Disease Mapping and Spatial Landscape Characterization of Tuberculosis Ecology in Malaysia

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Abstract:

This paper analyses the pattern distribution and influential risk factors of tuberculosis (TB) at 47 Sections of Shah Alam, Malaysia using spatial epidemiological (SE) approach. Quantifying environmental risk factors of the disease pattern can be a challenging task due to spatial environmental and transmission process, whereby each area may have its own unique risk factors and dynamics. A conceptual framework of spatial epidemiological data analysis (Pfieffer et al. 2008), and geographical information system (GIS) method (Chang 2011) are mainly adapted in this research method. Disease mapping of the 3-year datasets (2013 to 2015) was created using GIS analysis and satellite remote sensed land used in identifying the clustering areas of TB pattern. Meanwhile, the potential risk factors of TB in the clustering areas were assessed using spatial landscape ecology through site observation.

Figure 1 shows the spatial pattern of TB cases in the study area as a random medium, revealing that TB distribution is well distributed in the area. However, there is also some clustering concentration at the northern zone (Section U17 to Section U20) and some in U5 and U13, while in the central zone, the majority cases are concentrated at Section S7, S17, S18, S19 and S24. Section S27 and S28 are also indicated as high-case areas in the southern zone. It is interesting to note that in the recent years (2015), the disease was a little dispersed and scattered to the northern area especially in U13, U10, U15 and U17 due to the new township area, physical development and human mobility (Nava-Aguilera et al., 2011; Prussing et al., 2013). Furthermore, every zone or section may have its own risk factors; hence, there is a need for specific investigation to be conducted in a smaller area.
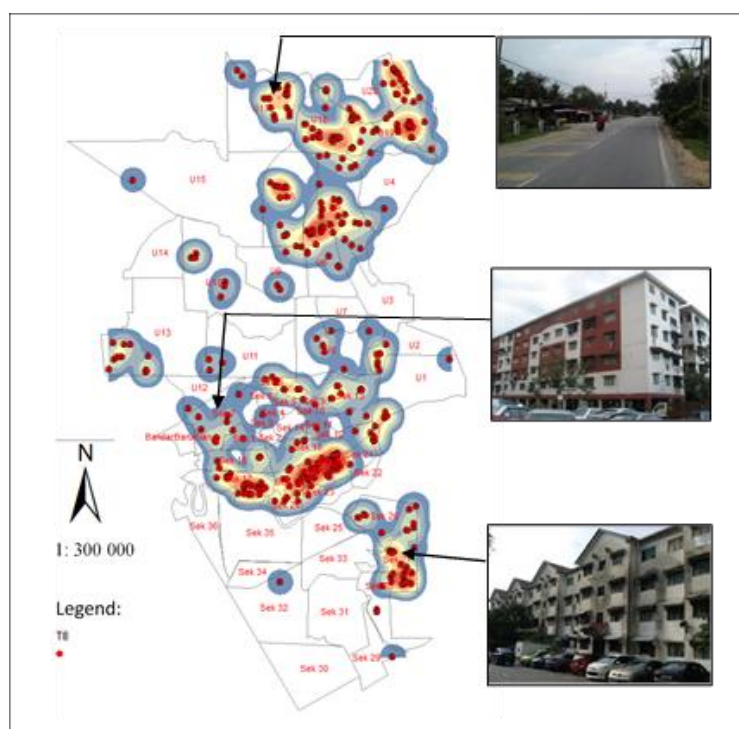

Figure 1. Spatial Clustering and Risk Areas of TB Cases in Shah Alam Using a GIS Analysis

With regards to the spatial landscape ecology of the clustering or risk areas, indicating that most cases of the are located in urban areas especially in small and poor environment conducive for TB transmission. It is notable most of the houses are small, located in slum areas or village setting, and are occupied people with no stable income which are found in sections S7, S17, S27, S28, U19 and U20. The total household income may not be regarded as an absolute indicator of TB cases because most of them have more than RM2,000 (USD 486.50) monthly average income and they choose to live in such a neighbourhood in order to save money. Therefore, it is important that academic and/or job status are taken into consideration in defining SES. Accessibility to healthcare facilities for high- and medium-income groups of people is not a major risk because they have the means to get to the healthcare facilities as they have their own transport.

It is evident that human factors are the main factors in Shah Alam instead of ecological factors, especially the number of population (housing or localities), risk group or low income, and TB mobility which require empirical proof. However, the combination of ecological risk factors such as urban area, type of house, healthcare distance may increase the risk factor in an area (Liu et al., 2011; Zhao et al., 2013; Abdul Rasam et al., 2016). This finding is important for the model development process and to enhance the understanding of the local health staff in explaining the TB dynamics. Since these findings are crucial for studying the relationships between TB ecological processes and environmental factors, future study needs to quantitatively assess the value of each local risk factor towards combating the epidemics in the country.

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