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## Impact of climate change on human health

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### Abstract

Climate is the long-term statistical expression of short-term weather. It plays a significant role in people's health. Environmental consequences of climate change, such as extreme heat waves, rising sea-levels, changes in precipitation, intense hurricanes, and degraded air quality, affect directly and indirectly the human health. Climate change brings an increase in malnutrition, mental health conditions, infectious disease spread and even death. Appropriate mitigation and adaptation strategies will positively affect both climate change and the environment, and thereby positively affect human health. This paper focuses on the impacts of climate change on the physical, social, and psychological health of humans. Some strategies for mitigating and adapting to climate change are also explained.

**Keywords:** Climate change, human health, statistical expression

### Introduction

Good health of population depends on the continued stability and functioning of the biosphere's ecological and physical systems, referred to as life-support systems. The earth's climate is an integral part of this complex of life-supporting systems.

Climate change can be defined by the differences between average weather conditions at two separate times. Climate may change in different ways, over different time scales and at different geographical scales. The world's climate system is now coming under pressure from the increasing average global temperature (McMichael *et al.*, 2003) [5]. Natural events and human activities are believed to be contributing to global warming and climate change, through the enhancement of the natural 'greenhouse effect'. This is caused primarily by increases in greenhouse gases (GHGs) such as Carbon Dioxide (CO<sub>2</sub>), water vapors (H<sub>2</sub>O), Methane (CH<sub>4</sub>), Chlorofluorocarbons (CFCs) etc. A warming planet due to high concentrations of GHGs leads to a change in climate. The climate change affects weather in various ways claiming human lives from diseases, heat and extreme temperature conditions. Global climate change is, therefore, threatening the ongoing efforts to protect human health.

Stresses on the climate system are already causing impacts on Earth's surface. These include not only rise in surface temperatures, but also increasingly frequent floods and droughts, and changes in natural ecosystems, such as earlier flowering of plants, and Poleward shifts in the distribution of several species. All of these changes are inextricably linked to human health (McMichael *et al.*, 2003) [5].

### Impacts of climate change on the physical health

The changes in the climatic conditions affect human health and well-being both directly, through the physical effects of climatic extremes, and indirectly, through influences on the levels of pollution in the air, on the agricultural, marine and freshwater systems that provide food and water, and on the vectors and pathogens that cause infectious diseases (Campbell-Lendrum *et al.*, 2003; Campbell-Lendrum & Woodward, 2007) [2, 1].

There is a well-studied relationship between rainfall and diseases spread by insect vectors which breed in water. The main species of interest are mosquitoes, which spread malaria and viral diseases such as dengue and yellow fever. Vector-borne disease transmission is sensitive to temperature fluctuations also. Increases in temperature reduce the time taken for vector populations to breed. Increases in temperature also decrease the incubation period of the pathogen (e.g. malaria parasite, dengue or yellow fever virus) meaning that vectors become infectious to human health more quickly (WHO, 1998) [16].

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Floods and droughts are each associated with an increased risk of diseases. Immediate effects of floods are largely death and injuries from drowning and being swept against hard objects. During and following flooding, there is a risk to health if the floodwaters become contaminated with human or animal waste. Heavy rainfall can wash contaminants into water supplies. Drought conditions can reduce the availability of fresh water leading to an increase in hygiene-related diseases. Major causes of diarrhea linked to contaminated water supplies are cholera, typhoid, and viruses such as hepatitis A (Rose *et al.*, 2001)<sup>[9]</sup>.

High-density populations in low-lying and environmentally degraded areas are particularly vulnerable to tropical cyclones, the majority of deaths caused by drowning in the coastal floods or tsunami-like phenomena of rising water commonly associated with low pressure weather systems (Noji, 1997)<sup>[6]</sup>.

The direct effects of fires on human health are burns and smoke inhalation. Loss of vegetation on slopes may lead to soil erosion and increased risk of landslides, often exacerbated when an urban population expands into surrounding hilly and wooded areas (Sastry, 2002)<sup>[12]</sup>.

Global climate change is likely to be accompanied by an increase in the frequency and intensity of heatwaves, as well as warmer summers and milder winters. Extreme summer heat's impact on human health may be intensified by increases in humidity. Heatwaves as responses to very high temperatures can kill the people. During heatwaves, excess mortality is greatest in the elderly and those with pre-existing illness (Kilbourne, 1989)<sup>[4]</sup>. Much of this excess mortality is due to cardiovascular, cerebrovascular and respiratory disease.

The elderly (aged 75 and over) are also vulnerable to winter death due to cardiovascular, cerebrovascular, circulatory and respiratory diseases (Sakamoto, 1977)<sup>[11]</sup>.

Many epidemiological studies have implicated UV radiations due to stratospheric ozone depletion as a cause of skin Cancer (IARC, 1992; WHO, 1994)<sup>[3, 15]</sup>. High intensity UVR also damages the eye's outer tissues causing "snow blindness", the ocular equivalent of sunburn. Chronic exposure to UVR causes both local and whole-body immuno-suppression (UNEP, 1998)<sup>[14]</sup>.

Globally, there is an increasing trend in natural disaster impacts. The health effects of natural disasters are difficult to quantify because secondary effects and delayed consequences are poorly reported and communicated. Developing countries like India are poorly equipped to deal with weather extremes. The number of people killed, injured or made homeless by natural disasters is increasing alarmingly.

The impacts vary geographically as a function both of environment and topography and of the vulnerability of the local population.

### **Impacts of climate change on the psychological health**

The year 2014 has been declared as the hottest year globally by the Meteorological department of United States of America. Not only climate change is expected to affect physical health, it is also likely to affect mental health. Increasing ambient temperatures is likely to increase rates of aggression and violent suicides, while prolonged droughts due to climate change can lead to more number of farmer suicides. Droughts otherwise can lead to impaired mental health and stress. Increased frequency of disasters with climate change can lead to post-traumatic stress disorder, adjustment disorder, and depression. Changes in climate and global

warming may require population to migrate, which can lead to acculturation stress. It can also lead to increased rates of physical illnesses, which secondarily would be associated with psychological distress (Padhy *et al.*, 2015)<sup>[7]</sup>.

### **Impacts of climate change on social life**

As a society, human beings have structured their day-to-day lives around historical and current climate conditions. We are accustomed to a normal range of conditions and may be sensitive to extremes that fall outside of this range. Climate change could affect social life through impacts on a number of different social, cultural, and natural resources contributing to rising inequality. For example, climate change could affect infrastructure, transportation systems, as well as food. Some groups of people will likely face greater challenges than others. Climate change may especially impact people who live in areas that are vulnerable to coastal storms, drought, and sea level rise or people who are poor. Similarly, some types of professions and industries may face considerable challenges from climate change. Professions that are closely linked to weather and climate, such as outdoor tourism and agriculture, will likely be especially affected (UNDP, 2008)<sup>[13]</sup>.

### **Adaptation and mitigation measures**

Adaptation and mitigation measures aim to make individual adept to the changing environment and attempt to reduce environmental change in the future, respectively.

Mitigation of greenhouse gases involves less reliance on fossil fuels, developing and using alternate efficient power sources, reducing encroachment on green cover and other similar measures. There is a developing global perspective about the need to reduce the carbon footprint per person over the next few decades, and to cover the inequities between the rich and the poor countries. Countering the challenge of climate change requires inter-sectoral and international collaboration to implement policies for reducing the emission of greenhouse gases (Rosswall, 1991)<sup>[10]</sup>.

Developing countries like India have also developed and articulated their policies toward challenging the impact of climate change. The National Action Plan on Climate Change (NAPCC) documents the Indian government's plan to deal with the issue of climate change (Pandve, 2009)<sup>[8]</sup>. The eight missions focused on by NAPCC involves National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, Green India Mission, National Mission for Sustainable Agriculture, and National Mission on Strategic Knowledge for Climate Change. Each of the missions aims at mitigating the process or reducing the impact of climate change. The effect of implementation of these policies needs to be seen.

The provision of adequate treatment facilities for managing mental health problems should be undertaken. This is especially required for natural disaster-related problems, when the vulnerability to stress is acute. Promoting positive mental health is another way to mitigate the psychological distress due to climate change. Human resilience and coping can reduce the effect of mental health stress due to climate change. Utilization of strategies like yoga can be indigenous and acceptable ways to deal with stress (Padhy *et al.*, 2015)<sup>[7]</sup>.

To reduce suicide fatalities due to secondary consequences of climate change may include debt-abolition or economic support for farmers (Padhy *et al.*, 2015)<sup>[7]</sup>.

Some other strategies to mitigate negative impacts of climate change include:

- Summits & Conferences on the issue.
- Afforestation, Reforestation
- Population Control
- Energy Conservation
- Preservation of Biodiversity
- Sustainable development

### Conclusion

Climate change is a critical public health problem. A changing climate impacts our health and wellbeing. Climate change influences human populations directly, through the effects of ambient temperature on human physiology (leading to heat stress or heat stroke), and the deaths and injuries caused by extreme weather events (floods, fires, hurricanes etc). There are also indirect effects. The patterns of many vector-borne and other infectious diseases are known to vary seasonally and inter-annually in response to changes in weather. Agricultural production can decrease due to drought or storm damage, leading to malnutrition, famine, and population displacement. There is now widespread consensus among the scientific community that the earth is warming, that this is mainly due to human activities, and that this will continue for at least the next several decades. It is therefore essential to have estimates of the likely magnitude of health effects to inform decisions about reducing greenhouse gas emissions and hence the rate and extent of global warming, and to develop strategies for those changes that are already inevitable. Given the complex linkages between climate change and health, attempts to estimate the health impacts of climate change should be based on careful analysis. It is important to provide a framework and first set of guidance for assessing health impacts, so that societies are better equipped to address this emerging threat.

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