

Climate Change and its Impact on Human Health: A Focus on Vector Borne Diseases

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ABSTRACT

Human activities are blamed for climate change, for instance, cutting trees, deforestation, desertification, arable lands abuse, increasing consumption of fossil fuels in industries and transportation have increased greenhouse gases such as carbon dioxide, methane and nitrous oxide in the earth's atmospheres that resulted in increased average temperature. Accumulation of greenhouse gases in the lower atmosphere is the main reason for global warming. The overall health effects of climate change are likely to be extremely negative. Climate change affects social and environmental factors related to health such as contaminating drinking water, less access to water, having adverse effects on food security, and ruining shelter. It also imposes new diseases and mortality on human population. Climate change especially extreme high temperature increases deaths due to complications from cardiovascular, cerebrovascular, diabetes, mental disorder, respiratory and renal diseases. Weather related natural disasters result in more deaths. Intense rainfall and floods cause direct trauma, ruin agricultural land, contaminate fresh water, increase the risk of waterborne disease and create suitable breeding grounds for vectorborne disease like malaria, leishmaniasis, CCHF, and others. Climate change also increases the rate of communicable and non-communicable diseases. All population is affected by climate change but elders, pregnant women and children are more vulnerable than others. Climate change is challenging all human societies, but areas with weak health infrastructure and low socioeconomic status are more affected.

Keywords: Climate change, Human health, Vectorborne disease, Vulnerable population

INTRODUCTION

Weather refers to the condition of the atmosphere at a certain place and time for a short period. It includes temperature, pressure, humidity, wind, clouds, precipitations and thunderstorms, dust storms and tornados. Climate is defined as the average weather over a long period of time ranging from months to years (Rossati, 2017). Climate change is defined as the change of temperature and weather patterns over a long period (Filho et al., 2019). Climate changes and global warming are two expressions which are usually used in an interchangeable manner although global warming is just one aspect of various aspects associated with climate change (Sayed and Kamel, 2020). Climate changes especially global warming is the greatest challenge of the 21st century which affects all aspects of human life (organization, 2018). Human activities result in global warming, such as cutting trees, deforestation, desertification, changing forest lands to arable lands, abuse of arable lands, increase consumption of fossil fuels in industries and transportation are those blamed human activities which have increased greenhouse gases (GHG) in the lower atmosphere (Sayed and Kamel, 2020). In 2017, 36.15 million tonnes of CO₂ was emitted worldwide which is one of the gases that enhances the greenhouse effect (Filho et al., 2019). Since 1880, global warming has been increased by 0.85°C (Wheeler and Watts, 2018). If accelerated human activities aren't stopped, it is expected to be faster in the next year and may range between 1.6 and 6°C (Sayed and Kamel, 2020). Global warming played an important role in sea level rise, glaciers melt and precipitation patterns change. Climate change affects clean air, safe drinking water, sufficient food, and secure shelter. Rising sea levels destroy homes, medical facilities and forces them to leave their properties, which in turn can increase social displacement, mental disorders, unemployment and crime rates (Khanjani, 2016). Climate change affects all aspects of life especially agriculture, tourism, transports, properties, social services, health and economics (Filho et al., 2019). Climate change increases weather extreme events which lead to deaths, injuries, disabilities and mental illness. Extreme weather events increase air pollution, create suitable environment for pathogens replication and affect human health indirectly. Climate change causes drought, lessens productivity of agricultural land, causes malnutrition during famine which in turn affects children

development. Climate change increases conflicts over food. It also increases heat-waves that increase the rate of mortality in older people. Reduced arable and drinking water, conflict, shrinking arable lands, enhancing chronic disease, increasing water-borne, food-borne, rodent-borne, vector-borne disease and Create habitats suitable to the transmission of human and animal pathogens are chronic negative impacts of climate change (Rossati, 2017). Four paths have been identified for climate change to impact human health. First path is water. Climate change may lead to inadequate water resources, especially in the regions where consuming water is supplied by melting ice from the mountains. Intense rainfall will probably increase the risk of floods and subsequent deaths. Intense precipitation and higher temperature may damage water supply and increase the risk of infectious diseases such as diarrhea, typhoid, cholera, malaria and dengue fever. Sea and ocean level rise threaten the life of people who live in coastal areas, through harming the industries and shelters and causing adverse effects on their physical and mental health (Musavi et al., 2020). The second path is heat-waves and high temperature. Higher temperature increases the risk of mortality from cardiovascular and heat-related diseases. Heat-wave causes premature deaths. In 2003, heat-waves caused up to 70000 premature deaths across Europe. The third path includes impacts on agriculture and food supplies. Higher temperature specially in tropical regions reduce agricultural resources and food production, leading to famine and hunger which will force the population to migrate to other regions that can also create conflicts. Reduction in food supplies will harm food security and create malnutrition specially in children. The fourth path is extreme weather events. Extreme weather events occur more frequently and more violently. The number of affected people by droughts, floods, storms and heat-waves has mounted up about ten folds globally (Musavi et al., 2020).

METHOD

This is a narrative non-systematic review where the concepts and findings of recently published researches on the topic of interest have been gathered through a comprehensive search of literatures. The search have been carried out in valid international databases namely Web of Science (WoS), SCOPUS, PubMed, and google scholar using appropriate key works and MeSH terms such as climate change, human health, vector-borne diseases, respiratory diseases, air pollution, communicable diseases, non-communicable diseases, incidence, and prevalence. Several Boolean logics such as AND, OR, NOT, and others where used to broaden or narrow down the search where appropriate. All the needed filters such as articles in English language, original articles and review articles were used. The obtained articles (37) were screened for the keywords of this study and only 13 articles were used for the development of this review article.

Alteration in Temperature and its Effect on Human Health

One of the most significant parameters of climate is rising in global temperature. It causes soil degradation, loss of productivity of agricultural land, desertification, loss of biodiversity, degradation of ecosystem, reduced fresh – water resources, acidification of the oceans, and the disruption and depletion of atmospheric ozone. All these have vast impact on human health (Rossati, 2017). People with chronic illness, for example hypertension, heart disease, diabetes and obesity are more vulnerable to excessive temperature and are at high risk of complications and mortality (Rossati, 2017). The European heat –waves of 2003 killed over 70000 people by causing premature deliveries. (Wheeler and Watts, 2018). The Increased number and duration of heat-wave leads to stress, respiratory arrest, circulatory collapse, heat stroke and the long term effects include squamous cell carcinoma (Sayed and Kamel, 2020). It is very likely that during the hot season, there will be intense wind, thunder storms and heavy rain fall, which triggers the release of fungal spores, resulting in increased exposure to these allergens, that is why patient suffering from asthma are more hospitalized during extreme heat and precipitation events. Hotter climates cause sweating and dehydration, which in turn enhance urine concentration and rising the incidence of urolithiasis (Rossati, 2017). Moreover, they have caused to melt the glaciers. According to the NASA report, there has been a recorded loss of 241. 4 billion tons ice per year in Antarctica since 2012, contributing to sea level rises (Fitho et al., 2019) which in turn destroys homes coastal work places, medical and other facilities. Nowadays sea level rise is 0.5 meter which can lead to the disappearance of many cities and river deltas during hurricanes (Sayed and Kamel, 2020). Sea level rise affects most badly those coastal inhabitants who have low incomes (Filho et al., 2019). Melting ice also reactivate frozen biological materials stored in frozen soil such as small pox, bacteria, virula viruses, Bacillus anthracis. Bacillus anthracis causes a disease called anthrax. Bacillus anthracis is spore forming bacteria whose spore is transported by floods and insect and enhances its incidence rates (Sayed and Kamal, 2020). It is documented

that poor income, lack of electricity and air conditioning, poor or no access to transport, poor education, poor hygiene and older age have been recognized as risk factors which increase vulnerability to heat, cold, and death (Khanjani, 2016). On the other hand, It is very likely that climate change will lead to more frequent cold waves in cold regions and cause excess deaths. Cold waves cause the epidemic spread of air – borne viral, secondary bacterial infections and cardiovascular complication. Low temperature causes cardiovascular and respiratory alterations including bronchoconstriction, and reduction in mucociliary defense which in turn make people more receptive to air borne pathogens. The waves force people more receptive to corona, Influenza, para influenza, Metapneumo virus and Respiratory syncytial virus (Rosatti, 2017).

Extreme Events and Its Impact on Human Health

Climate change increases the frequency and intensity of extreme events, such as intense winds, heavy rainfall, landslides, thunder storms, and floods. Floods can cause injuries, deaths and other sequelae. Extreme events destroy health infrastructures, reduce availability of water resources, cause poor hygiene and increase the chance of communicable diseases. Moreover extreme events contaminate drinking water with bacteria, viruses, and parasites and increase the incidence rate of cholera, typhoid and hepatitis A. Extreme events not only cause mortality, they also ruin houses, destroy roads and arable lands, affect crops production, force people to move and leave their properties, losing family-members, economical issues and social displacements increase mental disorders (Rossati, 2017). Rubonis and Bickmann reported an increase of approximately 17% in the global rate of psycho-pathology during disaster. Post-traumatic disorder does not only affect victims of disaster but also has a prevalence of 10 to 20% among rescue workers (Rossati, 2017).

Effects of Climate Change on the Incidence of Common Vector borne Diseases

More than half of the world's population is at risk of vector- borne diseases (Escobar et al., 2016). Risk from vector- borne diseases is intrinsically sensitive to changes in weather and climate (Ogden, 2017).

Malaria

Malaria is caused by parasitic protozoans of the genus plasmodium and is transmitted by female mosquito vectors of the Anopheles species (Caminade et al., 2014). Children under five years of age and pregnant women continue to be at risk (Ngarakana et al., 2016). Malaria is considered a significant global health burden at both global and regional levels (Cella et al., 2019). Excessive heat and cold kill malaria mosquito. Malaria mosquitoes persist in a range between 17 and 33°C. In mentioned range warmer temperatures increase mosquito reproduction and biting activity. It also increases the rate at which pathogen mature within them. For instance, at 20°C falciparum protozoa completes its life cycle in 26 days but at 25°C, they complete their life cycle in 13 days. Anopheles mosquitoes live only several weeks and warmer temperature elongates the mosquito's life span and permits parasites to mature earlier and let them to have more time to transfer the infection (Khanjani, 2016). Heavy rainfalls provide standing water surface required for egg- laying and larval development (Sayed and Kamel, 2020). High level air humidity has effect on mosquito's activity and enhances the vector population dynamics. The wind plays an important role in the spread of mosquitoes and their associated diseases (Sayed and Kamel, 2020). Cool temperatures and seasonally dry conditions limit malaria transmission (Midekisa et al., 2015).

Dengue Fever

It is climate -related disease characterized by severe headache and bony pain, and mortality occurs in case of hemorrhagic fever and shock syndrome. It is carried by Aedes aegypti and is restricted by 10°C winter isotherm. Warm weather, rainfall, and wind elongate their life spans, enhance their activity and help their geographical spread respectively (Khanjani, 2016).

CONCLUSION

This paper has illustrated how climate change affects all aspects of human life and the main links between climate change and health. It also described the examples provided by mosquito-born diseases, especially malaria, dengue, leishmaniasis and tick- born diseases. The key findings of this reviewed articles were also presented under two headings, namely alteration in temperature and its impact on health, extreme events and their impacts on health. It is seen that climate change poses various threats to human, animals and plants. In

conclusion, it is necessary to make all possible efforts to stop or at least slow down the accelerated damage of the global ecosystem due to global warming and climate changes. We need to promote actions that both reduce carbon emissions and improve health, build better, more resilient and environmentally sustainable health system.

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