Medical Xpress

Swine Flu Worst Case Scenario: Computer Simulations (w/Video, Podcast)

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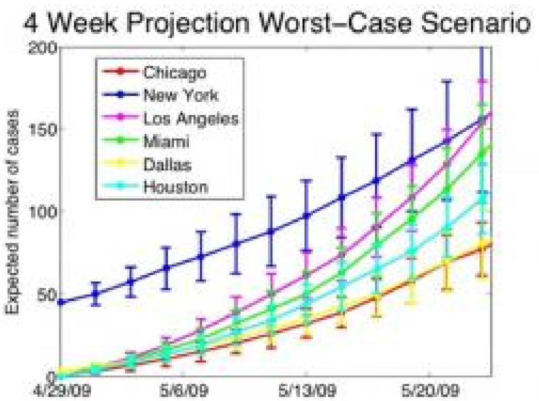

The figure indicates the time course of the number of infected individuals as a function of time in the next four weeks. The bars indicate the degree of uncertainty. This is again the projection of a worst-case scenario that does not take into account containment efforts.

(PhysOrg.com) -- Large-scale computer simulations run by Northwestern University researchers show worst-case scenario projections of approximately 1,700 cases of swine flu for the entire United States four weeks from now.

Associate Professor Dirk Brockmann and his research group have found that the major areas projected to have incidents in the worst-case scenario include California, Texas and Florida. Worst-case scenario means that no measures have been taken to combat the spread of disease.

These numbers would, of course, be lessened by preventive measures already under way.

Under the worst-case scenario, more than 100 cases are projected for the Chicago area. The affected locations largely correspond to major transportation hubs in the country. The researchers also will be running simulations on the possible time course of the spread of swine flu in Europe.

Brockmann says their swine flu results are in excellent agreement to those of a research group at Indiana University led by Alex Vespignani that is using a different method.

“The Indiana group uses a different computational approach, and the agreement of our results is promising and an indicator of reliability in both methods,” says Brockmann, associate professor of engineering sciences and applied mathematics at the McCormick School of Engineering and Applied Science.

Brockmann and his doctoral students Christian Thiemann, Rafael Brune and Alejandro Morales-Gallardo are constantly updating the simulation, taking into account new information on confirmed cases and more precise information on transmissibility and disease-specific parameters.

Brockmann has extensive experience modeling the spread of disease. His high-performance computer clusters can be used to simulate an infectious disease that spreads among 300 million people.

“We can, on a very realistic scale, try to model an epidemic that has the same size as a real epidemic,” he says. In order to understand how disease travels, Brockmann also must understand human transportation networks.

“These networks play an important role in the spread of infectious disease,” he says. “So we’re looking at how people travel in the United States and Europe and trying to find a theory behind human traffic. Then we can unravel the structures within these networks and explain them.”

One way to track how people travel is to monitor how money travels. In a 2006 study, Brockmann used data from WheresGeorge.com -- a site where users enter the serial numbers from their dollar bills in order to track their travels -- to create a model to predict the probability of a bill staying within a 10-kilometer radius over time. From that information, Brockmann found a key factor in his disease-spread modeling approach: very accurate datasets on human mobility. This multi-scale human mobility network included small-scale daily commuting traffic, intermediate traffic and long-distance air travel, which helps determine how a disease could potentially spread.

Brockmann and his research group also have created a map of community boundaries in the United States based on human mobility, rather than the usual state-line boundaries of rivers, mountain ranges or administrative lines. The map shows that some states, like Missouri, are essentially cut in half -- likely due to two large cities that lie on either side of the state. Other boundaries are islands in the middle of states, as is the case with Santa Fe, New Mexico.

“These boundaries might be better suited for developing mitigation strategies against epidemics,” Brockmann says. “We’re working on creating a similar map for Europe.”

For his work, Brockmann collaborates with linguists, epidemiologists, ecologists and other scientists from around the world. He is motivated by results that could potentially be useful for humanity.

“I want to do work that is important, that involves pressing matters,” he says. "It motivates me to do research on complex systems that will eventually improve life."

Provided by Northwestern University (news : web)

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