UNIVERSITI TEKNOLOGI MARA

EXPLORING THE SPATIAL AND TEMPORAL DISTRIBUTION OF DENGUE FEVER IN KUANTAN OF EAST COAST PENINSULAR MALAYSIA

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Sciences
(Environmental Health and Safety)

Faculty of Health Sciences

March 2022

ABSTRACT

Dengue fever is rapidly becoming Malaysia's most vital health concern, with cases nearly doubling in the previous decade. Given the uncertainties surrounding the recently announced tetravalent vaccination and the lack of efficient antiviral medications, vector management remains the most essential technique in the fight against dengue fever. A retrospective study was carried out using epidemiological data in Kuantan, Pahang. The confirmed dengue cases from the year 2011 to 2020 was retrieved and analysed using spatial temporal and time series analysis. The time series model could potentially provide useful information that could be further used to facilitate the planning of public health interventions in an effort to minimize dengue outbreaks. The objective of this study was first, to determine the spatial temporal distribution pattern of dengue fever cases in the study area. Secondly, to investigate the variation of dengue fever hot-spot in peri-urban area in Kuantan. Lastly, to developed a prediction model of dengue fever cases using SARIMA model. Moran's index for DF transmissions in the Kuantan area was tabulated monthly from 2011 to 2020. The lowest reading of Moran's index was -0.685 in May 2015, while the highest reading was 0.338 in May 2019. This reflects the strong spatial autocorrelation of dengue transmission over the last decade. According to the Getis-Ord Gi* statistic, there were four hot spots of dengue fever in 2011, and the locality increased to twenty-two hot spots around Kuantan district in 2020. High and low clusters of attributes were created using the z-scores and p-values. The expected outcome was a statistically significant hot spot of spatially clustered features and a statistically significant z-score. The time series prediction was made using the dengue cases from January to December 2011-2019. The study revealed that SARIMA (0, 1, 0) $(3, 0, 2)_{12}$ was the best fitted model and could be used to predict the cases up to twelve months in advance. The prediction of the cases in 2020 was relatively close to the actual cases within the confidence interval limit. Thus, the model derived from this study has the capability to not only forecast but also anticipate the future dengue cases. This would in turn enhance the current intervention program which is vital in minimizing the burden of the disease in Kuantan specifically.

Keywords: *Dengue Fever, Spatial Temporal, Time Series Analysis, Hotspot, SARIMA*

ACKNOWLEDGEMENT

In the name of Allah, The Most Gracious, The Most Merciful.

Assalamualaikum and Alhamdulillah, all praise to Allah S.W.T The Supreme Lord of the Universe. Peace and blessing to Nabi Muhammad S.A.W., all prophets and their families. I praise Allah S.W.T. for the strength and His blessings in which has enabled me the opportunity to complete this thesis.

Thousands of thanks to my parents Mr. Abdul Hadi bin Shamsuddin and Mrs. Wan Seta Kamal binti W. Abdullah; my wife Mrs. Nurul Akhillah binti Hassan Basri for their great love and support. I wish to express my sincere appreciation to my supervisor Associate Professor Ts. Dr. Nazri Che Dom for being instrumental in shaping my studies and key figures whose constructive criticism and advice contributed immensely towards the completion of this study. Without her great assistance, support and patience, this thesis would not be completed on time. Not to forget, I would like to thank all the lecturers in the Department of Environmental Health and Safety, Faculty of Health Sciences who always share their thoughts, knowledge and advice throughout my study in UiTM Puncak Alam. Only God can reward all of you with goodness.

Last but not least to my course mates from HS764, I would like to thank them for their help, support and encouragement from the start until I finished this thesis. Without the assistance and advice of those mentioned above, whether is perceive or not, I would not be able to finish this work as it should be.

TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 Background of Study

Dengue fever (DF) is an arbovirus disease transmitted by the Aedes mosquito that has spread rapidly over the past six decades and now at risk of infection for 2.5 billion people, around 40% of the world's population (Packierisamy et al., 2015). According to an estimation, there are about 96 million infections which involve 390 million people annually (Halstead, 2007; Guzman et al., 2010; Bhat et al., 2013). Dengue is a tropical disease, and the majority of cases occur in the Americas and Asia-Pacific areas. With the rising burden of disease, dengue has put a high economic toll on the countries in those regions (Shepard et al., 2013). Rapid urbanization growth, increased human movement within and between countries, and further development and spread of insecticide resistance in mosquito vector populations are some of the reasons why dengue transmission has increased in recent years.

DF has been endemic in Malaysia since the 1970s, with the increase of intensity and severity of the outbreaks that have occurred over the last decade (Mudin, 2015). The number of dengue cases in Malaysia escalated from 7,103 cases in 2000 to 130,101 dengue cases in 2019. The highest number of dengue cases recorded were 120,836 cases in 2015, although a slight reverse trend was recorded in 2016 to 2018 but there was a significant increase of dengue cases in 2019. In Malaysia, dengue occurs nationally in urban and peri-urban areas, with increased risk. Since 2010 the number of DF cases recorded in our country continues to grow (Ahmad et al., 2018). Until now, there is no official vaccine available for DF use throughout Malaysia. Preventing and managing the dengue virus is largely relying on managing the mosquito vector or breaking human-vector communication. Recent studies have indicated that weather variables play a significant role in the severity of the epidemics in Malaysia-because they directly influence the life cycle, activity, bite rate and vector incubation times (Dom et al., 2013; Cheong et al., 2013; Hii et al., 2016).