Flu on the go: mobile technology and respiratory illnesses
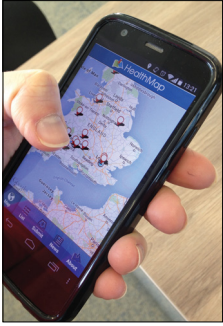
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For **Google Flu Trends** see http://www.google.org/flutrends/

For **HealthMap** see http://www.healthmap.org/en/

For **FluCast** see http://www.healthmap.org/flucast/

For **Flu Near You** see https://flunearyou.org/

For **OutSmart Flu** see https://outsmartflu.wordpress.com/

For **GoViral** see http://www.goviralstudy.com/

Outbreaks often begin, not with a bang, but with a whimper. In late 2002, when reports of a strange pneumonia began to surface in Guangdong, China, both the media and public health authorities were slow to recognise the danger of a novel pathogen with pandemic potential. Only after the SARS coronavirus had begun to spread did physicians and epidemiologists begin to work to stop it. Although the SARS outbreak happened more than a decade ago, the pandemic shares many features with other emerging respiratory illnesses, such as its first appearance in a resource-poor setting. Experts say that more recent novel influenza strains have appeared in a similar pattern. "The first reports of H1N1 flu came out of a small newspaper in Vera Cruz, Mexico", explained epidemiologist John Brownstein of Harvard University (Cambridge, MA, USA).

Interested laypeople are not the only ones turning to social media and other mobile technologies to obtain and share information about influenza and other respiratory illnesses. Researchers and physicians are increasingly relying on these sources to study and track such infections, which have the potential to provide new information about these illnesses.

In the past, formal surveillance of respiratory infections like influenza has been slow. Epidemiologists took several weeks to assemble and analyse physician and laboratory reports before they could report it. As such, physicians only had a picture of what influenza activity looked like previously, not what it looked like currently or even what it might look like in the future. Meanwhile, the widespread use of internet searches, smartphones, and social media has generated reams of real-time data about the health information people are searching for and sharing with others. In 2008, Google Flu Trends began to analyse its users' millions of searches about influenza and flu-like symptoms to provide accurate influenza surveillance without the delay of official reports from the US Centers for Disease Control and Prevention (CDC) and other public health agencies. Although the system has had a few hiccups along the way, its overall success has paved the way for tech startups to use different techniques to track influenza and other respiratory illnesses.

HealthMap, a Boston-based startup with which Brownstein is affiliated, was founded at Boston Children's Hospital (Boston, MA, USA) to aggregate "online informal sources for disease outbreak monitoring and real-time surveillance of emerging public health threats" through a website and mobile app. HealthMap mines everything from online news coverage from worldwide sources to Twitter feeds to user-reported flu symptoms and respiratory illnesses. These sources are used to create HealthMap's FluCast, which provides real-time and forecast data about flu activity, and Flu Near You, which tells users and researchers about influenza activity in their area.

"Google Flu Trends uses millions of Internet searches to map flu, but they don't have much information on each user. Flu Near You is a much smaller dataset, but with much richer information," Brownstein explained.

Suzanne Lindsay, a public health scientist at San Diego State University (SDSU; San Diego, CA, USA), has been especially interested in the usefulness of Twitter to track influenza activity. She teamed up with her colleague at SDSU, Ming-Hsiang Tsou, to mine tweets mentioning flu symptoms from across the USA during the 2013–14 flu season. Lindsay and colleagues then compared this information against official data collected by the CDC at ten sentinel cities in the USA. Overall, she showed that her Twitter data closely matched official CDC reports. "People began tweeting about flu before it was picked up by disease surveillance", Lindsay said.

Christine Muganda, a PhD student at the University of Wisconsin (Madison, WI, USA), is currently analysing data from a smartphone app called OutSmart Flu, with which university students can report influenza-like symptoms via their mobile phones. "The app data was most useful for identifying an influenza outbreak, but it was less useful for estimating levels of flu on campus", she said.

This type of syndromic surveillance is useful—indeed, it forms the backbone of both official governmental and many unofficial methods of tracking upper respiratory infections in populations. In recent years, however, the cost of these tests and the time it takes to obtain results have both decreased substantially, giving researchers and public health experts a way to identify the specific respiratory viruses that are circulating in a population at any particular time.

Enter GoViral. The brainchild of Rumi Chunara, an epidemiologist at New York University (New York, NY, USA), this project looks to take Flu Near You one step further. Instead of only reporting symptoms on their smartphones, participants in GoViral are also sent kits containing a nasal swab to send in for virus testing if they happen to feel ill. The project is still in a preliminary, pilot phase, such that only residents of the states of New York and Massachusetts are currently eligible to participate. But so far, Chunara says, the project has been running smoothly: "The information through traditional health systems is not complete. GoViral is a way to validate information and see what [viruses] folks actually have", she said.

Although these new efforts are increasing in popularity, all the researchers emphasised that they were ways to supplement more formal methods of respiratory illness tracking. "Data from Twitter and other sources adds to the information collected by the CDC and elsewhere, but it will never replace it", Lindsay said.

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