



Health Impacts of Climate Change-Realities and Challenges

KEYWORDS

Climate change, human health, greenhouse , carbon dioxide ,infectious diseases

Dr. G.L.Parvathamma

Associate professor, Department of Economics, Bangalore University P.G.Centre, Kolar

ABSTRACT *Climate change poses a major and largely unfamiliar challenge . Over the last 50 years, human activities particularly the burning of fossil fuels have released sufficient quantities of carbon dioxide and other greenhouse gases to trap additional heat in the lower atmosphere and affect the global climate.This paper discusses the process of global climate change, its current and future impacts on human health, and how our societies can lessen those adverse impacts, via adaptation strategies and by reducing greenhouse gas emissions. In the last 100 years, the world has warmed by approximately 0.75oC. Each of the last 3 decades has been successively warmer than any preceding decade since 1850. Sea levels are rising, glaciers are melting and precipitation patterns are changing. Extreme weather events are becoming more intense and frequent. The Lancet report cites research estimating that cutting carbon emissions would cut premature deaths from air pollution by 500,000 a year in 2030, 1.3m in 2050 and 2.2m in 2100, particularly in the heavily polluted cities of India and China. Other work in the US shows the boosts to human health can be worth 10 times the costs of cutting emissions. Climate Change threatens to undermine half a century of progress in global health. Climatic factors are an important determinant of various vector-borne diseases, many enteric illnesses and certain water-related diseases. Relationships between year-to-year variations in climate and infectious diseases are most evident where climate variations are marked, and in vulnerable populations.*

Introduction

The term ecosystem refers to the combined physical and biological components of an environment. These organisms form complex sets of relationships and function as a unit as they interact with their physical environment. Ecosystem services are the benefits that people obtain from ecosystems. Ecosystem services are indispensable to the wellbeing of all people, everywhere in the world. They include provisioning, regulating and cultural services that directly affect people and supporting services needed to maintain the other services. From the availability of adequate food and water to disease regulation of vectors, pests, and pathogens, human health and well-being depends on these services and conditions from the natural environment. Biodiversity underlies all ecosystem services. Our increasing understanding of climate change is transforming how we view the boundaries and determinants of human health. While our personal health may seem to relate mostly to prudent behaviour, heredity, occupation, local environmental exposures, and health-care access, sustained population health requires the life-supporting "services" of the biosphere. Populations of all animal species depend on supplies of food and water, freedom from excess infectious disease, and the physical safety and comfort conferred by climatic stability. The world's climate system is fundamental to this life-support. Today, human-kind's activities are altering the world's climate. We are increasing the atmospheric concentration of energy-trapping gases, thereby amplifying the natural "greenhouse effect" that makes the Earth habitable. These greenhouse gases (GHGs) comprise, principally, carbon dioxide (mostly from fossil fuel combustion and forest burning), plus other heat-trapping gases such as methane (from irrigated agriculture, animal husbandry and oil extraction), nitrous oxide and various human-made halocarbons.

In its Third Assessment Report (2001), the UN's Intergovernmental Panel on Climate Change (IPCC) stated: "There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human

activities." During the twentieth century, world average surface temperature increased by approximately 0.6°C, and approximately two-thirds of that warming has occurred since 1975. In the last 100 years, the world has warmed by approximately 0.75°C. Each of the last 3 decades has been successively warmer than any preceding decade since 1850. Sea levels are rising, glaciers are melting and precipitation patterns are changing. Extreme weather events are becoming more intense and frequent. Climatologists forecast further warming, along with changes in precipitation and climatic variability, during the coming century and beyond. Their forecasts are based on increasingly sophisticated global climate models, applied to plausible future scenarios of global greenhouse gas emissions that take into account alternative trajectories for demographic, economic and technological changes and evolving patterns of governance. The global scale of climate change differs fundamentally from the many other familiar environmental concerns that refer to localised toxicological or microbiological hazards. Indeed, climate change signifies that, today, we are altering Earth's biophysical and ecological systems at the planetary scale – as is also evidenced by stratospheric ozone depletion, accelerating biodiversity losses, stresses on terrestrial and marine food-producing systems, depletion of freshwater supplies, and the global dissemination of persistent organic pollutants.

The Lancet report (produced by the Lancet/UCL commission on health and climate change) cites research estimating that cutting carbon emissions would cut premature deaths from air pollution by 5,00,000 a year in 2030, 1.3m in 2050 and 2.2m in 2100, particularly in the heavily polluted cities of India and China.. Climate Change threatens to undermine half a century of progress in global health. The report details the range of damage to health that global warming causes, including heatwaves whose deadly effects are rising around the world, for example in Russia in 2010 where 11,000 people died. Dengue fever is likely to spread, the report finds, and malaria cases may rise in some areas while falling in others. Cholera outbreaks oc-

cur when hurricanes mix waste and drinking water and extreme weather is increasing. Food shortages may increase as climate change harms crops and livestock and the ability to work in hot climates, further the report states. Such shortages can lead people to migrate as refugees, leading to further health problems, or even to conflicts. People forced to move, whether by food shortages, floods or extreme storms, can suffer serious mental health problems. But the analysis also concludes that the benefits to health resulting from slashing fossil fuel use are so large that tackling global warming also presents the greatest global opportunity to improve people's health in the 21st century. **Mohga Kamal-Yann, Oxfam's senior health policy advisor, said:** "Rapid action to tackle global emissions and help communities adapt is crucial to reduce the threats of ill-health, hunger and additional hardship. Rich countries can and should make substantial cuts to their emissions by phasing out coal and by providing the funding that developing countries need to cope with climate change." **The Guardian's** Keep it in the Ground campaign has been highlighting the impact of climate change on public health by focusing on the world's two largest health charities – the Bill and Melinda Gates Foundation and the Wellcome Trust. The campaign is asking them to move their investments out of fossil fuel companies., a collaboration of dozens of experts from around the world, and is backed by Margaret Chan, head of the UN World Health Organisation. Other work in the US shows the boosts to human health can be worth 10 times the costs of cutting emissions.

Main causes of Climate Change

There are natural causes that contribute to climate fluctuation, but industrial practices are behind the recent rapid acceleration in global warming. The demands of a growing population have led to deforestation, burning fossil fuels, and intensive farming. These activities all produce greenhouse gases in our atmosphere, gases such as carbon dioxide, nitrous oxide and methane. Greenhouse gases trap heat from the sun instead of radiating it back to space. This causes the earth's atmosphere to heat up in what is known as the greenhouse effect. In just 200 years, the concentration of carbon dioxide in our atmosphere has increased by 30%.

Main impacts and effects of Climate Change

Extreme climate events are expected to become more frequent with climate change. These disruptive events have their greatest impact in poor countries. The direct effects of climate change include increased heat stress, floods, drought, and increased frequency of intense storms, with the indirect threatening population health through adverse changes in air pollution, the spread of disease vectors, food insecurity and under-nutrition, displacement, and mental ill health. The two categories of climatic extremes are:

- Simple extremes of climatic statistical ranges, such as very low or very high temperatures
- Complex events: droughts, floods, or hurricanes

Climate change has already had an impact on people's livelihoods, as well as on our wildlife and environment. In China, drought caused agricultural damage of \$4.5 million, while a delayed harvest in the Black Sea region in 2014 meant Turkish tea producers suffered a loss of 15%. Natural disasters in the last decade have cost the world an additional \$2.7 trillion dollars. Forest fires continue to threaten already endangered species, while changing cli-

mates and landscapes drive animals out of protected areas in search of water and inhabitable terrain. The cost of climate change is mounting but the level of impact depends on the rate of increase in the earth's temperature. A one-degree increase will have a serious ecological impact and could cost the world an estimated \$68 trillion. Climate change will cause some regions to become wetter, and others warmer. Sea levels will rise as glaciers melt, while some regions will be more at risk of heat waves, drought, flooding and natural disasters. Climate change could ruin food chains and ecosystems, putting whole species at risk of extinction. Main impacts and effects of Climate Change are narrated below;

(a) Extreme heat;

Extreme high air temperatures contribute directly to deaths from cardiovascular and respiratory disease, particularly among elderly people. In the heat wave of summer 2003 in Europe for example, more than 70 000 excess deaths were recorded. High temperatures also raise the levels of ozone and other pollutants in the air that exacerbate cardiovascular and respiratory disease. Pollen and other aeroallergen levels are also higher in extreme heat. These can trigger asthma, which affects around 300 million people. Ongoing temperature increases are expected to increase this burden. Global climate change will be accompanied by an increased frequency and intensity of heatwaves, as well as warmer summers and milder winters. Predictive modelling studies, using climate scenarios, have estimated future temperature-related mortality. For example, the annual excess summer-time mortality attributable to climate change, by 2050, is estimated to increase several-fold, to between 500-1000 for New York and 100-250 for Detroit, assuming population acclimatisation (physiological, infrastructural and behavioural). Without acclimatisation the impacts would be higher. The extent of winter-associated mortality directly attributable to stressful weather is less easy to determine. In temperate countries undergoing climate change, a reduction in winter deaths may outnumber the increase in summer deaths..

(b) Natural disasters and variable rainfall patterns

Globally, the number of reported weather-related natural disasters has more than tripled since the 1960s. Every year, these disasters result in over 60 000 deaths, mainly in developing countries. Rising sea levels and increasingly extreme weather events will destroy homes, medical facilities and other essential services. More than half of the world's population lives within 60 km of the sea. People may be forced to move, which in turn heightens the risk of a range of health effects, from mental disorders to communicable diseases. Increasingly variable rainfall patterns are likely to affect the supply of fresh water. A lack of safe water can compromise hygiene and increase the risk of diarrhoeal disease, which kills almost 600 000 children aged under 5, every year. In extreme cases, water scarcity leads to drought and famine. By the 2090s, climate change is likely to widen the area affected by drought, double the frequency of extreme droughts and increase their average duration six-fold. Floods are also increasing in frequency and intensity. Floods contaminate freshwater supplies, heighten the risk of water-borne diseases, and create breeding grounds for disease-carrying insects such as mosquitoes. They also cause drownings and physical injuries damage homes and disrupt the supply of medical and health services. Rising temperatures and variable precipitation are likely to decrease the production of staple foods in many of the poorest regions – by up to 50% by 2020 in some African countries⁴. This will increase the prevalence

of malnutrition and undernutrition, which currently cause 3.1 million deaths every year.

(c) Causing infection

Climatic conditions strongly affect water-borne diseases and diseases transmitted through insects, snails or other cold blooded animals. Changes in climate are likely to lengthen the transmission seasons of important vector-borne diseases and to alter their geographic range. For example, climate change is projected to widen significantly the area of China where the snail-borne disease schistosomiasis occurs. Malaria is strongly influenced by climate. Transmitted by *Anopheles* mosquitoes, malaria kills almost 800 000 people every year – mainly African children under 5 years old. The *Aedes* mosquito vector of dengue is also highly sensitive to climate conditions. Studies suggest that climate change could expose an additional 2 billion people to dengue transmission by the 2080.

(d) Stratospheric ozone depletion, UV radiation and health

It has been recognized for several decades that the release of chlorofluorocarbons and other atmospheric pollutants depletes stratospheric ozone, which in turn increases human exposure to ultraviolet radiation, causing skin cancer and cataracts. The recognition of direct effects on human health effects was a major stimulus to the Montreal Protocol, which acts to reduce emissions of pollutants that weaken the ozone layer. Although this international agreement is proving highly effective in reducing risks in the long term, UV radiation remains a health hazard. The World Health Organization, and partner organizations - through the Intersun project - have developed and promote the UV Index, a tool to inform and educate the public about sun protection.

Part-II

Climate change and health

Weather and climate play a significant role in people's health. Although global warming may bring some localized benefits, such as fewer winter deaths in temperate climates and increased food production in certain areas, the overall health effects of a changing climate are likely to be overwhelmingly negative. Climate change affects social and environmental determinants of health - clean air, safe drinking water, sufficient food and secure shelter. Changes in climate affect the average weather conditions that we are accustomed to. Warmer average temperatures will likely lead to hotter days and more frequent and longer heat waves. This could increase the number of heat-related illnesses and deaths. Increases in the frequency or severity of extreme weather events such as storms could increase the risk of dangerous flooding, high winds, and other direct threats to people and property. Warmer temperatures could increase the concentrations of unhealthy air and water pollutants. Changes in temperature, precipitation patterns, and extreme events could enhance the spread of some diseases. In a big new report released Monday, The implications of climate change for a global population of 9 billion people threatens to undermine the last half century of gains in development and global health":

The causal links between environmental change and human health are complex because they are often indirect, displaced in space and time, and dependent on a number of modifying forces. Human health ultimately depends upon ecosystem products and services (such as availability of fresh water, food and fuel sources) which are requisite for good human health and productive livelihoods. Signifi-

cant direct human health impacts can occur if ecosystem services are no longer adequate to meet social needs. Indirectly, changes in ecosystem services affect livelihoods, income, local migration and, on occasion, may even cause political conflict. The resultant impacts on economic and physical security, freedom, choice and social relations have wide-ranging impacts on well-being and health, and the availability and access to health services and medicines.

Key facts

- Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter.
- Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress.
- The direct damage costs to health (i.e. excluding costs in health-determining sectors such as agriculture and water and sanitation), is estimated to be between US\$ 2-4 billion/year by 2030.
- Areas with weak health infrastructure - mostly in developing countries - will be the least able to cope without assistance to prepare and respond.

Health impacts of climate change

Many Research studies is now emerging which suggests that the impacts of air pollution go beyond asthma and other respiratory disease as well as heart attacks and strokes. In July 2013, the European Study of Cohorts for Air Pollution Effects (ESCAPE) showed that living near polluting major roads in nine countries in Europe increased the chances of lung cancer. Three months later, the WHO's International Agency for Research in Cancer (IARC) formally classified outdoor air pollution as a carcinogen, causing both lung and bladder cancers. In October 2013, ESCAPE reported on air pollution and low birthweight babies. Among the participating cities was Bradford in England. As elsewhere, in the Born in Bradford cohort of mothers and babies, there was a higher likelihood of restricted foetal growth if the woman in her pregnancy was living in an area of high air pollution. Low birthweight babies often have health problems in later life. Studies have also shown reduced fertility in areas with high air pollution and links to obesity. There is concern now about cognitive effects as well, with research looking at dementia and neurological degeneration. Current figures of almost 30,000 UK deaths a year from air pollution do not factor in lethal nitrogen dioxide from diesel engines and wood, oil and coal burning, say experts

Measuring the health effects

Measuring the health effects from climate change can only be very approximate. Nevertheless, a WHO assessment, taking into account only a subset of the possible health impacts, and assuming continued economic growth and health progress, concluded that climate change is expected to cause approximately 250 000 additional deaths per year between 2030 and 2050; 38 000 due to heat exposure in elderly people, 48 000 due to diarrhoea, 60 000 due to malaria, and 95 000 due to childhood undernutrition⁷.

All populations will be affected by climate change, but some are more vulnerable than others. People living in small island developing states and other coastal regions, megacities, and mountainous and polar regions are particularly vulnerable. Children - in particular, children living in poor countries - are among the most vulnerable to the

resulting health risks and will be exposed longer to the health consequences. The health effects are also expected to be more severe for elderly people and people with infirmities or pre-existing medical conditions. Areas with weak health infrastructure mostly in developing countries – will be the least able to cope without assistance to prepare and respond.

Part-III

Policy Initiatives

Many policies and individual choices have the potential to reduce greenhouse gas emissions and produce major health co-benefits. For example, cleaner energy systems, and promoting the safe use of public transportation and active movement such as cycling or walking as alternatives to using private vehicles could reduce carbon emissions, and cut the burden of household air pollution, which causes some 4.3 million deaths per year, and ambient air pollution, which causes about 3.7 million deaths every year

Initiatives of WHO

In 2009, the World Health Assembly endorsed a new WHO work plan on climate change and health. This includes:

- **Advocacy:** to raise awareness that climate change is a fundamental threat to human health.
- **Partnerships:** to coordinate with partner agencies within the UN system, and ensure that health is properly represented in the climate change agenda.
- **Science and evidence:** to coordinate reviews of the scientific evidence on the links between climate change and health, and develop a global research agenda.
- **Health system strengthening:** to assist countries to assess their health vulnerabilities and build capacity to reduce health vulnerability to climate change.

Suggestions

Large-scale and global environmental hazards to human health include climate change, stratospheric ozone depletion, loss of biodiversity, changes in hydrological systems and the supplies of freshwater, land degradation and stresses on food-producing systems. Appreciation of this scale and type of influence on human health requires a new perspective which focuses on ecosystems and on the

recognition that the foundations of long-term good health in populations rely in great part on the continued stability and functioning of the biosphere's life-supporting systems. It also brings an appreciation of the complexity of the systems upon which we depend. In this regard in following lines some suggestions have been made for the future securitisation of human health;

- Investing in climate change research and surveillance to better understand how the environment is affecting population health
- Phasing out coal as a source of energy in order to protect people's cardiovascular and respiratory health
- Redesigning cities to promote healthier lifestyles
- Reducing emissions of greenhouse gases through better transport, food and energy-use choices can result in improved health, particularly through reduced air pollution

Conclusion

The increasing trend in natural disasters is partly due to better reporting, partly due to increasing population vulnerability, and may include a contribution from ongoing global climate change. Especially in poor countries, the impacts of major vector-borne diseases and disasters can limit or even reverse improvements in social development. Even under favorable conditions recovery from major disasters can take decades. Short-range climatic forecasts may help in reduce health impacts. But early warning systems must also incorporate monitoring and surveillance, linked to adequate response capacities. Focusing attention on current extreme events may also help countries to develop better means of dealing with the longer-term impacts of global climate change, although this capacity may itself decline because of cumulative climate change. For example, increased food imports might prevent hunger and disease during occasional drought, but poor, food-insecure, countries may be unable to afford such measures indefinitely in response to gradual year-by-year drying.

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