



**Testimony**  
**Select Committee on Energy**  
**Independence and Global Warming**  
**United States House of**  
**Representatives**

**Climate Change and Public Health**

*Statement of*

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## Introduction

Good morning Chairman Markey, Representative Sensenbrenner, and other distinguished members of the Committee. I am Howard Frumkin, Director of the National Center for Environmental Health at the Centers for Disease Control and Prevention (CDC), and Assistant Administrator of the Agency for Toxic Substances and Disease Registry (ATSDR). I am here to speak on our emerging understanding of climate change and its potential impact on health, and to discuss steps we are taking as public health officials regarding these potential consequences. I recognize that this topic remains controversial and some my testimony may not necessarily reflect broad consensus across the Administration. In addition, CDC is not a regulatory agency and does not express any opinions on regulatory decisions pending before the Environmental Protection Agency.

## Background

Scientific evidence supports the view that the earth's climate is changing. CDC considers climate change a serious public health concern, The programs and expertise used by CDC to address a broad range of public health challenges also are applicable to preparing for and responding to public health needs related to climate change. In this testimony, I will address the following dimensions of climate change and public health:

- 1) The likely public health threats of climate change,
- 2) The people most vulnerable to these threats, and

3) CDC activities to protect the public's health from these anticipated threats.

Climate change strategies are typically framed by two broad approaches. *Mitigation* encompasses efforts to reduce climate change itself, while *adaptation*, encompasses activities to manage those effects of climate change that are inevitable despite mitigation efforts. This framing aligns closely with the public health framework of prevention and preparedness. Like prevention, mitigation seeks to prevent negative outcomes. Like adaptation, preparedness acknowledges that, while not all negative outcomes can be prevented, they can be reduced and managed. For climate change, adaptation/preparedness is more broadly accepted as a public health activity. However, there is also a role for public health to play by articulating the health implications of climate change mitigation options, both by highlighting co-benefits to health of certain options and by identifying potential negative health outcomes of other possible mitigation strategies.

### Climate Change is a Public Health Concern

Over the next few decades in the United States, climate change is likely to have a significant impact on health. The anticipated health impacts of climate change have been well-reviewed and articulated by the Intergovernmental Panel on Climate Change<sup>1</sup> and by the U.S. Climate Change Science Program through

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<sup>1</sup> Intergovernmental Panel on Climate Change, 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, P.P. Palutikof, P.J. van

their Synthesis and Assessment Products<sup>2</sup>. While knowledge of the potential public health impacts of climate change will advance in the coming years and decades, the following are current best estimates of major anticipated health outcomes:

- Direct effects of heat,
- Health effects related to extreme weather events,
- Air pollution-related health effects,
- Water- and food-borne infectious diseases,
- Vector-borne and zoonotic diseases, and
- Other pathogens sensitive to weather conditions.

The United States is a developed country with a variety of climates. Because of its well-developed health infrastructure, and the greater involvement of government and nongovernmental agencies in disaster planning and response, the health effects from climate change are expected to be less significant than in the developing world. Nevertheless, Americans may experience difficult challenges, and different regions of the country may experience these challenges at varying degrees.

### *Heat Stress and Direct Thermal Injury*

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der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22. Available at: <http://www.ipcc.ch/ipccreports/assessments-reports.htm>.

<sup>2</sup> U.S. Climate Change Science Program. Public Review Draft of Synthesis and Assessment Product 4.6. Executive Summary. Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems. Available at: <http://www.climatechange.gov/Library/sap/sap4-6/public-review-draft/default.htm>

With climate change, the United States would expect to see an increase in the severity, duration, and frequency of extreme heat waves. Heat causes a range of health effects, from mild (heat cramps, heat exhaustion) to severe (such as heat stroke, which can be fatal). Certain populations are especially vulnerable to these health effects, including the elderly, those with certain underlying medical conditions, those who are socially isolated, and those without air conditioning. Midwestern and northeastern cities are at greatest risk, as heat-related illness and death appear to be related to exposure to temperatures much hotter than those to which the population is accustomed.<sup>3</sup>

### *Extreme Weather Events*

Scientific evidence suggests climate change will likely modify extreme weather events, such as floods, droughts, and heavy precipitation. In addition, some evidence suggests hurricanes could become more intense. The health effects of extreme weather events range from loss of life and acute trauma to indirect effects such as loss of home, large-scale population displacement and subsequent mental health effects, damage to sanitation infrastructure (drinking water and sewage systems), interruption of food production, and damage to the health-care infrastructure. Displacement of individuals often results in disruption of health care, of particular concern for those with underlying chronic diseases. Future climate projections also show likely increases in the frequency of heavy rainfall events, posing an increased risk of flooding. Climate change models

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<sup>3</sup> McGeehin MA, Mirabelli M. The potential impacts of climate variability and change on temperature-related morbidity and mortality in the United States. *Environ Health Perspect* 109 (suppl 2), 185-189 (2001)

also suggest some areas of the United States may have less rainfall leading to severe drought, reducing availability and quality of water.

#### *Air Pollution-Related Health Effects*

Climate changes will likely affect air quality by modifying local weather patterns and pollutant concentrations, affecting natural sources of air pollution, and promoting the formation of secondary pollutants. Studies show that higher surface temperatures, especially in urban areas, encourage the formation of ground-level ozone. Ozone can irritate the respiratory system, reduce lung function, aggravate asthma, and inflame and damage cells that line the lungs. In addition, it may cause permanent lung damage and aggravate chronic lung diseases.

#### *Water- and Food-borne Infectious Diseases*

Altered weather patterns resulting from climate change could affect the distribution and incidence of food- and water-borne diseases. Changes in precipitation, temperature, humidity, and water salinity have been shown to affect the quality of water used for drinking, recreation, and commercial use. For example, outbreaks of *Vibrio* bacteria infections following the consumption of seafood and shellfish have been associated with increases in temperatures. Heavy rainfall has also been implicated as a contributing factor in the overloading and contamination of drinking water treatment systems, leading to illness from organisms such as *Cryptosporidium* and *Giardia*. Storm water runoff from heavy precipitation events can also increase fecal bacterial counts in coastal waters as

well as nutrient load, which, coupled with increased sea-surface temperature, can lead to increases in the frequency and range of harmful algal blooms (red tides) and potent marine biotoxins such as ciguatera fish poisoning.

### *Vector-borne and Zoonotic Diseases*

Vector-borne and zoonotic diseases, such as, Lyme disease, West Nile virus, malaria, plague, hantavirus pulmonary syndrome, and dengue fever have been shown to have a distinct seasonal pattern, and in some instances their frequency has been shown to be weather sensitive. Because of the sensitivities of the vectors and animal hosts of these diseases to climactic factors, climate change-driven ecological changes, such as variations in rainfall and temperature, could significantly alter the range, seasonality, and human incidence of many zoonotic and vector-borne diseases. More study is required to fully understand all the implications of ecological variables necessary to predict climate change effects on vector-borne and zoonotic diseases. Moderating factors such as housing quality, land-use patterns, and vector control programs make it unlikely that climate change will have a major impact on tropical diseases such as malaria and dengue fever in the United States. However, climate change could facilitate the establishment of new vector-borne diseases imported into the United States, or alter the geographic ranges of some of these diseases that already exist in the country.

### Climate Change Vulnerability

The effects of climate change will likely vary by geographic area and demographic group. With respect to geographic vulnerability, urban centers in the west, southwest, mid-Atlantic, and northeast regions of the United States are expected to experience the largest increases in average temperatures; these areas also may bear the brunt of increases in ground-level ozone and associated airborne pollutants.<sup>4</sup> Populations in midwestern and northeastern cities are expected to experience more heat-related illnesses as heat waves increase in frequency, severity, and duration. Different rates of coastal erosion, wetlands destruction, and topography are expected to result in dramatically different regional effects of sea level rise. Distribution of animal hosts and vectors may change; in many cases, ranges could extend northward and increase in elevation. The West coast of the United States is expected to experience significant strains on water supplies as regional precipitation declines and mountain snow packs are depleted.

Some demographic groups are more vulnerable to the health effects of climate change than others. Children are at greater risk of worsening asthma, allergies, and certain infectious diseases. Those with underlying diseases and the elderly are at higher risk for health effects due to heat waves, extreme weather events, and exacerbations of chronic disease. In addition, people of lower socioeconomic status are particularly vulnerable to extreme weather events. The health effects of climate change on a given community will depend not only on a

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<sup>4</sup> Bernard SM, et al. The potential impacts of climate variability and change on air pollution-related health effects in the United States. *Environ Health Perspect.* 2001 May; 109 Suppl 2:100-209.



community's exposures and demographics, but also on how these characteristics intersect. For example, heat waves are both more likely to occur in urban areas and more likely to affect certain populations: the home-bound, elderly, poor, minority and migrant populations, and populations that live in areas with less green space and with fewer centrally air-conditioned buildings.

Given the differential burden of climate change health effects on certain populations, public health preparedness must include assessments to identify the most vulnerable populations and anticipate their risks. At the same time, health communication targeting these vulnerable populations must be devised and tested, and early warning systems focused on vulnerable communities should be developed. With adequate notice and a vigorous response, adverse health effects from climate change may be reduced.

### CDC's Current Public Health Preparedness for Climate Change

Climate change is anticipated to have a broad range of impacts on the health of Americans and the nation's public health infrastructure. As the nation's public health agency, CDC is uniquely poised to lead efforts to anticipate and respond to the health effects of climate change. In preparing for climate change, CDC works closely with a broad array of partners including other Federal Agencies (such as the Environmental Protection Agency, National Aeronautics and Space Administration, National Academy of Sciences, United States Department of Agriculture, Food and Drug Administration, National Institutes of Health) through the U.S. Climate Change Science Program; state and local organizations (such

as the National Association of County and City Health Officials, Association of State and Territorial Health Officials, and state and local veterinary officials); faith-based organizations; and many other organizations and agencies.

Preparedness for the health consequences of climate change aligns with traditional public health contributions, and – like preparedness for terrorism and pandemic influenza – reinforces the importance of a strong public health infrastructure. CDC’s expertise and programs in the following areas provide a strong platform:

- *Surveillance of Water-borne, Food-borne, Vector-borne, and Zoonotic Diseases:* CDC has a long history of surveillance of infectious, zoonotic, and vector-borne diseases. Preparing for climate change will involve working closely with state and local partners to document whether potential changes in climate have an impact on infectious and other diseases and to use this information to help protect Americans from the potential change in a variety of water-borne, food-borne, vector-borne, and zoonotic diseases. Among the tracking systems CDC has developed for these diseases is ArboNet, the national arthropod-borne viral disease tracking system. Currently, this system supports nationwide West Nile virus surveillance that links all 50 states and four large metropolitan areas to a central database that records and maps cases in humans and animals and would detect real-time changes in distribution and prevalence of arthropod-borne viral diseases. CDC also supports the major foodborne surveillance and investigative networks of FoodNet PulseNet, and OutbreakNet that rapidly identify and provide detailed data on cases of foodborne illnesses, the organisms that cause them, and the

foods that are the sources of infection. Altered weather patterns resulting from climate change may affect the distribution and incidence of food- and water-borne diseases, and these changes can be identified and tracked through PulseNet, the Electronic Foodborne Disease Outbreak Reporting System (eFORS) and the Waterborne Disease Outbreak Surveillance System (WBD OSS)

- *Environmental Public Health Tracking*: CDC is pioneering new ways to understand the impacts of environmental hazards on people's health. CDC's Environmental Public Health Tracking Program has funded several states to build a health surveillance system that integrates environmental exposures and human health outcomes. The Tracking Network will contain critical data on environmental trends and on the incidence, trends, and potential outbreaks of diseases, including those affected by climate change.
- *Geographic Information Systems (GIS)*: CDC has applied GIS technology in unique ways to a variety of public health issues. It has been used in data collection, mapping, and communication to respond to issues as wide-ranging and varied as the World Trade Center collapse, avian flu, SARS, Rift Valley fever, and plague. GIS allows CDC to overlay public health disease data with enviro-climatic datasets such as temperature and precipitation information to determine if associations exist. In addition, GIS technology was used to map issues of importance during the CDC response to Hurricane Katrina. This technology represents an additional tool for the public health response to climate change.

- *Modeling:* Projections of future climate change can be used as inputs into models that assess the impact of climate change on public health. For example, CDC has conducted heat wave modeling for the city of Philadelphia to predict the most vulnerable populations at risk for hyperthermia. CDC has also worked with others to model the potential impacts of climate change on the distribution of plague and tularemia in the United States.
- *Preparedness Planning:* The principles that guide us to prepare for terrorism and pandemic influenza also apply to preparedness for the health impacts of climate change. For example, CDC scientists have developed tools for local emergency planners and decision-makers to use in preparing for and responding to the threats posed by heat waves in urban areas. With other Federal partners, CDC helped develop an Excessive Heat Events Guidebook, which provides a comprehensive set of guiding principles and a menu of options for cities and localities to use in developing Heat Response Plans. These plans clearly define specific roles and responsibilities of government and non-governmental organizations during heat waves. They identify local populations at increased high risk for heat-related illness and death and define which strategies will be used to reach them during heat emergencies.
- *Training and Education of Public Health Professionals:* Preparing for the health consequences of climate change requires that professionals have the skills required to conceptualize the impending threats, integrate a wide variety of public health and other data in surveillance activities, work closely with other agencies and sectors, and provide effective health communication for vulnerable populations. CDC is holding a series of workshops to explore key

dimensions of climate change and public health, including drinking water, heat waves, health communication, and vulnerable populations. In addition, CDC recently published an article outlining the public health approach to climate change to guide public health professionals in prevention and preparedness.

- *Health Protection Research:* CDC can also promote research to further public health preparedness for climate change. This includes predictive research to model potential impacts of climate change on health outcomes, epidemiologic research to identify modifiable risk factors, and intervention research to determine the most effective public health practices. For example, CDC has conducted research to model the impact of the urban environment on temperature-related morbidity and mortality. The Agency has also conducted epidemiologic research on the relationship between rainfall and other climactic factors on Hantavirus pulmonary syndrome and plague. Finally, intervention research will help us focus public health action on the most appropriate target audiences.
- *Communication:* CDC has expertise in communicating health and risk information to the general public, and has deployed this expertise in areas as diverse as smoking, HIV infection, and cancer screening. Effective communication can alert the public to health risks associated with climate change and encourage constructive protective behaviors.

While CDC can conduct targeted research or offer technical support and expertise in these and other activities to states, local governments, tribes, and

territories be carried out at the state and local level and through other public health partners. For example, CDC can support climate change preparedness activities conducted by state and local public health agencies and climate change and health research in universities, approaches currently used by CDC to address a variety of other health challenges.

### Advancing Public Health Prevention and Preparedness for Climate Change

In addition to leveraging existing programs across the agency, CDC has identified the following opportunities for advancing public health prevention and preparedness for climate change:

1) Improve surveillance systems for food-borne, water-borne, vector-borne, zoonotic, and other diseases in cooperation with state and local partners to have a better understanding of the impact of climate change on public health, and to potentially develop models and early warning systems to improve health outcomes.

2) *Building research capacity within the Agency:* CDC could convene staff experienced in epidemiology, infectious disease ecology, disaster preparedness, modeling and forecasting, climatology/earth science, and communication. This group could support internal research on the links between climate change and public health outcomes. Enhanced capacity within the agency would position CDC to serve as a trusted resource for decision makers and the public, a role we currently provide for public health issues such as vaccinations for foreign travel.

*3) Supporting academic capacity to research linkages between climate change and public health:* This capacity would include research in such areas as forecasting and modeling anticipated health effects, vector-borne and zoonotic diseases, food-and water-borne diseases, vulnerable populations, and heat waves.

*4) Providing research-based communication and technical assistance on the health effects of climate change and best approaches to preparedness:*

Important audiences for outreach include health professionals, state and local health departments, university environmental studies departments, science teachers, federal, state and local officials, community groups, faith-based organizations, industry, and the public.

### Conclusion

An effective public health response to climate change can prevent injuries, illnesses, and death while enhancing overall public health preparedness.

Protecting Americans from adverse health effects of climate change directly correlates to CDC's four overarching Health Protection Goals of Healthy People in Every Stage of Life, Healthy People in Healthy Places, People Prepared for Emerging Health Threats, and Healthy People in a Healthy World.

While we still need more emphasis on public health preparedness for climate change, many of our existing programs and scientific expertise provide a solid foundation to move forward. The activities needed to protect overall public health and to protect Americans from adverse health effects of climate change are

mutually beneficial. CDC also has a role in examining the health implications of various mitigation efforts aimed at slowing, stabilizing, or reversing climate change by reducing greenhouse gas emissions. While these solutions will occur mainly in sectors other than health, such as energy, transportation, and architecture, the health sciences can contribute useful information regarding the choice of safe, healthful technologies.

Thank you again for the opportunity to provide this testimony on the potential health effects of global climate change and for your continued support of CDC's essential public health work.