New computer model takes a page from weather forecasting to predict regional peaks in influenza outbreaks

November 26 2012

Pedestrians contend with wintry weather in Boulder, Colorado. As flu outbreaks peak during the colder months, researchers are employing techniques from weather prediction to forecast outbreak timing and severity. Credit: ©UCAR. Photo by Carlye Calvin.

Scientists have developed a system to predict the timing and severity of seasonal influenza outbreaks that could one day help health officials and the general public better prepare for them. The system adapts techniques used in modern weather prediction to turn real-time, Web-based estimates of influenza infection into local forecasts of seasonal flu.

Results appear online in the Proceedings of the National Academy of Sciences.

Year to year, and region to region, there is huge variability in the peak of flu season, which, in temperate areas of the Northern Hemisphere, can happen as early as October or as late as April. The forecast system can provide "a window into what can happen week to week as flu prevalence rises and falls," says Jeffrey Shaman, PhD, an assistant professor of Environmental Health Sciences at Columbia University's Mailman School of Public Health.

As a test case, Dr. Shaman and Alicia Karspeck, PhD, of the National Center for Atmospheric Research, used Web-based estimates of flu-related sickness from the 2003-2008 influenza seasons in New York City to retrospectively generate weekly flu forecasts and found that the technique could predict the peak timing of the outbreak more than seven weeks in advance of the actual peak.

In the future, such flu forecasts might conceivably be disseminated on the local television news along with the weather report, says Dr. Shaman. Like the weather, flu conditions vary from region to region; Atlanta might peak weeks ahead of Anchorage. "Because we are all familiar with weather broadcasts, when we hear that there is a 80% chance of rain, we all have an intuitive sense of whether or not we should carry an umbrella," says Dr. Shaman. "I expect we will develop a similar comfort level and confidence in flu forecasts and develop an intuition of what we should do to protect ourselves in response to different forecast outcomes."

As individuals, a flu forecast could prompt us to get a vaccine, exercise care around people sneezing and coughing, and better tune in to how we feel. For health officials, it could inform decisions on how many vaccines and antiviral drugs to stockpile, and in the case of a virulent outbreak, whether other measures, like closing schools, is necessary.

"Flu forecasting has the potential to significantly improve our ability to

prepare for and manage the seasonal flu outbreaks that strike each year," says Irene Eckstrand, PhD, of the National Institutes of Health's National Institute of General Medical Sciences, which provided funding for the study.

Worldwide, influenza kills an estimated 250,000 to 500,000 people each year; in the U.S. about 35,000 die from the flu every year.

The seed of the new study was planted four years ago in a conversation between the two researchers, in which Dr. Shaman expressed an interest in using models to forecast influenza. Dr. Karspeck "recommended incorporating some of the data assimilation techniques used in weather forecasting to build a skillful prediction system" remembers Dr. Shaman.

In weather forecasting real-time observational data are used to "nudge the model to conform with reality and reduce error in the model simulations," he explains. Applying this method to flu forecasting, the researchers used near-real-time data from Google Flu Trends, which estimates outbreaks based on the number of flu-related search queries in a given region.

Going forward, Dr. Shaman will test the model in other localities across the country using up-to-date data. This is necessary, he says, since "there is no guarantee that just because the method works in New York it will work in Miami."

More information: "Forecasting seasonal outbreaks of influenza," by Jeffrey Shaman and Alicia Karspeck, *PNAS*, 2012.

Provided by Columbia University's Mailman School of Public Health

Citation: New computer model takes a page from weather forecasting to predict regional peaks in influenza outbreaks (2012, November 26) retrieved 27 April 2024 from https://medicalxpress.com/news/2012-11-page-weather-regional-peaks-influenza.html

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