

Building Resilience for Impact of Climate Change on Human Health

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Abstract—The World Health Organization estimates that the warming and precipitation trends due to anthropogenic climate change of the past 30 years already claim over 150,000 lives annually. There is near unanimous scientific consensus that greenhouse gas emissions generated by human activity will change Earth's climate. The recent (globally averaged) warming by 0.5°C is partly attributable to such anthropogenic emissions.

It is now widely accepted that climate change is occurring as a result of the accumulation of greenhouse gases in the atmosphere arising from the combustion of fossil fuels. Climate change may affect health through a range of pathways, for example as a result of increased frequency and intensity of heat waves, reduction in cold related deaths, increased floods and droughts, changes in the distribution of vector-borne diseases and effects on the risk of disasters and malnutrition. Mitigation of climate change by reducing the use of fossil fuels and increasing a number of uses of the renewable energy technologies should improve health in the near-term by reducing exposure to air pollution.

The United Nations 17 Sustainable Development Goals and 169 targets set out in the 2030 Agenda explicitly elaborate on the interlinkages across the economic, social and environmental dimensions of development and the opportunities to build positive synergies among them. Some of these interlinkages and synergies are fundamental to facets of building climate change resilience and reducing inequalities.

There is therefore a need for actions to reduce emissions of greenhouse gas emissions to avoid the more extreme climate change scenarios, and to ensure that human health is protected as far as possible from the negative effects of the climate variability and change that is already occurring. The necessity to mitigate and adapt to climate is the focus of this paper. It provides a summary of the main health effects of climate change, and outlines the functions necessary to increase resilience.

1. INTRODUCTION

Climate change is one of the all-encompassing global environmental changes likely to have deleterious effects on natural and human systems, economies and infrastructure. The risks associated with it call for a broad spectrum of policy responses and strategies at the local, regional, national and global level. The UNFCCC (United Nations Framework Convention on Climate Change) highlights two fundamental response strategies: mitigation and adaptation. While

mitigation seeks to limit climate change by reducing the emissions of GHG (greenhouse gases) and by enhancing 'sink' opportunities, adaptation aims to alleviate the adverse impacts through a wide-range of system-specific actions (Fussler and Klein, 2002).

Albeit both mitigation and adaptation measures must be pursued to tackle the climate change problem and to create an effective and inclusive international climate change regime, more attention has been devoted to mitigation in the past, both in scientific research and policy debate. Sensitivity to the issue of adaptation has grown over the last couple of years, particularly after the IPCC (Intergovernmental Panel on Climate Change) TAR (Third Assessment Report). Adaptation has now emerged as an urgent policy priority, prompting action both within and outside the climate change negotiations (Parry et al. 2005).

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have been identified as primary causes of ongoing climate change, often referred to as *global warming*.

There is near unanimous scientific consensus that greenhouse gas emissions generated by human activity will change Earth's climate. The recent (globally averaged) warming by 0.5°C is partly attributable to such anthropogenic emissions. Climate change will affect human health in many ways—mostly adversely.

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and the United Nations Environment Programme in 1988, in response to the widespread recognition that human-influenced emissions of greenhouse gases have the potential to alter the climate system. Its role is to provide an assessment of the

understanding of all aspects of climate change. At its first session, the IPCC was organized into three Working Groups.

- Working Group I to examine the scientific aspects of the climate system and climate change;
- Working Group II to address vulnerabilities to, impacts of and adaptations to climate change;
- Working Group III to explore the options for mitigation of climate change.

2. IMPACT OF CLIMATE CHANGE

In just 200 years — one-tenth of 1% of the 180,000-year existence of *Homo sapiens* — we humans have done what no other species has ever done. We have begun to change the Earth system itself, to affect the planet's functioning. Various eminent scientists describe this era as the 'Anthropocene', in which humans have become the dominant force influencing and disrupting many of Earth's great natural geophysical and ecological systems.

There is now ample evidence of the ecological impacts of recent climate change, from polar terrestrial to tropical marine environments. The responses of both flora and fauna span an array of ecosystems and organizational hierarchies, from the species to the community levels. It is now widely accepted that climate change is occurring as a result of the accumulation of greenhouse gases in the atmosphere arising from the combustion of fossil fuels. Climate change may affect health through a range of pathways, for example as a result of increased frequency and intensity of heat waves, reduction in cold related deaths, increased floods and droughts, changes in the distribution of vector-borne diseases and effects on the risk of disasters and malnutrition. climatic conditions influence the very foundations of the health of populations: food production, the flows and quality of freshwater, the stability of infectious disease patterns, and so on.

Climate change is the best-known of the human-induced global environmental changes in today's Anthropocene world. The list includes:

- greenhouse gas emissions into the lower atmosphere, causing changes to the climate
- stratospheric ozone depletion (emissions of chlorofluorocarbons, other halons, nitrous oxide)
- ocean acidification (increased CO₂ uptake, threatening viability of marine productivity)
- loss of biodiversity: loss of species, local populations, and resultant ecosystem disruption
- nitrification of soils and waterways, from increase in human generated bioactive nitrogenous compounds • degradation of much of the world's fertile land

- depletion of freshwater (including aquifers – the 'fossil water' stores)
- Exhaustion of many great fisheries.

The overall balance of effects on health is likely to be negative and populations in low-income countries are likely to be particularly vulnerable to the adverse effects. The experience of the 2003 heat wave in Europe shows that high-income countries may also be adversely affected. Adaptation to climate change requires public health strategies and improved surveillance. Mitigation of climate change by reducing the use of fossil fuels and increasing a number of uses of the renewable energy technologies should improve health in the near-term by reducing exposure to air pollution.

3. BUILDING RESILIENCE

Proactive health adaptation strategies are needed to protect the world's most vulnerable people from the effects of climate change on human health and well-being. Public health planning and decision making need to shift from only focusing on relatively short term risks to the projected long term impacts of climate change. It will be increasingly important to address the links between climate and health at different timescales.

Already today we need to be better at dealing with climate variability and its related health effects. Improving our capacity to prepare and respond, through using for example early warning systems and seasonal forecasts, will allow us to be better positioned to address the challenges that climate change will bring. Long-term climate projections will be increasingly important to ensure that we are prepared for risks changing over time when planning resource allocation, building infrastructure and ensuring that surveillance systems are able to detect changing patterns of disease.

To ensure that the health effects of climate change are not overlooked, the health sector needs improved integration into strategic planning in sectors such as water, agriculture and disaster management. This includes safeguarding the integration of health concerns into for example National Adaptation Programmes of Action.

The need of the hour is to deal with the environmental impact of climate change which can cause natural and human induced technological hazards. The urgent requirement for building resilience is by accurate predictions of various hazards. To attain Sustainable Human and Ecological Development and for building resilience the following centers should be established:

- Sustainable Biodiversity strengthening center
- Climate change and Agriculture center
- Hydrological development and planning center. (Flood, Draughts, Coastal, flood plains, aquifers and rivers)

- Social and economic security center
- Human health center

These centers should work for the following aims for strengthening the risk management:

- Early Alert and Warning (modeling, prediction and warning systems)
- Education and Awareness
- Mitigation planning
- Adaptation and control.
- Vulnerability assessment

Reducing vulnerabilities and increasing resilience in general will help populations cope with the health effects of climate change. This includes strengthening health systems and ensuring adequate water and sanitation facilities for all.

4. CONCLUSION

Modern climate change is dominated by human influences, which are now large enough to exceed the bounds of natural variability. The main source of global climate change is human-induced changes in atmospheric composition. These perturbations primarily result from emissions associated with energy use, but on local and regional scales, urbanization and land use changes are also important.

Although there has been progress in monitoring and understanding climate change, there remain many scientific, technical, and institutional impediments to precisely planning for, adapting to, and mitigating the effects of climate change. There is still considerable uncertainty about the rates of change that can be expected, but it is clear that these changes will be increasingly manifested in important and tangible ways, such as changes in extremes of temperature and precipitation, decreases in seasonal and perennial snow and ice extent, and sea level rise. Anthropogenic climate change is now likely to continue for many centuries. We are venturing into the unknown with climate, and its associated impacts could be quite disruptive. The health sector should make better use of early warning information available nationally, regionally or through global providers such as academic institutions for climate variability extremes (flooding, drought, storms, heatwaves, seasonal rainfall patterns) to aid public health decision-making and preparedness for the state sector as well as the non-state sector, at all levels but especially down to the community level. Focused surveillance efforts at

areas predicted to be at particularly high risk for changing patterns of disease.

Where appropriate, invest in win-win solutions that reduce greenhouse gas emissions as well as improve public health. Take health risks into account when planning adaptation measures. When planning cities, take into account the urban heat island effect, ensure availability of shaded spaces and green areas, ensure that water and sanitation infrastructure is resilient to extremes of precipitation, and facilitate modes of transport that contribute to public health and reduce greenhouse gas emissions.

It is also important to take into account future sea level rise and flood-plains when planning infrastructure and to take care of changing temperatures during building design.

In the end it can be said that the aim is to reduce risks and their impact, to reinforce the safety of the population and the environment, by strengthening the resilience and planning capacity of different areas at local and regional level for the management of natural and climatic risks as well as those derived from human activities by setting up centers for early warning, awareness, mitigation, adaptation and control.

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