Are We Ready?

PREPARING FOR THE PUBLIC HEALTH CHALLENGES OF CLIMATE CHANGE

NACCHO
National Association of County & City Health Officials
The National Connection for Local Public Health

ENVIRONMENTAL DEFENSE FUND
finding the ways that work

GEORGE MASON UNIVERSITY

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Executive summary

Global climate change currently contributes to disease and premature deaths worldwide, increasing the risk of adverse health impacts from more severe heatwaves and other extreme weather events, reduced air quality, malnutrition and infectious diseases. Even if drastic cuts in greenhouse gas emissions are implemented immediately, the climate will continue to warm and change during the next several decades because of processes already set in motion by human activities over the last century.

In the United States, illness and deaths related to heatwaves, floods, air pollution, and food- and waterborne infections may increase in certain locations. Because local public health departments are the "first line of defense" in our public health system, it is critical that the public health community has both the expertise and the resources to identify and respond to these challenges.

The nature of climate-related risks, such as those posed by extreme weather events and conditions, means that some adverse health outcomes are unlikely to be avoidable, even with efforts to improve population resilience. For this reason, members of the public health community recognize that reducing greenhouse gas emissions and enhancing the effectiveness of the public health system are absolutely essential to protect people and prevent climate-related illness and death.

The public health community has an important role to play in preventing the more severe impacts of climate change.

The public health community has a great interest and an important role to play in preventing the more severe impacts of climate change and optimizing the policy measures and personal behaviors that can lead to reductions in greenhouse gases. This is true not only because of the health threats associated with unchecked climate change, but also because of many potential health benefits associated with limiting greenhouse gas emissions.

In order to better understand the current state of preparedness for health effects of climate change, Environmental Defense Fund collaborated with the National Association of City and County Health Officials and George Mason University to conduct a survey of a representative sample of local health departments from around the country. The survey asked respondents to discuss their perception of climate-related health risks and the status and adequacy of their departments' programmatic activities in response to these risks. It also asked respondents to identify the regulatory roles they perform, the programs in place that address policies and activities to reduce greenhouse gas emissions, and the additional resources needed to allow their departments to more effectively deal with climate change as a public health issue.

Respondents to the survey generally recognized the reality of climate change impacts. Nearly 70% believed that their jurisdiction had already experienced climate change in the past 20 years, and 78% believed that their jurisdiction will experience climate change in the next 20 years. Roughly 60% thought that one or more serious public health problems will occur in their jurisdiction in the next two decades as a result of climate change, and slightly over half of the directors felt preventing or preparing for climate change was an "important priority," yet relatively few reported it as a top priority for their health department. Only 19% of respondents indicated that climate change was among their department's top 10 current priorities, and only 6% indicated climate change was one of their health department's current top five priorities.

The survey also revealed a lack of perceived expertise to prepare for public health problems that arise from climate change. Seventy-seven percent of local health directors felt they lacked the expertise to assess local health impacts of climate change in their region, and 83% felt they lacked the expertise to craft adaptation plans. Local health directors did not perceive that much help is currently available from their state or federal public health agencies. Only 26% felt their state had the needed expertise to assist with adaptation plans, while only 34% believed the Centers for Disease Control and Prevention (CDC) had such expertise. In addition to lacking expertise, 77% of the directors felt they lacked necessary resources to address climate-related health threats; additional funding and staff were the needed resources most frequently cited.

Nearly 70% of local health directors believed that their jurisdiction had already experienced climate change in the past 20 years.

Our recommendations can be summed up in three words: **protect, prevent** and **enhance.**

Protect...

public health from climate change effects by assuring the responsiveness and efficacy of the public health system.

The federal government should:

- Sponsor a study by the National Academy of Sciences and Institute of Medicine to make recommendations for designing an integrated public health system that can respond to the suite of 21st-century health threats, including climate change, pandemic influenza, emerging and reemerging communicable diseases, and bioterrorist acts.

- Increase funding to support and expand federal, state and local public health systems in order to:

  - Further strengthen and integrate current surveillance networks, such as FoodNet, and improve syndromic surveillance systems. This clearly has benefits for public health beyond just climate-related effects.

  - Develop an adequate rapid response system for extreme weather events. This will include dispatchable personnel, equipment and pharmaceuticals, as well as the assurance of having adequate emergency medical facilities located throughout the country in areas most likely to be affected by extreme weather.

  - Develop a robust, consultative system to assist state and local public health departments in vulnerability assessments and response planning for the health impacts of climate change.

  - Develop training programs for public health professionals on health risks, interventions, and opportunities related to climate change.

- Increase funding for research on climate change and health, including community-based, participatory study designs, in order to:

○ Develop improved climate and weather modeling capacity for local scale assessments.

○ Study characteristics of communities and individuals that increase vulnerability to climate-related health effects.

○ Study communications methods and materials to determine the most effective way to communicate with individuals and communities regarding health protective behaviors for climate-related health threats.

Prevent...

climate-related health dangers to the maximum extent possible by drastically reducing greenhouse gas emissions to levels required to avoid the more severe manifestations of climate change, including massive sea level rise, temperature increases, flooding and droughts.

The federal government should:

77% of local health directors surveyed felt they lack resources to address climate-related health threats.

● Adopt a tight cap on U.S. greenhouse gas emissions and promote global reductions.

● Fund research on the most effective methods of communicating with the general public to motivate needed behavior changes that will reduce greenhouse gas emissions; the public health community has a critical role to play in developing and disseminating such messages.

The public health and medical community should:

● Assess, document and educate policymakers regarding the health costs associated with inaction or inadequate action on greenhouse gas reductions, and conversely, the health risks and benefits associated with policies that produce greater, more effective reductions in greenhouse gas emissions.

● Study, develop and implement best practices for communicating with the general public regarding personal behavior changes needed to reduce greenhouse gas emissions.

● Study, develop and adopt best practices for reducing greenhouse gas emissions from public health and health care facilities and operations.

Enhance...

public health by guiding climate change policies towards "win-win" situations, whereby greenhouse gas reductions or other desirable goals align with critical public health goals. Examples include transportation policies that increase physical activity and hence address the obesity epidemic, and agricultural policies that reduce methane emissions and improve nutrition.

The federal government should:

- Ensure that all interagency committees that develop comprehensive climate change policies have representatives from public health agencies.

- Formally assess the health co-benefits and potential harmful effects of major climate change policy initiatives.

- Expand the resources of state and local public health agencies so that they may participate more effectively in state and local policy decisions.

Energy, transportation and nutrition policies can be double winners, serving climate and health goals.

The public health community should:

- Seek opportunities to collaborate with transportation, energy, agricultural, environmental and other state and local agencies to optimize policy initiatives for public health.

- Analyze, document and educate policy makers regarding the potential health co-benefits and harmful effects of various climate change policies.

This report points to critical gaps in resources, programs and expertise in the U.S. public health system's capacity to respond to the growing health threats from climate change. Closing this gap will require policymakers' attention and a greater commitment to funding public health and disease prevention. On the other hand, there are many opportunities for synergy between existing public health preparedness activities (e.g. bioterrorism, pandemic flu, and all-hazard preparedness) and those addressing health threats from climate change. Moreover, there are numerous opportunities to reduce overall health expenditures in this country through energy, transportation and nutrition policies that are double winners, serving climate and health goals. Whether limited to public health or applied more broadly to the societal threat of global climate change, the old adage "an ounce of prevention is worth a pound of cure" holds true.

CHAPTER 1

Introduction

Global climate change currently contributes to disease and premature deaths[1] worldwide, increasing the risk of adverse health impacts from more severe heatwaves and other extreme weather events, reduced air quality, malnutrition and infectious diseases. Even if immediate, drastic cuts in greenhouse gas emissions are implemented, the planet is committed to additional significant changes in climate because of processes already set in motion by human activities in the last century. Recent assessments conclude that this climate change to which we are already committed could increase the incidence of illness and mortality in the United States.[2,3] Climate-related diseases and disasters that occur outside of the country may also threaten U.S. public health, as travelers and refugees import novel diseases. The unprecedented nature of climate change is likely to result in the emergence of unexpected risks to public health, as well.[4,5]

Given the challenge that U.S. public health faces, the agencies and organizations that are responsible for protecting public health need to increase their capacity to cope with climate change-related health risks. Increased public health preparedness would reduce the severity and extent of climate-related health impacts. Effective heatwave early warning systems in the United States, for example, have been shown to reduce the number of deaths during a heatwave,[6] suggesting that improving awareness of the risks of extreme heat would prevent future mortality. Surveillance programs could also expand to include monitoring for the spread of vectorborne and zoonotic diseases to areas where the temperatures are currently too cold to support the organisms that participate in disease-spreading cycles. Regulations can take into consideration more ozone formation and faster growth of pathogens with warmer temperatures. Engagement of the public health community should also include evaluating the health implications of major climate change and using public health expertise in behavior change to aid measures for reducing greenhouse gas emissions.

Despite the evidence of increasing climate change, and thus the importance of proactive development and deployment of public health interventions, it is unclear to what extent public health professionals in general view climate change as a public health issue. Although many of the anticipated health threats of climate change are within the current focus areas of public health departments, public health professionals may not be associating these problems with climate change, and hence may not be adequately preparing for future needs. This report is intended to highlight the gaps between the likely challenges to public health posed by climate change and the U.S. public health system's current state of preparedness. Information comes from existing literature and the results of a recent survey conducted by the authors. Understanding and addressing gaps in preparedness is critical to protecting the U.S. population against the health risks of climate change.

Climate change is expected to threaten health in the U.S.

The United States is experiencing long-term changes in temperature, precipitation and intensity of extreme weather events that are consistent with global climate

change.[7] These changes may affect the geographic range, incidence and severity of health outcomes that are sensitive to weather and climate, and they are likely to have dramatic impacts on human health and well-being. A host of important factors, including baseline health and nutritional status of the population, financial resources, access to medical care and effectiveness of public health programs will also moderate the ultimate severity of these health outcomes.

A recent assessment of the potential human health impacts of climate change, conducted for the U.S. Climate Change Science Program, concluded that climate change poses a risk for U.S. populations.[8] Official assessments consistently state that the following impacts are likely:[9]

• Increased frequency, intensity and length of heatwaves, leading to increased mortality, particularly in regions currently vulnerable to heatwaves;[10]

• Increased frequency and intensity of floods, droughts, windstorms and wildfire, resulting in increases in adverse health outcomes, including mental health impacts associated with these events;[11,12,13]

• Increased exposures to ground-level ozone and aeroallergens, thereby exacerbating cardiovascular and pulmonary illness;[14]

• Shift of the temperature distribution towards warmer temperatures, leading to increased risk of several food- and waterborne diseases, including those caused by *Salmonella,*[15] *Campylobacter,*[16] *Vibrio spp.,*[17,18] *Leptospiras,*[19] *Giardia*[20] and *Cryptosporidium.*[21]

Changes in vectorborne and zoonotic diseases are more uncertain; such diseases currently tracked in the United States are unlikely to pose a significant threat as long as current levels of public health programs are maintained.

Even assuming that the capacity of the United States to implement effective and timely adaptation measures remains high, the possibility of severe climate-related health impacts is not eliminated. The nature of climate-related risks, such as those posed by extreme weather events and conditions, means that some adverse health outcomes are unlikely to be avoidable, even with efforts to improve population resilience. For this reason, members of the public health community recognize that reducing greenhouse gas emissions and enhancing the effectiveness of the public health system are absolutely essential to protect people and prevent climate-related illness and death.[22]

Climate change health impacts will affect regions and populations differently

Severe health impacts will not be evenly distributed across populations and regions, but will be concentrated in the most vulnerable groups and regions. Particularly vulnerable populations include children, older adults, pregnant women and those with pre-existing medical conditions or mobility and cognitive constraints.[23] Poverty also increases susceptibility to climate-related health effects independently of any

associations with medical conditions conferring risk. Hurricane Katrina demonstrated that climate-related health impacts can place a disproportionate burden on disadvantaged populations.[24] During extreme weather events, poor people and communities may lack adequate shelter or access to protective resources such as air conditioning,[25] transportation, health care and emergency assistance. Climate change will likely magnify health disparities[26] as more frequent and severe heatwaves,[27,28] hurricanes, wildfires and floods cause deaths and injury[29] while simultaneously damaging health infrastructure.[30]

In addition, climate change poses greater health risks for people living in regions that have marginal water supplies, are low lying and prone to flooding or coastal surges, or experience more severe ecosystem changes as a response to changing climate (such as residents in the permafrost areas of the Arctic). Dense urban areas characterized by lack of vegetation and high proportions of paved surfaces are also likely to experience greater heat stress.[31] Public health departments can use an understanding of local and regional ecosystems and built environment characteristics to help identify the most vulnerable populations and target interventions specifically for them.

The nation's public health system is currently overburdened and underfunded

The U.S. public health system is a network of organizations, people and information and communication systems dedicated to protecting and promoting health and preventing disease.[32] With no single entity in charge, responsibility is divided among federal, state and local agencies, which differ greatly in resources, services, staffing and performance capacity.[33] In general, public health constitutes a small share of the nation's overall health expenditures. Although state and local public health agencies run programs ranging from disease surveillance to Medicaid administration, their spending made up less than 2.32% of all U.S. health spending in 2005, down from 2.37% in 2004.[34] The Institute of Medicine has concluded that the public health infrastructure is "neglected,"[35] with serious deficits in workforce, information systems and organizational capacity.[36]

In the aftermath of the 2001 terrorist attacks, substantial increases in federal funding for preparedness and response to public health emergencies have allowed state and local health departments to significantly improve their emergency response capacities for bioterrorist attacks and pandemic influenza.[37] The Public Health Emergency Preparedness Cooperative has provided more than $5 billion to state, local, tribal and territorial public health departments since 2002, which has supported reporting networks and public health professional training, as well as the development of the Strategic National Stockpile and Cities Readiness Initiative.[38]

However, integrating preparedness activities with other public health responsibilities has been challenging. Although emergency preparedness funding has been distributed, local, state and federal public health agencies are only at the rudimentary stages of planning, sorting out responsibilities, sharing resources and establishing robust communication networks.[39] And even as state and local health agencies work to meet preparedness goals, funding has declined. Since 2005, a more than 25%

decline in public health preparedness funding[40] threatens the sustainability of new emergency preparedness programs.[41]

The increasing burden of chronic and emerging diseases has also added new responsibilities to already overburdened public health systems, but per capita spending and workforce availability have not kept pace.[42] Public health remains seriously underfunded.[43] Citing urgent threats including climate change, Centers for Disease Control and Prevention (CDC) Director Julie Gerberding advocated in March 2007 for a $1 billion increase to bring the CDC's budget to $10.2 billion.[44] Instead, the President's FY 2008 budget cut CDC funding by 2.8% of what would maintain 2007 funding levels (adjusted for inflation), although the CDC's final budget for FY 2008 was ultimately approved at $9.2 billion.[45] The proposed FY 2009 budget would once again cut CDC funding by $417 million from 2008 levels.[46]

How well can the nation's public health system respond to climate-related health threats?

Responses to Hurricanes Katrina and Rita[47] raise strong concerns as to how well public health systems will respond to increasingly frequent, severe and prolonged disasters because of climate change.[48] While there were some short-term success stories with these hurricanes, such as the limitation in food- and waterborne infectious disease outbreaks, there were serious shortcomings in the continuity of health services, follow-up of vulnerable populations and protective environmental health controls. In response, several federal programs are aiming to improve coordination by targeting limited resources and supplying accurate information to health care providers after climate-related disasters and disease outbreaks.[49] Nonetheless, public confidence is low. In 2007, nearly 60% of Americans felt that their community would be unprepared to respond to a natural disaster.[50] A 2006 White House report on lessons learned from Hurricane Katrina determined that nationwide disaster preparedness will "require significant and lasting change to the status quo, to include adjustments to policy, structure, and mindset."[51]

Current disease surveillance and response capabilities are likely insufficient to effectively address novel climate-related health effects.[52] Augmenting various CDC tracking and monitoring systems, including ArboNET,[53] FoodNet[54] and PulseNet,[55] could help combat potential mosquito- and foodborne disease increases caused by climate change. Twelve states presently lack an electronic disease surveillance system compatible with the national system,[56] and nationwide disease monitoring remains disconnected from monitoring of related health, behavioral and environmental factors.[57] A similar gap exists between human and animal health agencies, which if bridged, would facilitate quicker responses to climate-related emerging zoonotic disease outbreaks.[58,59] In addition, public health departments and state public health laboratories have reported difficulty recruiting and retaining qualified epidemiologists and laboratory scientists.[60]

Emergency medical facilities are a critical element of preparedness for climate change, especially for projected increases in extreme weather events. A series of recent Institute of Medicine reports raised concerns that the nation's facilities are challenged by day-to-day patient loads and are poorly prepared to deal with large disasters.[61,62,63]

Research on the health impacts of climate change is also essential for anticipating and reducing health risks. A 2007 Congressional Research Service report on federal climate change expenditures calls research "the cornerstone of the U.S. strategy to address global climate change."[64] However, funding for research on the health impacts of climate change is minimal. Between FY 2003 and 2007, funding for health research constituted less than 5% of the overall U.S. Climate Change Science Program (CCSP) budget.[65] And of the $50 million dollars spent on CCSP research in the Department of Health and Human Services, the vast majority went to research on the effects of UV radiation and the effectiveness of sunblocks, rather than health issues more directly related to climate change.[66] A National Academy of Sciences review of the CCSP noted the lack of progress in understanding human impacts and vulnerabilities, citing the low level of funding and "atomized" research effects among multiple agencies.[67]

A nationwide climate change health sector assessment updated in 2006 noted that although the United States has a high capacity to respond to climate change, little implementation of adaptive measures has been documented.[68] The Director of the Division of Environmental Hazards and Health Effects at the CDC asserted in March 2007 that the "public health effects of climate change remain largely unaddressed."[69]

What do previous surveys tell us about the state of public health preparedness in the United States?

Previous surveys of state and local health departments suggest deficiencies in the nation's ability to respond to the projected and unanticipated health impacts of climate change. When the Association of State and Territorial Health Officials surveyed 49 state environmental health directors in 2006–2007, 37% reported discontinuing environmental health programs, commonly because of lack of funding.[70] Furthermore, only 68% of state environmental health programs reported funding for emergency response planning.

The National Association of County and City Health Officials (NACCHO) surveyed 2,300 local health departments (with a response rate of 80%) in 2005.[71] Most local health departments reported strengthening preparedness planning (97%), communication systems (94%) and workforce training (91%) over the previous three years in order to improve emergency preparedness. Results indicated that 59% had an emergency preparedness coordinator and 80% had an environmental health specialist (sanitarian), while only 25% had an epidemiologist and 30% had an information systems specialist. Eighty-nine percent of local health departments conducted some surveillance for infectious diseases.

In 2007, NACCHO sent another survey to a random sample of the health departments that responded in 2005, as well as to one representative of the local health departments in each state.[72] Most local health departments were actively preparing for the weather-related emergencies that may increase in frequency and severity because of climate change, but many had reduced staff time on preparedness, delayed the completion of preparedness plans or canceled workforce training. Whereas 19% reported feeling "highly prepared" for an emergency, 77% believed

more improvement in preparedness was needed. Almost all local health departments had developed all-hazards preparedness plans (99%), administered workforce training in emergency response (95%) and implemented the National Incident Management System (96%), a template to coordinate emergency planning and response among various agencies. However, 40–60% of departments that had engaged in these activities reported completing them only "to a small extent." Local health officials expressed concern about the impact of funding cuts on preparedness programs, and 56% of departments reported that CDC funding was insufficient support for the deliverables expected by the CDC.

CHAPTER 2

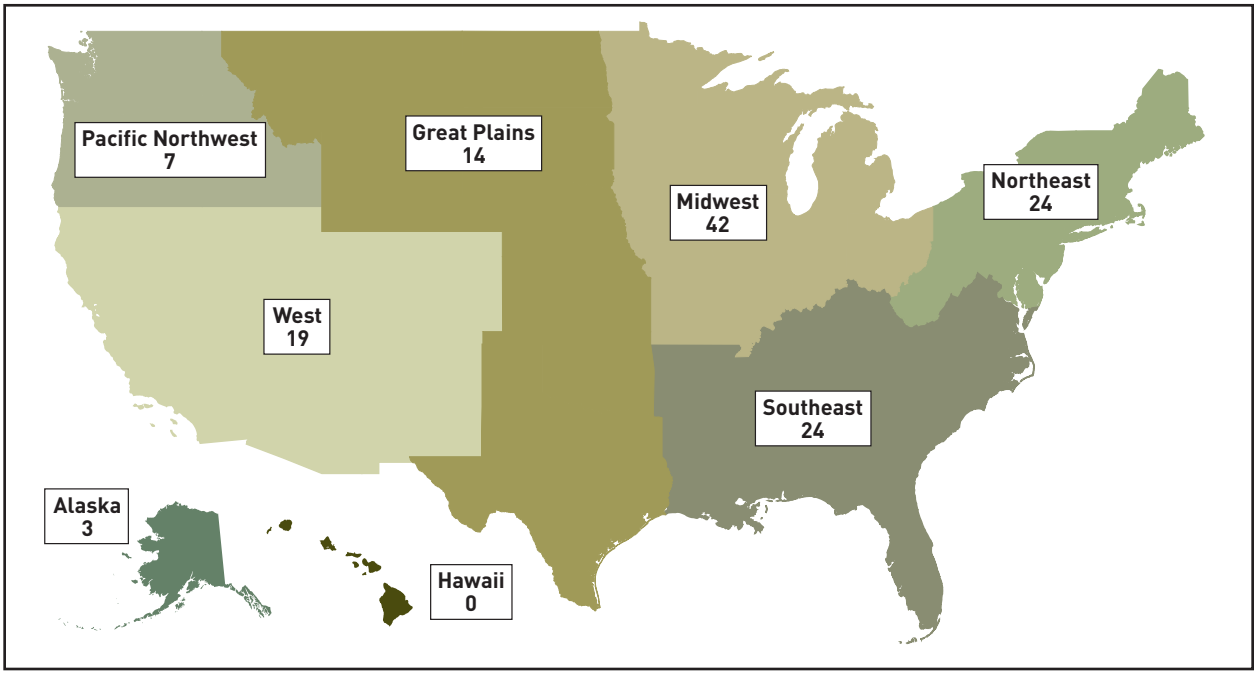
Survey methods

To gain a greater understanding of public health's preparedness for climate change, Environmental Defense Fund (EDF), George Mason University (GMU) and the National Association of County and City Health Officials (NACCHO) developed a telephone survey for the directors of local health departments that asked respondents to discuss their perception of climate-related health risks and the status and adequacy of their departments' programmatic activities in response to these risks. The survey asked several four-point Likert-type questions, to which participants could strongly disagree, disagree, agree or strongly agree, with an option to respond "don't know" (see Appendix for survey questions). It also asked respondents to identify the regulatory roles they perform, the programs in place that address policies and activities to reduce greenhouse gas emissions, and the additional resources needed to allow their departments to more effectively deal with climate change as a public health issue.

After pretesting the survey for length, clarity and comprehension, a geographically representative random sample was selected of 217 local health departments out of NACCHO's 2,296 members. On November 2, 2007, the directors of these departments received a letter from NACCHO that described the purpose of the survey and encouraged their participation. Approximately one week later, trained

FIGURE 1

Regional distribution of EDF-GMU-NACCHO survey respondents



Regions included: Great Plains (ND, SD, WY, NE, KS, OK, TX, MT), Midwest (OH, IN, IL, MO, IA, WI, MI, MN), Northeast (ME, NH, VT, MA, CT, RI, NY, NJ, PA, DE, MD, WV), Southeast (VA, NC, SC, GA, FL, LA, AL, MS, TN, KY, AR), West (CA, NV, UT, AZ, CO, NM), Pacific Northwest (WA, OR, ID) and Alaska.

Source: This regional distribution is based on that used in the U.S. National Assessment of Climate Change (2000). U.S. Climate Change Science Program. 2000. U.S. National Assessment of the Potential Consequences of Climate Variability and Change: A detailed overview of the consequences of climate change and mechanisms for adaptation. http://www.usgcrp.gov/usgcrp/nacc/default.htm (accessed April 10, 2008).

interviewers began contacting participants via email and telephone to request an interview. About five contact attempts were made before a participant was considered a passive refusal.

A total of 133 members of the sample agreed to be interviewed and completed the survey; most of these interviews (78.9%, n=105) were completed by December 22, 2007, and the fielding of the survey ended February 22, 2008. Of the remaining members of the sample, 17.5% (n=38) actively refused to participate, usually citing that their schedules were too busy, and 21.2% (n=46) passively refused by virtue of not responding to interviewer calls or emails. Thus, the survey completion rate for this study was 61.3%. Respondents were categorized by region of the country (see Figure 1) and by departmental budget size (less than $1 million, $1–10 million, greater than $10 million and unknown). All data were entered into Excel, with verification, and imported into SPSS version 14.0 for analysis.

CHAPTER 3
Findings

What are local health department directors' perceptions of climate change and its potential public health effects?

The majority of local health department directors surveyed perceived climate change to be a relevant threat in their jurisdiction (see Figures 2–5). Nearly 70% believed that their jurisdiction had experienced climate change in the past 20 years, and 78% believed their jurisdiction will experience climate change in the next 20 years. Approximately 60% believed their jurisdiction will experience one or more serious public health problems as a result of climate change over the next 20 years. Less than 10% believed their jurisdiction would not experience problems.

A significant proportion of respondents believed that climate change had already affected 12 distinct threats to health in their jurisdiction (see Figures 6–7). The majority of respondents believed that heatwaves and heat-related illness (73%) reduced air quality (65%), reduced water quality or quantity (63%), and droughts, forest fires and brush fires (59%) would become more common or severe over the next 20 years.

Despite their recognition of climate change as a threat to health in their jurisdiction, relatively few health department directors surveyed reported that climate change was a top priority for their health department. Only 19% of respondents indicated that climate change was among their department's top ten current priorities, and only 6% indicated climate change was one of their health department's current top five priorities.

Do local health directors believe they have the necessary knowledge and expertise available to them to address climate change health threats?

Most health department directors (approximately two-thirds) felt that they themselves were knowledgeable about the potential public health impacts of climate change, but fewer than half felt that other relevant senior managers in their health department were similarly knowledgeable. Moreover, less than one-third of respondents felt that other pertinent stakeholders in their community (i.e., appointed and elected officials, business leaders and health care delivery leaders) had knowledge of the potential public health impacts of climate change. It is important to note that very few respondents (less than 5%) "strongly agreed" that any key stakeholder group in their community, including themselves, was knowledgeable about the issue.

The large majority of directors (77%) believed that their local health department lacked expertise in assessing the public health risks of climate change in their jurisdiction. In addition, they believed their department lacked expertise in developing effective adaptation (83%) and mitigation plans (86%) (see Figures 8–10). The directors also believed that only 26% of their state departments had the expertise to develop adaptation plans, and only 16% of their state departments had the expertise to develop mitigation plans. Similarly, relatively few respondents believed that the CDC currently had sufficient expertise to help them develop an adaptation plan (34%) or a mitigation plan (25%) for their jurisdiction.

Local health department directors' perceptions about general climate change impacts and its priority (Figures 2–5)

FIGURE 2

My jurisdiction has experienced climate change **in the past 20 years**.

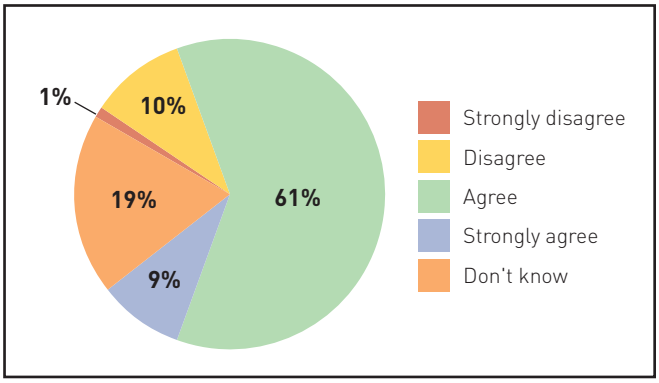


FIGURE 3

My jurisdiction will experience climate change **in the next 20 years**.

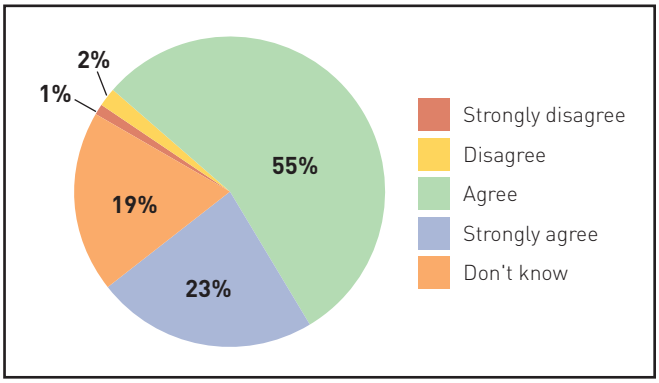


FIGURE 4

In the next 20 years, it is **likely that my jurisdiction will experience one or more serious public health problems** as a result of climate change.

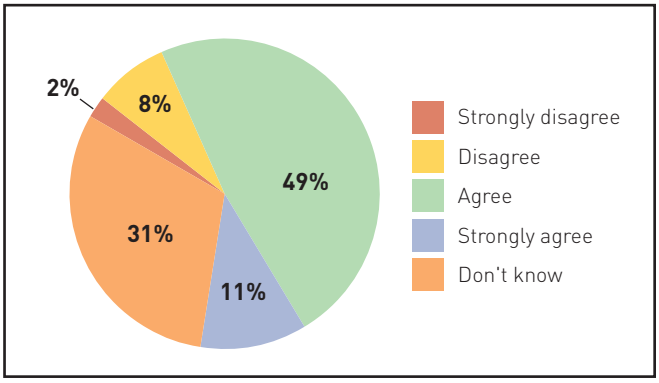
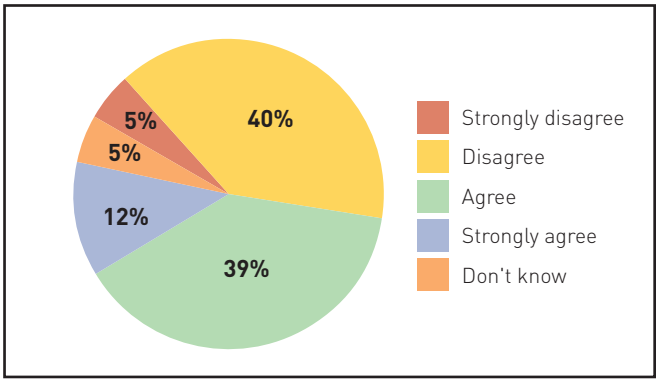


FIGURE 5

Preparing to deal with the public health effects of climate change is **an important priority for my health department**.



Local health department directors' perceptions about specific local impacts of climate change (Figures 6–7)

FIGURE 6
Has climate change **already affected** this health issue in your jurisdiction?

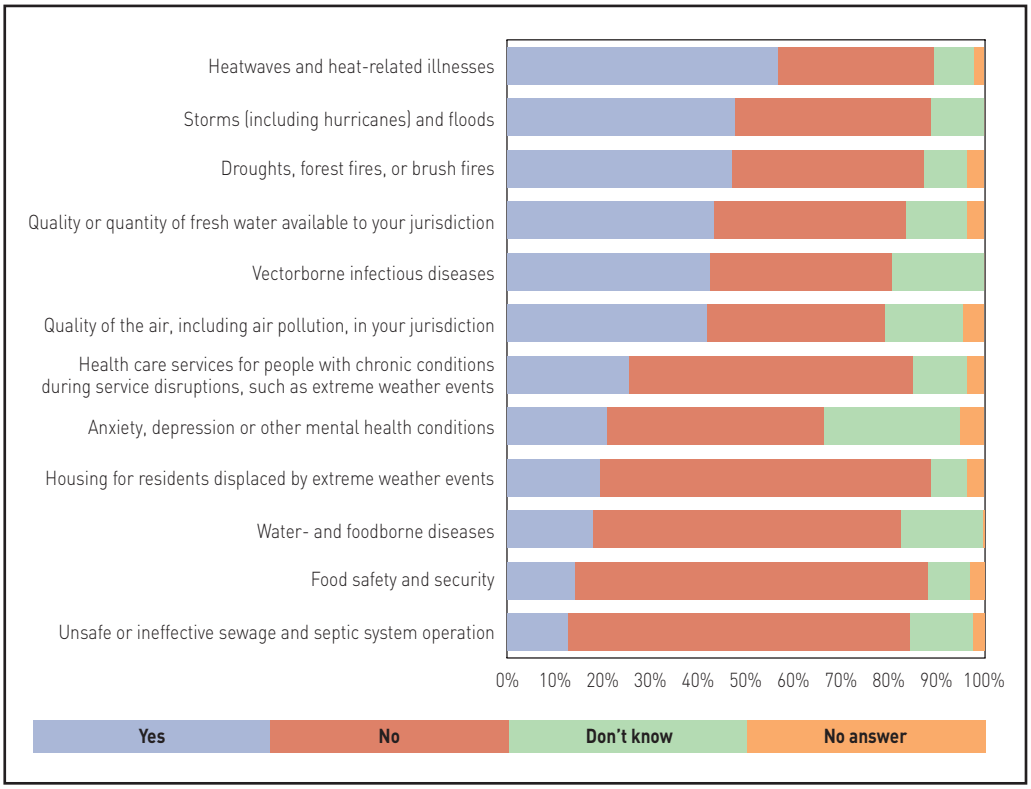
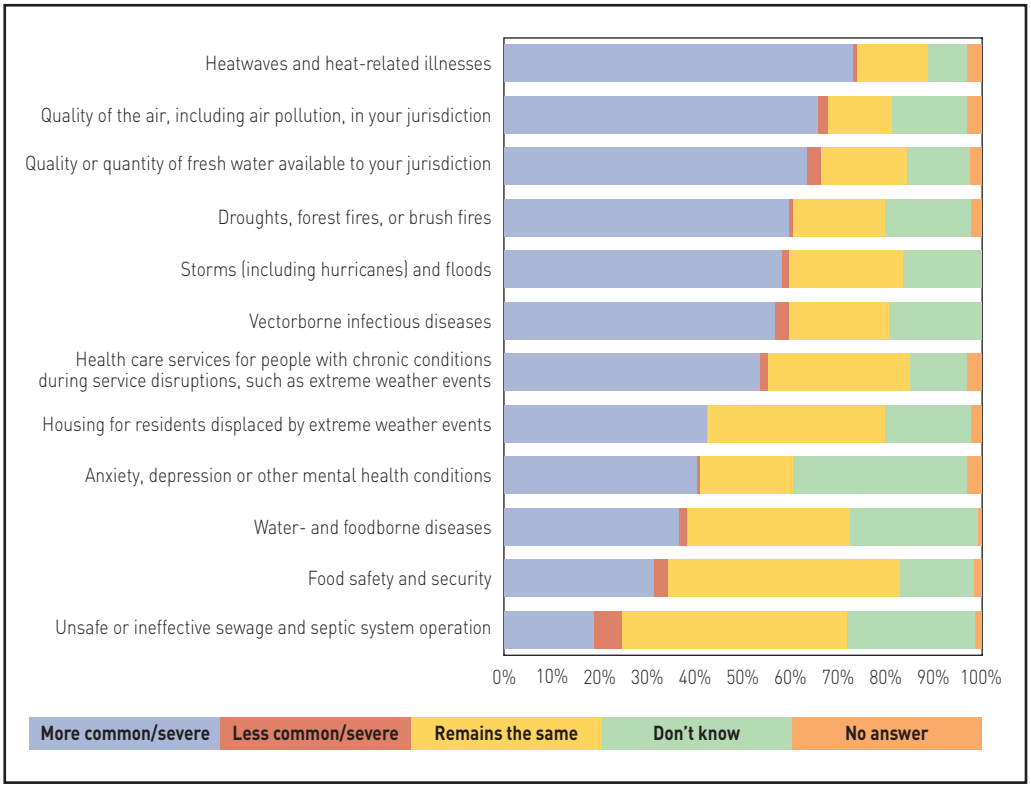


FIGURE 7
Over the next 20 years, will climate change make this issue **more** common or severe, **less** common or severe, or will it **remain the same** in your jurisdiction?



Local health department directors' perceptions of expertise available to them on the public health aspects of climate change (Figures 8–10)

FIGURE 8

My health department currently has ample **expertise to assess** the potential public health impacts associated with climate change that could occur in my jurisdiction.

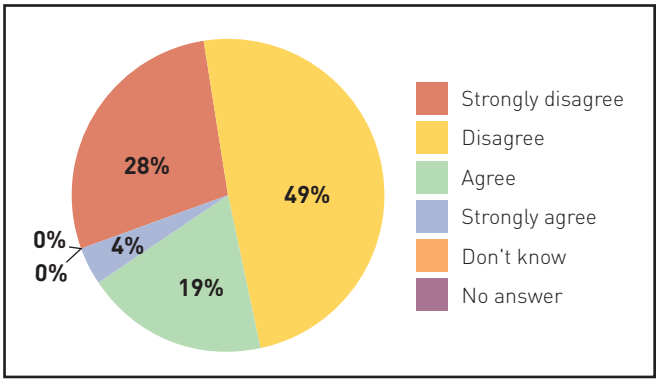


FIGURE 9

My health department currently has ample expertise to create an effective climate change **adaptation plan**.

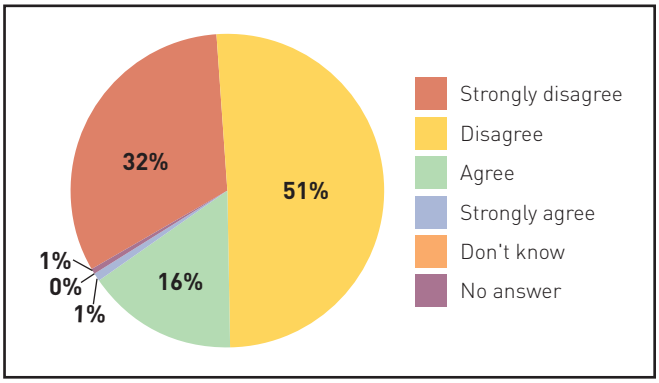
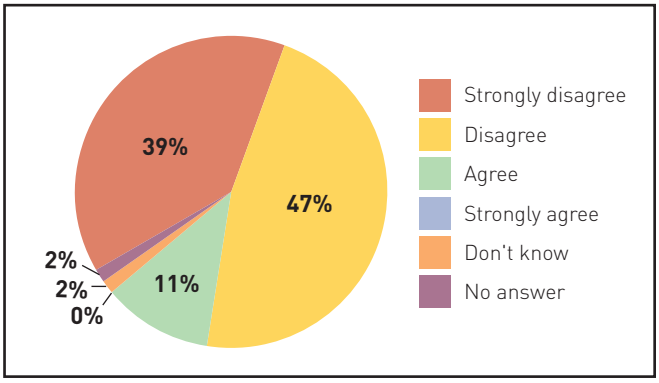


FIGURE 10

My health department currently has ample expertise to create an effective climate change **mitigation plan**.



Do health departments currently have programs that address climate-sensitive health threats?

Nearly all respondents indicated that their health department currently had program activities that address at least some of the potential effects of climate change on the public's health (see Figure 11). The most common areas of relevant programmatic activity were water- and foodborne diseases (97%), vectorborne infectious diseases (95%) and food safety and security (90%). The least common were housing for residents displaced by extreme weather events (38%), droughts, forest fires and brush fires (38%), and anxiety, depression and mental health conditions (31%).

Do current programs take into account the impacts of climate change?

Some respondents indicated that they did currently, or planned to, incorporate climate change adaptation into at least some of their programmatic activities (see Figure 12). The most common areas of current or future programmatic activity related to climate change were emergency preparedness (71%), storms and floods (56%), vectorborne infectious diseases (53%) and water- and foodborne diseases (50%). The least common were anxiety, depression and other mental health conditions (15%), droughts, forest fires and brush fires (24%), housing for residents displaced by extreme weather events (32%) and air quality (32%).

What activities are local health departments currently doing, or planning, that can help prevent further climate change?

Whereas few local health departments surveyed had programs explicitly designed to reduce greenhouse gas emissions, a substantial proportion did have programs whose goals were consistent with mitigation objectives. The most common relevant current programs were those that encourage active transportation, such as cycling and walking (50%), and programs that encourage purchase of locally grown, organic or plant-based foods (34%). The least common were those that pertain directly to climate change mitigation, including programs to help residents reduce their greenhouse gas emissions (5%), programs to reduce residents' fossil fuel use or conserve energy (6%) and programs to educate the public about the potential impact of climate change on health (8%).

Relatively few health departments were currently planning new public programs directly or indirectly relevant to mitigation. The most common of these were public education programs about the potential impact of climate change on health (17%) and active transportation programs (11%). The least common were programs to encourage use of mass transportation (6%) and programs to help residents reduce their greenhouse gas emissions (8%) or fossil fuel use (8%).

Of special note were current and planned efforts by health departments to reduce the greenhouse gas emissions and energy use associated with the operation of their department. Relatively few presently had a program to reduce fossil fuel use or

Climate change adaptation activities of local health departments (Figures 11–12)

FIGURE 11
Is this a **current activity** in your health department?

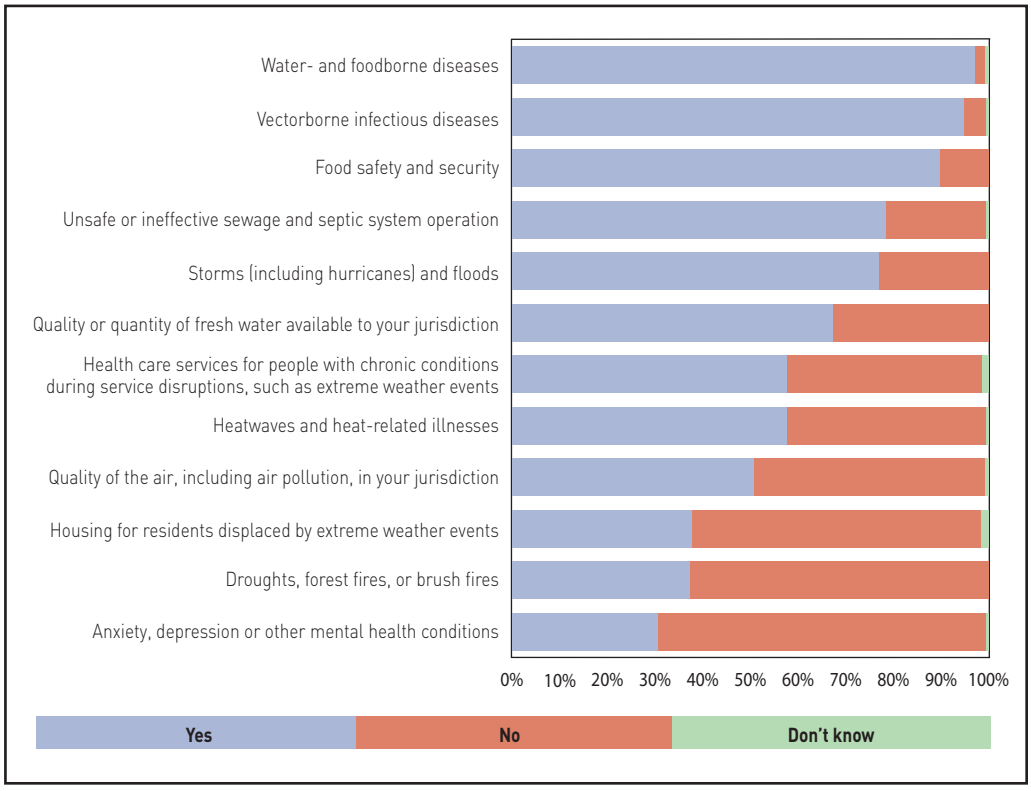
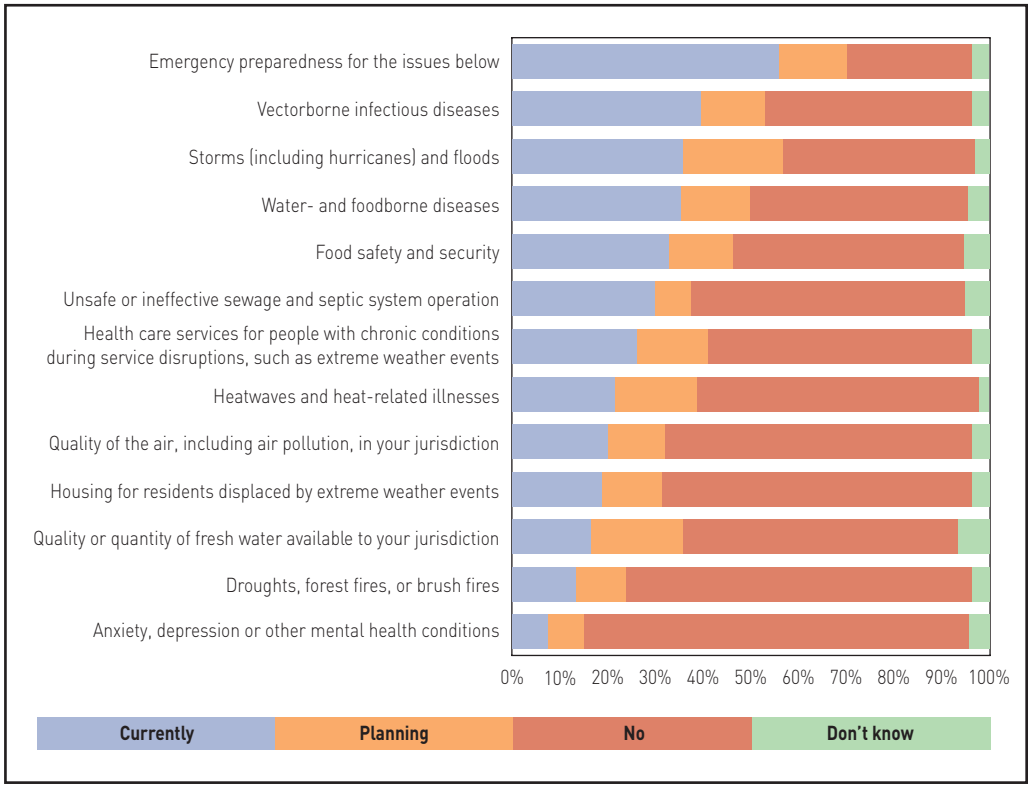


FIGURE 12
Do you currently or are you planning to **incorporate climate change adaptation** into your planning in the following area?



conserve energy in health department operations (21%) or to specifically reduce their greenhouse gas emissions (12%), with relatively few others planning such programs (19% and 14%, respectively).

What resources do local health departments need to better address climate change?

The large majority of respondents (77%) indicated that additional resources, if available, would significantly improve their department's ability to deal with climate change as a public health issue. A small number of respondents (9%) indicated that additional resources were not needed, and a few more (14%) indicated that they did not know if additional resources would be helpful or not.

Among respondents who indicated that additional resources would be helpful, the categories of resources specified were: additional funding to support the activity (63%), additional staff (54%), staff training (29%), equipment (10%) and assorted other resources (17%).

How did some of these responses compare by region or department size?

Over 50% of respondents in each region of the country agreed or strongly agreed that their jurisdiction will experience one or more serious climate-related health problems in the next 20 years. The response was 57% in the Great Plains, 55% in the Midwest, 58% in the Northeast, 63% in the Southeast, 68% in the West, 57% in the Pacific Northwest and 66% in Alaska (see Figure 1).

Similarly, at least half of respondents, regardless of budget size, agreed or strongly agreed that climate change was an important priority for their department. The response was 52% for departments with budgets of less than $1 million, 50% for departments with budgets of $1–10 million, 50% for departments with budgets greater than $10 million and 55% of those whose budgets were unknown.

In addition, very significant majorities in all four budget categories agreed that additional resources would significantly improve their ability to deal with climate change-related health threats (81% for departments with budgets of less than $1 million, 73% for departments with budgets of $1–10 million, 79% for departments with budgets greater than $10 million and 89% of those whose budgets were unknown). The most commonly cited resource was additional funding (41%, 49%, 53%, 56%), followed by additional staff (37%, 46%, 37%, 56%), staff training (15%, 32%, 13%, 22%), equipment (19%, 7%, 0%, 11%) and other (19%, 8%, 21%, 11%).

CHAPTER 4
Discussion

Climate change is currently causing death and disease around the world, and the health burden is certain to increase as the severity of climate change progresses over the foreseeable future. Climate-sensitive health outcomes of importance to the United States include death and morbidity from heatwaves; deaths, injuries and infections associated with more intense hurricanes and other extreme events; heart and lung diseases related to poor air quality; food- and waterborne diseases; and vectorborne and zoonotic diseases. Threats to the U.S. population may also arise from novel agents or from disease outbreaks in other parts of the world.

However, there is still limited awareness of the potential health impacts of climate change. As reported in the survey, local public health officials are only beginning to recognize the risks and to implement policies and measures to reduce current impacts and those projected to occur over the short and long term. Over the short term, increasing health protection through a range of adaptation measures is critical to increasing the resilience of the most vulnerable populations and regions.[73] Over the long term, limitations in the ability to adapt to more drastic climate change mean that greenhouse gas emissions must be reduced rapidly and comprehensively in order to decrease the severity of future health impacts.

Local public health departments are the "first line of defense" in our public health system. They are responsible for identifying cases of infectious diseases before an epidemic develops, ensuring that water and food are safe and free of pathogens and other contaminants, and protecting susceptible populations, such as persons with asthma and other chronic respiratory diseases, from ill effects of elevated concentrations of air pollutants and aeroallergens. Unfortunately, the current public health system is greatly challenged to keep up with existing levels of health threats, including climate-sensitive ones.

As noted in the survey, health department directors believe that climate change will make their job more difficult by increasing the frequency and intensity of extreme weather events, increasing concentrations of harmful air pollutants and providing opportunities for vectors and pathogens to alter their geographic range and intensity of disease transmission. Hurricane Katrina and the 2003 heatwave in Europe showed that the poor and the elderly were not sufficiently protected by current public health systems from the effects of extreme weather events. This raises concern about the adequacy of those systems to provide protections from more frequent and severe events. Although this survey demonstrates that public health departments recognize that climate change is likely to affect the health of their community, the low priority generally given to addressing climate change impacts must change if the most vulnerable members of society are to be adequately protected.

The CDC is beginning outreach and education efforts by identifying 11 priority health actions to prepare for and respond to climate change[74] and holding climate change workshops for health professionals.[75] However, the CDC can clearly expand these efforts,[76] and key organizations such as the American Medical Association and the Association of State and Territorial Health Organizations have yet to define policies and programs that will help address the health effects of climate change.

Directors of local health departments believe a lack of human and financial resources is a key constraint to incorporating climate change into public health

preparedness. The survey reveals concerns about availability of expertise on climate change health impacts within the public health community and the level of planning and capacity building initiated to respond to this shortfall. Additional training and capacity building are necessary to prepare public health professionals to deal with the urgent threats of climate change. This training needs to include approaches to identifying climate-related novel health problems at an early stage, quantifying possible future health risks at local and regional scales, and identifying and deploying effective adaptation and mitigation measures to address those risks. There also needs to be better coordination and collaboration across sectors, as choices taken and technologies implemented in other sectors will influence human health. Support from federal, state and local policymakers and funders to bolster public health agencies will not only improve the ability of those agencies to respond effectively to future health threats, it will also provide greater capacity for public health agencies to lend their expertise in critical policy decisions that have significant public health implications.

Recent examples of extreme weather events strongly suggest that even a greatly enhanced public health system will still have limited ability to protect people from many of the more dire consequences of climate change. This is especially true of the severe changes that are likely to ensue if greenhouse gases emissions are not drastically reduced around the world in the coming decades. Therefore, the public health community has a great interest and an important role to play in changing policies and personal behaviors that can lead to reductions in greenhouse gases. This is true not only because of the health threats associated with unchecked climate change, but also because of many potential health benefits associated with greenhouse gas reduction measures. Changes in energy and transportation policies, urban planning and community development and food systems all have enormous implications for public health. It is critical that the public health community has both the expertise and the resources to help assure the public's health is considered and appropriately protected in the midst of these changes.

CHAPTER 5

Recommendations

Our recommendations can be summed up in three words: **protect, prevent** and **enhance.**

Protect...

public health from climate change effects by assuring the responsiveness and efficacy of the public health system.

The federal government should:

- Sponsor a study by the National Academy of Sciences and Institute of Medicine to make recommendations for designing an integrated public health system that can respond to the suite of 21st-century health threats, including climate change, pandemic influenza, emerging and reemerging communicable diseases, and bioterrorist acts.

- Increase funding to support and expand federal, state and local public health systems in order to:

  - Further strengthen and integrate current surveillance networks, such as FoodNet, and improve syndromic surveillance systems. This clearly has benefits for public health beyond just climate-related effects.

  - Develop an adequate rapid response system for extreme weather events. This will include dispatchable personnel, equipment and pharmaceuticals, as well as the assurance of having adequate emergency medical facilities located throughout the country in areas most likely to be affected by extreme weather.

  - Develop a robust, consultative system to assist state and local public health departments in vulnerability assessments and response planning for the health impacts of climate change.

  - Develop training programs for public health professionals on health risks, interventions, and opportunities related to climate change.

- Increase funding for research on climate change and health, including community-based, participatory study designs, in order to:

  - Develop improved climate and weather modeling capacity for local scale assessments.

  - Study characteristics of communities and individuals that increase vulnerability to climate-related health effects.

  - Study communications methods and materials to determine the most effective way to communicate with individuals and communities regarding health protective behaviors for climate-related health threats.

Prevent...

climate-related health dangers to the maximum extent possible by drastically reducing greenhouse gas emissions to levels required to avoid the more severe manifestations of climate change, including massive sea level rise, temperature increases, flooding and droughts.

The federal government should:

- Adopt a tight cap on U.S. greenhouse gas emissions and promote global reductions.

- Fund research on the most effective methods of communicating with the general public to motivate needed behavior changes that will reduce greenhouse gas emissions; the public health community has a critical role to play in developing and disseminating such messages.

The public health and medical community should:

- Assess, document and educate policymakers regarding the health costs associated with inaction or inadequate action on greenhouse gas reductions, and conversely, the health risks and benefits associated with policies that produce greater, more effective reductions in greenhouse gas emissions.

- Study, develop and implement best practices for communicating with the general public regarding personal behavior changes needed to reduce greenhouse gas emissions.

- Study, develop and adopt best practices for reducing greenhouse gas emissions from public health and health care facilities and operations.

Enhance...

public health by guiding climate change policies towards "win-win" situations, whereby greenhouse gas reductions or other desirable goals align with critical public health goals. Examples include transportation policies that increase physical activity and hence address the obesity epidemic, and agricultural policies that reduce methane emissions and improve nutrition.

The federal government should:

- Ensure that all interagency committees that develop comprehensive climate change policies have representatives from public health agencies.

- Formally assess the health co-benefits and potential harmful effects of major climate change policy initiatives.

- Expand the resources of state and local public health agencies so that they may participate more effectively in state and local policy decisions.

The public health community should:

- Seek opportunities to collaborate with transportation, energy, agricultural, environmental and other state and local agencies to optimize policy initiatives for public health.

- Analyze, document and educate policy makers regarding the potential health co-benefits and harmful effects of various climate change policies.

CHAPTER 6

Conclusion

This report points to critical gaps in resources, programs and expertise in the U.S. public health system's capacity to respond to the growing health threats from climate change. Closing this gap will require policymakers' attention and a greater commitment to funding public health and disease prevention. On the other hand, there are many opportunities for synergy between existing public health preparedness activities (e.g. bioterrorism, pandemic flu, and all-hazard preparedness) and those addressing health threats from climate change. Moreover, there are numerous opportunities to reduce overall health expenditures in this country through energy, transportation and nutrition policies that are double winners, serving climate and health goals. Whether limited to public health or applied more broadly to the societal threat of global climate change, the old adage "an ounce of prevention is worth a pound of cure" holds true.

APPENDIX

EDF-GMU-NACCHO survey

The following questions comprised the EDF-GMU-NACCHO survey on public health departments' responses to climate change. For reading ease, the form of the survey below omits certain explanatory and contextual information given to the respondents at the time of the interviews. The full survey instrument is available upon request.

Background

1. What is your position at your health department?

2. What is the approximate annual budget for your health department?

3. Approximately how many staff members in full-time equivalents does your health department have?

Climate change

4. People have different ideas about what climate change is. In your own words, what do you think the term "climate change" means?

Knowledge

5a. I am knowledgeable about the potential public health impacts of climate change.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

5b. The other relevant senior managers in my health department are knowledgeable about the potential public health impacts of climate change.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

5c. Many of the other relevant appointed officials in my jurisdiction outside of the public health system—such as environmental, agricultural, forestry and wildlife, energy and transportation officials—are knowledgeable about the potential public health impacts of climate change.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

5d. Many of the relevant elected officials in my jurisdiction are knowledgeable about the potential public health impacts of climate change.
☐ Strongly disagree ☐ Disagree ☐ Agree; ☐ Strongly agree ☐ Don't know

5e. Many of the business leaders in my jurisdiction are knowledgeable about the potential public health impacts of climate change.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

5f. Many of the leaders of the health care delivery system in my jurisdiction—including the hospitals and medical groups—are knowledgeable about the potential public health impacts of climate change.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

Perception

6a. My jurisdiction has experienced climate change in the past 20 years.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

6b. My jurisdiction will experience climate change in the next 20 years.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

6c. In the next 20 years, it is likely that my jurisdiction will experience one or more serious public health problems as a result of climate change.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

6d. My health department currently has ample expertise to assess the potential public health impacts associated with climate change that could occur in my jurisdiction.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

6e. Preparing to deal with the public health effects of climate change is an important priority for my health department.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

7a. Would you say that preventing or preparing for the public health consequences of climate change is among your health department's top ten current priorities?
☐ Yes ☐ No ☐ Don't know

7b. *(If Yes for Q7a)* Which number—from one to ten, with one being the highest priority—would you say best characterizes the priority given to climate change currently in your health department?

Programmatic activity

8. Are the following health issues currently areas of programmatic activity for your health department?

a. Heatwaves and heat-related illnesses? ☐ Yes ☐ No ☐ Don't know
b. Storms, including hurricanes and floods? ☐ Yes ☐ No ☐ Don't know
c. Droughts, forest fires or brush fires? ☐ Yes ☐ No ☐ Don't know
d. Vectorborne infectious diseases? ☐ Yes ☐ No ☐ Don't know
e. Water- and foodborne diseases? ☐ Yes ☐ No ☐ Don't know
f. Anxiety, depression or other mental health conditions? ☐ Yes ☐ No ☐ Don't know
g. Quality or quantity of fresh water available to your jurisdiction? ☐ Yes ☐ No ☐ Don't know

h. Quality of the air, including air pollution, in your jurisdiction? ☐ Yes ☐ No ☐ Don't know
i. Unsafe or ineffective sewage and septic system operation? ☐ Yes ☐ No ☐ Don't know
j. Food safety and security? ☐ Yes ☐ No ☐ Don't know
k. Housing for residents displaced by extreme weather events? ☐ Yes ☐ No ☐ Don't know
l. Health care services for people with chronic conditions during service disruptions, such as extreme weather events? ☐ Yes ☐ No ☐ Don't know

9a. Are there other possible health effects associated with climate change in your jurisdiction that I have not mentioned? ☐ Yes ☐ No ☐ Don't know

9b. *(If Yes for Q9a)* What are those health effects?

9c. *(If Yes for Q9a)* Is this health issue currently an area of programmatic activity for your department? ☐ Yes ☐ No ☐ Don't know

10a. Does your health department use long-range weather or climate information in planning or implementing any programmatic activities? ☐ Yes ☐ No ☐ Don't know

10b. *(If Yes for Q10a)* Do you use long-range weather or climate information in your planning or implementation of *(each of the health issues a–l listed above)*?
☐ Yes ☐ No ☐ Don't know

11. Do you think climate change has already affected *(each of the health issues a–l listed above)* in your jurisdiction? ☐ Yes ☐ No ☐ Don't know

12. Do you think that over the next 20 years climate change will likely make *(each of the health issues a–l listed above)* more common or severe, less common or severe, or that the problem will remain the same in your jurisdiction over the next 20 years?
☐ More common or severe ☐ Less common or severe ☐ Remain the same ☐ Don't know

13. Which of the potential health impacts of climate change that we have discussed, if any, are of greatest concern to you as a public health official? Feel free to name up to three outcomes.

14. Which of these three is your greatest concern? And which is your second greatest concern?

Adaptation expertise

15a. My health department currently has ample expertise to create an effective climate change adaptation plan.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

15b. My state health department currently has ample expertise to help us create an effective climate change adaptation plan in this jurisdiction.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

15c. The Centers for Disease Control and Prevention currently has ample expertise to help us create an effective climate change adaptation plan in this jurisdiction.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

15d. The health care delivery system in my jurisdiction—including the hospitals and medical groups—has ample expertise to create an effective climate change adaptation plan.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

Adaptation plans

16. Is your health department currently incorporating, planning to incorporate or not planning to incorporate adaptation into your programs for *(each of the health issues a–l listed above)*?
☐ Currently incorporating ☐ Planning to incorporate ☐ Neither currently nor planning to incorporate ☐ Don't know

The following questions were only asked if the response to Q16 was "currently" or "planning":

17. How many staff members—in full-time equivalents—does/will this program have?

18. What is/will be the annual budget for this program?

19. In your opinion, is this an adequate level of funding for the program?
☐ Yes ☐ No ☐ Don't Know

The following question was only asked if the response to Q16 was "currently":

20. Next year, will the annual budget for this program increase, decrease or remain about the same?
☐ Increase ☐ Decrease ☐ Remain the same; ☐ Don't know

Mitigation expertise

21a. My health department currently has ample expertise to create an effective climate change mitigation plan.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

21b. My state's health department currently has ample expertise to help us create an effective climate change mitigation plan in this jurisdiction.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

21c. The Centers for Disease Control and Prevention currently has ample expertise to help us create an effective climate change mitigation plan in this jurisdiction.
☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree ☐ Don't know

Mitigation plans

22. Does your department currently have, plan to have, or not have nor plan to have programs focused on the following activities?

- **a.** Mitigating climate change by reducing greenhouse gas emissions from the health department? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know
- **b.** Helping residents of your jurisdiction reduce their greenhouse gas emissions? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know
- **c.** Reducing fossil fuel use or conserving energy in the operation of the health department? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know
- **d.** Helping residents of your jurisdiction reduce their fossil fuel use or conserve energy? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know
- **e.** Encouraging or helping people to use active transportation such as walking or cycling? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know
- **f.** Encouraging or helping people to use mass transportation? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know
- **g.** Encouraging or helping people to change the way they purchase foods such as buying locally grown foods, organic foods or plant-based foods? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know
- **h.** Educating the public about climate change and its potential impact on health? ☐ Currently have ☐ Plan to have ☐ Neither currently nor plan to have ☐ Don't know

23a. Are there other activities associated with climate change mitigation in your jurisdiction that I have not mentioned? ☐ Yes ☐ No ☐ Don't know

23b. *(If Yes for Q23a)* What are those activities?

23c. *(If Yes for Q23a)* Is this a current, future or not an area of programmatic activity for your department? ☐ Yes ☐ No ☐ Don't know

The following questions were only asked if the response to Q22 was "currently" or "planning":

24. How many staff members—in full-time equivalents—does/will this program have?

25. What is/will be the annual budget for this program?

26. In your opinion, is this an adequate level of funding for the program?
☐ Yes ☐ No ☐ Don't know

The following question was only asked if the response to Q22 was "currently":

27. Next year, will the annual budget for this program increase, decrease or remain about the same? ☐ Increase ☐ Decrease ☐ Remain the same ☐ Don't know

Regulatory role

28. Does your health department have any regulatory responsibility for the following functions?

- **a.** Water supply and quality ☐ Yes ☐ No ☐ Don't know
- **b.** Air quality ☐ Yes ☐ No ☐ Don't know
- **c.** Food safety and security ☐ Yes ☐ No ☐ Don't know
- **d.** Sewage or septic systems ☐ Yes ☐ No ☐ Don't know
- **e.** Health care services ☐ Yes ☐ No ☐ Don't know
- **f.** Mental health services ☐ Yes ☐ No ☐ Don't know
- **g.** Housing code ☐ Yes ☐ No ☐ Don't know

Resources

29a. Are there resources that your department does not currently have that, if made available, would significantly improve its ability to deal with climate change as a public health issue? ☐ Yes ☐ No ☐ Don't know

29b. *(If Yes for Q29a)* What are those resources?
☐ Additional Staff ☐ Staff Training ☐ Equipment ☐ Budget/Money/Funding
☐ Other. *Respondents were also asked to describe their answers in further detail:*

- **a.** How many additional staff and what would they do?
- **b.** What kind of training?
- **c.** What kind of equipment?
- **d.** How much money and what would you use it for?

Conclusion

30. Is there anything else that you would like to tell me that will help us understand the public health response to climate change in your jurisdiction?

Notes

1 Confalonieri, U., B. Menne, R. Akhtar, K.L. Ebi, M. Hauengue, R.S. Kovats, B. Revich, and A. Woodward. 2007. Human health. In *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, J.P. Palutikof, P.J. van der Linden. and C.E. Hanson, eds. Cambridge, UK: Cambridge University Press, 391–431.

2 U.S. Climate Change Science Program. 2008. *Synthesis and Assessment Product 4.6: Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems: Third Review Draft for CCSP and CENR Clearance, April 2008.* Washington, DC: U.S. Climate Change Science Program and the Subcommittee on Global Change Research.

3 Ebi, K.L., D.M. Mills, J.B. Smith, and A. Grambsch. 2006. Climate change and health impacts in the United States: An update on the results of the U.S. National Assessment. *Environmental Health Perspectives*, 114:1318–1324.

4 Bartlett, K.H., S.E. Kidd, and J.W. Kronstad. 2008. The Emergence of *Cryptococcus gattii* in British Columbia and the Pacific Northwest. *Current Infectious Disease Reports*, 10(1):58–65.

5 Balbus, J.M., and M.L. Wilson. 2000. *Human Health and Global Climate Change: A Review of Potential Impacts in the United States.* Arlington, VA: Pew Center on Global Climate Change.

6 Ebi, K.L., T.J. Teisberg, L.S. Kalkstein, L. Robinson, and R.F. Weiher. 2004. Heat watch/warning systems save lives: Estimated costs and benefits for Philadelphia, 1995–1998. *Bulletin of the American Meteorological Society*, 85(8):1067-1073.

7 Intergovernmental Panel on *Climate Change. 2007. Summary for policymakers. In 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, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson, eds. Cambridge, UK: Cambridge University Press, 7–22.

8 Ebi et al. 2006, see note 3.

9 U.S. Climate Change Science Program. 2008, see note 2.

10 Field, C.B., L.D. Mortsch,, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running, and M.J. Scott. 2007. North America. In *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, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, eds. Cambridge, UK: Cambridge University Press, 617–652.

11 Field et al. 2007, see note 10.

12 Garrett, A.L., R. Grant, P. Madrid, A. Brito, D. Abramson, and I. Redlener. 2007. Children and mega-disasters: lessons learned in the new millennium. *Advances in Pediatrics*, 54:189–214.

13 Warren, J.A., J.E. Berner, and T. Curtis. 2005. Climate change and human health: infrastructure impacts to small remote communities in the north. *International Journal of Circumpolar Health*, 64(5):487–97.

14 Field et al. 2007, see note 10.

15 D'Souza, R.M., N.G. Becker, G. Hall, and K.B.A Moodie. 2004. Does ambient temperature affect foodborne disease? *Epidemiology*, 15(1):86–92.

16 Newel, D.G. 2002. The ecology of Campylobacter jejuni in avian and human hosts and in the environment. *International Journal of Infectious Diseases*, 6:16–21.

17 Cook, D.W. 1994. Effect of time and temperature on multiplication of Vibrio vulnificus in post-harvest Gulf Coast shellstock oysters. *Applied and Environmental Microbiology*, 60(9):3483–3484.

18 McLaughlin, J.B. et al. 2005. Outbreaks of Vibrio parahaemolyticus gastroenteritis associated with Alaskan oysters. *New England Journal of Medicine*, 353(14):1463–1470.

19 Howell, D. and D. Cole. 2006. Leptospirosis: A waterborne zoonotic disease of global importance. *Georgia Epidemiology Report*, 22(8):1–2.

20 Kistemann, T., T. Cla_en, C. Koch, F. Dangendorf, R. Fischeder, J. Gebel, V. Vacata, and M. Exner. 2002. Microbial load of drinking water reservoir tributaries during extreme rainfall and runoff. *Applied and Environmental Microbiology*, 68(5):2188–97.

21 Davies, C.M., C.M. Ferguson, C. Kaucner, M. Krogh, N. Altavilla, D.A. Deere, and N.J. Ashbolt. 2004: Dispersion and transport of Cryptosporidium oocysts from fecal pats under simulated rainfall events. *Applied and Environmental Microbiology*, 70(2):1151–1159.

22 American Public Health Association. "Policy Statement: Addressing the Urgent Threat of Global Climate Change to Public Health and the Environment." http://www.apha.org/advocacy/policy/policysearch/default.htm?id=1351 (accessed 9 April 2008).

23 U.S. Climate Change Science Program. 2008, see note 2.

24 U.S. Congress. 2006. *Hurricane Katrina: A Nation Still Unprepared.* U.S. Senate Committee on Homeland Security and Governmental Affairs. Washington DC: 109th Congress, 2nd Session, S. Rept. 109–322.

[25] Klinenberg, E. 2002. *Heat wave: A social autopsy of disaster in Chicago*. Chicago: The University of Chicago Press.

[26] Patz, J.A., M.A. McGheehin, S.M. Bernard, K.L. Ebi, P.R. Epstein, A. Grambsch. D.J. Gubler, P. Reiter, I. Romieu, J.B. Rose, J.M. Samet, and J. Trtanj. 2000. Potential consequences of climate variability and change for human health in the United States. In *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, National Assessment Synthesis Team, eds. U.S. Global Change Research Program. Cambridge, UK: Cambridge University Press, 437–458.

[27] Field et al. 2007, see note 10.

[28] Curriero, F.C., K. Heiner, S. Zeger, J.M. Samet, and J.A. Patz. 2002. Temperature and mortality in 11 cities of the eastern United States. *American Journal of Epidemiology*, 155:80–87.

[29] Confalonieri et al. 2007, see note 1.

[30] Townsend, F.F., P. Rapuano, J.B. Bagnal, M.L Malvesti, K.M. Nielsen, T.P Bossert, D.J. Kaniewski, M. O'Neill Sciarrone, J.C. Dozor, and M.J. Taylor. 2006. *The Federal Response to Hurricane Katrina: Lessons Learned*. Washington, DC: U.S. White House. http://www.whitehouse.gov/reports/katrina-lessons-learned.pdf (accessed 2 April 2008).

[31] U.S. Climate Change Science Program. 2008, see note 2.

[32] Beitsch, L.M., R.G.Brooks, N. Menachemi, and P.M Libbey. 2006. Public Health at Center Stage: New Roles, Old Props. *Health Affairs*, 25(4):911–922. http://minority-health.pitt.edu/archive/00000519/01/PUBLIC_HEALTH_AT_CENTER_STAGE.pdf (accessed 3 April 2008).

[33] Baker, E.L., M.A. Potter, D.L. Jones, S.L. Mercer, J.P. Cioffi, L.W. Green, P.K. Halverson, M.Y. Lichtveld, D.W. Fleming. 2005. The Public Health Infrastructure and Our Nation's Health. *Annual Review of Public Health*, 26:303–318. http://arjournals.annualreviews.org/doi/full/10.1146/annurev.publhealth.26.021304.144647 (accessed 3 April 2008).

[34] Beitsch et al. 2006, see note 32.

[35] Institute of Medicine. 2002. *The Future of the Public's Health in the 21st Century*. Board on Health Promotion and Disease Prevention. Washington, DC: National Academies Press.

[36] Baker et al. 2005, see note 33.

[37] National Association of County and City Health Officials. 2005. *2005 National Profile of Local Health Departments*. Washington, DC: National Association of County and City Health Officials, http://www.naccho.org/topics/infrastructure/documents/NACCHO_report_final_000.pdf (accessed 3 April 2008).

[38] Centers for Disease Control and Prevention. 2008. *Public Health Preparedness: Mobilizing State by State. A CDC Report on the Public Health Preparedness Cooperative Agreement*. http://emergency.cdc.gov/publications/feb08phprep/pdf/feb08phprep.pdf (accessed 3 April 2008).

[39] Lurie, N., J. Wasserman, and C. Nelson. 2006. Public health preparedness: Evolution or revolution? *Health Affairs*, 25(4):935–945. http://minority-health.pitt.edu/archive/00000520/ (accessed 7 April 2008).

[40] Trust for America's Health. 2007. *Ready or Not? Protecting the Public's Health from Diseases, Disasters, and Bioterrorism*, 55. http://healthyamericans.org/reports/bioterror07/ (accessed 7 April 2008).

[41] National Association of County and City Health Officials. 2007. *Federal Funding for Public Health Emergency Preparedness: Implications and Ongoing Issues for Local Health Departments*. Washington, DC: NACCHO. http://www.naccho.org/pubs/documents/na154_federalfunding.pdf (accessed 7 April 2008).

[42] Beitsch et al. 2006, see note 32.

[43] Baker et al. 2005, see note 33.

[44] Nesmith, J. "CDC Must Have a Raise, Not Cuts, Chief Tells House," *Atlanta Journal Constitution*, 9 May 2007. http://www.fundcdc.org/documents/CDCmusthavearaisenotcutschieftellsHouse.pdf (accessed 7 April 2008).

[45] American Academy of Family Physicians. "U.S. Department of Health and Human Services FY 2008 Budget Highlights." http://www.aafp.org/online/etc/medialib/aafp_org/documents/policy/fed/background/pres08bud.Par.0001.File.tmp/fy2008budget.pdf (accessed 7 April 2008).

[46] Campaign for Public Health. "Campaign for Public Health's Historic Program Funding at CDC: FY08 Tracking Sheet." http://www.fundcdc.org/documents/CDC08funding-historicaltracking2408.pdf (accessed 7 April 2008).

[47] Townsend et al. 2008, see note 30.

[48] Woodruff, R.E., A.J. McMichael, and S. Hales. 2006. Action on climate change: no time to delay. Global warming is real, so what are we going to do about it, who will do it, and when? *The Medical Journal of Australia*, 184(11):539–40.

[49] Institute of Medicine. 2007. *Environmental Public Health Impacts of Disasters: Hurricane Katrina (Workshop Summary)*. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=11840#toc (accessed 7 April 2008).

[50] Trust for America's Health. 2007, see note 40.

[51] Townsend et al. 2008, see note 30.

[52] Tucker, J. 2001. *Improving Infectious Disease Surveillance to Combat Bioterrorism and Natural Emerging Infections*. Testimony before the U.S. Senate Committee on Appropriations, Subcommittee on Labor, Health,

and Human Services, Education, and Related Agencies, October 3, 2001. http://cns.miis.edu/research/cbw/testtuck.htm (accessed 7 April 2008).

53 King, L. 2006. *CDC Agroterrorism and Zoonotic Threat Preparedness Efforts*. Testimony before the U.S. House of Representatives Committee on Homeland Security, Subcommittee on Prevention of Nuclear and Biological Attack, August 24, 2006. http://www.hhs.gov/asl/testify/t060824.html (accessed 7 April 2008).

54 Centers for Disease Control and Prevention. "FoodNet: Foodborne Diseases Active Surveillance Network." http://www.cdc.gov/foodnet/ (accessed 9 April 2008).

55 Centers for Disease Control and Prevention. "PulseNet." http://www.cdc.gov/pulsenet/ (accessed 9 April 2008).

56 Trust for America's Health. 2007, see note 40.

57 Trust for America's Health. 2004. *West Nile Virus: 2004 Expected to Be Most Severe Year Yet*. http://healthyamericans.org/reports/wnv/wnv2004.pdf (accessed 7 April 2008).

58 Tucker. 2001, see note 52.

59 Kahn, L. 2006. Confronting Zoonoses, Linking Human and Veterinary Medicine. *Emerging Infectious Diseases*, 12(4):556–561.

60 Centers for Disease Control and Prevention. 2008, see note 38.

61 Institute of Medicine. 2007. *Emergency Medical Services: At the Crossroads*. IOM Board on Health Care Services, Committee on the Future of Emergency Care in the United State Health System. Washington, DC: National Academies Press.

62 Institute of Medicine. 2007. *Emergency Care for Children: Growing Pains*. IOM Board on Health Care Services, Committee on the Future of Emergency Care in the United States Health System. Washington, DC: National Academies Press.

63 Institute of Medicine. 2007. *Hospital-Based Emergency Care: At the Breaking Point*. IOM Board on Health Care Services, Committee on the Future of Emergency Care in the United States Health System. Washington, DC: National Academies Press.

64 Leggett, J. 2007. *CRS Report for Congress: Climate Change: Federal Expenditures*. January 22, 2007. Congressional Report RL 33817. http://assets.opencrs.com/rpts/RL33817_20070122.pdf (accessed 7 April 2008).

65 Leggett. 2007, see note 64.

66 U.S. Global Change Research Program. "Our Changing Planet: The U.S. Climate Change Science Program for Fiscal Year 2008: A Supplement to the President's Fiscal Year 2008 Budget: Department of Health and Human Services." http://www.usgcrp.gov/usgcrp/Library/ocp2008/ocp2008-budget-hhs.htm (accessed 9 April 2008).

67 National Research Council. 2007. *Evaluating Progress of the U.S. Climate Change Science Program: Methods and Preliminary Results*. NRC Committee on Strategic Advice on the U.S. Climate Change Science Program, Division on Earth and Life Studies, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press, 5.

68 Ebi et al. 2006, see note 3.

69 McGeehin, M. 2008. *Climate Change and Human Health: The Public Health Response*. PowerPoint Presentation. National Center for Environmental Health, Centers for Disease Control and Prevention. http://www.astho.org/pubs/McGeehinClimateChange.pdf (accessed 7 April 2008).

70 Association of State and Territorial Health Officials. 2006. *Ensuring Healthy Communities: Results of the 2006 State Environmental Health Directors Survey*. Arlington, VA: ASTHO. http://www.astho.org/pubs/Ensuringhealthycommunitiesastho.pdf (accessed 7 April 2008).

71 National Association of County and City Health Officials. 2005, see note 37.

72 National Association of County and City Health Officials. 2007, see note 41.

73 U.S. Climate Change Science Program. 2008, see note 2.

74 Centers for Disease Control and Prevention. National Center for Environmental Health. "CDC Policy on Climate Change and Public Health." http://www.cdc.gov/climatechange/policy.htm (accessed 7 April 2008).

75 Gerberding, J. 2007. *Climate Change and Public Health*, Testimony before the U.S. Senate Committee on Environment and Public Works, 23 October 2007. http://epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=7c34e37a-8a6f-4753-bc2e-26d19b8a2794 (accessed 7 April 2008).

76 Gerberding, J. 2007, see note 75.

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