urban planning, increase in R& D, crop diversification, soil management, investments in water storage capacity, water harvesting, improvements in irrigation systems, improved health services and greater accessibility, public education and government action together can offset the impacts of future climate change in India.

References

- Markandya Anil and Chiabai Aline (2008). Valuing Climate Change Impacts on Human Health: Empirical Evidence from the Literature, Int. J. Environ. Res. Public Health 2009, 6, 759-786; doi: 10.3390/ijerph6020759.
- Inter-governmental Panel on Climate Change (IPCC). 2001. Climate Change 2001: Impacts, Adaptation Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Geneva: UNEP/WMO.
- ChandranVipin K.P. & Sandhya P (2013). Climate Change: A Threat to Human Health, retrieved from https://www.researchgate.net/publication/48375741_Climate_Change_A_Threat_to_Human_Health on 10 Feb 2017.
- K R Kumar et al (2006). High Resolution Climate Change scenarios for India for the 21st century; Current Science; Vol 90; No.3; February 2006.
- Stern N. (2006). What is the Economics of Climate Change? World Economics, Vol. 7, No. 2, April–June 2006.
- Solomon M. Hsiang, Marshall Burk, Edward Miguel. Quantifying the Influence of Climate on Human Conflict, Science 01 Aug 2013, DOI: 10.1126/science.1235367.
- Global Warming: News, Facts, Causes & Effects. Retrieved from: http://www.livescience.com/topics/global-warming

  India: Climate Change Impacts (2013). Retrieved from: http://www.worldbank.org/en/news/feature/2013/06/19/india-climate-change-impacts