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## Climatic Changes and Its Effects on Human Health- A Review

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**Abstract:** Climatic changes are the totality of the climatic variability and changes which consists of it's descriptions, causes, implications and interactions. In the last 5 decades, human activities, particularly the burning of fossil fuels have released sufficient quantities of carbon dioxide and other greenhouse gases and this trap the additional heat in the lower atmosphere which therefore affect the global climate and temperature. Each of these effects have caused significant changes in the human health cycle and causes harm to our body and environment Around 40 articles from online databases like Pubmed and Google Scholars are taken. The articles which are related to the topic are taken. The relevant articles are taken and discussed. The various effects of climate changes are discussed. The direct and indirect changes, effect on infectious diseases, population and the major risk factors are assessed. The climatic changes are the mainstream issue of today's generation. Potentially huge health defects affect the society and people in it. Hence measures should be taken to prevent climatic changes and global warming.

**Keywords:** Climatic changes, health, global warming.

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### INTRODUCTION

Climatic changes are the totality of the climatic variability and changes which consists of its descriptions, causes, implications and interactions. In the last 5 decades, human activities, particularly the burning of fossil fuels have released sufficient quantities of carbon dioxide and other greenhouse gases and this traps the additional heat in the lower atmosphere which therefore affect the global climate and temperature. Each of the effects are very harmful. In the last 130 years, the global temperature has warmed up to about 0.85 degrees more. The last 3 decades are successively warmer than the preceding decades since 1850. (Pearce, 2007) The rising sea levels are melting glaciers and changes precipitation patterns. The extreme weather events are more intense and frequent. Although global warming bring some benefits such as fewer winter deaths in temperate climates, increased food production, the overall health effects are overwhelmingly negative (Vardoulakis *et al.*, 2015). Climatic changes affects the social and environmental determinants of health such as clean air, safe drinking water, sufficient food source and secure shelter. (Balmer, 2017)

Studies show that extreme high air temperatures contribute directly to death from cardiovascular and respiratory disease, especially the elderly people. In the heat wave of summer in 2003 in Europe, more than 70,000 excess deaths were recorded. (Robine *et al.*, 2008) Another study shows the changes in climate which are likely to lengthen transmission seasons and are important for vector borne diseases to alter according to geographic ranges. In that, the climate change is projected to widen significantly the area of China where the snail-borne disease, schistosomiasis occurs. (Darling *et al.*, 2017). Malaria is strongly influenced by climate. It is transmitted by Anopheles mosquitoes and kills 400,000 people every year, mainly children who are under 5 years of age in certain African countries (Péron *et al.*, 2016). The Aedes mosquito which is the vector of dengue is also highly sensitive to climatic conditions (Chersich *et al.*, 2018). Some of the bacterial infections that are influenced by climatic changes are Lyme's disease, cholera (Girija, Jayaseelan and Arumugam, 2018). Studies suggest that climatic changes are likely to cause the continuation of the increased exposure to dengue and other diseases. (Koh, 2016) Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et*

*al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

The review is required to create awareness and to study about the severity of these effects. By taking action to reduce the greenhouse gas emissions, increased health resilience among people can be looked forward to in the near future. This study might be helpful about the health effects caused by climatic changes.

## **METHODOLOGY**

A minimum of about 40 articles are chosen from online databases like Pubmed and Google Scholar. The articles are chosen based on their relevance to the topic (Woodward *et al.*, 2014). Articles from other languages are excluded. Articles which are unrelated to the topic are excluded (Myers and Bernstein, 2011). The data are extracted from the articles based on their characteristics specified. (Ziervogel *et al.*, 2014)

### **Direct Effects of Climate Changes**

The climate changes are often coalesced based on their physical effects in the environment. The most direct effects listed are the acclivity in the death rate and the infections caused due to extreme climatic changes (Watts *et al.*, 2017). The increase in the natural disasters incidence is caused by changes in climate. The natural disasters paved way for the increased mortality rate (Sarfaty *et al.*, 2014). There is also a rise in infections due to climate change. This is mainly seen in drug resistant ESKAPE organisms. (Ashwin and Muralidharan, 2015; Girija As and Priyadharsini J, 2019; Girija *et al.*, 2019)

### **Indirect Effects of Climate Change**

The indirect change seen in climatic changes is the increase in global temperature. Increase in the global temperature along with air pollution results in the production of gases. (Abayomi and Cowan, 2014) These gases cause disturbances in the ozone layer, which is a protective layer around the atmosphere of Earth (Haines and Patz, 2004). Individuals susceptible to dust in air are highly affected. Increased ozone production leads to acute exacerbation of asthma which progresses to permanent lung damage. (Cohen *et al.*, 2017)

### **Effects of Climate Change on Infectious Diseases**

Increase in the global temperature has its own drawbacks. One of the drawback is linked to the increase in the vector organism population (Yang *et al.*, 2019). The recent studies have stated that the changes in the distribution of disease vectors like *Aedes aegypti* and *Aedes albopictus* have raised the likelihood in the transmission of diseases, notably dengue fever, Zika virus infection and other parasitic infections (Haines *et al.*, 2009; Luber and Lemery, 2015). This causes other complications such as diarrhoea due to the viral and bacterial infections (Marickar, Geetha and Neelakantan, 2014; M, Geetha and Thangavelu, 2019).

### **Effect of Climate Change on A Population of People**

The changes in climate have led to immense depletion in food sources and scarcity. This ultimately led to people experiencing nutritional deficiencies (Benatar, Sullivan and Brown, 2018). On the other occasion, people who are susceptible to air pollution and dust experience allergic reactions which might progress to some anaphylactic and other hypersensitivity reactions (Shisana *et al.*, 2016). Some emerging fungal infections also leads to triggering of allergies (Shahzan *et al.*, 2019). Other common conditions are poor oral hygiene which can be counteracted by use of mouth washes and mouth rinses. (Vaishali and Geetha, 2018)

In another case, the population of people who are immunocompromised are subjected to pathological overload. This overload causes the individual to have an undermined resilience to any infections (Mastrorillo *et al.*, 2016). In case of patients with sexually transmitted terminal diseases like Acquired Immunodeficiency Syndrome, the extreme climatic changes pushes them to a situation where migration seems to be the only choice. Hepatitis B infection and nosocomial infections are other complications during migration. (Haque *et al.*, 2012; Pratha, Ashwatha Pratha and Geetha, 2017; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018)

### **Major Risk Factors**

The risk factors are defined as the disease burden which comprises the amount of disease or premature death with a population. The risk factors are mostly associated with the diseases categorized to food and water borne diseases, vector borne diseases, natural disasters, malnutrition risks. (Kabir *et al.*, 2016) The incidence of food and water borne diseases causes diarrhoea episodes in the children (US Global Change Research Program, 2018). The incidence of vector borne diseases caused increased malaria cases in the tropical countries. (Patz *et al.*, 2008) Natural disasters causes the incidence of fatal unintentional injuries in the people. Deficient calorie

intake in the people is reported in people with risk of malnutrition. The risk factors have contributed to the mortality of people and infections and diseases of people all around the world. (Hathaway and Maibach, 2018)

## DISCUSSION

In this review, we are discussing the articles related to climatic changes and its impact on human health. We have evaluated the direct and indirect changes, its impact on human population, infectious diseases and organisms and the major risk factors associated with climatic changes. The direct changes are the acclivity in death and infection which is caused due to extreme climatic changes. The indirect changes include the increased ozone level leading to acute exacerbation of asthma in asthmatic patients which may progress to permanent lung damage. Impact on infectious diseases include the increase in vector organism population due to increase in global temperature. The impact of climatic changes to a population of people is huge (Mishra and Roy, 2015).

The climatic changes causes immense depletion in food sources and leads to individuals suffering from various nutritional deficiencies. The risk factors play a major role in the incidence of harm to human health. The diseases caused due to water borne, vector borne, natural disasters, food and malnutrition factors have led to people experiencing various infections caused due to parasites, bacterial and viral organisms. In the maintenance of oral health from caries producing bacteria, chlorhexidine has a high efficacy even on patients undergoing orthodontic treatment (Shahana and Muralidharan, 2016). However chlorhexidine has a complication of staining apparatus and allergic reactions and so herbal mouth rinses are preferred (Selvakumar and Np, 2017). The diseases caused through heat strokes can lead to serious cardiovascular complications like hypertension and other valvular heart diseases (Smiline, Vijayashree and Paramasivam, 2018; Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020).

Although the global climatic changes have many cons, there are a few pros to it. The incidence of increased global temperature caused a reduction of mortality in tropical countries. Human beings are individuals who can adapt to various situations. Hence adapting to the climatic changes through effort is one of the accomplishments of human beings (Priyadharsini *et al.*, 2018). The health sector have been made resilient enough to withstand climatic changes. It has created a disease control by strengthening human health by means of various vaccines and prophylactic measures. (Roser-Renouf, Maibach and Li, 2016) The limitations faced in the study include the facts being not circulated among the community. The current generation are very much interested in the global effects but the awareness about these changes are not circulated properly. Hence an entire population cannot gain awareness. (Ciesielski, 2017)

The future scope of the article is the absolute necessity towards the use of clean renewable energy and transitioning away from fossil fuel usage. The actions have been made globally to limit the change of global climate and prevent health consequences. The use of conventional sources of energy is considered for a clean and disease free environment. The main aim of this study is to create awareness to reduce the greenhouse gas emissions and to increase the health resilience and ensure the people to look forward to a healthy future. Our institution is passionate about high quality evidence based research and has excelled in various fields ( Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

## CONCLUSION

The climatic changes are the mainstream issue of the public. The necessary methods to reduce the fluctuation of global temperature has been discussed above. The health impacts are potentially huge and threaten human life. Hence recognition of those health impacts is important to know about its potential damage. Support from the public sector is necessary to implement any future plans regarding this major issue.

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