KNOWLEDGE, ATTITUDES AND PRACTICES OF DENGUE FEVER AMONG THE ORANG ASLI IN PENINSULAR MALAYSIA

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ABSTRACT

Dengue is prevalent among Malaysia's indigenous people, known as the Orang Asli, and it poses a serious health threat to them. The study aims to look at the socio-demographic factors, health beliefs, and knowledge about dengue and its association to dengue prevention practices among Orang Asli communities in Peninsula Malaysia. A cross-sectional survey was conducted in 16 randomly selected Orang Asli villages from eight states in Peninsula Malaysia from April 2012 until February 2013. A total of 560 Orang Asli were interviewed and 505 completed the survey. Overall dengue knowledge score among the respondent were low; tribes, occupational status and average monthly household income significantly correlated to dengue knowledge. The Semoq Beri tribe (OR=11.137, 95% CI= 2.98-41.61), was more likely to have higher dengue knowledge compared to the reference group (Kensui tribe). Skilled workers (OR=3.66, 95 % CI=1.07-12.52) were more likely to have higher dengue knowledge compared to the reference group (unemployed). However, those with income less than RM500 (OR=0.60, 95%CI = 0.39-0.94) were less likely to have dengue knowledge compared to the reference group (RM500 - RM1200). With regards to the constructs of HBM, majority of the Orang Asli respondents had perceived dengue severity score of 6-10 (n=445, 88.1%) and only 11.9 % had perceived dengue severity score of 1-5 (n=60). 82.0% of respondents had a score of 1-5 for perceived susceptibility towards dengue (n=414) while only 18.0 % of the Orang Asli respondents had score of 6-10 for perceived susceptibility towards dengue (n=91). Majority of the Orang Asli respondents had score of 1-5 for perceived barriers to prevent dengue (n=435, 86.1%) and only 18.0% (n=70) of the respondents had score 6-10 for perceived barriers to prevent dengue. Majority of the Orang Asli respondents “Disagree and strongly disagree” that there is a lack of self –efficacy in taking preventive measures against dengue (n=376, 74.5%). Overall dengue prevention practices were slightly high; perceived barriers to

prevent dengue, knowledge score and tribes were factors which were significant correlate to dengue prevention practices. Respondent with low perceived barrier (OR=1.867, 95% CI= 1.051-3.317) were more likely to carry out dengue prevention practices. Respondents with low knowledge score (OR=0.522, 95% CI= 0.343-0.794) were less likely to carry out dengue prevention practices. Respondents from the Jakun tribe (OR=0.167, 95% CI= 0.054-0.514) and Temuan tribe (OR=0.407, 95% CI= 0.181-0.916) were less likely to carry out dengue prevention practices compared to the reference group (Kensui tribe). Findings imply that efforts to enhance dengue prevention practices should focus on eliminating the foremost important factors which are the perceived barriers to prevent dengue and lack of knowledge of dengue. Intervention should focus on educating the Orang Asli to remove barriers to prevent dengue and impart more knowledge of dengue.

ABSTRAK

Denggi adalah prevalen di kalangan Orang Asli di Malaysia, dan ia menimbulkan satu ancaman kesihatan yang serius terhadap mereka. Kajian ini bertujuan untuk melihat faktor-faktor sosio-demografi, kepercayaan kesihatan, dan pengetahuan mengenai denggi dan kaitannya dengan amalan pencegahan denggi di kalangan masyarakat Orang Asli di Semenanjung Malaysia. Satu kajian keratan rentas telah dilakukan di 16 perkampungan Orang Asli yang dipilih secara rawak daripada lapan buah negeri di Semenanjung Malaysia mulai April 2012 sehingga Februari 2013. Seramai 560 Orang Asli telah ditemuramah dan 505 telah melengkapkan kaji selidik itu. Skor keseluruhan pengetahuan denggi antara responden adalah rendah; suku kaum, status pekerjaan dan purata pendapatan bulanan isi rumah mempunyai signifikasi korelate terhadap pengetahuan denggi. Suku kaum Semoq Beri (OR = 11.137, 95% CI = 2.98-41.61), lebih cenderung untuk mempunyai pengetahuan denggi yang lebih tinggi berbanding dengan kumpulan rujukan (kaum Kensui). Pekerja-pekerja mahir (OR = 3.66, 95% CI = 1,07-12.52) adalah lebih cenderung untuk mempunyai pengetahuan denggi yang tinggi berbanding dengan kumpulan rujukan (tidak berkerja). Walau bagaimanapun, mereka yang mempunyai pendapatan kurang daripada RM500 (OR = 0.60, 95% CI = 0.39-0.94) adalah kurang berkemungkinan mempunyai pengetahuan denggi berbanding dengan kumpulan rujukan (RM500 - RM1200). Berkaitan dengan konstruk HBM, majoriti daripada responden Orang Asli mempunyai skor 6-10 persepsi keterukan denggi (n = 445, 88.1%) dan hanya 11.9% mempunyai skor 1-5 persepsi keterukan denggi (n = 60). 82.0% responden mempunyai skor 1-5 untuk persepsi kecenderungan mendapat denggi (n = 414) manakala hanya 18.0% responden Orang Asli mempunyai skor 6-10 untuk persepsi kecenderungan mendapat denggi (n = 91). Majoriti daripada responden Orang Asli mempunyai skor 1-5 untuk persepsi menghalang pencegahan denggi (n = 435, 86.1%) dan hanya 18.0% (n = 70) responden mempunyai skor 6-10

untuk persepsi menghalang pencegahan denggi. Majoriti daripada responden Orang Asli "Tidak setuju dan sangat tidak setuju" bahawa terdapat kekurangan diri yang keberkesanan dalam mengambil langkah-langkah pencegahan terhadap kes demam denggi (n = 376, 74.5%). Keseluruhan amalan pencegahan denggi adalah sedikit tinggi; persepsi menghalang pencegahan denggi, skor pengetahuan dan suku kaum adalah faktor-faktor yang mempunyai signifikasi korelate terhadap amalan pencegahan denggi. Responden dengan persepsi rendah untuk menghalang pencegahan denggi (OR = 1.867, 95% CI = 1.051-3.317) adalah lebih cenderung untuk melaksanakan amalan-amalan pencegahan denggi. Responden dengan skor pengetahuan denggi yang rendah (OR = 0.522, 95% CI = 0.343-0.794) adalah kurang berkemungkinan untuk melaksanakan amalan-amalan pencegahan denggi. Responden dari suku kaum Jakun (OR = 0.167, 95% CI = 0.054 0.514) dan suku kaum Temuan (OR = 0.407, 95% CI = 0.181 0.916) adalah kurang berkemungkinan untuk melaksanakan amalan-amalan pencegahan denggi berbanding dengan kumpulan rujukan (suku kaum Kensui). Penemuan ini menandakan bahawa usaha untuk meningkatkan amalan-amalan pencegahan denggi harus menumpukan pada menghapusan faktor-faktor utama penting yang dilihat menghalang pencegahan denggi dan kekurangan pengetahuan denggi. Intervensi harus ditumpukan untuk mendidik Orang Asli bagi menghapuskan halangan untuk mencegah denggi dan memberikan pengetahuan yang lebih untuk denggi.

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LIST OF SYMBOLS AND ABBREVIATIONS

KAP	Knowledge, Attitude and Practices
et al.,	*et alia* (others)
WHO	World Health Organization
%	Percentage
HBM	Health Belief Model
DHF	Dengue hemorrhagic fever
JAKOA	Department of Orang Asli Affairs (*Jabatan Kemajuan Orang Asli*)
p	Level of significance
IgG	Immunoglobulin G
r	Correlation coefficient
KBP	Knowledge, Beliefs, And Practices
PPRT	Housing Project for the Hardcore Poor (*Projek Perumahan Rakyat Termiskin*)
>	More than
<	Less than
SPSS	Statistical Package for the Social Sciences
Inc.,	In a corporation
IL	State of Illinois
n	Sample size
N	Population size
RM	Ringgit Malaysia
SD	Standard deviation
OR	Odds ratio
CI	Confidence interval
χ^2	Chi-square test
R^2	Percent of variance explained
vs.	*Versus* (in contrast with)

CHAPTER 1: INTRODUCTION

This chapter introduces the overall scope of the study that is to investigate the Knowledge, Attitude and Practices (KAP) of the Orang Asli in Peninsular Malaysia regarding dengue fever. This chapter briefly describes the overall context of study, the purpose and significance of the study.

1.1 Background

Dengue fever is a mosquito borne infection which has become a major public health concern around the world. This mosquito borne infection has peaked at an alarming rate in the recent years. It has become one of the most important diseases found mostly in the tropics and subtropical areas in the world (Gibbons and Vaughn, 2002). Yearly, an estimated 50-100 million cases of dengue fever is reported and about 250 000-500 000 cases of dengue hemorrhagic fever happen worldwide (Guzman *et al.*, 2003). The mortality rate for dengue fever among children has been reported to be 2.5%. In addition, there is an estimated rate of 500,000 hospitalization cases due to severe dengue (WHO, 2012).

Dengue fever and dengue hemorrhagic fever are viral diseases transmitted by *Aedes* mosquito, usually *Aedes aegypti* or *Aedes albopictus*. Dengue is known to be brought into Malaysia by seafarers from Africa by the *Aedes aegypti* mosquito which was then replaced by the local *Aedes albopictus* (Abubakar and Shafee, 2002) as the main carrier of dengue fever. The four dengue viruses (DEN-1, DEN-2, DEN-3 and DEN-4) are

immunologically related, but do not provide cross-protective immunity against each other (Siegel JD *et al.*, 2007).

The clinical symptoms of dengue may range from being asymptomatic to non-specific acute febrile illness known as dengue fever to fatal illness known as dengue hemorraghic fever. Here there iscirculatory shock which has potential to lead to death to the infected person. Dengue hemorraghic fever is the severe and critical stage of the disease which may evolve into dengue shock syndrome that may cause death to the infected person. Dengue fever is characterized by several clinical manifestation such as severe headaches, pain behind the eyes, muscle and joint pains, nausea, vomiting, swollen glands or rash. These symptoms usually last for 2–7 days. The incubation period is 4–10 days after the bite from an infected mosquito (WHO, 2012)

1.1.2 Dengue in Malaysia

Dengue fever has been endemic in Malaysia for decades. The earliest report of dengue in Peninsular Malaysia was from Singapore and the first incidence of a dengue epidemic was reported in Penang in the begining of December 1901 (Skae, 1902). The first dengue hemorrhagic fever was recorded in 1962 (Rudnick, 1965).

In Malaysia, the morbidity rate for dengue haemorrhagic fever in adults aged 20-29 years was the highest from 1987-1991 (Poovaneswari, 1993). In 1982, it was reported that the fatality rate was higher in Malaysian adults, consisting of 51.4% of dengue deaths (Lam, 1993). According to World Health Organisation, in 2009, a total of 33, 684 people were infected with dengue in Malaysia and in October 2010, there were 40, 152 cases of dengue resulting in 118 deaths. A recent WHO report in February 2015

showed that there are 23,966 reported cases in Malaysia with 62 deaths. This showed an increase of 46% from the previous year in the same period (WHO, 2015a).

1.1.3 Dengue among Orang Asli in Peninsular Malaysia

According to the Annual Report of the Department of Orang Asli Affairs (JAKOA) in 2006, there are about 147 412 Orang Asli living in 869 villages in Peninsular Malaysia. They represent 0.6% of the total population in Malaysia (Kamarulzaman Kamaruddin and Jusoh, 2008). Studies have shown that the incidence rate of dengue is higher in rural areas compared to urban areas due to land development (Van Benthem *et al.*, 2002). Studies have shown that the typical dengue mosquito breeds outdoors (Dieng *et al.*, 2012), mainly on plant leaves and in tree holes, which are in highly vegetated state. Considering the relatively large number of Orang Asli in Malaysia and their high vegetative surrondings they are at high risk of getting dengue fever. Further, most Orang Asli are in the rural areas and live deep in the jungle.

1.1.4 Dengue Prevention Practices

Since there is no specific treatment or vaccine to prevent dengue fever from spreading, the primary prevention against dengue is vector control (WHO, 2015b). Therefore, good practices of dengue preventive measures are essential for successful disease control. However, there are many studies indicate that, despite adequate knowledge regarding dengue prevention; the implementation of dengue control methods is still insufficient among the community. A recent study found that there was a need to increase the application of dengue prevention methods in the community to prevent the transmission of dengue fever (Mayxay *et al.*, 2013). Similarly, another study in a semi-urban town in

Jamaica, reported that inadequate dengue control practices among the community may prevent dengue from spreading (Shuaib *et al.*, 2010). These studies suggest that health education and promotion activities are important to improve the public's knowledge and practices of dengue preventive methods. Studies have found that there are also other factors that contribute to the spread of dengue fever. Socio demographic characteristics, environmental factors influencing dengue prevention, knowledge about dengue and their attitudes to prevent dengue fever were among the few factors that were found to influence dengue prevention practices.

1.1.5 Knowledge about Dengue

Knowledge or awareness about the disease is important in dengue prevention and control. According to a recent study, inadequate knowledge about dengue was a major risk factor that prevented the elimination of dengue (Yboa and Labrague, 2013). A recent study reported that inadequate knowledge about the signs and symptoms, transmission mode of dengue, and preventive practices increased the spread of dengue fever among the Malaysian population (Al-Adhroey *et al.*, 2010; Wong *et al.*, 2014). Similarly, another study conducted among Malaysians showed that they generally had good knowledge of dengue fever and its prevention (Naing *et al.*, 2011). However, evidence found that higher knowledge did not necessarily result in adoption of the recommended preventive behaviour (Isa *et al.*, 2013; Shuaib *et al.*, 2010).

1.1.6 Socio-demographic characteristics and environmental factors influencing dengue prevention

It has been recognized that socio-demographic characteristics have an important impact on dengue prevention practices and control. Younger and married people reported a higher prevention practices against dengue fever compared to those from older age groups and those who were single. A study conducted in Malaysia reported that eliminating breeding sites and mosquito prevention practices were higher among the Malaysian rural population when compared to the aborigines (Al-Adhroey *et al.*, 2010). Geographic expansion and distribution of the mosquito vector are associated with an increased transmission of dengue (Gubler, 1998, 2004).

The propagation of the virus is associated with high rates of population growth, unorganized urbanization and the proliferation of slums, over-crowding, poor water supply, sewer, and waste management systems, global warming, rise in global commerce and tourism, changes in public health policy, and the development of hyperendimicity among other factors (Al-Dubai *et al.*, 2013; Gubler, 1998; Jacobs, 2000; Ooi and Gubler, 2009; Torres and Castro, 2007). The success of efforts in dengue prevention and control comes mainly from improving public and household environmental sanitation, water supply, and alteration of human behaviour towards dengue fever (Artwanichakul *et al.*, 2012). Since Malaysia is located within the equatorial zone with high temperature and stable humidity, the dengue vector are widely distributed in the country (Nazni *et al.*, 2009).

1.1.7 Attitudes

Human attitudes contribute majorly in the controlling of breeding grounds for these mosquitoes and in reducing their number (Fang *et al.*, 1984). The Health Belief Model (HBM) is used to assess the attitudes and health behavior pattern of humans, and is by far the most commonly used theory in health education and health promotion (Glanz *et al.*, 2002). The underlying concept of the original HBM is that health behavior is determined by personal beliefs or perceptions about a disease and on the strategies available to decrease its occurrence (Hochbaum, 1958; Lennon, 2005). The HBM consist of four perceptions that serve as the main constructs of the model: 1) Perceived seriousness, 2) Perceived susceptibility, 3) Perceived benefits and 4) Perceived barriers (Hayden, 2009).

These four main constructs will be implemented in our study to assess the health behavior pattern accordingly. The construct of perceived seriousness assess an individual's belief about the severity of dengue symptoms, thus predicting the treatment seeking behavior. The second construct, perceived susceptibility determines an individual's belief about the risk of getting dengue fever. This in turn may lead to the prediction of prevention behavior in order to minimize the chances of getting dengue fever or dengue hemorrhagic fever (DHF). The third construct, perceived benefit, assesses an individual's belief about the usefulness of adopting a positive behavior that reduces the risk of getting dengue fever. The last construct, perceived barriers, determines an individual's own evaluation of obstacles faced by adopting a positive behavior to maintain clean surrounding environment which can prevent dengue fever. Through these main constructs of HBM, the pattern of treatment seeking and prevention behavior can be predicted. Additionally, people's knowledge and practices of dengue, is

important in order to improve integrated control measure (Dégallier *et al.*, 2000) and in reducing the incidence of dengue fever.

Identification of these factors (KAP's, socio-demographic and environmental factors influencing dengue prevention) in association with dengue prevention practices may help interventions to target specific segment of the populations. It is hoped that the results of this study can be used as guidelines in the formulation of administative policies and community orientated programes to increase dengue prevention and reduce the incidence of dengue fever in the country.

1.2 Research Question

What are the factors associated to dengue prevention practices?

1.3 Research Objective (s)

The following are the general and specific objectives of the study.

1.3.1 General Objective

The study aims to explore the knowledge, attitudes, and prevention practices behavior regarding dengue fever among the Orang Asli population in Peninsular Malaysia.

1.3.2 Specific Objectives

This study embarks on the following objectives:

1. To assess the experiences (self-reported prevalence) of dengue fever.
2. To assess the level of knowledge about dengue fever (general knowledge include sign and symptoms, causes, preventive practices, help and treatment seeking) in Orang Asli population.
3. To measure the attitudes towards dengue fever utilizing the Health Belief Model (perceived barriers, perceived severity, perceived susceptibility, and perceived self-efficacy) in Orang Asli setting.
4. To assess the preventive practices of dengue fever among the Orang Asli population.
5. To determine the factors (socio demographic characteristics, environmental factors influencing dengue prevention, knowledge, HBM factors, and

experience of dengue) associated with dengue prevention practices among the Orang Asli Population in Peninsular Malaysia

1.4 Expected Outcomes and Benefits

Identifying the factors associated with dengue prevention can provide insights into the planning of operative solutions to health problems regarding dengue fever among the Orang Asli.

1.5 Operational Defination

1.5.1 Knowledge : The knowledge that the respondent have regarding the sign and symptoms, causes, preventive practices, help and treatment seeking of dengue fever.

1.5.2 Attitude: The feeling and belief of the respondents with regard to dengue fever and its prevention.

1.5.3 Practices: The actions intended to do in order to prevent dengue fever.

1.6 Conceptual Framework

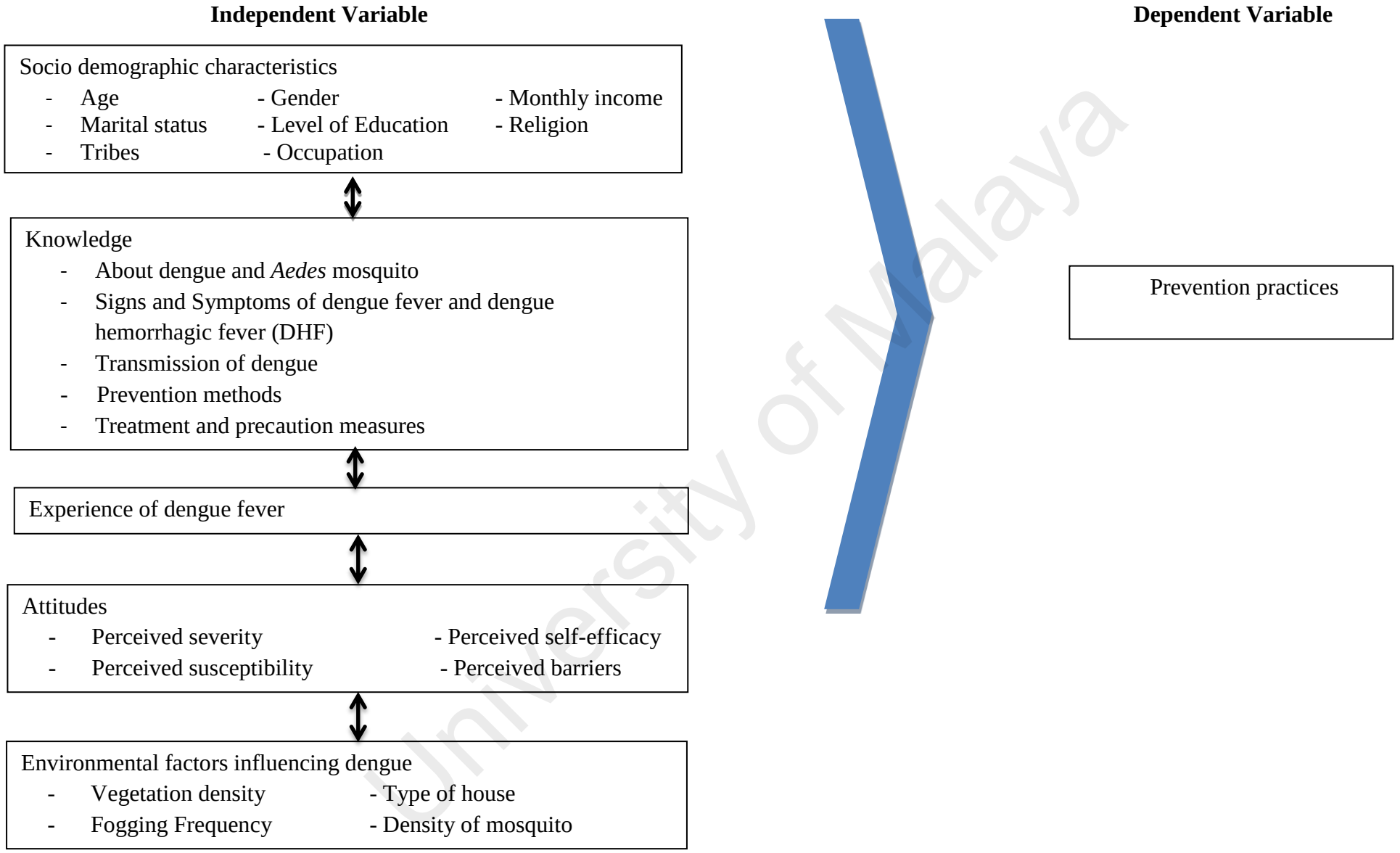

Figure 1: Conceptual Framework of the study

1.7 Significance of the study

No studies have been conducted to identify the factors associated to dengue prevention among the Orang Asli in Peninsular Malaysia. Therefore it is important to identify these factors to help improve dengue prevention among this community. Since there is no commercialized dengue vaccine, the implementation of effective vector control is very important to reduce the number of dengue cases and outbreaks. The Orang Asli in Malaysia is at risk of dengue fever as they live in highly vegetative surroundings. They also lack knowledge about dengue prevention practices.

The findings will provide information on factors associated with dengue prevention practices among Orang Asli, and thus provide important insight into policies that target interventions based on the identified factors that will be significantly associated to dengue prevention.

1.8 Outline of the thesis

The thesis is presented in seven chapters to facilitate clarity and ease of understanding of the study

- Chapter One provides an introduction to the study, including the background, objectives, research questions, expected outcomes and benefits, operational definitions, conceptual framework and significance of the study.
- Chapter Two consists of a review of the literature on relevant issues and on previous studies related to Knowledge, Attitude and Practices (KAP) of dengue.
- Chapter Three presents a detailed description of the methodology, research design, research instruments, sampling method and the data collection process. Details of plans for data analysis and ethical considerations are also described in this section.
- Chapter Four describes the major findings of the quantitative study
- Chapter Five presents discussion of the findings of the study. Quantitative findings are integrated in the discussion of the various issues that emerged from the findings. Results of previous studies are used to support and draw conclusions from the findings of the present study.
- Chapter Six provides a conclusion of the study, followed by implications and recommendations for dengue prevention practices. The limitations and the strengths of the study are mentioned in this section. The chapter ends with an overview of the study findings.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature on dengue prevention and people's knowledge, attitudes and practices of dengue fever. This chapter examines the socio-demographic characteristics, social environment and their dengue experience, health beliefs regarding dengue fever, knowledge of dengue fever, dengue prevention practices and control against dengue fever.

2.2 Mosquito Vector

Dengue Fever is caused by *Aedes* mosquito. Figure 2.1 shows the life cycle of the *Aedes* mosquito. It is a mosquito-borne viral infection transmitted by the infected *Aedes aegypti* and *Aedes albopictus* mosquitoes. Of these, *Aedes aegypti* is more important as it is a day biting mosquito, rests indoors and can breed in a small collection of water. *Aedes albopictus* predominates in the rural settings (Hairi *et al.*, 2003). The breeding behavior of *Aedes albopictus* are indoors. This helps in a longer lifespan of the mosquito and is more easily in contact with humans for blood feeding (Dieng *et al.*, 2010).

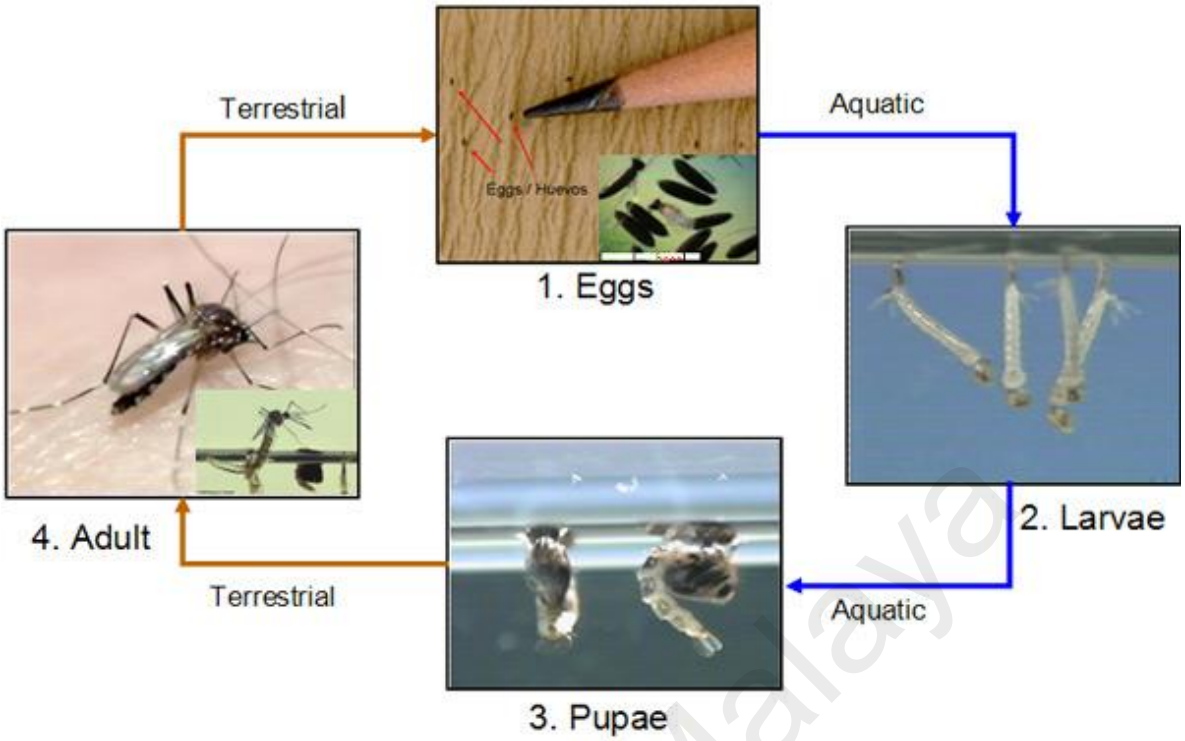

Figure 2.1: Life Cycle of an *Aedes* Mosquito

(Source: http://www.cdc.gov/Dengue/entomologyEcology/m_lifecycle.html)

2.3 Dengue fever in Malaysia

Dengue fever is a serious problem overwhelming the world: annually, there are about 50–100 million dengue infections (Rigau-Perez *et al.*, 1998) which include 500,000 dengue haemorrhagic fever (DHF) cases with 22,000 deaths, mostly among children (WHO, 2012). In the future, it is estimated at least 50–60% of the world population will be at risk of dengue fever (Dieng *et al.*, 2012).

Dengue fever has been endemic in Malaysia for decades. The earliest report of dengue in Peninsular Malaysia was from Singapore and the first incidence of dengue epidemic was reported in Penang in the begining of December 1901 (Skae, 1902). Dengue is known to be brought in by seafarers from Africa by the *Aedes aegypti*

mosquito which was then replaced the local *Aedes albopictus* (Abubakar and Shafee, 2002) as the main carrier of dengue fever.

In 1982, a study reported that the case fatality rate was higher among Malaysian adults, ranging about 51.4% of dengue deaths (Lam, 1993). In Malaysia, the morbidity rate for DHF was highest among adults aged 20–29 years from 1987 to 1991 (Poovaneswari, 1993). According to World Health Organisation (WHO) in 2009, a total of 33, 684 people were infected with dengue in Malaysia and in October 2010, there were 40, 152 cases of dengue that resulted in 118 deaths. WHO recorded a two-fold increase in the incidence rate of dengue fever from the year 2012, with 21,900 cases, when compared to 2013, with 49,346 cases, in Malaysia.

2.4 Dengue among Orang Asli and the prevalence of dengue in rural areas

The Orang Asli are the indigenous minority people in Malaysia. They represent 0.6% of the total population in Malaysia (Kamarulzaman Kamaruddin and Jusoh, 2008). According to the Annual report of the Department of Orang Asli Affairs (JAKOA) in 2006, there are about 147 412 Orang Asli living in 869 villages in Malaysia. Figure 2.2 shows the distribution of Orang Asli accoding to their sub-groups in Peninsular Malaysia.

The indigenous peoples in Malaysia, known as ‘Orang Asli’, make up 1% of the total population in Malaysia (Nicholas, 2007). Approximately, 61 % of the Orang Asli live at the fringes of the jungle or in rural areas, while 37% live deep within the jungle, and only 1% are found in or close to urban areas. The prevalence of dengue fever in the rural areas of Malaysia was estimated to range from 24% in the Lundu District, Sarawak

(Cheah *et al.*, 2006) to about 91% throughout the Malaysian population (Muhammad Azami *et al.*, 2011). A recent study conducted in Malaysia, found that prevalence of dengue was significantly higher in the rural areas when compared to the urban areas (Wong *et al.*, 2014) . A study conducted in 1956 (Smith, 1956) among the Orang Asli population in Peninsular Malaysia showed that most adults above the age of 30 years from the Temuan and Semai community in Hulu Langat, Selangor, had been affected by dengue fever. Another study conducted in 1986 (Rudnick and Lim, 1986) showed that 73% of the Temuan Orang Asli community in Kampung Tanjong Rabok, Selangor had been affected by dengue fever and its related viruses.

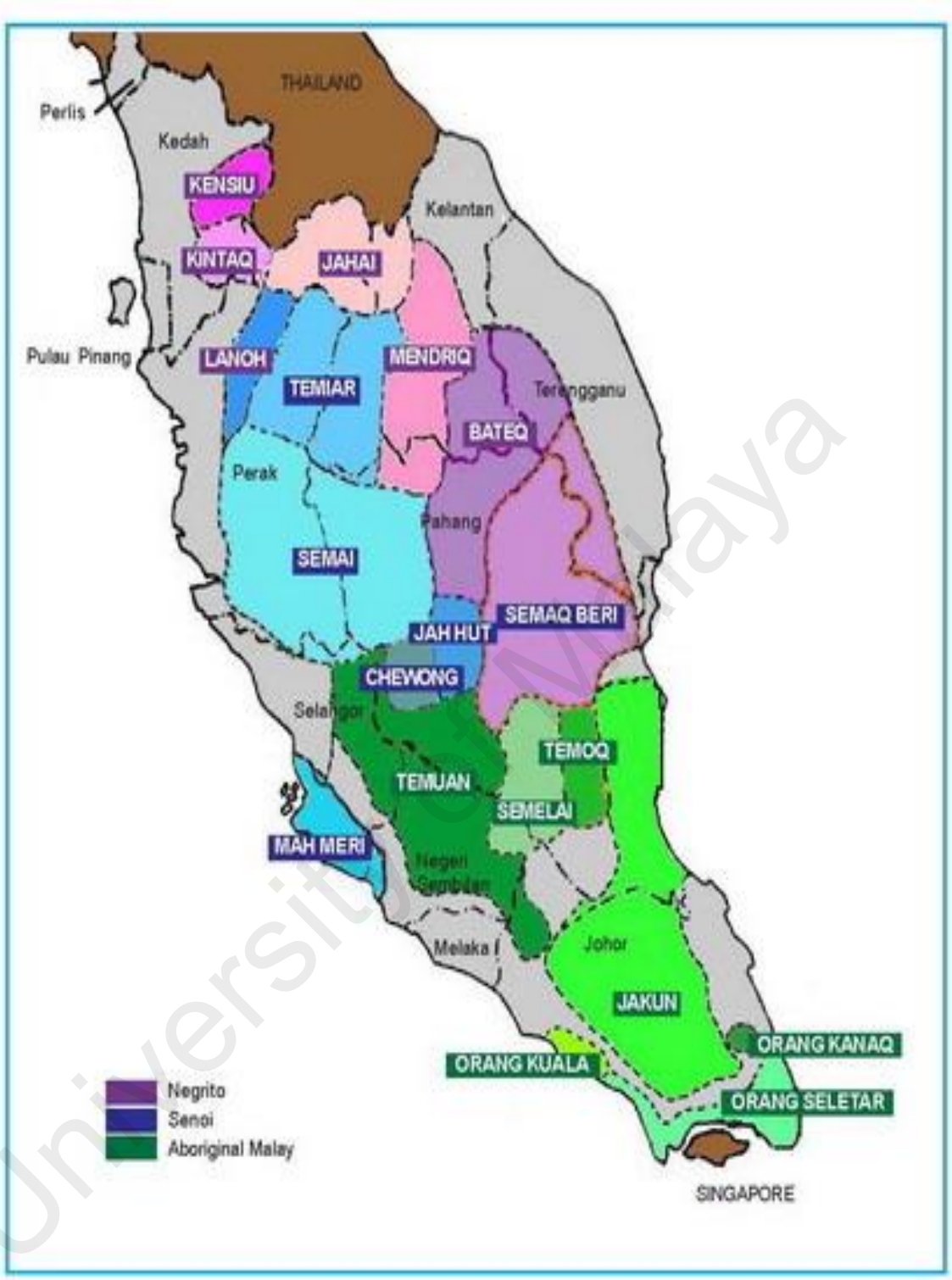

Figure 2.2: Distribution of the Orang Asli according to their sub-groups

(Source: http://www.coac.org.my/main)

2.5 Knowledge, Attitudes's and Practices (KAP) studies on Dengue Fever

Gupta *et al* (1998) assessed the knowledge and attitude about dengue and dengue prevention practices among the residents of a rural area and an urban resettlement in East Dehli. It was an interview based cross sectional KAP study which was conducted in 1997, a few months after the dengue epidemic in the area. A total of 687 people responded to the interview in which 334 were from the rural areas and 353 from the urban areas. Nearly 82.3% of the respondents were aware of dengue fever. Mass media was the most common source of information in both areas. Knowledge about the disease was fair to good. Fever was the most commonest symptom of the disease as reported by 92% of the urban repondents and 83% of the rural area respondents. This was followed by symptoms of bleeding and headache. Mosquito was known to spread the disease (71% by rural repondents and 89% by urban respondents). More than two third of the respondents had used some method of mosquito control or personal protection to prevent mosquito bites during the dengue epidemic outbreak.

Van Benthen *et al* (2002) conducted a study on the knowledge and use of prevention measure related to dengue in northern Thailand. They found that 67% of the total respondents had knowledge of dengue. People with knowledge of dengue reported a significantly higher use of preventive measures than people without knowledge of the disease. In the multivariate analysis, knowledge of dengue was significantly different for age, sex, and occupation where the *p* value was less than 0.05.

Hairi *et al* (2003) conducted a study on KAP's on dengue among the selected communities in Kuala Kangsar district in Malaysia. The study sample was 1511 and obtained by random sampling method. The data was collected by face-to-face interview of the head of the household using a semi-structured questionnaire. It was found that the knowledge on dengue among this community was good. Cross tabulation was done between knowledge and practises, knowledge and attitude, and attitute and practices. There was no significant association seen between knowledge and practices. However, there was a significant association seen between knowledge and attitude towards *Aedes* mosquito control (p=0.047).

Claro *et al.* wrote an article on dengue prevention and control: a review of studies on knowledge, belief's and practices (Claro *et al.*, 2004). This article aim was about practices concerning dengue and dengue prevention. They found that adequate knowledge of dengue and prevention methods were in close association with high rates of domiciliary infestation of *Aedes aegypti*. However, traditional education strategies, although efficient in transmitting information, had failed to change population behaiviour in dengue prevention and control. Qualitative studies revealed two important issues that explained these attitudes: representation of dengue and dangers connected with mosquitoes and difficulties in preventing infestation of household water containers due to sanitation problems in communities.

In a hospital based study conducted by Matta *et al* (2006), 82.4% of the respondents knew that dengue fever was transmitted by mosquitos while 54% associated dengue with flies or person to person transmission. Regarding knowledge on dengue, about 79.8% of the respondents knew about the breeding places of mosquitoes. 24.2% of the respondents identified that 'coolers and tyres' are the most probable

breeding sites of mosquitoes. Knowledge regarding dengue among the respondents was good in general but practices of checking coolers, tyres and flower pots was poor.

In a study conducted by Wong *et al* (2014), among Malaysian students who were IgG seropositive from the surrounding area showed a significant correlation with househlod income, high-rise residential building type, high surrounding vegetation density, rural locality, high perceived severity and susceptibility, perceived barriers to prevention, knowing that a neighbour has dengue, frequent fogging and a higher level of knowledge about dengue. However, weak correlations were found between self-practices to prevent dengue and the level of dengue seropositivity in the community, and between HBM constructs and knowledge ($r = 0.09$).

Several small scale studies on knowledge, beliefs, and practices (KBPs) related to dengue fever have also been conducted locally (Hairi *et al.*, 2003; Wan Rozita *et al.*, 2006) among the lay public, but there is lack of baseline data on knowledge, beliefs and practices among the Orang Asli population in Malaysia.

Not many people have done KBP's on Dengue Fever among the Orang Asli population in Peninsular Malaysia. It is important to access this, not only because they are also a part of our nation but because almost a quater of dengue cases occur in rural setting (Hairi *et al.*, 2003). One way in preventing dengue is by acessing the KBP's of people and their practices done in preventing the spread of dengue virus

2.6 Socio-demographic characteristics and environmental factors influecing dengue prevention

Socio-economic conditions of the community were were related to the incidence of dengue fever. In a study conducted in Kuala Kangsar, those who were illiterate showed a better attitude towards dengue fever prevention when compared to literate people (Hairi *et al.,* 2003). Married and younger people reported better prevention practices against dengue fever compared to those from older age groups and those who were single. Respectively, another study reported that eliminating breeding sites and mosquito prevention practices were higher among the Malaysian rural population compared to the aborigines (Al-Adhroey *et al.*, 2010). This could perhaps be explained by the fact that the rural populations have a higher level of education and living nearer to health facilities. Therefore, this shows that socio-demographic characteristics are an important factor in dengue elimination and prevention.

Additionally, people's knowledge about dengue, its spread, its symptoms and its prevention is of paramount importance in reducing the incidence of dengue fever. Hairi *et al.,* (2003) also mentioned that those with no education showed better practices than those who received higher education. This could be because although most housewives are not educated, they play an important role in keeping the household clean. Maintaining a clean surrounding environment helps to prevent dengue mosquito breeding. However in another study done by Ahmed Itrat *et al* (2008) showed that literate individuals were relatively more well-informed about dengue fever compared to illiterate people. But their results were not statistically significant. From these studies, we can gather that the Orang Asli education level being low, therefore their practices is preventing dengue fever may be limited.

Studies have shown that the incidence of dengue is higher in rural areas when compared to urban areas because of the development of land (Van Benthem *et al.*, 2002). Most Orang Asli are in the rural areas and live deep in the jungle and are surrounded by many plants. The typical dengue mosquito breeds outdoors (Dieng *et al.*, 2012), mainly on plant leaves and in tree holes, all of which are in highly vegetative state. Considering the relatively large number of Orang Asli living in highly vegetative surroundings, they are therefore at high risk of getting dengue fever.

2.7 Knowledge on Dengue Fever

Knowledge on dengue fever has been reported as an important factor in its prevention and control. Knowledge on the sign and symptoms of dengue fever are important for seeking treatment early. Prolonged fever and late treatment may lead to death. Common signs and symptoms include sudden onset of fever, marked thrombocytopenia, abdominal and joint pains, nausea and vomitting (Rudnick, 1965), congestion of the skin (ecchymosis), haemorrhage from the nose, enlarged lymph nodes (Skae, 1902), headaches (Matta *et al.*, 2006).

According to a recent study, inadequate knowledge about dengue is a major obstacle faced in the elimination of dengue (Yboa and Labrague, 2013). A recent study found that inadequate knowledge about the signs and symptoms, the transmission of dengue, and preventive practices can increase the spread of dengue among Malaysians (Wong *et al.*, 2014) (Al-Adhroey *et al.*, 2010). Another study conducted among Malaysians however, found that they generally had good knowledge of dengue fever and on its prevention (Naing *et al.*, 2011). However, it was shown that higher knowledge did not necessarily result in adopting the recommended preventive

behaviour (Shuaib *et al.*, 2010) (Isa *et al.*, 2013). Therefore, given these differences further studies are needed to investigate the association between knowledge and dengue prevention practices.

2.8 Attitudes

Human attitudes play a major factor in controlling the breeding grounds for these mosquitoes and reducing the number of its population (Fang *et al.*, 1984). The most effective method in controlling or preventing dengue is vector control (Dieng *et al.*, 2010); (Oki *et al.*, 2011). Vector control can be done by frequent fogging in endemic areas. But these are done mainly outdoors However, the *Aedes aegypti* mosquito tends to rest hidden indoors, making it hard for insecticide to reach adult mosquitoes (Gubler, 1989). The methods for eliminating the breeding sites of dengue mosquitoes both indoors and outdoors are therefore limited. The success in dengue prevention and control is mainly from improving public and household environmental sanitation, water supply, and alteration of human behaviour towards dengue fever (Artwanichakul *et al.*, 2012).

2.8.1 Health Belief Model

Dengue fever prevention and control can be improved through health behavior theory. The Health Belief Model (HBM), (Strecher and Rosenstock, 1997) a well-established theoretical approach, has been employed to address the problem in dengue control (Lennon, 2005). Another study also showed that HBM is an effective framework for understanding mosquito control, understanding dengue fever and

identifying factors associated with preventative behaviors (Thompson and Caltabiano, 2010).

We belief that KBPs survey is important as the results may identify knowledge deficiency, understand community barriers to practice, and the factors that facilitate the adoption of recommended preventive measures. Ultimately, the results may encourage the development of interventions that will close the gap of knowledge about dengue fever.

2.9 Dengue Prevention Practices

One of the methods of dengue prevention is eliminating the breeding sites of dengue mosquitoes. The success was seen in Thailand where eliminating mosquito breeding sites has definitely reduced the number of dengue cases in the region (Van Benthem *et al.*, 2002). The success of the efforts in dengue prevention and control is also from improving public and household environmental sanitation, water supply, and alteration of human behaviour towards dengue fever (Artwanichakul *et al.*, 2012). A recent study conducted in Philippines among the urban poor community showed that half of the respondents practiced only moderate dengue prevention methods, while 39.2% of the respondents did effective prevention practices in their everyday life. However, the study also showed that there was no significant association between knowledge, attitude and their practices because the respondents lacked of dengue knowledge and had negative attitude scores (Kwon and Crizaldo, 2014) .

CHAPTER 3: METHODOLOGY

3.1 Study design

The research methods used in this study were quantitative questionnaire surveys. The statistical methods are mainly descriptive techniques or standard statistical tests, such as cross tab, chi-square test, analysis of variance, and correlation analyses. Multivariate analyses were used to identify factors associated with dengue prevention practices.

3.2 Study area

The sample for this study was Orang Asli originating and living in Peninsular Malaysia. According to the Department of Orang Asli Affairs (JAKOA), there are eight states in Malaysia where Orang Asli live. Figure 3 shows the states and districts in which the Orang Asli was approached. From these eight states, two villages from each state were randomly selected for which JAKOA was able to provide assistance for the study.

In the planning of this study, the research group first approached Orang Asli members with JAKOA's permission to familiarise themselves and ascertain responses from the Orang Asli community. This was to ensure that the Orang Asli respondents were comfortable with the interviewers and to acquire better responses.

The Orang Asli villages were selected based on their location, the villages were either (1) forest fringe areas – Orang Asli villages which were relocated and have access to basic resources such as electricity and pipe water or (2) deep within the jungle – Orang Asli villages where most basic resources were not readily available.

In total, 16 Orang Asli villages were selected based on (1) accessibility of these villages by land transport and (2) permission being granted by the head of the village.

Figure 3: Map of the states in which Orang Asli villages were visited

3.3 Study population

The target population in this study was Orang Asli respondents living in Peninsular Malaysia, and who were 18 years old and above. Having identified the villages, each household in the selected villages was then approached individually.

For each household in the village selected, two people were selected: (1) resident aged between 18–40 years old and (2) resident aged 41 years old or above. If there was more than one eligible person available in a household, only one participant was selected randomly. If respondents refused to be interviewed or if the resident of the house was not present, it was regarded as a non-response. Trained enumerators administered the questionnaire to the respondents.

3.4 Inclusion criteria

Inclusion criteria for the study were:

1) Orang Asli above 18 years of age

2) Originating from and living in the selected villages

3) Could understand and comprehend Bahasa Melayu

3.5 Sample size calculation

For calculation of sample size for the study, the Department of Orang Asli Affairs (JAKOA), Malaysia was referred to in order to get the number of population of Orang Asli in Peninsular Malaysia. Orang Asli in Sabah and Sarawak are not obtained, as they are known as 'Orang Bumiputra'. The total population of Orang Asli in Peninsular Malaysia which were accessible was 103, 783 (Table 3.1).

Table 3.1: List of States and Districts in Peninsular Malaysia where Orang Asli live

District	Number of villages	Number of villagers
Selangor		
Hulu Selangor	16	2129
Gombak	8	818
Petaling	4	823
Klang	3	263
*Hulu Langat	9	1502
Sepang	15	2073
Kuala Langat	20	3201
Negeri Sembilan		
Jempol	16	2169
*Jelebu	10	1423
Tampin	4	255
Port Dikson	2	334
Kuala Pilah	13	1296
Rembau	7	421
Seremban	12	1696
Melaka		
*Alor Gajah	9	893
Jasin	5	567
Johor		
Kluang	8	1008
Muar	8	971
Mersing	6	969
Batu Pahat	6	2204
Segamat	7	1357
Johor Baharu	9	1466
*Kota Tinggi	5	1265

Pontian	7	1314
Pahang		
Rompin	42	9599
Pekan	28	9746
Kuantan	11	1565
Maran	8	1371
*Temerloh	12	4663
Bera	7	1651
Bentong	13	2678
Raub	20	2897
Jerantut	9	2087
Kuala Lipis	8	1117
Cameron Highlands	6	1765
Kelantan		
Gua Musang	40	4240
Jeli	4	525
Besut	1	29
*Hulu Terengganu	1	334
Kemaman	1	759
Perak		
Hulu Perak	8	932
Kuala Kangsar	14	3483
Kinta	31	6724
Hilir Perak	4	1624
*Perak Tengah	5	2286
Batang Padang	76	13061
Kedah		
*Baling Kedah	1	230
Total	**560**	**103 783**

* Randomly selected district

Sample size was calculated based the most conservative expected rate of dengue of 50%, and margin error of 3% with a 95% Confidence interval (CI). Hence, the sample size required for 103, 783 Orang Asli for accuracy level of 0.95 with a margin error ±5.0% is 383 as shown below.

- N = In which n = Z * Z [P (1-P)/(D*D)]

  N = 1.960 * 1.960 [0.5(1 - 0.5) / (0.05 * 0.05)

- N = 1.960 * 1.960 [0.5(0.5) / (0.00025)]

  =383

  [Adjustment for the size of the population]

- S = n / [1 + (n / population)

- S = 383 / [1 + (383 /103 783]

  =383

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice, expressed as decimal

(0.5 used for sample size needed)

c = confidence interval, expressed as decimal

3.6 Instrumentation

The questionnaire consists of six main sections: (1) socio-demographic characteristic, (2) social environment and dengue experience, (3) health beliefs regarding dengue fever, (4) knowledge of dengue fever, (5) self-reported prevention practices and (6) control against dengue fever.

The first section of the questionnaire assesses the socio-demographic characteristics of the respondents, namely: age, gender, marital status, religion, states,

tribe, highest attainment of education, occupation, and average monthly household income.

The second section assesses the social environment and dengue experience of the respondents, namely: dengue experience, hospitalized due to dengue, type of house, living condition, density of vegetation or plants, density of mosquito in neighbourhood and fogging frequency. Dengue experience and hospitalization due to dengue fever is assessed with a 'Yes' and 'No' response.

Type of house is assessed as 'Wooden house' and 'Single story house' which was built by the government under the Housing Project for the Hardcore Poor (PPRT = Projek Perumahan Rakyat Termiskin). Living condition was assessed on the area where the Orang Asli lived, as in 'Forest Fringe' or 'Deep within the forest'.

The measurement of density of vegetation or plants, density of mosquito in neighbourhood and fogging frequency, were assesses as 'None', 'Low', 'Moderate' and 'A Lot'.

The third section assessed the health beliefs of respondents regarding dengue fever which was measured using the Health Belief Model (HBM) construct. This construct consists of four mains parts:

1) Perceived Susceptibility of Dengue that is, ones' belief in susceptibility in contracting dengue fever. This was measured on a scale of 1–10, where a higher score indicates higher susceptibility towards dengue fever.

2) Perceived Severity of Dengue is one's perception of the seriousness of dengue fever. This was measured on a scale of 1–10, where a higher score indicates higher perceived severity towards dengue fever.

3) Perceived Barrier examines the perceptions of barriers to prevent dengue fever. This was also measured on a scale of 1–10, where a higher score indicates higher perceived barriers.

4) Self-efficacy is the perception of one's own self efficacy to successfully implement dengue prevention measures. This is measured by a four-point Likert scale that ranges from 1 (strongly agree) to 4 (strongly disagree).

The forth section assessed the knowledge of dengue fever. This section consisted of 43 items divided into five sub-parts: Knowledge about (1) dengue and the *Aedes* mosquito, (2) transmission of dengue, (3) prevention of dengue, (4) signs and symptoms, and (5) treatment, curability and precautionary measures for people infected with dengue. For each item, the respondents could choose between 'yes', 'no', or 'don't know' responses. For the analysis of level of knowledge, correct responses were scored as 1 and incorrect or 'don't know' responses were scored as 0. Scores ranged from 0–43, where higher scores indicate greater level of knowledge about dengue fever.

The fifth section assessed self-reported prevention practices against dengue fever and control. This section was sub-divided into three parts: prevention practices of mosquito breeding (9-items), prevention practices of mosquito bites (7-items), and prevention practices of dengue transmission (1-item). The options for dengue prevention practices were 'not at all', 'rarely', 'sometimes', 'often', and 'not

applicable'. For the calculation of level of prevention practices score, each question was assigned points 0, 1, 2, and 3 respectively. For the option 'not applicable', 0 points was assigned. The answers were calculated based on the number of total applicable answers. The prevention practices scores were calculated based on 'number of points obtained' over 'total points of applicable answer'. Results were reported as percentages, where higher percentages indicate higher dengue preventive practices.

The questions on social environment and dengue experience, health beliefs regarding dengue fever, knowledge of dengue fever, self-reported prevention practices and control against dengue fever was adapted from 'Community knowledge, health beliefs, practices and experiences related to dengue fever and its association with dengue prevalence' by Wong *et al* 2014. The reliability of the dengue prevention scale questionnaire has been previously reported, with the value of internal consistency, Cronbach's alpha >0.70. Cronbach's alpha coefficient measurement for prevention of mosquito breeding and mosquito bite were 0.791 and 0.898 respectively, demonstrating good internal consistency. Cronbach's alpha coefficient measurement for dengue knowledge was 0.916, showing high internal consistency. The Cronbach's alpha coefficient measurement for self-reported preventive practices was 0.655, demonstrating a good internal consistency.

3.7 Ethics statement and consideration

The study received permission from the Department of Orang Asli Affairs (JAKOA) and was approved by the Medical Ethics Committee of the University Malaya Medical Centre, Kuala Lumpur (MEC Ref. No: 896.15). Due to cultural reasons and the sensitivity to outside visitors of the Orang Asli community, a JAKOA representative

who was known to the Orang Asli community was present to help during the entire study in the selected villages.

The confidentiality of this research and informed written consent was obtained from each respondent after a clear and detailed explanation of the study was given. They were assured that the study was for academic purposes.

3.8 Statistical analyses

Besides descriptive analyses where appropriate, the data were tested for statistical significance between the associative variables and the outcome variables using chi-square test, where $p < 0.05$ was taken as being significant.

The dependent variable (Percentage Scores of Dengue Prevention Practices) was cross-tabulated with the independent variable (socio-demographic characteristic, social environment and dengue experience, health beliefs regarding dengue fever, and level of knowledge of dengue fever) and the chi-square analysis was to see how strongly the variables were associated with dengue prevention practices. Logistic multivariate regression models were used to see the independent effect of each of these variables on the dependent variables. In the modelling strategy, the independent variables were included if they had a $p<0.05$ on univariate analysis. Associations were expressed with adjusted odds ratios of 95% confidence intervals for each variable included in the multivariate model.

All statistical analyses were performed using SPSS 20.0 (SPSS Inc., Chicago, IL). In all analyses, a *p*-value of less than 0.05 was considered statistically significant.

CHAPTER 4: RESULTS

4.1 Response Rate

According to JAKOA, there are eight states in Peninsular Malaysia where Orang Asli live. Among these eight states, two villages from each state were chosen randomly to be surveyed. In total, 16 villages were approached to take part in this study. All households in the 16 villages were approached and invited to participate in the survey.

In total there were 560 adult Orang Asli in the selected 16 villages that were approached. This was higher than the sample size calculated. The survey was carried out between 14 April 2012 and 5 February 2013.

Among the total 560 Orang Asli approached, a total of 505 complete responses were obtained: the response rate being 90.1%. The Orang Asli respondents who could not comprehend Bahasa Melayu were excluded from this study (n=3). Fifty-two individuals did not complete the study. The reason for non-completion included refusing to answer the questionnaire (n=30) and not interested in taking part in the survey (n=22).

4.2 Socio-demographic characteristics

Details of the demographic characteristic for the sample of respondents are summarized in Table 4.1. There were more female respondents (n= 343, 67.9%) than male respondents (n= 162, 32.1%). Most of the Orang Asli respondents were aged between 18-40 years old (n=366, 72.5%) and only 27.5% (n=139) of the respondents were more than 41 years old. Most of the respondents were married (n=441, 87.3%). Three hundred and seven respondents (60.8%) did not have a religion (Atheist).

Most of the respondents were from the state of Perak, (n=92, 18.2%), followed by Negeri Sembilan, (n=89, 17.6), Kelantan (n=74, 14.7%), Pahang (n=57, 11.3%), Kedah (n=54, 10.7%), Melaka (n=49, 9.7%), Selangor (n=48, 9.5%) and Johor (n=42, 8.3%). Approximately, 36.0% (n=182) of the respondents were from the Temuan tribe, followed by the Semai tribe (n=90, 17.8%), Temiar tribe (n=75, 14.9%), Kensui tribe (n=47, 9.3%), Jakun tribe (n=38, 7.5%), Semoq Beri tribe (n=32, 6.3%), and the Jah Hut tribe (n=25, 5.0%).

Less than half of the Orang Asli respondents were primary school educated (n= 205, 40.9%) and most of them were unemployed (n=253, 50.1%). Most of the respondents (n= 347, 68.7%) had less than RM 500 as an average monthly household income because they only work in the village as a helping hand and do odd jobs around the village. Only 31.3% (n= 158,) of the villagers have an average monthly income of RM500-RM1200 most of whom work as assistant kindergarten teachers in the village and as bus or tourist drivers.

Table 4.1: Distribution of respondents by socio-demographic characteristics (N=505)

Characteristic	Frequency	
	N	(%)
Gender		
Male	162	32.1
Female	343	67.9
Age		
18-40	366	72.5
>41 years	139	27.5
Marital Status		
Married	441	87.3
Not married	64	12.7
Religion		
Islam	147	29.1
Christian	51	10.1
Other (Atheist)	307	60.8
States		
Johor	42	8.3
Pahang	57	11.3
Negeri Sembilan	89	17.6
Kelantan	74	14.7
Selangor	48	9.5
Melaka	49	9.7
Perak	92	18.2
Kedah	54	10.7
Tribes		
Temiar	75	14.9
SemoqBeri	32	6.3
Semai	90	17.8
Temuan	182	36.0
Jakun	38	7.5
Jah Hut	25	5.0
Kensui	47	9.3
Others	16	3.2
Highest Education Attainment		
No Formal Education	151	29.9
Primary Education	205	40.9
Secondary Education and more	149	29.5
Occupation		
Skilled worker	20	4.0
Non-skilled worker	232	45.9
Unemployed (Student, Housewife, Retiree)	253	50.1
Average monthly household income[‡]		
<RM500	347	68.7
RM500-RM1200	158	31.3

[‡]The national average monthly household income in Malaysian Ringgit (RM) is RM3,686 (US$1= MYR3.23, as of July, 2013).

4.3 Social environment and density of vegetation

Most of the Orang Asli respondents live in the forest fringe (n=319, 63.2%), and a minority live deep within the forest (n=186, 36.8%).

Most of the respondents lived in Housing Project for the Hardcore Poor (PPRT= Projek Perumahan Rakyat Termiskin) houses which were sponsored by the government (n=264, 52.3%) while 47.7% (n=241) of the respondents lived in village houses. About 39.0% (n= 197) of the Orang Asli respondents had low density of plants and vegetation surrounding their houses.

4.4 Density of mosquito and fogging frequency

Less than half of the Orang Asli responded (n= 252, 49.9%) that the density of mosquito in their neighborhood was severe. About 35.6% of the respondents reported moderate density of mosquito in their neighborhood (n=180). Only 63 respondents reported that the density of mosquito in their neighborhood was low (12.5%).

About 36.8% of the respondents reported that the authorities fog their village rarely with insecticide (n=186). About one third of the Orang Asli respondents (n= 173, 34.3%) reported that the authorities fog their village occasionally with insecticide. Only a minority of the respondents (n= 60, 11.9%) reported that their village was fogged often.

4.5 Dengue experience

Only 2.8% (n= 14) of the respondents self-reported that they have had dengue fever. Of the 14 respondents, only 12 reported that they had been hospitalized for dengue fever (85.7%) (Table 4.2).

Table 4.2: Social environment, density of vegetation, density of mosquito, fogging frequency and dengue experience

Characteristics	Frequency	
	N	%
Dengue Experience		
Yes (Once)	14	2.8
No	491	97.2
Hospitalized of dengue		
Yes	12	2.3
No	493	97.6
Type of house		
Village house (Wooden)	241	47.7
Single story house (PPRT)	264	52.3
Living Condition		
Forest Fringe	319	63.2
Deep within the forest	186	36.8
Density of vegetation/plants		
None	22	4.4
Low	197	39.0
Moderate	180	35.6
A Lot	106	21.0
Density of mosquito in neighborhood		
None	10	2.0
Low	63	12.5
Moderate	180	35.6
Severe	252	49.9
Fogging Frequency		
None	86	17.0
Rarely	186	36.8
Occasionally	173	34.3
Often	60	11.9

4.6 Knowledge of dengue fever

Measurement of level knowledge of dengue fever consisted of 43 items questions divided into five sub-parts: Knowledge about (1) dengue and the *Aedes* mosquito, (2) transmission of dengue, (3) prevention of dengue, (4) signs and symptoms, and (5) treatment, curability and precautionary measures for people infected with dengue. For each item, the respondents could choose between 'yes', 'no', or 'don't know' responses. For the analyses, correct responses were scored as 1 and incorrect or 'don't know' responses were scored as 0. Total knowledge scores ranged from 0–43, where higher scores indicate greater level of knowledge about dengue fever.

4.6.1 Knowledge about dengue and the *Aedes* mosquito

Knowledge about dengue and its mosquito consisted of 12 item questions. Table 4.3 shows that 85.9% (n= 434) of the respondents correctly answered that dengue fever is transmitted by a mosquito. Most of them correctly answered (n= 324, 64.2%) that dengue fever is caused by *Aedes* mosquito. About one-third responded 'Don't know' that dengue fever may become dengue hemorrhagic fever (n=179, 35.4%). Most of the respondents reported 'Don't know' that dengue hemorrhagic fever usually occurs to people who have had several dengue infections (n=259, 51.3%). Most of the Orang Asli respondents correctly answered that the *Aedes* mosquito has black and white stripes on its body (n=319, 63.2%) and breeds in clean stagnant water (n=246, 48.7%). A majority responded 'Don't know' that *Aedes* mosquito live in houses and building rather than natural wetlands (n=276, 54.7%).

Table 4.3: Knowledge about dengue and *Aedes* mosquito

	N (%)		
Knowledge about dengue and *Aedes* mosquito	**True**	**False**	**Don't know**
Transmission by mosquito	434 (85.9)*	3 (0.6)	68 (13.5)
Virus transmitted by *Aedes* mosquito	324 (64.2)*	7 (1.4)	174 (34.5)
Dengue fever is a virus	201 (39.8)*	9 (1.8)	295 (58.4)
Dengue fever may become dengue haemorrhagic fever	320 (63.4)*	6 (1.2)	179 (35.4)
Dengue haemorrhagic fever can be fatal	331 (65.5)*	7 (1.4)	167 (33.1)
Dengue haemorrhagic fever usually occur to people who have had several dengue infection	185 (36.6)*	61 (12.1)	259 (51.3)
Aedes mosquito has black and white stripes on its leg and body	319 (63.2)*	17 (3.4)	169 (33.5)
Breeds in clean stagnant water	246 (48.7)*	201 (39.8)	58 (11.5)
Lives in houses and building rather than natural wetlands	276 (54.7)	152 (30.1)*	77 (15.2)
Do not live in places with lots of plants	337 (66.7)*	89 (17.6)	79 (15.6)
Bite during dusk and dawn	311 (61.6)*	119 (23.6)	75 (14.9)
Aedes mosquito biting an infected person can spread it to another	296 (58.6)*	35 (6.9)	174 (34.5)

*correct answers

4.6.2 Knowledge about the transmission of dengue

Knowledge of the transmission of dengue consists of 8 item questions. In Table 4.4, most of the Orang Asli responded 'Don't know' about the transmission of dengue. A majority of the Orang Asli responded 'Don't know' that fever occurs after 4-7 days after a bite by the *Aedes* mosquito (n=263, 52.1%). Only 38% of the Orang Asli respondents correctly answered that they were aware that dengue fever cannot be transmitted by touch (n=184). Most of the respondents knew that dengue fever can be transmitted by blood (n=240, 47.5%). About half of the Orang Asli respondents reported wrongly that dengue epidemic occurs only during rainy season (n=252, 49.9%).

Table 4.4: Knowledge about the transmission of dengue

Knowledge about the transmission of dengue	**N (%)**		
	True	**False**	**Don't know**
Fever after 4-7days after mosquito bite	200 (39.6)*	42 (8.3)	263 (52.1)
Transmitted by touch	76 (15.0)	192 (38.0)*	237 (46.9)
Transmitted by air	78 (15.4)	184 (36.4)*	243 (48.1)
Transmitted by body fluids	75 (14.9)	174 (34.5)*	256 (50.7)
Transmitted by blood	240 (47.5)*	40 (7.9)	225 (44.6)
The mosquito egg contains dengue virus	224 (44.4)*	37 (7.3)	244 (48.3)
Only can get dengue fever once	84 (16.6)	225 (44.6)*	196 (38.8)
Dengue epidemic occurs only during rainy season	135 (26.7)	252 (49.9)*	118 (23.4)

* correct answers

4.6.3 Knowledge about prevention of dengue

Knowledge about prevention of dengue consisted of 5 item questions (Table 4.5). Most of the respondents correctly answered about dengue knowledge prevention. About 81.2 % of the Orang Asli respondents answered correctly that a weekly change of stagnant water can prevent dengue fever from spreading (n=410, 81.2%). Slightly more than half of the Orang Asli respondents correctly answered that the use of abate or chemicals in water container is a method in preventing dengue (n=274, 54.3%).

Table 4.5: Knowledge about prevention of dengue

Knowledge about prevention	N (%)		
	True	False	Don't know
Weekly change of stagnant water (pet bowls, vases)	410 (81.2)*	8 (1.6)	87 (17.2)
Put abate/chemical in water containers	274 (54.3)*	42 (8.3)	189 (37.4)
Covering water containers	416 (82.4)*	9 (1.8)	80 (15.8)
Emptying or drying out containers around the house	424 (84.0)*	1 (0.2)	80 (15.8)
Proper disposal of items that can retain water	431 (85.3)*	2 (0.4)	72 (14.3)

*correct answers

4.6.4 Knowledge about sign and symptoms of dengue

Knowledge about sign and symptoms of dengue fever consist of 15 item questions. In Table 4.6 more than half of the respondents correctly answered that high fever for 5-6 days is one of the main sign and symptoms of dengue fever (n=312, 61.8%). About 57% of the Orang Asli respondents correctly answered that chills occur to people who are infected with dengue fever (n=288). Most of them responded 'Don't know' that pain in the eyes are one of the sign and symptoms of dengue (n=254, 50.3%). As a whole, majority of them did not know about the sign and symptoms of dengue fever.

Table 4.6: Knowledge about sign and symptoms

Sign and symptoms	N (%)		
	True	False	Don't know
5-6 days high fever	312 (61.8)*	7 (1.4)	186 (36.8)
Chills	288 (57.0)*	18 (3.6)	199 (39.4)
Rash	223 (44.2)*	48 (9.5)	234 (46.3)
Pain in the eyes	190 (37.6)*	61 (12.1)	254 (50.3)
Joint pains	226 (44.8)*	37 (7.3)	242 (47.9)
Headache	246 (48.7)*	22 (4.4)	237 (46.9)
Stomach ache	173 (34.3)*	70 (13.9)	262 (51.9)
Nausea and vomiting	179 (35.4)*	65 (12.9)	261 (51.7)
Small red/purple spots under the skin	196 (38.8)*	18 (3.6)	291 (57.6)
Bleeding in the nose	150 (29.7)*	42 (8.3)	313 (62.0)
Bleeding in the gums	142 (28.1)*	39 (7.7)	324 (64.2)
Blood in the stool	73 (14.5)*	62 (12.3)	370 (73.3)
Blood in the urine	67 (13.3)*	62 (12.3)	376 (74.5)
Shortness of breath	94 (18.6)*	52 (10.3)	359 (71.1)
Dizziness or fainting	124 (24.6)*	48 (9.5)	333 (65.9)

*correct answers

4.6.5 Knowledge about treatment, curability and precaution measures for people infected with dengue fever

Knowledge about treatment, curability and precaution measures for people infected with dengue fever consisted of 3 item questions. Only a minority of the Orang Asli respondents correctly answered that there is no medication for dengue (n=134, 26.4%). Most of the respondents correctly answered that immediate treatment can prevent complication and death from dengue fever (n=296, 58.6%). However, 197 responded 'Don't know' (39%) that there is a vaccine to prevent dengue fever (Table 4.7).

Table 4.7: Knowledge about treatment, curability and precaution measures for people infected

Knowledge about treatment, curability and precaution measures for people infected with dengue fever	**N (%)**		
	True	**False**	**Don't know**
No Medication for dengue	134 (26.5)*	233 (46.1)	138 (27.3)
Immediate treatment can prevent complication and death	296 (58.6)*	111 (22.0)	98 (19.4)
There is vaccine to prevent dengue with dengue fever	171 (33.9)	126 (25.0)*	197 (39.0)

*correct answers

4.6.6 Association between socio-demographic and level of knowledge

Level of knowledge is measured by totaling the entire knowledge items. Each correct item were scored as 1 and incorrect or 'don't know' responses were scored as 0. Scores ranged from 0–43, where higher scores indicate greater level of knowledge about dengue fever.

The total knowledge score was not normally distributed thus; data was analysed categorical by using the mean as the cut-off point. The mean total knowledge score for the overall sample was 18.4, (SD± 9.45) out of a possible score of 43. The level of knowledge was categorised into two levels, lower knowledge level (Score 0-18) and higher knowledge level (Score 19-36). Chi-square test was carried out to examine the association between the socio-demographic factors and level of knowledge between the respondents.

4.6.6.1 Univariate analysis between socio-demographic and level of knowledge

Table 4.9 shows the univariate analysis of socio demographic factors associated with the outcome variable (knowledge score). Significant associates (p<0.05) were included in the multivariate model analysis. Univariate analysis showed 6 factors that are significantly associated.

Slightly more than half of the respondents, 50.1% (n=253) had a lower range of total dengue knowledge score of 0 to 18, while 49.9% of the Orang Asli respondents (n=252) had a higher range of total dengue knowledge score of 19 to 36. More of the Islam Orang Asli had a lower range of total dengue knowledge score of 0 to 18 (n=96, 65.3%) when compared to the other religions. The different tribes of Orang Asli were

found to be significantly different in total knowledge score. The Semoq Beri tribe had a higher range of total dengue knowledge score of 19 to 36 (n=23, 71.9%) than the other tribes. Furthermore, majority of the unemployed Orang Asli respondents had a lower range of total dengue knowledge score of 0 to 18 (n= 137, 54.2%) when compared to those non-skilled respondents who had a higher range of total dengue knowledge score of 19 to 36 (n=120, 51.7%). Slightly more than half of the Orang Asli respondents (n=161, 50.5%) living in the forest fringe had a higher range of total dengue knowledge score of 19 to 36, while 51.1% of the Orang Asli respondents living deep within the jungle (n=95) had a lower range of total dengue knowledge score of 0 to 18. Orang Asli respondents with more than RM500 average monthly income had a higher range of total dengue knowledge score of 19 to 36 when compared to those who earn RM500–RM1200 a month (n= 96, 60.8%). Orang Asli respondents living in village houses (n= 137, 56.8%) had a higher range of dengue knowledge score of 19 to 36, compared to Orang Asli respondents living in single story houses (n= 115, 43.6%) under the Housing Project for the Hardcore Poor (PPRT).

4.6.6.2 Multivariate analysis between socio-demographic and level of knowledge

Significant associations in the univariate analysis that had a *p* value less than 0.05 were selected and included in the multivariate model. The significant variables were religion, tribes, occupation, average monthly household income and type of house. The outcome variable of the model is knowledge level. The independent variable was the socio-demographic factors. An 'Enter' method was used in this model. In the 'Enter' method, the entire significant variables were entered simultaneously at the same time. By using the 'enter' method, the findings revealed 8 significant correlates with the level of knowledge.

There was a significant association between tribes and total knowledge score. The reference group, Kensui tribe was less likely to have higher dengue knowledge score compared to the other tribes. Semoq Beri tribe (OR=11.137, 95% CI= 2.98-41.61), the Temuan (OR= 8.79, 95% CI= 3.03-25.52), the Jah Hut (OR= 4.46, 95% CI=1.81-16.85), Semai (OR= 4.03, 95% CI= 1.26-12.83), and Jakun (OR= 3.47, 95% CI= 1.02-11.83), tribes were more likely to have higher dengue knowledge compared to the reference group.

Occupational status also had a significant association with total knowledge score in which skilled workers (OR=3.66, 95 % CI=1.07-12.52) were more likely to have a higher dengue knowledge compared to the reference group (unemployed). Average household monthly income was also significantly associated with total knowledge scores where, respondents with RM500-RM1200 income (OR = 0.60, 95% CI = 0.39-0.94) was less likely to have higher dengue knowledge compared to reference group. In the test for goodness of fit, the Chi-square value for the Hosmer-Lemeshow test was 4.066 with a significance level of 0.851 (p>0.05), implying a good fit.

Table 4.8: Association between socio demographic characteristics and total dengue knowledge score (N=505)

Socio Demographic	Univariate analysis			Multivariate logistic regression
	Total knowledge score (0-43) items scale			Total knowledge score 19-36 *vs.* 0-18
	0-18 (Low score) N= 253	19-36 (High score) N= 252	χ^2	Adjusted OR (95% CI)
	n (%)	n (%)	*p*-value	
Gender				
Male	82 (50.6)	80 (49.4)	0.873	-
Female	171 (49.9)	172 (50.1)		
Age				
18-40	185 (50.5)	181 (49.5)	0.744	-
>41 years	68 (48.9)	71 (51.1)		
Marital Status				
Married	218 (86.2)	223 (88.5)	0.432	-
Not married	35 (13.8)	29 (11.5)		
Religion				
Islam	96 (65.3)	51 (34.7)	<0.001***	0.611(0.333-1.122
Christian	27 (52.9)	24 (47.1)		0.804(0.402-1.606)
Other (Atheist)	130 (42.3)	177 (57.7)		Reference
Tribes †				
Temiar	48 (64.0)	27 (36.0)	<0.001***	0.4832 (1.665-14.023)**
SemoqBeri	9 (28.1)	23 (71.9)		11.137 (2.980-41.617)***
Semai	49 (54.4)	41 (45.6)		4.033 (1.267-12.834)*
Temuan	65 (35.7)	117 (64.3)		8.792 (3.029-25.516)***
Jakun	22 (57.9)	16 (42.1)		3.477 (1.022-11.836)*
Jah Hut	12 (48.0)	13 (52.0)		4.462 (1.181-16.851)*
Kensui	42 (89.4)	5 (10.6)		Reference
Living Condition				
Forest fringe	158 (49.5)	161 (50.5)	0.738	-
Deep within	95(51.1)	91 (48.9)		
Highest Education Attainment				
No Formal Education	88 (58.3)	63 (41.7)	0.053	
Primary Education	97 (47.3)	108 (52.7)		
Secondary Education and more	68 (46.3)	81 (54.4)		
Occupation				
Skilled worker	4 (20.0)	16 (80.0)	0.010**	3.662 (1.071-12.521)*
Non-skilled worker	112 (48.3)	120 (51.7)		1.276 (0.857-1.901
Unemployed (Student, Housewife, Retiree)	137 (54.2)	116 (45.8)		Reference
Average monthly household income‡				
<RM500	191 (55.0)	156 (45.0)	0.001**	0.606 (0.390-0.942)*
RM500-RM1200	62 (39.2)	96 (60.8)		Reference

Self-Reported - House &Surrounding Dengue Experience				
Yes (Once)	4 (28.6)	10 (71.4)	0.102	-
No	249 (50.7)	242 (49.3)		
Type of house				
Village house (Wood)	104 (43.2)	137 (56.8)	0.003**	1.339 (0.861-2.083)
Single story house (PPRT)	149 (56.4)	115 (43.6)		Reference
Density of vegetation/plants				
None/Low	116 (53.0)	103 (47.0)	0.345	-
Moderate	90 (50.0)	90 (50.0)		
A Lot	47 (44.3)	59 (55.7)		
Fogging Frequency				
None	40 (46.5)	46 (53.5)	0.138	-
Rarely	87 (46.8)	99 (53.2)		
Occasionally	88 (50.9)	85 (49.1)		
Often	38 (63.3)	22 (36.7)		
Density of mosquito in neighborhood				
None/Low	39 (53.4)	34 (46.6)	0.498	-
Moderate	84 (46.7)	96 (53.3)		
Severe	130 (51.6)	122 (48.4)		

[†]Other tribe groups not included in analysis; number does not total 550.

[‡]The national average monthly household income in Malaysian Ringgit (RM) is RM3,686 (US$1= MYR3.23, as of July, 2013).

Source: Mid-term review of the Ninth Malaysia Plan 2006-2010, Economic Planning Unit (EPU), Prime Minister's Department, 2008

***P<0.001; **P<0.01; *P<0.05

Model; Hosmer and Lemeshow test, $\chi^2(8) = 4.066$, $p = 0.851$; Cox & Snell $R^2 = 0.160$; Nagelkerke $R^2 = 0.214$

4.7 Attitudes

Attitudes of the respondents towards dengue fever was measured by using the Health Belief Model which includes four main constructs namely, perceived severity of dengue, perceived susceptibility of dengue, perceived barrier to prevent dengue and perceived self-efficacy in carrying out dengue prevention. Perceived severity of dengue, perceived susceptibility of dengue, and perceived barrier to prevent dengue construct was measured using a 10-point Likert scale. Self-efficacy was measured by the behaviour of respondents that successfully execute dengue prevention measures. This is measured by a four-point Likert scale that ranges from 1 (strongly agree) to 4 (strongly disagree).

4.7.1 Level of perceived dengue severity

Level of perceived dengue severity was assessed by total score of 1 -10. The score of perceived dengue severity were grouped into 2 categories, where a score of 1-5 implies low level perceived dengue severity and score of 6-10 implies high level of perceived dengue severity. Majority of the Orang Asli respondents had perceived dengue severity score of 6-10 (n=445, 88.1%) and only 11.9 % of the respondents had perceived dengue severity score of 1-5 (n=60).

4.7.1.1 Univariate analysis between socio-demographic characteristics and level of perceived dengue severity

Table 4.9 shows the univariate analysis of the factors (socio demographic) associated with the outcome variable (level of perceived dengue severity). *P* value less than 0.05 were considered significant. Univariate analysis showed 5 factors that are significantly associated.

Level of dengue severity was significantly observed for living conditions, highest attainment of education, fogging frequency and density of mosquito in the neighborhood. Majority of the respondents living deep within the jungle had a significantly higher perceived severity of dengue (n=172, 92.5%) compared to the respondents living in the forest fringe (n=46, 14.4%). Respondents with secondary education or more had a higher perceived severity towards dengue fever (n=140, 94%). Respondent's houses which were occasionally fogged had higher perceived severity to dengue (n=163, 94.2%) when compared to the respondent's house which were rarely fogged (n=32, 17.2%). Respondents that had severe density of mosquito in their neighborhood had a significantly higher perceived severity towards dengue (n=233, 92.5%).

4.7.1.2 Multivariate analysis between socio-demographic characteristics and level of perceived dengue severity

In the multivariate analysis (Table 4.9), significant associations in the univariate analysis ($p<0.05$), were selected to be included in the multivariate model. The significant variables were living condition, highest attainment of education, fogging frequency and density of mosquito in the neighborhood. The outcome variable of the

model was perceived severity score of 6-10 versus score of 1-5. An 'Enter' method was used in this model. In the 'Enter' method, the entire significant variables were entered simultaneously at the same time. By using the 'enter' method, the findings revealed 4 significant correlates for the level of perceived severity.

Living conditions was found to have a significant association with level of perceived severity towards dengue. Respondents living in the forest fringe (OR= 0.35, 95% CI= 0.18-0.71) had less perceived severity towards dengue compared to the reference group, respondents living deep within the jungle. Highest education attainment was also observed to have a significant association with the level of perceived severity. Respondents with primary education had less perceived severity towards dengue (OR= 0.36, 95% CI= 0.16-0.82) compared to the reference group, secondary education or more. Villages that were occasionally fogged had a significantly higher perceived severity towards dengue (OR= 2.92, 95% CI= 1.01-8.50) compared to the reference, village that were often fogged. Villages with none/low density of mosquitoes had a significantly lower perceived severity towards dengue (OR= 0.22, 95% CI= 0.11-0.46) compared to the reference group. The Chi-square value for the Hosmer-Lemeshow test was 7.432 with a significant level of 0.491 (p>0.05), implying a good fit.

Table 4.9: Association between socio demographic characteristics and level of perceived dengue severity

Socio Demographic	Univariate analysis Level of dengue severity			Multiple logistic regression Level of perceived severity 6-10 *vs*. 1-5
	1-5 (Low level) N (%)	6-10 (High level) N (%)	χ^2 *p*-value	Adjusted OR (95% CI)
Gender				
Male	20 (12.3)	142 (87.7)	0.825	-
Female	40 (11.7)	303 (88.3)		
Age				
18-40	39 (10.7)	327 (89.3)	0.167	-
>41 years	21 (15.1)	118 (84.9)		
Marital Status				
Married	53 (12.0)	388 (88.0)	0.803	-
Not married	7 (10.9)	57 (89.1)		
Religion				
Islam	18 (12.2)	129 (87.8)	0.888	-
Christian	5 (9.8)	46 (90.2)		
Other (Atheist)	37 (12.1)	270 (87.9)		
Tribes				
Temiar	13 (17.3)	62 (82.7)	0.176	-
SemoqBeri	6 (18.8)	26 (81.2)		
Semai	6 (6.7)	84 (93.3)		
Temuan	26 (14.3)	156 (85.7)		
Jakun	2 (5.3)	36 (94.7)		
Jah Hut	2 (8.0)	36 (94.7)		
Kensui	3 (6.4)	44 (93.6)		
Others	2 (12.5)	14 (87.5)		
Living Condition				
Forest fringe	46 (14.4)	273 (85.6)	0.021*	0.357 (0.180-0.709)**
Deep within	14 (7.5)	172 (92.5)		Reference
Highest Education Attainment				
No Formal Education	24 (15.9)	127 (84.1)	0.023*	0.375 (0.162-0.869)*
Primary Education	27 (13.2)	178 (86.8)		0.361 (0.159-0.819)*
Secondary Education and more	9 (6.0)	140 (94.0)		Reference
Occupation				
Skilled worker	2 (10.0)	18 (90.0)	0.907	-
Non-skilled worker	29 (12.5)	203 (87.5)		
Unemployed (Student, Housewife, Retiree)	29 (11.5)	224 (88.5)		
Average monthly household income‡				
<RM500	47 (13.5)	300 (86.5)	0.087	-
RM500-RM1200	13 (8.2)	145 (91.8)		

Self-Reported - House &Surrounding Dengue Experience				
Yes (Once)	1 (7.1)	13 (92.9)	0.578	-
No	59 (12.0)	432 (88.0)		
Type of house				
Village house (Wood)	29 (12.0)	212 (88.0)	0.920	-
Single story house (PPRT)	31 (11.7)	233 (88.3)		
Density of vegetation/plants				
None/Low	30 (13.7)	189 (86.3)	0.514	-
Moderate	18 (10.0)	162 (90.0)		
A Lot	12 (11.3)	94 (8.7)		
Fogging Frequency				
None	11 (12.8)	75 (87.2)	0.010**	0.841 (0.2887-2.466)
Rarely	32 (17.2)	154 (82.8)		0.910 (0.357-2.319)
Occasionally	10 (5.8)	163 (94.2)		2.924 (1.006-8.503*
Often	7 (11.7)	53 (88.3)		Reference
Density of mosquito in neighborhood				
None/Low	20 (27.4)	53 (72.6)	0.000***	0.222 (0.107-0.463)*
Moderate	21 (11.7)	159 (88.3)		0.587 (0.295-1.170)
Severe	19 (7.5)	233 (92.5)		Reference
Knowledge score				
0-18	33 (13.0)	220 (87.0)	0.419	-
19-36	27 (10.7)	225 (89.3)		

[‡]The national average monthly household income in Malaysian Ringgit (RM) is RM3,686 (US$1= MYR3.23, as of July, 2013).

Source: Mid-term review of the Ninth Malaysia Plan 2006-2010, Economic Planning Unit (EPU), Prime Minister's Department, 2008

***P<0.001; **P<0.01; *P<0.05

Model; Hosmer and Lemeshow test, $\chi^2(8) = 7.432$, $p = 0.491$; Cox & Snell $R^2 = 0.083$; Nagelkerke $R^2 = 0.161$

4.7.1.3 Statements of perceived dengue severity

Perceived severity of dengue was assessed with 3 detailed questions. Slightly more than half of the Orang Asli respondents 'Agree' that dengue fever does not usually lead to death (n=262, 51.9%). However, 41.8% of the Orang Asli respondents 'Disagree' that dengue fever does not always lead to death (n=211). Majority of the Orang Asli respondents 'Disagree' that dengue infection is only dangerous to children (n=428, 84.8%) or to old aged (n=434, 85.9%).

Table 4.10: Statements of perceived severity of dengue

Statements	**N**	(%)
Dengue does not always lead to death		
Strongly Agree	20	4.0
Agree	262	51.9
Disagree	211	41.8
Strongly disagree	12	2.4
Dengue infection is only dangerous to children		
Strongly Agree	16	3.2
Agree	42	8.3
Disagree	428	84.8
Strongly disagree	19	3.8
Dengue infection is only dangerous to old		
Strongly Agree	16	3.2
Agree	36	7.1
Disagree	434	85.9
Strongly disagree	19	3.8

4.7.2: Level of perceived susceptibility of dengue

The level of perceived susceptibility of dengue was assessed by a total of score of 1 -10. The score of perceived susceptibility of dengue were grouped into 2 categories, where score of 1-5 implies low level of perceived susceptibility of dengue and a score of 6-10 implies high level of perceived susceptibility of dengue. The majority of the Orang Asli respondents had a score of 1-5 for perceived susceptibility towards dengue (n=414, 82.0%) and only 18.0 % of the Orang Asli respondents had score of 6-10 for perceived susceptibility towards dengue (n=91).

4.7.2.1 Univariate analysis between socio-demographic characteristics and level of perceived dengue susceptibility

Table 4.11 shows the univariate analysis for socio demographic factors associated with the outcome variable (level of perceived dengue susceptibility). A value of *P* less than 0.05 were considered significant. Univariate analysis showed 6 factors that are significantly associated. They were age, marital status, tribes, highest education attainment, density of vegetation or plants, and knowledge score.

The majority of the Orang Asli respondents aged more than 41 years had a lower perceived dengue susceptibility score of 1-5 (n=122, 87.8%) when compared to the respondents aged 18-40 years old (n=17, 12.2%). Moreover, Orang Asli respondents that were married also had a lower perceived dengue susceptibility score of 1-5 (n=369, 83.7%) when compared to the respondents that were not married (n=72, 16.3%). About 88.1% of the Orang Asli respondents with no formal education had lower perceived dengue susceptibility score of 1-5 (n=133) when compared to those with secondary education or more (n=40, 26.8%). Orang Asli respondents with knowledge score 19-36

had higher perceived dengue susceptibility score of 6-10 towards dengue fever (n=57, 62.6%) when compared to the respondents with knowledge score 0-18 (n=34, 37.4%).

4.7.2.2 Multivariate analysis between socio-demographic characteristics and level of perceived dengue susceptibility

All significant factors from the univariate analysis with a *P* value less than 0.05 were selected and included in the multivariate analysis. There were six significant factors in the univariate analysis which was included in the multiple logistic regression analysis for level of perceived susceptibility score of 6-10 versus score of 1-5. Ages, marital status, tribes, highest attainment of education, density of vegetation, and knowledge level were the significant factors. 'Enter' method was used in this model. In the 'Enter' method, the entire significant variables were entered simultaneously at the same time and the findings revealed 8 significant correlates for the level of perceived susceptibility.

The Orang Asli tribes were found to have a significant association with level of perceived susceptibility towards dengue. The Semai tribe had lower perceived susceptibility towards dengue fever (OR= 0.91, 95% CI= 0.66-0.92) compared to the reference, the Kensui tribe. This was followed by the Temiar tribe (OR= 0.32, 95% CI= 0.13-0.82), the Semoq Beri tribe (OR= 0.32, 95% CI= 0.10-0.97), the Temuan tribe (OR= 0.18, 95% CI= 0.07-0.44), the Jah Hut tribe (OR= 0.13, 95% CI= 0.03-0.57) and finally with the Jakun tribe (OR= 0.09, 95% CI= 0.01-0.47) compared to the reference group.

Density of plants and vegetation in the surroundings was found to have a significant association with level of perceived susceptibility towards dengue by which Orang Asli respondents that had none/low plants or vegetation in the surrounding had lower perceived susceptibility towards dengue fever (OR= 0.42, 95% CI= 0.22-0.82) compared to the reference group (a lot of plants or vegetation).

Orang Asli respondents that had knowledge score of 0-18 had lower perceived susceptibility towards dengue fever (OR= 0.36, 95% CI= 0.20-0.65) compared to the reference group, knowledge score of 19-36. In the test for goodness of fit, the Chi-square value for the Hosmer-Lemeshow test was 7.024 with a significance level of 0.534 (p>0.05), implying a good fit.

Table 4.11: Association between socio demographic characteristics and level of perceived dengue susceptibility

Socio Demographic	Univariate analysis			Multivariate logistic regression
	Level of dengue susceptibility			Level of perceived susceptibility 6-10 *vs.* 1-5
	1-5 (Low level) N (%)	6-10 (High level) N (%)	χ^2 p-value	Adjusted OR (95% CI)
Gender				
Male	132 (81.5)	30 (18.5)	0.841	-
Female	282 (82.2)	61 (17.8)		
Age				
18-40	292 (79.8)	74 (20.2)	0.037*	1.322 (0.667-2.622)
>41 years	122 (87.8)	17 (12.2)		Reference
Marital Status				
Married	369 (83.7)	72 (16.3)	0.009**	0.636 (0.316-1.283)
Not married	45 (70.3)	19 (29.7)		Reference
Religion				
Islam	120 (81.6)	27 (18.4)	0.521	-
Christian	39 (76.5)	12 (23.5)		
Other (Atheist)	255 (83.1)	52 (16.9)		
Tribes †				
Temiar	62 (82.7)	13 (17.3)	0.008**	0.323 (0.127-0.821)*
SemoqBeri	24 (75.0)	8 (25.0)		0.316 (0.103-0.971)*
Semai	68 (75.6)	22 (24.4)		0.391 (0.166-0.924)*
Temuan	157 (86.3)	25 (13.7)		0.188 (0.079-0.448)***
Jakun	36 (94.7)	2 (5.3)		0.094 (0.019-0.472)**
Jah Hut	22 (88.0)	3 (12.0)		0.133 (0.031-0.576)**
Kensui	31 (66.0)	16 (34.0)		Reference
Living Condition				
Forest fringe	260 (81.5)	59 (18.5)	0.716	-
Deep within	154 (82.8)	32 (17.2)		
Highest Education Attainment				
No Formal Education	133 (88.1)	18 (11.9)	0.002**	0.700 (0.333-1.472)
Primary Education	172 (83.9)	33 (16.1)		0.618 (0.339-1.126)
Secondary Education and more	109 (73.2)	40 (26.8)		Reference
Occupation				
Skilled worker	16 (80.0)	4 (20.0)	0.675	-
Non-skilled worker	194 (83.6)	38 (16.4)		
Unemployed (Student, Housewife, Retiree)	204 (80.6)	49 (19.4)		

Average monthly household income‡				
<RM500	290 (83.6)	57 (16.4)	0.167	-
RM500-RM1200	124 (78.5)	34 (21.5)		
Self-Reported - House &Surrounding Dengue Experience				
Yes (Once)	12 (85.7)	2 (14.3)	0.712	-
No	402 (81.9)	89 (18.1)		
Type of house				
Village house (Wood)	206 (85.5)	35 (14.5)	0.051	-
Single story house (PPRT)	208 (78.8)	56 (21.2)		
Density of vegetation/plants				
None/Low	15 (68.2)	7 (31.8)	0.000***	0.427 (0.221-0.824)**
Moderate	142 (78.9)	38 (21.1)		0.802 (0.431-1.493)
A Lot	78 (73.6)	28 (26.4)		Reference
Fogging Frequency				
None	75 (87.2)	11 (12.8)	0.081	-
Rarely	159 (85.5)	27 (14.5)		
Occasionally	133 (76.9)	40 (23.1)		
Often	47 (78.3)	13 (21.7)		
Density of mosquito in neighborhood				
None/Low/ Moderate	210 (83.0)	43 (17.0)	0.594	
Severe	204 (81.0)	48 (19.0)		
Knowledge score				
0-18	219 (52.9)	195 (47.1)	0.007**	0.369 (0.209-0.652)**
19-36	34 (37.4)	57 (62.6)		Reference

†Other tribe groups not included in analysis; number does not total 550.

‡The national average monthly household income in Malaysian Ringgit (RM) is RM3,686 (US$1= MYR3.23, as of July, 2013).

Source: Mid-term review of the Ninth Malaysia Plan 2006-2010, Economic Planning Unit (EPU), Prime Minister's Department, 2008

***P<0.001; **P<0.01; *P<0.05

Model; Hosmer and Lemeshow test, χ^2 (8) = 7.024, p = 0.534; Cox & Snell R^2 = 0.097; Nagelkerke R^2 = 0.159

4.7.2.3 Statements of Perceived Dengue Susceptibility

Perceived susceptibility of dengue was assessed with 6 detailed questions (Table 4.12). Slightly less than half of the respondents 'Agree' to the statement that 'It is unlikely to get dengue because there are no dengue cases in my neighborhood' (n=246, 48.7%). However, 44.0% of the respondents 'Disagree' to the statement that 'It is unlikely to get dengue because there are no dengue cases in my neighborhood' (n=222). Majority of the Orang Asli respondents 'Agree' to the statement that 'It is unlikely to get dengue because I carry out proper mosquito prevention practices' (n=413, 81.8%). Only 47.5% of the Orang Asli respondents 'Agree' to the statement that 'It is unlikely to get dengue because my body is strong' (n=240), however 44.6% of the Orang Asli respondents 'Disagree' with the statement (n=225).

The majority of the Orang Asli respondents 'Disagree' with the statement that 'Unlikely to get dengue infection because I already had it before' (n=386). Furthermore, 60.0% of the Orang Asli respondents 'Disagree' with the statement that 'It is unlikely to get dengue because dengue is likely to occur at rural folk living near forest / swamps' (n=303). Majority of the Orang Asli respondents 'Agree' to the statement that 'It is unlikely to get dengue because my house surrounding is clean' (n=374).

Table 4.12: Statements of perceived dengue susceptibility of dengue

Statements	N	(%)
Unlikely to get dengue because there are no dengue cases in my neighborhood		
Strongly Agree	27	5.3
Agree	246	48.7
Disagree	222	44.0
Strongly disagree	10	2.0
Unlikely to get dengue because I carry out proper mosquito prevention practices		
Strongly Agree	21	4.3
Agree	413	81.8
Disagree	63	12.5
Strongly disagree	8	1.6
Unlikely to get dengue because my body is strong		
Strongly Agree	19	3.8
Agree	240	47.5
Disagree	225	44.6
Strongly disagree	21	4.2
Unlikely to get dengue infection because I already it before		
Strongly Agree	6	1.2
Agree	44	8.7
Disagree	386	76.4
Strongly disagree	69	13.7
Unlikely to dengue because dengue is likely to stike rural folk living near forest / swamps		
Strongly Agree	14	2.8
Agree	121	24.0
Disagree	303	60.0
Strongly disagree	67	13.3
Unlikely to get dengue because my house surrounding is clean		
Strongly Agree	42	8.3
Agree	374	74.1
Disagree	81	16.0
Strongly disagree	8	1.6

4.7.3: Level of perceived barriers to prevent dengue

Level of perceived barriers to prevent dengue was assessed from total of score of 1 -10. The score of perceived barriers to prevent dengue were grouped into 2 categories, where a score of 1-5 implies low level perceived barriers to prevent dengue and a score of 6-10 implies high level of perceived barriers to prevent dengue. Majority of the Orang Asli respondents had low level of perceived barriers to prevent dengue (score 1-5) (n=435, 86.1%) and only 18.0 % (n=70) of the respondents had high level of perceived barriers to prevent dengue (score 6-10).

4.7.3.1 Univariate analysis between socio-demographic characteristics and level of perceived barriers to prevent dengue

Univariate analysis of the socio demographic factors associated with the outcome variable (level of perceived barriers to prevent dengue) is shown in Table 4.13. A *P* value less than 0.05 were considered significant. The results showed 3 factors that are significantly associated. They were religion, highest education attainment and density of vegetation or plants in the neighborhood.

Majority of the Islam Orang Asli respondents had lower perceived barriers in preventing dengue (score 1-5) (n=136, 92.5%). Respondents who were Atheist had lower perceived barriers in preventing dengue (n=254, 52.7%).

About 91.9% of the Orang Asli respondents with secondary education and more had lower perceived barriers in preventing dengue (score 1-5) (n=137). Respondents that had moderate density of vegetation or plants in their neighborhood had a significantly lower perceived barriers to prevent dengue (score 1-5) (n=158, 87.8%).

Only 13.7% (n=30) of the Orang Asli respondents that had reported none/low density of vegetation or plants in the neighborhood had a higher perceived barriers (score 6-10) to prevent dengue.

4.7.3.2 Multivariate analysis between socio-demographic characteristics and level of perceived barriers to prevent dengue

There were 2 significant factors in the univariate analysis which was included in the multiple logistic regression analysis (Table 4.14). The outcome variable for the model was level of perceived barriers to prevent dengue score 6-10 *versus* score 1-5. The factors were religion and density of vegetation or plants which had a *P* value less than 0.05 in the univariate analysis. An 'Enter' method was used in this model. In the 'Enter' method, the entire significant variables were entered simultaneously at the same time. By using the 'enter' method, the findings revealed 2 significant correlates versus level of perceived barriers to prevent dengue.

Islam respondents had lower perceived barriers in preventing dengue (OR= 0.406, 95% CI= 0.203-0.812) compared to the reference group (Atheist). Orang Asli village that had moderate density of vegetation or plants in the neighborhood had lower perceived barriers in preventing dengue (OR= 0.524, 95% CI= 0.293-0.939) compared to the reference group, severe density of vegetation or plants in the neighborhood. In the test for goodness of fit, the Chi-square value for the Hosmer-Lemeshow test was 7.601 with a significance level of 0.473 (p>0.05), implying a good fit.

Table 4.13: Association between socio-demographic characteristics and level of perceived barriers to prevent dengue

Socio Demographic	Univariate analysis			Multivariate logistic regression
	Level of perceived barriers to prevent dengue			Level of perceived barriers to prevent dengue 6-10 *vs.* 1-5
	1-5 (Low level)	6-10 (High level)	χ^2	Adjusted OR (95% CI)
	N (%)	N (%)	*p*-value	
Gender				
Male	140 (86.4)	22 (13.6)	0.900	-
Female	295 (86.0)	48 (14.0)		
Age				
18-40	316 (86.3)	50 (13.7)	0.833	-
>41 years	119 (85.6)	20 (14.4)		
Marital Status				
Married	379 (85.9)	62 (14.1)	0.736	-
Not married	56 (87.5)	8 (12.5)		
Religion				
Islam	136 (92.5)	11 (7.5)	0.017**	0.406 (0.203-0.812)**
Christian	45 (88.2)	6 (11.8)		0.727 (0.290-1.819)
Other (Atheist)	254 (82.7)	53 (17.3)		Reference
Tribes †				
Temiar	71 (94.7)	4 (5.3)	0.068	-
SemoqBeri	28 (87.5)	4 (12.5)		
Semai	79 (87.5)	11 (12.2)		
Temuan	151 (83.0)	31 (17.0)		
Jakun	30 (78.9)	8 (21.1)		
Jah Hut	23 (92.0)	2 (8.0)		
Kensui	11 (68.8)	5 (10.6)		
Living Condition				
Forest fringe	272 (85.3)	47 (12.7)	0.458	-
Deep within	163 (87.6)	23 (12.4)		
Highest Education Attainment				
No Formal Education	126 (83.4)	25 (16.6)	0.050*	2.092 (0.994-4.403)
Primary Education	172 (83.9)	33 (16.1)		1.950 (0.959-3.964)
Secondary Education and more	137 (91.9)	12 (8.1)		Reference
Occupation				
Skilled worker	16 (80.0)	4 (20.0)	0.715	-
Non-skilled worker	200 (86.2)	32 (13.8)		
Unemployed (Student, Housewife,	219 (86.6)	34 (13.4)		

Retiree)				
Average monthly household income‡				
<RM500	293 (84.4)	54 (15.6)	0.101	-
RM500-RM1200	142 (89.9)	16 (10.1)		
Self-Reported House &Surrounding Dengue Experience				
Yes (Once)	11 (78.6)	3 (21.4)	0.406	-
No	424 (86.4)	67 (13.6)		
Type of house				
Village house (Wood)	209 (86.7)	32 (13.3)	0.717	-
Single story house (PPRT)	226 (85.6)	38 (14.4)		
Density of vegetation/plants				
None/Low	189 (86.3)	30 (13.7)	0.031*	0.412 (0.167-1.019)
Moderate	158 (87.8)	22 (12.2)		0.524 (0.293-0.939)*
A Lot	88 (83.0)	18 (17.0)		Reference
Fogging Frequency				
None	79 (91.9)	7 (8.1)	0.225	-
Rarely	160 (86.0)	26 (14.0)		
Occasionally	143 (82.7)	30 (17.3)		
Often	53 (88.3)	7 (11.7)		
Density of mosquito in neighborhood				
None/Low	67 (91.8)	6 (8.2)	0.072	-
Moderate	161 (89.4)	19 (10.6)		
Severe	207 (82.1)	45 (17.9)		
Knowledge score				
0-18	218 (86.2)	35 (13.8)	0.986	-
19-36	217 (86.1)	35 (13.9)		

†Other tribe groups not included in analysis; number does not total 550.

‡The national average monthly household income in Malaysian Ringgit (RM) is RM3,686 (US$1= MYR3.23, as of July, 2013).

Source: Mid-term review of the Ninth Malaysia Plan 2006-2010, Economic Planning Unit (EPU), Prime Minister's Department, 2008

***P<0.001; **P<0.01; *P<0.05

Model; Hosmer and Lemeshow test, $\chi^2(5) = 3.293$, p = 0.655; Cox & Snell $R^2 = 0.027$; Nagelkerke $R^2 = 0.049$

4.7.3.3 Statement in perceived barriers to prevent dengue

Perceived barriers in preventing dengue were further assessed with 2 detailed questions in Table 4.15. Majority of the Orang Asli respondents 'Disagree' with the statement that 'There is a lack of community participation in taking preventive measure against dengue' (n=323, 64.0%). Only 9.5% (n=48) of the Orang Asli respondents 'Strongly agree' with the statement that 'There is a lack of preventive measures from authorities'. However, majority of the Orang Asli respondents 'Disagree' with the statement that 'There is a lack of preventive measures from authorities' (n=362, 71.7%).

Table 4.14: Statements of perceived barriers to prevent dengue

Statements	N	(%)
Lack of community participation in taking preventive measure against dengue		
Strongly Agree	37	7.3
Agree	141	27.9
Disagree	323	64.0
Strongly disagree	4	0.8
Lack of preventive measures from authorities		
Strongly Agree	48	9.5
Agree	89	17.6
Disagree	362	71.7
Strongly disagree	6	1.2

4.7.4 Level of Perceived Self-efficacy towards dengue prevention

The level of perceived self – efficacy in taking preventive measures against dengue were measured by a four-point Likert scale that ranged from 'Strongly agree', 'Agree', 'Disagree' to 'Strongly disagree'. This scale was grouped into 2, where 'Agree and strongly agree' was categorized as one group and the second group was 'Disagree and strongly disagree'.

Majority of the Orang Asli respondents 'Disagree and strongly disagree' that there is a lack of self – efficacy in taking preventive measures against dengue (n=376, 74.5%). Only 25.5% of the Orang Asli respondents 'Agree and strongly agree' that there is a lack of self – efficacy in taking preventive measures against dengue (n=129).

4.7.4.1 Univariate analysis between socio-demographic characteristics and level of perceived self-efficacy towards dengue prevention

Table 4.15 shows the univariate analysis of socio demographic factors associated with the outcome variable (level of perceived self-efficacy towards dengue prevention). A *P* value of less than 0.05 was considered significant. Univariate analysis showed 6 factors that are significantly associated and they were religion, tribes, living condition, type of house, fogging frequency and knowledge level.

Majority of the Islam respondents 'Disagree or strongly disagree' that there is a lack of self – efficacy in taking preventive measures against dengue (n=130, 88.4%). Only a minority of the respondents who were Islam reported 'Agree or strongly agree' that there is a lack of self – efficacy in taking preventive measures against dengue

(n=17, 11.6%). Majority of the Temiar tribe 'Disagree or strongly disagree' that there is a lack of self – efficacy in taking preventive measures against dengue (n=73, 97.3%). Respondents living in the forest fringe 'Disagree or strongly disagree' that there is a lack of self – efficacy in taking preventive measures against dengue (n=260, 81.5%) while 62.4% of respondents living deep within the jungle 'Disagree or strongly disagree' that there is a lack of self –efficacy in taking preventive measures against dengue.

About 84.5% of the respondents living in single story house (PPRT) 'Disagree and strongly disagree' that there is a lack of self – efficacy in taking preventive measures against dengue (n=84.5%). Only 14.4% (n=25) of the respondents living in villages that were occasionally fogged 'Agree or strongly agree' that there is a lack of self – efficacy in taking preventive measures against dengue. Respondents that had knowledge score 0-18, 'Disagree or strongly disagree' that there is a lack of self - efficacy in taking preventive measures against dengue (n=209, 82.6%).

4.7.4.3 Multivariate analysis between socio-demographic characteristics and level of perceived self-efficacy towards dengue prevention

In the multivariate analysis, significant associations in the univariate analysis ($p<0.05$), were selected to be included in the multivariate model. The significant variables were religion, tribes, living condition, type of house, fogging frequency and knowledge level. The outcome variable for the model was perceived self-efficacy towards dengue prevention 'Disagree and strongly disagree' versus 'Agree and strongly agree'. An 'Enter' method was used in this model. In the 'Enter' method, the entire significant variables were entered simultaneously at the same time. Using this method,

the findings revealed 2 significant correlates for the level of perceived self- efficacy towards dengue prevention (Table 4.15).

Islam respondents had a higher perceived self – efficacy in taking preventive measures against dengue (OR= 1.80, 95% CI= 0.82-3.95) when compared to the reference group (Atheist). This was followed by the Christian respondents who had higher perceived self – efficacy in taking preventive measures against dengue (OR= 1.15, 95% CI= 0.43-3.08) when compared to the reference group (Atheist).

The Semoq Beri tribe had a lower perceived self – efficacy in taking preventive measures against dengue (OR= 0.07, 95% CI= 0.01-0.36), when compared to the reference group (Kensui tribe). This was followed by the Jah Hut tribe (OR= 0.22, 95% CI= 0.49-1.01), Jakun tribe (OR= 0.49, 95% CI= 0.11-2.14) and the Temuan tribe (OR= 0.52, 95% CI= 0.13-2.06). The Temiar tribe (OR= 4.86, 95% CI= 0.71-32.9) and the Semai tribe (OR= 4.48, 95% CI= 0.80-25.07) had higher perceived self –efficacy in taking preventive measures against dengue.

The respondents living in the forest fringe had lower perceived self – efficacy in taking preventive measures against dengue (OR=0.85, 95% CI= 0.44-1.65) when compared to the reference group (live deep within the jungle). The Orang Asli respondents living in village houses had lower perceived self – efficacy in taking preventive measures against dengue (OR=0.69, 95% CI= 0.40-1.19) when compared to the reference group (live deep within the jungle).

Orang Asli villages that were not fogged (OR=1.47, 95% CI= 0.49-4.39), rarely fogged (OR=1.13, 95% CI= 0.44-2.84), and occasionally fogged (OR=1.80, 95% CI= 0.69-4.65), had a higher perceived self – efficacy in taking preventive measures against dengue when compared to the reference group (villages that were often fogged).

Orang Asli respondents that had knowledge scores of 0-18 had higher perceived self – efficacy in taking preventive measures against dengue (OR= 1.87, 95% CI= 1.12-3.12) when compared to the reference group (knowledge score 19-36). In the test for goodness of fit, the Chi-square value for the Hosmer-Lemeshow test was 8.736 with a significance level of 0.365 (p>0.05), implying a good fit.

Table 4.15: Association between socio-demographic characteristics and level of perceived self-efficacy towards dengue prevention

Socio Demographic	Univariate analysis			Multivariate logistic regression
	Level of perceived self-efficacy towards dengue prevention			Level of perceived self-efficacy towards dengue prevention Disagree or Strongly disagree vs. Agree or strongly agree
	Agree or strongly agree N (%)	Disagree or Strongly disagree N (%)	χ^2 p-value	Adjusted OR (95% CI)
Gender				
Male	45 (27.8)	117 (72.2)	0.429	
Female	84 (24.5)	259 (75.5)		
Age				
18-40	85 (23.2)	281 (76.8)	0.052	
>41 years	44 (31.7)	95 (68.3)		
Marital Status				
Married	114 (25.9)	327 (74.1)	0.679	
Not married	15 (23.4)	49 (76.6)		
Religion				
Islam	17 (11.6)	130 (88.4)	0.000***	1.802 (0.821-3.956)
Christian	7 (13.7)	44 (86.3)		1.156 (0.433-3.086)
Other (Atheist)	105 (34.2)	202 (65.8)		Reference
Tribes †				
Temiar	2 (2.7)	73 (97.3)	0.000***	4.869 (0.719-32.994)
SemoqBeri	25 (78.1)	7 (21.9)		0.073 (0.015-0.365)***
Semai	4 (4.4)	86 (95.6)		4.484 (0.802-25.0.73)
Temuan	62 (34.1)	120 (65.9)		0.526 (0.134-2.061)
Jakun	11 (28.9)	27 (71.1)		0.494 (0.114-2.146)
Jah Hut	13 (52.0)	12 (48.0)		0.223 (0.049-1.014)
Kensui	5 (10.6)	42 (89.4)		Reference
Living Condition				
Forest fringe	59 (18.5)	260 (81.5)	0.000***	0.858 (0.445-1.654)
Deep within	70 (37.6)	116 (62.4)		Reference
Highest Education Attainment				
No Formal Education	40 (26.5)	111 (73.5)	0.107	
Primary Education	60 (29.3)	145 (70.7)		
Secondary Education and more	29 (19.5)	120 (80.5)		
Occupation				
Skilled worker	4 (20.0)	16 (80.0)	0.760	
Non-skilled worker	62 (26.7)	170 (73.3)		
Unemployed	63 (24.9)	190 (75.1)		

(Student, Housewife, Retiree)				
Average monthly household income‡				
<RM500	81 (23.3)	266 (76.7)	0.093	
RM500-RM1200	48 (30.4)	110 (69.6)		
Self-Reported - House &Surrounding Dengue Experience				
Yes (Once)	4 (28.6)	10 (71.4)	0.792	
No	125 (25.5)	366 (74.5)		
Type of house				
Village house (Wood)	88 (36.5)	153 (63.5)	0.000***	0.693 (0.403-1.190)
Single story house (PPRT)	41 (15.5)	223 (84.5)		Reference
Density of vegetation or plants				
None	3 (13.6)	19 (86.4)	0.356	
Low	46 (23.4)	151 (76.6)		
Moderate	52 (28.9)	128 (71.1)		
A Lot	28 (26.4)	78 (73.6)		
Fogging Frequency				
None	37 (43.0)	49 (57.0)	0.000***	1.479 (0.498-4.392)
Rarely	55 (29.6)	131 (70.4)		1.139 (0.449-2.844)
Occasionally	25 (14.5)	148 (85.5)		1.803 (0.699-4.651)
Often	12 (20.0)	48 (80.0)		Reference
Density of mosquito in neighborhood				
None	2 (20.0)	8 (80.0)	0.535	
Low	19 (30.2)	44 (69.8)		
Moderate	50 (27.8)	130 (72.2)		
Severe	58 (23.0)	194 (77.0)		
Knowledge score				
0-18	44 (17.4)	209 (82.6)	0.000***	1.875 (1.125-3.125)**
19-36	85 (33.7)	167 (66.3)		Reference

†Other tribe groups not included in analysis; number does not total 550.

‡The national average monthly household income in Malaysian Ringgit (RM) is RM3,686 (US$1= MYR3.23, as of July, 2013). Source: Mid-term review of the Ninth Malaysia Plan 2006-2010, Economic Planning Unit (EPU), Prime Minister's Department, 2008

***P<0.001; **P<0.01; *P<0.05

Model; Hosmer and Lemeshow test, $\chi^2(8) = 8.736$, p = 0.365; Cox & Snell $R^2 = 0.237$; Nagelkerke $R^2 = 0.351$

4.8 Dengue Prevention Practice

Self-reported prevention practices against dengue fever and control was sub-divided into three parts: (1) Prevention practices of mosquito breeding, (2) Prevention practices of mosquito bites, and (3) Prevention practices of dengue transmission. The questions were assessed using nine-item, seven-item, and one-item question respectively. The options were 'not at all', 'rarely', 'sometimes', 'often', and 'not applicable' and were assigned points of 0, 1, 2, and 3, respectively. For the option 'not applicable', 0 points were given. Answers were calculated based on the number of applicable answers. Scores were calculated based on 'Number of points obtained' over 'Total points of applicable answer'. Results were reported as percentages (%) where, higher percentages indicate a higher dengue preventive practice.

4.8.1 Prevention of mosquito breeding

Prevention of mosquito breeding consisted of 6 item questions. Table 4.16 shows that 56.2% (n= 284) of the respondents practice covering all water used for storing in and outside the house. Only 5.5% of the respondents rarely carry out this practice (n=25). More than half of the respondents changed stored water in flower vases, drip trays and in pails (n= 263, 52.1%). About 62.0% of the Orang Asli respondents do not put abate or chemical in water storage containers (n=313) where only 5.9% (n=30) of the Orang Asli respondents practice using abate or chemicals in water storage containers. 188 (37.2%) respondents do not examine for mosquito larva in water storing containers. Nearly half of the Orang Asli respondents clear out debris that block water flow in drains or roof gutter (n=252, 49.9%). The majority of the Orang Asli respondents often practice proper disposal of items that can collect rain water (n=281, 55.6%).

Table 4.16: **Prevention of mosquito breeding**

Prevention Practices	Frequency N (%)				
	Not at all	Rarely	Sometimes	Often	Not Applicable
Cover all water used for storing in or outside the house	79 (15.6)	25 (5.0)	84 (16.6)	284 (56.2)	33 (6.5)
Change stored water in flower vases, drip tray or pails	59 (1)	29 (5.7)	117 (23.2)	263 (52.1)	37 (7.3)
Put abate or chemical in water storage containers	313 (62.0)	32 (6.3)	31 (6.1)	30 (5.9)	99 (19.6)
Examine for mosquito larvae in containers for storing water	188 (37.2)	54 (10.7)	121 (24.0)	88 (17.4)	54 (10.7)
Clear out debris that may block water flow in drain or roof gutters	22 (4.4)	24 (4.8)	200 (39.6)	252 (49.9)	7 (1.4)
Proper disposal of items that can collect rain water	11 (2.2)	23 (4.6)	187 (37.0)	281 (55.6)	3 (0.6)

4.8.2 Cues-to action to prevent dengue

Cues-to action to prevent dengue was assessed with a 3 item questions (Table 4.17). Majority of the respondents practices proper disposal of household garbage (n=311, 61.6%). Only 4.6% of the Orang Asli respondents did not practice proper garbage disposal.

More than half of the Orang Asli respondents practice cleaning the surrounding house area (n=297, 58.8%) where only 2.8% of the respondents rarely practice cleaning the surrounding house area (n=14).

Only 30.9% of the Orang Asli respondents often practice mosquito preventive measure before going on a long holiday (n=156). About 28.3% of the respondents sometimes practice cleaning the surrounding house area (n=143).

Table 4.17: Cues-to action to prevent dengue

Cue to action	Frequency N (%)				
	Not at all	Rarely	Sometimes	Often	Not Applicable
Proper disposal of household garbage	23 (4.6)	9 (1.8)	159 (31.5)	311 (61.6)	3 (0.6)
Clean up surrounding house area	20 (4.0)	14 (2.8)	163 (32.3)	297 (58.8)	11 (2.2)
Take mosquito preventive measure before going on long holiday	151 (29.9)	37 (7.3)	143 (28.3)	156 (30.9)	18 (3.6)

4.8.3 Practices to prevent mosquito bite

Practices to prevent mosquito bites consisted of 7 item questions (Table 4.18). Majority of the Orang Asli respondents reported that they often sleep under a mosquito net or have mosquito screens on windows to prevent mosquito bites (n=338, 66.9%). Only 38.0% of the respondents did not practice using mosquito coils to prevent mosquito bites (n=193), whereas 37.4% of the respondents used mosquito coils to

prevent mosquito bites (n=189). Slightly more than half of the Orang Asli respondents, 55.2% did not practice spraying in dark places with an insecticide to prevent mosquito bites (n=279). The majority of the Orang Asli respondents did not use a mosquito repellent on the body to prevent mosquito bites (n=399, 79%). Only a minority of the respondents often practiced using a mosquito repellent on the body to prevent mosquito bites (n=20, 4.0%). The majority of the Orang Asli respondents reported that they did not avoid dark places in their home to prevent mosquito bite (n=319, 63.2%). Only a minority, 7.7% of the respondents wore long sleeved shirts and pants to avoid mosquito bite (n=39). The majority of the Orang Asli respondents reported that they do not wear bright colour clothes to avoid mosquito bites (n=318, 63.0%).

Table 4.18: Practices about prevention against mosquito bite

	Frequency N (%)				
Prevention of mosquito bite	**Not at all**	**Rarely**	**Sometimes**	**Often**	**Not Applicable**
Sleep in mosquito net or have mosquito screens on windows	107 (21.2)	4 (0.8)	50 (9.9)	338 (66.9)	6 (1.2)
Use mosquito coil, electrical mosquito mat, liquid vapourizer	192 (38.0)	22 (4.4)	58 (11.5)	189 (37.4)	44 (8.7)
Spraying dark places with an insectidal spray	279 (55.2)	22 (4.4)	65 (12.9)	100 (19.8)	39 (7.7)
Use mosquito repellent on body	399 (79.0)	5 (1.0)	29 (5.7)	20 (4.0)	52 (10.3)
Avoid dark areas in the home where there is no light and no wind	319 (63.2)	13 (2.6)	146 (28.9)	20 (4.0)	7 (1.4)
Wear long-sleeved shirts and pants to avoid mosquito bites	229 (45.3)	36 (7.1)	197 (39.0)	39 (7.7)	4 (0.8)
Wear bright colour clothes to avoid mosquito bites	318 (63.0)	17 (3.4)	145 (38.7)	20 (4.0)	5 (1.0)

4.8.4 Prevention of dengue transmission

Majority of the respondents did not take measures to prevent mosquitos from biting a dengue patient (n=229, 45.3%). Only 11.5% of the Orang Asli respondents often take measure to prevent mosquito from biting a dengue patient (n=58). Only 178 Orang Asli respondents sometimes take measure to prevent mosquito from biting a dengue patient (35.2%).

4.8.5 Association between socio-demographic characteristics and dengue prevention practices

The percentage of dengue prevention practices was not normally distributed, thus the data was analysed categorical by using the mean as the cut-off point. The mean percentage for dengue prevention practices for the overall sample was 52.97, (SD±15.8) out 100%. The percentage of dengue prevention practices were categorised into two levels, a lower range of percentage of dengue prevention practices of 0-50% and higher range of percentage of dengue prevention practices of 51-100%.

Referring to Table 4.19, more than half of the respondents, 55.4% (n=280) had a lower range of percentage of dengue prevention practices of 0-50%, while 44.6% of the respondents (n=225) had a higher range of percentage of dengue prevention practices of 51-100%.

4.8.5.1 Univariate analysis between socio-demographic characteristics and dengue prevention practices

Table 4.19 shows the univariate analysis of the socio demographic factors associated with the outcome variable (percentage of dengue prevention practices).A *P* value less than 0.05 was considered significant. Univariate analysis showed 5 socio-demographic factors that are significantly associated.

The Orang Asli tribes were found to be significantly associated with percentage of dengue prevention practices. The Semai tribe had a higher range of percentage of dengue prevention practices of 51-100% (n=64, 71.1%) when compared to the other tribes. However, the Jakun tribe had a lower range of percentage of dengue prevention practices of 0-50% (n=30, 78.9%). Fogging frequency was found significantly different with percentage of dengue prevention practices. Orang Asli respondents that reported that the village was often fogged had a higher range of percentage of dengue prevention practices of 51-100% (n=40, 66.7%) when compared to the respondents with lower range of percentage of dengue prevention practices of 0-50% (n=20, 33.3%). However, 54.3% of the Orang Asli villages that was rarely fogged had a lower range of percentage of dengue prevention practices of 0-50% (n=101) when compared to the respondents with higher range of percentage of dengue prevention practices of 51-100% (n=85, 45.7%).

In the Health Belief Model, perceived susceptibility and perceived barriers was found to be significantly associated with dengue prevention practices. Orang Asli respondents with level 6-10 dengue susceptibility had a higher range of percentage of dengue prevention practices of 51-100% (n=64, 70.3%) when compared to those with

lower range of percentage of dengue prevention practices of 0-50% (n=27, 29.7%). Orang Asli respondents with level 1-5 perceived barriers, had a higher range of percentage of dengue prevention practices of 51-100% (n=251, 57.5%). However, Orang Asli respondents with level 6-10 perceived barriers had a lower range of percentage of dengue prevention practices of 0-50% (n=41, 58.6%).

Knowledge score was found to be significantly associated with dengue prevention practices. Orang Asli respondents that had a dengue knowledge score of 19-36 had a higher range of percentage of dengue prevention practices of 51-100% (n=153, 60.7%). Orang Asli respondents that had a dengue knowledge score of 0-18, had a lower range of percentage of dengue prevention practices of 0-50% (n=126, 49.8%).

4.8.5.2 Multivariate analysis between socio-demographic characteristics and dengue prevention practices

Significant factors from the univariate analysis with a *P* value less than 0.05 were selected and included in the multivariate analysis. The outcome variable of the model was percentage of dengue prevention practices 51-100% *versus* 0-50%. There were 5 significant factors in the univariate analysis that was included in the model and these were tribes, fogging frequency, perceived susceptibility towards dengue, perceived barriers to prevent dengue and knowledge level. An 'Enter' method was used in this model. In the 'Enter' method, the entire significant variables were entered simultaneously at the same time. The findings revealed 4 significant correlates with dengue prevention practices (Table 4.19).

The Temuan tribe had lower percentages of dengue preventive measures (OR= 0.40, 95% CI= 0.18-0.91), compared to the reference group, the Kensui tribe. The Jakun tribe also had lower percentages of dengue preventive measures (OR= 0.16, 95% CI= 0.05-0.51), compared to the reference group (Kensui tribe).

Orang Asli respondents that reported level 1-5 perceived barriers towards dengue prevention had a higher dengue preventive measures (OR= 1.86, 95% CI= 1.05-3.31) when compared to the reference group (perceived barriers level 6-10). Orang Asli respondents that reported knowledge scores of 0-18 had lower dengue preventive measures (OR= 0.52, 95% CI= 0.34-0.79) when compared to the reference group (knowledge score of 19-36). In the test for goodness of fit, the Chi-square value for the Hosmer-Lemeshow test was 7.469 with a significance level of 0.487 (p>0.05), implying a good fit

Table 4.19: Association between socio-demographic characteristics and dengue prevention practices

Socio Demographic	Univariate analysis			Multivariate logistic regression
	Dengue prevention practices by %			Dengue prevention practices 51-100% *vs*. 0-50%
	0-50% (N=225)	51-100% (N=280)	χ^2	Adjusted OR (95% CI)
	N (%)	N (%)	p-value	
Gender				
Male	72 (44.4)	90 (55.6)	0.973	
Female	153 (44.6)	190 (55.4)		
Age				
18-40	154 (42.1)	212 (57.9)	0.069	
>41 years	71 (51.1)	68 (48.9)		
Marital Status				
Married	195 (44.2)	246 (55.8)	0.689	
Not married	30 (46.9)	34 (53.1)		
Religion				
Islam	64 (43.5)	83 (56.5)	0.103	
Christian	16 (31.4)	35 (68.6)		
Other (Atheist)	145 (47.2)	162 (52.8)		
Tribes †				
Temiar	28 (37.3)	47 (62.7)	0.001**	0.846 (0.358-2.001)
SemoqBeri	14 (43.8)	18 (56.2)		0.569 (0.182-1.780)
Semai	26 (28.9)	64 (71.1)		1.077 (0.462-2.509)
Temuan	98 (53.8)	84 (46.2)		0.407 (0.181-0.916)**
Jakun	30 (78.9)	8 (21.1)		0.167 (0.054-0.514)**
Jah Hut	8 (32.0)	17 (68.0)		1.200 (0.368-3.911)
Kensui	15 (31.9	32 (68.1)		Reference
Living Condition				
Forest fringe	137 (42.9)	182 (57.1)	0.341	
Deep within	88 (47.3)	98 (52.7)		
Highest Education Attainment				
No Formal Education	79 (52.3)	72 (47.7)	0.068	
Primary Education	83 (40.5)	122 (59.5)		
Secondary Education and more	63 (42.3)	86 (57.7)		
Occupation				
Skilled worker	9 (45.0)	11 (55.0)	0.831	
Non-skilled worker	100 (43.1)	132 (56.9)		
Unemployed (Student, Housewife, Retiree)	116 (45.8)	137 (54.2)		
Average monthly household income‡				
<RM500	155 (44.7)	192 (55.3)	0.939	
RM500-RM1200	70 (44.3)	88 (55.7)		

Self-Reported - House &Surrounding				
Dengue Experience				
Yes (Once)	4 (28.6)	10 (71.4)	0.222	
No	221 (45.0)	270 (55.0)		
Type of house				
Village house (Wood)	106 (44.0)	135 (56.0)	0.805	
Single story house (PPRT)	119 (45.1)	145 (54.9)		
Density of vegetation/plants				
None	6 (27.3)	16 (72.7)	0.197	
Low	96 (48.7)	101 (51.3)		
Moderate	75 (41.7)	105 (58.3)		
A Lot	48 (45.3)	58 (54.7)		
Fogging Frequency				
None	42 (48.8)	44 (51.2)	0.001**	0.692 (0.296-1.618)
Rarely	101 (54.3)	85 (45.7)		0.597 (0.290-1.225)
Occasionally	62 (35.8)	111 (64.2)		0.997 (0.493-2.016)
Often	20 (33.3)	40 (66.7)		Reference
CUES-TO-ACTION				
Density of mosquito in neighborhood				
None	6 (60.0)	4 (40.0)	0.708	
Low	29 (46.0)	34 (54.0)		
Moderate	82 (45.6)	98 (54.4)		
Severe	108 (42.9)	144 (57.1)		
Health Belief Modal (HBM)				
Perceived Severity				
1-5	29 (48.3)	31 (51.7)	0.530	
6-10	196 (44.0)	249 (56.0)		
Perceived Susceptibility				
1-5	198 (47.8)	216 (52.2)	0.002**	0.651 (0.384-1.104)
6-10	27 (29.7)	64 (70.3)		Reference
Perceived Barriers				
1-5	184 (42.3)	251 (57.7)	0.011**	1.867 (1.051-3.317)**
6-10	41 (58.6)	29 (41.4)		Reference
Self-Efficacy				
Agree	64 (49.6)	65 (50.4)	0.180	
Disagree	161 (42.8)	215 (57.2)		
Knowledge Score				
0-18	126 (49.8)	127 (50.2)	0.017**	0.522 (0.343-0.794)**
19-36	99 (39.3)	153 (60.7)		Reference

†Other tribe groups not included in analysis; number does not total 550.
‡The national average monthly household income in Malaysian Ringgit (RM) is RM3,686 (US$1= MYR3.23, as of July, 2013).
Source: Mid-term review of the Ninth Malaysia Plan 2006-2010, Economic Planning Unit (EPU), Prime Minister's Department, 2008
***P<0.001; **P<0.01; *P<0.05
Model; Hosmer and Lemeshow test, χ^2 (8) = 7.464, p = 0.487; Cox & Snell R^2 = 0.124; Nagelkerke R^2 = 0.166

CHAPTER 5: DISCUSSION

5.1 Response Rate

Out of the 560 respondents approached, a total of 505 responded to the questionnaire. A response rate of 90.1% was obtained. Non-response was due to their shy nature, especially towards other people outside their own community.

5.2 Socio demographic characteristics

Among the 505 respondents, there were more female respondents when compared to the male respondents. The majority of these respondents were housewives and also had at least primary education. The government has encouraged more schools to be built to emphasize education among the Orang Asli population (Salleh, 1990). Despite this effort, majority of the Orang Asli are not educated. Majority of the Orang Asli have an average monthly income of less than RM500. This is because they make a living by trading gathered forest products, fishing, hunting and farming [www.coac.org.my]. Education is an important enhancement to self-development and to increase the standard of living. By providing a better education system to the Orang Asli communities, we can improve their life style.

According to the Department of Orang Asli Affairs (JAKOA), there are eight states where Orang Asli live. Among these eight states, Perak had the highest number of respondents compared to the other states. In this study, the Temuan tribe had the most number of respondents wherelse the Jah Hut tribe had the least number of respondents. There was a difference in number of respondents according to their subgroups because

the Orang Asli live scattered in Peninsular Malaysia and villages were selected randomly by JAKOA.

5.3 Self –reported dengue experience

In Malaysia, it was reported that the actual number of dengue cases is higher than the number of self-reported dengue cases (WHO, 2012). In a recent study conducted in Malaysia among the Orang Asli, the Semai Perak community showed the highest seroprevalence of dengue fever above 50% (Abd-Jamil *et al.*, 2014) . However, in this study, only a minority of the Orang Asli participants reported that they have had dengue fever. The low self-report of dengue experience in this study may indicate that the Orang Asli were actually not aware that they have had dengue fever. They probably would have had dengue fever and recovered from the illness without receiving treatment. Personal experience is the best teacher and it is a useful factor in understanding the disease (Dhimal *et al.*, 2014). Although using personal experience as a preventive factor is limited, using people to relate their suffering may be used effectively in creating better public awareness. Hence, it is important to educate the Orang Asli to recognise the sign and symptoms of dengue fever and encourage them to visit a health care practitioner early if they have the disease to avoid complications.

5.4 Social environment

With regards to the surrounding environment, the majority of the respondents live in the forest fringe and only a few live deep within the jungle. Most of the Orang Asli has been relocated to have better assess to schools and other facilities through the ‘regroupment schemes’ by the Government (www.coac.org.my). The Orang Asli were

resettled to areas more accessible for the Department officials and the security forces and yet being close to their traditional homelands.

Due to development, most of the respondents live at the forest fringe where the area surrounding the house had low levels of plants and vegetation. In a study conducted in Malaysia among the community where the students have been tested for dengue fever reported that no vegetation in the surrounding environment had the highest proportion of dengue IgG present (82.1%) compared with those reporting a high vegetation density in the surrounding environment (77.1%) (Wong *et al.,* 2014). This may show that, low levels of plants and vegetation does not reduce the chance of getting dengue fever. Therefore, they should be educated that density of plants in the surrounding does not affect the incidence of dengue fever and dengue can occur at any place.

In this study, majority of the Orang Asli reported severe density of mosquito in the neighborhood. According to a study conducted in Penang, Malaysia reported that the *Aedes* mosquito is well adapted to the indoor environment (Dieng *et al.,* 2010). There are many places in the house where *Aedes* mosquitoes can be found, such in vases containing water plants, water containers, toilets, and water bowls for pets (Medronho *et al.,* 2009; Zuhriyah *et al.,* 2008). These mosquitoes often rest in dark corners of the houses, like behind the curtains and under beds (Rigau-Perez *et al.,* 1994). Therefore it is profound to educate the Orang Asli that dengue mosquito can be found indoors and cleaning the house where dengue mosquito is found can greatly influence the reduction of density of mosquito in the neighborhood.

5.5 Knowledge about dengue

Most of the participants were aware that dengue is transmitted by a mosquito which bites during dusk and dawn. A study conducted in the urban, semi urban and rural communities in Malaysia, however reported poor knowledge about the transmission of dengue where, mosquitoes transmitting dengue only bite early in the morning (Al-Dubai *et al.*, 2013). This is in contrast with the findings reported in this study. Findings from this study is consistent with studies conducted by Degallier *et al*, 2000 and Itrat *et al*, 2008 who reported that the majority of the respondents knew that mosquitoes transmitting dengue bite either during sunrise or sunset. Respondents in this study were aware that *Aedes* mosquito biting an infected person can spread to another person. This is consistent with a study conducted in Pakistan and in Malaysia, where respondents reported dengue is an infectious disease and can be transmitted through direct blood contact (Al-Dubai *et al.*, 2013; Itrat *et al.*, 2008).

In this study, the majority of the respondents wrongly viewed that dengue epidemic occurs only during the rainy season. Mosquito population dynamics vary in different geographic regions where dengue is transmitted, suggesting that the influence of weather on dengue may be site-specific. Researchers from many Asian countries reported that seasonal outbreaks of dengue coincides with the rainy season (Rozilawati *et al.*, 2007; Sulaiman *et al.*, 1996). However, dengue fever is not a seasonal disease. The Orang Asli should be educated and aware that dengue fever can occur throughout the year.

With regards to the sign and symptoms of dengue fever, majority of the respondents in this study reported that a person infected with dengue may have fever 4–

7 days after a mosquito bite. This is in accordance with a study conducted in Jamaica and India, where participants could identify one of the common and obvious sign and symptom is the presence of fever (Gupta *et al.*, 1998; Shuaib *et al.*, 2010). Nevertheless, the respondents in this study had low knowledge about joint pains, rashes, and headaches which are the other main signs and symptoms of dengue fever. This implies that the majority of the participants did not have good knowledge about the signs and symptoms of dengue fever. Therefore, it is vital to educate the Orang Asli to recognise the signs and symptoms of dengue fever to seek immediate treatment to prevent unwarranted complications caused by dengue fever.

Only a minority of the Orang Asli were aware of the use of Abate to prevent mosquito breeding in water containers. Using Abate was found useful in Thailand to reduce *Aedes aegypti* in water holding containers (Koenraadt *et al.*, 2006). The reasons for lack of Abate use among the Orang Asli could be due to a lack of awareness and knowledge about the usefulness of Abate in dengue prevention. Another reason is that the Orang Asli were unable to obtain Abate easily as they have to travel into the nearest towns to obtain it for their use. A large number of the Orang Asli living in remote areas do not have proper water supply, and therefore mostly depend on containers to store water. Thus providing Abate may be helpful to the Orang Asli community in preventing dengue fever.

The participants in this study had a low overall mean knowledge score of 18.4 (out of a possible highest score of 43). Participants living deep within the jungle had a low total knowledge score compared to those living in the forest fringe. Orang Asli participants from Kedah living deep within the jungle had a lowest total score of knowledge as most of them were living in remote areas where most resources was not

readily available. A study conducted among the rural and urban population in India showed that the urban population had more sufficient knowledge on dengue compared to those living in rural areas (Raghuveer *et al.*, 2013). In Malaysia, the majority of dengue educational messages were in the form of mass media such as television and radio advertisements (Hairi *et al.*, 2003). As Orang Asli live in remote areas, they may not be exposed to such educational messages. Outreach educational intervention should be provided, focusing on enhancing knowledge about dengue among the rural Orang Asli.

The occupation group with highest knowledge scores was the skilled workers. Most of them are higher educated, and have higher dengue knowledge score when compared to those non skilled workers and those unemployed. Furthermore, most of the skill workers were men working outside of the village and are exposed to information of dengue through mass media outside their villages (Raghuveer *et al.*, 2013). In contrast, those who are unemployed and non-skilled workers are mainly housewives. Secondly, this study also found those who had an average monthly income of RM500-RM1200 had a significantly higher knowledge score. These were skilled workers that sought employment outside their villages. This implies a lack of dengue awareness campaign that targets on the orang Asli communities particularly on non-skilled workers and those unemployed. Specifically, dengue awareness educational intervention should also be targeted among the Orang Asli community that live deep within the jungle and those of socio-economic disadvantage groups.

In this study, the type of house was significantly associated with dengue knowledge score. Participants that lived in village houses had a higher dengue knowledge score when compared to those living in single story houses (PPRT). The

study participants living in villages houses are of higher socio-economic status and working as skill workers, as such they are more expose to information about dengue. Most of those living is PPRT houses are Orang Asli who formally resided deep in the jungle and with the help of government they migrate out of the jungle and reside in PPRT houses provided by the government. The findings imply that more education awareness needed to be given to orang Asli living in the PPRT houses.

5.6 Attitudes

Perceived severity of dengue is a persons' belief in contracting the disease that may result in harsh health consequences (Lennon, 2005). In this study, the majority of the respondents had high levels of perceived severity towards dengue. Though the respondent's level of knowledge of dengue was poor, majority of the respondent knew that dengue fever can lead to death. However, a study conducted among the urban and rural community in Selangor and Kuala Lumpur, found an alarming number of respondents had a small amount of fear for dengue (Al-Dubai *et al.*, 2013). This is inconsistent with our study. Our study was also consistent with a previous study conducted in Laos where the community had a positive attitude towards dengue whereby they sought immediate treatment as soon as dengue infection was suspected (Nalongsack *et al.*, 2009). This shows that the respondents in that study have higher perceived severity towards dengue.

The findings from the multivariate analysis suggest that significant correlates of perceived severity of dengue were fogging frequency, highest education attainment, living conditions, and density of mosquitoes.

In this study, villages that were occasionally fogged had a higher perceived severity of dengue. In Malaysia, fogging activity is conducted during dengue outbreaks but this is not done consistently (Chen *et al.*, 2005). This activity shows that fogging creates awareness among the community about the severity of dengue fever. Villages that are never fogged carry out community activities such as 'gotong-royong' to clean up the surrounding of the village (Al-Dubai *et al.*, 2013). This shows that the villagers are aware of the severity of dengue fever and take precautions in preventing dengue.

There is only a slight difference among the respondents that either agree or disagreed that dengue fever does not always lead to death. The majority of the respondents in this study were not aware of the seriousness of the dengue fever. The number of suspected dengue cases and incidence rate in Malaysia continue to rise with the biggest outbreak reported in 2014 (Mudin, 2015). On the other hand, the majority of the respondents disagreed that dengue infection is only dangerous to children and old age. Most of the respondents were aware that dengue fever is dangerous to all age groups. A study conducted in 2003 in Malaysia reported that previously, dengue deaths were more frequent among children. However, this pattern had changed over the years and currently about 50% of deaths due to dengue occur in those aged 15 years and above (Hairi *et al.*, 2003).

The majority of the respondents with secondary education or more had a higher perceived severity of dengue. In another similar study conducted, it was reported that there was a significant association between attitudes and level of education (Al-Dubai *et al.*, 2013; Wan Rozita *et al.*, 2006). With the rise of dengue fever in Malaysia, dengue education is conducted in schools. Therefore, those with secondary education or more will be better informed about the severity of dengue fever. Prior to 1993, there was no

specific attempt to educate school children on dengue. In 1993, the Ministry of Health came up with a book 'Buku Panduan Program Bebas Denggi di Sekolah' where 'Program Bebas Denggi' or Dengue Free Programme was introduced in schools in Malaysia to educate the children about the fatality and awareness to prevent dengue fever. Thus, education should be implemented among the Orang Asli to increase the perception of severity of dengue fever.

Perceived susceptibility of dengue is a person's belief in the possibility of contracting dengue fever (Lennon, 2005). In this study, the majority of the respondents had a low likelihood of perceived susceptibility towards dengue fever. The attitude of low perceived susceptibility towards dengue is perhaps because the majority of the Orang Asli perceived that they never experienced dengue fever. In the self-reported dengue cases among the respondents, only 14 out of 505 respondents had experienced dengue fever. Therefore, many presume that there is a low chance of them in getting the disease.

The findings from the multivariate analysis found significant correlates of perceived susceptibility of dengue among the following; the Orang Asli tribes, density of plants and vegetation, and knowledge scores. Among the Orang Asli tribes, the Semai tribe had a higher perceived susceptibility towards dengue fever. This is in accordance to a study conducted by Abd-Jamil *et al*, 2014 reported that the seroprevalence of dengue fever among the Semai Perak tribes was the highest compared to the other tribes in the study. Findings imply that the Semai community having higher dengue fever experience is associated with higher perception of susceptibility to dengue infection. Having experience about dengue is likely to increase ones knowledge about dengue and therefore enhance their perception of susceptibility about dengue.

Therefore, it is important to impart dengue awareness among the Orang Asli communities where dengue incidence low, as these communities may have low level of susceptibility perception. Having higher level of perception of susceptibility is vitally important as they will be more cautious of the disease and hence carry out prevention measures against dengue infection.

Perceived barriers refers to the belief in cost or material that limits a person to carry out the necessary health related measures (Lennon, 2005). In this study, the majority of the Orang Asli respondents had low levels of perceived barriers to prevent dengue fever. The respondents did not find it difficult to remove barriers to prevent dengue fever as most of the respondent in this study were females, primary educated and unemployed. Routine cleaning are a normal and everyday affair. Therefore, removing these barriers to prevent dengue is not a difficult task among the respondents. A study conducted in Kuala Kangsar, Malaysia reported that respondents with no education showed better dengue prevention practices than those who received a higher level of education (Hairi *et al.*, 2003). Our study revealed that respondents who were primary educated and unemployed have lower barriers to prevent dengue. This could be because the higher educated orang Asli are employed and occupied with their daily task and thus exhibited higher perception in barrier to carry out dengue prevention. The lower educated and unemployed are more likely to have less barriers as most of them have more free time to carry out dengue prevention.

The findings from the multivariate analysis found significant correlates of perceived barriers to prevent dengue were density of plants or vegetation in the environment and religion. Respondents that reported moderate density of plants or vegetation in the neighbourhood were less likely to have perceived barriers to prevent

dengue fever. This could be as the Orang Asli assumes that less plants or vegetation in the surrounding has a lower chance of getting dengue fever, which leads to lower perceived barriers. However, the density of plants or vegetation in the surrounding does not affect the occurrence of dengue fever as the *Aedes* mosquito can be found indoors and outdoors. Therefore, more campaigns to educate the Orang Asli to remove perceived barriers to prevent dengue fever should be enhanced to reduce the occurrence of dengue fever.

5.7 Dengue Prevention Practices

The ideal approach to prevent dengue is to eliminate areas where the dengue mosquito lays its eggs (Gubler, 1989; Reiter, 2014). Majority of the participants in this study often cover all the water used for storing in or outside their house and also change stored water in flower vases or in pails. This is because *Aedes* mosquitoes lay their eggs in clean stagnant water. Another study conducted in Malaysia reported that the majority of the participants practiced changing stored water, empting or covering unused water jars or tanks as the main preventive practices to prevent dengue fever (Al-Dubai *et al.*, 2013; Ibrahim *et al.*, 2009; Itrat *et al.*, 2008).

In this study, majority of the participants know that proper disposal of items that can retain water and of garbage is one of the main cue-to actions to prevent dengue fever. Cleaning the surroundings of the house which can bring about stagnant water is basic to limiting *Aedes* mosquitoes from spreading. In the rural communities in Malaysia, collective community activity are frequently organised by the head of the village to clean the surrounding village. It has been a traditional village practice to bury old cans or bottles, old tyres and coconut shells to prevent dengue breeding sites (Al-

Dubai *et al.*, 2013). However, the majority of the participants did not know that the *Aedes* mosquitoes breeds in clean water. Respondents presume that it breeds in dirty water, as most *Aedes* mosquitoes breed outdoors in stagnant water in drains or empty cans which are dirty. The majority of the public associate 'dirty' sites outside the house as prominent breeding sites for dengue causing mosquitoes (Phuanukoonnon *et al.*, 2006). There appears to be a misconception that the *Aedes* mosquito only breed in dirty water. This implies education should focus on informing the Orang Asli community that in fact dengue causing mosquitoes prefer to breed in clean stagnant water such as in water jars and flower pots.

It was observed that slightly more than half of the participants took precautions against mosquito bites by using mosquito coils. Participants need to be aware that using mosquito coils should also be practiced at home to prevent mosquito bites as the dengue mosquito can be found both indoors and outdoors. In a study conducted by Dieng H. *et al*, 2010, it was found that indoor containers contained immature *Aedes* mosquito eggs which further shows that the *Aedes* mosquitoes have adapted to breeding indoors due to easy access to a blood source. Therefore, precautions against mosquito bites to prevent dengue fever from spreading should not only be taken outdoors, but in-house prevention is also important. Most of the Orang Asli live below the poverty line, and cannot afford to buy precautionary materials such as mosquito coils or bed nets. Therefore, it is recommended that the government should provide subsidy in buying mosquito coils and put more emphasis in introducing cost effective ways of preventing dengue fever.

In the univariate analysis, percentage of dengue prevention practices was significantly associated with tribes, fogging frequency, perceived susceptibility, perceived barriers and knowledge score. The Jakun tribe had lower percentages of

dengue prevention practices compared to the Semai tribe. Campaigns on dengue prevention practices should be enhanced on the Semai tribe to increase their prevention practices. Therefore, the Semai tribe should be educated on dengue prevention practices.

Fogging frequency was significantly associated with percentages of dengue prevention practices. Fogging is a commonly used method in dengue prevention in many countries (Eisen *et al.*, 2009). One study proved that fogging has greatly influenced the reduction of dengue cases but it was influenced by seasonality and the level of transmission intensity of dengue fever in an area (Oki *et al.*, 2011). The association between fogging and prevention practices found in this study imply that fogging may create a sense of awareness among the community being fogged that mosquitoes are a hazard. This may triggers them to perform preventive practices. Orang Asli living in areas where mosquito fogging is less frequent should therefore be targeted and fogging should be increased in all villages to enhance dengue prevention among the community. Although fogging frequency may create awareness among the population, it also has some disadvantages that should be taken into consideration. Many fogging companies use petrol as its base. This may create oily stains that are hard to clean especially indoors. Another problem that may arise is difficulty in breathing due to heavy fog for those with asthma and breathing problems.

Significant association in perceived susceptibility towards dengue fever and prevention practices was shown in this study. Participants with higher perceived susceptibility to dengue fever had higher percentages of dengue prevention practices. This could be because they are aware of the dangers of dengue fever. Studies have shown that if action is likely to occur, the individual perceives a higher susceptibility of getting the illness (Rosenstock *et al.*, 1994). Education programmes need to highlight

the risk of getting the disease to create awareness among people who are unconscious of the serious threat of dengue. Testimonials and campaigns can be used from families who have lost a family member due to dengue fever.

Perceived barriers were also significantly associated with dengue prevention practices. Respondents with higher level of perceived barriers to prevent dengue fever had lower percentages of dengue prevention practices. Hence, it is important to educate the Orang Asli that anyone can get dengue fever, and removing the barriers to prevent dengue can help save lives. Authorities should provide facilities to remove these barriers such as increasing community participation to eliminate mosquito breeding sites and increase campaigns to boost responsibilities towards neighbourhood cleanliness to facilitate prevention practices among the Orang Asli communities.

The findings from the multivariate analysis suggest that significant correlates of dengue prevention practices were perceived barriers to prevent dengue, knowledge score and tribes from the highest significant odds ratio to the lowest. Therefore, efforts to enhance dengue prevention practices should focus on eliminating the foremost important factors which are the perceived barriers to prevent dengue and to lack of knowledge of dengue. Intervention should focus on educating the Orang Asli to remove barriers to prevent dengue and impart more knowledge of dengue.

5.8 Limitation of the study

The study had a few limitations. Orang Asli villages were selected by JAKOA based on accessibility by land transport. Nevertheless, we could not assess the Orang Asli community without the supervision from JAKOA due to protection regulation by the government. This may result in selection bias because of the sample which was not representative of the overall Orang Asli population in Peninsular Malaysia since the Orang Asli living in more remote or inaccessible areas were not surveyed. Secondly, all information obtained from the interview was self-reported, thus bias towards socially desirable responses and behaviours might exist.

Despite some of the limitations in the study, the results provided useful information about the level of knowledge, attitude and practices that revealed important factors associated to prevention practices that would guide government officials in the development of programmes and activities to initiate dengue prevention to address the every growing problem of dengue fever.

CHAPTER 6: CONCLUSION

From this study, several conclusions could be inferred having important implications for dengue fever prevention. Firstly, the findings indicate that the level of knowledge about dengue fever among the respondents were low. Among the general knowledge items assessed, most of the respondents had high knowledge about prevention of dengue and least knowledge on the sign and symptoms of dengue fever. Respondents also knew that immediate treatment can prevent further complications and that the disease can lead to death. In the multivariate analysis, skilled workers were found more likely to have dengue knowledge when compared to the non-skilled workers. Respondents with monthly income RM500-RM1200 were less likely to have dengue knowledge compared to respondents with monthly income less than RM500.

With regards to the health beliefs, the level of perceived severity of dengue fever was high among the Orang Asli respondents. In the multivariate analysis, it was found that respondents living in the forest fringe had less perceived severity towards dengue fever when compared to the respondents living deep within the jungle. Moreover, respondents that were primary school educated had a less perceived severity towards dengue fever compared to the respondents that were secondary school educated or more. Villages that were occasionally fogged observed a higher level of perceived dengue severity compared to the villages that were often fogged. Villages that had none/low density of mosquitoes in the neighbourhood had a lower perceived severity towards dengue fever compared to severe density of mosquitoes in the neighbourhood.

The level of perceived susceptibility towards dengue fever among respondents was low. A minority of them perceived that they were unlikely to get dengue infection because they have already had it before. In the multivariate analysis, it was found that

the Semai tribe was less susceptible to dengue fever when compared to the Kensui tribe. Respondents that reported low or none plants or vegetation in the surrounding was significantly less susceptible towards dengue fever when compared to the respondents that reported a lot of plants or vegetation in their surroundings. Orang Asli respondents that reported none/low density of mosquitoes in the neighbourhood were significantly less susceptible towards dengue fever compared to the respondents that reported severe density of mosquito in their neighbourhood. Orang Asli respondents that had low knowledge level were also significantly less susceptible towards dengue fever when compared to respondents with high knowledge level.

For level of perceived barriers to prevent dengue fever, the majority of the respondents had low perceived barrier to prevent dengue fever. Most of the respondents disagreed that there was a lack of community participation and lack of preventive measures from authorities in taking preventive measure against dengue fever. In the multivariate analysis, the Islam and Christian respondents had higher level of perceived barriers when compared to the respondents who were Atheist.

With regards to perceived self-efficacy in taking preventive measures against dengue, the majority of the respondents 'Disagree and strongly disagree' that there is a lack of self –efficacy in taking preventive measures against dengue. In the multivariate analysis, the Semoq Beri tribe was less likely to report perceived self-efficacy towards dengue preventive measures when compared to the Kensui tribe. Respondents that reported low level of knowledge about dengue had a higher perceived self-efficacy towards dengue preventive measures when compared to participants with high level of knowledge about dengue.

The proportion of dengue prevention practices among the respondents was low. The general dengue prevention practices practiced by the respondents were most often sleeping in mosquito nets or having mosquito screen on windows. The least often dengue prevention practices practiced were using mosquito repellent on the body, avoiding dark places in the home where there is no light or wind and wearing bright coloured clothes to avoid mosquito bites. The Temuan tribe and Jakun tribe were less likely to carry out dengue preventive measures when compared to the Kensui tribe. Respondents with low level of perceived barriers to prevent dengue were more likely to carry out dengue preventive measures when compared to respondents that reported high level of perceived barriers to prevent dengue. Respondents that reported low level of dengue knowledge had taken less dengue preventive measures when compared to respondents with high level of dengue knowledge.

The multivariate findings of dengue prevention practices indicate that effort should focus on eliminating perceived barriers to prevent dengue, enhance knowledge about dengue. As tribes was found to be significantly associated to dengue prevention practices, intervention to enhance dengue prevention practices should be tribes specific and focus on the Orang Asli tribes who are less likely to carry out dengue prevention practices.

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