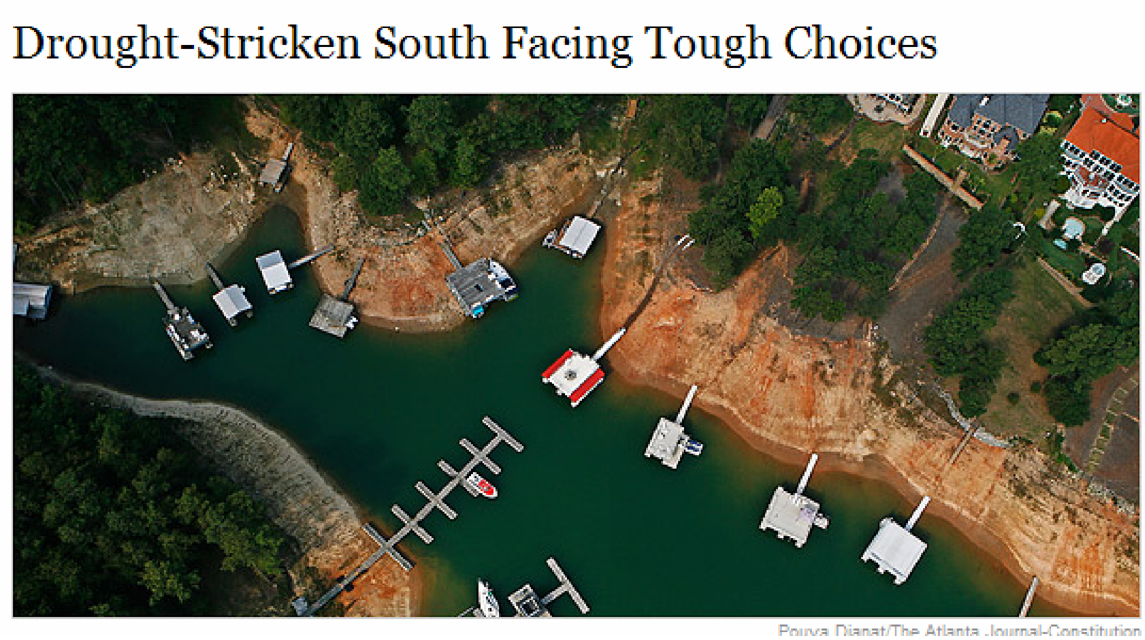
Visuals for 10/23/07 hearing on Climate Change

Extreme Climate Change

We live in a world where extreme climate changes are taking place. In this New York Times headline, we see extreme drought in the southeast as an example. Currently, the California wildfires and the floods in New Orleans are also examples.



Health Impact of Climate Change

We need to change the environment from a climate of uncertainty to a climate of preparedness, preemption and planning. In order to anticipate what might be in store, the following is a list of some potential consequences of climate changes such as a raise in temperature, a raise in the sea level, and hydrologic changes. Some of these changes we know will occur, others might happen that we have uncertainty about, and still others we can't predict.

Table 1. Potential Consequences of Climate Changes (Adapted from J. Patz)

CLIMATE CHANGE CAN EFFECT:	RESULTING NEGATIVE HEALTH IMPACTS
Heat	Heat stress, cardiovascular failure
Severe weather	Injuries, fatalities
Air pollution	Asthma, cardiovascular disease

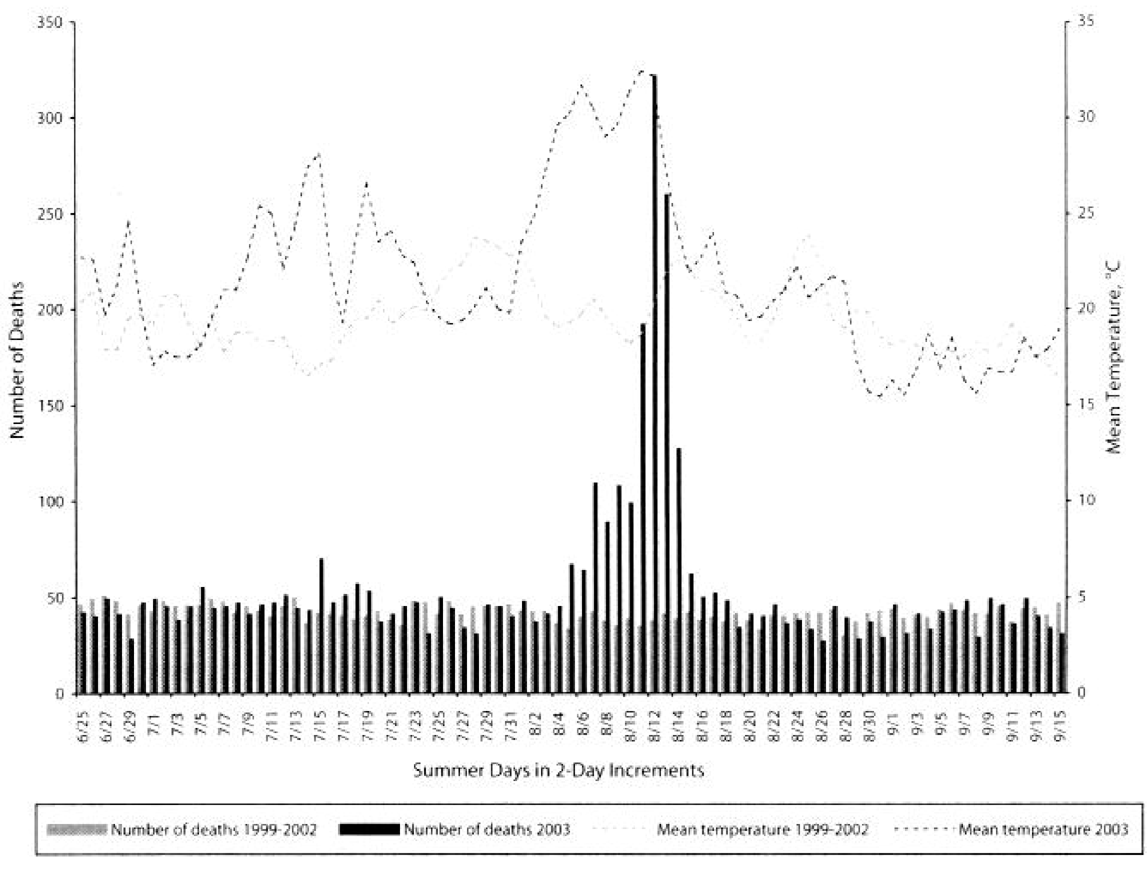
Allergies	Respiratory allergies, poison ivy
Vector-borne and other zoonotic diseases	Malaria, dengue, hantavirus, Rift Valley fever
Water-borne diseases	Cholera, cryptosporidiosis, campylobacter, leptospirosis, Vibriosis, Naegleria
Water and food supply	Malnutrition, diarrhea, harmful algal blooms, hygiene-related diseases
Mental health	Anxiety, despair, depression, post-traumatic stress
Environmental refugees or civil conflict	Morbidity, mortality, and migration

What we can say is that weather is inextricably linked to health. We see it in the weather events that occur everyday, seasonally with influenza, and over years as in El Nino.

The catastrophes that happen in 2003 in Europe should never happen again. Somewhere between 25,000 and 44,000 people died as a result of the heat wave. In this day and time in a develop country, this should never happen.

The following graph shows a comparison of mortality in France during the 2003 heat wave compared to mortality rates between 1999 and 2000. In 2003, more deaths occurred.

Figure 1. Timeline of Mortality Rates in France, 2003 compared to 1999-2000



The citation for the graph is: Vandentorren et al. Mortality in 13 French cities during the August 2003 heat wave. *Am J Public Health 2004; 94(9):1518-20.*

The mortality rates for Europe during the 2003 heat wave are shown in the table below.

Table 2. Mortality in Europe, 2003

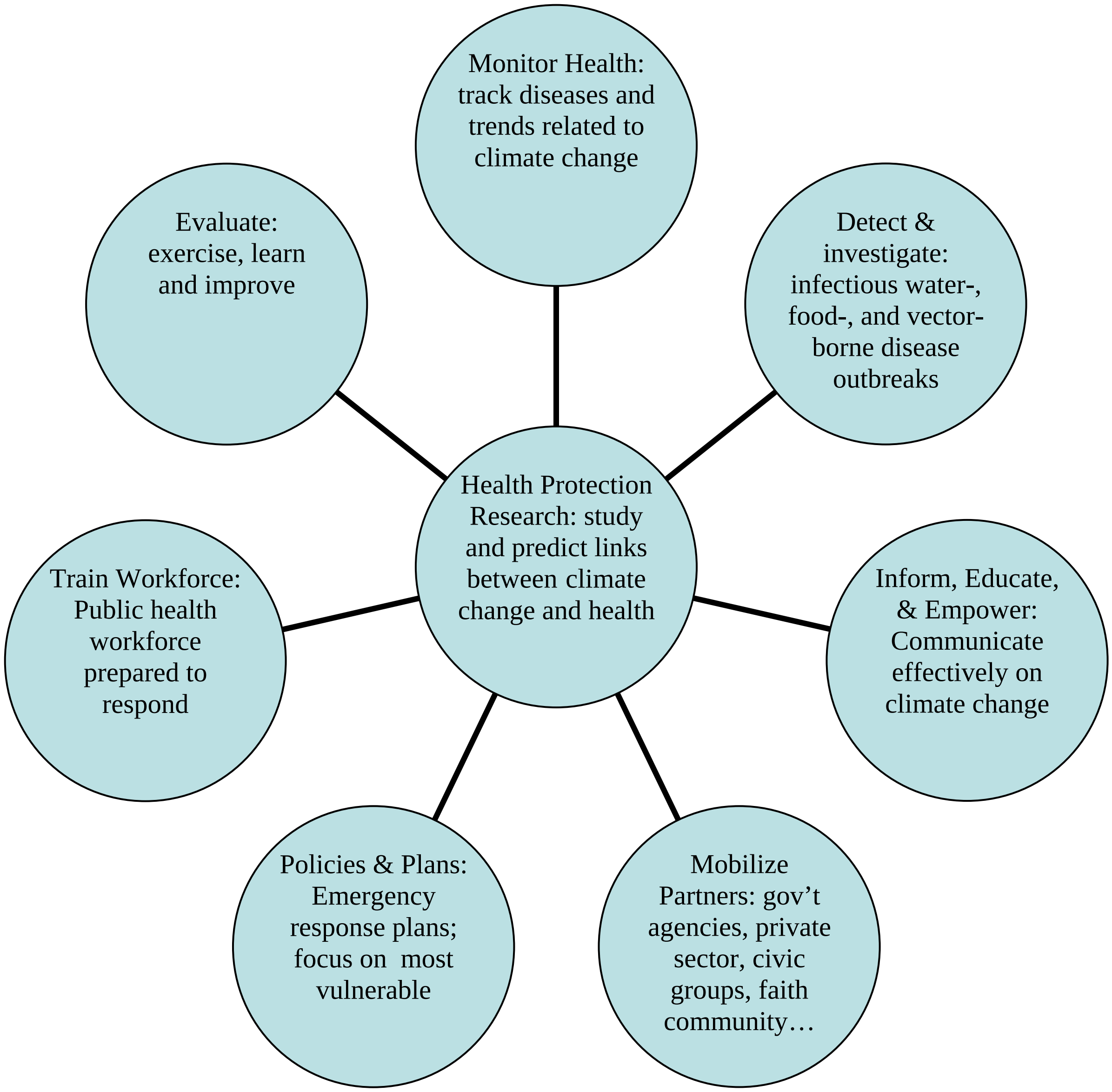
Country	**Confirmed Mortality**
UK	2,091
Italy	3,134
France	14,802
Portugal	1,854
Spain	4,151
Switzerland	975
Netherlands	1,400 – 2,200
Germany	1,410
Total	29,817 – 30,617

Table citation: Haines et al. Climate change and human health: Impacts, vulnerability and public health. *Public Health* 2006;120:585-96.

Health Protection Research

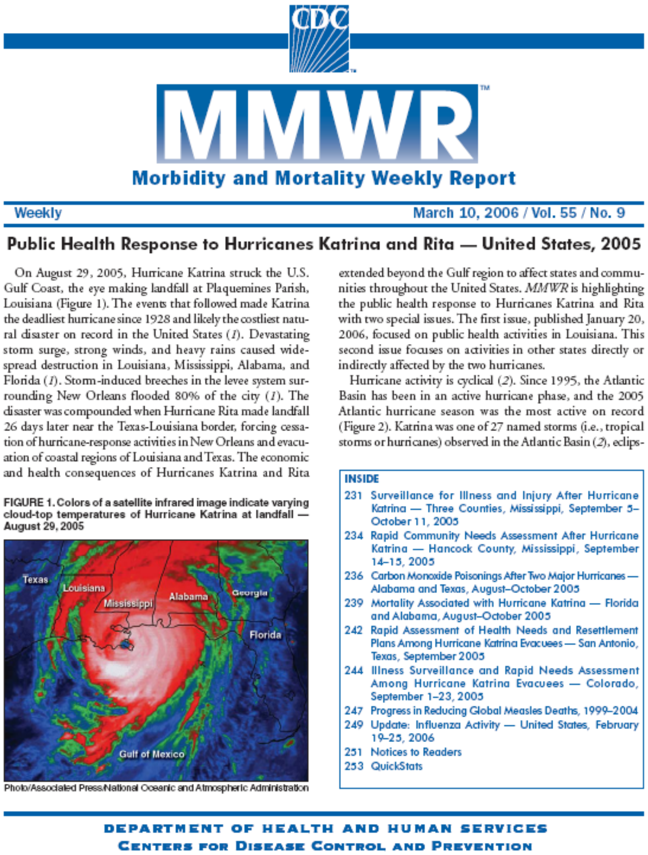
There is an important role for public health and CDC. There are many things that CDC and its partners would be responsible for doing, but one of the things to highlight is the area of health protection research.

Figure 2. Radial Diagram of Public Health's Role in Climate Change



There is a tragedy in not knowing what to do. We need to do the science to try and understand the range of issues that may emerge with climate change. An even greater tragedy is not doing what we know. We have examples where we can apply the science and the knowledge that we have in more creative ways.

Example 1. MMWR Headline "Public Health Response to Hurricanes Katrina and Rita – United States, 2005."



CDC

MMWR

Morbidity and Mortality Weekly Report

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Public Health Response to Hurricanes Katrina and Rita — United States, 2005

On August 29, 2005, Hurricane Katrina struck the U.S. Gulf Coast, the eye making landfall at Plaquemines Parish, Louisiana (Figure 1). The events that followed made Katrina the deadliest hurricane since 1928 and likely the costliest natural disaster on record in the United States (*1*). Devastating storm surge, strong winds, and heavy rains caused widespread destruction in Louisiana, Mississippi, Alabama, and Florida (*1*). Storm-induced breeches in the levee system surrounding New Orleans flooded 80% of the city (*1*). The disaster was compounded when Hurricane Rita made landfall 26 days later near the Texas-Louisiana border, forcing cessation of hurricane-response activities in New Orleans and evacuation of coastal regions of Louisiana and Texas. The economic and health consequences of Hurricanes Katrina and Rita extended beyond the Gulf region to affect states and communities throughout the United States. *MMWR* is highlighting the public health response to Hurricanes Katrina and Rita with two special issues. The first issue, published January 20, 2006, focused on public health activities in Louisiana. This second issue focuses on activities in other states directly or indirectly affected by the two hurricanes.

Hurricane activity is cyclical (*2*). Since 1995, the Atlantic Basin has been in an active hurricane phase, and the 2005 Atlantic hurricane season was the most active on record (Figure 2). Katrina was one of 27 named storms (i.e., tropical storms or hurricanes) observed in the Atlantic Basin (*2*), eclips-

FIGURE 1. Colors of a satellite infrared image indicate varying cloud-top temperatures of Hurricane Katrina at landfall — August 29, 2005

Photo/Associated Press/National Oceanic and Atmospheric Administration

INSIDE

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

Example 2. The Ecology and Evolutionary History of an Emergent Disease.

The Ecology and Evolutionary History of an Emergent Disease: Hantavirus Pulmonary Syndrome

TERRY L. YATES, JAMES N. MILLS, CHERYL A. PARMENTER, THOMAS G. KSIAZEK,
ROBERT R. PARMENTER, JOHN R. VANDE CASTLE, CHARLES H. CALISHER, STUART T. NICHOL,
KENNETH D. ABBOTT, JONI C. YOUNG, MICHAEL L. MORRISON, BARRY J. BEATY, JONATHAN L. DUNNUM,
ROBERT J. BAKER, JORGE SALAZAR-BRAVO, AND CLARENCE J. PETERS

In the spring of 1993, a previously undescribed disease emerged in the Southwest, killing 10 people during an 8-week period in May and June. Early during an infection, victims experienced flu-like symptoms for several days, but their condition suddenly and rapidly deteriorated as their lungs filled with fluids; death usually occurred within hours of the onset of this crisis period. There was no cure, no successful medication or treatment, and the disease agent (virus, bacterium, or toxin) was completely unknown. For the first few weeks, the mortality rate was 70%.

Researchers from many disciplines immediately focused on the outbreak, attempting to identify the agent and understand the causes and dynamics of the disease. Within weeks, scientists at the Centers for Disease Control and Prevention (CDC) identified the agent as a previously unknown hantavirus (Bunyaviridae), subsequently named Sin Nombre virus, or SNV (Nichol et al. 1993). Because hantaviruses were known to be transmitted by rodents, investigators undertook an intensive small mammal field sampling campaign in the Four Corners region of New Mexico and Arizona. Shortly thereafter, CDC identified the viral reservoir host as a common and widely distributed rodent, the deer mouse, *Peromyscus maniculatus* (figure 1; Childs et al. 1994). During the identification period, on the medical side, physicians and medical staff made rapid progress in developing treatment methods to stabilize and sustain patients through the crisis period, thereby substantially improving patient survivorship; nonetheless, the mortality rate fell only to about 40%, where it remains today.

The emergence of this new disease prompted many questions about its history, causes, and dynamics. Was this a newly

EVIDENCE FROM TWO EL NIÑO EPISODES IN THE AMERICAN SOUTHWEST SUGGESTS THAT EL NIÑO–DRIVEN PRECIPITATION, THE INITIAL CATALYST OF A TROPHIC CASCADE THAT RESULTS IN A DELAYED DENSITY-DEPENDENT RODENT RESPONSE, IS SUFFICIENT TO PREDICT HEIGHTENED RISK FOR HUMAN CONTRACTION OF HANTAVIRUS PULMONARY SYNDROME

Terry L. Yates (e-mail: tyates@unm.edu) is a professor in the Department of Biology and Pathology at the University of New Mexico, Albuquerque, NM 87131. Cheryl A. Parmenter, Robert R. Parmenter, John R. Vande Castle, Jorge Salazar-Bravo, and Jonathan L. Dunnum are with the Department of Biology and the Museum of Southwestern Biology, University of New Mexico. James N. Mills, Thomas G. Ksiazek, Stuart T. Nichol, and Joni C. Young are with the Centers for Disease Control and Prevention, Atlanta, GA 30333. Charles H. Calisher and Barry J. Beaty are with the Arthropod-borne and Infectious Diseases Laboratory, Foothills Campus, Colorado State University, Fort Collins, CO 80523. Kenneth D. Abbott is with the Department of Biology, Yavapai College, Prescott, AZ 86301. Michael L. Morrison is with the Department of Wildlife and Fisheries Science, University of Arizona, Tucson, AZ 85721. Robert J. Baker is with the Department of Biology and The Museum, Texas Tech University, Lubbock, TX 79409. Clarence J. Peters is with the Department of Pathology, University of Texas Medical Branch, Galveston, TX 77555.

Example 3. Title reads "The Potential Impacts of Climate Variability and Change on Temperature-Related Morbidity and Mortality in the United States."

The Potential Impacts of Climate Variability and Change on Temperature-Related Morbidity and Mortality in the United States

Michael A. McGeehin and Maria Mirabelli

Division of Environmental Hazards and Health Effects, National Center for Environmental Health, U.S. Centers for Disease Control and Prevention, Atlanta, Georgia, USA

Heat and heat waves are projected to increase in severity and frequency with increasing global mean temperatures. Studies in urban areas show an association between increases in mortality and increases in heat, measured by maximum or minimum temperature, heat index, and sometimes, other weather conditions. Health effects associated with exposure to extreme and prolonged heat appear to be related to environmental temperatures above those to which the population is accustomed. Models of weather–mortality relationships indicate that populations in northeastern and midwestern U.S. cities are likely to experience the greatest number of illnesses and deaths in response to changes in summer temperature. Physiologic and behavioral adaptations may reduce morbidity and mortality. Within heat-sensitive regions, urban populations are the most vulnerable to adverse heat-related health outcomes. The elderly, young children, the poor, and people who are bedridden or are on certain medications are at particular risk. Heat-related illnesses and deaths are largely preventable through behavioral adaptations, including the use of air conditioning and increased fluid intake. Overall death rates are higher in winter than in summer, and it is possible that milder winters could reduce deaths in winter months. However, the relationship between winter weather and mortality is difficult to interpret. Other adaptation measures include heat emergency plans, warning systems, and illness management plans. Research is needed to identify critical weather parameters, the associations between heat and nonfatal illnesses, the evaluation of implemented heat response plans, and the effectiveness of urban design in reducing heat retention. *Key words:* climate change, cold weather, global warming, heat waves. — *Environ Health Perspect* 109(suppl 2):185–189 (2001).
http://ehpnet1.niehs.nih.gov/docs/2001/suppl-2/185-189mcgeehin/abstract.html

The relationship between human health and stressful weather is a complex medical, social, and environmental issue (Figure 1). Future-climate scenarios suggest that higher global mean temperatures could result in marked changes in the frequency of temperature extremes (*1*). Software developed by the National Oceanic and Atmospheric Administration (*2*) can be used to estimate changes in the probability that a given extreme temperature will occur for a specified duration under a defined climate scenario.

Heat-Related Health Risks

Heat waves are sporadic but recurrent. Elevated temperatures during summer months are associated with excess morbidity and mortality. Conservative estimates are that, on average, 240 heat-related deaths occur annually in the United States; in a 1980 heat wave, there were 1,700 deaths (*3*). Following a 5-day heat wave in 1995 in which maximum temperatures in Chicago, Illinois, ranged from 93 to 104°F, the number of deaths reported increased by 85%, and the number of hospital admissions increased by 11% compared with numbers recorded during the same period in the preceding year (*4–6*). During this period at least 700 excess deaths (i.e., deaths beyond those expected for that period in that population) in Chicago were recorded, most of which were directly attributed to heat (*4–6*).

Exposure to extreme and prolonged heat is associated with heat cramps, heat syncope (fainting), heat exhaustion, and heatstroke (*7*). The initial human physiologic response to heat entails increasing surface blood circulation, thereby promoting heat loss through radiation, convection, perspiration, and increased rates of evaporative cooling (*8*). The ability to respond to heat stress is limited by the capacity to increase the maximum cardiac output required for cutaneous blood flow. The cardiac output, in turn, is a function of maximal heart rate, intravascular volume, and sustainable renal and splanchnic vasoconstriction. Under mild heat stress, heat acclimatization can increase the body's tolerance to heat stress. However, under extreme or chronic heat stress, the body loses its ability to maintain temperature balance and death may occur.

The most common cause of death and the most acute illness directly attributable to heat is heatstroke, a condition characterized by a body temperature of 105.0°F (40.6°C) or higher and altered mental status (*9*). Other causes of death observed to increase following heat waves include ischemic heart disease, diabetes, stroke, respiratory diseases, accidents, violence, suicide, and homicide (*10,11*). Even when appropriate, medical examiners do not routinely record these causes of death as heat related.

As observed following a 1980 heat wave in Kansas City, Missouri, heatstroke victims showed few symptoms of illness prior to the onset of heat stroke (*12*). The onset of heatstroke occurs rapidly through progressively serious symptoms, including lethargy, confusion, disorientation, delirium, and coma (*4,13*). Survivors of heatstroke often experience persisting organ dysfunction that is predictive of 1-year mortality (i.e., death within 1 year of an event) (*14*). Heat stroke mortality and heat-related mortality from all causes appear to peak with a 1- to 2-day lag following high temperatures (*6,15,16*). One epidemiologic study of deaths during and following a heat wave indicated that a rise in the heat index (HI) is followed by an increase in the number of deaths due to heat (Figure 2) (*6*).

The impact of heat on morbidity is less certain than the heat–mortality association (*17,18*). A 5% increase in hospital admissions was observed during the 1980 heat wave in Kansas City (*12*). During periods of excessive heat, emergency rooms report an overall increase in visits, specifically for fainting, nausea, dizziness, and heat cramps (*16,19*). A detailed analysis of all inpatient hospital admissions during the 1995 heat wave in Chicago found that individuals with a wide range of underlying medical conditions were at increased risk for hospitalization. These underlying medical conditions included cardiovascular and respiratory diseases, diabetes, renal diseases, nervous system disorders,

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Address correspondence to M.A. McGeehin, Division of Environmental Hazards and Health Effects, National Center for Environmental Health, MS E-19, CDC, 1600 Clifton Rd., NE, Atlanta, GA 30333 USA. Telephone: (404) 639-4571. Fax: (404) 639-2555. E-mail: mmcgeehin@cdc.gov
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CDC has the infrastructure to conduct the health protection research.

Photo 1. CDC Laboratorian at Work

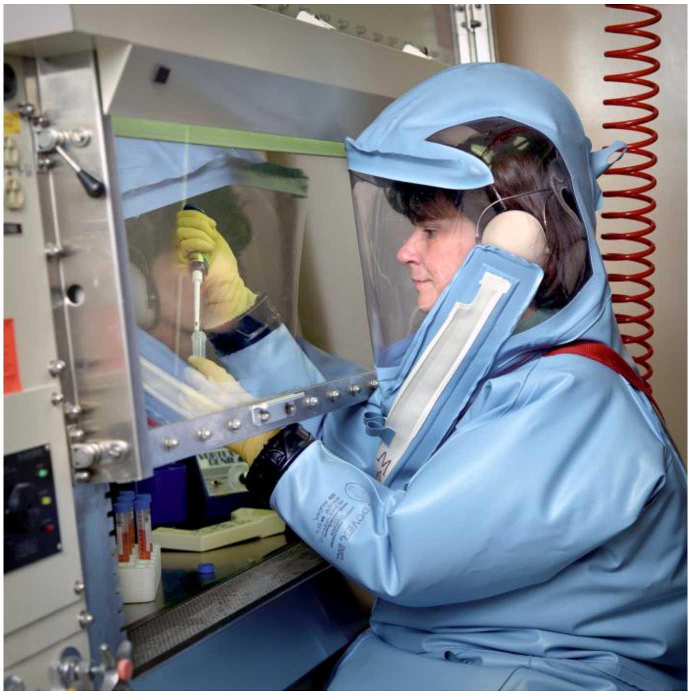

Photo 2. CDC Facility, Roybal Campus

Photo 3. CDC Facility, Chamblee Campus

Photo 4. CDC Facility, Fort Collins Campus

Photo 5. CDC Facility, Puerto Rico