

# IMPACT OF CLIMATE CHANGE ON HUMAN HEALTH

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## Abstract

Climate Change is an area of environmental science that has been studied for many years. The fossil record has taught humankind much about conditions on Earth long prior to our arrival. We now live in a unique time in that our scientific abilities have not only given us a precise age of the planet, but of the universe itself. Yet there are many things we do not understand, and some of the questions that remain before us may have a significant impact on the quality of our lives in the future. As our current civilization observes an unquestioned period of warming on Earth, the issue of the nature of this change remains a topic of discussion for both scientists and the public at large. It is important, therefore, for those of us in the educational community to help our reader get the best information with which to guide their own thoughts and decisions in a changing world. This research paper explores the complex relationship between climate change and human health, focusing on five key areas: increased heat-related illnesses, changes in disease patterns, air quality and respiratory issues, mental health implications, and food security and nutrition. It highlights the importance of heat wave preparedness, surveillance systems for diseases, reducing greenhouse gas emissions, providing mental health support, and implementing sustainable agriculture practices. The paper emphasizes the urgency of taking action to alleviate climate change and promote adaptation strategies to protect human health and build resilience.

**Keywords:** - *Climate, Environment, Earth, Diseases, Health, Sustainable, Human.*

## Introduction

Climate change is a very important, extensive and intensive global environmental problem. It has the number of evil consequences on the economic development along with the different productive sectors and economic development activities in the economy. "The noteworthy feature is that it is being a global problem all the countries of the World have to bear with the evil consequences and negative impacts on their economic and development, irrespective of their contribution to the climate change. This poses the urgent need for studying the health and economic impact of the climate change. Besides this, the developing economies are dominated by the rural economy in general and health related issues in particular. Hence the studying of impact of climate change on health coupled with world environmental issue is of pivotal importance. India is a very well-known country in the world on various grounds. There is misunderstanding in the world that India is like that of China is also a prominent contributor to the problem of climate change. But majority of countries are also responsible for climate change and environmental degradation as well which is create heath cost of environmental problems. Hence it is of very much importance to study the impact of the climate change on and its impact on people's health and also its adverse impact on development of world along with their environmental condition" (Kamble, 2006) It is against this overall background, the present research paper intends to examine the impact of the climate change on health, in which the environmental problem and health issues are the crucial significance

## Review Of The Literature

There are lot of numerous research studies have been reviewed and examined by the researcher the impact of climate change on human health, providing valuable insights into the complex relationship between the two problems. This section is trying to studies that have contributed to

our understanding of the health risks associated with climate change. And those reviews are in below.

Climate change and global warming are terms that are sometimes used synonymously, but they have different meanings in the sense that a ‘warming’ is only one phase of the larger climate system on Earth that naturally features change. Physical evidence on Earth and in space has helped scientists understand that there are many factors that can contribute to the changing of the planet’s climate on a long-term basis. Examples of these factors are solar radiation levels, Earth’s orbit around the sun, volcanic activity, ocean currents, and even plate tectonics. The periods of warming and cooling are referred to as interglacial and glacial, respectively, with the latter being partly characterized by enormous sheets of ice extending from the poles. Recent periods of change within human history include the Medieval Warm Period (A.D.1000-1270) and the Little Ice Age (A. D. 1270-1850) (Singer & Avery, 2007)

The history of climate change discussion among people goes farther back in time than one might think. Weart (2007) notes that climate change was conceptualized in ancient times, with knowledge of the subject growing as the technology to study it improved over time. An important figure in climate science history who warned of possible problems was Guy Stewart Callendar, whose idea of carbon dioxide as a heat trapping agent was indeed borne out by computer climate simulations in the 1970s- “Even subtle changes in the Earth's orbit could make a difference. To the surprise of many, studies of ancient climates showed that astronomical cycles had partly set the timing of the ice ages. Apparently the climate was so delicately balanced that almost any small perturbation might set off a great shift” (Weart, 2007. Para. 10).

In a study written by Leiserowitz, (2007), the point is made that people’s understanding of climate change is critical to addressing the issue because it is in the public domain that political pressure emerges. “Public opinion is critical because it is a key component of the socio-political context in which policy makers operate. Public opinion can fundamentally compel or constrain political, economic, and social action to address particular risks. (p. 3) Although there is not a substantial amount of data from which to draw conclusions about American citizens’ perception of climate change risk, various surveys in recent years can inform questions on current thought in the country.

Kumar and Sharma (2013) analyze the impact of climate change on agricultural productivity in quantity terms, value of production in monetary terms and food security in India. Climate variation affects food grain and non-food grain productivity and both these factors along with other socioeconomic and government policy variables affect food security. Regression results for models proposed in this study show that for most of the food grain crops, non-food grain crops in quantity produced per unit of land and in terms of value of production climate variation cause negative impact. The adverse impact of climate change on the value of agricultural production and food grains indicates food security threat to small and marginal farming households.

Dev Mahendra S. (2011) in his study says climate change is a major challenge for agriculture, food security and rural livelihoods for billions of people including the poor in the Asia-Pacific region. Agriculture is the sector most vulnerable to climate change due to its high dependence on climate and weather and because people involved in agriculture tend to be poorer compared with urban residents. More than 60 per cent of the population is directly or indirectly relying on agriculture as a source of livelihood in this region. The climate change is already making adverse impact on the lives of the population particularly the poor. The study examines the impact of climate change on rural livelihoods, agriculture, and food security. It discusses the

options for adaptation and mitigation and requirements for implementation at local, national and international level of these measures.

### **Research Gap**

The foregoing review of some of the, but important research studies reveals that, yes there are some research studies on the climate change, but a very few studies on the Health impact of climate change on India as well. These studies are in macro and international perspectives. No study relating to the assessment of health impact of climate change at local and grass root level, is found. More importantly, the study concerning health impact and consequently economic burden and cost of climate change on people has not been touched upon at all and taken up, which indicates the plenty of scope and relevance for the present study to be taken up. Hence it is very much urgent, necessary as well as relevant to take up the present research study, which will significantly meet the research gap on this research topic.

### **Objectives Of The Study**

1. To study the problem of climate change.
2. To assess the health impact of climate change.

### **Research Methodology**

The present study endeavors to examine the impact of climate change on the health of human society for the latest study period from 2003 to 2022. The prime objective of the present study is assessing the impact of climate change and the health impact of people on European countries and Asian countries within the framework of indicators given by the IPCC. Besides this, the study has an objective of analysing the present state of climate change with emphasis on India, and to examine the prominent contributor to the global warming and consequently climate change. The study exclusively relies on the secondary data, which has been collected from the sources such as Government of India Economic Survey, Inter Governmental Panel on Climate Change (IPCC) (2014). Fifth Assessment Report (AR5), Chapter IX; Rural Areas - Government of India (2014). Annual Climate Summary, Ministry of Earth Sciences, National Climate Centre, India Metrological Department, Pune, UNICEF (2013). Water in India: Situation and Prospects, UNICEF, India Country Office 73 Lodi Estate New Delhi 110 003 India, etc. For the supporting the results and analysis the help of the previous research studies is taken. The collected secondary data has been classified and tabulated in the light of objectives and parameters or indicators of the study.

### **Present State of Climate in India:**

As of my knowledge cutoff in September 2021, the present state of climate in India can be described as follows:

**Increasing Temperatures-** India has been experiencing a significant increase in temperatures over the past few decades. Heat waves have become more frequent and intense, particularly in northern and central parts of the country. Several cities in India have recorded record-breaking high temperatures, leading to health risks, heat-related illnesses, and even fatalities.

**Monsoon Patterns:** The Indian monsoon is a vital climatic phenomenon for the country, bringing the majority of its annual rainfall. There have been observed changes in the monsoon patterns, including alterations in onset and withdrawal dates, spatial distribution of rainfall, and intra-seasonal variability. Certain regions have experienced prolonged dry spells or intense rainfall events, leading to challenges such as droughts and floods.

**Extreme Weather Events:** India is vulnerable to various extreme weather events, including cyclones, storms, and heavy rainfall events. Coastal regions, particularly in the Bay of Bengal and Arabian Sea, are prone to cyclones, which can cause significant damage to infrastructure, agriculture, and coastal communities. Urban areas, especially those with inadequate drainage systems, are susceptible to urban flooding during intense rainfall events.

**Melting Glaciers:** The Himalayan region, including the Indian Himalayas, is home to numerous glaciers, which are a vital source of freshwater for rivers and downstream communities. There is evidence of glacier retreat and thinning in some parts of the Indian Himalayas, which could impact water availability in the long run.

**Agricultural Impacts:** Agriculture is a crucial sector in India, and climate change poses challenges to agricultural practices and productivity. Changes in rainfall patterns, temperature, and pest dynamics can affect crop yields, leading to implications for food security and rural livelihoods.

**Climate Change Policies and Initiatives:** The Indian government has taken steps to address climate change, including the adoption of the National Action Plan on Climate Change (NAPCC) and the commitment to renewable energy expansion India aims to increase the share of renewable energy in its total energy mix and has set ambitious targets for renewable energy capacity installation.

It is essential to note that the present state of climate in India may have evolved since my knowledge cutoff in September 2021. To stay updated with the current climate conditions, it is recommended to refer to recent reports from reputable climate research institutions and national meteorological agencies in India.

### The Current Scenario Of Climate Change In India

India is very important for global community. Any aberration in the context of sustainability in this region may affect the other parts of world sooner or later in different intensities. It is essential to understand that disturbance in any part of a land system will ultimately affect the entire land ecosystem. And when it is about India which is hugely populous & is very significant in the context of biodiversity; it becomes very important to be watchful. Effects of climate change in India is also evident and is concerning

Year	Atmosphere, Climate and Weather								
	Annual and Seasonal Temperature								
	Annual			June-September			October-December		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
In Celsius	In Celsius	In Celsius	In Celsius	In Celsius	In Celsius	In Celsius	In Celsius	In Celsius	
2011	20.3611	30.8897	25.6254	24.1585	31.9299	28.0442	17.9261	29.5281	23.7271
2012	20.2791	30.9455	25.6123	24.2598	32.2498	28.2548	17.5412	29.1493	23.3453
2013	20.5327	30.8408	25.6868	24.2068	31.8334	28.0201	17.8931	28.8423	23.3677
2014	20.542	30.9395	25.7408	24.4864	32.6304	28.5584	17.9731	29.1258	23.5495
2015	20.7511	31.1069	25.929	24.366	32.5285	28.4472	18.5061	29.6852	24.0957
2016	20.8751	31.5443	26.2097	24.4105	32.2658	28.3382	17.8091	29.8778	23.8435
2017	20.7719	31.3141	26.043	24.3986	32.3656	28.3821	18.1831	29.5115	23.8473
2018	20.5749	31.2291	25.902	24.3306	32.2032	28.2669	17.7795	29.359	23.5693
2019	20.8317	30.8842	25.8579	24.6555	32.5442	28.5998	18.5754	28.4044	23.4899
2020	20.76	30.81	25.78	24.6	32.31	28.45	18.25	29.26	23.75
2021	20.9036	30.9625	25.9331	24.5337	32.1948	28.3642	18.4934	28.8281	23.6608

**Source:-EPWRF India Time Series.**

The above table tells us that the annual rate of climate change is increasing rapidly and because of that reason all likelihood, more than 40% of India population will be facing water scarcity by 2050 because of the seasonal temperature ratio which is are mention on the above table the average temperature had already been risen by 0.7 degree Celsius during 2011-2021 and It is also expected that there is possibility of almost 4.4 degree

Celsius rise in average temperature by the end of twenty first century as per the data Thousands of lives were killed in India and Pakistan by 2015 deadly heat waves. A phenomenon of this kind can become very frequent in this region recently; Delhi recorded more than 49 degree Celsius. Gurgaon which falls under national capital region also recorded 48 degree Celsius. There is urgent need for eradicate the above problem for sustainable environmental development is necessary.

#### **IMPACT OF CLIMATE CHANGE ON HUMAN HEALTH:**

The impact of climate change on human health is significant and multifaceted. Here are some key areas where climate change affects human health:

**Increased Heat-Related Illnesses:** Rising temperatures and more frequent heat waves lead to increased heat-related illnesses, including heatstroke, dehydration, and heat exhaustion. Vulnerable populations, such as the elderly, children, and individuals with pre-existing health conditions, are particularly at risk.

**Changes in Disease Patterns:** Climate change affects the distribution and prevalence of diseases. Changes in temperature, precipitation, and humidity create suitable conditions for disease vectors and pathogens. Vector-borne diseases such as malaria, dengue fever, and Lyme disease may expand their geographic range and increase in incidence.

**Air Quality and Respiratory Issues:** Climate change contributes to poor air quality through the formation of ground-level ozone and increased allergenic pollen production. This worsens respiratory conditions such as asthma, allergies, and chronic obstructive pulmonary disease (COPD).

**Mental Health Implications:** Climate change impacts mental health and well-being. Increased exposure to natural disasters, loss of livelihoods, and displacement can lead to psychological distress, anxiety, depression, and post-traumatic stress disorder (PTSD). The concept of "eco-anxiety" has emerged, reflecting the psychological distress caused by the environmental crisis.

**Food Security and Nutrition:** Climate change disrupts agricultural systems, leading to decreased crop yields, altered nutritional content, and changes in food availability and quality. Inadequate nutrition resulting from reduced crop productivity can contribute to malnutrition and related health issues, especially in vulnerable populations.

**Waterborne Diseases:** Changes in precipitation patterns and increased flooding can contaminate water sources, leading to an increased risk of waterborne diseases like cholera, dysentery, and typhoid fever.

**Extreme Weather Events:** More frequent and intense extreme weather events, such as hurricanes, floods, and wildfires, pose direct risks to human life and health. These events can result in injuries, displacement, mental trauma, and the breakdown of healthcare systems.

**Vulnerable Populations:** Climate change disproportionately affects vulnerable populations, including the poor, marginalized communities, children, and the elderly, who have limited resources and are more susceptible to health risks. Developing countries, with limited adaptive capacity, face greater challenges in addressing the health impacts of climate change.

Addressing the health impacts of climate change requires a comprehensive approach, including mitigation efforts to reduce greenhouse gas emissions, adaptation strategies to build resilience, and strengthening healthcare systems and public health infrastructure. It necessitates interdisciplinary collaboration between the fields of climate science, public health, policy, and community engagement to protect and promote human health in a changing climate.



The size and kind of the health effects of heat depend on the frequency, severity, and length of a temperature event, the degree of acclimatization, and the degree of climatic adaptation of the local populace, infrastructure, and institutions. The specific temperature threshold that signals a dangerous state varies by place, along with other elements like humidity and wind, human acclimatization levels locally, and readiness for hot weather conditions. With proper public health measures, the harmful effects of heat are foreseeable and largely avoidable. All individuals are physiologically affected in different ways by prolonged exposure to heat, which frequently exacerbates pre-existing illnesses and causes early mortality and disability.

The following are some of the main negative effects of heat on health: • Rapid heat increase from exposure to hotter.

## **RESULTS AND DISCUSSION**

A growing number of studies present evidence for the effects of observed climate change on vector borne and other infectious diseases. “Although the literature to date does not constitute strong evidence of an impact of climate change on human vector-borne diseases (such as malaria), there is now evidence of vector species responding to recent climate change in Europe”(Haines, Kovats, Campbell-Lendrum, & Corvalan, 2006) There have been latitudinal shifts in ticks which carry Tick Borne Encephalitis in northern Europe but alternative explanations such as changes in confounding factors like land use or in socio-economic, demographic and other environmental factors remain plausible.

“There is some evidence for changes in frequency of weather extremes over recent decades. Many health outcomes are sensitive to isolated extreme events (e.g. heavy rainfall and high temperatures). Analyses of the 2003 heat wave in Europe have concluded that it was a truly extreme event and the summer of 2003 was probably the hottest in Europe since 1500. Climatologists now consider it ‘very likely’ that human influence on the global climate has at least doubled the risk of a heat wave such as that experienced in 2003. “Recent evidence has also emerged about a possible causal role of climate change (and specifically the warming of sea surface temperatures) in increasing the intensity of tropical cyclones, although a single event such as Hurricane Katrina cannot be definitely attributed to climate change. Where health surveillance data are available for several decades up to the present day, it may be possible to determine whether any observed changes in disease might be related to changes in climate. Interpretation is complicated by potential competing explanations due to changes in important health determinants over time, as well as changes in the way in which diagnoses may be recorded. Empirical observation of the health consequences of recent climate change, followed by formulation, testing and then modification of hypotheses would require long time-series (probably several decades)” (Kamble & Kamble, **Health effects of water pollution, 2022**) of careful monitoring. While this process may accord with the principles of empirical science, it would not provide the timely information needed to inform current policy decisions on GHG (greenhouse gas) emission abatement, so as to offset possible health consequences in the future. Nor would it allow early implementation of policies for adaptation to some level of climate change, which is now inevitable owing to past GHG emissions. Therefore, the best estimation of the future health effects of climate change will necessarily come from risk assessment based on current understanding of the effects of climate variation on health from observations made in the present and recent past, acknowledging the influence of a large range of

modulating factors. Observations of short-term variations in climate or weather show that even small temperature increases and precipitation changes can result in measurable impacts on malaria, diarrhoeal episodes, injuries related to floods, and malnutrition. Knowledge of these relationships allows approximate estimates of the health effects of past and future climate change to be made” (Haines, Kovats, Campbell-Lendrum, & Corvalan, 2006)

### Impact on Health of climate Change

The life expectancy has crossed 67 years, infant and under-five mortality rates are declining as is the rate of disease incidence. “Many diseases, such as polio, guinea worm disease, and tetanus, have been eradicated. In spite of this progress, communicable diseases are expected to continue to remain a major public health problem in the coming decades posing a threat to both national and international health security. Besides malaria and neglected tropical diseases, communicable disease eruptions will continue to challenge public health, requiring a high level of readiness in terms of early detection and rapid response. In this regard, vector-borne diseases, such as dengue and acute encephalitis syndrome, are of particular concern. Climate change is one of the most vital global environmental challenges of the present century. The IPCC report of 2009 wraps up that climate change is projected to increase threat to human health, particularly in underdeveloped countries. It would have implications on food production, water supply, air quality, coastal settlements, and human health. As most of the Indian population” (Kamble & Kamble, 2022) relies directly on climate-sensitive sectors like agriculture, fisheries, and forests, it is necessary to have a positive impact.

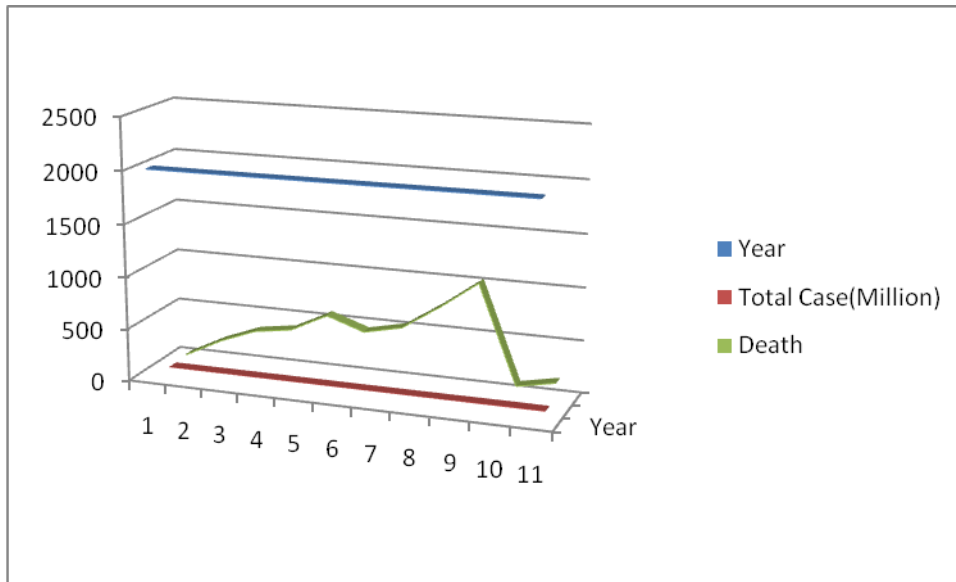
### LEVEL OF COMMUNICABLE AND VECTOR-BORNE DISEASES

Spatial and temporal distribution of communicable and vector-borne diseases like malaria, dengue and chikungunya are likely to be affected the most as the mosquitoes which transmit the diseases are cold-blooded. There is a high incidence of occurrence of vector-borne diseases like Malaria, Kala-azar, Japanese Encephalitis, filaria, Chikungunia, etc., in the immediate past. It is observed that changes in climatic patterns may alter the distribution of vector species and increase its spread in new areas. Deaths due to heat wave are reported from several parts of the country from time to time, particularly during the summer. The expert Committee identified Health deterioration as one of the impacts of Climate Change. Structure for statistics related to climate change included the following variables/indicators.

#### Malaria cases and deaths in the country since 2010-20

Year	Total case (million)	Death
2010	0.17	14
2011	0.84	194
2012	1.09	331
2013	1.17	384
2014	1.1	562
2015	0.88	440
2016	1.07	519
2017	1.31	754
2018	1.6	1018
2019	3.38	77
2020	1.57	150

Source: National Vector Borne Disease Control Programme (NVBDCP), Ministry of Health & Family.

**LEVEL OF COMMUNICABLE AND VECTOR-BORNE DISEASES**

*Source- computed by the author in Excel.*

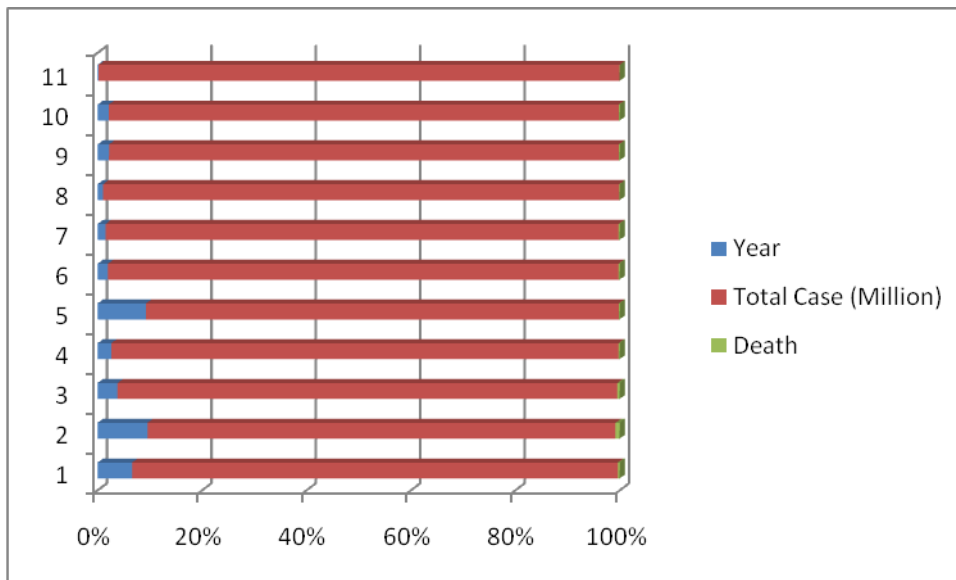
According to the above table and graph, the data indicates that, based on the estimates of a 16-member committee set up by the National Vector Borne Disease Control Programme (NVBDCP) to assess India's actual malaria death burden, the total annual number of cases in India may be about 9.7 million, with about 30,014-48,660 deaths (40,297 on an average). Another paper estimates the malaria burden in India at 180 million, with as many as 90 million cases of *P. falciparum* malaria per year. India has also contributed to the largest drop in cases region-wide, from approximately 20 million to about 6 million. The percentage drop in the malaria cases was 71.8% and deaths was 73.9% between 2000 to 2019. India achieved a reduction of 83.34% in malaria morbidity and 92% in malaria mortality between the year 2000 (20,31,790 cases, 932 deaths) and 2019 (3,38,494 cases, 77 deaths), thereby achieving Goal 6 of the Millennium Development Goals (50-75% decrease in case incidence between 2000 and 2019).

**DENGUE CASES AND DEATHS IN THE COUNTRY SINCE 2010-20**

Year	Total Case (Million)	Death
2010	28292	108
2011	18860	169
2012	50222	242
2013	74454	167
2014	19704	37
2015	99913	220
2016	129166	245
2017	188401	225
2018	89974	144
2019	92237	167
2020	978777	297

*Source: National Vector Borne Disease Control Programme (NVBDCP), Ministry of Health & Family.*





**Source- computed by the author in Excel.**

The above table and graph demonstrated that the impact of climate change on dengue also the table of the above are reveals that an increase in transmission with a 2°C rise in temperature in India as reviewed in 2017. The thresholds of temperature and relative humidity for indigenous transmission of dengue need to be redefined. There has been a more than 300 percent hike in dengue cases since 2009, and even the total number of deaths in 2017 was the highest in the last one decade Last year, the spike in cases of dengue was the highest in the last one decade, according to the data from National Vector Borne Disease Control Programme (NVBDCP) and National Health Profile 2018. From less than 60,000 cases in 2009, cases increased to 188,401 in 2017 more than 300 percent spike. When compared to 75,808 cases in 2013, it is more than a 250 percent point.

### Major Conclugances And Policy Suggestions

Climate change is a problem that is facing our planet and it has progressed a lot after the industrial revolution. The emission of greenhouse gases has accelerated the progress of climate change and made our weather more intense. However, the world's dependence on fossil fuel for energy, transportation, and manufacturing have created a major obstacle for us to switch to renewable energy. Would like to conclude with what the above research article is mentioned regarding the solutions that have been developed to prevent climate change from progressing, he said, "We need to transfer our energy to renewable energy. Also, one of the things we must do is to adapt to the changes that occurred and will occur. We need to prevent any future changes from happening, but adaptation is a major thing we need to do". Scientists, environmentalists, communities, as well as policy makers need to diligently and cooperatively to live up to these challenges and combat climate change and lastly we conclude to say that by moving forward, we can reduce the adverse effects of this climate change on human health and bravely face the great crisis of the future.

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