To stop epidemics, acting locally more important than globally

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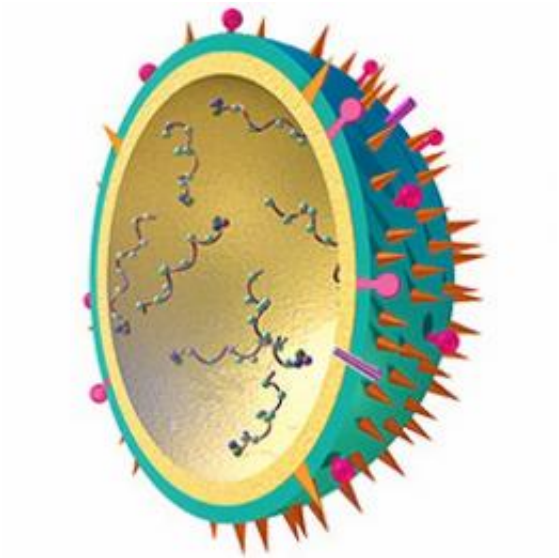

Influenza, or flu, is a respiratory infection caused by several flu viruses. Credit: NIAID

It's flu season. You know this because you hear it on television and read about it in newspapers, so you get flu shots and generally avoid crowds.

All that may tilt the odds against your catching the flu, but it won't affect the spread of an epidemic around you.

Altering the spread of the disease, it turns out, depends on where you get your information and who you know, according to mathematicians in

China and Australia.

People who are highly connected to others, such as schoolteachers who deal with a room full of children, are far more likely to get sick than a freelance writer working at home. But the researchers found that while many of those highly connected people are more likely to catch the disease because of their contacts, they are even more likely to take actions that can halt its spread.

The upside of hampering the spread of the infection overtakes the downside of being more likely to catch it, said Michael Small at the University of Western Australia, in Crawley.

That was not the result he and several collaborating mathematicians thought they'd get when they started the study.

Publishing their results in the journal Chaos, Small, Qingchu Wu of Jiangxi Normal University in Nanchang, China, and their Chinese colleagues found the source of "awareness" that a disease is loosely related to how it spreads in what researchers call networks.

The researchers divided forms of information into global and local.

Global information is what you get through the media, such as news of a flu epidemic, or through more subtle hints, for instance when many coworkers are home sick, said Small.

People react generally to global information to avoid infection and on the individual scale, that works. They mostly keep a social distance to avoid infection, the researchers wrote.

"If everyone you know is already sick than you probably do not go to pub with them or share chips or nuts and have a high chance of getting

disease," Small said. "You change your behavior based on what's going on around you."

The response to local information is more acute and personal, according to Small.

Besides all the things people do in reaction to global information, Small said, they also take more specific actions. They may avoid particular people or particular environments that seem especially risky, for instance, taking children from school or from other group activities if there appears to be a significantly increased rate of infection.

It's this local information that can make or break a disease, stopping the transmission, he said.

"Initially we didn't expect this. We thought more information is better and you stop the disease. It turns out only the local information can do that. It changes the shape of the network by making highly connected people less connected," Small said.

"It will change how the disease behaves," he said.

"I actually was not surprised at the results," said Charles Chiu, a virologist and infectious disease researcher and physician at the University of California at San Francisco, who was not involved with the research. "It's quite intriguing what they did. The results sort of mimic common sense, a validation of what we already knew empirically without doing the actual modeling. It's consistent with the data we collected or the date we had from experience."

"If you study networks, you clearly realize the power of local networks. Real outbreaks essentially jump from community to community. It's not as though they spread out from a local area," Chiu said. That's why local

networks are more effective in halting epidemics.

Chiu said that the only weakness in the study is that he wished the mathematicians had based the results on real-world epidemiological data instead of pure mathematical modeling.

Small said his group is beginning a collaboration with the School of Public Heath at the Chinese University of Hong Kong to do just that, monitoring health across a community during a seasonal influenza epidemic. He eventually hopes that will lead to ways of predicting the effects of the flu and explore possible control strategies.

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