



# Perspective

## Preventive Medicine for the Planet and Its Peoples

David J. Hunter, M.B., B.S., Sc.D., Howard Frumkin, M.D., Dr.P.H., and Ashish Jha, M.D., M.P.H.

“Health is the human face of climate change” was the motivating idea behind the Climate and Health conference held at the Carter Center in Atlanta on Thursday, February 16, 2017.

Originally scheduled by the Centers for Disease Control and Prevention (CDC), which then postponed it indefinitely, the meeting was resurrected by a coalition of nongovernmental organizations and universities and convened by former Vice President Al Gore. More than 300 attendees and a worldwide audience watching the live stream (<https://livestream.com/ClimateReality/ClimateChangesHealth/videos/149575200>) listened to more than 25 speakers addressing the health effects of climate change, the role of health professionals in adapting to these effects and communicating with the public and policymakers, and the health benefits of climate-change mitigation.



An interactive graphic is available at [NEJM.org](http://NEJM.org)

For many Americans, the ef-

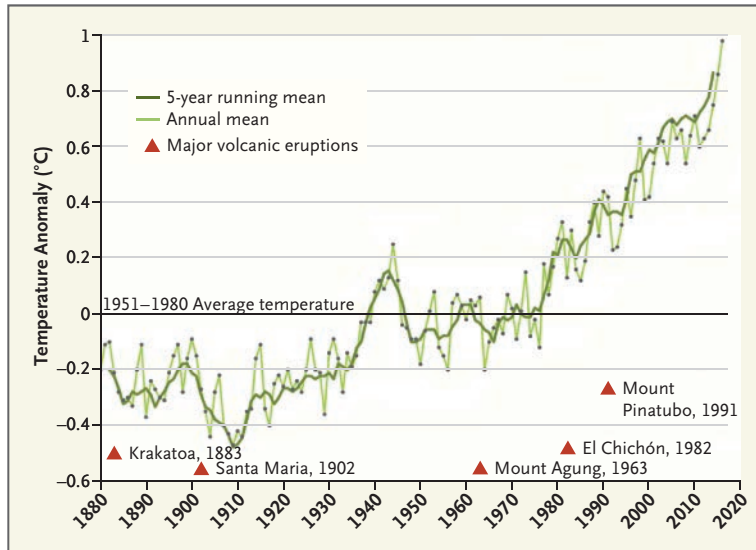
fects of climate change seem distant: island nations will sink beneath rising seas, areas of the Middle East will become uninhabitable because of extreme heat. But though the worst effects will be felt by poorer people in poorer countries that are less resilient to droughts, floods, and heat, climate change already affects the health of vulnerable U.S. populations, and U.S. health professionals see these effects.

Average temperatures have increased by 1.3 to 1.9°F (0.7 to 1.1°C) over the past century, particularly in the North and West, and increases have accelerated in recent years (see graph).<sup>1</sup> The three hottest years recorded in the United States were 2012, 2015, and 2016. Average temperatures are predicted to rise by 3 to 10°F (1.7 to 5.6°C)

within the lifetimes of children now being born. What do these changes mean for health?

With warming temperatures come longer summer heat waves that increase mortality, particularly among vulnerable populations — elderly and poor people, residents of urban heat islands, and people with mental illness. Higher temperatures also increase ozone levels, compromising lung function and exacerbating asthma. Earlier and longer pollen seasons elevate exposure to allergens, increasing allergic sensitization and asthma episodes. Higher temperatures result in larger and longer forest fires, reducing downwind air quality and increasing hospitalizations for respiratory and cardiovascular conditions.

Climate change is also making dry areas drier, wet areas wetter, and severe storms with heavy precipitation more common. Hurricanes and floods kill people directly, and their indirect effects, such as waterborne-disease outbreaks



**Annual Changes in Mean Surface-Air Temperature, 1880–2016.**

Data are from the Goddard Institute for Space Studies, National Aeronautics and Space Administration. An interactive graphic is available at NEJM.org.

following floods, cause broader harm to human health. Warmer water temperatures also facilitate the growth of pathogenic waterborne organisms such as coliform and vibrio species.<sup>2</sup>

The distribution of vectorborne diseases such as Lyme disease, West Nile virus, Rocky Mountain spotted fever, plague, and tularemia expands as the range of their vectors changes. The distribution of the Lyme disease tick, *Ixodes scapularis*, for instance, is projected to expand to cover most of the eastern half of the United States over the next 60 years.<sup>3</sup> The mosquito vectors of pathogens not currently common in the United States, such as dengue, chikungunya, and Zika, may find more favorable conditions.

Food production — crops, livestock, and fisheries — is projected to decline in some regions of the world. Poor countries will be hit harder than wealthy ones, which will be better able to adapt, but even in the United States disruptions in food supplies are like-

ly to raise prices and aggravate food insecurity among at-risk populations.

Finally, weather extremes can also adversely influence mental health. There is strong evidence that extreme heat leads to more aggression and violence. Newer data suggest that extreme weather events can cause stress and anxiety, exacerbating depression and other mental illnesses.

So how do we protect the public? Adaptation, or “managing the unavoidable,” is accomplished through secondary prevention — strategies and practices designed to reduce harm and protect people from climate-related threats. Examples include urban heat-wave preparedness plans, discouragement of building in flood plains, and enhanced air-pollution warning systems. Many such actions lie “upstream” from the health sector, in arenas such as urban planning, but collaboration with health professionals can optimize health protection. The CDC’s Building Resilience against Climate

Effects (BRACE) framework (<https://www.cdc.gov/climateandhealth/>) offers an approach to adaptation planning.

Mitigation, or “avoiding the unmanageable,” requires primary prevention — strategies and practices designed to reduce the underlying causes of climate change. Shifting away from greenhouse-gas-emitting energy sources toward cleaner energy is critical. Mitigation also means redesigning cities to encourage more walking and biking (activities with low carbon footprints and big health benefits). We can also make meaningful progress in areas ranging from promoting more energy-efficient buildings to reforestation and reduction of food waste. Encouragingly, most efforts that prevent carbon pollution lead to substantial secondary health gains: healthier food, more exercise, and reduced air pollution, for example, which translates into less asthma and fewer myocardial infarctions and strokes.

Our health care system has a role in both adaptation and mitigation. To anticipate and prepare for climate-related health threats, we need acute capacity for managing extreme-weather-related events. Much of our health infrastructure is ill prepared for these events, as became clear after Hurricanes Katrina and Sandy. As for mitigation, health care facilities are among the most energy-intensive forms of commercial space, accounting for an estimated 8 to 10% of U.S. greenhouse-gas emissions. Efforts at “green health care” — including reducing energy and material use, sourcing supplies including food in environmentally responsible ways, and encouraging employees to walk, cycle, or commute using other energy-efficient approaches — are not only helpful (and possibly

cost-saving) themselves but can also set an example for our communities.

The health effects of climate change will be much more severe in many other countries. Yet we believe the United States has a responsibility to act for two reasons: we are a leading emitter of greenhouse gases — number one in cumulative emissions to date, and number two (after China) in ongoing emissions — and many other countries expect U.S. leadership before they commit to action.

Even if we lacked moral reasons for action, there would be a compelling national security rationale: strong evidence indicates that climate-related habitat disruptions and food and water scarcity contribute to armed conflict, population dislocation, and refugee crises. Alterations in global patterns of hunger and infectious diseases will expose the United States to new diseases that could spread quickly through our population. We will need to increase investments to ensure that regional infectious disease outbreaks are managed quickly and locally, before they become global outbreaks.

The good news is that we know how to reduce the impact of climate change. Global carbon dioxide emissions have plateaued in the past 3 years, and continuation of the policies in place would lead to reductions in the coming years. The Paris Agreement, if fully implemented, would keep world temperature rise to less than 2°C (3.6°F). U.S. commitment to

the agreed-on targets is essential because U.S. leadership is critical to global action. Jobs in the renewable-energy sector (mainly solar and wind) already outnumber those in power generation from coal, natural gas, and oil combined. From a health perspective, efforts like the Environmental Protection Agency's Clean Power Plan (or effective carbon pricing) are critical both because of their direct effect on greenhouse gases and because they're expected to save 3600 lives a year in the United States by 2030, mainly through reductions in air pollution.<sup>4</sup> These future benefits will be threatened if the Trump administration reverses these important public health policies.

Health professionals are trusted communicators about health risks and their management. Unfortunately, climate change has become unnecessarily politicized. Health professionals can focus on the science and use standard tools of health communication to explain the risks of climate change and the benefits of mitigation and adaptation. Patients and the public respond to simple, clear messages, repeated often, from trusted sources. Tools (<http://climateforhealth.org/lets-talk>) are available to help with this communication.<sup>5</sup>

Many of our professional organizations (<https://medsocietiesforclimatehealth.org/>) have been active in documenting the health threats posed by climate change. As opinion leaders, we can remind

our communities that climate change is verified by strong science, is already harming health, and is solvable if we act soon. As citizens, we can support policies that help tackle climate change. We can work with our hospitals and clinics to reduce their carbon footprints. We can help devise adaptation and mitigation strategies that optimize health protection. And we can emphasize the good news that tackling climate change will benefit not only the health of the planet but also the health of its peoples.

Disclosure forms provided by the authors are available at [NEJM.org](http://NEJM.org).

From the Harvard T.H. Chan School of Public Health, Boston (D.J.H., A.J.), and the Harvard Institute for Global Health, Cambridge (A.J.) — both in Massachusetts; and the University of Washington, Seattle (H.F.).

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1. Crimmins A, Balbus J, Gamble JL, et al. The impacts of climate change on human health in the United States: a scientific assessment. Washington, DC: U.S. Global Climate Research Program, 2016.
2. Vezzulli L, Grande C, Reid PC, et al. Climate influence on *Vibrio* and associated human diseases during the past half-century in the coastal North Atlantic. *PNAS* 2016; 113(34):E5062-71.
3. Ogden NH, Radojevic M, Wu X, Duvvuri VR, Leighton PA, Wu J. Estimated effects of projected climate change on the basic reproductive number of the Lyme disease vector *Ixodes scapularis*. *Environ Health Perspect* 2014;122:631-8.
4. Ross KR, Rice MB, Takaro TK. The Clean Power Plan: a public health victory needing medical attention. *Am J Respir Crit Care Med* 2016;193:359-61.
5. Krygsman K, Speiser M. Let's talk health and climate: communication guidance for health professionals. Washington, DC: Climate for Health, 2016.

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