Flu forecasting system tracks geographic spread of disease

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Scientists at Columbia University's Mailman School of Public Health developed a system to accurately predict the geographic spread of seasonal influenza in the United States, as reported in a paper published in the journal *PNAS*.

For the public, the flu forecast may promote greater vaccination, the exercise of care around people sneezing and coughing, and a better awareness of personal health. For health officials, it could inform decisions on how to stockpile and distribute vaccines and antiviral drugs, and in the case of a virulent outbreak, whether other measures, like closing schools, are necessary.

In a retrospective test for the 2008-2009 through 2012-2013 influenza seasons in 35 states, the Mailman School researchers found their forecasting system accurately predicted local onset of flu six weeks ahead of time. Compared to the previous version of the system, the new version improved forecasting accuracy with regard to onset, by 35 percent; peak timing, by 31 percent; and intensity, by 13 percent. Similar improvements were seen at the county level in a test using data from Virginia.

The researchers expect to use the system in their online forecasts for the 2018-19 flu season. Currently, it is being employed as one of the Mailman School entries in the 2017-18 Center for Disease Control and Prevention flu forecast challenge, which the research team previously won outright in 2014 and tied for first in 2015 and 2017.

"The system could also be adapted for use with other respiratory viruses, and with some modification, for infectious diseases more broadly," says lead author Sen Pei, a postdoctoral scientist in Environmental Health Sciences at Columbia's Mailman School of Public Health.

The forecasting system employs techniques used in modern weather prediction to generate local forecasts. It starts with data from the Department of Defense on local incidence of influenza-like illness combined with laboratory-verified cases of influenza and adds a spatial element by incorporating information from Census data on commuting patterns. The system accounts for differences in population location between day and night and irregular travel such as for business trips and vacations.

"Influenza, like many infectious diseases, is spread from person-to-person and as people move from place to place," says Jeffrey Shaman, the study's senior author and associate professor of Environmental Health Sciences at the Mailman School. "By assimilating information on commuting patterns, we've taken a big step forward and improved our ability to accurately forecast where the flu might crop up next."

More information: Sen Pei el al., "Forecasting the spatial transmission of influenza in the United States," *PNAS* (2018). www.pnas.org/cgi/doi/10.1073/pnas.1708856115

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