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ORIGINAL PAPER

Cross-Sectional Survey on the Dengue Knowledge, Attitudes and Preventive Practices Among Students and Staff of a Public University in Malaysia

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Abstract Behavioural impact programmes are especially effective for dengue control and prevention. Universities are key settings for health promotion, so understanding factors that influence the practice of dengue prevention within a university community becomes important. This study aimed to examine the factors affecting dengue knowledge, attitude and preventive practices amongst students and staff of a public university. A cross-sectional survey study was conducted in Kuala Lumpur, Malaysia. A total of 372 students and staff of the NDUM were recruited by stratified sampling method. Data were collected via self-administered pre-tested structured questionnaires covering socio-demography and dengue KAP. Data were analysed descriptively. For bivariate analysis, Chi square test was applied. To explore the factors independently associated with the practice of dengue prevention, a logistic regression model was introduced. Overall, the participants had moderate dengue-related knowledge, good attitudes and good preventive practices. The majority had misconceptions about mosquito biting habits (83.8%), seasonality of dengue epidemics (73.2%), and mosquito breeding sites (70.3%). Staff were more likely to have good dengue-related knowledge ($p<0.001$) and attitudes ($p=0.008$) than students. There was statistically significant positive association between the level of dengue knowledge and monthly average household income ($p=0.008$), age ($p<0.001$) and education ($p<0.001$). Having good attitudes towards dengue was associated with being a non-Malay ($p=0.034$), having higher monthly average household income ($p=0.047$) and tertiary education ($p<0.001$). In regression analysis, only dengue knowledge and dengue attitudes were significantly and positively associated with practice of dengue prevention. Dengue preventive strategies amongst university students and staff should focus on maintaining good dengue-related preventive practices. Educational campaigns should mainly target students, young staff members, and those with lower level of education and income.

Keywords Dengue · Prevention · Knowledge · Attitude · Practice

Introduction

Over the past 50 years, dengue has evolved from a sporadic and relatively rare disease into a global public health problem. Southeast Asian countries share a disproportionate dengue burden [1]. From 2001 to 2010, the region lost 214,000 disability-adjusted life years and US$ 950 million a year due to dengue; the dengue burden is higher than that of upper respiratory infections and many other conditions [2]. In Malaysia, the incidence of dengue has risen dramatically over the past few decades, accounting for 31.6 cases per 100,000 population in 2000 and peaking at 361.4 per 100,000 population in 2014, the highest ever reported incidence of dengue [3]. Dengue ranks third in terms of mortality among infectious diseases in Malaysia after tuberculosis and HIV/AIDS [3].

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Currently, no licensed vaccine or chemoprophylaxis is available for the dengue virus. Vector control and personal protection remain the most effective measures for limiting dengue transmission [4, 5]. The vector is a day-biting *Aedes* mosquito that rests indoors and can breed in small collections of water, which contributes to problems in vector control [6]. However, sustainable involvement of the populations at risk in the prevention and control of dengue is the biggest challenge [7]. The WHO developed an approach to communication, advocacy and social mobilisation in neighbourhoods, educational and workplace settings, known as the Communication for Behavioral Impact (COMBI) [8]. COMBI emphasises the role of knowledge, attitudes and practices (KAP) surveys in identifying key barriers to desirable behaviors regarding dengue [9].

Despite the availability of dengue KAP studies in Malaysia and neighboring countries, their findings do not provide reliable universal indicators that could be used across contexts to understand dengue-related behavior. Hairul et al. [10] suggest that female gender is associated with good knowledge and preventive practices. However, a number of KAP studies did not reveal any significant relationship between gender and dengue preventive behaviour among different communities in Malaysia [11–13]. Leong [13] found a significant relationship between Malay ethnicity and better dengue KAP. Yet, Al-Dubai et al. [11] and Juni et al. [12] did not reveal any association between ethnicity and dengue preventive behaviour. Findings regarding the association of dengue preventive behavior with age and income level are also conflicting [12–17].

The findings should be compared with caution because each study had different study populations and criteria for measuring dengue KAP in addition to methodological strengths and limitations. Some of the research focused on specific residential, rural or semi-urban areas [10, 13, 16], whereas other studies were conducted among different communities [11, 17]. The questionnaires used in the studies differed greatly from each other. Thus, in some studies, the dengue knowledge component of the questionnaire included questions on disease transmission and dengue signs and symptoms [14] while others focused exclusively on mosquito biting and breeding habits [18, 19]. Several studies reported that they applied convenience sampling [11, 16, 20], and some studies did not specify a sampling method [12, 14], which might have compromised the generalizability of the findings.

Most of the dengue KAP studies in Malaysia have been conducted in residential settings. There is no local data available on dengue KAP within a university community that serves both as a school and a workplace—two key settings for health promotion [21, 22]. University settings have the potential to become disease hotspots with active transmission of agents and a negative impact on larger communities due to the close social contact, divergence of student behavior from non-student populations and permeability of universities' boundaries and groups [23]. Establishing the level of dengue KAP of the students and staff will enable the development of effective anti-dengue strategies in a context where it is easier to target large percentages of the population for preventive work. The aim of this study is to compare KAP towards dengue between students and staff of the National Defence University of Malaysia (NDUM) and to examine factors affecting dengue KAP among students and staff in order to inform public health authorities with regard to the prioritisation of dengue behavioral impact programs in university settings in Malaysia.

Methods

Study Design and Setting

This study applied a quantitative cross-sectional study design. Specifically, a questionnaire survey assessing dengue-related KAP amongst students and staff of the NDUM was carried out. The NDUM offers foundation (FD), undergraduate (UG) and postgraduate (PG) courses in engineering, management, sciences and medicine. The choice of the study site was determined by the NDUM location in the most populated and rapidly developing Kuala Lumpur Metropolitan Area, which is highly affected by dengue disease [24]. The people who are most vulnerable to dengue are of productive age, between 15 and 49 years old [25].

Participants

A stratified random sampling method was used to achieve a better representation of the study participants. The strata were defined by role in the university ('student' and 'staff'), year of enrolment for students and type of position for staff. Individuals aged 18 and above, who were employees or students of the NDUM at the time of the research, were included in this study. Medical students and staff with medical background were excluded. PG students also met exclusion criteria because most of them were present on campus only during examinations. Non-Malaysian citizens were excluded because their dengue-related KAP could have been influenced by factors that were not present in the study area. A sample size was calculated based on the population of 3773 students and staff that complied with inclusion and exclusion criteria, a 95% confidence level and a 5% margin of error. The expected prevalence of good KAP with regard to dengue was estimated as 50% based on previous studies [26]. By adding 15% to the calculated sample size to compensate for non-responses, the final sample size was 401 participants.

Sample recruitment and data collection were conducted from 1 to 27 June 2015. A structured validated questionnaire [27] was pre-tested, modified and used in this study. The questionnaire contained four domains: socio-demographic characteristics, dengue knowledge, attitudes towards dengue and preventive practices against dengue. Self-administered questionnaires, participant information sheets and informed consent forms were distributed through the NDUM official mailing system. Designated support staff in hostels and offices took consent and secured the forms with their signature. The questionnaires were distributed to those who had given informed consent. Upon completion, the participants put the questionnaires in boxes anonymously. Finally, the boxes with all the completed forms were collected at the student hostels and workplaces by the lead researcher.

Ethical Considerations

The study was approved by the University of Liverpool International Online Research Ethics Committee, and permission to conduct the study was granted by the local authorities. All questionnaires were completed anonymously. The informed consent forms were stored separately from the questionnaires and did not have any link with the completed questionnaire. To avoid language-related misunderstandings, all distributed forms were written in both Malay and English.

Data Analysis

The data were analysed using PASW 21 (SPSS, Chicago, IL) [28]. Each correct answer from the 'knowledge' domain received 1 point while incorrect and 'not sure' answers received 0 points. The options for the attitudes 'strongly agree', 'agree', 'not sure', 'disagree' and 'strongly disagree' were assigned points of 4, 3, 2, 1 and 0, respectively. Regarding the 'practice' domain, an answer of 'yes' was scored as 1 and an answer of 'no' as 0. Those who responded 'not applicable' were excluded from the analysis. The scores for 4 knowledge and 6 attitude negatively worded items were reverse coded to produce the same direction of scoring. The responses were summed up. Based on the cut-off of achieving more than 75 % of the total score for dengue KAP [26], a score of 13–17 points was categorised as 'good knowledge' while a score of 0–12 points was categorised as 'moderate to poor knowledge'; a score of 30–40 points was categorised as 'good attitudes' while a score of 0–29 was categorised as 'moderate to poor attitudes'; and a score of 8–11 points was categorised as 'good practices on preventive measures' while a score of 0–7 points was categorised as 'moderate to poor practices'. For descriptive purposes, the answers to the statements on dengue attitudes were collapsed into a 3-point scale ('agree', 'not sure', 'disagree').

The total scores for dengue KAP were treated as continuous data and tested for normality. All tested variables were negatively skewed and markedly non-normally distributed, so median and interquartile range (IQR) were used to describe the data. Frequencies and percentages were used to describe the categorical variables. Statistical significance for the comparison of dengue KAP levels between students and staff as well as between people with different socio-demographic characteristics was calculated using a Chi square test. A logistic regression technique was used to explore the factors affecting dengue preventive practice. Socio-demographic factors, dengue knowledge level and dengue attitude level were regressed onto the dengue preventive practice level as a dependent variable. A multiple logistic regression model was introduced to identify the independent effects of exploratory variables defined by univariate analysis. The level of significance was established as $p \leq 0.05$.

Results

Descriptive Analysis

A total of 372 individuals participated in this study. The overall response rate was 94.9 %. Table 1 provides socio-demographic characteristics of the participants. Students accounted for 79.0 % (294/372) of the sample. The majority were males (71.8 %; 267/372) with at least high school education (72.0 %; 268/372) and in the group with an age range of 18–30 years old (88.4 %; 329/372).

Total scores of knowledge, attitudes and preventive practices in this sample displayed a median of 11 (IQR = 10–12), 32 (IQR = 29–35) and 8 (IQR = 7–10), respectively. Based on the established cut-offs, participants had moderate to poor dengue-related knowledge and good attitudes and self-reported preventive practices. Nearly all respondents were aware that dengue is spread by bites of *Aedes* mosquito (97.6 %; 363/372) that breeds in clean, stagnant water (86.8 %; 323/372) and recognized fever as the main symptom of dengue infection (97.0 %; 361/372). The majority of respondents knew other main symptoms of dengue such as body pain (87.4 %; 325/372) and headache (84.6 %; 314/371). However, more than one-third incorrectly indicated that heart attack is among the main symptoms (37.6 %; 137/364) and the majority were not aware that there is no specific treatment for dengue (64.5 %; 240/372). Only 16.2 % of the participants (60/370) were aware that dengue spreads mainly during daylight hours (data not shown).

With regards to dengue-related attitudes, a large majority were concerned about dengue (95.1 %; 353/371) and believed that immediate treatment is necessary for dengue (95.2 %; 352/370). Of all the participants, only 10 % (37/371) believed that the elimination of *Aedes* mosquito

Table 1 Socio-demographic characteristics of the participants (n = 372)

Characteristics	n	%
Age group (years old)		
18–30	329	88.4
31–40	26	7.0
41–50	7	1.9
Over 51	10	2.7
Gender		
Male	267	71.8
Female	105	28.2
Ethnicity		
Malay	338	90.9
Chinese	10	2.7
Indian	18	4.8
Others	6	1.6
Average monthly income		
Less than MYR 3000	188	50.5
MYR 3000–5900	113	30.4
Over MYR 5900	71	19.1
Highest educational level		
Primary school	1	0.3
Lower secondary education	5	1.3
Secondary school	98	26.3
High school	211	56.7
Diploma	16	4.3
Degree	41	11.0
Occupation		
Student		
FD	92	24.7
UG	202	54.3
Academic staff	28	7.6
Non-academic staff	50	13.4

breeding sites is a waste of time. The majority (83.3 %; 310/372) admitted that individuals play an important role in the prevention of dengue (data not shown).

For prevention of dengue, the majority of participants reported that their water tank has a cover (92.3 %; 336/364) and they cover water containers immediately after use (82.4 %; n = 304/369). Self-reported participation in community 'clean our surroundings' campaigns was also high (81.9 %; n = 303/370). However, more than half (57.7 %; n = 211/366) do not use window or door screening against mosquitoes (data not shown).

Bivariate and Multivariate Analysis

Table 2 presents the association between knowledge, attitudes and practice of dengue prevention and factors that may affect them in the study population. Staff were more likely to have good dengue-related knowledge ($\chi^2 = 20.60$, $p < 0.001$) and attitudes ($\chi^2 = 6.93$, $p = 0.008$) than students. There was a statistically significant positive association between the level of dengue knowledge and monthly average household income ($\chi^2 = 9.60$, $p = 0.008$), age ($\chi^2 = 15.00$, $p < 0.001$) and education ($\chi^2 = 21.62$, $p < 0.001$). Having good attitudes towards dengue was associated with being a non-Malay ($\chi^2 = 4.50$, $p = 0.034$), having a higher monthly average household income ($\chi^2 = 6.12$, $p = 0.047$) and tertiary education ($\chi^2 = 13.77$, $p < 0.001$). There was no statistically significant association between dengue prevention practices and socio-demographic variables.

The results of multiple logistic regression are presented in Table 3. The final model documented that dengue knowledge [OR = 2.09, 95 % CI (1.12, 3.92)] and attitudes [OR = 1.71, 95 % CI (1.03, 2.84)] were both independently associated with good dengue-related preventive practices. This model could explain only 5.3 % of the variability.

Discussion

We found a moderate level of dengue-related knowledge, which is consistent with the results of community-based studies in Malaysia [10, 11]. There was a gap in knowledge regarding the daytime biting habits of *Aedes* mosquitoes and dengue seasonality among the study participants, and this is consistent with other studies across the region [11, 29]. The findings of this study demonstrated that participants were knowledgeable of dengue fever symptoms. This is crucial as a person must be able to recognise disease and seek adequate medical help in a timely manner [30]. However, only slightly more than one-third of the participants were aware that there is no specific treatment against dengue. Incorrect knowledge regarding treatment may result in detrimental self-treatment practices and hamper patients from seeking medical assistance [31]. There is evidence that a substantial number of people believe that dengue can be treated with antimalarial drugs or antibiotics [18].

This study showed that the university community had good attitudes towards dengue, with the median total score corresponding to over 75 % of the maximum possible attitudinal score. This distinguishes our results from the findings of community-based dengue KAP studies in Malaysia. For example, Al Dubai et al. [11] reported that only 4 % of the respondents in rural, semi-urban and urban areas were concerned about dengue fever, and a substantial percentage believed the elimination of mosquito breeding sites to be a waste of time. It could be hypothesised that university community members were more likely to perceive dengue as a serious concern because either them or their families or friends may have been exposed to previous dengue fever

Table 2 Association between socio-demographic factors and dengue knowledge, attitudes and preventive practices

Socio-demographic variables	Knowledge (%)		χ^2 (p value)	Attitudes (%)		χ^2 (p value)	Preventive practices (%)		χ^2 (p value)
	Moderate to poor	Good		Moderate to poor	Good		Moderate to poor	Good	
Age group									
18–30 years	251 (80.4)	61 (19.6)	15.00 (<0.001)	107 (32.9)	218 (67.1)	2.53 (0.112)	110 (39.0)	172 (61.0)	2.30 (0.129)
>30 years	20 (52.6)	18 (47.4)		9 (20.9)	34 (79.1)		10 (26.3)	28 (73.7)	
Gender									
Male	195 (78.9)	52 (21.1)	1.11 (0.293)	87 (33.0)	177 (67.0)	0.89 (0.346)	89 (38.7)	141 (61.3)	0.50 (0.480)
Female	76 (73.8)	27 (26.2)		29 (27.9)	75 (72.1)		31 (34.4)	59 (65.6)	
Ethnicity									
Malay	243 (76.7)	74 (23.3)	1.15 (0.284)	111 (33.1)	224 (66.9)	4.50 (0.034)	110 (37.5)	183 (62.5)	<0.001 (0.959)
Non-Malay	28 (84.8)	5 (15.2)		5 (15.2)	28 (84.8)		10 (37.0)	17 (63.0)	
Monthly average household income									
<MYR3000	149 (84.2)	28 (15.8)	9.60 (0.008)	68 (36.8)	117 (63.2)	6.12 (0.047)	62 (37.8)	102 (62.2)	0.02 (0.988)
MYR3000-5900	74 (71.8)	29 (28.2)		33 (29.5)	79 (70.5)		36 (37.5)	60 (62.5)	
>MYR5900	48 (68.6)	22 (31.4)		15 (21.1)	56 (78.9)		22 (36.7)	38 (63.3)	
Highest educational level									
Secondary	243 (81.8)	54 (18.2)	21.62 (<0.001)	110 (35.4)	201 (64.6)	13.77 (<0.001)	104 (38.8)	164 (61.2)	1.20 (0.273)
Tertiary	28 (52.8)	25 (47.2)		6 (10.5)	51 (89.5)		16 (30.8)	36 (69.2)	

Table 3 Logistic regression analysis of factors associated with good dengue preventive practices

Predictor variables	Univariate analysis		Multivariate analysis	
	OR (95 % CI)	p value	OR (95 % CI)	p value
Age group				
18–30 years	1		–	
>30 years	1.79 (0.84, 3.83)	0.133	–	
Gender				
Male	1		–	
Female	1.20 (0.72, 2.00)	0.480	–	
Ethnicity				
Malay	1		–	
Non-Malay	1.02 (0.45, 2.31)	0.959	–	
Monthly average household income				
<MYR3000	1		–	
MYR3000-5900	1.01 (0.60, 1.70)	0.961	–	
>MYR5900	1.05 (0.57, 1.94)	0.876	–	
Highest educational level				
Secondary	1		–	
Tertiary	1.43 (0.75, 2.70)	0.275	–	
Dengue knowledge				
Moderate to poor	1		1	
Good	2.36 (1.28, 4.38)	0.006	2.09 (1.12, 3.92)	0.021
Dengue attitudes				
Moderate to poor	1		1	
Good	1.90 (1.17, 3.08)	0.009	1.71 (1.03, 2.84)	0.039

situations due to living in an area highly affected by dengue [24].

Previous community-based research in Malaysia reported insufficient dengue control practices [15, 16]. However, this was not the case in this study. Overall, more than 75 % of the respondents reported that they complied with correct dengue preventive behaviour. A possible explanation for higher levels of preventive practices among the NDUM students and staff could be related to previous experience of dengue in a highly endemic area [17]. Alternatively, people studying and working in a public university could possibly be more compliant with government policies with regard to infectious disease prevention and control than those from the private sector, including recommendations from the MOH with regard to infectious disease prevention and control.

In the study setting, the staff exhibited significantly higher dengue knowledge and attitude scores than students. However, roles within the university are strongly related to age and education. Therefore, socio-demographic variables—and not role in the university—were later included in a regression model to measure the contribution of independent predictors of good dengue preventive practices. Nevertheless, the implication of comparison dengue KAP between students and staff was that, in the university setting, more persuasive messages on dengue prevention should be used amongst students than staff.

In the present study, individuals below 30 years of age have lower levels of dengue-related knowledge. This is supported by an earlier study among a rural population in Malaysia with a similar sample size [13]. The lack of knowledge in younger persons could be explained by a smaller amount of time spent watching TV, which was found to be the main source of information about dengue prevention [16].

We found that attitudes towards dengue were significantly better among Chinese, Indian and other ethnicities than among Malay. In contrast, Leong [13] reported the opposite findings among a rural population. The difference in findings may be attributable to differences in study populations. Malay living in rural areas are known to have a more traditional lifestyle, spending large amounts of time in and around the house and thus developing positive attitudes towards the elimination of mosquito breeding sites.

In our study, individuals with higher education and income were more likely to have good knowledge and attitudes than those less educated and with lower income. Several earlier studies in Malaysia similarly found that education was an important determinant of dengue knowledge and attitudes [11, 13, 17]. In contrast, most previous studies did not reveal an association between dengue KAP and monthly household income [11, 12].

Based on the results of multiple logistic regression analysis, both knowledge and attitudes were found to strongly

predict good dengue-related preventive practices. Previous research has shown conflicting results. Many studies have similarly reported a significant and positive association of dengue knowledge and attitude with prevention and control practices [16, 17]. Nevertheless, both factors can confound the effects of each other. Thus, a study in urban Malaysia found that the association between dengue knowledge and preventive practices lost significance when the attitude variable was added to the model [32].

There were certain limitations in this study. The insignificance of associations of socio-demographic factors with dengue preventive practices could be partly explained by the homogenous socio-demographic characteristics of the sample. Students accounted for almost 80 % of the sample. Comparison of the other studies presented serious challenges because the studies varied in sample size and study area. Other studies used different cut-offs for age, education and income groups. The study populations differed according to residence, economic standards and epidemiologic situation regarding dengue. Moreover, different criteria for measurement of the dengue KAP level were used. Most of the studies were community-based and more heterogeneous in terms of the socio-demographic characteristics of the sample than the current study. With regard to generalizability, the results of this study are mostly applicable to public universities in Malaysia. There are concerns about whether the findings can be generalized to populations at large, particularly rural populations, or to tertiary educational institutions in other countries with different cultural backgrounds.

Recommendations

- Health promotion campaigns should target universities to support them as centres of excellence in terms of good dengue preventive behavior. Universities provide a health resource to a significant percentage of the population. They also provide access to target populations that are difficult to reach through household health promotion activities.
- There is a need for continuous health promotion campaigns in university settings to ensure the sustainability of dengue control programmes. Our results were obtained during the largest dengue epidemic ever, so there is a high possibility that the current unprecedented outbreak only temporarily mobilised the community to take action.
- Dengue education campaigns should be specifically reinforced among students and young staff members, staff without tertiary education and in households with low average monthly income. Such education campaigns should address the identified gaps in dengue-related knowledge.

Conclusion

This study provides useful information that could guide public health authorities in developing programmes and activities aimed at dengue prevention and control in university settings in Malaysia. We argue that to be most effective dengue-related knowledge and attitudes should be maintained at appropriate level. There is an important need for further research in educational and workplace settings in Malaysia that generates empirically sound and context-specific data to identify factors associated with effective dengue preventive practices.

Compliance with Ethical Standards

Conflict of Interest The author declares no conflict of interest.

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