

Estimating future emerging risks of dengue fever outbreaks in Japan

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Dengue fever is a common mosquito-borne viral disease in tropical and subtropical regions in the world. There is a serious concern that the disease may spread into current non-endemic areas due to climate change, rapid urbanization, and increasing international travels. With a sudden outbreak of dengue fever in 2014, the concern became true in Japan, a country regarded to be a non-endemic area for the last about 70 years. The outbreak clarified that at least some parts of Japan already have suitable conditions for the dengue transmission. Although no outbreak occurred after 2014, imported cases have been increasingly reported among those who traveled in endemic regions of the disease. In addition, the vector mosquito, *Aedes albopictus*, are widely found in various landscapes in the country and expanding its habitat region over the last several decades.

The aim of this study is to estimate the geographic distribution of potential risks of dengue fever outbreaks in Japan by applying empirical relationships between dengue fever transmission and geographic factors in recent Taiwan. Although several methods of risk mapping of dengue fever have been already proposed, methods for estimating the future risk of dengue fever in non-epidemic regions are still limited, except those for habitat mapping of vector mosquitoes by using only climatic data. However, the outbreak risk known to be affected by a wide range of factors including not only the presence of vector mosquitoes but also socio-economic factors such as population density and degrees of urbanisation.. Thus, we built a statistical model to replicate Taiwanese experience of the disease outbreaks from 1998 to 2015 by using geographic information of both climate and socio-economic indicators. Then, we applied the estimated model to the Japanese dataset for estimating the risk distribution of dengue fever outbreak in the country.

At the current situation, the result of the risk mapping indicated that while Hokkaido, Tohoku areas, and mountainous parts of the main islands have the lowest risk, central parts of large metropolitan regions has some risk of local outbreaks even in the current condition.

However, the risk distribution of dengue fever outbreaks was estimated to drastically increase in the large part of the urbanized regions due to the effect of possible climate change predicted under global warming scenarios. The results would contribute public health implication to reduce the increased burden of the disease by targeting the hot spots of the potential risk.

Keywords: dengue fever, risk mapping, non-endemic areas, climate change