UCLA develops new model to predict the spread of a 'super-bug' in L.A. county jail

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Researchers at UCLA have developed a mathematical model that mimics a particularly nasty and ongoing outbreak in the Los Angeles County Jail (LACJ) of the flesh eating bacteria Staphylococcus Aureus.

Reporting in the September issue of *Nature Reviews Microbiology* and currently online, Sally Blower, a professor of biomathematics at the Semel Institute for Neuroscience and Human Behavior at UCLA, and colleagues constructed a simple model of the outbreak in order to assess its severity, predict the consequences of a catastrophic outbreak in the jail, and suggest effective interventions to stop or control it.

Blower was intrigued by the outbreak in the LACJ of community-acquired meticillin-resistant Staphylococcus aureus (CA-MRSA), a “super bug” that’s difficult to eradicate, and easy to catch through crowded conditions and less than optimal hygiene. When someone is infected, the bug can cause illnesses that range from minor skin infections, to severe ulcers on the skin, to life-threatening diseases.

A major risk factor for CA-MRSA has been identified as incarceration. While large outbreaks have been reported in jails around the country, the researchers choose the LACJ for two reasons—it is the nation’s largest jail, housing some 165,000 inmates per year and 20,000 inmates at any given time, and it has a high rate of CA-MRSA—an outbreak was first reported in 2002 and continues to this day. To date, nearly 8,500 cases have been reported in the jail, and, said Blower, “Inmates, once they are released, are spreading the pathogen throughout the community as well.”

With cooperation from the LACJ, the researchers compiled information that determined booking rates or inflow, duration of stay or outflow, the rate of transmission of the bug within the jail, and the three "states" the prisoners were in while imprisoned: not infected, asymptomatic but infectious (colonized bugs living on the skin), or infected and infectious (ulcers appearing on the skin).

The researchers used the data to establish the parameters of the disease and then built a mathematical model that established the extent of the outbreak, and suggested the best way to control the pathogen.

The research showed that the LACJ outbreak is extremely large but not catastrophic, but would have become catastrophic if inmates had been incarcerated for more than two to two-and-a-half months. If catastrophic, thousands of infected inmates would have been released each month. Their model also revealed that the outbreak was sustained because of a continuous inflow of colonized and infected individuals who had picked up the bug from the community and brought it into the jail, and not from within-jail transmission.

"And that's the value of such modeling," said Blower, "because one of the things it can do is help to pinpoint where the best point is for intervention which, in this case, is at the point of inflow. This model also shows that it is very likely that jails are "hot-spots" for contributing to the spread of CA-MRSA in the community". More complex models can be developed using the simple transmission model as a platform, so that additional quantitative insight can be gained into the outbreak dynamics of such nasty pathogens.

Source: University of California - Los Angeles