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Climate change concerns prompt improved disease forecasting

Small changes in temperature can mean big differences when it comes to the spread of infectious disease. With this in mind, health officials and researchers recently held meetings to discuss how to best prepare for the potential impact of global warming on disease.

At a three-day workshop on this topic in December, held alongside the recent United Nations climate conference in Bali, Indonesia, representatives from the World Health Organization (WHO) urged delegates to plan for the consequences of warmer temperatures.

A growing body of evidence has suggested that climate change might influence the distribution of devastating illnesses such as malaria and heat stroke (*Nature* **438**, 310–317; 2005). Researchers estimate that global warming could mean a 45–70% increase in the number of people exposed to dengue fever worldwide (*Lancet* **360**, 830–834; 2002). At the Bali meeting, Maria Neira, director for public health and the environment at the WHO, noted that a 1 °C increase in temperature could lead to an eight percent increase in the incidence of diarrhea (*Lancet* **355**, 442–450; 2000).

As temperatures increase, certain regions might also become more prone to West Nile fever, explains Bill Reisen, an entomologist at University of California, Davis. He says that warmer weather can have a huge impact on how fast the disease spreads: "In cold weather it typically takes three weeks for West Nile to multiply within a mosquito and become transmissible. But when it's hot, this can happen in as few as five days."

Scientists are increasingly able to correlate changes in weather patterns with the ranges of disease-bearing insects and microbes, thanks in part to improvements in satellite sensors and computing technologies. New modeling systems that layer climate trends over maps of illnesses transmitted by mosquitoes and rodents have key roles in forecasting the spread of infectious disease, say researchers.

"You can reduce mortality if you can prepare, and forecasting climate dynamics and their impact is a big part of this," says Paul Epstein, director of the Center for Health and the Global Environment at the Harvard Medical School in Boston.

For example, with early prediction of potential outbreaks, people can apply chemicals that kill mosquitoes to the right storm drains during springtime. "Then you don't have to spray the entire city in July or August," Epstein explains, pointing out that early, targeted use of insecticides reduces the overall need for these toxic chemicals.

Photo by Alex Wong/Getty Images

An inconvenient text: The White House watered down Gerberding's prepared testimony on the health impacts of global warming.

Additionally, by remotely monitoring slight changes in soil moisture, snow pack and the amount of land covered by surface water, other systems can provide clues as to whether conditions will favor an outbreak of vector-borne disease. Floods and drought can boost the rate of disease transmission. But scientists stress that even small variations in moisture and runoff greatly increase the chances of a mosquito outbreak.

On 5 December, at a workshop held in Washington, DC, by the Institute of Medicine, Reisen presented details about how he and his colleagues at the University of California, Davis combine historical data about disease incidence with new technology to build better predictions. Scientists at the university have set up mosquito-monitoring stations around California to capture these insects for disease testing in the lab. When West Nile became a concern, the team branched out to survey bird deaths and examined satellite data from the Terrestrial Observation and Prediction System, a monitoring program supported by the US National Aeronautics and Space Administration (NASA) that offers a real-time glimpse at changes in moisture and temperature on the ground.

"This past year, there were above-normal temperatures in Bakersfield [, California], and a test run of the system successfully predicted there would be an outbreak of West Nile," prompting officials to increase surveillance, says Reisen. Although the researchers weren't able to predict the exact weeks when the risk would be the highest, they say this level of detail is only a year or two away. As a result, health officials will be able to warn doctors and members of the public and take preventative action.

In the US, the National Oceanic and Atmospheric Association and NASA remain the primary funders of projects that explore how human health and global warming might relate. But as grants typically go toward research that falls under already-existing programs, scientists have begun to call on the government to support a broader range of investigations into how climate and infection rates relate. "The [US] National Institutes of Health needs to dedicate funds to research on the impacts of climate on health—and to solutions," says Epstein.

Despite the many potential benefits of remote sensing, those pressing for new funding opportunities will face difficult political hurdles, say researchers. The issue of how global warming might affect health reached a new level of controversy with reports in late October 2007 that the Bush administration had censored Julie Gerberding, director of the US Centers for Disease Control and Prevention (CDC), on this topic. Gerberding was asked to brief senators on the issue during a government hearing on 23 October. According to the news reports, the White House received a preview of the testimony the day before and cut 6 pages of the original 12 pages of text.

Gerberding's deleted testimony described how some areas of the Midwest and Northeast might experience more heat-related illnesses and heat waves. The censored text also mentioned that areas in the northern part of the US will probably bear the brunt of increases in ground-level ozone and airborne pollutants.

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