MedicalXpress

Researchers propose new model to design better flu shots

December 22 2011, By B. Rose Huber

(Medical Xpress) -- The flu shot, typically the first line of defense against seasonal influenza, could better treat the U.S. population, thanks to University of Pittsburgh researchers.

New research that focuses on the composition and timing of the shot design was published in the September-October issue of Operations Research by Pitt Swanson School of Engineering faculty members Oleg Prokopyev, an assistant professor, and Professor Andrew Schaefer, both in the Department of Industrial Engineering, and coauthors Osman Ozaltin and Mark Roberts, professor and chair in Pitt's Department of Health Policy and Management. Ozaltin, who is now an assistant professor of engineering at the University of Waterloo in Ontario, did his research for the study as a Pitt graduate student in the Swanson School; he earned his Pitt PhD degree in industrial engineering earlier this year.

The exact composition of the flu shot is decided every year by the Food and Drug Administration (FDA), and the decision is complicated.

"The flu's high rate of transmission requires frequent changes to the shot," said Prokopyev. "Different strains can also cocirculate in one season, which gives us another challenge for figuring out the composition."

The Pitt researchers used powerful optimization methods from engineering to examine whether they could improve the yearly decisions

made regarding what strains of influenza should be included in the current year's vaccine. The strains of flu that will be most likely to appear in the regular flu season are not known with certainty, but waiting longer to finalize the composition of the vaccine and observing what strains are occurring in other parts of the world improves the accuracy of the selection. However, the longer the FDA waits to make the decision, the more likely it is that there will be insufficient vaccine produced by the start of flu season. The model developed by the Pitt researchers balances these two important characteristics of the flu selection decision and integrates the composition and timing decisions of the flu shot design.

The model allows examination of the effect of many changes to the design and production of the vaccine, such as how many strains to include in the shot, when to make the final decision, how many times the FDA should meet to re-examine the current information concerning strains in other parts of the world, and the potential benefits from improved production methods.

"With this model, several policy questions can be addressed," said Schaefer. "For example, incorporating more than three strains might increase the societal benefit substantially, particularly under more severe flu seasons."

"The strains in the flu shot are now chosen at least six months before the actual flu season," added Schaefer. "This leaves a lot of uncertainty because we're really not sure which strain will emerge. Our models provide insights into a better flu shot."

The Pitt study focused solely on the United States, where the FDA makes the final decision about the flu shot composition soon after recommendations from the World Health Organization and the Centers for Disease Control. The current flu shot contains inactivated strains of

two influenza A subtypes and one influenza B lineage. The flu shot production is also limited by the scarcest strain, as the three strains are combined together to compose the shot.

“The three strains in the current flu shot are grown separately in chicken eggs and combined together to produce a single dose,” said Ozaltin. “Our model considers all three strains simultaneously, because unanticipated difficulties in growing a strain might result in reductions in the overall flu shot supply.”

The Pitt researchers note that currently only six manufacturers provide the flu shot for the U.S. market. Once the strains are selected by an FDA advisory committee, manufacturers move forward in making their own plans to maximize profits.

“We’re suggesting a policy that includes more frequent committee meetings,” said Prokopyev. “That could provide additional gains in the annual societal benefit of the flu shot.”

For the future, the results suggest a substantial potential benefit from improved manufacturing techniques. With more research in this area, a more appropriate flu shot could be produced annually, saving Americans millions of dollars and preventing substantial influenza complications.

“This is another excellent example of the benefits of collaborative, multidisciplinary research that the University of Pittsburgh is famous for,” notes Roberts. “Our group has been applying methods developed in engineering and designed for industry to very real problems in health and disease, and finding that they can provide insights not previously observed using traditional clinical research methods.”

Provided by University of Pittsburgh