How 'social contagion' begins and escalates

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Credit: Michael Helfenbein, Yale University

Understanding the roots of a global, contagious spread of online information may help better predict political revolutions, consumer behavior, box office revenues, public policy debates, and even public health epidemics, a new study co-led by Yale University reveals. The model devised for this study, which identifies those roots and analyzes common patterns of dissemination on a global scale, even predicted the rise of "#Obamacare" as a global Twitter trend. The study appears in *PLOS ONE.*

Attempts to globally monitor the spread of online information have

become increasingly difficult because of the explosive growth in the amount of information available and heightened concerns about personal privacy. To get a better understanding of social contagion, the team focused instead on smaller, local network structures, where messages are transmitted from individuals at the center and spread out rapidly to other individuals, who then retransmit them.

They developed a model to test whether the careful collection of information from a sample of more central individuals in social networks could be used to detect contagious outbreaks before they happen in the population at large.

Researchers reasoned that if they could identify popular people at the center of these networks and monitor what they were talking or tweeting about to friends on the edges, they could get advance warning about a coming epidemic spread of information. They called this the "sensor hypothesis."

The researchers analyzed six months of data from Twitter, recorded in 2009. From a starting network of 40 million users around the world who were connected by 1.5 billion "follows," they randomly chose a small fraction of central individuals, and at least one person who followed them, to include in a group for monitoring.

Their study showed that this model of smaller "friend groups" is key to the eventual explosive spread of information, and can therefore help detect or predict viral outbreaks of novel hashtags about nine days earlier than most of the public would have noticed. These "sensor friends" were early indicators of the deluge to come.

"The central individuals in these 'friend groups' are early conduits of information, selecting or passing on novel information," explained co-senior author Nicholas Christakis, M.D., Yale's Sol Goldman Family

Professor of Social and Natural Science, professor of internal medicine at Yale School of Medicine, and co-director of the Yale Institute for Network Science. "We found that monitoring social media in this manner offers a whole new way to monitor the global spread of information about all sorts of topics."

The researchers note that their "sensor" model actually forecast the viral rise of "#Obamacare" as a Twitter trend, detecting it a full two months before it peaked on Twitter, and three months before searches with that name peaked on Google. "We were really surprised. We thought the method would give us a few hours early warning, but instead it gave us several days, and sometimes even weeks or months," said co-senior author James Fowler, professor of medical genetics and political science at the University of California-San Diego.

The team's findings have great implications for the early detection of social, political, economic, and consumer moods, and even health trends. Christakis said, "Public health officials around the world could use our sensor method to mount a quicker and more focused response to health epidemics. It would give them more lead time to save lives."

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