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A Comparative Study on Dengue-Related Knowledge, Attitude, and Practice in Hotspot and Non-Hotspot Areas in Selangor

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ABSTRACT

Dengue fever is a deadly vector-borne disease. Prevention strategies without specific drugs or vaccines emphasise community involvement in dengue vector control. Identifying dengue-related knowledge, attitudes, and behaviours is critical to developing more effective intervention strategies. A cross-sectional study compared the knowledge, attitudes, and practices on dengue in selected dengue hotspots and non-hotspot areas in Selangor, Malaysia. A self-administered questionnaire was distributed among 320 randomly selected residents. Data were analysed using an independent t-test and Spearman's rank-order correlation. Despite having a good understanding of the dengue virus, most respondents (83.1%) from both hotspot and non-hotspot areas were unaware that a person could be infected with the virus more than once in their lifetime, and 62.8% agreed that dengue patients could recover without treatment. Most respondents (76.9%) agreed that buying mosquito repellent is a waste of money, and most reported not sleeping under the insecticide net at night (74.7%). Respondents from dengue hotspot areas had significantly higher attitude scores (32.00±4.60) compared to those of non-hotspot regions (28.78±5.51), t (307) = 5.674, $p<0.05$. There was a significant positive correlation between knowledge and attitude scores ($r_s=0.214$, $p<0.01$), between knowledge and practices ($r_s=0.563$, $p<0.01$), and attitude and practices ($r_s=0.374$, $p<0.01$). In addition to the high levels of knowledge

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and practice, attitudes toward dengue must be improved to implement proper prevention measures.

Keywords: Attitude, dengue, hotspot area, knowledge, practice, Selangor

INTRODUCTION

Dengue is a mosquito-borne viral disease that affects tropical and subtropical countries in the Americas, Southeast Asia, Africa, the Western Pacific, and the Eastern Pacific (Rodenhuis-Zybert et al., 2010). Dengue virus (DENV) is spread between hosts by female *Aedes aegypti* and *Aedes albopictus* mosquitoes (Kamal et al., 2018). Previously known as break-bone fever, the infection can cause asymptomatic to mild dengue fever (DF) (Jordan et al., 2020; Tantawichien, 2012).

Since there are no specific dengue drugs, controlling the mosquito populations has become a major priority. In Malaysia, dengue control is based on rapid reactive vector management, which includes source reduction, space spraying, and larviciding (Saadatian-Elahi et al., 2021). Although these measures effectively reduce mosquito populations, community understanding and acceptance are required to ensure their effectiveness. Therefore, a knowledge, attitudes, and practices survey was conducted among residents of the hotspot and non-hotspot areas to understand better what residents know, believe, and do. Understanding the knowledge, attitude, and practices will provide valuable information for resource allocation, planning, and implementing dengue prevention interventions (Andrade et al., 2020).

An earlier study conducted in 2016 by Ghani et al. (2019) compared the knowledge, attitude, and practices related to dengue among communities in dengue hotspots and non-hotspot areas of Selangor. An area with a dengue outbreak lasting over 30 days is classified as a dengue hotspot. In the study, Ghani et al. (2019) found that respondents living in non-hotspot areas had better knowledge and attitude, which may have contributed to the decrease in dengue cases from 2016 until 2018, as reported by the Ministry of Health Malaysia. However, in the 25th week of 2019, 59,615 cases were reported nationwide, up 96.2% from the same period the previous year (Ministry of Health Malaysia, 2019). In addition, 117 hotspot areas were reported, 92 of which were in Selangor. The increase in the number of cases and hotspot locations necessitated this study to determine the present state of dengue knowledge, attitudes and practises among people living in hotspot and non-hotspot areas.

METHODOLOGY

Study Setting

A descriptive cross-sectional survey was designed and conducted among selected residents in dengue hotspot and non-hotspot areas in Selangor, Malaysia, from July to September

2019. Selangor is located on the west coast of Peninsular Malaysia and had a population of 6.53 million in 2019 (Department of Statistics Malaysia, 2020). Selangor was chosen because it has had the most dengue cases in recent years.

This study included eight dengue hotspots and eight non-hotspots in Selangor. Areas with dengue outbreaks for 30 days or more were classified as hotspots, while areas without dengue outbreaks for 30 days or more were classified as non-hotspots. In contrast to a previous study conducted by Ghani et al. (2019), the study sites (Table 1) were chosen at random using SPSS Version 22 from the Malaysian Crisis Preparedness Resource Centre's (CRPC) list of dengue hotspot areas provided on the iDengue Remote Sensing website dated June 26, 2019 (Week 26) (Malaysian Remote Sensing Agency, 2019).

Study Design and Respondents

A self-administered questionnaire was used to assess the level of dengue KAP in 16 selected hotspot and non-hotspot areas in Selangor from July to September 2019. The inclusion criteria for respondents include adults aged 18 and above living in Petaling District, Selangor and Malaysian. One hundred sixty respondents were selected in hotspot areas and 160 in non-hotspot areas. Each participant received a consent letter and a brief explanation. The respondents had the right to withdraw from the survey at any time. They could also ask questions if they did not understand them. Each survey session lasted 15 minutes, and the enumerator collected the completed questionnaire on the spot.

Table 1
Selected sampling sites of dengue hotspot and non-hotspot areas in Selangor, June 26, 2019

Dengue hotspot areas	Dengue non-hotspot areas
Apartment Baiduri, Shah Alam	Seksyen 2, Shah Alam
Dataran Otomobil, Shah Alam	Seksyen 11, Shah Alam
Palm Spring Condominium, Petaling Jaya	Mutiara Damansara, Petaling Jaya
Ridzuan Condominium, Petaling Jaya	Desa Mentari, Petaling Jaya
Pangsapuri Perdana, Shah Alam	Taman Tadisma, Shah Alam
Kampung Bukit Sungai Puteh, Ampang Jaya	Taman Lembah Jaya, Ampang Jaya
Mentari Court, Petaling Jaya	SS 9, Petaling Jaya
Gugusan Dedap, Petaling Jaya	Gugusan Semarak, Petaling Jaya
Kampung Baru Hicom, Shah Alam	Taman Sri Muda, Shah Alam

Instrument

The questionnaire was based on published studies on dengue-related knowledge, attitude, and practice (KAP). The questionnaire used in this study differed from that used in the study conducted by Ghani et al. (2019). The questionnaire used in the present study consisted of four parts. Part 1 consisted of 20 closed-ended questions about dengue knowledge (yes/

no), while Part 2 consisted of 14 closed-ended questions about dengue attitude. "Strongly disagree," "disagree," "agree," and "strongly agree" were the options for dengue attitudes. Part 3 had ten closed-ended questions about dengue prevention practices. The respondents could select "no" or "yes" for each item. Finally, part 4 included nine closed-ended questions to collect respondents' socio-demographic data. Putting the socio-demographic items at the end of the questionnaire encourages respondents to fill it out because some may find them intrusive and threatening, affecting their performance on the other KAP items (Parmenter & Wardle, 2000).

The questionnaire was pretested among 200 residents of Petaling District to ensure its clarity. The data was entered into SPSS version 22 and tested for reliability. The Cronbach's alpha coefficient for dengue knowledge was 0.70, dengue attitude was 0.824, and dengue prevention practices were 0.702. These values reflect the measuring questionnaire's high reliability and internal consistency (Flynn et al., 1990; Streiner, 2003).

Sampling and Data Collection

A total of 320 respondents were recruited using a systematic random sampling method to participate in this study. The sample size was calculated using Cochran's formula in Equation 1 (Cochran, 1977).

$$n_o = \frac{z^2 pq}{d^2} = \frac{1.960^2 \times (0.296 \times 0.704)}{0.050^2} = 320 \quad (1)$$

where

n_o= the required sample size,

z = 1.960 (standard normal score at 95% confidence interval)

p = 0.296 (estimated prevalence present in the population) (Othman et al., 2019)

$q = 1 - p$

d = an acceptance error of 5%

Respondents were approached in the selected residential areas. The enumerators chose one qualified respondent for every three houses they passed, yielding 320 eligible respondents (Ghani et al., 2019). This method was used to ensure that everyone in the population had an equal chance of being chosen (Acharya et al., 2013).

Data Handling and Analysis

Before data entry into SPSS, collected questionnaires were checked for appropriateness and completeness of responses (Diema et al., 2019). For the analyses to assess the level of knowledge, correct responses were scored as one, and wrong responses were scored as 0. The scores ranged from 0 to 20, and each response was classified into three levels based on Bloom's cut-off point: good knowledge level (16 to 20), fair knowledge level

(12 to 15), and poor knowledge level (≤11). Attitude towards dengue was measured by a four-point Likert scale that ranged from 1 (strongly disagree) to 4 (strongly agree). The scores ranged from 14 to 56, and each response was classified into three levels according to Bloom's cut-off point: good attitude level (45 to 56), fair attitude level (34 to 44), and poor attitude level (≤33). For practice, each positive response was scored one, and the negative response was scored 0. The scores ranged from 0 to 10, and respondents' practice levels were defined as good practice level (9 to 11), fair practice level (7 to 8), and poor practice level (≤6) based on Bloom's cut-off point.

The data was entered and analysed by using SPSS version 22. Descriptive analysis was done to calculate frequencies and percentages of socio-demographic characteristics of the respondents and the proportion of the correct answer for each item for every domain. An Independent t-test was used to compare the mean of knowledge, attitude, and practice scores between non-hotspot and hotspot areas Spearman's rank-order correlation was conducted to examine the relationship between knowledge, attitude, and practice scores.

Ethical Considerations

The National Institutes approved the study of Health Malaysia Medical Research Ethics Committee (Reference No. KKM.NIHSEC.P18-1250 (6)) on June 20, 2018. Human participant protection procedures were adopted. The respondents were fully informed of the study's purpose, the questions to be asked, the data collection process and the data use before consenting to participate. The consent was verbal, as most people dislike signing documents (Khun & Manderson, 2007). The respondent's identity was protected. After collection, the data is entered into a computer only the researchers can access.

RESULTS

Socio-Demographic Characteristics of Respondents

Table 2 provides information on the socio-demographic characteristics of 320 respondents from Selangor enrolled in this study. Females constituted the majority of the recruited respondents (70.7%). In this study, the age was categorised according to the timeline of generations. Respondents aged 43 to 54 years formed the majority (46.7%), and only a small percentage of the respondents were aged 18 to 21 and above 73 years, both at 2.2%. Most respondents were married (87.4%), while the rest were single (7.7%), divorced (3.9%), and widowed (1.0%). Nearly three-quarters of the respondents were Malay (73.5%), followed by Chinese (18.5%) and Indian (8.0%). Most respondents were employed, accounting for 70.2% of the total sample (Table 3). For many respondents, secondary school was their highest educational attainment (70.0%). Over half of the respondents earned between RM3000 and RM5999 per month on average, which suggests that they are well off (53.9%). Nearly a third of the respondents said that at least one family member had been

Table 2
Socio-demographic characteristics of respondents

Characteristics	Frequency (N=320)	Percentage (%)
Gender		
Male	93	29.3
Female	224	70.7
Age group		
18-21 years	7	2.2
22-42 years	123	38.8
43-54 years	148	46.7
55-73 years	32	10.1
>73 years	7	2.2
Marital status		
Single	24	7.7
Married	271	87.4
Divorce	12	3.9
Widowed	3	1.0
Race		
Malay	230	73.5
Chinese	58	18.5
Indian	25	8.0
Occupation		
Employed	221	70.2
Retired	34	10.8
Housewife	40	12.7
Student	9	2.9
Unemployed	11	3.5
Education level		
Tertiary education	67	21.1
Secondary education	222	70.0
Primary education	27	8.5
Informal education	1	0.3
Household average monthly income		
≤RM999	7	2.3
RM1000-RM2999	105	34.1
RM3000-RM5999	166	53.9
≥RM6000	30	9.7
Previous dengue infection (own self)		
Yes	57	18.0
No	260	82.0
Previous dengue infection (family member)		
Yes	93	29.5
No	222	70.5

RM indicates Ringgit Malaysia

diagnosed with dengue fever (29.5%). Only a very small percentage of the respondents had been exposed to dengue before (18.0%).

Dengue-Related Knowledge

Table 3 presents the results of the Chi-square test of item-by-item analysis of respondents' knowledge of dengue. Respondents from dengue hotspots and non-hotspot areas showed comparable knowledge about the causal agent of dengue; dengue could affect all age groups and the capability of *Aedes* mosquitoes to transmit dengue. Most respondents from non-hotspot areas knew that dengue could be transmitted through blood transfusion, and it was significantly different from respondents in hotspot areas, $p<0.05$. Surprisingly, only 24.4% of the respondents knew that a person could be infected with dengue more than once. A significant association was found between respondents' knowledge and hotspot and non-hotspot areas, $p<0.05$.

Respondents from the hotspot and non-hotspot areas showed significant differences in knowledge about the characteristics of *Aedes* mosquitoes, with more respondents from hotspots being able to identify the features of *Aedes* mosquitoes with black and white stripes on their legs and bodies, $p<0.05$. Most respondents (93.8%) knew that *Aedes* mosquitoes could not breed in stagnant dirty water, whereas only 6.3% of respondents answered incorrectly for this item. Both respondents from the hotspot (93.1%) and non-hotspot areas (93.1%) showed similar knowledge of mosquito peak biting times between dawn and dusk.

Table 3
Item-by-item analysis of respondents' knowledge of dengue

Variables	Hotspot, n (%)	Non-hotspot n (%)	Total n (%)	p-value
Knowledge of dengue transmission				
Dengue is caused by the virus				
Yes	142 (88.8)	149 (93.1)	291 (90.9)	0.173
No	18 (11.3)	11 (6.9)	29 (9.1)	
Dengue affects all age group				
Yes	158 (98.8)	158 (98.8)	316 (98.8)	1.000
No	2 (1.3)	2 (1.3)	4 (1.3)	
Aedes mosquito can transmit dengue				
Yes	157 (98.1)	158 (98.8)	315 (98.4)	0.652
No	3 (1.9)	2 (1.3)	5 (1.6)	
Blood transfusion can transmit dengue				
Yes	125 (78.1)	141 (88.7)	266 (83.4)	0.011*
No	35 (21.9)	18 (11.3)	53 (16.6)	
A person can only get dengue once in their lifetime				
Yes	133 (83.1)	109 (68.1)	242 (75.6)	0.002*
No	27 (16.9)	51 (31.9)	78 (24.4)	
Knowledge of dengue vector				
Aedes mosquito has black and white stripes on its leg and body				
Yes	155 (96.9)	140 (87.5)	295 (92.2)	0.002*
No	5 (3.1)	20 (12.5)	25 (7.8)	
Aedes mosquito breeds in stagnant dirty water				
Yes	6 (3.8)	14 (8.8)	20 (6.3)	0.065
No	154 (96.3)	146 (91.3)	300 (93.8)	
Aedes mosquito bites/feeds during dawn and dusk				
Yes	148 (93.1)	149 (93.1)	297 (93.1)	0.988
No	11 (6.9)	11 (6.9)	22 (6.9)	
Knowledge of dengue symptoms				
Having a fever reaching 40°C				
Yes	147 (91.9)	141 (88.1)	288 (90.0)	0.264
No	13 (8.1)	19 (11.9)	32 (10.0)	
Consistent headache				
Yes	149 (93.1)	152 (95.0)	301 (94.1)	0.478
No	11 (6.9)	8 (5.0)	19 (5.9)	
Muscle and joint pain				
Yes	151 (94.4)	148 (92.5)	299 (93.4)	0.498
No	9 (5.6)	12 (7.5)	21 (6.6)	
Small and red pinhead-like rashes appear on the body				
Yes	139 (86.9)	123 (76.9)	262 (81.9)	0.020*
No	21 (13.1)	37 (23.1)	58 (18.1)	
Pain behind the eyes				
Yes	141 (88.1)	126 (78.8)	267 (83.4)	0.024*
No	19 (11.9)	34 (21.3)	53 (16.6)	

Table 3 *(continue)*

Variables	Hotspot, n (%)	Non-hotspot n (%)	Total n (%)	p-value
Nausea and vomit				
Yes	142 (88.8)	124 (77.5)	266 (83.1)	0.007*
No	18 (11.3)	36 (22.5)	54 (16.9)	
Knowledge of dengue treatment				
There is a vaccine to prevent dengue				
Yes	13 (8.1)	27 (16.9)	40 (12.5)	0.018*
No	147 (91.9)	133 (83.1)	280 (87.5)	
There is medication for dengue				
Yes	22 (13.8)	25 (15.6)	47 (14.7)	0.636
No	138 (86.3)	135 (84.4)	273 (85.3)	
Knowledge of dengue prevention				
Removing standing water can prevent mosquitoes to breed				
Yes	157 (98.1)	145 (90.6)	302 (94.4)	0.004*
No	3 (1.9)	15 (9.4)	18 (5.6)	
Covering water-filled containers can prevent mosquitoes to breed				
Yes	156 (97.5)	147 (92.5)	303 (95.0)	0.039*
No	4 (2.5)	12 (7.5)	16 (5.0)	
Insecticide spray can kill adult mosquitoes				
Yes	157 (98.1)	153 (95.6)	310 (96.9)	0.199
No	3 (1.9)	7 (4.4)	10 (3.1)	
Larvicide such as Abate is used to kill mosquito larvae				
Yes	158 (98.8)	152 (96.2)	310 (97.5)	0.147
No	2 (1.3)	6 (1.9)	8 (2.5)	

*Indicates a significant difference as a p-value less than 0.05

Most respondents who live in both areas have correctly identified the dengue symptoms. Both respondents from the hotspot and non-hotspot areas had comparable knowledge about dengue symptoms, such as body temperature as high as 40°C, consistent headache, and muscle and joint pain. On the other hand, a significantly higher percentage of respondents from hotspot areas knew that skin rash, pain behind the eyes, nausea, and vomiting were symptoms of dengue fever than respondents from non-hotspot areas ($p<0.05$).

Responses to the item 'there is a vaccine to prevent dengue' differed significantly between the hotspot and non-hotspot areas, $p<0.05$. More respondents from hotspot areas (91.9%) knew that the dengue vaccine is unavailable in Malaysia to prevent dengue infection compared to respondents from non-hotspot areas (83.1%). In addition, respondents from the hotspot and non-hotspot areas had similar knowledge about the absence of specific medication to treat dengue.

Regarding knowledge on dengue prevention, the responses to each item were statistically significant between the hotspot and non-hotspot areas except for the item 'insecticide spray can kill adult mosquito' and 'larvicide such as Abate is used to kill

mosquito larvae. More respondents from hotspot areas knew that removing standing water and covering water-filled containers could prevent mosquitoes from breeding than respondents from non-hotspot areas, $p<0.05$. Respondents from the hotspot and non-hotspot areas have comparable knowledge about insecticides capable of killing adult mosquitoes and larvicides such as Abate to kill mosquito larvae.

Attitudes Towards Dengue Disease

Table 4 shows the results of an item-by-item analysis of attitude related to dengue using the Chi-square test. The responses to each item were statistically significant between the hotspot and non-hotspot areas except for the responses to the item 'spending money to buy mosquito repellent is a waste' and 'preventing dengue in government's responsibility. Most respondents from hotspot areas believed that they were at risk of getting dengue and that anyone could be infected by dengue, compared to respondents from non-hotspot areas. More than 90.0% of the respondents from hotspot areas agreed and strongly agreed that dengue is a life-threatening disease and can be prevented compared to respondents from non-hotspot areas. Surprisingly, only a few respondents (13.7%) disagreed and strongly disagreed that eliminating mosquito breeding sites could reduce the mosquito population, and most of them were from non-hotspot areas. Most respondents (93.8%) from hotspot areas agreed and strongly agreed that avoiding mosquito bites could prevent dengue, 14.4% higher than respondents from non-hotspot areas. Health authorities often implement dengue campaigns to educate the community about the dengue-related issue. In this study, a higher percentage of the respondents from hotspot areas agreed and strongly agreed that the dengue campaign is beneficial compared to respondents from non-hotspot areas.

A total of 31 respondents from non-hotspot areas agreed and strongly agreed that fogging is enough to prevent dengue, 5.6% lower than the total percentage of respondents from hotspot areas that answered 'agreed' and 'strongly agreed'. Most respondents from the hotspot and non-hotspot areas agreed and strongly agreed that spending money to buy mosquito repellent is a waste. Likewise, less than half of the respondents from the hotspot and non-hotspot areas agreed and strongly agreed that preventing dengue is the government's responsibility (40.9%).

More respondents from hotspot areas (90.6%) agreed and strongly agreed that the public plays an important role in preventing dengue compared to respondents from non-hotspot areas (69.4%). In addition, more respondents from hotspot areas (78.1%) strongly agreed that they could prevent dengue compared to respondents from non-hotspot areas (58.1%). Overall, only 23.2% of the respondents from the hotspot and non-hotspot areas disagreed and strongly disagreed that a dengue-infected person could recover without any treatment. Regarding vaccination, 267 respondents from the hotspot and non-hotspot areas agreed and strongly agreed that vaccination is important to prevent dengue.

Table 4
Item-by-item analysis of respondents' attitudes on dengue

Variables	Hotspot n (%)	Non-hotspot n (%)	Total n (%)	p-value
Anyone can get dengue				
Strongly agree	37 (23.1)	10 (6.3)	47 (14.7)	<0.001*
Agree	100 (62.5)	106 (66.3)	206 (64.4)	
Disagree	19 (11.9)	39 (24.4)	58 (18.1)	
Strongly disagree	4 (2.5)	6 (3.1)	9 (2.9)	
I am at risk of getting dengue				
Strongly agree	27 (16.9)	10 (6.3)	37 (11.6)	0.001*
Agree	117 (73.1)	123 (76.9)	240 (64.4)	
Disagree	13 (8.1)	27 (16.9)	40 (12.5)	
Strongly disagree	3 (1.9)	0 (0.0)	3 (0.9)	
Dengue is a life-threatening disease				
Strongly agree	47 (29.4)	21 (13.1)	68 (21.3)	<0.001*
Agree	101 (63.1)	107 (66.9)	208 (65.0)	
Disagree	11 (6.9)	26 (16.3)	37 (11.6)	
Strongly disagree	1 (0.6)	6 (3.8)		
Dengue can be prevented				
Strongly agree	117 (73.1)	91 (56.9)	208 (65.0)	<0.001*
Agree	36 (22.5)	33 (20.6)	69 (21.6)	
Disagree	6 (3.8)	36 (22.5)	42 (13.1)	
Strongly disagree	1 (0.6)	0 (0.0)	2 (0.6)	
Eliminating mosquito breeding sites can reduce mosquito				
Strongly agree	115 (71.9)	93 (58.1)	208 (65.0)	<0.001*
Agree	37 (23.1)	31 (19.4)	68 (21.3)	
Disagree	8 (5.0)	34 (21.3)	42 (13.1)	
Strongly disagree	0 (0.0)	2 (1.3)	2 (0.6)	
Avoiding mosquito bites can prevent dengue				
Strongly agree	120 (75.0)	97 (60.6)	217 (67.8)	0.001*
Agree	30 (18.8)	30 (18.8)	60 (18.8)	
Disagree	10 (6.3)	27 (16.9)	37 (11.6)	
Strongly disagree	0 (0.0)	6 (3.8)	6 (1.9)	
Dengue campaign is beneficial				
Strongly agree	121 (75.6)	96 (60.0)	217 (67.8)	0.007*
Agree	25 (15.6)	31 (19.4)	56 (17.5)	
Disagree	11 (6.9)	21 (13.1)	32 (10.0)	
Strongly disagree	3 (1.9)	12 (7.5)	15 (4.7)	
Fogging is enough to prevent dengue				
Strongly agree	24 (15.0)	31 (19.4)	55 (17.2)	0.014*
Agree	34 (21.3)	18 (11.3)	52 (16.3)	
Disagree	9 (5.6)	21 (13.1)	30 (9.4)	
Strongly disagree	93 (58.1)	90 (56.3)	183 (57.2)	
Spending money to buy mosquito repellent is a waste				
Strongly agree	125 (78.1)	121 (75.6)	246 (76.9)	0.893
Agree	26 (16.3)	31 (19.4)	57 (17.8)	
Disagree	5 (3.1)	4 (2.5)	9 (2.8)	
Strongly disagree	4 (2.5)	4 (2.5)	8 (2.5)	

Table 4 *(continue)*

Variables	Hotspot n (%)	Non-hotspot n (%)	Total n (%)	p-value
Preventing dengue is the government's responsibility				
Strongly agree	35 (21.9)	40 (25.0)	75 (23.4)	0.191
Agree	24 (15.0)	32 (20.0)	56 (17.5)	
Disagree	9 (5.6)	3 (1.9)	12 (3.8)	
Strongly disagree	92 (57.5)	85 (53.1)	177 (55.3)	
The public played an important role in preventing dengue				
Strongly agree	124 (77.5)	88 (55.0)	212 (66.3)	<0.001*
Agree	21 (13.1)	23 (14.4)	44 (13.8)	
Disagree	9 (5.6)	29 (18.1)	38 (11.9)	
Strongly disagree	6 (3.8)	20 (12.5)	26 (8.1)	
I am capable of preventing dengue				
Strongly agree	125 (78.1)	93 (58.1)	218 (68.1)	<0.001*
Agree	27 (16.9)	37 (23.1)	64 (20.0)	
Disagree	8 (5.0)	26 (16.3)	34 (10.6)	
Strongly disagree	0 (0.0)	4 (2.5)	4 (1.3)	
Dengue patients can recover without any treatment				
Strongly agree	103 (64.4)	98 (61.3)	201 (62.8)	0.001*
Agree	25 (15.6)	20 (12.5)	45 (14.1)	
Disagree	20 (12.5)	41 (25.6)	61 (19.1)	
Strongly disagree	12 (7.5)	1 (0.6)	13 (4.1)	
Vaccination is important to prevent dengue				
Strongly agree	121 (75.6)	87 (54.4)	208 (65.0)	0.001*
Agree	21 (13.1)	38 (23.8)	59 (18.4)	
Disagree	11 (6.9)	23 (14.4)	34 (10.6)	
Strongly disagree	7 (4.4)	12 (7.5)	19 (5.9)	

*Indicates a significant difference as a p-value less than 0.05

Practices Against Dengue

Table 5 summarises the Chi-square test of item-by-item analysis of practice against dengue transmission. Respondents from the hotspot and non-hotspot areas demonstrated significant differences in practising dengue prevention measures except for wearing long pants and long-sleeve shirts while outdoors, cleaning refrigerator trays once a week, and covering water-filled containers indoors and outdoors, participating in neighbourhood clean-up activities and using insecticide spray to kill mosquitoes. Regarding avoiding mosquito contact, only 81 out of 320 respondents used insecticide bed nets while sleeping at night. Of these, 57 respondents were from non-hotspot areas, while the remaining 24 were from hotspot areas. In addition, most respondents from the hotspot and non-hotspot areas took personal measures against dengue by using mosquito repellent on their bodies (79.1%) and wearing long pants and long-sleeve shirts while outdoors (87.2%). On the other hand, more respondents from hotspot areas reported that they properly disposed of their household garbage, removed standing water inside and outside their houses, cleaned refrigerator

trays once a week, covered water-filled containers indoors and outdoors, participated in neighbourhood clean-up activities, open windows and doors during fogging activity, used Abate to kill mosquito larvae, and used insecticide spray to kill the adult mosquito.

Table 5
Item-by-item analysis of respondents' practice on dengue

Variables	Hotspot (%)	Non-hotspot n (%)	Total n (%)	p-value
I sleep under an insecticide net at night				
Yes	24 (7.5)	57 (17.8)	81 (25.3)	< 0.001*
No	136 (42.5)	103 (32.2)	239 (74.7)	
I use mosquito repellent on my body				
Yes	119 (37.2)	134 (41.9)	253 (79.1)	0.039*
No	41 (12.8)	26 (8.1)	67 (20.9)	
I wear long pants and long sleeve shirt while outdoors				
Yes	134 (41.9)	145 (45.3)	279 (87.2)	0.066
No	26 (8.1)	15 (4.7)	41 (12.8)	
I properly dispose of household garbage				
Yes	154 (48.1)	142 (44.4)	296 (92.5)	0.011*
No	6 (1.9)	18 (5.6)	24 (7.5)	
I remove standing water indoor and outdoor				
Yes	153 (47.8)	137 (42.8)	290 (90.6)	0.002*
No	7 (2.2)	23 (7.2)	30 (9.4)	
I clean the refrigerator tray once a week				
Yes	150 (46.9)	144 (45.0)	294 (91.9)	0.220
No	10 (3.1)	16 (5.0)	26 (8.1)	
I cover water-filled containers indoor and outdoor				
Yes	147 (45.9)	138 (43.1)	285 (89.1)	0.107
No	13 (4.1)	22 (6.9)	35 (10.9)	
I participate in neighbourhood clean-up activities				
Yes	146 (45.6)	139 (43.4)	285 (89.1)	0.210
No	14 (4.4)	21 (6.6)	35 (10.9)	
I open windows and doors during fogging activity				
Yes	152 (47.5)	132 (41.3)	284 (88.8)	< 0.001*
No	8 (2.5)	28 (8.8)	36 (11.3)	
I use Abate to kill mosquito larvae				
Yes	152 (47.5)	139 (43.4)	291 (90.9)	0.011*
No	8 (2.5)	21 (6.6)	29 (9.1)	
I use insecticide spray to kill mosquitoes				
Yes	155 (48.4)	149 (46.6)	304 (95.0)	0.124
No	5 (1.6)	11 (3.4)	16 (5.0)	

*Indicates a significant difference as a p-value less than 0.05

Mean Knowledge, Attitude, and Practice Scores

The results of the independent t-test used to compare the mean of knowledge, attitude, and practice scores between respondents who live in dengue hotspot areas and those who do not live in hotspot areas are shown in Table 6. The findings indicate that respondents who live in hotspot areas had statistically significantly higher attitude scores (32.00±4.60) compared to those who live in non-hotspot areas (28.78±5.51), t (307) = 5.674, p<0.05. On the other hand, no significant differences were found between areas with knowledge scores and practice scores. Respondents who live in hotspot areas seemed to have slightly better knowledge and good practices of dengue prevention measures; however, this was not statistically significant.

Correlation between Dengue Knowledge, Attitude, and Practice Scores

This study uses Spearman's rank-order correlation to examine the relationship between knowledge, attitude, and practice scores. As shown in Table 7, there was a positive correlation between knowledge and attitude scores (r_s=0.214, p<0.01), between knowledge and practices (r_s=0.563, p<0.01), and attitude and practices (r_s=0.374, p<0.01), which were statistically significant.

Table 6
Comparison of mean knowledge, attitude, and practice between respondents living in dengue hotspot and non-hotspot areas

KAP score	Hotspot area	Non-hotspot area	P-value
Knowledge	16.48±0.99	16.25±1.34	0.120
Attitude	32.00±4.60	28.78±5.51	<0.05*
Practice	9.29±1.25	9.10±1.21	0.175

*Indicates a significant difference as a p-value less than 0.05

Table 7
Correlation between dengue knowledge, attitude, and practice scores of respondents in Selangor

Variables	**Spearman's correlation**	**P-value**
Knowledge & attitudes	0.214	<0.01**
Knowledge & practices	0.563	<0.01**
Attitude & practices	0.374	<0.01**

**Indicates a significant association as the p-value is less than 0.01

DISCUSSION

A survey was conducted to assess dengue knowledge, attitudes, and practices among the residents of dengue hotspots and non-hotspot areas in Selangor. It was found that the level of knowledge about dengue among respondents from both areas was high. It is suggested

that the dengue campaigns implemented through various platforms in the country have effectively disseminated dengue-related information.

In the present study, many respondents knew that the virus is the causative agent of dengue fever, most of whom were from hotspot areas. It may be due to the health education programs implemented by the Ministry of Health Malaysia, which often focuses on the *Aedes* mosquitoes instead of the virus (Leong, 2014; Naing et al., 2011). It should be noted that knowledge of *Aedes* mosquitos is more important because, at the moment, the best ways to prevent the spread of dengue are to control the *Aedes* mosquito population and avoid mosquito bites (Leong, 2014; Roiz et al., 2018). According to the findings, almost all respondents from both areas knew that *Aedes* mosquitos are the dengue vector. It could be due to a public education campaign using the slogan 'No *Aedes*, No Dengue.'

Most surveyed respondents from both areas knew that dengue fever could affect all age groups. This knowledge is expected to encourage people to take preventive measures and seek medical treatment immediately if their family members develop dengue symptoms, especially for those aged 0–4 years, because they are at high risk of being infected with dengue. According to Woon et al. (2018), the incidence rate for children aged 0 to 4 was 176.6 per 1,000 in 2013. Despite having a high level of knowledge, most respondents, particularly those living in hotspot areas, were unaware that a person could contract dengue more than once in their lifetime. Because they are more susceptible to dengue infection, it is critical to disseminate important information about dengue, particularly because someone diagnosed with dengue has a second chance of being infected with heterologous serotypes. Secondary infection should be avoided by maintaining proper prevention practices, as it has been reported to be more severe than primary infection (Soo et al., 2016).

In terms of the dengue vector, most respondents from hotspot areas had significantly better knowledge of the physical characteristics of *Aedes* mosquitos. It could be due to dengue education talks or exhibitions displaying dengue-related information, such as replicas of adult *Aedes* mosquitos, which were held in conjunction with cleanliness activities in hotspot areas. Another reason for this is educational advertisements on television or social media that feature the image of an *Aedes* mosquito. Furthermore, most respondents in both areas knew that *Aedes* mosquitos breed in clean stagnant water rather than dirty water. In Malaysia, the weather is hot and humid all year, with rain, which can create breeding grounds for *Aedes* mosquitoes if rainwater stagnates in artificial containers (Tang, 2019). *Aedes aegypti* and *Aedes albopictus* lay their eggs in various containers, including tanks, buckets, gutters, and air conditioner drip trays, all of which can be found in or around the home. As a result, identifying potential breeding grounds may assist people in keeping their homes clean by removing unused containers that can hold water, emptying water-filled containers, and treating stored water with larvicides.

Most respondents from both areas were knowledgeable about *Aedes* mosquito feeding habits. However, a small percentage of the respondents were unaware that *Aedes* mosquitos

are most active at dawn and dusk and are more likely to bite humans during these times. Therefore, it can lead to poor protection practices, such as being outside in the early morning and late afternoon and increasing mosquito contact. The most commonly recognised symptoms were high fever, headache, muscle pain, and joint pain. Surprisingly, less than a fifth of respondents living in non-hotspot areas were aware that dengue also causes skin rashes, back pain, nausea, and vomiting.

Compared to those who live in dengue hotspot areas, respondents from the non-hotspot area may have had less experience with infection or have witnessed close relatives contract dengue, limiting their knowledge of dengue symptoms. It is suggested that dengue education campaigns emphasise the symptoms of dengue that many people are unaware of and can be used to determine whether a person has dengue fever or a common fever. The ability of an individual to recognise dengue symptoms is critical to avoid confusion with similar illnesses such as influenza and initiate treatment promptly (Karimah Hanim et al., 2017; Khun & Manderson, 2007). It could contribute to a decrease in dengue cases and deaths.

Many respondents were aware of the lack of an effective dengue vaccine and specific dengue medications. With this knowledge, it is hoped that the community will keep their homes clean and free of mosquito breeding grounds, thereby reducing mosquito populations. Additionally, the current study established that respondents from both areas possessed a high level of knowledge regarding dengue prevention. It could be a result of frequent dengue campaigns emphasising dengue prevention practices. Additionally, this could account for respondents' improved dengue prevention practices, as knowledge about dengue was found to correlate positively with practices. In other words, it can be asserted that increased community awareness of dengue fever has resulted in improved dengue prevention practices.

The study found that respondents, particularly those living in dengue hotspot areas, have a favourable attitude toward dengue. Having a high level of knowledge about dengue may be one of the reasons, as this study discovered a positive correlation between knowledge and attitude. For instance, knowing that dengue can infect people of all ages may have led them to believe that everyone, including themselves, has a chance of contracting dengue. Although they are aware that there is no vaccine to prevent the spread of dengue, they continue to believe and feel that dengue can be prevented. Additionally, the respondents agreed that eradicating mosquito breeding grounds and avoiding mosquito bites can help protect them from dengue infection. It may increase people's awareness of the importance of protecting themselves and their families by implementing preventive activities in their residential areas to eradicate mosquitoes and prevent dengue infections that can be fatal. While most respondents, particularly those from hotspot areas, believed it was their responsibility to prevent dengue, some believed it was the government's sole responsibility. According to Lisut (2018), one of the primary reasons it is difficult to eradicate *Aedes* mosquitoes is the expectation that others will prevent dengue. As a result, such attitudes

must be corrected, as the government is incapable of always locating and eliminating mosquito breeding grounds in every home, especially when doing so would be costly.

Most respondents thought the dengue campaign was beneficial because it educated the public about dengue and instilled a sense of responsibility to protect their families, neighbours, and themselves from dengue infections and care for their environment. However, most respondents agreed that fogging is insufficient to prevent dengue in this study. Aung et al. (2016) reported a similar finding in Terengganu and suggested that this could be due to increased dengue cases despite frequent fogging activities. Fogging is not the primary method of combating dengue; it is only used when a dengue case is detected in each area (Kumarasamy, 2006). According to the findings of this study, respondents from both urban and rural areas believed that purchasing mosquito repellents was a waste of money. This study also dispelled the myth that dengue patients can improve independently. Health messages should emphasise the importance of seeking treatment to avoid harmful self-treatment practices (Hamid et al., 2015), which may be dangerous for them, particularly those suffering from dengue haemorrhage fever. Additionally, the respondent believed vaccination was critical for preventing dengue infection. It is hoped that with the advancement of technology, an effective dengue vaccine will be developed to prevent dengue fever, thereby resolving the dengue burden.

The survey respondents demonstrated poor practices regarding using insecticide nets at night, with respondents from hotspot areas exhibiting the worst practices. Several studies conducted in the dengue-prone area of Selangor revealed similar findings. For example, in a study by Said et al. (2018), respondents stated that sleeping with a bed net can be uncomfortable. Additionally, most respondents from non-hotspot areas engaged in basic personal protective behaviours to avoid mosquito bites, such as applying mosquito repellent to the body and wearing long pants and long-sleeve shirts outdoors.

Over 80.0% of respondents in both areas claimed to practise some form of environmental measure to reduce the mosquito population, such as properly disposing of household garbage, removing standing water in and around their home, cleaning the refrigerator frequently, and covering water-filled containers indoors and outdoors. Additionally, most of them said they engaged in cleanliness activities to maintain a clean-living environment. However, most respondents, particularly those from hotspot areas, are still unaware of fogging activity when they do not open their windows and doors when health authorities perform it. Over 90% of respondents reported using some form of insecticide, such as Abate, to kill mosquito larvae in water containers or insecticide spray to kill adult mosquitoes. Most respondents' widespread use of Abate as a precautionary measure, particularly those from hotspot areas, may be due to overall awareness of Abate's ability to disrupt the development of immature mosquitoes in water containers. According to Noor and Suddin (2017), health professionals will provide Abate free of charge to the

public, particularly during dengue outbreaks, which may contribute to the prevalence of abate use among them. Additionally, Hairi et al. (2003) suggested that this could result from aggressive media advertising regarding the use of insecticides.

This study also found positive correlations between knowledge and attitude and between knowledge and practice, indicating that the translation of knowledge to attitude and practice was good among the respondents. Previous studies in Malaysia also reported that the higher a person's knowledge of dengue, the better their attitude towards dengue and the more likely they are to adopt proper prevention practices (Mohamad et al., 2014; Naing et al., 2011; Noor & Suddin, 2017). In addition, a significant positive correlation between attitudes and practices was observed. Previous studies have shown that people with better attitudes were more likely to practice proper dengue prevention measures (Suwanbamrung et al., 2021).

There are some limitations of the present study. All information was obtained through self-report, and it could not be verified whether the reported practice followed actual practice. Also, while enumerators were trained in conducting the survey, errors may occur when different enumerators explain the question differently when asked by the respondents, which may influence the responses.

CONCLUSION

In conclusion, residents in both hotspot and non-hotspot areas of Selangor, Malaysia, have a high level of knowledge about dengue. Nonetheless, continuous appropriate education is critical to ensuring that the community has accurate information about dengue. For instance, a sizable proportion of respondents in this study were unaware that they could contract dengue more than once; thus, dispelling any doubts about this risk is critical to ensuring that they do not become complacent and continue to practise preventive measures in their daily lives even if they have previously been infected. Additionally, this study reveals that respondents' attitudes toward dengue were significantly lower in non-hotspot areas. It is hoped that this information will assist authorities in designing and improving existing intervention programmes to be more effective and foster a more positive attitude toward dengue among residents of non-hotspot areas, which may influence the pattern of prevention practices.

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