Spatial and temporal dynamics of tuberculosis in Fukuoka, Japan

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BACKGROUND

Tuberculosis (TB) has reemerged as a global public health epidemic in recent years. TB remains a serious public health problem among certain patient populations, and is prevalent in many urban areas. The World Health Organization estimates that approximately nine million individuals will develop active TB disease and more than two million will die from TB [1,2]. The global burden of TB remains enormous, and will likely rank high among public health problems in the coming decades [3-5]. Although evaluating local disease clusters leads to effective prevention and control of TB, there are few, if any, spatiotemporal comparisons for epidemic diseases. In this study, we used the space-time scan statistic to identify where and when the prevalence of TB is high in Fukuoka Prefecture. The ability to detect disease outbreaks is important for local and national health departments to minimize morbidity and mortality through timely implementation of disease prevention and control measures. Because the statistic meets these needs completely, results that are effective and practical for public health officials are expected from this study.

METHODS

Relevant data for Fukuoka Prefecture, which is southwest of Tokyo, Japan were used in the study. Demographic data were compiled for each of the 109 Fukuoka Prefecture census tracts from the Japan Census. Data on TB cases in Fukuoka Prefecture were obtained from the TB surveillance system, which monitors TB events among the roughly five million residents in Fukuoka Prefecture. Addresses were matched to towns for 9,119 TB cases from 1999 to 2004. All cases were geocoded to latitude and longitude coordinates. We used 109 different geographic TB data sets for the spatial scan statistic, in each year. The spatial and space-time scan statistics were then used to identify clusters of census tracts with elevated proportions of TB cases. Finally, this study using the TB surveillance data was approved by the Fukuoka Prefecture Environmental Health Research Advancement Committee (ethics committee) on December 17, 2004 (Reference Number: 16-1803).

RESULTS

In the purely spatial analyses, the most likely clusters were in the Chikuho coal mining area (in 1999, 2002, 2003, 2004), the Kita-Kyushu industrial area (in 2000), and the Fukuoka urban area (in 2001). In the space-time analysis, the most likely cluster was the Kita-Kyushu industrial area (in 2000). The north part of Fukuoka Prefecture was the most likely to have a cluster with a significantly high occurrence of TB.

CONCLUSIONS

In summary, using data from 1999 to 2004, we used the space-time scan statistic to examine clusters of TB in Fukuoka Prefecture, Japan. The most likely significant cluster for a high occurrence of TB was identified in the north part of Fukuoka Prefecture. Since the efficacy of TB control measures in specific areas could be evaluated by reviewing the control measures and a longitudinal change in TB prevalence, the space-time scan statistic can contribute to health program evaluation. Although the method used here could help prioritize the assignment and investigation of diseases, the applicability of our methodology might be limited. We need to develop more sophisticated analytical methodology for future studies.

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