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Pronouncer: Hsu sounds like "shoe"

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K-STATE ENGINEERS FINE TUNE COMPUTER MODELS TO PREDICT, PREVENT SPREAD OF FOOT-AND-MOUTH DISEASE; DEPENDING ON SITUATION, VACCINATION OR CULLING BEST PREVENTION

MANHATTAN -- Combining technology and animal health, a group of Kansas State University researchers is developing a more effective way to predict the spread of foot-and-mouth disease and the impact of preventative measures.

The researchers are finding that if a foot-and-mouth disease outbreak is not in the epidemic stage, preemptive vaccination is a minimally expensive way to halt the disease's spread across a network of animals. But if there's a high probability of infection, computer models show that culling strategies are better.

"We are trying to do predictive as well as preventative modeling using a network-based approach," said Sohini Roy Chowdhury, a master's student in electrical engineering. "First we track how the infection is spreading in space and time. Then we try to mitigate that with certain strategies. The novel contribution of this project is that we considered networks in countries like Turkey, Iran and Thailand that don't have a highly built database."

Roy Chowdhury is working with Caterina Scoglio, associate professor of electrical and computer engineering, and William Hsu, associate professor of computing and information sciences. They presented the work in December 2009 at the Second International Conference on Infectious Diseases Dynamics in Athens, Greece.

The researchers used mathematical equations to predict how foot-and-mouth disease spreads over a network of infected herds. In the network, the nodes are places like stockyards and grazing lands where animals are held. They are connected in various ways, such as by animals' grazing movements and by how people and vehicles move among the herds. Hsu said the researchers' goal is to increase the accuracy of models that predict disease spread in these networks over space and time.

In the experiments, the researchers ran up to a week of predictive modeling on a real network and saw how well it matched data from the actual episode. Roy Chowdhury said they also used artificial intelligence-based modules to cross compare the model's accuracy.

The researchers also tested such mitigation strategies as vaccination, culling and isolation to see how they affected the network. In real-world outbreaks of foot-and-mouth disease, culling often is

presumed to be the best strategy, but Scoglio said their research could shed more light on the effectiveness of this practice.

"It is the hope to properly contain a disease like foot-and-mouth disease that is so infectious while minimizing the economic losses," Scoglio said.

Hsu said this study also could benefit relief workers sent to help contain foot-and-mouth disease. The K-State network models improve upon existing ones, he said, because they consider such factors as wind, animal grazing and human movements between regions, as well as the number of meat markets in an area.

Scoglio's research group has studied disease outbreaks using computer models of networks before, but this project is different in that it considers a specific disease, she said.

Hsu contributed his research in data mining, which seeks to scour news stories and other online public sources and extract information that could offer clues about disease outbreaks. For this project, Hsu's system crawled and analyzed Web articles from news agencies like the BBC and CNN, as well as such sources as disease control fact sheets from universities.

"Just as Google indexes sites based on authoritativeness and looks for hub sites, we also look to start our crawls of the Web from sites like the World Health Organization and the Centers for Disease Control and Prevention," Hsu said.

At the conference in Athens, Roy Chowdhury also presented a poster on preliminary work the group has done on H1N1 infections. Using temporal models, they generated predictions on when infections would peak and the rate at which they would drop off after that peak. Roy Chowdhury used data from the Centers for Disease Control and Prevention. The group plans to extend this analysis of the H1N1 epidemic using network-based models.