Size of airborne flu virus impacts risk, researchers say

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Linsey Marr, associate professor of civil and environmental engineering at Virginia Tech, pictured, and her colleagues, Wan Yang, of Blacksburg, Va., one of her graduate students, and Elankumaran Subbiah, a virologist in the biomedical sciences and pathobiology department of the Virginia-Maryland Regional College of Veterinary Medicine, conducted a study on the risk of airborne infection in public places from concentrations of influenza A viruses. Marr is a National Science Foundation CAREER Award recipient; this award allowed her to focus on sources of unhealthy air pollutants. Credit: Virginia Tech Photo

A parent's wise advice to never go to a hospital unless you want to get sick may be gaining support from scientific studies on a specific airborne virus.

The results of a Virginia Tech study by environmental engineers and a virologist on the risk of airborne infection in public places from concentrations of influenza A viruses is appearing today in the on-line,

Feb. 2 issue of the United Kingdom's *Journal of the Royal Society Interface*.

Linsey Marr, associate professor of civil and environmental engineering at Virginia Tech, and her colleagues, Wan Yang, of Blacksburg, Va., one of her graduate students, and Elankumaran Subbiah, a virologist in the biomedical sciences and pathobiology department of the Virginia-Maryland Regional College of Veterinary Medicine, conducted their research in a health center, a daycare facility, and onboard airplanes.

"The relative importance of the airborne route in influenza transmission-in which tiny respiratory droplets from infected individuals are inhaled by others-is not known," Marr, who received a National Science Foundation CAREER Award to pinpoint sources of unhealthy air pollutants, said.

What is known is that influenza A viruses are "transmitted through direct contact, indirect contact, large respiratory droplets, and aerosols that are left behind by the evaporation of larger droplets," they reported in the journal. "The aerosol transmission route is particularly controversial since there is scant proof of infection mediated by virus-laden aerosols, partly due to the difficulties in studies involving human subjects and partly due to the challenges in detecting influenza A viruses in ambient air."

What happens is an infected person might cough or sneeze or just be engaged in conversation, and release the viruses into the air. However, these aerosols are quickly diluted to very low concentrations by the surrounding air.

Marr said, "Few studies have measured actual concentrations of influenza A viruses in air and determined the size of influenza-laden particles. Size is important because it determines how long the particles

will remain suspended in the air before being removed due to the forces of gravity or other processes."

To conduct their studies, the Virginia Tech researchers collected samples from a waiting room of a health care center, two toddlers' rooms and one babies' area of a daycare center, as well as three cross-country flights between Roanoke, Va., and San Francisco, Ca. They collected 16 samples between Dec. 10, 2009 and Apr. 22, 2010.

"Half of the samples were confirmed to contain aerosolized influenza A viruses," Marr said. "In the others, it is possible that no infected individuals were present."

Marr added, "The average concentration was 16,000 viruses per cubic meter of air, and the majority of the viruses were associated with fine particles, less than 2.5 micrometers, which can remain suspended for hours. Given these concentrations, the amount of viruses a person would inhale over one hour would be adequate to induce infection."

Subbiah indicated that most studies of airborne transmission of influenza viruses in animals examined the ability of infected animals to transmit the infection to susceptible in-contact animals. How the ambient environment affects the virus after release from the infected host until it reaches the recipient host is relatively unknown. Results of the study show that under defined conditions of humidity and temperature, viruses may remain suspended in air.

Incorporating the concentrations of influenza A viruses and breathing rates, Marr and her colleagues estimated the inhalation dose incurred by someone in the same room and concluded that it was sufficient to induce infection.

"As a whole," the three authors concluded in the *Journal of the Royal*

Society Interface, "our results provide quantitative support for the possibility of airborne transmission of influenza in indoor environments."

Provided by Virginia Tech