

Link found between influenza, absolute humidity

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A new study by Oregon researchers has found a significant correlation between "absolute" humidity and influenza virus survival and transmission. When absolute humidity is low - as in peak flu months of January and February - the virus appears to survive longer and transmission rates increase.

Results of the study were published this week in the *Proceedings of the National Academy of Sciences (PNAS)*.

Researchers have long suspected a link between humidity and flu transmission and prevalence; however, these efforts have focused on relative humidity, according to lead author Jeffrey Shaman, an Oregon State University atmospheric scientist who specializes in ties between climate and disease transmission. Relative humidity is the ratio of air water vapor content to the saturating level, which itself varies with temperature, while absolute humidity quantifies the actual amount of water in the air, irrespective of temperature.

The *PNAS* study re-analyzed data from a 2007 study published in *PLoS Pathogens*, which found a tenuous relationship between influenza transmission and relative humidity. Shaman used the team's research data and substituted absolute humidity for relative humidity in analyzing potential correlations with flu transmission. This effort led to additional investigation of the relationship between absolute humidity and influenza "survival," which is the length of time the virus remains viable once airborne.

"The correlations were surprisingly strong," Shaman said. "When absolute humidity is low, influenza virus survival is prolonged and transmission rates go up." Shaman's co-author on the study is Melvin Kohn, an epidemiologist with the Oregon Department of Health Services.

The 2007 PLoS Pathogens study, by researchers at Mt. Sinai School of Medicine in New York, looked at the effects of temperature and relative humidity on transmission of influenza using influenza-infected guinea pigs in climate-controlled chambers. The researchers used 20 different combinations of temperature and relative humidity in an effort to identify a trigger point for changes in transmission of the virus between infected guinea pigs and adjacent control animals.

In general, the study found that there were more infections when it was colder and drier. However, Shaman and Kohn demonstrated that relative humidity could only explain about 12 percent of the variability of influenza virus transmission from these data. In addition, numerous other experiments, dating back to the 1940s, have shown that low relative humidity favors increased influenza virus survival.

However, in their *PNAS* analysis, Shaman and Kohn demonstrated that relative humidity only explains about 36 percent of influenza virus survival. The Oregon researchers then retested the various data using absolute humidity and found a dramatic rise in accounting for both transmission (50 percent, up from 12 percent) and survival (90 percent, up from 36 percent).

For decades, researchers have been searching for answers as to why there is such a pronounced seasonality of influenza incidence, which peaks during the winter in temperate regions. Potential explanations are that people spend more time indoors and thus transmit the virus more easily; less sunlight may have a chemical effect on the virus and/or

people's immune response; or there might be an unknown environmental control.

The findings of Shaman and Kohn indicate that absolute humidity is the control. Though counter-intuitive, absolute humidity is much higher in the summer. On a typical summer day in Oregon there is twice as much water vapor in the air as in winter, even though it may be raining.

"In some areas of the country, a typical summer day can have four times as much water vapor as a typical winter day - a difference that exists both indoors and outdoors," Shaman said. "Consequently, outbreaks of influenza typically occur in winter when low absolute humidity conditions strongly favor influenza survival and transmission."

Source: Oregon State University

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