MedicalXpress

Weather forecast could predict cholera outbreaks: study

May 31 2011

With recent deadly cholera outbreaks in Haiti and Cameroon providing the latest indication of a menacingly resurgent disease, scientists have discovered rain and temperature fluctuations in at-risk areas could predict epidemics months in advance, according to a new study published today in the June 2011 issue of the *American Journal of Tropical Medicine and Hygiene*.

After analyzing several years of disease and environmental data from cholera-endemic areas of Zanzibar, Tanzania, scientists from the International Vaccine Institute in Seoul, Korea found that a mere one degree Celsius increase in the average monthly minimum temperature was a warning sign that cholera cases were likely to double within four months. Similarly, a 200-millimeter increase in monthly rainfall totals indicated a slightly lower but still substantial increase could be expected within two months.

The authors note their work eventually could allow public health authorities in areas where cholera is common to anticipate outbreaks and move to intervene, given that such measures as vaccines are far less effective once an epidemic is in full swing. Moreover, cholera outbreaks are on the rise while in the coming decades climate experts predict hotter and wetter weather in many cholera-endemic areas that could add fuel to the fire.

"Our work validates the notion that rainfall and temperature increases are often precursors to cholera outbreaks in vulnerable areas," said Rita

Reyburn, a Research Associate at IVI and the study lead author. "We are getting very close to developing a reliable forecasting system that would monitor temperatures and rainfall patterns to trigger pre-emptive measures—like mobilizing public health teams or emergency vaccination efforts—to prepare for an outbreak before it arrives."

"Cholera outbreaks are occurring with increasing frequency and severity," said Peter J. Hotez, MD, PhD, President, American Society of Tropical Medicine and Hygiene. "This research is an example of an innovative approach that if used in conjunction with other preventive measures could significantly reduce the needless suffering and deaths of thousands of people."

"Predicting outbreaks is crucial because right now public health officials only know for sure that an outbreak is underway when people start getting sick, which is too late for things like vaccines to have maximum effectiveness," said Mohammad Ali, PhD, a senior scientist at IVI. "If we wait for clinical signs of the disease to emerge, that means a large portion of the population is already carrying the cholera bacteria, they just are not yet exhibiting clinical symptoms."

In Cameroon, an outbreak of cholera now underway in the capital city of Yaoundé is being blamed on the unprecedented arrival of heavy rains in February, months before the rainy season usually commences—a phenomenon some speculate is illustrative of climate change. In Haiti, an outbreak aggravated by unsanitary conditions caused by last year's earthquake has already sickened 300,000 people, killing almost 5,000. Now, with the regular rainy and hurricane season in Haiti starting, experts fear a major resurgence in both cases and deaths by the end of the year.

Cholera is endemic to impoverished, tropical areas—mainly in sub-Saharan Africa and South and Southeast Asia— where poor sanitation

and lack of clean water facilitate the spread of the disease, which is mainly through fecal contamination of food and water. Cholera is particularly feared for its ability to cause such a sudden and intense onset diarrhea that a victim can go from seemingly healthy to death in 24 hours. Also, when outbreaks occur, the number of people infected increases dramatically and the case fatality rate can skyrocket; rates of up to 50% are being reported in complex emergencies with limited resources.

In their efforts to develop a cholera prediction tool, the IVI scientists—along with a cholera expert from the University of North Carolina— looked at several years of monthly cholera disease surveillance reports from Zanzibar that enabled them to see when the disease was at a relatively normal level and when it spiked to epidemic proportions. They then looked at a wide variety of monthly environmental data for the same period, including rainfall totals, high and low temperatures, humidity, and sea surface temperatures. In comparing the data, they found that cholera outbreaks were most closely associated with a rise in minimum average temperatures and average rainfall levels.

They employed a statistical model that has been used to study seasonal trends for other infectious diseases, such as malaria and dengue fever, to retrospectively predict the cholera case-load in the region for 2003 to 2008. The predicted levels based on climate conditions closely matched actual cholera cases and outbreaks recorded in surveillance reports over the same time period.

The researchers note that their study represents an advance in developing a forecasting system for cholera outbreaks because there are many environmental factors known to contribute to cholera infections, but it has been difficult to single out which ones are the most important to monitor.

Also, the fact that cholera cases doubled following only a small increase in the average minimum temperature could be a particularly troubling sign. In the study, the doubling occurred when the average minimum temperature rose 23º C/73ºF to 24º/75º. The study notes that climatologists predict that the build-up of greenhouse gases in the atmosphere could cause average temperatures globally to increase from 1.4ºC to 5.8º C over the next 100 years.

"Based on the results of this analysis we would expect a very high cholera caseload in Asia and Africa if the temperatures hit the higher end of that range," Ali said.

Provided by American Society of Tropical Medicine and Hygiene