Stanford researchers focus on social networks to curb spread of disease

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(PhysOrg.com) -- Anthropologist James Holland Jones and biologist Marcel Salathe developed a mathematical model to identify social networks and predict how they'll interact during a disease outbreak. They say that's the key to heading off an epidemic.

When it comes to curbing epidemics, it makes sense to understand social networks. Figuring out who might have a disease and is most likely to spread it to others is essential to controlling an outbreak.

But scientists haven't had good ways to do that. They often rely on unrealistic models that assume all people interact with each other with equal frequency. Think of a bag of Shake 'n Bake: chances are all the pieces of meat will be coated with equal amounts of breadcrumbs simply because they're tossed together.

Stanford researchers Marcel Salathé and James Holland Jones have come up with a better, more strategic way to track and curb the spread of disease that reflects real-life relationships. Developing an algorithm and testing it on Facebook data, they've figured out how to identify the social interactions between communities - the relationships most likely to link one group to another and get more people sick.

Their "community bridge finder" algorithm is presented in a paper published in the April 8 edition of *PLoS Computational Biology.*

The model takes into account community structure, social networks and

the fact that tightly knit groups are often connected by just a few individuals - ideas that seem obvious but have not been applied by epidemiologists.

"If there's a disease popping around a community with only one road out of town, then chances of it randomly making its way to another tightly knit community are pretty low," said Jones, an assistant professor of anthropology. "The more roads there are out of town, the more likely it is that the disease will get out and spread. So the key is to find those roads and shut them down."

The Facebook data Salathé and Jones used to test their theory comes from 2005, when the social networking site was available only to college students. Tracking the relationships and interactions of students on five university campuses helped the researchers develop their mathematical model that recognizes clusters of people and predicts the likely bridges between them.

"When a new virus starts spreading, neither the time nor the necessary doses of vaccine to immunize everyone is available," said Salathé, a postdoctoral fellow in biology. "So you'd want a strategy that allows you to protect a population as much as possible given the limited resources that you have. Our analysis shows that targeting the bridges between communities is such a strategy, and the algorithm that we propose is an efficient way of finding those bridges."

Provided by Stanford University