

CLIMATE CHANGE, RISING TEMPERATURE AND HEAT RELATED ILLNESS: INDIAN SCENARIO

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Abstract: *Rising temperature is one of the immediate results of climate change. Projections reflect that this phenomenon will intensify in future. This increases the risk of several harmful consequences that the ecosystem and the world are getting exposed to. Impact on human health, both direct and indirect, is one of such serious concerns in this context. The objective of this study is to understand how rising temperature and extreme heat is impacting human health with reference to India. This has been done mainly through literature review pertaining to climate change impact on human health along with interpretation of statistics and outcomes from existing studies to present extreme heat related mortality and morbidity cases in India. The study finds that in developing countries like India, the issue of rising temperature induced health impacts is more complicated to tackle given the infrastructural, economic, socio-cultural, demographic and environmental conditions. Already increase in temperature has caused multiple ailments, disabilities and deaths in the country along with a projected risk of intensification. In view of above situation, building up sufficient coping and adaptive strategies and implementing them in a planned way is required to restrict and reduce chances of any further loss of human health and lives. The study finally highlights some of the coping measures against adverse health impacts of climate change.*

Key words: Climate Change, Temperature, Human Health, Coping Strategies, Adaptation

Introduction

There is substantial scientific corroboration which indicates that the earth's climate is changing with time as a result of emission of Green House Gases (GHG) caused by anthropogenic activities (IPCC, 2007); (Stern, 2007). It is certain that the global mean surface temperature has increased since the late 19th century and each of the past three decades has been successively warmer at the Earth's surface compared to the previous decades in the instrumental record (IPCC, 2013). Climate models predict that doubling of preindustrial levels of GHG (which was at 280 ppm CO₂ equivalent) will raise the global mean temperature of the earth by (2-5)°C and this level of GHG will be reached probably between 2030 and 2060 (Stern, 2007). Detailed projections by the Intergovernmental Panel on Climate Change (IPCC) in its Fifth Assessment Report for the 21st century under different Representative Concentration Pathways (RCPs) scenarios show that global warming will not only persist but will also accelerate in future (IPCC, 2014). Scientific assessments indicate that rising global temperature as a result of climate change is likely to bring about an increase in the frequency and severity of extreme weather events like heavy precipitation, heat waves, floods etc. Changing climate will make summers warmer. This will be coupled with an increase in the frequency and intensity of hot days and nights (WHO, 2004) ; (IPCC, 2013). Rising daily maximum temperature is also very likely to be accompanied by an increase in the number of heat related deaths (IPCC, 2014). Increasing humidity levels will further deteriorate the impact of extreme summer heat on human health (IPCC, 2007);(WHO, 2004). Heat waves will produce direct threats to human health through

heat stress with its dire consequences. Globally, the number of warm days/nights has already increased since 1950s and will continue to do so in the coming decades. (IPCC, 2014). Also, cases of hot extremes along with heat stress are expected (IPCC, 2014). In the long term, heat waves will occur at a higher frequency and for prolonged duration in response to higher seasonal mean temperatures (IPCC, 2014).

Developing countries like India that are located over lower latitudes are considered to be more threatened due to climate warming and heat induced health hazards (Mazdiyasi, et al., 2017). In the Indian context, the challenge of warming and its immediate consequences are important to take into consideration given the phenomenon of population growth, large share of coastal zones, growing urbanisation and so on. India has a share of approximately 52 percent¹ coastal land area in total land area of the country. Also the coastal zones of India share a large proportion of total population of the country along with rapid population growth. According to a recent report of the United Nations (United Nations, 2018), around 30 percent of total Indian population stays in urban areas. It is further projected that by 2050 India will have 416 million growths in the population of urban dwellers (United Nations, 2018). These are likely to pose a threat to the health status of Indian population, if the scenarios of climate change and warming are considered. Incidences of extreme weather and climatic events like cold and heat waves, hailstorm, thunderstorm and dust storms, tropical cyclones, tidal waves, flooding, heavy rainfall, droughts have been experienced by India at various scales over the years (De, Dube, & Rao, 2005). In the country, the overall number of incidences of heat waves has increased over the years (De, Dube, & Rao, 2005) and some of the states having higher likelihood to get exposed to heat waves are Uttar Pradesh, Punjab, Madhya Pradesh and Gujarat. But the number of deaths till 1999 due to heat waves is found to be highest in Rajasthan, Bihar, Uttar Pradesh and Orissa (De & Sinha Ray, 2000). Also the phenomenon of global warming is considered to intensify the threat of heat waves (De, Dube, & Rao, 2005). It is projected that, given the global mean temperature limit of 2 °C above pre-industrial setting, by the end of 21st century, the number of heat waves will increase by 30 times the present status and that for the RCP 8.5 *business-as-usual* emissions situation is 2.5 times in India (Mishra, Mukherjee, Kumar, & Stone, 2017). Mishra, Mukherjee, Kumar, & Stone (2017) further projected that the number of exposed people to severe heat waves in India would inflate by more than 90 times by the end of 21st century under the target of 2°C low-warming. Therefore understanding the scale of the possible threat and building up sufficient adaptive and mitigation strategies are vital.

This study mainly tries to understand how rising temperature and extreme heat is impacting human health with reference to India. Section 2 gives a brief overview of how climate change is impacting human health. Section 3 presents cases of extreme heat related mortality and morbidity in Indian context. Section 4 makes a concluding remark by highlighting the importance of coping mechanisms against the adverse heat related health impacts of climate change.

Warming and Human Health Nexus-A Brief Overview

Climate is a key driver in the promulgation of majority of the diseases, either impacting directly or indirectly through interaction with the ecological systems. Temperature rise, which is one of the phenomenon of climate change, has a serious impact on public health (Rossati, 2017). The impacts of climate change on human health are broadly classified into direct and indirect impacts. The direct health impacts of climate change, mainly categorised as non - infectious health impacts primarily relate to changes in the frequency and severity of extreme weather events pertaining to heat, drought, precipitation etc. On the other hand, the indirect health

¹Estimated from Census of India, 2001 and UN, 2005. Human Development Report. International Cooperation at a Crossroads: Aid, Trade and Security in an Unequal World.

impacts of climate change mainly categorised as infectious diseases relate to infectious agents like protozoa, virus, bacteria and their associated vector organisms like mosquitoes, ticks, sand-flies etc. They are devoid of thermostatic mechanisms and their reproduction and survival rates are strongly affected by fluctuations in temperature (IPCC, 2007);(WHO, 2004).

The various human diseases are linked to climate fluctuations, from cardio-vascular mortality and respiratory illness to altered transmission of infectious diseases, malnutrition due to crop failures (Patz J. A., Campbell-Lendrum, Holloway, & Foley, 2005) and so on. Immediate impacts of rise in temperature consist of degradation of soil, loss of agricultural land productivity, desertification, biodiversity loss, ecosystem damage, reduction in fresh-water resources, ocean acidification, exhaustion of stratospheric ozone etc. (Rossati, 2017). These changes in the ecosystem and the atmosphere result in numerous impacts on human health by causing injuries at the time of natural disasters, malnutrition, heat wave induced mortality and deterioration of mental health and these are considered to be more intensified in the case of low income countries (Rossati, 2017). The outbreak of infectious diseases due to temperature rise also adds to the vulnerability of population. Changes in the weather and climate pattern pertaining to warming and subsequent alteration of ecosystem contribute to shift in disease pattern through human migration, resistance to infections and so on (Khasnis & Nettleman, 2005). Decline in potable water availability, access and quality triggered by various functional changes results in increased disease transmission. Warming effects are also likely to cause increased incidences of vector-borne diseases like malaria, dengue, plague etc. (Khasnis & Nettleman, 2005).

In assessing certain direct impacts of rising temperature on human health, mention may be made of air temperature which is the one of the several environmental factors that maintains the body heat balance in human beings (Kjellstrom, Holmer, & Lemke, 2009). Increase in temperature therefore leads to a number of health hazards. Heat stress, which is a clinical syndrome, with fatal consequences at times is a result of being exposed to high temperature. (Ramsey & Bernard, 2000);(Parsons, 2003). The consequences of heat stress induced health impacts include: reduction in work performance, increased number of accidents while working as a result of tiredness and fatigue, reproductive problems in both males and females, strain in internal human organs like heart, lung, kidney etc. (Dash & Kjellstrom, 2011);(Coris, Ramirez, & Van Durme, 2004). Also prolonged exposure to high temperature causes disorders like rashes, radiation burns, heat syncope, cramps, exhaustion etc. and more serious consequences like heat stroke (Judge, 2003).

As per the estimates of The World Health Organization (WHO), (WHO, 2002), changes in temperature and precipitation due to anthropogenic climate change over the past 30 years, already claimed 150,000 lives annually. The direct impacts of climate change through increased number of extreme weather events like heat waves, more frequent and intense droughts, floods, storms will be felt by millions of people around the world. Health risks are posed by exposures to such extreme events (like heat waves, floods, droughts etc.) whose incidences and frequencies are likely to increase due to climate change. There is growing evidence that these effects will pose unique problems and challenges for coastal zones, cities, large urban areas and their growing population.

Extreme Heat Related Mortality and Morbidity: The Indian Scenario

In India, both mortality and morbidity have been affected due to extreme heat triggered by warming effects. The older age groups of the population, urban poor people who live in slums and squatter settlements, sun exposed workers are considered to be more vulnerable in this regard(IPCC, 2001); (Akhtar, 2007). The mean summer temperature and incidences of heat waves both have increased in India (Table 1). Between 1960 and 2009 the mean summer

temperature has increased by around 0.5 °C along with annual fluctuations in temperature and rise in number of heat waves (Mazdiyasni, et al., 2017).

Table 1: Change in decadal number of cases of heat waves in India: 1970-2016

Time period	Number of heat wave cases in India
1970-1979	44
1980-1989	82
1990-1999	131
2000-2009	226
2010- 2016	178
Total	661

Source: Ministry of Statistics and Programme Implementation, Govt. of India.

Along with increase in number of heat waves incidences in India, accordingly number of deaths has increased too. For example, between 1979-1988 the rise in number of deaths due to heat waves increased to a large extent between 1999 and 2004 (Akhtar, 2007). Mazdiyasni, et al (Mazdiyasni, et al., 2017) estimated that rise in mean summer temperature in the country between 1960 and 2009 can be held responsible for increase in the probability of occurrence of heat induced mortality of greater than 100 people by 146 percent.

Between 1997 and 2011 the total number of accidental deaths due to heat stroke has increased in India : the corresponding statistics being 383 in 1997, 720 in 2002 and 793 in 2011 (Ministry of Home Affairs, Government of India, 2011) although the percentage share of deaths due to heat stroke to the total number of deaths has increased between 1997 and 2002 from 2.08% to 4.31% respectively (Ministry of Home Affairs, Government of India, 2011). As seen in Table 2, more than 80 percent of deaths in India due to heat stroke corresponded to male population. It might be due to the fact that male workforce has higher outdoor exposure in the country compared to female. Thus measures need to be focused on reducing the heat induced health hazard for occupational categories that are practiced outdoor. Among different states and union territories of India, Punjab, Uttar Pradesh, Bihar and Andhra Pradesh had comparatively higher number of heat stroke deaths. But apart from these states, Haryana and Maharashtra also face considerable risk to heat stroke if the percentage share of deaths due to heat strokes to total number of death figures are seen (Table 2).

Conclusion

Coping against the adverse health impacts of climate change is an age old phenomenon. Since time immemorial, societies and human beings have coped to natural climate variability by altering settlements, sustenance practices, and various other aspects of their economies and lifestyles. It is thus imperative to understand the new coping challenges posed by climate change risks within the broader context of climate risk generally and against a backdrop of rising vulnerability driven by other forces. Protection against adverse impacts of high temperature requires formulation and adoption of various coping policy guidelines. These among others include awareness about the threat, information on possible coping and adaptive strategies, monitoring and decision making power in certain situations. Coping measures also include actions like change in work schedule, temperature control (applicable for those where outdoor work can be avoided) and various other engineering and technical measures. Academic institutions may provide guidelines for systematic identification of heat stress intensity and possible measures against it. In formulation of coping measures to deal with adverse impacts of rising temperature, the policy guidelines must take into consideration the targeted population

and locational characteristics for more effective impact. Thus, proper identification of the vulnerable group along with involvement of multiple stakeholders is of utmost importance for proper formulation and effective implementation of various coping mechanisms against adverse health impacts of climate change.

Table 2: Number of Accidental Deaths by Heat Stroke in India in 2011

States/UTs	Male	Female	Total	Percentage share to total number of deaths
Andaman and Nicobar Islands	0	0	0	0
Andhra Pradesh	73	18	91	20.1
Arunachal Pradesh	0	0	0	0
Assam	1	0	1	0.5
Bihar	62	24	86	5
Chandigarh	0	0	0	0
Chhattisgarh	2	1	3	1
Dadra and Nagar Haveli	0	0	0	0
Daman and Diu	0	0	0	0
Delhi	6	0	6	0.4
Goa	0	0	0	0
Gujarat	12	3	15	0.9
Haryana	30	0	30	5.5
Himachal Pradesh	1	0	1	0.2
Jammu and Kashmir	1	0	1	0.3
Jharkhand	21	8	29	3.2
Karnataka	17	4	21	0.8
Kerala	0	0	0	0
Lakshadweep	0	0	0	0
Madhya Pradesh	16	8	24	3
Maharashtra	35	6	41	8.7
Manipur	0	0	0	0
Meghalaya	0	0	0	0
Mizoram	0	0	0	0
Nagaland	0	0	0	0
Odisha	41	10	51	4.5
Pondicherry	0	0	0	0
Punjab	168	8	176	17.6
Rajasthan	30	7	37	1.4
Sikkim	0	0	0	0
Tamil Nadu	0	1	1	0.2
Tripura	6	0	6	2
Uttar Pradesh	62	42	104	5.5
Uttarakhand	0	0	0	0
West Bengal	42	27	69	2
India	626	167	793	3.3

Source: Ministry of Home Affairs, Government of India, 2011

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