Climate Change and Human Health

Fluctuating temperatures and other changes, such as more severe weather events and rising sea levels, may affect people's environments in ways that, in turn, harm their health and well-being. At the National Institute of Environmental Health Sciences (NIEHS), research seeks to better understand how climate change-related environmental factors may affect people's health. NIEHS has funded grants exploring the health effects of climate change for more than a decade.

NIEHS is also leading a new NIH Climate Change and Health Initiative to coordinate solutions-focused research throughout the National Institutes of Health (NIH) with an aim to reduce health consequences associated with evolving climate conditions and extreme weather events.

Major U.S. Climate Change Trends

**Rising Temperatures**
U.S. average temperature has increased by 1.3°F to 1.9°F since record keeping began in 1895. Warming has been the greatest in the North and West while some parts of the Southeast have experienced little change.

**Extreme Precipitation**
Heavy downpours are increasing nationally, especially over the last three to five decades. The largest increases are in the Midwest and Northeast.

**Heat Waves**
Heat waves have become more frequent and intense, especially in the West.

**Drought**
Drought has increased in the West. Over the last decade, the Southwest has experienced the most persistent droughts on record.

**Cold Waves and Winter Storms**
Cold waves have become less frequent and intense across the nation. Winter storms have increased in frequency and intensity since the 1950s and their tracks have shifted northward.

**Floods**
Floods have been increasing in parts of the Midwest and Northeast.

**Hurricanes**
The intensity, frequency, and duration of North Atlantic hurricanes, as well as the frequency of the strongest (category 4 and 5) hurricanes, have all increased since the early 1980s.

**Sea Level**
Sea levels along the Mid-Atlantic and parts of the Gulf Coast have risen by about 8 inches over the last half century.


How Does Climate Change Affect Human Health?

While climate change is a global process, its impacts may affect communities in different and unequal ways. Some of these effects are relatively direct, as when heat waves or hurricanes cause injury and illness, and even death. Some effects of climate change are less direct and involve shifts in our environment that, in turn, can affect human health. For example, changes in temperatures and rainfall can affect the lifecycles of insects that transmit Lyme disease and West Nile virus, leading to new or varied outbreaks. Rising sea levels can worsen the flooding from hurricanes in coastal areas, leading to more people exposed to contaminated water, pollutants, and hazardous wastes. Climate fluctuations often occur with other health stressors, such as poverty, social disadvantage, and impaired language ability, to increase vulnerability. Under-resourced and marginalized populations are most at risk. Examples of the ways that climate change may affect people's health are shown in the table on the next page.
### Examples of Climate Change Impacts on Health

<table>
<thead>
<tr>
<th>Climate Driver</th>
<th>Exposure</th>
<th>Health Outcome</th>
<th>Impact</th>
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<tbody>
<tr>
<td>Extreme Heat</td>
<td>More frequent, severe, prolonged heat events</td>
<td>Elevated temperatures</td>
<td>Heat-related death and illness</td>
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<tr>
<td>Outdoor Air Quality</td>
<td>Increasing temperatures and changing precipitation patterns</td>
<td>Worsened air quality (ozone, particulate matter, and higher pollen counts)</td>
<td>Premature death, acute and chronic cardiovascular and respiratory illnesses</td>
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<tr>
<td>Flooding</td>
<td>Rising sea level and more frequent or intense extreme precipitation, hurricanes, and storm surge events</td>
<td>Contaminated water, debris, and disruptions to essential infrastructure</td>
<td>Drowning, injuries, mental health consequences, gastrointestinal and other illness</td>
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<tr>
<td>Vector-Borne Infection (Lyme disease)</td>
<td>Changes in temperature extremes and seasonal weather patterns</td>
<td>Earlier and geographically expanded tick activity</td>
<td>Lyme disease</td>
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<td>Water-Related Infection (Vibrio vulnificus)</td>
<td>Rising sea surface temperature, changes in precipitation, and runoff affecting coastal salinity</td>
<td>Recreational water or shellfish contaminated with Vibrio vulnificus</td>
<td>Vibrio vulnificus-induced diarrhea and intestinal illness, wound and bloodstream infections, death</td>
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<tr>
<td>Food-Related Infection (Salmonella)</td>
<td>Increases in temperature, humidity, and season length</td>
<td>Increased growth of pathogens, seasonal shifts in incidence of Salmonella exposure</td>
<td>Salmonella infection, gastrointestinal outbreaks</td>
</tr>
<tr>
<td>Mental Health and Well-Being</td>
<td>Climate impacts, especially extreme weather</td>
<td>Level of exposure to traumatic events, like disasters</td>
<td>Distress, grief, behavioral health disorders, social impacts, resilience</td>
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Who Is Most at Risk From Climate Change?

Although the U.S. has a well-developed public health and medical system, every American may be vulnerable to the impacts of climate change at some point in their lives, no matter where they live. Certain U.S. populations are more vulnerable to climate-related health threats as a result of specific physical, environmental, and sociodemographic factors, as well as age and life stage.

Low-Income Groups

People with low incomes live with many factors that increase their vulnerability to the health effects of climate. They are more likely to live in risk-prone areas, such as urban heat islands, isolated rural areas, or coastal and other flood-prone areas, or where there is older or poorly maintained infrastructure. Low-income groups often face an added burden of air or water pollution that may be worsened by climate events like severe storms. They experience relatively more chronic medical conditions, such as diabetes and cardiovascular, respiratory, and kidney diseases, all of which may be amplified by climate change. Also, limited transportation and access to health care and education can impede their ability to prepare for, respond to, and cope with climate-related health risks.

Indigenous Peoples

A number of health risks are higher among indigenous populations, such as poor mental health related to historical or personal trauma, environmental exposures from pollutants or toxic substances, and diabetes. Because of existing vulnerabilities, Indigenous people, especially those who are dependent on the environment for sustenance or who live in geographically isolated or impoverished communities, are likely to experience greater exposure and lower resilience to climate-related health effects. Indigenous communities face threats to their homes, food sources, and cultural traditions from environmental impacts, such as reductions in sea ice, increases in flooding and landslides, damage to wildlife habitats, loss of medicinal plants, and effects on the abundance and nutrition of certain traditional foods.

Children and Pregnant Women

Many factors, such as economic status, nutrition and diet, living conditions, geographic location, and stage of development, will affect children’s exposure to health threats due to climate change in the U.S. and internationally. These factors, combined with climate fluctuations, may increase their exposure to environmental contaminants. Extreme heat threatens student athletes who practice outdoors, as well as children in homes or schools without air conditioning. Children may be vulnerable to injury during extreme weather events, as they depend on adults to escape harm, and can suffer emotional trauma from displacement, loss of home or school, and exposure to the event itself. Climate-related exposures may lead to adverse pregnancy outcomes, including spontaneous abortion, low birth weight, preterm birth, and risks to newborns and infants, including increased neonatal death, dehydration, malnutrition, diarrhea, and respiratory diseases.

Older Adults

The percentage of people age 65 and older is increasing rapidly in the U.S. Older adults are a population of concern for climate change impacts from extreme heat and weather events, degraded air quality, vector-borne diseases, and other factors. Older adults may be further challenged by social factors such as isolation or living in older structures that make them vulnerable to heat and extreme events, such as hurricanes and floods; preexisting health conditions, such as respiratory conditions that may be worsened by extreme climate; and mental health challenges, such as depression, dementia, and other cognitive impairments. Older adults are also more likely to take medications to treat chronic medical conditions, including antidepressant and antipsychotic drugs and diuretics, which make them more vulnerable to complications from heat exposure.

Occupational Groups

Outdoor workers are often among the first to be exposed to the effects of climate. Severe climate change may affect the health of outdoor workers through increases in ambient temperature, degraded air quality, extreme weather, vector-borne diseases, industrial exposures, and altered built environment. Agricultural and construction workers are particularly vulnerable to rising temperatures. These workers may also experience socioeconomic disadvantages, including limited access to health care and limited control over work environments. Also, laborers exposed to hot indoor work environments that lack air conditioning may be at risk for extreme heat exposure. Military personnel who train and conduct operations in hot field environments may be at risk for heat-related illness, and may also be at increased risk for certain vector-borne diseases.

Persons With Disabilities or Chronic Medical Conditions

The term “disability” covers a variety of functional limitations related to hearing, speech, vision, cognition, and mobility. An increase in climate change can be expected to disproportionately affect populations with disabilities. Preexisting medical conditions present risk factors for increased illness and death associated with climate-related stressors, especially exposure to extreme heat. Chronic medical conditions, including cardiovascular disease, respiratory disease, diabetes, asthma, and obesity, are likely to increase over the coming decades, resulting in larger populations at risk of medical complications from climate-related exposures. Communities that are both medically underserved and have a high prevalence of chronic medical conditions can be especially at risk.
**What Is NIEHS Doing to Help People Prepare?**

Working closely with researchers, communities, and decision-makers, NIEHS is supporting research and developing strategies to help people and communities prepare for potential health impacts of climate change, while also protecting health and the environment for future generations. Examples include the following:

- Developing models to define and predict high-risk days to determine when those with heart disease are most vulnerable.
- Investigating the impact of climate on the spread of disease in food and water.
- Researching the effects of extreme weather events on pregnant women and fetuses.
- Developing toolkits for sustainable and climate-resilient health care facilities.
- Assisting with public development of informational resources and tools.
- Partnering with other federal agencies through the U.S. Global Change Research Program, and internationally with the Intergovernmental Panel on Climate Change and the World Health Organization, to identify research gaps and develop tools for decision-making.
- Developing climate change and health learning materials for a wide range of student audiences.

**NIEHS Climate Change and Human Health Lesson Plans**
https://www.niehs.nih.gov/health/scied/teachers/cchh

**The NIEHS Climate Change and Human Health Literature Portal**
This comprehensive knowledge-management tool offers access to curated scientific literature on the health implications of climate change. Search the database: https://tools.niehs.nih.gov/cchhl

**Climate Change and Human Health Glossary**
A glossary of terms used to describe the science of climate change and its impacts on human health. https://tools.niehs.nih.gov/cchhglossary

Additional References

**Climate Change Affects the Health of All Americans**

The Fifth National Climate Assessment (NCA5) was released in November 2023. The report draws on the expertise of nearly 500 authors and 250 contributors from every state, as well as Guam, Puerto Rico, and the U.S. Virgin Islands. NCA5 is the most comprehensive analysis of the state of climate change in the United States, providing authoritative, decision-relevant information on how people across the country are experiencing climate change, the risks we face now and will face in the future, and actions underway to reduce carbon pollution and build resilience.

Mandated by the Global Change Research Act of 1990, the U.S. Global Change Research Program delivers a National Assessment Report to Congress and the president every four years. The reports inform decision-making, but do not recommend specific policies. Read more at https://www.globalchange.gov.

**Where Can I Get More Information?**

NIH Website
NIH Climate Change and Health Equity
https://www.niehs.nih.gov/research/programs/climatechange

NIH Climate Change and Human Health Research
https://www.niehs.nih.gov/research/programs/climatechange

U.S. Department of Health and Human Services Climate
https://hhs.gov/ash/ocche

National Oceanic and Atmospheric Administration (NOAA) Climate – https://cpo.noaa.gov

Sustainable and Climate-Resilient Health Care Facilities Toolkit

U.S. Centers for Disease Control and Prevention Climate and Health
https://www.cdc.gov/climateandhealth

U.S. Climate Resilience Toolkit
https://toolkit.climate.gov


For more information on the National Institute of Environmental Health Sciences, go to https://www.niehs.nih.gov