Impacts of Climate Change on Human Health

Hüseyin Gökçeku, Dania AL-Othman

Abstract*: Climate change poses major challenges to human society and to Earth systems, influencing the functioning of many ecosystems and thereby affecting human health. Many climate change/variability and extreme weather-associated events, such as sea level rise, hurricanes, and storm surge, as well as other weather extremes, including excessive precipitation and heatwaves, have direct and/or indirect impacts on human health. These impacts include death/injury, cardiovascular and respiratory diseases, environmentally-mediated infectious diseases, and mental health, among others. The aim of this study is describing health impacts of the climate change through projected trends in climate-change-related health. The paper consists, the priority of introduction part is to define impacts of climate change on human health, and to present the relevant relationship between global climate change and health and it's provide a background on climate change effect on health.

Keywords: Climate Change, Health, Health Systems, Diseases.

I. INTRODUCTION

Global average temperatures are projected to increase between 1.4 and 5.8 C by the end of this century [1]; an associated rise in sea level is also expected. The number of people at risk from flooding by coastal storm surges is projected to increase from the current 75 million to 200 million in a scenario of mid-range climate changes, in which a rise in the sea level of 40 cm is envisaged by the 2080s[2]. Extremes of the hydrologic cycle (such as floods and droughts) are projected to increase with warmer ambient temperatures. Evidence is mounting that such changes in the broad-scale climate system may already be affecting human health, including mortality and morbidity from extreme heat, cold, drought or storms; changes in air and water quality; and changes in the ecology of infectious diseases [3, 4]. Climate change is adversely affecting the health of populations around the world, with the greatest impacts in low-income countries [5, 6, 7, and 8]. Impacts can arise from the following:

- The effects of climate change on natural and physical systems, which in turn alter the number of people at risk of malnutrition, the geographical range and incidence of vector-borne, zoonotic and food- and waterborne diseases, and the prevalence of diseases associated with air pollutants and aeroallergens. Additional climate change in coming decades is projected to significantly increase the number of people at risk of these major causes of ill health [5].
- Climate change-related alterations in the frequency, intensity and duration of extreme weather events (e.g. heatwaves, floods, Droughts and windstorms). Each year, these events affect millions of people, damage critical public health infrastructure, and cause billions of dollars of economic losses. The frequency and intensity of some types of extreme weather events are expected to increase over coming decades as a consequence of climate change [9] , suggesting that the associated health impacts could increase without additional preventive actions.
- Climate change can affect population health through climate-induced economic dislocation and environmental decline, and through development setbacks incurred by damage to critical public health infrastructure and to livelihoods by extreme weather events. Public health has experience in coping with climate-sensitive health outcomes. The current state of population health reflects (among many other factors) the degree of success or failure of the policies and measures designed to reduce climate-related risks. Climate change will make it more difficult to control a wide range of climate-sensitive health outcomes. Therefore, to maintain and improve current levels of population health, it will be necessary not only to continue to strengthen core functions of health systems, but also to explicitly consider the risks posed by a changing climate and to modify current health risk management activities to respond. Policies and programs will need to go beyond addressing current vulnerabilities, to protect against health risks from future and possibly more severe climate change. Because of the inherent inertia in the climate system and the length of time required for carbon dioxide to come to equilibrium in the atmosphere, the world is committed to three to five decades of climate change, no matter how quickly greenhouse gas emissions are reduced [9]. The future health impacts of climate change will vary over spatial and temporal scales, and will depend on changing socioeconomic and environmental conditions, with possibilities for diseases to increase in incidence or change their geographical range. Therefore, capacity needs to be built within and outside the health sector to identify increased risks and then prepare and then manage them by evaluating the effectiveness of current and proposed programs. These evaluations should consider both rapid climate change over the next few decades and longer-term changes in the averages of meteorological variables. Policies and programs to address the health risks from climate change should explicitly consider how to avoid severe health impacts from cumulative or catastrophic events.

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II. BACKGROUND

Global climate change, largely a result of ozone layer depletion, is caused by human activities that release greenhouse gases that trap heat within the atmosphere. These human activities include increased use of fossil fuel, land use change and agriculture [10]. An increase in greenhouse gases leads to increased warming of the atmosphere and the Earth's surface. As the concentration of these gases in the atmosphere increases, climate models project that the average surface temperature will rise by 1.1°C to 6.4 °C in the 21st century, with extremes potentially occurring beyond this range [11, 12] . These changes are likely to have significant impacts on the fundamental determinants of human health, most notably on the ecosystems and these impacts will be added to existing health burdens.

Tanzania has been experiencing real and visible impacts of climate change. The Initial National Communication has reported that the mean annual temperatures will increase by 2.10C to 40C in the northern, central and southern parts of the country by 2100. This increase will markedly be observed particularly during the cool months. During the same period of time, an annual increase by 10% in precipitation is expected. Climate projections indicate that northern and southern parts of the country would experience an increase in rainfall ranging from 5-45% and that most parts of the country might experience a decrease in rainfall of 10-15% [13]. Changes in temperature and precipitation resulting in changes in soil moisture, increases in sea level and more extreme weather events, such as floods and droughts are among the most known impacts of global climate change [14, 15]. During the past three to five decades, there has been a steady increase in temperature, adversely affecting almost all sectors of the economy. Several droughts have been recurrent while water levels in Lakes Victoria, Tanganyika, Rukwa, Manyara and many other small lakes have dropped significantly. Rise in sea levels has been experienced in Tanzania, with Islands of Maziwi (in Pangani) and Fungu la Nyani (on the Rufiji River estuary) been already submerged due to rise in sea level. It is predicted that islands of Zanzibar and Mafia are likely to be submerged by 2100 following rise in sea level caused by melting of polar ice [16]. Mount Kilimanjaro, the highest mountain in Africa, is undergoing rapid transformation since 1912. The snow-capped mountain is losing its glacial top at an astounding rate; and it is expected that within the next 10-20 years, the summit will be bare [17]. The major impacts of climate change include severe floods, frequent and prolonged droughts, rising sea levels, crop failure, lower water availability and quality and an increase in vector and water-borne diseases [18, 19]. Heavy rains, floods, drought and landslides have resulted into food shortages and increased disease transmissions. Drought itself has significantly contributed to malnutrition due to lack of adequate food, increased infectious diseases transmission and scarcity of clean and safe water [20].

III. HEALTH IMPLICATIONS OF CLIMATE VARIABILITY

Non-infectious health effects. The summer of 2003 was probably Europe's hottest summer in over 500 years, with average temperatures 3.5◦C above normal [21, 22]. With approximately 22,000 to 45,000 heat-related deaths occurring across Europe over two weeks in August 2003 [23], this is the most striking recent example of health risks directly resulting from temperature change. Judging from this extreme event, changes in climate variability associated with long-term climate change could be at least as important for future risk assessment as upward trends in mean temperature. The European heatwave in 2003 was well outside the range of expected climate variability [22]. In addition, comparisons of climate model outputs with and without anthropogenic drivers show that the risk of a heatwave of that magnitude had more than doubled by 2003 as a result of human-induced climate change [3]. The demonstration of a causal link between global warming and the occurrence of regional heatwaves indicates a potential for more frequent and/or more severe heatwaves in a future warmer world. On local and regional scales, changes in land cover can sometimes exacerbate the effect of greenhouse-gas-induced warming, or even exert the largest impact on climatic conditions. For example, urban 'heat islands' result from lowered evaporative cooling, increased heat storage and sensible heat flux caused by the lowered vegetation cover, increased impervious cover and complex surfaces of the cityscape.

IV. IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH

The prevalence of some of the tropical diseases and other threats to human health depend largely on local climate. According to the Intergovernmental Panel on Climate Change [11], extreme temperatures can lead directly to loss of life, while climate-related disturbances in ecological systems can indirectly impact the incidence of infectious diseases. On the other hand, warm temperatures can increase air and water pollution, which in turn harm human health. Extreme weather can destroy shelter, contaminate water supplies, cripple crop and livestock production, tear apart existing health and other service infrastructures. This will ultimately increase the existing burden of disease and other non-health need of vulnerable human population. The magnitude and nature of climate change impacts on human health vary by region, by relative vulnerability of population groups, by the extent and duration of exposure to climate change itself and by society's ability to adapt to or cope with the change [11]. Climate change can affect human health and well-being through a variety of mechanisms [18, 19, and 24]. The risk of emerging diseases may increase due to changes and survival of pathogens in the environment, changes in migration pathways, carriers and vectors and changes in the natural ecosystems [24]. Infectious agents are in a state of perpetual adaptation to their new host (s) or vectors, which can lead to the emergence of 'new' diseases or the spread of known diseases to previously unaffected areas. Factors that lead to the adaptation of infectious agents are complex and dynamic, ranging from deforestation, irrigation, species competition, human and animal migration patterns,

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drug resistance and changing vector lifecycle due to variations in temperature and rainfall [19, 24]. The climate sensitive infections have some commonalities; they are focal, and their distribution is limited by the ecology of their vectors or reservoirs. Usually, the range of the vectors or reservoirs is delineated by temperature and sometimes availability of water bodies [25]. Predicted changes in climate and climate impacts will have direct and indirect impacts on human health. Warming is predicted to increase or decrease the incidence of vector-borne diseases. The increased frequency of droughts and flooding is in turn likely to increase the frequency and magnitude of epidemics of water-borne diseases, as well as to influence the incidence of vectorborne diseases. Warming will also aggravate the impacts of air pollution on respiratory illnesses [14, 18, 19, 24, and 26].

V. CONCLUSIONS

In summary, there are number of potential impacts of climate change on the national development goals. Climate change is projected to reduce poor people's livelihood assets, health, and access to water, homes, and infrastructure. Climate change is expected to alter the path and rate of economic growth due to changes in natural systems and resources, infrastructure, and labor productivity. Indirectly, loss of livelihood assets may reduce opportunities for full-time education and accessibility to health in numerous ways. Climate change is expected to exacerbate current gender inequalities in the sense that depletion of natural resources and decreasing agricultural productivity may place additional burdens on women's health and reduce time available to participate in decision making processes and income generating activities. Climate change may increase the geographical distribution and prevalence of vector- and water-borne diseases. These changes in disease prevalence and incidence are likely to mediate through biological, ecological, sociologic, and epidemiologic processes that interact with each other and which may themselves be influenced by climate change. Climate change will likely result in declining quality and quantity of drinking water, which is a prerequisite for good health, and exacerbate malnutrition by reducing natural resource productivity and threatening food security. There is now a consensus that the earth is warming due to emissions of greenhouse gases caused by human activities. The current trends in energy use, development and population growth will lead to continuing and more severe climate change. Societies have adapted to past changes in climate, although some with much more difficult than others. Enhanced capacity to adapt to the impacts of climate change on health can reduce the associated threats to human health and wellbeing. By generating and acquiring new knowledge or synthesizing existing knowledge on anticipated future climate change risks and their possible consequences, responses to these stresses can be faster, more efficient and effective. Better organizing institutions, processes and actions around present and anticipated health challenges across sectors and levels of decision-making can also help with preparedness.

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