



Testimony Before the

**Committee on Environment and
Public Works**

Climate Change and Public Health

Statement of

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Introduction

Good morning Madam Chairwoman, Senator Inhofe, and other distinguished members of the Committee. It is a pleasure to appear before you as Director of the Centers for Disease Control and Prevention (CDC), the Nation's leading public health protection agency located within the Department of Health and Human Services. Thank you for the opportunity to present on climate change and human health and to highlight the role of CDC in preparing for and responding to the health effects of climate change.

Background

The health of all individuals is influenced by the health of people, animals, and the environment around us. Many trends within this larger, interdependent ecologic system influence public health on a global scale, including climate change. The public health response to such trends requires a holistic understanding of disease and the various external factors influencing public health. It is within this larger context where the greatest challenges and opportunities for protecting and promoting public health occur.

~~Scientific evidence supports the view that the earth's climate is changing. A broad array of organizations (federal, state, local, multilateral, faith-based, private and nongovernmental) is working to address climate change. Despite this extensive activity, the public health effects of climate change remain largely unaddressed. CDC considers climate change a serious public health concern.~~

Climate Change is a Public Health Concern

In the United States, climate change is likely to have a significant impact on health, through links with the following outcomes:

- Direct effects of heat;
- Health effects related to extreme weather events;
- Air pollution related health effects;
- Allergic diseases;
- Water and food-borne infectious diseases;
- Vector-borne and zoonotic diseases;
- Food and water scarcity, at least for some populations;
- Mental health problems; and
- Long-term impacts of chronic diseases and other health effects

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, many Americans will likely experience difficult challenges. Catastrophic weather events such as heat waves and hurricanes are expected to become more frequent, severe, and costly; the U.S. population is anticipated to continue to age and move to vulnerable locations such as coastal areas, increasing exposures to specific risks; and concurrent challenges such as water scarcity in certain regions could limit our resilience.

In addition, climate change is likely to alter the current geographic distribution of some vector-borne and zoonotic diseases; some may become more frequent, widespread, and outbreaks could last longer, while others could be reduced in incidence.

Heat Stress and Direct Thermal Injury

One of the most likely climate change projections is an increase in frequency of hot days, hot nights, and heat waves. The United States is expected to see an increase in the severity, duration, and frequency of extreme heat waves. This, coupled with an aging population, increases the likelihood of higher mortality as the elderly are more vulnerable to dying from exposure to excessive heat. 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.

Extreme Weather Events

Climate change is anticipated to alter the frequency, timing, intensity, and duration of extreme weather events, such as hurricanes and floods. The health effects of these extreme weather events range from loss of life and acute trauma, to indirect effects such as loss of home, large-scale population displacement, damage to sanitation infrastructure (drinking water and sewage systems), interruption of food production, damage to the health care infrastructure, and psychological problems such as post-traumatic stress disorder. 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 events and overwhelming of sanitation infrastructure.

Air Pollution-Related Health Effects

Climate change can affect air quality by modifying local weather patterns and pollutant concentrations, affecting natural sources of air pollution, and promoting the formation of secondary pollutants. Of particular concern is the impact of increased temperature and UV radiation on ozone formation. Some studies have shown that higher surface temperatures, especially in urban areas, encourage the formation of ground-level ozone. As a primary ingredient of smog, ground-level ozone is a public health concern. 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.

Allergic Diseases

Studies have shown that some plants, such as ragweed and poison ivy, grow faster and produce more allergens under conditions of high carbon dioxide and warm weather. As a result, allergic diseases and symptoms could worsen with climate change.

Water and Food-borne Infectious Diseases

Altered weather patterns resulting from climate change are likely to 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 plague, Lyme disease, West Nile virus, malaria, hantavirus pulmonary syndrome, and dengue fever have been shown to have a distinct seasonal pattern, suggesting that they are weather sensitive. 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 these climate changes will have a major impact on tropical diseases such as malaria and dengue fever spreading into the United States. However, climate change could aid in the establishment of exotic vector borne diseases imported into the United States.

Food Scarcity

Climate change is predicted to alter agricultural production, both directly and indirectly. This may lead to scarcity of some foods, increase food prices, and threaten access to food for Americans who experience food insecurity.

Mental Health Problems

Some Americans may suffer anxiety, depression, and similar symptoms in anticipating climate change and/or in coping with its effects. Moreover, the aftermath of severe events may include post-traumatic stress and related problems, as was seen after Hurricane Katrina. These conditions are difficult to quantify but may have significant effects of health and well-being.

Climate Change Vulnerability

The effects of climate change will likely vary regionally and by population. The northern latitudes of the United States are expected to experience the largest increases in average temperatures; these areas also will likely bear the brunt of increases in ground level ozone and associated airborne pollutants. Populations in mid-western and northeastern cities are expected to experience more heat-related illnesses as heat waves increase in frequency, severity, and duration. Coastal regions will likely experience essentially uniform risk of sea level rise, but 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. For some pathogens associated with wild animals, such as rodents and hantavirus, ranges will change based on precipitation changes. The west coast of the United States is expected to experience significant strains on water supplies as regional precipitation declines and mountain snowpacks are

depleted. Forest fires are expected to increase in frequency, severity, distribution, and duration.

The health effects of climate change on a given community will depend not only on the particular exposures it faces, but also on the underlying health status, age distribution, health care access, and socioeconomic status of its residents. Local response capacity will also be important. As with other environmental hazards, members of certain ethnic and racial minority groups will likely be disproportionately affected. For example, in low-lying coastal communities facing increasingly frequent and severe extreme precipitation events, there could be increased injuries, outbreaks of diarrheal disease, and harmful algal blooms; saltwater may intrude into freshwater tables and infrastructure is likely to be damaged by severe storms, hampering economic recovery. In certain Southern coastal communities with little economic reserve, declining industry, difficulty accessing health care, and a greater underlying burden of disease, these stressors could be overwhelming. Similarly, in an urban area with increasingly frequent and severe heat waves, certain groups are expected to be more affected: the home-bound, elderly, poor, athletes, and minority and migrant populations, and populations that live in areas with less green space and with fewer centrally air-conditioned buildings are all more vulnerable to heat stress.

Some populations of Americans 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, 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. Members of racial and ethnic minority groups suffer particularly from air pollution as well as inadequate health care access, while athletes and those who work outdoors are more at risk from air pollution, heat, and certain infectious diseases.~~

~~Given the differential burden of climate change's health effects on certain populations, public health preparedness for climate change must include vulnerability assessments that identify the most vulnerable populations with the most significant health disparities and anticipate their risks for particular exposures. 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, the ill health effects of many exposures from climate change can be dampened.~~

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. 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 the strong platform needed:

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- *Environmental Public Health Tracking*: CDC has a long history of tracking occurrence and trends in diseases and health outcomes. CDC is pioneering new ways to understand the impacts of environmental hazards on people's health. For example, 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. This system, the Tracking Network, will go live in 2008, providing information on how health is affected by environmental hazards. The Tracking Network will contain critical data on the incidence, trends, and potential outbreaks of diseases, including those affected by climate change.
 - *Surveillance of Water-borne, Food-borne, Vector-borne, and Zoonotic Diseases*: CDC also 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 of a variety of dangerous water-borne, food-borne, vector-borne, and zoonotic diseases. CDC has developed ArboNet, the national arthropod-borne viral disease tracking system. Currently, this system supports the nationwide West Nile virus surveillance system 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 changes in real-time in the distribution and prevalence of cases of arthropod-borne viral diseases. CDC also supports the major foodborne surveillance and investigative networks of FoodNet and

PulseNet which rapidly identify and provide detailed data on cases of foodborne illnesses, on the organisms that cause them, and on the foods that are the sources of infection. Altered weather patterns resulting from climate change are likely to may affect the distribution and incidence of food- and water-borne diseases, and these changes can be identified and tracked through PulseNet.

- *Geographic Information System (GIS):* At the CDC, GIS technology has been applied in unique and powerful 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, and Rift Valley fever. 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:* Currently sophisticated models to predict climate and heat exist. For example,~~ *Modeling:* Model projections of future climate change can be used as inputs into models that assess the impact of climate change on public health. CDC has conducted heat stroke modeling for the city of Philadelphia to predict the most vulnerable populations at risk for hyperthermia. ~~Modeling and forecasting represent an important preparedness strategy, in that it can help predict and respond to the most pressing health vulnerabilities at the state and local level. Armed with modeling data, we can target response plans for heat and other extreme weather events to the most vulnerable communities and populations.~~ In light of these

projections, CDC has initiated efforts to model the impact of heat waves on urban populations to identify those people most vulnerable to hyperthermia.

- *Preparedness Planning:* Just as we prepare for terrorism and pandemic influenza, we should use these principles and prepare for health impacts from climate change. For example, to respond to the multiple threats posed by heat waves, the urban environment, and climate change, CDC scientists have focused prevention efforts on developing tools that local emergency planners and decision-makers can use to prepare for and respond to heat waves. In collaboration with other Federal partners, CDC participated in the development of an Excessive Heat Events Guidebook, which provides a comprehensive set of guiding principle and a menu of options for cities and localities to use in the development of 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 determine 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 regarding the evolving threat of climate change. CDC is holding a series of five workshops to further explore key dimensions of

climate change and public health, including drinking water, heat waves, health communication, vector-borne illness, and vulnerable populations.

- *Health Protection Research:* CDC can promote research to further elucidate the specific relationships between climate change and various health outcomes, including predictive models and evaluations of interventions. Research efforts can also identify the magnitude of health effects and populations at greatest risk. For example, CDC has conducted research on the relationship between hantavirus pulmonary syndrome and rainfall, as well as research assessing the impact of climate variability and climate change on temperature-related morbidity and mortality. This information will help enable public health action to be targeted and will help determine the best methods of communicating risk. CDC can serve as a credible source of information on health risks and actions that individuals can take to reduce their risk. In addition, CDC has several state-of-the-art laboratories conducting research on such issues as chemicals and human exposure, radiological testing, and infectious diseases. This research capacity is an asset in working to more fully understand the health consequences of climate change.
- *Communication:* CDC has expertise in communicating to the general public health and risk communication information, 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, ~~avoid inappropriate responses,~~ and encourage constructive protective behaviors.

While CDC can offer technical support and expertise in these and other activities, much of this work needs to be carried out at the state and local level. For example, CDC can support climate change preparedness activities in public health agencies, and climate change and health research in universities, as is currently practiced for a variety of other health challenges.

Conclusion

An effective public health response to climate change can prevent injuries, illnesses, and death and enhance overall public health preparedness. Protecting Americans from ~~the~~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 focus and emphasis on public health preparedness for climate change, many of our existing programs and scientific expertise provide a solid foundation to move forward. Many of the activities needed to protect Americans from ~~the~~adverse health effects of climate change are mutually beneficial for overall public health. In addition, health and the environment are closely linked, ~~as strongly demonstrated by the issue of climate change.~~ Because of this linkage it is also important that potential health effects of environmental solutions be fully considered.

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.

