

Review Paper

Climate Change and Its Consequences on Human Health: A Review Study



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ABSTRACT

Climate change is a significant threat to global health in the 21st century. This study aimed to investigate climate change and its health consequences in order to increase public awareness. This review study examined the climate change and its effects on human health by reviewing the literature and research conducted worldwide. According to the results, diseases associated with increased temperature and heatwaves include heat stroke, dehydration, heart and respiratory diseases. The most important diseases associated with rising sea levels and floods include harmful waterborne diseases, injuries, respiratory diseases, and mental health problems. The diseases caused by global warming include vector-borne diseases such as malaria and Lyme disease. Problems caused by forest fires include those caused by air quality degradation like respiratory diseases and mental illnesses. In general, vulnerable groups such as minors, the elderly, the disabled, pregnant women, are prone to be affected by climate change. Mental illness, non-communicable diseases, poisoning, diseases related to food insecurity and nutrition, water and foodborne diseases, and reproductive health care are among the factors affected by climate change. Since climate change has numerous direct and indirect impacts on human health, responsible institutions must educate the public through mass media and take adequate measures to offset the health effects of climate change.

1. Introduction

Climate change is a major global health threat in the 21st century [1]. It is one of the most severe and pervasive challenges we face today. Climate change affects the environment and its ecosystems, as well as human health [2]. According to the definition of the

United Nations Framework Convention on Climate Change (UNFCCC), climate change is a change that can be attributed directly or indirectly to human activity; it alters the composition of the global atmosphere and in addition to natural climate variability, can be observed over comparable periods [3]. Climate change is a public health issue that is increasingly being considered [4]. In 2014, the World Health Organization predicted that

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5000000 additional deaths would occur due to climate change between 2030 and 2050. This estimate is the least significant because of the increasing exposure to urban climate change. This number does not include population growth, aging, and migration [5]. Although the change in global or regional climate patterns is a significant threat to global health, climate change has recently been considered “the greatest global health opportunity of the 21st century” by the Lancet Commission on Climate Change. The variable can lead to sustainable human health [6]. Climate change affects human growth and development by increasing greenhouse gas concentration [3].

Current efforts to reduce greenhouse gas emissions do not match with global emission reduction commitments [7]. The global climate change situation is unfavorable, and the efforts made so far to achieve global goals are insufficient. According to the Intergovernmental Panel on Climate Change, the planet Earth has already experienced one degree Celsius temperature higher than the Earth’s temperature in the pre-industrial period [8]. 2019 was the warmest year after 2016, which was very hot that year due to El Niño [9]. Carbon dioxide accounts for about 78% of greenhouse gas heating [10]. Of course, methane, fluorinated gases, nitrogen oxides, and carbon black are all more effective at absorbing heat than CO₂ [11]. Some of these gases also act as hazardous pollutants that directly harm human health and ecosystems. Denmark can be a good role model for the world in the field of climate change. Since 2016, it has reduced greenhouse gas (CO₂) emissions by half [12]. The Danish government has done this through investments in wind energy and biomass in energy production, and the development of bicycle lanes. Now, there are more bicycles on the streets of Denmark than cars [13]. Denmark will supply 47% of its electricity from wind energy in 2019 [14]. Reduced coal mining, combined with improved landfill gas collection and a 23% reduction in food waste, allowed the UK to reduce methane emissions by 61% from 1990 to 2017 [15]. In climate change, health risks attract people’s attention. Perceptions of the health risks associated with climate change vary among people and health professionals. The findings indicate limited knowledge of health-related risks of climate change among the population. The results of studies show that health infrastructure, decision-making, and management should be strengthened to respond effectively to emerging climate risks and similar contexts [16].

Globally, discussions of health adaptation strategies and climate change in governments are often limited. Climate forecasts include a warmer and potentially drier future with increasing frequency and severity of severe weather events. The focus areas of priority for govern-

ments that need further research on health risk factors are population and refugee migration, the environment, land-use change, violence and human conflict, and vulnerable groups. The other areas of interest include mental illness, non-communicable diseases, injuries, poisonings (e.g. pesticides), diseases related to food insecurity and nutrition, diseases caused by water and food, and reproductive health care. Studies show that international subsidiaries should consider the “health and climate change in all policies” when developing adaptation and mitigation strategies to address climate change [17]. Following human activities and population growth, the global environment is undergoing changes that are transforming our planet and posing threats to human health. So additional measures are expected to increase in the coming years. Global changes at geographic and temporal scales include climate change, marine pollution, ozone depletion, soil degradation, and urbanization. Climate change affects the quantity and quality of food as well as water.

On the other hand, it increases air pollution and changes the distribution of pathogens. Therefore, studies in this field are necessary. To meet these emerging challenges, health systems should be improved and upgraded as soon as possible [18]. Studies show that patients and physicians alike are concerned about climate change and its health consequences. Therefore, there is an excellent opportunity for family physicians to educate patients about the emerging issue of climate change and health [19]. Because of the significant effects of climate change on human health and the environment, the importance of this issue, and the lack of sufficient awareness of many people, officials, and communities in this field, this study is necessary.

2. Materials and Methods

The present study is a review. We investigated climate change and its effects on human health and the environment, as well as the existing strategies to control and reduce its adverse effects by reviewing the texts and research conducted in the world. Scientific papers were collected from the databases of Science Direct, Springer, PubMed, Taylor and Francis, ISI Web of Knowledge, Research Gate, and Google Scholar. From a large number of studies, this study collects and presents data and information on climate change and its effects on health to satisfy the study’s objectives.

3. Results and Discussion

Global climate change and mental health

Poor mental health is associated with three different weather-related events: depression, anxiety, and post-traumatic stress disorder are the most common complications. These effects reflect the direct and indirect consequences of global climate change [19, 20]. Children and residents of low- and middle-income countries are more vulnerable. Understanding the scope and scale of the effect is crucial for its prevention and treatment [21]. One study investigated the effects of mental health on three types of weather-related events. First, acute events such as hurricanes, floods, and fires. Second, minor or long-term changes such as drought and heat stress. Third, the existential threat of long-term change, such as high temperatures, rising sea levels, and a constantly changing and potentially uninhabitable physical environment. This study has shown that global climate change effects are both direct (i.e., heat stress) and indirect (i.e., economic losses, threats to health and well-being, displacement and forced migration, mass violence, and civil strife, and alienation from a degraded environment) [19].

Studies have shown that rising temperatures, as well as increasing air pollutants, have a significant and adverse effect on human health [21]. These effects may vary according to the geographical locations of the affected areas. It is possible to identify where the most vulnerable areas are so that by paying more attention to these areas, we can help programs and implement strategic measures to reduce the effects of global climate change on people's health [21]. Research shows that rapid climate change and global warming can increase violent behavior [22]. The relationship between heat and aggression has reportedly been both psychological and physiological but not necessarily compatible [23-25]. Climate change and subsequent increase in temperature can cause changes in the everyday activities of people in the community and cause heatstroke and the possibility of aggressive behavior [26, 27]. The results of the studies are summarized in Table 1.

Climate change and environmental health

Every human being must enjoy the highest levels of health that can be achieved. This right is one of the fundamental human rights. Many human rights, including health, life, liberty, security, livelihoods, culture and customs, and free access to information, may change and sometimes even is violated as the environment and climate change. What we call climate change can exacerbate existing threats to humanity and the environment. Thus,

global climate change can be challenging in many areas, including social, environmental, and economic issues at the international community level [28].

Climate change highlights human vulnerability levels to environmental change, including the relationship between environmental quality and human health. Despite the growing recognition of these links, the relationship between climate change and environmental health, and the parallel relationship between environmental health and human rights, has remained neglected or increasingly controversial. As a result, the international community continues to negotiate a legal agreement to address climate change. Climate change affects many areas, from the rise of waterborne diseases to diseases related to air quality, damage to agriculture and fisheries, the collapse of aquaculture and agricultural productivity leading to malnutrition. How can climate change affect the quality of the environment? What specific changes in the quality of the environment will affect humans in terms of human rights? Is the passing of laws a suitable mechanism for addressing the links between climate change and human health? Is there a need for a new set of rights to do this? These questions are investigated and answered in the field of climate change and its relationship with human health [28].

Overall, climate change, air pollution, and health risks are very worrying. In many studies, scientists have studied and observed climate change's effects on various health aspects, including climate-related diseases [29]. A study in Iran was conducted on the common health challenges related to climate change, such as increased temperature, frequent severe weather events, decreased air quality, food, water, and carrier diseases. It mentions the consequences of mental health and well-being and the increasing trend of natural disasters and deaths related to climate hazards [30] [Table 2].

The effects of climate change on human health-educating

More efforts should be made to educate about the effects of climate change on human health. Everyone in the community should be aware of this issue; the development of environmental literacy and its capacity in climate change should be strengthened. Climate change and its health effects should be included in students' current curricula. All people, especially students and all officials, should be aware of climate change and feel responsible [1].

Global temperatures continue to rise. Climate change and the risk of natural disasters are threats to human

Table 1. Summary of evidence for diseases related to climate change

Authors/Year (Ref.)	Purpose	Conclusion
Liao et al./2010 [36]	Investigating the effect of climate change on heart disease	The study results show that a 1% increase in temperature increases deaths due to cardiovascular diseases by 0.226%.
Mohammadkhani et al. 2010 [34]	Relationship between climate factors and malaria prevalence in Kerman, South East of Iran	A 1°C increase in maximum temperature increased malaria rates by 15% and 19% during and after the same months, respectively.
Ghaemi et al./2007 [35]	Evaluation of diarrhea in connection with Shigella in Gorgan, the northern part of Iran	The seasonal pattern of diarrhea is mostly reported in the warm months of Iran.
Vapalahti et al 2012 [37]	Investigation of new infectious diseases caused by climate change in Finland	The occurrence of infections transmitted by ticks, insects, and rodents depends at least in part on climate change.
Short et al. 2017 [38]	Investigating the contribution of climate change in the emergence of parasitic diseases	Climate change has the potential to guide the spread of parasitic disease worldwide.

health. Better awareness of climate change is needed and can help reduce vulnerability strategies [31].

Climate change can have significant health effects and contribute to the spread of disease. In this regard, developing countries are more vulnerable, and reliable policies are needed to solve it [32]. Climate change is the underlying cause of many health risks, from increasing the spread of disease carriers, such as mosquitoes at warmer temperatures, to increasing air pollution that increases respiratory, coronary heart diseases, and stroke [33]. More acute cases of malaria have been reported in Iran during the warm seasons. The incidence of some diseases in Iran follows a seasonal pattern [34]. A 1°C increase in maximum temperature increased malaria rates by 15% and 19% during and after the same months, respectively [35]. Also, the seasonal pattern of diarrhea has been reported more in the warm months of Iran [36].

Given the impact of climate change on cardiovascular mortality, everyone in the United States is willing to spend \$51 to \$97 a year to prevent it [37]. Climate affects the life cycle of arthropod-borne viruses, also the evolution and transmission efficiency of the viruses [38]. Climate change is involved in the prevalence of parasitic diseases. Diseases such as protozoan diseases and soil clematis, malaria, lymphatic filariasis, Chagas disease, African human trypanosomiasis, leishmaniasis, babesiosis, schistosomiasis, and echinococcus, as well as livestock parasites, are affected by climate and environmental changes. The results of the studies are summarized in Table 2.

The findings indicate limited knowledge of health-related risks of climate change among the population. Therefore, to create sustainable communities aware of the effects of climate change, implementing climate change sensitization programs is very important. Also,

Table 2. Summary for the effects of climate change on human health

Authors/Year	Purpose	Conclusion
Miles-Novelo et al. 2019 [21]	Investigating the effects of rapid global warming on violence and aggression	Rapid climate change can increase violent behavior.
Nriagu JO 2019 [27]	Investigating the effects of rapid global warming on anger, rage, and aggression	Global climate change poses serious social, environmental, and economic problems for people and the environment.
Leal Filho et al./2018 [31]	Investigating the relationships between the spread of disease and climate change	Climate change can contribute to the spread of disease.
Hussey LK, Arku G 2019 [16]	Understanding the health risks associated with the climate among health professionals and the public	Knowledge about the health problems caused by climate change is limited among the people.
Watts et al. 2015 [6]	Public health protection policies	Adaptation to changing weather conditions can lead to sustainable human health.

health infrastructure, decision-making, and management should be strengthened to respond effectively to emerging climate hazards and similar contexts [16]. The results of the studies are summarized in Table 2.

4. Conclusion

Risks of climate change include the emergence of a variety of diseases, changing the quantity and quality of food, and affect the behavior of individuals. Climate change affects the concentration of air pollution. Climate change can also cause widespread and irreversible damage to ecosystems. In sum, climate change is a significant threat to global health, so health infrastructure, decision-making, and management should be strengthened to respond effectively to emerging climate risks and related areas. More efforts should be made to educate about the effects of climate change on human health.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

All authors participated equally in the collection and analysis of data. The authors have reviewed, edited, and verified the manuscript.

Conflict of interest

The authors declared no conflict of interest.

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