

Prevention of Chronic Diseases in Climate Change Scenario in India

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ABSTRACT

The two-thirds of the Indian population depends directly on the climate-sensitive sectors of agriculture, fisheries, and forests. They are adversely affected by extreme weather, vector-borne diseases, and decrease in crop production. The diverse array of temperate zones, coastal megacities, and deserts of 50°C are vulnerable to Indian climate change. The health implications from these vulnerabilities render uninhabitable places with risk of air pollution, respiratory diseases, malaria, and cholera. The scarcity of potable water coupled with vectors carrying disease exacerbates health disparities and disease burden. Being the second largest populated country in the world with lack of adaptive capacity coupled with limited resources and bolster health infrastructure, it has 600 million people at the risk of infectious diseases and nutrition. The meagre allocation of the climate finance is precarious for India to cope with public health challenges. The integration of social, demographic, and land cover data identifying sustainable health solutions under health infrastructure and large population deserves effective mechanism in climate change scenario in India. There is need to predict the climate change impacts and augur effective interventions failing which it will negate the right to health and widen health inequalities in India.

Keywords: climate change, health right, diseases burden, water scarcity, vector diseases

INTRODUCTION

THE ENVIRONMENT AND CLIMATE CHANGE in India are intrinsically linked to health and inequities in access to food, water, and natural resources.¹ Factually, it contributes only 2% of the total carbon emissions from fossil fuel burning but experiencing the extreme weather due to global climate change. The predicted effects of climate change geographically, climatically, and culturally in one-sixth of the world's population are a major source of dengue, yellow fever, cholera, and the chikungunya virus.² Sharing 1/50 of the world's land and 1/25 of the world's water chronic diseases related to cardiovascular and re-

spiratory illness, asthma, and diabetes is on the rise.³ The people below poverty line are vulnerable to burden of climate-related disease and myriad of health risks in India.⁴

The 1°C rise in global temperatures caused the Himalayan ice sheets to melt, drying rivers, rising sea levels, and livelihood.⁵ The increase of 1.2°C higher than during the baseline year of 2001 made accessibility of health services and infrastructure a distant goal post for healthy India. The rise of 3°C in winter months, 2°C in premonsoon periods, altered the climate change adaptation preparedness and projections of the *Intergovernmental Panel on Climate Change (IPCC)*. The rise of temperatures in Phalodi,

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¹Md. Zafar Mahfooz Nomani. "The Human Right to Environment in India: Legal Precepts and Judicial Doctrines in Critical Perspective," *Asia and Pacific Journal of Environmental Law* 5 (2000): 113–134.

²Robert Shope. "Global Climate Change and Infectious Diseases," *Environmental Health Perspectives* 96 (1991): 171–174.

³Neeru Singh, Sheetal K. Chand, Awadhesh Mishra, and Avinash C. Nagpal. "Migration Malaria Associated With Forest Economy in Central India," *Current Science* 87 (2004): 1396–1399.

⁴Ramesh C. Dhiman, Sharmila Pahwa, and Aditya P. Dash. "Climate Change and Malaria in India: Interplay Between Temperature and Mosquitoes," *Regional Health Forum* 12 (2008): 27–31.

⁵Muthukumara Mani, Sushenjit Bandyopadhyay, Shun Chonabayashi, Anil Markandya, and Thomas Mosier. "South Asia's Hotspots The Impact of Temperature and Precipitation Changes on Living Standards," *International Bank for Reconstruction and Development/The World Bank* 18 (2018): 6–8.

Rajasthan, to 51°C in May 16, 2016, impacted heat stroke, exhaustion, kidney failure, and severe dehydration.⁶

Thus, the negative health effects of climate change lead to negation of the right to health and widening health inequalities.⁷ According to the World Health Organization (WHO), the direct damage costs to health are predicted to be between \$2 and 4 billion per year by 2030, more than the entire gross domestic product of Bhutan. It also reported that only 0.5% of the multilateral climate finance has been assigned to health projects exacerbating stress on public health scenario.⁸ The article develops a comprehensive catalog of climate change-associated health outcomes across the range of environments and populations for a better understanding of specific solutions.

DISCUSSION

Before we embark upon the prognostic solution, it seems imperative to take stock of chronic diseases and climate change scenario. The incidence and prevalence of chronic diseases range from extreme weather, air pollution, water- and vector-borne diseases, food and water shortages to psychosocial impacts and conflicts over access to vital resources.⁹

Temperature extremes and air pollution

According to an estimate, the climate change exposure to air pollution causes 7 million deaths worldwide annually. It is calculated that a temperature of 50°C with 40% humidity is equivalent to a wet bulb temperature of 36°C with 100% humidity, which results to death within 6 hours.¹⁰ It is found that strenuous work on construction sites in the National Capital Region of Delhi¹¹ increases heat exhaustion, temperature-related ailments, and shortening of longevity in India.¹² The lack of drinking water in temperatures soar leads to severe dehydration and heat stroke.¹³ The heat

wave-related deaths occur with pre-existing cardiovascular or chronic respiratory diseases.¹⁴ Seen in this perspective, we find that millions of Indians suffer from respiratory problems due to smoke inhalation and increased temperatures.¹⁵ The capital city Delhi's ambient air quality is more than six times of the permissible pollutant level leading to respiratory diseases, lung cancer, and brain death.¹⁶ The air pollution data on suspended particulate matter need consistent monitoring of ozone and nitrogen oxides across locations on Chennai model.¹⁷ The periodic surveillance of relevant variables will determine prospective climate and health research endeavors.

Water- and vector-borne diseases

Climate change is altering water availability and spread of disease-causing pathogens and chemical hazards in terms of diarrhea and cholera.¹⁸ An expected increase by 13.1% in northern regions by the 2040s¹⁹ is prone to 5 million cases of cholera.²⁰ Already cholera has been reported in 21 of 35 Indian states, with high incidence in coastal regions in monsoons.²¹ The impacts of climate change on the mental health range from depression to psychological distress and suicide.²² A dramatic rise in suicides in the traditionally prosperous farming region is associated with poor harvests due to climate vulnerability alone, which accounts for 60,000 suicides over the past 30 years in India.²³

According to an estimate, 96% of the Indian population's exposure to malaria aggravates vector organisms

⁶Geert Jan Van Oldenborgh, S. Philip, S. Kew, M. van Weele, P. Uhe, F.E.L. Otto, K. Achuta Rao. "Extreme Heat in India and Anthropogenic Climate Change," *Natural Hazards and Earth System Sciences* (2017): 1–23.

⁷Md. Zafar Mahfooz Nomani. "Right To Health: A Socio-Legal Perspective," *Uppal Publications, New Delhi* (2004): 56–85.

⁸Shetty Disha. Impact of Climate Change on Health in India. <https://www.indiaspend.com/author/disha_shetty> (Last accessed on September 24, 2019).

⁹IPCC. *Climate Change: The Physical Science Basis: Summary For Policymakers*, Geneva (Contribution of Working Group I to the Fourth Assessment Report, Cambridge University Press, Cambridge, 2007).

¹⁰D. Carrington. Climate change to cause humid heat waves that will kill even healthy people. (2017). <<https://www.theguardian.com/environment/2017/aug/02/climate-change-to-cause-humid-heatwaves-that-will-kill-even-healthy-people#img-3>> (Last accessed on September 24, 2019).

¹¹Md. Zafar Mahfooz Nomani. "Health, Environment and Industrial Relation: Emerging Judicial Trend in India," *Academy Law Review* 20 (1996): 153–172.

¹²Amit Garg, Ramesh C. Dhiman, Sumana Bhattacharya, and Priyadarshi R. Shukla. "Development, Malaria and Adaptation to Climate Change: A Case Study From India," *Environmental Management* 43 (2009): 779–789.

¹³*Climate Change and Human Health: Risks and Responses: Summary*. (WHO, 2003).

¹⁴A.J. McMichael, D.H. Campbell-Lendrum, C.F. Corvalán, K.L. Ebi, A.K. Githeko, J.D. Scheraga, and A. Woodward. *Climate Change and Human Health: Risks and Responses*. (WHO, 2003).

¹⁵A.J. McMichael, R.E. Woodruff, and S. Hales. Climate Change and Human Health: Present and Future Risks. In: *Encyclopedia of World Climatology*. (Netherlands: Springer, 2005): 209–213.

¹⁶Md. Zafar Mahfooz Nomani. "Legal and Judicial Policy for Control of Air Pollution in India: Problems and Prospects," *Indian Bar Review* 37 (2000): 93–128.

¹⁷Santu Ghosh, P. Johnson, S. Ravinder, M. Chakraborty, M. Mittal, and K. Balakrishnan. "Development and Application of Spatially Disaggregated Exposure Series in Time-Series Analyses of Air Pollution-Related Health Effects in Chennai, India," *Epidemiology* 22 (2011): S81–S82.

¹⁸Enzo Funari, Maura Manganelli, and Luciana Sinisi. "Impact of Climate Change on Waterborne Diseases," *Annali Dell'istituto Superiore Di Sanita* 48 (2012): 473–487.

¹⁹Eddy Moors, Tanya Singh, Christian Siderius, Sneha Balakrishnan, and Arabinda Mishra. "Climate Change and Waterborne Diarrhea in Northern India: Impacts and Adaptation Strategies," *Science of the Total Environment* (2013): S139–S151.

²⁰Jane N. Zuckerman, Lars Rombo, and Alain Fisch. "True Burden and Risk of Cholera: Implications for Prevention and Control," *The Lancet Infectious Diseases* 7 (2007): 521–530.

²¹P.K. Singh and R.C. Dhiman. "Climate Change and Human Health: Indian Context," *Journal of Vector Borne Diseases* 49 (2012): 55–60.

²²François Bourque and Ashlee Cunsolo Willox. "Climate Change: The Next Challenge for Public Mental Health?" *International Review of Psychiatry* 26 (2014): 415–422.

²³M. Safi. India floods: 213 killed in Gujarat as receding waters reveal more victims. (2017). <<https://www.theguardian.com/world/2017/jul/31/india-monsoon-floods-gujarat-death-toll-over-200>> (Last accessed on September 24, 2019).

and pathogen replication to climate change.²⁴ The humidity and temperature indicate that the number of people likely to be at risk of malarial infection will increase between 5% and 15%. India's malaria-free region is expected to become malaria prone in the future in the wake of IPCC estimates regarding temperature.²⁵ This is precipitous to the outbreak of zika, climate-sensitive diseases in India.

Case of northeastern states

An assessment of biophysical determinants affecting malaria and cholera in the northeastern states of India such as Assam, West Bengal, and Orissa puts to 31 million cases. Assam, state of India, is vulnerable to climate change due to geographic proximity to the delta region, poverty, and consumption inequality.²⁶ According to the *State Action Plan for Climate Change*, the annual mean temperature in the state has increased by 0.59°C over the past 60 years (1951–2010) and is likely to increase by 1.7°C–2.2°C by 2050. Climate projections in the state action plan also predict that extreme rainfall events will increase by 38%.²⁷ This is compounded by exposure, sensitivity, and adaptive capacity of the local population to climate-induced extreme events such as floods.²⁸ The state is characterized by high rainfall, subtropical climate, frequent floods, and droughts due to adverse climatic conditions. The incidence of cholera in West Bengal and Orissa states found that 72% of one study group tested positive for cholera in West Bengal after heavy monsoon rainfall, whereas multiple studies have revealed severe cholera epidemics in Orissa following extreme weather events such as cyclones and flash floods.²⁹

To come out of this syndrome, the regional climate models for India such as Providing Regional Climates for Impacts Studies (PRECIS) developed at the Indian Institute of Tropical Meteorology must be integrated with climate change-induced survey of the health effects. The region-specific nature of the relationship between climate variability and health requires satellite and geospatial technology to assess the geographic distribution of risk and disease.

CONCLUSION

The study of chronic diseases and climate change scenario in India reveals retrospective studies investigating

climate variability and health. The prospective studies related to climate change need high-quality data for environmental epidemiological analysis. The Indian Institute of Tropical Meteorology³⁰ and the India Meteorological Department³¹ have useful meteorological data with varying degrees of access, whereas the Census of India and the National Family Health Survey provide important information on social and economic variables, chronic diseases, and climate change scenario in India. Thus, a perusal of epidemiological analysis summons urgency for setting up of institutional, legal, and participatory mechanism to combat chronic diseases and climate change scenario in India.

Institutional mechanism

The IPCC, 2007, in its Fourth Assessment Report identified alteration in distribution of some infectious disease vectors, seasonal distribution of some allergenic pollen species, and increased heat wave-related deaths.³² However, WHO has defined a general methodology to quantify the disease burden caused by 26 risk factors at selected time points up to 2030.³³ Under this backdrop, the 2009 *Joint Indo-U.S. Workshop on Climate Change and Health* hone out climate change strategies by identifying gaps in understanding and outlining research directions related to the human health effects of climate change by focusing on prediction and prevention of public health infrastructure.³⁴ The major recommendations include environmental monitoring and surveillance, geographic information systems and spatial analysis, vulnerability assessments, and environmental exposure assessments.³⁵ These surveillance methods and analytical techniques will enhance public education on climate change-associated health impacts. The climate change under *EU-India Cooperation*, 2008, admitted that it is confronted with development imperatives and severity of climate change.³⁶

³⁰Indian Institute of Tropical Meteorology, A World Centre of Excellence in Basic Research on the Ocean–Atmosphere Climate System Required for Improvement of Weather and Climate Forecasts. (2010). <<http://www.tropmet.res.in>> (Last accessed on November 10, 2018).

³¹India Meteorological Department. <<http://www.imdpune.gov.in>> (Last accessed November 10, 2018).

³²P. Martens and A.J. McMichael. *Environmental Change, Climate and Health*. (Cambridge: Cambridge University Press, 2002).

³³M. Ezzati, A.D. Lopez, A. Rodgers, S. Vander Hoorn, and C.J. Murray. “Selected Major Risk Factors and Global and Regional Burden of Disease,” *Lancet* 360 (2002): 1347–1360.

³⁴Kathleen F. Bush, George Luber, S. Rani Kotha, R.S. Dhaliwal, Vikas Kapil, Mercedes Pascual, Daniel G. Brown, Howard Frumkin, R.C. Dhiman, Jeremy Hess, Mark L. Wilson, Kalpana Balakrishnan, Joseph Eisenberg, Tanvir Kaur, Richard Rood, Stuart Batterman, Aley Joseph, Carina J. Gronlund, Arun Agrawal, and Howard Hu. “Impacts of Climate Change on Public Health in India: Future Research Directions,” *Environmental Health Perspectives* 119 (2011): 766.

³⁵Michael Jerrett, Sara Gale, and Caitlin Kontgis. “Spatial Modeling in Environmental and Public Health,” *International Journal of Environmental Research and Public Health* 7 (2010): 1302–1329.

³⁶Climate Change and India. Impacts, Policy Responses and Framework for EU-India Cooperation. Policy Department Economic and Scientific Policy, European Parliament. (2008).

²⁴Amit Garg, Ramesh C. Dhiman, Sumana Bhattacharya, and Priyadarshi R. Shukla. “Development, Malaria and Adaptation to Climate Change: A Case Study from India,” *Environmental Management* 43 (2009): 779–789.

²⁵S. Bhattacharya, et al. “Climate Change and Malaria in India,” *Current Science* 90 (2006): 369–375.

²⁶Assam: Poverty, Growth and Inequality. Brief. World Bank Group, June 20, 2017.

²⁷Assam State Action Plan on Climate Change 2015–2020. Department of Environment and Forest, Government of Assam, India, (September 2015):1–127.

²⁸Swati Chaliha, et al. “Climate Variability and Farmers Vulnerability in a Flood-prone District of Assam,” *International Journal of Climate Change Strategies and Management* 4 (2012): 179–200.

²⁹D. Sur, P. Dutta, G.B. Nair, and S.K. Bhattacharya. “Severe cholera outbreak following floods in a district in West Bengal,” *Indian Journal of Medical Research* 112 (2000): 178.

The *National Action Plan on Climate Change*, 2009, envisages adaptive capacity to combat climate change with close economic ties to natural resources and climate-sensitive sectors.³⁷ The *Planning Commission of India* estimated that 27.5% of the population is below the poverty line and vulnerable to climate change.³⁸ This reality is equally shared by the WHO that the major brunt of global climate change will be mostly borne by the poor.³⁹ Thus, to strengthen the health care systems, emphasis should be placed on service delivery mechanisms, drinking water and sanitation facilities, funding for low-income communities, and educating people about climate-related diseases.

Legal mechanism

In a search for climate change friendly legal regimen, India passed new laws and amendment to the existing laws.⁴⁰ India passed *Ozone Depleting Substances (Regulation and Control) Rules*, 2000, to give effect to *Vienna Convention for the Protection of the Ozone Layer*, 1985, and the *Montreal Protocol on Substances that Deplete the Ozone Layer*, 1992, internationally, and Sections 6, 8, and 25 of the *Environment (Protection) Act*, 1986, nationally. India, being a Party to the Vienna Convention and Montreal Protocol, has deep concern for protecting the ozone layer and phasing out of the ozone-depleting substances (ODS). Ever since IPCC, 2007, dovetailed human health and climate change and WHO launched *International Perspectives on Global Environmental Change: Protecting Health from Climate Change*, 2008, India, developed the *National Action Plan on Climate Change*, 2008, to guide the symbiotic relationship between climate change and human health. India adopted slew of legal reform in energy sector by passing of *Energy Conservation Act*, 2001 (amended in 2010), *Electricity Act*, 2003 (amended in 2007), *Petroleum and Natural Gas Regulatory Board Act*, 2006, for dispensing climate justice. These laws are supplemented by strong policy support in *National Auto Fuel Policy*, 2003; *National Electricity Policy*, 2005; *Energy Tariff Policy*, 2006 (amended 2011); *Integrated Energy Policy Report*, 2006; *Greenhouse Gas Emissions Policy*, 2007; *Ethanol Production Incentives*, 2007; *Energy Conservation Building Code*, 2007; *National Action Plan on Climate Change*, 2008; *Solar Power Generation Based Incentive*, 2008; *National Policy on Biofuels*, 2009; *Incentives for Wind Power*, 2009; *Climate Change—Post Copenhagen Domestic Actions*, 2010; *National Mission on Enhanced Energy Efficiency*, 2010; *National Solar Mission*, 2010; *India's 12th Five-*

Year Plan, 2011, and *National Electricity Plan*, 2012, to usher climate friendly regimen in energy sector India.

Community initiatives

The emissions of greenhouse gases through mitigation gained worldwide recognition in India's climate change policy toward local communities planning and decision-making processes. The stoves release smoke into Indian homes contributing to greenhouse gas pollution and putting the villagers at risk of diseases including lung cancer and pneumonia, addressed by robustness of lives and livelihoods policies. The *Tata Energy and Resources Institute* in Delhi is one example of such a group linking collaborative research and sharing the developing country perspective on climate change. The *National Institute of Malaria Research* in partnership with the University of Michigan conducted a study to assess the impacts of climate change on malaria and dengue at a national scale and developed adaptation strategies. Several NGOs such as the *Local Governments for Sustainability*, *Resources for the Future*, *Public Health Foundation of India*, and *Toxics Link* are working on traditional environmental health with a new focus on climate change at grass root level. These strategies are directed to low-carbon rural development, and food and energy security of poor people.

India navigates between declining social conditions and inadequacy of public health infrastructure to come out of the morass of climate change-associated chronic diseases. India's two-thirds youth requires new stake holding in complex governance processes and participation in climate change administration by improving strategies, capacity development, and adaptation technologies. The implications of climate change on health present a dilemma for faster economic growth, consuming fossil fuels, and environmental sustainability. Therefore, the adoption of mitigation measures such as strengthening health systems and service delivery mechanisms through early monitoring, disease surveillance, vector and disease control, and health insurance becomes imperative. Investment in research and development, health risk assessment studies, vulnerability mapping studies, establishment of baseline conditions, scenario modeling, and adoption of clean development mechanisms are the need of the hour.

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³⁷National Action Plan on Climate Change. (2009). <http://moef.nic.in/downloads/others/CC_ghosh.pdf> (Last accessed on August 24, 2018).

³⁸Planning Commission, Government of India (2011). <http://planningcommission.nic.in/reports/genrep/Press_pov_27Jan11.pdf> (Last accessed on August 18, 2018).

³⁹Climate and health. Fact sheet, (2005). <<http://www.who.int/globalchange/news/fsclimandhealth/en/index.html>> (Last accessed on September 24, 2019).

⁴⁰Md. Zafar Mahfooz Nomani. "Climate Change, Environment Sustainability and Consumer Justice," *International Journal of Environmental Consumerism* 4 (2009): 52–63.