Early vaccination could save lives, dollars in next flu pandemic, study shows

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A young man receives a vaccination. The cost and reimbursement levels of vaccines vary widely, according to new studies from the University of Michigan Health System. Credit: Scott Soderberg, University of Michigan

(Medical Xpress)—Early vaccination could save both lives and money during the next flu pandemic, according to a study led by Stanford University School of Medicine researchers.

Using lessons learned from the 2009 H1N1 flu pandemic, researchers calculated the costs of waiting to vaccinate, looking at both the price tag

to treat sick patients and the number of lives lost. Generally, a new flu vaccine takes at least six months to develop and distribute, but a vaccination campaign at four months after the start of an outbreak would save thousands more lives and millions of dollars in a large metropolitan area, according to the study. Additional measures, such as wearing face masks, using cough etiquette, washing hands or closing schools, can limit the virus' spread while a vaccine is in production.

Seasonal flu viruses sicken and kill large numbers of people each year, but the flu becomes a pandemic when it fulfills three criteria: It must be unusually infectious and deadly, it must be a new strain to which humans do not have immunity and it must spread worldwide. The H1N1 strain was a new virus that traveled around the globe at the end of the last decade, but it killed a small percentage of the people infected—less than 0.3 percent. In comparison, the deadly 1918 Spanish flu pandemic killed 2.5 percent of people it infected.

"We had a test run of our preparedness in 2009," said Nayer Khazeni, MD, assistant professor of medicine and lead author of the study. "It's great that it happened under a very mild pandemic situation, and I think that's given us a lot of opportunity to learn and revise. I hope that recommendations based on our study findings will help make us even more prepared."

When to vaccinate?

Though the World Health Organization declared the H1N1 virus a pandemic in June 2009, large-scale vaccination did not occur until January 2010. By then, many people had already contracted the virus, recovered and developed immunity. The delay spurred the researchers to ask when would be the best time to vaccinate, and how many people should receive the vaccine.

The new study, published online May 19 in *Annals of Internal Medicine*, also looked at the economic impacts of the flu, which previous models had not quantified.

The model simulates how a more severe flu virus would spread through a densely populated metropolitan area such as New York City. It considered the deadliness of the virus, whether the population had immunity from a similar strain and how easily the virus spreads between people.

By adding a vaccination campaign into the model at different times, the researchers could predict the best time to vaccinate for a future pandemic. Vaccinating at six months after the start of the outbreak instead of nine (the timing of vaccination for the 2009 H1N1 pandemic) would prevent more than 230,000 infections and almost 6,000 additional deaths in a city of 8.3 million people. The city would also save $51 million in medical bills.

Production bottleneck

The bottleneck that slows vaccination is the production process. Most doses of flu vaccine are grown in chicken eggs. And when companies must adapt the process to a novel virus, it cuts into the production time for the seasonal flu vaccine. Six months is the least amount of time in which these companies can produce and distribute a sufficient number of doses.

Newer technologies that use cell cultures and DNA manipulation to create vaccines may one day cut down on vaccine-development time. If these technologies could yield enough doses within four months, then a metropolis like New York could save almost twice as many lives and save another $50 million.

"Timing is crucial," said Douglas Owens, MD, professor of medicine at Stanford and a senior investigator at the Veterans Affairs Palo Alto Health Care System. Owens is the senior author of the paper. "Delays of a few weeks or months can make an enormous difference in the number of people who are infected. If you had a bad pandemic flu, it can have an enormous impact on the number of people who die."

Before the vaccine becomes available, other strategies can limit the virus' spread. Nonpharmaceutical interventions include hand washing, wearing a face mask, coughing into one's elbow and staying home while sick. In a severe pandemic, schools, businesses and public transit systems could be closed down to reduce exposure, the researchers said.

"I think the most encouraging finding of our study is that nonpharmaceutical interventions can really serve as a bridge to mass-vaccine creation and delivery," said Khazeni. The researchers found that even if a city did not vaccinate until nine months after an outbreak began, by instituting these measures, they could see the same positive effects as if they had vaccinated at four months.

In future studies, the researchers will add more complexity to their model by including additional consideration for young children, who tend to spread flu germs more widely than adults, and people with underlying medical conditions, who are more susceptible to serious illness and death.

Possible threats

Though it's impossible to predict which flu virus will become the next deadly pandemic—and when it will strike—two specific viruses are on epidemiologists' radars: H5N1, a virus in Southeast Asia contracted from birds, and H7N9, a new flu virus strain to which humans have no natural immunity. Both strains have a high mortality rate but cannot yet spread

from human to human.

"I don't know that we can predict what the virus is going to be, but I do think it's possible to say that there might be a pandemic," said Khazeni. "There are some similarities in the viruses and the way we prepare that are generalizable. It doesn't actually matter what virus it is."

Provided by Stanford University Medical Center

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