Medical Xpress

FluPhone: Disease tracking by app

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Influenza is sweeping the UK, schools are closing, workplaces are decimated, and the race for a vaccine has begun: all the elements of a scenario not so very hard to imagine.

Localized epidemics and global pandemics periodically pose a significant national and global threat. When this happens, it becomes vital for public health and government authorities to track how far and how fast the disease is spreading.

But, to minimise the health, social and economic impact as far as possible, it's also important to know how people are likely to change their behavior during the course of an epidemic.

"How people behave could limit or exacerbate their risk of infection," explained Professor Jon Crowcroft. "Patterns of social interaction that

worsen the spread of disease pose a significant risk. On the other hand, if people stay at home rather than work, the cost to the economy may be greater than the cost incurred through actual illness."

Understanding how people change their activities during an epidemic might not only help authorities devise strategies to reduce the scale or length of the crisis but might also help them to tailor healthcare messages effectively.

Meet, connect, communicate

The FluPhone study at the Computer Laboratory, led by co-principal investigators Professor Crowcroft and Dr. Eiko Yoneki, has developed a new tool to study behavior and its consequences using mobile phones.

Dr. Yoneki explained: "The application in the mobile phone monitors influenza-like symptoms by prompting questions for the mobile phone owner. It also captures physical proximity information between individuals by recording other devices nearby via Bluetooth communication."

In a pilot study, volunteers (mainly University of Cambridge employees and students) downloaded a Java-based application to their mobile phones using an intuitive interface. Ethical issues were handled carefully during participant registration to the FluPhone study, and the study did not record the location information using GPS because of ethical considerations.

"A post-facto analysis of these data will yield valuable insight into how human communities are formed, how much time people spend together, and how frequently they meet. Such data show complex network-like structures, which is very useful for understanding the spread of diseases," said Dr. Yoneki.

Data collected over a few months – ironically coinciding with an outbreak of swine flu – demonstrated the enormous potential of mobile phones as scientific instruments with which to measure the social activity of a population in real-time. “There are more cell phones than people,” said Professor Crowcroft, “and, in most urban areas, network coverage is close to 100%, hence we can get very accurate measurement and sampling of the population.”

In fact, the study highlighted how mobile phones can provide data that would be otherwise unavailable, as Professor Crowcroft explained: “In this particular outbreak it’s now known that some people carried the disease yet were asymptomatic. Our system is capable of identifying these asymptomatic ‘superspreaders’ because they show up by virtue of the contacts who develop the disease.”

To develop the model further, a virtual-disease epidemic application has been prototyped. Dr. Yoneki explained: “A specific disease infection model can be programmed, and the fake ‘pathogens’ can be transmitted via Bluetooth radio communication when two individuals are in proximity range.”

“This has proved to be a fantastic tool – you can run a ‘what-if’ experiment on the live population based on their contacts, simply by randomly choosing some of the mobile phones to be infectious,” said Crowcroft. “We can then model the effect of behaviour on disease spread.”

Given that technology such as this raises ethical issues concerned with privacy, and approval from the relevant ethics committees was required before the project commenced, the team are now developing a series of guidelines. They hope that this resource will smooth future deployment of a communication protocol via a mobile phone app, particularly in the event of a major disease outbreak.

Spreading information

FluPhone is part of a wider project involving seven academic institutions and government agencies led by the University of Liverpool and funded by the Economic and Social Sciences Research Council. The Cambridge team is planning a larger project using the FluPhone technology together with one of the project partners, the London School of Hygiene and Tropical Medicine, to work in several African countries at village population level in Malawi, Kenya, Tanzania, Uganda, Gambia, Ethiopia and Ghana.

Dr. Yoneki also leads a new five-year project funded by the Engineering and Physical Sciences Research Council to extend and develop the analysis and modelling approaches used in FluPhone. “Specific individuals can be identified who act as coalescing hubs at different points in space and time and who influence data flow. I want to investigate these spatial and social clusters to determine what impact they have on the spread of viruses.”

Together, the multi-institution network of epidemiologists, psychologists, economists and computer scientists is developing new ideas about the different ways individuals and organizations might respond to an outbreak of infectious disease.

These include how people might behave when they or their dependants become ill, why they might avoid populated areas or workplaces for fear of infection, how they might respond if their workplace or school was closed, and what might be driving their attitude to risk and infection. Crucially, they are also considering ways that could be used to counteract unhealthy or risky behaviours, or those that threaten economic stability.

The researchers see potential use for the approach in targeting and measuring the effectiveness of public health messages – something that

is traditionally very difficult to do because of the time it takes to gather data using traditional methods that involve surveys through primary care providers. Tellingly, their findings indicate that people are more likely to intend to heed health advice if it is underpinned with an understanding of why people may not be able to conduct a recommended behavior, such as carrying on working during a pandemic.

More information: www.cl.cam.ac.uk/research/srg/netos/fluphone/

Provided by University of Cambridge