Climate Change Is Shifting the Course of Infectious Diseases

Have policymakers learned the right lessons from recent pandemics?

Author: Julie Kirkwood // **Date:** AUG.1.2018 // **Source:** Clinical Laboratory News

Topics: Infectious Diseases, Policy Issues

In the summer of 2004, several passengers aboard a cruise ship in Alaska developed gastrointestinal illness that was later linked to Vibrio parahaemolyticus from the fresh, local oysters they ate on board. It was the first known outbreak of V. parahaemolyticus that far north in Alaska, and health authorities noted that climate trends were a likely culprit. The median summer temperature of Prince William Sound had been rising each year, and in 2004 it had just surpassed 15 degrees Celsius, the minimum temperature required for V. parahaemolyticus to thrive. This is just one example of how infectious disease patterns are evolving as climate changes cause warmer, longer summers and more extreme weather events.

Already Lyme disease has spread into Canada to places where the summers used to be too short and cool for the disease to establish itself. Further south, the Aedes aegypti mosquito has expanded its range, carrying diseases such as Zika, dengue fever, and chikungunya to new locations in the United States. In fact, cases of disease from mosquito, tick, and flea bites have tripled in the U.S. since 2004, according to a report from the Centers for Disease Control and Prevention.

"We've seen a number of instances where particular infectious diseases are changing their range," said Kristie L. Ebi, PhD, MPH, MS, a professor of global health and of environmental and occupational health sciences at the University of Washington in Seattle. "We're seeing diseases well outside of where you would expect them, in months when you won't expect them, at levels of intensity that you wouldn't expect."

CLINICAL LABORATORIANS ON THE FRONT LINES

As climate change continues, clinical laboratorians should expect to be on the front lines whenever a new infectious disease occurs in an unexpected place, Ebi emphasized. "It's critically important for laboratorians and others to be aware of these possibilities so that they take them into account when they're trying to figure out, 'What's the diagnosis here? What should I look for? What should I analyze?'" she said.

Predicting exactly how climate change will affect infectious diseases is not easy, however. For years there has been speculation that warming due to climate change could increase malaria transmission, said Laurence Slutsker, MD, MPH, program leader for malaria and neglected tropical diseases at PATH, an international health organization based in Seattle.

Warmer temperatures are known to speed the development of malaria parasites within mosquitos, while also increasing mosquito activity and biting patterns.

Yet so far there is little evidence that climate change has had a noticeable impact on malaria, aside from a few documented cases occurring at higher altitudes, Slutsker noted. "As a general trend, I think we would say that we don't see large-scale effects at this point," he said. Clinical laboratories have played a critical role in providing that evidence, Slutsker added. With the advent of rapid diagnostic tests for malaria, scientists now have improved surveillance data, especially in the developing world.

"Over the last decade we've done a much better job in the malaria community of trying to link a diagnosis of malaria to an actual laboratory test, aided in particular by the development of rapid diagnostic tests," Slutsker said. "We're in a much better position with laboratory-confirmed diagnosis to be able to really begin to track these trends over the long term."

The fact that there has not yet been a climate-related increase in malaria speaks to the complexities of climate change. Perhaps climate change has caused some places to become so warm or dry that mosquito breeding opportunities have decreased, Slutsker

said. It's also possible that climate change effects have been dwarfed by the success of malaria prevention and treatment programs.

"There has been a massive scale of control efforts over the last decade," he said, "and so anything that might have been seen in terms of an extension in the range of where malaria is transmitted or a general increase in the intensity of transmission in certain places due to climate change, might have been more difficult to observe in the context of overall decreasing incidence over the last decade."

Meanwhile, there are other factors besides climate change driving the spread of infectious diseases to new locations, such as globalization and urbanization, said Albert Icksang Ko, MD, professor and department chair of epidemiology and microbial diseases and of medicine at the Yale School of Public Health in New Haven, Connecticut.

Certainly, higher temperatures and more extreme weather events will impact the range and intensity of infectious diseases, Ko said, but it's not clear exactly where and how. "I think it's fair to say that there's going to be a large degree of uncertainty about how fast this is going to happen and how it's going to play out," Ko said.

In addition to direct effects of climate on infectious diseases, there are also indirect effects, he said. For example, if traditional farming regions in the United States become unsuitable for farming, the country may need to import more food from other countries, thus increasing the chances of introducing new infectious diseases.

Likewise, Ebi said, while dry weather caused by climate change may reduce mosquito breeding grounds, it may also cause people to harvest rainwater, which creates new breeding grounds for mosquitos. Wetter weather can increase mosquito breeding areas, but heavy rains can wash away breeding grounds and shift the highest mosquito populations to later in the season.

TOUGH QUESTIONS ON PREPAREDNESS, RESPONSE

Douglas E. Norris, PhD, professor at Johns Hopkins Bloomberg School of Public Health, agreed that it's hard to predict the impact of climate change on disease patterns. "There are lots of things that could happen," Norris said. "And they will happen. It's hard to know whether we'll be ready for it."

Funding for surveillance programs is inconsistent and subject to political whim, Norris emphasized. When West Nile virus arrived in New York in 1999, for example, there was a public outcry over lapsed mosquito surveillance and a brief surge in new funding. "Now we're talking almost 20 years later, Zika comes in and everybody looks and says, 'Well, why are we not ready for this?' and we say, 'Well, because we let all those programs die again. We didn't learn our lesson,'" Norris said.

In addition to better surveillance, one of the most important ways to prepare for changing infectious disease patterns due to climate change is to strengthen our health systems overall, according to Ebi. Clinical laboratory professionals can help by working to improve communication among hospitals and with local health authorities, so they know what new pathogens such as Lyme disease or Zika or V. parahaemolyticus may be arriving in their area, she said. She would also like to see more funding and support for data-driven disease prediction systems that can be used to target surveillance and prevention measures. "There's an enormous potential for promoting and protecting population health right now using early warning systems," Ebi commented.

In the meantime, clinical laboratory professionals will continue to be part of the teams that first alert the public to the arrival of new infections that are the direct or indirect result of climate change, Ko noted. "Traditionally our surveillance has always relied on astute clinicians, nurses, health practitioners, and laboratory diagnosticians," he said.

Clinical laboratories will also play a role in developing real-time surveillance systems and the rapid point-of-care tests that will inform these systems. "I think there is an extremely important role for people working in clinical laboratories in that sense," Ko added. "I think it requires both the laboratory—including of course astute healthcare professionals who will send samples to the lab—but it also is the surveillance systems and how we can make them more robust to identify these emerging infections earlier."

*Julie Kirkwood is a freelance journalist who lives in Rochester, New York.**+Email:** julkirkwood@gmail.com*