UNIVERSITI TEKNOLOGI MARA

THE DOCTORAL RESEARCH ABSTRACTS

Volume: 8, Issue 8 November 2015

EIGHTH ISSUE

INSTITUTE of GRADUATE STUDIES

IGS Biannual Publication

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Title :
Mathematical Models of the Spread of Dengue Fever in Shah Alam

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Dengue fever has been a serious health threat in Malaysia and more than 50 other countries which are located in tropical and subtropical regions. It is a vector-borne disease and its main vector is the *Aedes aegypti* mosquito. Understanding the spread of this disease will certainly help in controlling it and this can be done with the help of mathematical models. In order to come up with a suitable model, an in depth study on the role of temperature and amount of rainfall in contributing to the number of dengue fever cases was done. In this study, two main parts of modeling were done, one was the modeling of the population dynamics of the vector, and another was on the modeling of the epidemic. In the modeling of the *Aedes aegypti* mosquito, a stage-structured model was constructed based on the temperature and rainfall of Shah Alam. A simulation was done and verified with the surveillance data collected by Majlis Bandaraya Shah Alam. The result obtained was tabulated and represented as a cosine function. For the epidemic model, the vector population was divided into two stages, before and after first egg-laying. This was done because it was found that the biting rates for these two groups of vectors vary and affect the modeling result. Result from the modeling of *Aedes aegypti* mosquitoes was used as the recruitment rate for vectors in the construction of the vector-host epidemic model. In the process of modeling, the classic SIR epidemic model was also explored and a method of parameter identification was obtained. This method was known as the multistage Adomian decomposition method and it was used to compute the transmission rate. One of the results obtained in the modeling of the *Aedes aegypti* mosquito is the identification of the conditions (temperature and amount of rainfall) that contributed to the abundance of *Aedes* population. In this study, a climate-dependent stage-structured model of the population of *Aedes aegypti* was constructed. It was found that the peak of infected cases of dengue fever was observed after about 4 weeks of the peak of mosquito abundance. Secondly, the transmission rates estimated from the SIR helped in studying how the basic reproduction number varied throughout the year 2008, instead of only one value for the whole year. Lastly, the one-stage and two-stage vector host epidemic models constructed and simulated. Their results were compared and the two-stage model gave a better representation of the actual dengue fever cases in Shah Alam for the year 2008.