Medical Xpress

Measuring the uncertainties of pandemic influenza

July 2 2012

A major collaboration between US research centers has highlighted three factors that could ultimately determine whether an outbreak of influenza becomes a serious epidemic that threatens national health. The research suggests that the numbers in current response plans could be out by a factor of two or more depending on the characteristics of the particular pandemic influenza.

Researchers from Argonne, Los Alamos, and Sandia National Laboratories, and the National Renewable Energy Laboratory, have used sensitivity analysis to uncover the most important disease characteristics pertaining to the spread of infection with an influenza virus. These are: the fraction of the transmission that occurs prior to symptoms, the reproductive number, and the length of each disease stage. Their use of data from past pandemics as well as information on potential viral evolution demonstrates that current response planning may underestimate the pandemic consequences significantly.

"It has become critical to assess the potential range of consequences of a pandemic influenza outbreak given the uncertainty about its disease characteristics while investigating risks and mitigation strategies of vaccines, antiviral drugs, and social distancing measures," explains Jeanne Fair of Los Alamos National Laboratory and her colleagues. The team has used a simulation model and rigorous experimental design with sensitivity analysis to show the extremes of consequences of a potential pandemic outbreak in the USA. The simulation incorporates uncertainty in the evolution and characteristics of the pathogen and differences in

the epidemic response, and uncertainties in the sociological response to a pandemic.

Although we are yet to face an H5N1 avian influenza epidemic, the team suggests that they have nevertheless been able to develop a worst-case scenario for all possibilities considering mortality rates and infectiousness based on current knowledge and historical patterns dating back to the 1917-1918 global pandemic. They suggest that a future worst-case influenza pandemic might be up to four times as lethal as the pandemic that occurred towards the end of the Great War. Moreover, their simulation suggests that the use of antiviral drugs may not be as effective as healthcare authorities would hope. On a positive note, they have found that social distancing could be the most effective way to contain the spread of infection, usefully reducing symptoms by an average of 16% although it will cost 50% more than antiviral use through lost working days and commerce.

"Do we prepare for the worst-case scenario when preparing for a pandemic?" asks Fair. "While the worst-case scenario is indeed the worst, it may not be as likely. As far as mortality rates, the 1918 was the worst but really still was only around 2% which is could be considered low." While, the next pandemic could be worse than that of 1917-1918, the worst case scenario may not be as likely, the team concludes. Their study supports earlier findings that no single, pure strategy is best and that a mix of pharmaceutical and non-pharmaceutical interventions will be needed to contain the disease and reduce the total number of deaths. It would be prudent to incorporate these findings in planning for the next pandemic, the team asserts.

More information: "Measuring the uncertainties of pandemic influenza" in Int. J. Risk Assessment and Management, 2012, 16, 1-27