Bayesian Modeling of Spatiotemporal patterns of TB-HIV co-infection risk in Kenya

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Research article

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Abstract

Background TB and HIV diseases are globally acknowledged as a public health challenge that exhibits adverse bidirectional relations due to the co-epidemic overlap. To understand the co-infection burden we use the case notification data to generate spatiotemporal maps that describe new distribution and exposure hypotheses for further epidemiologic investigations in areas with unusual case notification levels. These model maps are important in deciding relevant geographically targeting interventions and resource allocation for suppressing co-infection Methods We did an extensive analysis of the TB and TB-HIV case notification data from the Kenya national TB control program. We analyzed the case notification data aggregated for forty-seven counties over a seven-year period (2012 – 2018). We assessed the geographic patterns by mapping the cumulative co-infection incidence rate in each county. We performed the chi-square tests to determine the association between HIV status and risk factors; TB-type, age, gender, and patient type. We stratified the data by HIV status. Using the Integrated Nested Laplace Approach (INLA), we modeled the risk of TB-HIV co-infection Results Of the total 608312 TB case notifications, 194129 were HIV co-infected. Over the period, the co-infection temporal risk trend was consistently higher in women as compared to men with patients aged below 25 years and above 54 years registering a considerably lower risk trend of TB-HIV co-infection. The spatial pattern of co-infection risk was widespread in males compared to the female. The counties with high co-infection burden for both male and female were Homabay, Siaya, Kisumu, Migori and Busia counties Conclusions TB-HIV co-epidemic in Kenya is at a critical point portending a dual endemic challenge for many years to come. The government of Kenya needs to combine surveillance systems for the TB and HIV National programs to optimize the TB-HIV coinfection case notification processes at all levels. Integration of care for both TB and HIV using a single facility and single health provider will enable proper monitoring of the co-infection trends, which will ensure adequate resource allocation to cause a significant impact in the reduction of HIV burden amongst TB patients and TB burden amongst HIV patients

Manuscript Text

Figures

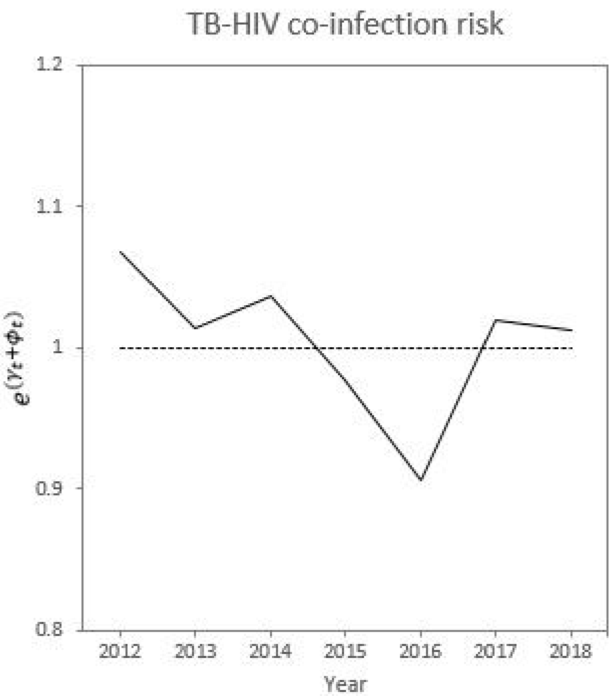

Figure 1

Temporal trend of co-infection risk in Kenya

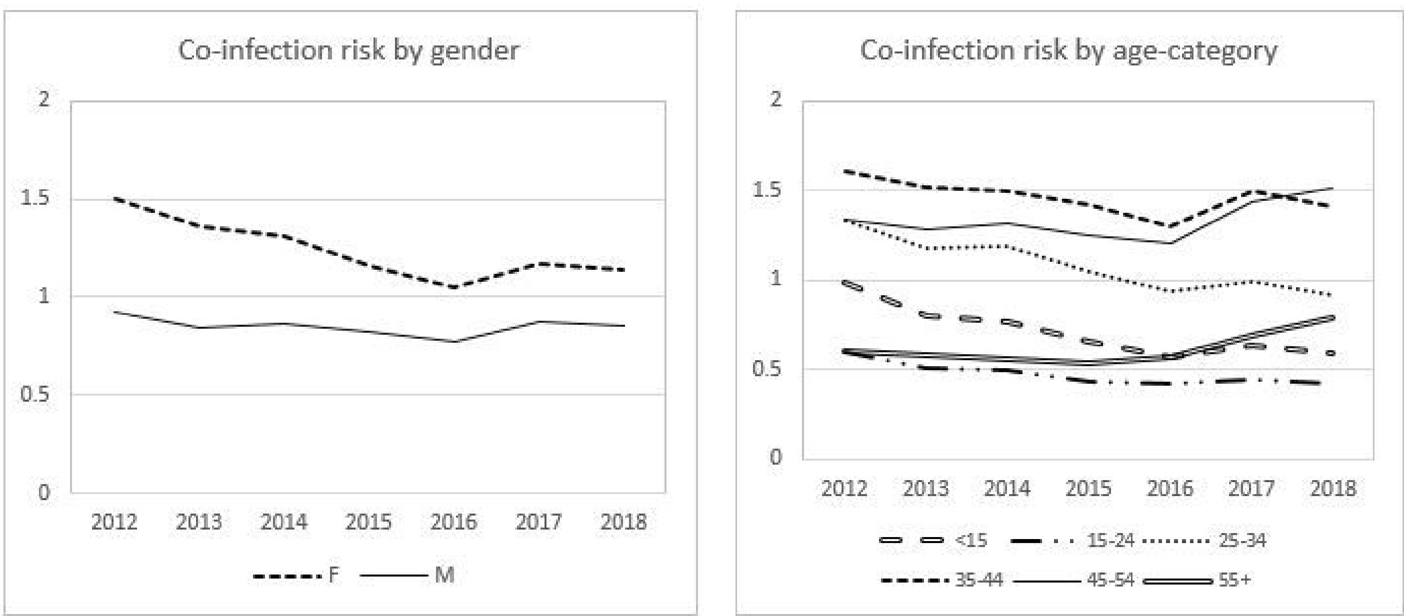

Figure 2

Temporal trend of co-infection risk by gender and age-category

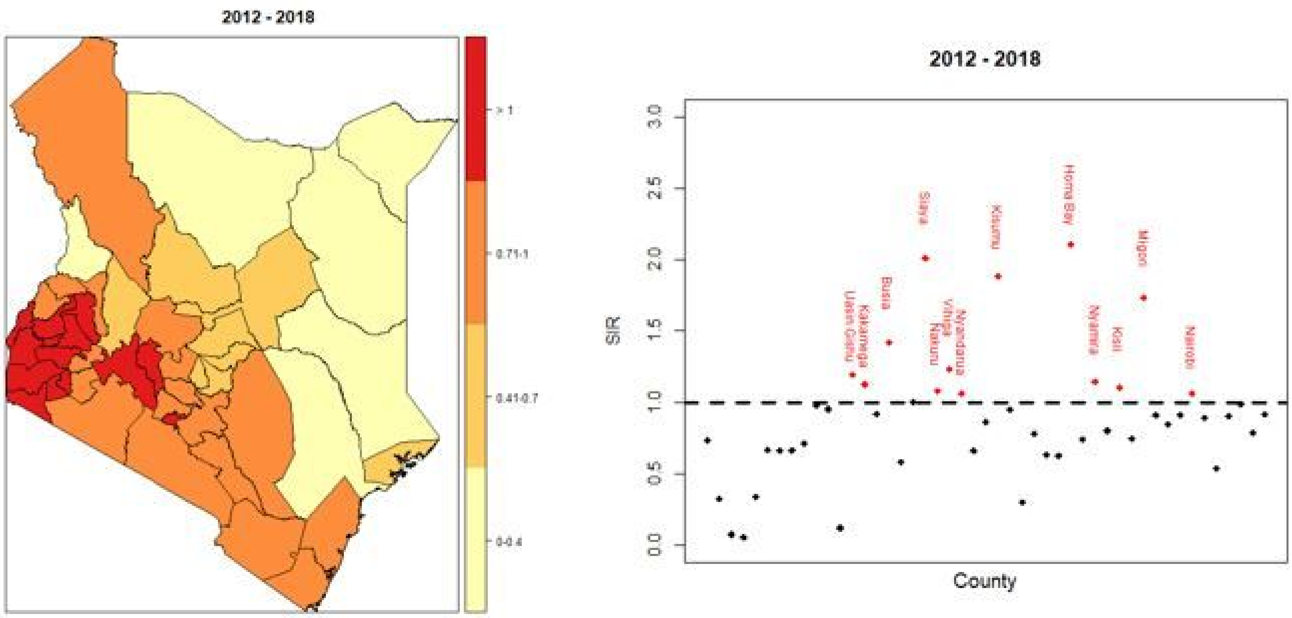

Figure 3

Spatial pattern of co-infection burden per County (2012 - 2018)

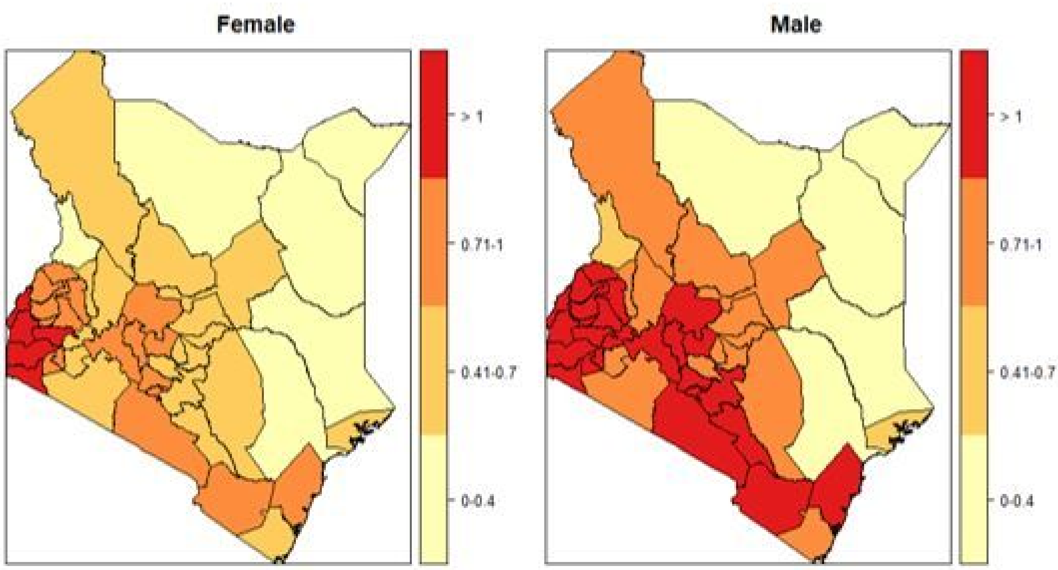

Figure 4

Spatial patterns of co-infection burden by gender

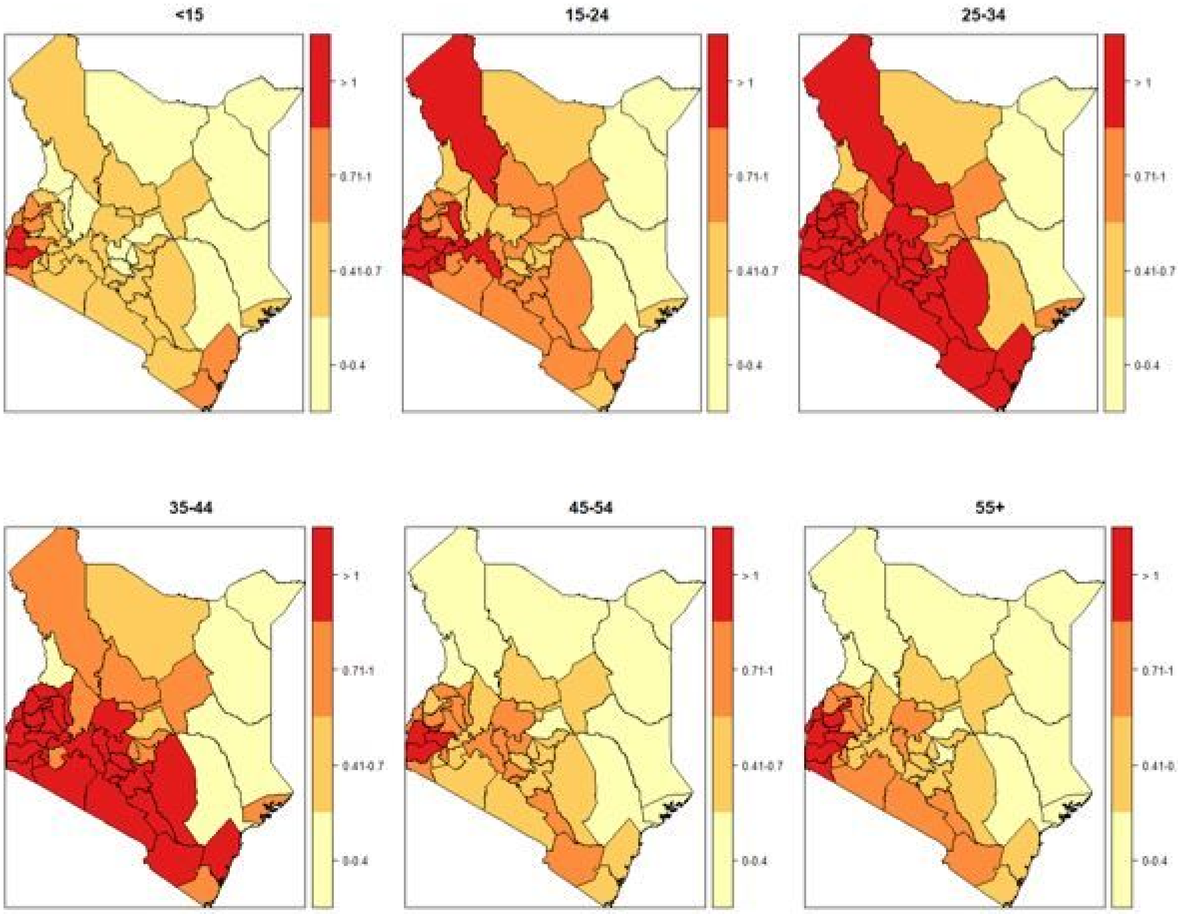

Figure 5

Spatial patterns of co-infection burden by age category

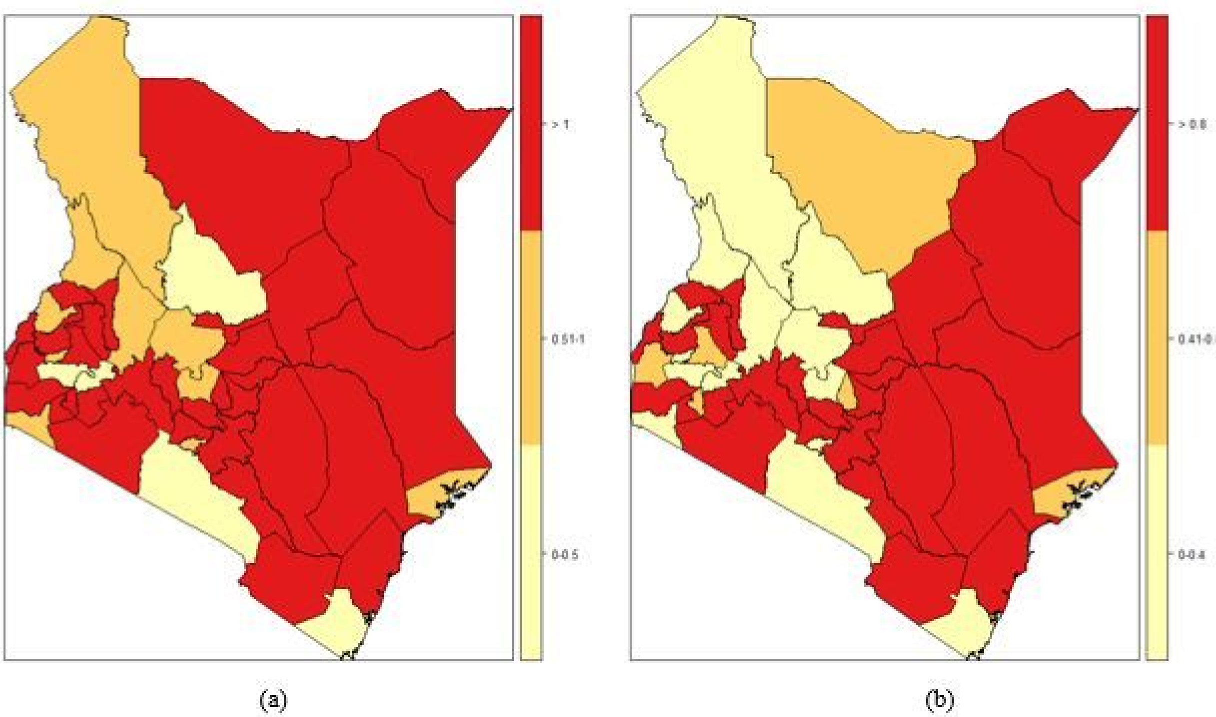

Figure 6

County-specific relative risks and posterior probabilities. (a) Spatial pattern of coinfection risk (b) Uncertainty for the spatial effect

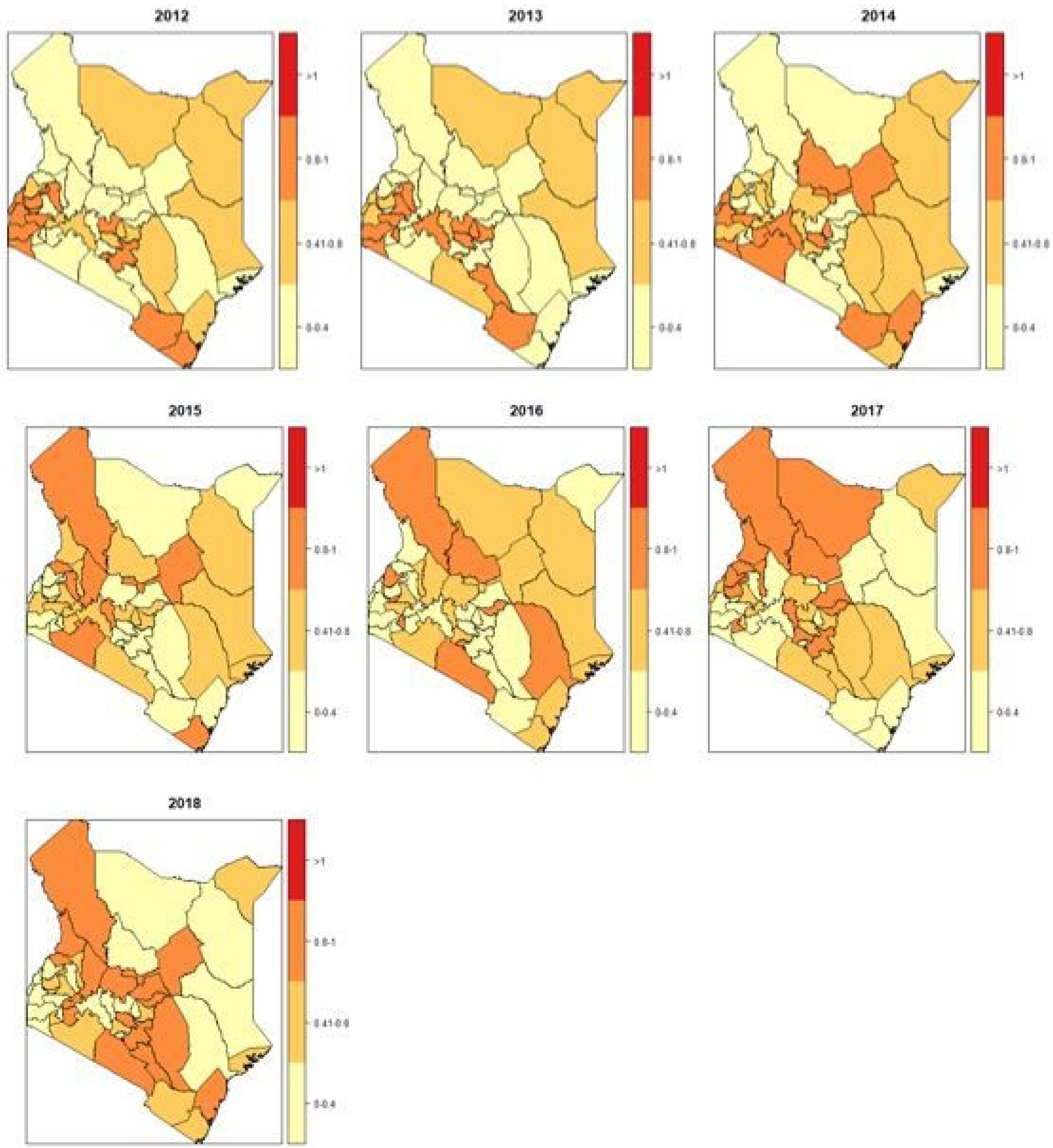

Figure 7

Posterior probabilities for the space-time interaction: 47 counties and 2012-2018 years