Developing a predictive model for plasmodium knowlesi-susceptible areas in Malaysia using geospatial data and artificial neural networks

ABSTRACT

Plasmodium knowlesi is an emerging species for malaria in Malaysia, particularly in East Malaysia. This infection contributes to almost half of all malaria cases and deaths in Malaysia and poses a challenge in eradicating malaria. The aim of this study was to develop a predictive model for P. knowlesi susceptibility areas in Sabah, Malaysia, using geospatial data and artificial neural networks (ANNs). Weekly malaria cases from 2013 to 2014 were used to identify the malaria hotspot areas. The association of malaria cases with environmental factors (elevation, water bodies, and population density, and satellite images providing rainfall, land surface temperature, and normalized difference vegetation indices) were statistically determined. The significant environmental factors were used as input for the ANN analysis to predict malaria cases. Finally, the malaria susceptibility index and zones were mapped out. The results suggested integrating geospatial data and ANNs to predict malaria cases, with overall correlation coefficient of 0.70 and overall accuracy of 91.04%. From the malaria susceptibility index and zoning analyses, it was found that areas located along the Crocker Range of Sabah and the East part of Sabah were highly susceptible to P. knowlesi infections. Following this analysis, targetted entomological mapping and malaria control programs can be initiated.

Keyword: GIS; Plasmodium; Artificial neural network; Climate; environment; Knowlesi; Malaria; Remote sensing