Epidemics: The end of containment measures?

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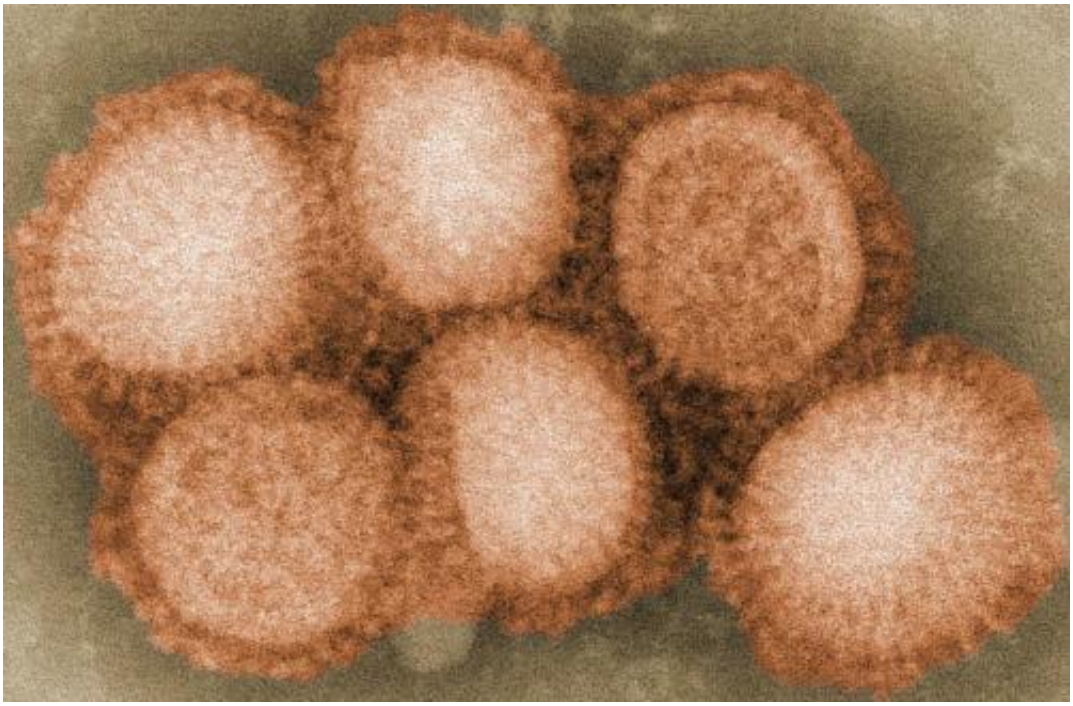

H1N1 virus. Credit: C. S. Goldsmith and A. Balish, CDC

When an epidemic outbreak such H1N1, Zika or SARS viruses occurs, containment measures may seem to be the most reasonable solution. However, an EPFL study casts doubt on that idea, showing that such measures make a society less resilient and less able to return tor pre-epidemic economic and social conditions. The study, published in *Nature Scientific Reports*, coincides with another publication on the same subject but based on other mathematical models, published in *Nature Physics* in

December. That study also compared the advantages of containment measures with those of non-intervention, and reached the same conclusion: Preventing travel and social interactions is not always the best way to deal with an epidemic outbreak.

"In this field, thinking in terms of cost/benefit is a fairly new development," explained Emanuele Massaro, first author of the study and a postdoctoral researcher at EPFL's Laboratory for Human-Environment Relations in Urban Systems (HERUS). "Previously, the sole focus was on limiting the number of people infected. As a result, studies looked mainly at the severity of the disease, its prevalence and its impact on the health of a population. Of course, that's the first stage, but we should also consider the cost to society caused by a long-term breakdown of mobility and services, a possible recession and social conflict," said Massaro, who wants those dealing with epidemic outbreaks to think about them in a new way. There are other studies that back up his conclusions. Two articles, one published in *Eurosurveillance* in 2014 about the Ebola virus and one published in *Nature* in 2006 about the transmission of the flu virus, showed that closing borders merely delayed the epidemic peak by a few weeks and did not decisively reduce the number of people infected.

In this latest study, Massaro tested his hypotheses on real mobility data, simulating the outbreak of an epidemic in New York City and its subsequent spread. He also looked at the impact of behavioral changes that individuals would willingly adopt in the event of an epidemic—such as avoiding public spaces, limiting leisure activities and working at home—in connection with varying levels of intervention. Taking into account this socio-economic factor is the study's main innovation: "We quantified a variable that is often difficult to predict. The authorities need to understand the risks they create in terms of the system's resilience if they adopt alarmist media campaigns. Above all, they need to know the severity of the disease before disseminating messages

encouraging people to limit their movements or change their habits," Massaro explains.

The study's calculations show that without political intervention, infections peak within a short space of time, but then society quickly reverts to its pre-epidemic state. By limiting movements, the authorities create greater risks: "Preliminary studies showed that there is a critical value for the reduction in movements—around 80-90% - that prevents the spread of an epidemic across a population. However, our research shows that this reduction in mobility dramatically reduces the resilience of the system, because it impairs the basic functioning of a society over a long period." When building his models, Massaro adopted the US National Academy of Sciences' definition of resilience, i.e., a system's ability to plan and prepare for, and absorb and adapt to, a new situation.

The conclusions of the EPFL study and the article published in *Nature Physics* may be rather counterintuitive. They also pose an ethical question for decision-makers: should they allow more people to become infected initially in an epidemic outbreak in order to prevent a breakdown in the functioning of a city or a country? The next step for Massaro will be to refine his conclusions by applying his models to past epidemics. He also intends to work with others involved in dealing with epidemics, such as insurers and government officials, to find out what they regard as the most important issues and factor them into his models. In the end, Massaro believes that scientists also need to take an ethical approach: "Scientists must remain cautious in these studies and make sure that their core focus is always on human beings."

More information: Emanuele Massaro, Alexander Ganin, Nicola Perra, Igor Linkov, Alessandro Vespignani, "Resilience management during large-scale epidemic outbreaks", *Nature Scientific Reports*, 30 January 2018. www.nature.com/articles/s41598-018-19706-2

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