Assessing Human Health Vulnerability and Public Health Adaptation to Climate Variability and Change

The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve: in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The long lifetime of some greenhouse gases and the inherent inertia of the climate system mean that, even if all emissions are stopped, the physical composition of the present atmosphere will continue to influence the climate system for decades or even centuries. These constraints mean that adaptation measures, designed to reduce the potential impacts of climate change, are required in addition to mitigation measures to reduce greenhouse gas emissions.

Intergovernmental agencies, nongovernmental and regional institutions, and some national organizations have begun to assess the population health vulnerability to the potential health hazards resulting from climate variability and change, and to develop methods of assessing risk and enhancing adaptation. In response to the need to develop standard approaches, we developed flexible methods with the aims to achieve better understanding of the current and future vulnerability to climate variability and change, and to review the adaptation options available to reduce the potential adverse impacts.

Human health vulnerability to climate change is a function of:

1. Sensitivity, which includes the extent to which health, or the natural or social systems on which health outcomes depend, are sensitive to changes in weather and climate (the exposure–response relationship) and the characteristics of the population, such as the level of development and its demographic structure;
2. The exposure to the weather or climate-related hazard, including the character, magnitude and rate of climate variation; and
3. The adaptation measures and actions in place to reduce the burden of a specific adverse health outcome (the adaptation baseline), the effectiveness of which determines in part the exposure–response relationship.

Populations, subgroups and systems that cannot or will not adapt are more vulnerable, as are those that are more susceptible to weather and climate changes. In general, the vulnerability of a population to a health risk depends on the local environment, the level of material resources, the effectiveness of governance and civil institutions, the quality of the public health infrastructure, and the access to relevant local information on extreme weather threats. These factors are not uniform across a region or country, or across time, and differ based on geography, demography, and socioeconomic factors. Effectively targeting prevention or adaptation strategies requires understanding the potential vulnerabilities to climate variability and change, where and when climate risks are likely to arise, and which demographic or geographical subpopulations may be most at risk. Thus, individual, community, and geographical factors determine vulnerability.

Adaptation includes the strategies, policies, and measures undertaken now and in the future to reduce potential adverse health effects. Adaptation can be decomposed into adaptive and coping capacity. Coping capacity includes the interventions that are feasible to implement today (in a specific population), and adaptive capacity includes the strategies, policies, and measures that have the potential to expand future coping capacity. The primary goal of building adaptive capacity is to reduce future vulnerability to climate variability and change. Increasing the adaptive capacity of a population shares similar goals with sustainable development – increasing the ability of countries, communities, and individuals to effectively and efficiently cope with changes and challenges.
Specific adaptation interventions arise from the coping capacity of a community, country, or region. These interventions, similar to all interventions in public health, are designed to maximize the number of avoidable adverse health effects. Adaptation can be anticipatory (actions taken in advance of climate change effects) or responsive, and can encompass both spontaneous responses to climate variability and change by affected individuals and planned responses by governments or other institutions. Examples of adaptation interventions include watershed protection policies and effective public warning systems for floods and storm surges such as advice on water use, beach closings, and evacuation from lowlands and seashores.

An adaptation assessment describes specific strategies, policies, and measures that can be implemented to reduce current and future vulnerability as well as the resources needed (financial, technological, and human capital) to implement them. The information generated from an adaptation assessment can be combined with a cost–benefit or other decision support tools to inform priority setting by policy-makers.

Vulnerability and adaptation assessments should aim to evaluate:

- The potential impacts of climate variability and change in a range of areas and populations, especially among vulnerable populations and, when possible, to determine the attributable burden of weather and climate, including extreme events, to climate-sensitive diseases;
- Possible threshold effects;
- The effects of multiple stresses, including changes in socioeconomic systems;
- Uncertainty and its implications for risk management;
- The effects of reducing emissions, such as by comparing impacts under scenarios with business-as-usual and stabilization of emissions; and
- Coping capacity, especially under different socioeconomic futures and in the context of sustainable development.

Steps in Assessment

Assessment of vulnerability and adaptation uses similar concepts to those used in health impact assessment. Not all steps may be possible or desirable in a particular assessment, and the determination of which steps to be included depends on the objectives and resources available. Assessments can have different levels of in-depth analysis depending on the objectives, the interest of stakeholders, and the funding available.

1. Determine the scope of the assessment: the geographical region, time period, and health outcomes to be included.
2. Describe the current distribution and burden of climate-sensitive diseases. Describe the associations between disease outcomes and climate variability and change. If data and resources are available, quantify the relationships using epidemiologic methods.
3. Identify and describe current strategies, policies, and measures that reduce the burden of climate-sensitive diseases.
4. Review the health implications of the potential impacts of climate variability and change on other sectors, such as agriculture and food supply, water resources, disasters, and coastal and river flooding. Review the feedback from changes in population health status on these sectors.
5. Estimate the future potential health impacts using scenarios of future climate change, population growth and other factors and describe the uncertainty.
6. Synthesize the results and draft a scientific assessment report.
7. Identify additional adaptation policies and measures to reduce potential negative health effects, including procedures for evaluation after implementation.
These steps, along with methods applicable for a variety of climate-sensitive diseases, are discussed in detail in: Methods of Assessing Human Health Vulnerability and Public Health Adaptation to Climate Change. Editors: Kovats RS, Ebi KL, Menne B. Available from WHO European Centre for Environment and Health at bme@who.int.

References


Background
Dr. Kristie L. Ebi is a Senior Managing Scientist in Exponent’s Health practice and is based in Alexandria, VA. Dr. Ebi, an epidemiologist, has worked on a range of environmental issues, including both potential human health and environmental impacts. In the field of climate change, she specializes in research both on potential impacts, including impacts associated with extreme events, thermal stress, and vector-borne diseases, and on the design of adaptation response options to reduce negative impacts. She recently worked with the WHO European Centre for Environment and Health in Rome, Italy to provide scientific oversight to the three-year, EU-funded project: climate Change Adaptation Strategies and Human health (cCASHh). She is a Convening Lead Author on the just-released WHO publication: Methods of Assessing Human Health Vulnerability and Public Health Adaptation to Climate Change. She is a Lead Author for the Human Health chapter of the Intergovernmental Panel on Climate Change Fourth Assessment Report. She is a lead author for two chapters in Working Group II (Response Options) of the Millennium Ecosystem Assessment, and for the Adaptation Policy Framework. She was a lead author of the Health Sector Analysis Team of the U.S. National Assessment of the Potential Consequences of Climate Variability and Change, and was a contributing author to the Human Health chapter of the Third Assessment Report of the Intergovernmental Panel on Climate Change. Dr. Ebi has more than 25 years of multidisciplinary experience in environmental issues, and has more than 50 publications. Dr. Ebi’s scientific training includes a M.S. in toxicology and a Ph.D. and MPH in epidemiology, and two years of postgraduate research in epidemiology at the London School of Hygiene and Tropical Medicine.