

UNDER THE WEATHER: CLIMATE, ECOSYSTEMS, AND INFECTIOUS DISEASE

Committee on Climate, Ecosystems, Infectious Disease, and Human Health, Board on Atmospheric Sciences and Climate, National Research Council, 2001, 160 pp., \$37.95, hardbound, National Academy Press, ISBN 0-309-07278-6

That climate affects human health has long been known, but advances in climatology are renewing interest in this subject. Evolving techniques for climate forecasting could be the basis of systems for early warning to take action to protect public health. A growing understanding of the impact of human activities on the global climate system raises larger concerns about the potential increase of threats to public health.

The National Research Council appointed the Committee on Climate, Ecosystems, Infectious Disease, and Human Health (CEIDH) in 1999 to review the known linkages between temporal and spatial variations in climate and the transmission of infectious disease agents. Other aspects of climate-related health impacts, such as heat stress, were beyond the scope of their work. The CEIDH was also charged with examining the potential for climate-based early warning systems in public health and identifying future research activities. *Under the Weather* is their report.

The CEIDH report aims to introduce scientists to the study of climate and infectious disease with seven major components: 1) a historical overview of environmental medicine and meteorology; 2) basic concepts in climatology and infectious disease epidemiology; 3) the influences of climate on some specific diseases; 4) analytical approaches for studying climate-disease linkages; 5) an ecological perspective on temporal and spatial scaling; 6) the feasibility of using climate forecasts in public health warning systems; and, 7) key findings and recommendations.

The CEIDH has great breadth and depth. They have presented far more than studies of temperature, rainfall, and specific diseases. The reader will learn, for example, that 1) the links between meteorology and medicine reach back to the early scientific revolution; 2) stakeholder participation is critical for the implementation of early warning systems; and 3) nonclimatic factors that affect infectious disease dynamics are essential for appreciating the “web of causation” in public health.

The inset boxes provide succinct commentary. For instance, box 3-5 compares the border towns of Reynosa, Mexico, and Brownsville, Texas, with similar climates to show the effect of nonclimatic factors

on the incidence of dengue, which is caused by a virus transmitted by *Aedes aegypti* mosquitoes. Despite a higher number of *A. aegypti* pupae per person in Brownsville, the level of dengue transmission is much lower in Brownsville because its residents make much greater use of air conditioning and window screens that reduce exposure to biting mosquitoes.

The CEIDH report does have some surprising deficiencies. Its list of observational study designs in epidemiology includes only populations as units of analysis, comparing disease incidence across time or space. That list omits cross-sectional, case-control, and cohort studies that can assess the effects of multiple factors on an individual’s risk of disease (Aron and Patz 2001). Yet the report itself presents this kind of information, such as a reference (shown above) to cross-sectional surveys of household living conditions influencing dengue transmission in Texas. Another problem is a curious lack of ethical or legal concerns in a section on field-based experimental manipulation of disease ecology. And a study of climate and health that is “global in scope” should have at least one committee member based in an institution in a developing country.

The analyses of climatic influences on specific diseases could have been much richer, as demonstrated here by examples from cholera epidemiology. An assessment of the cholera epidemic that struck Peru in early 1991 should consider the complexity of the El Niño–Southern Oscillation during 1990–95 (Glantz 1996) and the effect of stopping the chlorination of water in coastal areas of Peru in the 1980s (Aron and Zimmerman 2002). The limitation of official disease reports is dramatically illustrated by the recognition that Bangladesh does not report cholera cases to the World Health Organization (WHO). Bangladesh probably had between 250,000 and 400,000 cholera cases in 1998 (R. B. Sack 2002, personal communication), which is greater than the 211,748 cases in Africa reported to WHO in 1998 and cited by the CEIDH.

The topic of evaluation deserves more attention. How should one interpret a claim of “success”? A seasonal climate forecast might successfully predict above-average rainfall in a region for three months, but its spatial and temporal resolution might not be

adequate for making public health decisions. Must an early warning system handle both climatic and nonclimatic factors that cause epidemics? Key factors in a dengue epidemic in Rio de Janeiro in early 2002 appear to have been the introduction of a new strain of dengue virus and a cutback in mosquito control programs. It is unfortunate that the “evaluation/feedback” component of a disease early warning system in fig. 7-2 lacks the discussion in the text accorded the other components.

A clear explanation of climate change and climate variability is missing and would have contributed to the stated goal of helping “different groups of researchers involved in climate and infectious disease studies gain a more realistic understanding of the current capabilities and limitations of each other’s fields.” Climatologists use “climate change” to refer to changes from all causes over at least a century. The report’s background section on climate change stresses the consequences of enhanced global warming due to increased emissions of greenhouse gases from anthropogenic sources; later, “anthropogenic global climate change (AGCC)” is used. The chapter on early warning systems focuses on shorter time periods and climate variability, but avoids that terminology. More emphasis is placed on making decisions related to climate variability, although a lot of the publicity surrounding this report has dealt with climate change.

On balance, I recommend *Under the Weather*. Its key findings and recommendations are sound. It provides insights on climate and infectious disease that can assist the reviewer of climate-related health assessments, such as those from the Intergovernmental Panel on Climate Change and the U.S. Global Change Research Program. The reader will gain even greater benefit by using *Under the Weather* as a point of departure for exploring a variety of perspectives on climate and health.

—JOAN L. ARON

Joan L. Aron, Ph.D., is the president of Science Communication Studies, Columbia, Maryland, and an associate in the department of epidemiology of Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland. She is an editor of the textbook *Ecosystem Change and Public Health: A Global Perspective* (www.jhupbooks.com/aron) and participates in the *Climate and Health Information Exchange* (chiex.net), a collaborative research network on climate variability and human health impacts in the tropical Americas.

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