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# Research uses smart surveillance to rapidly identify emerging disease threats

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February 13, 2013 – EcoHealth Alliance, the nonprofit organization that focuses on local conservation and global health issues, announced new research focused on the rapid identification of disease outbreaks in the peer reviewed publication, *Journal of the Royal Society Interface*.

The article, authored by leading scientists in the fields of emerging disease ecology, biomathematics, computational biology and bioinformatics, shows how network theory can be used to identify outbreaks of unidentified diseases. The strategy builds on the wealth of online surveillance data and increased reporting and tracking of emerging infectious diseases via the Internet. Pandemics often first emerge in remote regions, and early in their development, the identity of the cause is often unknown. In many cases these events turn out to be known diseases that don't require emergency action, and cutting through the clutter and uncertainty to determine which outbreaks are important is a critical challenge.

The newly released research used a simple set of data collected at the earliest stages of an outbreak such as symptoms, time of year, and percentage of the population that died (the case fatality rate). This information was collected from 125 reports of outbreaks on 10 known infectious diseases causing encephalitis (brain or neural infection) in South Asia – a known 'hotspot' for new disease outbreaks. The data was analyzed to examine whether outbreaks of the same disease clustered together, based on basic outbreak properties (symptoms, timing and case fatality rate). Results showed that diseases such as Nipah virus – an

emerging and very lethal disease – showed distinct characteristic patterns within such a network and clustered separately to other more established diseases such as malaria and Japanese encephalitis. The team was then able to take outbreaks caused by unknown pathogens and provide a probable diagnosis for these 'mystery diseases'. The initial analysis shows a promising advantage to aid in predicting and preventing possible pandemic diseases that can result in devastating losses in life and global economic crises. "This application of network theory is exciting not only because it provides a fast, affordable method for associating undiagnosed outbreaks with a set of most likely known diseases, but perhaps most importantly because it provides a method for researchers to work with public health experts to identify potentially novel pathogen threats, as these agents will not fall into any of the known disease clusters and therefore can be easily identified," said Dr. Tiffany Bogich, Princeton University.

Often, new pandemics start as a few cases of an unknown disease in a remote region of the globe. After a few weeks or months depending on conditions, the disease continues to spread through the rapid movement of global travelers. As with the SARS outbreak, the virus incubated for a few months in China before it spread to Hong Kong, Canada and other points around the world. In 2009, the outbreak of H1N1 'Swine' flu circulated in Mexico for at least a couple of months before it was discovered as a real threat to public health. When Nipah virus caused outbreaks in pigs and farm workers in Malaysia, many health officials thought the disease was symptomatic of Japanese encephalitis. All of these examples illustrate the need to identify highly infectious diseases at the very earliest stage – when there are just a few cases – allowing public health officials to thwart these new viruses from spreading globally.

"This research may be critical to rapidly deciding which outbreaks are something completely novel and have pandemic potential, rather than a repeat outbreak of a known pathogen. It allows public health agencies to

target their resources in the most efficient way, and helps protect us from new emerging diseases, which often erupt in remote corners of the Earth where it is sometimes very difficult to obtain vital information, let alone biological samples to test for various pathogens," said Dr. Peter Daszak, corresponding author and President of EcoHealth Alliance. "Another aspect that we are looking at is using this tool to pinpoint possible bio-terrorism, such an act will produce immediate symptoms that are unusual, and would likely light up on our network analysis," added Dr. Daszak.

Provided by EcoHealth Alliance