**ORIGINAL ARTICLE**

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# Positive impact of educational intervention on knowledge, attitude, and practice towards dengue among university students in Malaysia

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## Abstract

**Introduction** Dengue continues to have a significant effect on the general population of Malaysia, particularly in urban areas, and it is important to ensure that members of the public have adequate awareness to curb the disease.

**Aim** This study assesses the baseline knowledge, attitude, and practice (KAP) levels among university students and the impact of educational intervention on KAP levels.

**Subjects and methods** The study consists of part 1 (baseline study) with 307 students and part 2 (impact of the intervention study) with 85 students. A validated self-administered questionnaire was used to determine KAP levels. For part 2, baseline KAP was obtained before the intervention, and the post-intervention KAP was obtained after 1 month.

**Results** In part 1, only 26.1% have a good knowledge level regarding dengue, but the majority have good attitude (88.6%) and practice (71.0%). In part 2, the knowledge levels obtained pre-intervention were poor (mean score, $10 \pm 2.46$), while attitude and practice were good (mean scores, $8.82 \pm 1.35$ and $6.92 \pm 2.5$, respectively). The mean scores post-intervention increased for all KAP domains after the health campaign with knowledge at $12.61 \pm 0.17$, attitude $9.01 \pm 1.09$, and practice $7.11 \pm 2.49$. This study revealed that educational intervention was effective in creating awareness about dengue and that the social media is the most used and preferred source of information for respondents for learning about dengue.

**Conclusion** Health authorities could implement a nationwide dengue awareness programme focusing on social media and other media as a platform to disseminate information regarding disease and outbreaks and to promote healthy lifestyles.

**Keywords** Dengue · Educational intervention · Knowledge, attitudes, and practices (KAP) · Urban health · Public health

## Introduction

Dengue fever causes a major vector-borne public health problem in tropical countries. According to the World Health Organisation, approximately 2.5 billion individuals around the world live under the threat of this disease, including its severe forms, known as dengue haemorrhagic fever and dengue shock syndrome (WHO 2009). Dengue carries one of the highest disease burdens in Southeast Asia (SEA) and has been hyperendemic for decades. Moreover, dengue infection has caused significant economic burdens in the affected countries. A study conducted in 12 countries in the SEA region from 2001 to 2010 showed that dengue led to costs of US$950 million a year there (Shepard et al. 2013). Hence, the economic burden can be reduced if the disease can be prevented.

In general, this disease is highly associated with urbanisation and cities, which are known to be ideal habitats for the urban vector (Mulligan et al. 2012). More importantly, DF has become the major cause of morbidity and mortality in Malaysia (Cheah et al. 2014). Several major national outbreaks were reported in 1974, 1978, 1982, and 1990, exhibiting a 4-year cycle (Muhammad Azami et al. 2011). In addition, 108,698 cases were reported in 2014 with 56% detected in the Klang Valley, while Selangor and the Federal Territory of Kuala Lumpur-Putrajaya contributed 49% of the cases (Mudin 2015). It is worrying that Selangor had the highest percentage of cases reported consecutively for 2015 and 2016 with 50.6 and 52.3%, respectively (Department of Statistics Malaysia 2017).

Dengue is a vector-borne viral infection commonly found in tropical and subtropical areas worldwide. Dengue infection is caused by a single-strand RNA virus that belongs to the Flaviviridea family, which is comprised of four different

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serotypes, namely DENV-1, DENV-2, DENV-3, and DENV-4. Generally, it can infect individuals of any gender, age group, or ethnicity (Cheah et al. 2014). More importantly, so far there is no cure for this disease (Koenraadt et al. 2006). The basic principles to control dengue involve reducing the number of mosquito breeding places, shortening the survival rate of the mosquito, preventing human-vector contact, and identifying and managing cases as early as possible (Jayawardene et al. 2011).

Dengue fever can be prevented, but doing this successfully greatly depends on communities' knowledge, attitudes, and practices (KAP) (Alyousefi et al. 2016). Furthermore, the rate of community participation relies heavily on the awareness, knowledge, and attitude of the public about the disease (Jeelani et al. 2015). On a similar note, behavioural impact programmes have been proven effective in controlling and preventing dengue. Education campaigns have also played a role in increasing people's awareness of this disease, but the extent to which this knowledge has been put into practice and how it has helped in reducing the transmission of the disease are still unclear (Wan Rozita et al. 2006). Moreover, universities have been the key settings for health promotion; increased understanding in university communities has become significantly important as it is believed to positively influence the practice of dengue prevention (Lugova and Wallis 2017). However, students had the lowest knowledge score compared with teachers and supervisors (Khamis Nahla Ibrahim et al. 2009). Therefore, more focus should be placed on students to increase their awareness regarding dengue infection.

This study was conducted to assess the level of baseline knowledge, attitude, and practice (KAP) among university students regarding dengue infection to determine the most effective media for dengue awareness and to evaluate the impact of an educational intervention in the form of a health education programme to improve the participants' KAP levels.

## Methodology

### Study design

The present study consisted of two parts: part (1): the baseline KAP study followed by collection of part (2): pre- and post-intervention data. The first part of the study was cross sectional and performed using a self-administered questionnaire on 307 students. Recruitment of respondents was performed by first circulating an advertisement to invite members of the university to a dengue awareness talk. During the day of the campaign, all available students were invited to the event and given a briefing on the study, after which respondents signed informed consent forms and filled in the baseline questionnaire prior to admittance to the campaign venue. Then, the

Health Education Campaign was delivered by invited personnel from the Ministry of Health Malaysia. One month after the date of the campaign, respondents were contacted and invited to the post-intervention study, and a total of 85 respondents voluntarily participated in the follow-up session. Respondents were then given the same questionnaire to assess the effectiveness of the intervention in improving the KAP of respondents. This research was conducted from January to December 2016. All aspects of the study protocol were reviewed and approved by the CUCMS Research Ethics Review Committee (CRERC) and conducted at the Cyberjaya University College of Medical Sciences (CUCMS) Main Campus.

### Study instrument and data collection

The instruments employed in the present study comprised a questionnaire as well as an intervention in the form of a health education campaign. The questionnaires were adapted from Al-Zurfi et al. (2015) and were validated before being administered to the participants. The questionnaire used in this study was divided into five parts—part A (demographic information), B (knowledge), C (attitude), D (practice), and E (effectiveness of media)—to evaluate the KAP of respondents as well as the relevance of various communication outlets used for disseminating dengue awareness information. Part B of the questionnaire had 15 questions to assess the knowledge of respondents with a score of 1 point for each correct answer. Those who scored 12 points or more were considered to have a good level of knowledge. Part C had ten questions that focused on attitude with 1 point given for each agreed upon statement, denoting a positive attitude. Those scoring 8 points or more were considered to have good attitudes. Part D is the practice domain with a total of 11 statements. One point was given for each positive answer, and those scoring 6 points or more had a good level of practice.

### Pilot study

A pilot study was carried out on a total of 50 students, and face validation performed for the whole questionnaire showed that the questionnaire was comprehensible and relevant. Cronbach's alpha for part B was 0.816, for part C was 0.723, for part D was 0.785, and for part E was 0.713.

### Statistical analysis

All the data were analysed using IBM SPSS software v.20. Descriptive analysis was used and the results reported in terms of frequency and percentages. Paired t-test was utilised to compare the mean scores of the KAP domains pre- and post-intervention. Correlations between KAP domains were assessed using Spearman's rho. Normality of the data was

checked for all data to determine the appropriate analysis, and the results were only considered significant if $p < 0.05$.

## Results

### Part 1: Baseline KAP study

#### Socio-demographic data

A total of 307 undergraduate students were selected for this study; 247 (80.5%) were females and 60 (19.5%) males with mean age 21.44 years old (SD ± 1.90). The respondents were from multiracial backgrounds, but most were Malay (251, 81.8%), followed by Chinese with 22 (7%), Indian with 27 (8.8%), and other ethnicities 7 (2.3%).

#### Baseline levels of knowledge, attitude, and practice

The overall baseline level of knowledge, attitude, and practice of respondents presented in Table 1 shows most respondents (73.9%) had poor knowledge (mean ± SD 10.10 ± 2.12) but good attitudes regarding dengue (mean ± SD 9.00 ± 1.17) and a good level of practice of prevention measures (mean ± SD 6.90 ± 2.57). The findings revealed that most of the respondents (85.3%) could identify the vector of the virus, *Aedes aegypti*. More specifically, 94.8% of the 307 respondents correctly identified the breeding sites, 97.7% were familiar with the signs and symptoms of dengue fever, 65.5% of the students realised that dengue is a flu-like illness, 96.4% recognised the fact that dengue affects all age groups, 71.3% were aware that there is no vaccine for dengue, and 90.6% knew that dengue can be controlled by combating the breeding of mosquitoes. However, only 59.6% knew about the life cycle of the Aedes mosquito, 68.4% of the students scored poorly regarding the onset of the epidemic, and only 55% knew that direct blood contact would not spread the disease. Most (54.7%) knew the transmission cycle of dengue, mosquito biting times (63.8%), and the use of "Abate" (54.4%). However, 54.1% incorrectly thought that paracetamol is the drug of choice for dengue treatment, and 56.4% knew that they were still at risk for dengue even if a family member had been diagnosed with the illness. The student responses are summarised in Table 2.

In terms of Attitude scores, 66.4% of the respondents were aware that they were at risk of getting dengue, while 96.7% realised that dengue is a serious illness. Moreover, 89.9% of the respondents were confident that dengue can be prevented, whereas 98.0% agreed that the public plays a very important role in curbing dengue. The summary of the responses is presented in Table 3.

The Practice scores of respondents were good. The current research shows that the respondents play their role in ensuring that all the possible mosquito breeding sites around their house are inspected, covered, or discarded. However, only 30% of them use temephos to eliminate the larvae. The response details are shown in Table 4.

#### Correlation among the domains of knowledge, attitude, and practice

In this study, Spearman's correlation was utilised to assess the relationship between domains and revealed a weak positive correlation ($r = 0.153$, $p = 0.01$) between knowledge and attitude as well as weak positive correlation ($r = 0.118$, $p = 0.05$) between knowledge and practice. The correlation between attitude and practice showed an insignificantly negative relationship.

#### Preference of information source

The majority of the respondents (44%) indicated that they obtained dengue-related information from social media (Fig. 1). This was also reflected by their selection of social media as the preferred information source, as shown in Fig. 2.

#### Effectiveness of the intervention

Section E of the questionnaire explored the effectiveness of the media used to disseminate information regarding dengue.

**Table 1** Baseline level of knowledge, attitude, and practice

| Variables | Good, n (%) | Poor, n (%) | Mean (SD) | Scoring | |
|---|---|---|---|---|---|
| Knowledge | 80 (26.1) | 227 (73.9) | 10.10 (2.12) | 1 = Correct 2 = False/do not know | ≥ 12 good, maximum 15 |
| Attitude | 272 (88.6) | 35 (11.4) | 9.00 (1.17) | 1 = Agree 2 = Disagree | ≥ 8 good, maximum 10 |
| Practice | 218 (71.0) | 89 (29.0) | 6.90 (2.57) | 1 = Yes 2 = No | ≥ 6 good, maximum 11 |

**Table 2** Summary of responses on knowledge about dengue

| No | Statement | Responses | Distribution (%) |
|----|-----------|-----------|------------------|
| B1 | Dengue fever is caused by the mosquito *Aedes aegypti* | Yes* | 262 (85.3) * |
|    |  | No | 45 (14.7) |
| B2 | Life cycle of the Aedes mosquito is 1 week | Yes* | 183 (59.6) * |
|    |  | No | 124 (40.4) |
| B3 | Stagnant water is the main source for mosquito breeding | Yes* | 291 (94.8) * |
|    |  | No | 16 (5.2) |
| B4 | Dengue is a flu-like illness | Yes* | 201 (65.5) * |
|    |  | No | 106 (34.5) |
| B5 | Dengue epidemics start during hot weather | Yes | 210 (68.4) |
|    |  | No* | 97 (31.6) * |
| B6 | Dengue fever affects all age groups | Yes* | 296 (96.4) * |
|    |  | No | 11 (3.6) |
| B7 | Chills and high fever, intense headache, muscle and joint pains are the most common presentation of dengue fever | Yes* | 300 (97.7) * |
|    |  | No | 7 (2.3) |
| B8 | Dengue fever can be transmitted by direct blood contact | Yes | 138 (45.0) |
|    |  | No* | 169 (55.0) * |
| B9 | Transmission cycle is "man-mosquito-man" | Yes* | 168 (54.7) * |
|    |  | No | 139 (45.3) |
| B10 | Mosquitoes transmitting dengue only bite in the early morning (4.00–8.00 a.m.) | Yes | 111 (36.2) |
|    |  | No* | 196 (63.8) * |
| B11 | Dengue is controlled by combating the breeding of mosquitoes | Yes* | 278 (90.6) * |
|    |  | No | 29 (9.4) |
| B12 | "Abate" can be beneficial in killing mosquito larvae | Yes* | 167 (54.4) |
|    |  | No | 140 (45.6) |
| B13 | There is a vaccine for dengue fever | Yes | 88 (28.7) |
|    |  | No* | 219 (71.3) |
| B14 | Paracetamol (Panadol®) is the drug of choice for dengue treatment | Yes | 166 (54.1) |
|    |  | No* | 141 (45.9) |
| B15 | Do I have to worry if one of my family members was diagnosed with dengue fever a year ago? | Yes* | 173 (56.4) |
|    |  | No | 134 (43.6) |

*Correct

The results showed that 99.7% of the respondents understood the importance of knowing about dengue. Most of the respondents (64.8%) stated that they tend to believe the information available on social media but feel that it is not adequate. Details of responses are shown in Table 5.

## Part 2: Pre- and post- intervention

### Socio-demographic data

Eighty-five undergraduate students were selected for the intervention study; 76 (89.4%) respondents were females. Sixty-eight (80%) of the respondents were from the Faculty of Pharmacy, 11 (14.1%) from the Faculty of Medicine, and 5 (5.9%) were Foundation students. The respondents were from multiracial backgrounds with the majority being Malay students, representing 59 (69.4%) of the total respondents, followed by 17 (20%) Chinese students, 7 (8.2%) Indian students, and 2 (2.4%) in th others category.

### Overall pre- and post-intervention scores

According to Table 6, there was an increase in all KAP domains in the post-intervention results. However, only the increase in knowledge was found to be significant after the health education campaign had been conducted ($p < 0.05$). A specific breakdown of the respondents' feedback is summarised according to the following domains: knowledge (Table 7), attitude (Table 8), and practice (Table 9).

**Table 3** Summary of responses on the attitude towards dengue

| No | Statement | Responses N (%) | |
|----|-----------|------|------|
| | | Agree | Disagree |
| C1 | I am afraid of dengue fever | 281* (91.5) | 26 (8.5) |
| C2 | Dengue is a serious illness | 297* (96.7) | 10 (3.3) |
| C3 | Dengue fever cannot be prevented | 31 (10.1) | 276* (89.9) |
| C4 | I am at risk of getting dengue | 204* (66.4) | 103 (33.6) |
| C5 | It is not necessary to seek immediate treatment for dengue fever as there is no cure for it | 41 (13.4) | 266* (86.6) |
| C6 | The public has the most important role in dengue control | 301* (98.0) | 6 (2.0) |
| C7 | It is not the responsibility of the public health staff and local government to prevent dengue | 39 (12.7) | 268* (87.3) |
| C8 | Fogging is not enough to prevent dengue | 294* (95.8) | 13 (4.2) |
| C9 | Elimination of larval breeding grounds is a complete waste of time | 24 (7.8) | 283* (92.2) |
| C10 | It is likely that dengue will spread in the future | 292* (95.1) | 15 (4.9) |

*Graded with 1 point

## Correlation among the domains of knowledge, attitude, and practice

In this study, Spearman's correlation was utilised to assess the relationship among KAP domains. Pre-intervention, the result revealed a weak positive correlation that was statistically significant, $r = 0.244$, $p < 0.05$, between knowledge and attitude. All other correlations were insignificant. Post-intervention, all KAP domains showed no significant correlations.

## Discussion

### Baseline KAP of respondents

This study has provided reliable insights concerning the baseline knowledge, attitude, and practice (KAP) regarding dengue fever among university students. The findings revealed that 73.9% of the respondents have poor baseline knowledge regarding dengue; this was higher than the previous findings

**Table 4** Response of students on practices to combat dengue

| No | Statement | Responses N (%) | |
|----|-----------|------|------|
| | | Yes* | No |
| D1 | Do you cover water jars at home? | 250 (81.4) | 57 (18.6) |
| D2 | Do you cover water tanks at home? | 279 (90.9) | 28 (9.1) |
| D3 | Do you regularly inspect the refrigerator tray? | 165 (53.7) | 142 (46.3) |
| D4 | Do you examine mosquito larvae both indoors and outdoors? | 182 (59.3) | 125 (40.7) |
| D5 | Do you drain water from flower pots? | 218 (71.0) | 89 (29.0) |
| D6 | Do you examine any discarded material that may hold water? E.g.: car tires, empty bottles | 244 (79.5) | 63 (20.5) |
| D7 | Do you use mosquito nets or mosquito coils at home? | 165 (53.7) | 142 (46.3) |
| D8 | Do you use mosquito repellant? | 225 (73.3) | 82 (26.7) |
| D9 | Do you participate in community cleaning activities? | 172 (56.0) | 135 (44.0) |
| D10 | Do you participate in community fogging in your area? | 125 (40.7) | 182 (59.3) |
| D11 | Do you use temephos, e.g., Abate®, to eliminate mosquito larvae? | 92 (30.0) | 215 (70.0) |

*Graded with 1 point

**Fig. 1** The major source of information for respondents was social media
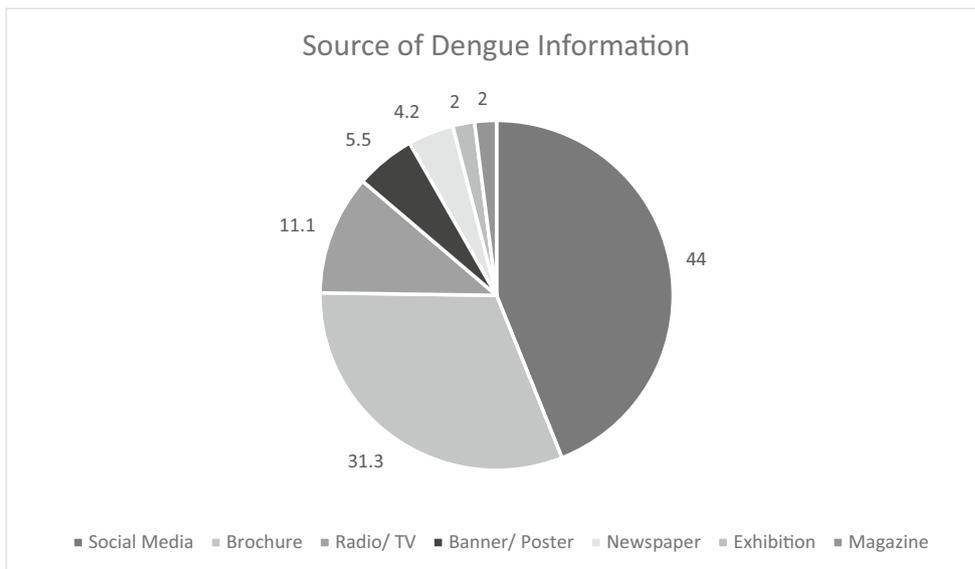


that indicated 63.2% of students possess good knowledge about dengue (Al-Zurfi et al. 2015). A possible explanation for the poor knowledge among the respondents could be the lack of exposure to dengue fever prior to this study, which indicated that knowledge regarding dengue is not widespread among the students. This is in line with results from a nationwide study involving 2512 Malaysians that showed the respondents on average had moderate knowledge about dengue and that higher knowledge scores were obtained by participants who had dengue experience compared with participants without it (Ping et al. 2015). According to the Health Belief Model (HBM), it is hypothesised that those who had high scores in the knowledge section had to have an interest in seeking information related to dengue (Ping et al. 2015). This could be because during an individual's experience with

dengue, they received much more information from health professionals and also took the initiative to seek information about the disease, which contributed to higher knowledge scores and vice versa. However, it has to be noted that the questionnaire used in this study separated the respondents into good and poor levels of knowledge and included those with a moderate level in the poor knowledge category. This was done to identify the key issues of concern related to dengue knowledge to be emphasised in dengue-related health communication efforts. Based on the results, emphasis should be given to conditions that would cause mosquitoes to thrive, conditions that facilitate the spread of disease, and the suitable treatment for dengue.

The data revealed that 88.6% of the respondents have good attitudes towards dengue. One of the possible contributing

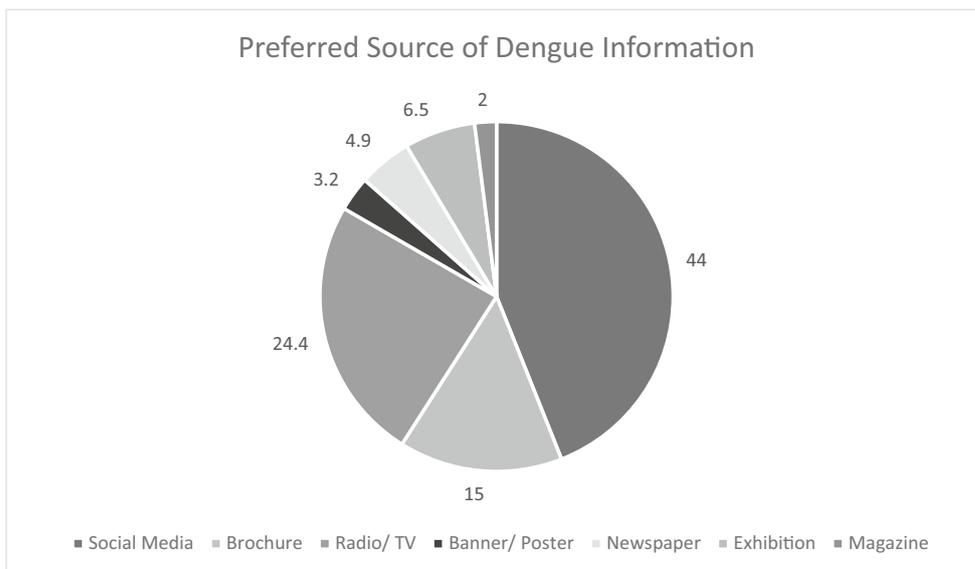**Fig. 2** The preferred source of information regarding dengue was social media

**Table 5** Effectiveness of the intervention

| No | Statement | Responses N (%) | |
|---|---|---|---|
| | | Yes | No |
| E3 | Do you think it is important to know about dengue? | 306 (99.7)** | 1 (0.3) |
| E4 | Have you ever participated in any dengue awareness exhibition previously? | 220 (71.7)** | 87 (23.3) |
| E5 | Do you understand what is provided in the information material? | 297 (96.7)** | 10 (3.3) |
| E6 | Do you think using the 3D model of the Aedes mosquito will help people identify the vector easily? | 245 (79.8)** | 62 (20.2) |
| E7 | Do you search for information about dengue fever in social media? Eg: Facebook, Twitter, Instagram, etc. | 185 (60.3)** | 122 (39.7) |
| E8 | Do you find social media provides relevant information that you need? | 236 (76.9)** | 71 (23.1) |
| E9 | Do you believe whatever stated in the social media? | 199 (64.8)** | 108 (35.2) |
| E10 | Do you feel the information provided in social media is adequate? | 104 (33.9) | 203 (66.1)** |
| E11 | Have you attended any activities to clear dengue breeding sites? E.g., Gotong-royong | 198 (64.5)** | 109 (35.5) |

**Majority response

factors that leads to the development of good attitudes among the students is their heightened awareness considering that they live in a city that is highly affected by dengue and the consistent efforts of Ministry of Health and local authorities to increase awareness about dengue. More importantly, they may have experienced dengue before or encountered dengue cases in the news, or among their friends and families, because the area has been declared a hotspot for dengue. Therefore, this may make them aware of the importance of preventive measures towards dengue. It has been demonstrated before that individuals who have been affected by dengue directly or through their friends or relatives have a significantly better attitude compared with individuals who have never encountered it (Wan Rozita et al. 2006).

In part 1, most of the students (71.0%) had overall good practice concerning dengue prevention. The majority of them played a very active role by covering, examining, and discarding any water that could possibly be a breeding site for mosquitoes. They also took the necessary care by protecting themselves from being bitten by the mosquitoes as 73.3% of the respondents used mosquito repellent, mosquito nets, and mosquito coils. However, temephos, such as Abate, is not widely used by the students. This finding is in agreement with a previous study where only 18% of the respondents were found to use temephos (Al-Dubai et al. 2013). Temephos is an organophosphate compound with a larvaecidal property that that can kill mosquito larvae. Nevertheless, not using temephos could be due to the incorrect

**Table 6** Knowledge, attitude, and practice regarding dengue pre- and post-intervention

| Domain | Pre-intervention scores | | Mean (SD) | Post-intervention scores | | Mean (SD) | $p$ value* | Interpretation |
|---|---|---|---|---|---|---|---|---|
| | Good (%) | Poor (%) | | Good (%) | Poor (%) | | | |
| Knowledge | 28.2 | 71.8 | 10 (2.46) | 80 | 20 | 12.61 (1.52) | < 0.01[b] | ≥ 12 good, max 15 |
| Attitude | 87.1 | 12.9 | 8.82 (1.35) | 91.8 | 8.2 | 9.01 (1.09) | < 0.05[b] | ≥ 8 good, max 10 |
| Practice | 64.7 | 35.3 | 6.92 (2.5) | 68.2 | 31.8 | 7.11 (2.49) | < 0.05[b] | ≥ 6 good, max 11 |

[b] Paired t test, *$p < 0.05$ shows statistical significance

**Table 7** Responses regarding knowledge about dengue pre- and post-intervention

| No. | Statement | Correct (pre) | | Correct (post) | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| B1 | Dengue fever is caused by the mosquito *Aedes aegypti* | 76 | 89.4 | 77 | 90.6 |
| B2 | Life cycle of the *Aedes* mosquito is 1 week | 52 | 61.2 | 69 | 81.2 |
| B3 | Stagnant water is the main place for mosquito breeding | 76 | 89.4 | 72 | 84.7 |
| B4 | Dengue is a flu-like illness | 48 | 56.5 | 77 | 90.6 |
| B5 | Dengue epidemics start during hot weather | 61 | 71.8 | 69 | 81.2 |
| B6 | Dengue fever affects all age groups | 83 | 97.6 | 74 | 87.1 |
| B7 | Chills and high fever, intense headache, muscle and joint pains are the most common presentations of dengue fever | 84 | 98.8 | 74 | 87.1 |
| B8 | Dengue fever can be transmitted by direct blood contact | 42 | 49.4 | 78 | 91.8 |
| B9 | Transmission cycle is "man-mosquito-man" | 51 | 60.0 | 66 | 77.6 |
| B10 | Mosquitoes transmitting dengue only bite in the early morning (4.00–8.00 am) | 52 | 61.2 | 71 | 83.5 |
| B11 | Dengue is controlled by combating the breeding of mosquitoes | 76 | 89.4 | 74 | 87.1 |
| B12 | Abate can be beneficial in killing mosquito larvae | 47 | 55.3 | 68 | 80.0 |
| B13 | There is a vaccine for dengue fever | 55 | 64.7 | 66 | 77.6 |
| B14 | Paracetamol (Panadol®) is the drug of choice for dengue treatment | 48 | 56.5 | 70 | 82.4 |
| B15 | Do I have to worry if one of my family members was diagnosed with dengue fever a year ago? | 36 | 42.4 | 67 | 78.8 |

*Graded with 1 point

## Preferred source of information and effectiveness

Health education is deemed very important in controlling diseases such as dengue as well as ensuring that community members have adequate understanding of the mechanisms of infection, including the aspects that require attention to prevent transmission, reduce severe disease forms, and avoid fatalities (Khun and Manderson 2007). The finding of this study revealed that 99.7% of the students think it is important to know about dengue, a positive indication of their awareness.

Furthermore, health education can be conveyed through various means, including television, radio, and newspapers (Gladys and Sungkar 2013). A separate study showed that the respondents preferred television (93%), newspapers

assumption that it is a harmful chemical or simply not knowing how to use it.

**Table 8** Responses regarding attitude towards dengue pre- and post-intervention

| No. | Statement | Agree (pre) | | Agree (post) | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| C1 | I am afraid of dengue fever | 77 | 90.6 | 78 | 91.8 |
| C2 | Dengue is a serious illness | 76 | 89.4 | 79 | 92.9 |
| C3 | Dengue fever cannot be prevented | 70 | 82.4 | 71 | 83.5 |
| C4 | I am at risk of getting dengue | 58 | 68.2 | 62 | 72.9 |
| C5 | It is not necessary to seek immediate treatment for dengue fever as there is no cure for it | 78 | 91.8 | 78 | 91.8 |
| C6 | The public has the most important role in dengue control | 73 | 85.9 | 76 | 89.4 |
| C7 | It is not the responsibility of the public health staff and local government to prevent dengue | 79 | 92.9 | 80 | 94.1 |
| C8 | Fogging is not enough to prevent dengue | 78 | 91.8 | 79 | 92.9 |
| C9 | Elimination of larval breeding grounds is a complete waste of time | 82 | 96.5 | 83 | 97.6 |
| C10 | Dengue is likely to spread in the future | 79 | 92.9 | 80 | 94.1 |

*Graded with 1 point

**Table 9** Practices to eradicate dengue pre- and post-intervention

| No | Statement | Yes (pre) | | Yes (post) | |
|---|---|---|---|---|---|
| | | n | % | n | % |
| D1 | Do you cover water jars at home? | 79 | 92.9 | 81 | 95.3 |
| D2 | Do you cover water tanks at home? | 60 | 70.6 | 63 | 74.1 |
| D3 | Do you regularly inspect the refrigerator tray? | 49 | 57.6 | 53 | 62.4 |
| D4 | Do you examine mosquito larvae both indoors and outdoors? | 61 | 71.8 | 62 | 72.9 |
| D5 | Do you drain water from flower pots? | 65 | 76.5 | 66 | 77.6 |
| D6 | Do you examine any discarded material that may hold water? E.g., car tires, empty bottles | 55 | 64.7 | 55 | 64.7 |
| D7 | Do you use mosquito nets or mosquito coils at home? | 57 | 67.1 | 59 | 69.4 |
| D8 | Do you use mosquito repellent? | 57 | 67.1 | 58 | 68.2 |
| D9 | Do you participate in community cleaning activities? | 42 | 49.4 | 43 | 50.6 |
| D10 | Do you participate in community fogging in your area? | 30 | 35.3 | 30 | 35.3 |
| D11 | Do you use temephos, e.g., Abate®, to eliminate mosquito larvae? | 33 | 38.8 | 34 | 40.0 |

*Graded with 1 point

(90.5%), and the internet (73%) as they are popular sources for obtaining dengue information (Bhanu Vaishnavi et al. 2015). Other studies found that radio and television are the predominant sources of information among the respondents (Shuaib et al. 2010; Dhimal et al. 2014). In contrast with these studies, the study respondents were all university students who perceive social media as the major source of information and the preferred method to obtain information. This is no surprise as Malaysia is a connected nation with 84% of users using the internet while on the go; incidentally, the age group represented in this study is from the cohort with the highest ownership of cell phones (MCMC 2017). The survey also showed that 88.1% use their smartphone for social networking and 87.5% use them to browse the internet. The proportion of Malaysians who utilise the internet to search for health information is not known. A study by Waldman et al. (2018) on the use of information and communications technology among college students in Bangladesh revealed that 12% of respondents used the internet to seek health information. A possible explanation for the shift to social media could be the widespread use of the internet and its convenient accessibility. Moreover, it is evident that social media can provide fast and reliable information (Cross 2014). However, a significant number of the students surveyed in this study (66.1%) did not feel that the information provided on social media is adequate, which explains why 56% of the students in this study still preferred conventional methods such as brochures, radio/television, and newspapers. This finding is not exclusive to this study because college students in Bangladesh used various media sources to seek health-related information and preferred television, campaigns, and printed materials (Waldman et al. 2018). This clearly shows that the current effort to distribute information via multiple media sources such as the internet, television, radio, and printed materials is still relevant and should be continued.

In addition, efforts such as placing more banners and posters along crowded sidewalks, roads, and even in schools will have a positive impact as they help increase awareness regarding dengue. However, notably only 2.4% of the students obtained information about dengue by attending exhibitions, probably because of students' busy schedules, which seem to hinder their attendance at the exhibitions. Hence, it is appropriate for the authorities to take measures that could involve students in exhibitions as volunteers. Finally, the least preferred channel of obtaining information about dengue among the students was magazines (1.2%), which can be explained by the hesitancy of most students to invest money and time to purchase magazines.

## Pre- and post-intervention

A group of 85 students were given the questionnaire again a month after determining the baseline KAP of the respondents. The initial baseline mean score was $10 \pm 2.46$; however, it increased to $12.61 \pm 0.17$ after the campaign. This is similar to other studies that found that the mean knowledge score in their studies increased after a health education programme (Al-Zurfi et al. 2015; Bhanu Vaishnavi et al. 2015). This further proves that knowledge improved among the study population after conducting the health education programme.

The students' post-intervention attitude score was higher compared with pre-intervention, shown by the increase in the overall score from $8.82 \pm 1.35$ to $9.01 \pm 1.09$. Moreover, the site where the present study was conducted has been

declared a hotspot area for dengue based on the frequent outbreaks and nuisances caused by mosquitoes, which may have led to a higher level of attitude about dengue prevention measures (Dhimal et al. 2014). Subsequently, individuals who fully perceive the risks of dengue and support controlling it tend to have better attitudes about the control and awareness of dengue.

Exposure to dengue through the intervention increased the perception of risk among the respondents, thus contributing to better attitude scores. Generally, the key to dengue control is reducing the gap between community knowledge and practice to eradicate the vector's breeding sites (Kyle and Harris 2008). The knowledge obtained from the campaign was then translated into good practices based on the increase in the mean scores for the practice questions post-intervention, particularly for two questions asking about regularly inspecting the refrigerator tray and covering water tanks. These two practices are easily carried out and practiced by the respondents. This observation also falls in line with the HBM theory that behaviours are driven by cues to action and self-efficacy (Ping et al. 2015). For example, students may now start to cover the water containers that they use for soaking clothes and checking to clean any containers that hold water to eliminate the breeding places of mosquitoes. Therefore, future health initiatives should include immediate, actionable, and easy steps to prevent dengue that the students can readily integrate into their daily lives and not just the usual recommendations that do not take into account some restrictions faced by students.

There was also an overall increase in the practice scores for each item, including the question on temephos. During the campaign, temephos was distributed among attendees of the campaign, and the methods to use it against mosquitoes were explained by the speaker. Therefore, this further suggests that if the distribution of temephos as an example can enhance the knowledge of respondents, it can be concluded that the utilisation of other 3D props in the education process may have positive impacts. Overall, the authorities should consider providing practical interventions in the future, and more efforts should be made to expose students to the current practices of dengue prevention, especially the use of temephos.

### Correlations between domains

Part 1 of this study showed a weak but positive correlation between knowledge and attitude, whilst in part 2 this relationship was observed during pre-intervention, but no correlation was found post-intervention. This was different from the study by Hairi et al. (2003) and Dhimal et al. (2014) who found a significant association between knowledge and practice. Adequate knowledge of dengue will result in positive attitudes since people will be more cautious about preventing infection when they are fully aware of the danger of dengue (Wiwanitkit 2010). Based on HBM, the attitude of participants regarding the importance of dengue prevention measures is influenced by their consideration of their susceptibility to the disease and how they regard its severity (Ping et al. 2015). As knowledge would increase their awareness regarding susceptibility to dengue and the severity of the illness, the impact on attitude would be positive. As the association was not observed post-intervention, future studies incorporating more participants may need to be conducted to establish the true association between knowledge and attitude.

The current study shows no significant association between knowledge and practice or attitude and practice. In relation to this, it must be acknowledged that the habits developed by a person cannot be changed instantaneously but rather must be formed over a longer period. This emphasises the need for continuous efforts towards health education on media platforms as this is deemed to have the most impact on the community. Encouragingly, a report from the Ministry of Health Malaysia reported that dengue cases decreased 17.3% in 2017 compared with the previous year (Health Ministry: Dengue cases down in 2017 2018). This indicates the importance of continued efforts to combat dengue to instil awareness in the public.

## Conclusion

Dengue is widely known as a major health hazard in Malaysia. Hence, it is important to apply proper preventive measures to stop the transmission of this disease. The interventional study suggests that the increase in knowledge can slightly influence the increase in positive attitude and practice of dengue prevention measures. In addition, social media was revealed to be the preferred source of information and was the source that allowed the students to obtain most of their knowledge regarding dengue infection. Therefore, it is highly recommended for the health authorities to increase the focus on social media to spread awareness regarding dengue. However, it is also important to use multiple channels to disseminate information regarding dengue such as the internet, television, and printed materials to ensure maximum reach to the public. In conclusion, efforts to increase awareness of dengue could benefit from the use of education campaigns and information dissemination using various media outlets leading to a positive impact on the knowledge, attitude, and practice regarding dengue among university students.

## Compliance with ethical standards

**Ethical approval**   This study has been reviewed by the CUCMS Research Ethics Review Committee (CRERC). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

**Conflict of interest**   The authors declare that they have no conflict of interest.

## References

Al-Dubai SAR, Ganasegeran K, Rahman Alwan M, Ahmed Alshagga M, Saif-Ali R (2013) Factors affecting dengue fever knowledge, attitudes and practices among selected urban, semi-urban and rural communities in Malaysia. Southeast Asian J Trop Med Public Health 44(1):37–49

Alyousefi TAA, Abdul-Ghani R, Mahdy MAK, Al-Eryani SMA, Al-Mekhlafi AM, Raja YA, Shah SA, Beier JC (2016) A household-based survey of knowledge, attitudes and practices towards dengue fever among local urban communities in Taiz governorate, Yemen. BMC Infect Dis 16(1):543. https://doi.org/10.1186/s12879-016-1895-2

Al-Zurfi BMN, Fuad MDF, Abdelqader MA, Baobaid MF, Elnajeh M, Ghazi HF, Ibrahim MH, Abdullah MR (2015) Knowledge, attitude and practice of dengue fever and health education programme among students of Alam Shah Science School, Cheras, Malaysia. Malays J Public Health Medicine 15(2):69–74

Bhanu Vaishnavi G, Shobha C, Narahari MG, Kurian J, Lalremruata B, Laldinpuii E, Baby FS (2015) Study of impact of health education on knowledge, attitude and practice related to dengue fever. World J Pharm Pharm Sci 4210(10):748–761

Cheah WK, Ng KS, Abdul Rahman M, Lum Chai See L (2014) A review of dengue research in Malaysia. Med J Malaysia 69

Cross M (2014) What is social media? In: Social media security. Elsevier, p 1–20. https://doi.org/10.1016/B978-1-59749-986-6.00001-1

Department of Statistics Malaysia (2017) Social Statistics Bulletin, Malaysia. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=aktTTjhhRHd1aHBCZGF1N01aaTl3dz09

Dhimal M, Aryal KK, Dhimal ML, Gautam I, Singh SP, Bhusal CL, Kuch U (2014) Knowledge, attitude and practice regarding dengue fever among the healthy population of highland and lowland communities in Central Nepal. PLoS One 9(7):e102028. https://doi.org/10.1371/journal.pone.0102028

Gladys, Sungkar S (2013) Effectiveness of health education on first aid of dengue haemorrhagic fever on school teachers in North Jakarta, 2011. eJKI 1(1):30–36

Hairi F, Ong C-HS, Suhaimi A, Tsung T-W, Anis Ahmad MA, Sundaraj C, Soe MM (2003) A knowledge, attitude and practices (KAP) study on dengue among selected rural communities in the Kuala Kangsar District. Asia Pac J Public Health 15(1):37–43. https://doi.org/10.1177/101053950301500107

Health Ministry (2018) Dengue cases down in 2017 compared to 2016. The Star Online https://www.thestar.com.my/news/nation/2018/01/10/dengue-cases-down-in-2017-compared-to-2016/#LTKijD0qOCzT8gFK.99. Accessed 10 Jan 2018

Jayawardene WP, Lohrmann DK, YoussefAgha AH, Nilwala DC (2011) Prevention of dengue fever: an exploratory school-community intervention involving students empowered as change agents. J Sch

Health 81(9):566–573. https://doi.org/10.1111/j.1746-1561.2011.00628.x

Jeelani S, Sabesan S, Subramanian S (2015) Community knowledge, awareness and preventive practices regarding dengue fever in Puducherry – South India. Public Health 129(6):790–796. https://doi.org/10.1016/J.PUHE.2015.02.026

Khamis Nahla Ibrahim R, Al-Bar A, Kordey M, Al-Fakeeh A (2009) Knowledge, attitudes, and practices relating to dengue fever among females in Jeddah high schools. J Infect Public Health 2:30–40. https://doi.org/10.1016/j.jiph.2009.01.004

Khun S, Manderson L (2007) Community and school-based health education for dengue control in rural Cambodia: a process evaluation. PLoS Negl Trop Dis 1(3):e143. https://doi.org/10.1371/journal.pntd.0000143

Koenraadt CJ, Tuiten W, Sithiprasasna R, Kijchalao U, Jones JW, Scott TW (2006) Dengue knowledge and practices and their impact on Aedes Aegypti populations in Kamphaeng Phet, Thailand. Am J Trop Med Hyg 74(4):692–700

Kyle JL, Harris E (2008) Global spread and persistence of dengue. Annu Rev Microbiol 62(1):71–92. https://doi.org/10.1146/annurev.micro.62.081307.163005

Lugova H, Wallis S (2017) Cross-sectional survey on the dengue knowledge, attitudes and preventive practices among students and staff of a Public University in Malaysia. J Community Health 42(2):413–420. https://doi.org/10.1007/s10900-016-0270-y

Malaysian Communications And Multimedia Commission (2017) Hand phone users survey 2017: statistical brief number twenty-two. Selangor: Malaysian Communications and Multimedia Commission. Retrieved from https://www.skmm.gov.my/skmmgovmy/media/General/pdf/HPUS2017.pdf

Mudin RN (2015) Dengue incidence and the prevention and control program in Malaysia. Int Med J Malaysia 14(1):5–9

Muhammad Azami NA, Salleh S, Neoh H, Syed Zakaria S, Jamal R (2011) Dengue epidemic in Malaysia: not a predominantly urban disease anymore. BMC Res Notes 4(1):216. https://doi.org/10.1186/1756-0500-4-216

Mulligan K, Elliott SJ, Schuster-Wallace C (2012) The place of health and the health of place: dengue fever and urban governance in Putrajaya, Malaysia. Health Place 18(3):613–620. https://doi.org/10.1016/J.HEALTHPLACE.2012.01.001

Ping WL, Sharina Mahavera MS, Narges A, Sazaly AB (2015) Factors affecting dengue dengue prevention practices: Nationwide survey of the Malaysian public. PLoS One 10(4):e0122890. https://doi.org/10.1371/journal.pone.0122890

Shepard DS, Undurraga EA, Halasa YA (2013) Economic and disease burden of dengue in Southeast Asia. PLoS Negl Trop Dis 7(2): e2055. https://doi.org/10.1371/journal.pntd.0002055

Shuaib F, Todd D, Campbell-Stennett D, Ehiri J, Jolly PE (2010) Knowledge, attitudes and practices regarding dengue infection in Westmoreland, Jamaica. West Indian Med J 59(2):139–146

Waldman L, Ahmed T, Scott N, Akter S, Standing H, Rasheed S (2018) We have the internet in our hands': Bangladeshi college students' use of ICTs for health information. Glob Health 14(1):31. https://doi.org/10.1186/s12992-018-0349-6

Wan Rozita WM, Yap BW, Veronica S, Muhammad AK, Lim KH, Sumarni MG (2006) Knowledge, attitude and practice (KAP) survey on dengue fever in an urban Malay residential area in Kuala Lumpur. Malays J Public Health Med 6(2):62–67

Wiwanitkit V (2010) Dengue fever: diagnosis and treatment. Expert Rev Anti-Infect Ther 8(7):841–845. https://doi.org/10.1586/eri.10.53

World Health Organization (2009) Dengue guidelines for diagnosis, treatment, prevention and control: New edition. World Health Organization, Geneva. Retrieved from www.who.int/neglected_diseases/en