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Combating dengue with infectious disease forecasting

New project seeks help of modelers to turn troves of environmental and health data into predictions for the next dengue epidemic

Dengue viruses are on the move. Spread among humans by mosquitoes, and across geographic boundaries through travel, the virus affects up to an estimated 390 million people every year around the world. In the U.S., recent outbreaks have occurred in Florida, Texas, Hawaii, and Puerto Rico. Scientists know one of the best ways to reduce the impact of the disease is to prepare healthcare providers by forecasting epidemics before they happen.

To address this public health issue, several U.S. federal agencies have joined together and are seeking scientists to design infectious disease forecasting models to improve efforts to predict dengue epidemics and potentially improve public health outcomes. To support this effort, the Department of Commerce, Department of Defense and Department of Health and Human Services are providing those interested free access to previously unavailable historical dengue surveillance data from Puerto Rico and Peru that they can use to develop infectious disease forecasting models.

As the first phase of an effort to improve prediction of global disease outbreaks, this project asks participants to deliver forecasts focusing on dengue surveillance data in San Juan from 1990 through 2009 and Iquitos from 2000 through 2009.

"The dengue data provided for this project is a further illustration of why long-term investment in global health surveillance and capacity building is important," said Navy Commander Jean-Paul Chretien, team lead of Innovation and Evaluation for the Armed Forces Health Surveillance Center's (AFHSC) Integrated Biosurveillance division. "Developing accurate epidemic predictive models requires a long and detailed epidemiological record. We have that record in Puerto Rico and Peru, among other areas, because the U.S. government and its academic partners have supported public health programs, and related mosquito surveillance programs, there for decades."

Starting June 5, participants will have nearly four months to develop and test the capabilities of their models through September 2, 2015, when final submissions are due for review by an evaluation team lead by representatives of the Department of Health and Human Services. Finalists will be invited to a meeting at the White House in the fall with representatives of the National Science and Technology Council's (NSTC) Interagency Pandemic Prediction and Forecasting Science and Technology Working Group to provide their viewpoints on lessons learned and potential next steps in strengthening infectious disease forecasting, consistent with the Federal Advisory Committee Act. No travel funds for finalists will be provided.

The project is open to individuals 18 years of age and older. A participant may compete individually or as part of a team, but only one submission per team may be submitted. Full details, rules, and registration instructions for the project are available at: http://DengueForecasting.noaa.gov.

The U.S. Centers for Disease Control and Prevention, in collaboration with the Puerto Rico Department of Health, will provide the dengue surveillance data from San Juan. The DoD's Naval Medical Research Unit 6, in collaboration with the Peruvian government, U.S. universities and supported by AFHSC, will provide dengue data from Iquitos. The National Oceanic Atmospheric Administration, in cooperation with the Cooperative Institute for Climate and Satellites, will provide environmental and climate data and outputs from climate models from Puerto Rico and Peru.

"NOAA is America's environmental intelligence agency. We provide timely, reliable, and actionable information — based on sound science — every day to millions of Americans," said Kathryn Sullivan, Ph.D., NOAA administrator. "NOAA's local weather and climate data and models, provide a foundation for the public health community to predict the next outbreak of infectious disease, such as dengue, and ensure they are prepared to meet these challenges head-on."

Dengue virus infection causes high fever, severe headache, eye pain, joint, muscle and bone pain, mild bleeding and low white cell count in infected individuals. There are no vaccines available to prevent infection with the virus, though some candidates are being tested. The most effective way to prevent dengue is to avoid mosquito bites using measures such as window screens, repellant, or protective clothing. Current treatment involves symptomatic care for mild diseases and hospitalization and more intense patient management to reduce mortality for people who develop severe disease.

An estimated 390 million dengue infections occur worldwide each year, including about 500,000 severe cases – mostly children – requiring hospitalization. Dengue is now endemic in more than 100 countries and several U.S. territories, especially Puerto Rico, where major epidemics occur roughly every three- to-five years. The risk to U.S. travelers is on the rise, and in recent years, local dengue outbreaks have occurred in the continental U.S. In the U.S. military, 279 cases of dengue fever have been diagnosed among active component and reserve and guard service members from 2005-2014, according to figures from the AFHSC.

"These newly released long-term datasets offer a unique opportunity to address a major public health problem on a foundation of high quality data. Dengue epidemics in both Puerto Rico and Peru can be highly disruptive. Accurate forecasts could help authorities prepare for epidemics and reduce their impact," said Michael Johansson, biologist in CDC's Dengue Branch.

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