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Analyzing disease transmission at the community level

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Researchers at the Johns Hopkins Bloomberg School of Public Health have found evidence of a role for neighborhood immunity in determining risk of dengue infection. While it is established that immunity can be an important factor in the large-scale distribution of disease, this study demonstrates that local variation at spatial scales of just a few hundred meters can significantly alter the risk of infection, even in a highly mobile and dense urban population with significant immunity. The study is published in May 28 edition of the journal *PNAS*.

Dengue is a mosquito-borne disease that infects nearly 50 million people worldwide each year, resulting in more than 19,000 deaths. There are four serotypes of dengue virus (DENV1) circulating in Bangkok, Thailand, where the study was conducted. Infection with dengue provides lifelong immunity to the infecting serotype and there is evidence infection temporarily protects from infection by other serotypes. When susceptibility to other serotypes returns there is an increased risk for severe disease. For the study, the research team used the household location of 1,912 confirmed dengue cases in Bangkok that were admitted to a local children's hospital between 1995 and 2000. The available data enabled the researchers to pair dengue serotype infections with specific households.

Observations indicated that immunological memory of dengue serotypes occurs at the neighborhood level in this large urban setting. The researchers developed methods that have broad application to studying

the spatiotemporal structure of disease risk where pathogen serotype or genetic information is known.

"We observe patterns of spatiotemporal dependence consistent with the expected impacts of lifelong and short-term immunity, and immune enhancement of disease at distances of under one kilometer," said Henrik Salje, lead author of the study and doctoral candidate in the Bloomberg School's Department of Epidemiology.

"By providing insight into the potential spatial scales that immunity in a population is correlated and distances over which the disease is dispersed, these findings can help us further understand how dengue is being maintained in endemic populations," said the study's senior author, Derek Cummings, PhD, assistant professor with the Bloomberg School's departments of Epidemiology and International Health.

More information: "Revealing the microscale spatial signature of dengue transmission and immunity in an urban population" by Henrik Salje, et al. *PNAS*.

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