

Health Effects of Climate Change



All human societies, from primitive to advanced, have had to adapt to the challenges posed by climate. It affects where people live, how they make a living, what they eat, the abundance or lack of fresh water and even what they do in their leisure time. Deeply embedded in this fundamental relationship between climate and human life are the many ways in which climate has always played a role in human health. Climate defines health concerns such as the direct effects of excess heat or cold, the lack of sufficient water during drought, impacts on air quality, and the risk of various waterborne or vectorborne diseases based on conditions favorable to their spread.

Yesterday

- Some variation in climate has long been recognized, such as a series of especially cold winters or seasonal drought. But climate has historically been seen as a consistent characteristic of particular areas.
- Though it is clear that shifts in climate have occurred over time in the past, these changes have occurred very slowly and gradually, and the human response has been similarly gradual over generations.

Today

It is now established that climate changes are occurring at an increasingly rapid rate. These changes require active monitoring and coordinated responses in all aspects of their impacts on human society, including health.

Researchers, clinicians, and public health officials are becoming alert to the dynamic relationship between climate change and human health. Some of these impacts are readily apparent, while others are subtler and require additional study. A recent interagency white paper led by NIH (available online at www.niehs.nih.gov/climatereport) examined the state of the science on effects of climate change on human health. Key findings include:

- When populated areas heat up, residents must adapt to heat as a stressor. This is more difficult for the most vulnerable populations such as the very young and

elderly, those already stressed by disease or poverty, and those living in certain geographic locations such as urban areas where heat waves can be intensified.

- As the ambient temperature of a region rises, it affects the region's ecology and may create conditions in which populations of disease-carrying animals or insects can increase. Disease vectors such as mosquitoes, ticks, and flies may occur in greater numbers over longer periods during the year, and expand the locations in which they thrive.
- Climate change also affects air movement and quality by increasing airborne allergens and pollution, thereby expanding or changing patterns of human exposure and resulting health effects.
- Extreme weather events due to climate change may cause people to experience geographic displacement, damage to their property, loss of loved ones, and chronic stress—all of which can negatively affect mental health. Populations already experiencing social, economic, and environmental disruption are particularly vulnerable to these effects.
- Climate change may be associated with staple food shortages, malnutrition, and food contamination (of seafood from chemical contaminants, biotoxins, and pathogenic microbes, and of crops by pesticides).
- Increases in water temperature, precipitation frequency and severity, evaporation-transpiration rates, and changes in coastal ecosystem health could increase the incidence of water contamination with harmful pathogens and chemicals, resulting in increased human exposure.
- Malnutrition, particularly during the prenatal period and early childhood as a result of decreased food supplies, as well as exposure to toxic contaminants and biotoxins released during extreme weather events, increased pesticide use for food production, and increases in harmful algal blooms in recreational areas, may all affect normal human development.

Many avenues of research currently funded by NIH are relevant to these diseases and conditions. For example,

existing investments in research on air pollution and respiratory disease; characteristics of vector range; and effects of acute and chronic exposure to agricultural chemicals are yielding important research advances that may help to solve the health problems generated by the environmental impacts of climate change.

Tomorrow

While much is known about the actual and potential human health impacts of climate change, many effects are speculative and targeted research efforts are needed to address them. The interagency white paper identified extensive research needs, particularly regarding adaptive responses to climate change, which may hold promise for understanding and addressing health impacts. Examples of key research needs include:

- Identifying health effects of changes in air, soil, and water quality, distribution of toxicants, and new mixtures of air pollutants formed by changing temperature and humidity.
- Integrating climate modeling and health monitoring and surveillance data at the local and regional levels to predict risk of health impacts and to develop preventive strategies.
- Developing health early warning systems, risk communication, and decision-making frameworks for climate change response strategies.
- Understanding of how changes in agriculture and fisheries may affect food availability and nutrition, and identifying and mapping of complex food webs and sentinel species that may be vulnerable to climate change.
- Identifying the physical impacts of heat exposure, especially in vulnerable populations, and developing public health interventions.
- Improving the capabilities of health care and emergency services to address disaster planning and management.
- Research to understand the benefits of alternative fuels, new battery and voltaic cells, and other technologies, as well as any potential adverse risks from exposure to their components and wastes.

- Better understanding of climate change impacts on the capacity of ocean and coastal systems to provide cancer curative agents and other health-enhancing products.
- Identifying susceptible, vulnerable, and displaced populations, and differential risk factors that lead to or are associated with increased vulnerability to exposures, diseases, and other adverse health outcomes related to climate change.
- Enhancing public health and health care infrastructure to build community public health resilience.
- Developing capacities and skills in modeling and prediction of climate and health outcomes.
- Improving climate literacy, risk communication, and public health education to facilitate effective adaptation.
- Inter-disciplinary training of the next generation of earth and life scientists to prepare for the climate and health research needs of tomorrow.

NIH Institutes and Centers are actively engaged in interagency efforts at the Federal level including the National Climate Assessment and the U.S. Global Change Research Program, and internationally through the United Nations Framework Convention on Climate Change and global health initiatives, to prioritize, coordinate, and conduct research to expand the knowledge base on climate change effects on human health, as well as to inform decision making at local, regional, national, and global levels on societal responses to mitigate and adapt to these effects.

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