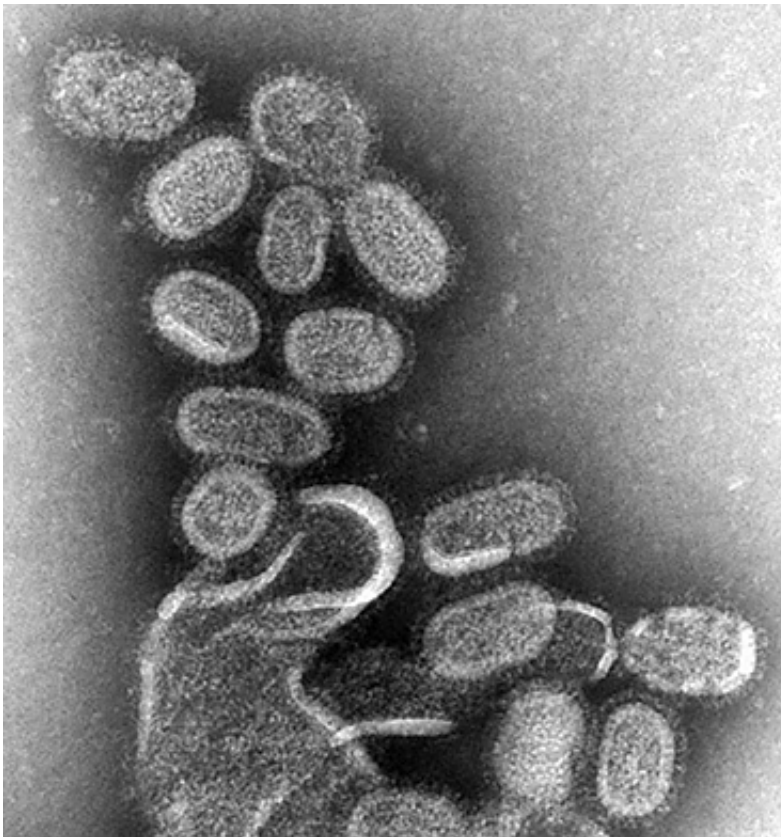


# Mathematical analysis offers clues on timing of flu outbreaks

November 1 2016, by Bob Yirka

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Electron microscopy of influenza virus. Credit: CDC

(Phys.org)—A team of researchers with the University of California and Stanford University has found that applying "empirical dynamic modeling" techniques to heat and humidity readings over a period of several years revealed some of the factors that cause flu outbreaks to

occur. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes the mathematical modeling techniques they used and what it revealed about the spread of the flu.

Most everyone in places like Europe and the U.S. knows that winter is cold and flu season—but not so clear is when flu is more likely to spread in tropical regions, though scientists have long suspected it is tied to warmer or rainy periods. In this new effort, the researchers applied mathematical models to the problem in an attempt to provide more concrete answers.

The researchers used what they describe as an "empirical dynamic modeling framework" to analyze flu outbreak patterns—such time-series models have proven useful in detecting causality in nonlinear systems before (e.g. making connections in anchovy and sardine populations). As possible factors, they used heat and absolute humidity (the actual amount of water in the air), relative humidity (the amount of water in the air relative to temperature) and precipitation amounts over the course of 18 years of flu outbreak data.

They report that their models indicate humidity is the strongest environmental factor influencing the spread of the flu, though temperature also plays a part. Interestingly, they found that at temperatures of approximately 70 to 75 degrees, the impact of humidity switches—below that number, drier air supports more [flu transmission](#), but above that mark, more humid air means more flu transmission. The models, the team claims, parallel real-world observations—in places like North America, when the temperature dips below the switch point and humidity levels drop, the [flu season](#) starts, but in tropical areas, flu "seasons" typically occur during times when the humidity rises. The results also match with prior research showing that the [flu virus](#) tends to swell and burst when exposed to a cold, humid environment and dries up when things get hot and dry.

These findings, the team suggests, means that simply adding humidifiers to homes in temperate climates and running them during the cold months might actually slow the spread of an outbreak.

**More information:** Global environmental drivers of influenza, *PNAS*, [www.pnas.org/cgi/doi/10.1073/pnas.160774711](http://www.pnas.org/cgi/doi/10.1073/pnas.160774711)

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