数理モデルを活用した在留外国人の在留年数別人口再構築と出生国別の結核リスクの推定

Reconstructing the demographic prevalence of foreign residents in Japan using a mathematical model and its use for estimating the risk of tuberculosis infection by country of birth

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Among newly notified tuberculosis cases in Japan, both the number and the proportion of foreign-born cases have steadily increased over time. As Japan prepares to introduce pre-entry tuberculosis screening for foreign-born persons entering Japan, various epidemiological evidence is needed to ensure its effectiveness, including the risk of tuberculosis among current foreign residents in Japan, by country of birth. Yet as of today, even the underlying population dynamics has yet to be quantified. The present study therefore aimed to firstly reconstruct the demographic prevalence of foreign residents by the length of stay in Japan and by country of birth, and secondly, to estimate the risk of infection from notification data among foreign residents in Japan. We employed the McKendrick partial differential equation model to reconstruct the dynamics among six Asian countries which account for 80% of foreign-born tuberculosis patients notified in Japan i.e. China, the Philippines, Vietnam, Nepal, Indonesia, and Myanmar. Compared with China and the Philippines, the recent remarkable increase in the number of residents from Myanmar and Vietnam was identified. The estimated risk of infection ranged from 3.5% to 21.3%, and all the estimates were more than three times greater than the crude estimate that ignored the time since immigration. The proposed method may be used to further estimate the risk by age, sex and residential status, which could potentially provide critical evidence towards establishing policies to prevent transmission of tuberculosis in Japan and also possibly in the country of birth.