Multivariate spatial point process models for analysis of patterns of urban malaria

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There is increasing scientific interest towards eliminating malaria in areas of low prevalence including urban areas in Africa. Particular attention is towards determination of risk factors and characterization of the epidemiology of urban malaria. In this study, we traced all child cases of malaria reported to a health facility in Blantyre, Malawi between 2007 and 2009; recorded the geo-coordinates of households and putative sources of malaria transmission; calculated distance of households to each source of transmission; and documented the travel history to rural areas. The overall objective of the study was to analyze the spatial variation in the risk of malaria, and quantify the effect of travel to rural areas and distance from putative sources of malaria transmission, adjusting for availability and use of insecticide-treated bednets and socio-economic status. We used spatial point pattern methods to study whether there clustering of cases or any raised prevalence near putative sources. We then fitted a marked point process model for the joint analysis of the spatial pattern of malaria cases, and the marks (nearness of each malaria case to a swamp/ standing water, or a garden or a river), with dependence incorporated through a shared spatial effect.

Keywords: spatial point process, multivariate analysis, shared spatial effect, urban malaria