Risk map of cholera infection for vaccine deployment: The eastern Kolkata case


BACKGROUND:
Despite advancement of our knowledge, cholera remains a public health concern. During March-April 2010, a large cholera outbreak afflicted the eastern part of Kolkata, India. The quantification of importance of socio-environmental factors in the risk of cholera, and the calculation of the risk is fundamental for deploying vaccination strategies. Here we investigate socio-environmental characteristics between high and low risk areas as well as the potential impact of vaccination on the spatial occurrence of the disease.

METHODS AND FINDINGS:
The study area comprised three wards of Kolkata Municipal Corporation. A mass cholera vaccination campaign was conducted in mid-2006 as the part of a clinical trial. Cholera cases and data of the trial to identify high risk areas for cholera were analyzed. We used a generalized additive model (GAM) to detect risk areas, and to evaluate the importance of socio-environmental characteristics between high and low risk areas. During the one-year pre-vaccination and two-year post-vaccination periods, 95 and 183 cholera cases were detected in 111,882 and 121,827 study participants, respectively. The GAM model predicts that high risk areas in the west part of the study area where the outbreak largely occurred. High risk areas in both periods were characterized by poor people, use of unsafe water, and proximity to canals used as the main drainage for rain and waste water. Cholera vaccine uptake was significantly lower in the high risk areas compared to low risk areas.

CONCLUSIONS:
The study shows that even a parsimonious model like GAM predicts high risk areas where cholera outbreaks largely occurred. This is useful for indicating where interventions would be effective in controlling the disease risk. Data showed that vaccination decreased the risk of infection. Overall, the GAM-based risk map is useful for policymakers, especially those from countries where cholera remains to be endemic with periodic outbreaks.

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