Knowledge towards Prevention and Management of Dengue: A Cross-Sectional study among Dental, Medical and Pharmacy Students in a Private University, Malaysia.

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ABSTRACT

Aim: The objectives of the study were: 1) to assess the knowledge regarding dengue viral infection among undergraduate healthcare professional (HCP) students 2) to investigate the association of socio-demographic factors towards dengue knowledge among the study participants.3) to compare the dengue knowledge among the three HCP (Dental, Medical and Pharmacy) students.

Study Design: A cross sectional study study design was used in the study.

Place and Duration of Study: The study was conducted in AIMST University campus, Kedah state, Malaysia between January, 2017 and June, 2017.

Method: The study was conducted among HCP students using pre-validated questionnaire with knowledge as a single dependent variable. The questionnaire was distributed in class room setting after obtaining informed consent forms signed by participants. Summary statistics for categorical variables was used with chi-square test to see if there was any association between the variables. Inferential statistics was done using Spearmans correlation.

Results: Among the 636 participants, an overall good knowledge (≈90%) was observed regarding the cause, breeding sites and common clinical symptoms of dengue fever. However, poor knowledge was observed regarding the time of dengue mosquitoes bite (51%, *P=.58*) and transmission through blood transfusion (59%, *P* <.001). Very poor knowledge was observed regarding transmission through person to person contact (25%, *P* <.001). The median knowledge score was 12(3) ranging from 0 to 15. There was a statistically significant differences (*P* < .001) in response to 14/15 knowledge based items. Further, a statistically significant association between dengue knowledge score was observed among field of study (*P* < .05) and year of study (*P* < .006) variables. The Spearman's correlation test showed a weak positive correlation [$r_s(2) = 8.6$, *P* < .01] and [$r_s(10) = 108$, *P* < .001] between year of study and age categories for dengue knowledge scores.

Conclusion: Overall, the HCT students in AIMST University showed good knowledge score towards dengue however, educational intervention programmes can further enrich their knowledge in the

prevention, treatment and management of this deadly infection.

Keywords: Knowledge, Dengue fever, Associated factors, Malaysia

1. INTRODUCTION

Dengue virus (DENV) infection is an important arthropod-born viral infection infecting about 2.5 billion people worldwide, of which approximately 975 million belong to large and small cities of tropical and sub-tropical countries in Southeast Asia, the Pacific and the America [1]. The flaviviruses comprises of a large genus, arthropod-transmitted, enveloped viruses and is one of the most significant human viral pathogen transmitted by infected female *Aedes* mosquitoes and causes over 50 million or more cases of infection worldwide resulting in around 24,000 deaths each year [2, 3]. Dengue virus causes mainly two types of infections, the primary infection and the secondary infection. Primary infection results in acute fever known as dengue fever (DF) which is cleared by the patients own immune response in approximately seven days. Whereas, secondary infection is more severe and results in dengue haemorrhagic fever (DHF) or dengue shock syndrome (DSS) [4]. Both DHF and DSS, severe dengue was first recognized in Philippine and Thailand during dengue epidemics in 1950s, which recently affects most Asian and Latin American countries [5]. Dengue risk is influenced by rainfall, temperature, relative humidity and unplanned rapid urbanization caused by a virus of *flaviviridae* family with four distinct serotypes (DENV-1, DENV-2, DENV-3 and DENV-4). Recovery provides lifelong immunity against that particular serotype only. Dengue virus is often transported by infected travellers with alarming impact on both national and global economies [5].

A vast majority of dengue cases are asymptomatic, mild, self-managed and/or misdiagnosed and hence mostly under-reported [6]. One estimate indicates 390 million infections per year of which about 96 million (67–136 million) manifest clinically [7]. Another study on the prevalence of dengue estimates 3.9 billion people at risk of dengue infection, of which 70% is shouldered by Asia [7, 8].

The year 2016 was characterized by large global dengue outbreaks, the Western Pacific region reporting more than 375,000 suspected cases, of which Malaysia reported 100,028 cases [9]. After a drop in the number of dengue cases in 2017-18, a sharp increase was again observed in 2019 in Australia, Malaysia, Philippines, Singapore, Vietnam etc [9]. Dengue should be suspected when a high fever (40°C/104°F) is accompanied by two of the following symptoms during the febrile phase: severe headache; pain behind the eyes, muscle and joints; nausea, vomiting; swollen glands and/or rash. A patient enters the critical phase normally about 3-7 days after onset of illness, when the fever is dropping below 38°C/100°F and warning signs can manifest. Severe dengue is potentially a fatal complication characterised by plasma leaking, fluid accumulation, respiratory distress, severe bleeding or organ impairment. If patients manifest these symptoms during the critical phase, close observation for the next 24-48 hours is essential, so that proper medical care can be provided to avoid complications and risk of death [10].

Thus dengue, the mosquito borne disease caused major healthcare issues that drew attention from every individual, and thus awareness and knowledge requirement regarding dengue infection were inevitable. Hence the need to evaluate the knowledge of future healthcare professionals (HCP) became important.

1.1 Outcome Measures

The outcome measures of the study were: 1) to assess the knowledge regarding dengue viral infection among undergraduate healthcare professional (HCP) students 2) to investigate the association of socio-demographic factors towards dengue knowledge among the study participants.3) to compare the dengue knowledge among the three HCP (Dental, Medical and Pharmacy) students.

2. MATERIAL AND METHODS

2.1 Study Design, Site, Target Population and Period of Study

A cross sectional study with knowledge as a single dependent variable was carried out in AIMST University, Kedah state, Malaysia involving undergraduate (UG) students from HCP courses in their second, third and fourth year of study. The study was conducted between January and June, 2017.

2.2 Inclusion/ Exclusion criteria

Students who have studied the courses like microbiology and/or pathology (year-2 to year-4) among medicine, dentistry and pharmacy (HCP) faculties and those willing to participate in the study by signing the informed consent form were

included in the study. Those involved in pilot study, year-1 students and year-5 medical students (not available due to clinical attachments), other HCP students (nursing and physiotherapy) with no UG level programme in University and incomplete survey forms were excluded from the study.

2.3 Development of the Questionnaire

The questionnaire was adapted from previous published studies and modified to meet the need of this study. It consisted of two sections, the first with socio-demographic details (age, gender etc.) and the second with 15 knowledge based items using close-ended questions (Yes or No). The questions were related to cause, progression of disease; signs and symptoms; diagnosis; risk factors; transmission, prevention, treatment and control of dengue fever (DF). The questionnaire was prepared with reference to CDC and WHO fact sheet: dengue virus [11-14]. One point was given for each correct answer and zero point for incorrect answer. Higher the cumulative knowledge score, the better was the knowledge.

2.4 Validation of Questionnaire

The questionnaire was developed in English and was subjected to content validation by six academicians from clinical pharmacy and pharmacy practice unit belonging to the faculty of pharmacy, AIMST University. After the content validation by the expert panel was satisfactory, the questionnaire was subjected to face validated among 36 potential respondents, 12 from each participating faculties. The participants were encouraged to inquire any doubt or clarify confusing items which was explained in a more understandable manner and noted for later corrections. Once completed, the results were analysed to validate the degree of understanding within each group. All recommendations found appropriate were considered and modified wherever necessary to reflect the pre-testing results. A pilot study (N=36) to determine the validity and reliability of the study tool was carried out using cronbach alpha coefficient (α = .86), which showed good reliability and internal consistency [15].

2.5 Sample Size Calculation

The total population of the three targeted HCP students in the University as per inclusion criteria was approximately 950. The sample size was calculated with this figure as prevalence of students' population using on-line Raosoft sample size calculator [16]. The estimated sample size was calculated at 95% CI, 5% margin of error with 50% response distribution and the estimated sample size was 274. A 10% margin for drop-outs (27) was added to overcome errors and the final recommended sample size was rounded off to 300.

2.6 Modality of Obtaining Response

The purpose of the study was explained to the study participants and the informed consent forms were signed from each participant before distributing the questionnaires. The average time taken to complete the questionnaire was about 15 minutes and the completed questionnaires were retrieved and compiled for data analysis.

2.7 Scoring Grades and Scoring Pattern

The scoring grades was adopted from the original Bloom's cut-off grade. A score of 80-100% correct responses were graded as good knowledge score, 60-79% was satisfactory and a score of < 60% was poor [17].

2.8 Statistical Analyses

The survey data was tabulated using Microsoft excel workbook and analysed using Statistical Package for Social Sciences 'SPSS version - 23'. The categorical variables were illustrated using descriptive statistics for frequency, percentage, median and IQR (data not normally distributed) and p-values computed using Pearson's chi-square test. A p value < .05 was considered significant. The Spearman's correlation was used for inferential statistics. All percentages are displayed in text or parentheses with no decimal places [18].

3. RESULTS

3.1 Response rate

A total of 930 questionnaires were distributed among the three faculty students, and an overall 68% (N=636) valid questionnaires were retrieved with 32% drop-outs, mainly due to incomplete questionnaires or unwilling to participate.

3.2 Socio-demographic Characteristics

The median (IQR) age of the participants was 22(2). Almost 93% were aged 21 to 23 years, about 63% were females, 78% Chinese, 44% from medical faculty and 38% from year-3 education (Table 1).

Table 1: Socio-demographic data of Respondents (N = 636)

Variables	N	Percentage

Age		
18-20	20	3
21-23	593	93
24-26	23	4
Gender		
Male	234	37
Female	402	63
Race		
Malay	10	2
Indian	142	22
Chinese	484	76
Field of study		
Medicine	282	44
Dentistry	143	23
Pharmacy	211	33
Years of Study		
Year-2	208	33
Year-3	244	38
Year-4	184	29

3.3 Responses towards Knowledge based items on Dengue

Table 2 summarizes the responses for the knowledge based items. About 90% of the participants knew how DF is spread, their breeding sites and their clinical symptoms. However, poor knowledge was observed regarding DF infection transmission. Very poor knowledge was observed regarding transmission through person to person contact. The median knowledge score was 12(3) ranging from 0 to 15. There was a statistically significant differences ($P < .001$) in responses to all the knowledge based items except for the likely time dengue mosquitoes bite (P=.58).

Table 2, Responses towards Dengue Knowledge Items (N = 636)

Qn. No.	Knowledge items	Incorrect		Correct		*P* value
		N	(%)	N	(%)	
1.	Dengue is often spread by Aedes mosquitoes.	31	5	605	95	<.001
2.	The mosquitoes that spread dengue breed in clear stagnant water.	118	19	518	81	<.001
3.	Empty bottles, containers, tires etc. are appropriate breeding sites for the mosquitoes that spread dengue.	66	10	570	90	<.001
*4.	The time at which people are most likely to be infected by dengue is night.	311	49	325	51	.58
5.	Dengue causes sudden high fever.	88	14	547	86	<.001
6.	Rashes and abdominal pain are the symptoms of dengue.	67	11	569	89	<.001
7.	Joints pain is the symptom of dengue.	66	10	570	90	<.001
8.	Bleeding from gums is a symptom of dengue.	118	30	448	70	<.001
9.	People infected with dengue virus without warning signs but with comorbidities should be hospitalized.	146	23	490	77	<.001
*10.	Those suspected to have dengue should be treated with antibacterial or antiviral agent.	254	40	382	60	<.001
11.	Person to person contact may transmit dengue fever.	479	75	156	25	<.001
12.	Dengue fever can be transmitted through blood transfusion.	220	41	376	59	<.001
13.	Use of mosquito repellents can reduce the mosquitoes spreading dengue.	90	14	546	86	<.001
14.	Dengue fever could even be fatal.	51	8	585	92	<.001
15.	Taking rest and plenty of fluids to prevent dehydration can reduce the prevalence of dengue fever.	137	22	499	78	<.001

Median knowledge score	12(3) range 0-15

Chi square test, *P* < .05 is significant; *Negative statements and the answers were reversed

3.4 Association of Socio-demographic Factors towards Dengue Knowledge Score

Table 3 summarizes the cross tabulated results of the dengue knowledge scores against the socio-demographic variables. There was no statistical significance (*P* >.05) observed among age, gender or race category towards knowledge score. However, a statistically significant association between the knowledge score and socio-demographic factors was observed among field of study (*P* <.05) and year of study (*P* < .006).

Table 3, Socio-demographic factors Vs. Knowledge score (N=636)

Variables	Response N(%)	Knowledge Score [N (%)]			*P* value
		Poor	Moderate	Good	
Age in Years					
18 - 20	20 (3)	4 (20)	6 (30)	10 (50)	
21 - 23	593 (93)	42 (7)	228 (38)	323 (54)	.20
24 - 26	23 (4)	1 (4)	7 (31)	15 (65)	
Gender					
Male	234 (37)	21 (9)	81 (35)	132 (56)	.29
Female	402 (63)	26 (6)	160 (40)	216 (54)	
Race					
Chinese	484 (76	36 (7)	189 (39)	259 (54)	
Indian	142 (22)	9 (6)	48 (34)	85 (60)	.36
Others	10 (2)	2 (20)	4 (40)	4 (40)	
Field of study					
Medicine	282 (44)	20 (7)	100 (36)	162 (57)	
Dentistry	143 (23)	15 (11)	65 (45)	63 (44)	.049*
Pharmacy	211 (33)	12 (6)	76 (36)	123 (58)	
Year of Study					
Year-2	208 (33)	25 (12)	84 (40)	99 (48)	
Year-3	244 (38)	13 (5)	96 40)	135 (55)	.006*
Year-4	184 (29)	9 (5)	61 (33)	114 (62)	

Pearsons chi square test, significant at **P* <.05 level.

3.5 Correlation of Dengue Knowledge Score with Socio-demographic Variables

A Spearman correlation was run to assess the relationship between field of study, year of study, age in years and dengue knowledge scores using a sample of 636 participants. There was a significant negative correlation [rs(2) = 45.57, P < .001] between field of study; and a weak positive correlation [rs(2) = 8.6, P < .01] and [rs(10) = 108, P < .001] was observed between year of study and age categories for dengue knowledge scores respectively (Table 4)

Table 4: Spearman's correlation matrix for continuous variables (N = 636)

	Variables	1	2	3	4	5	6
1.	Age in years	-					
2.	Gender	-.01	-				
3.	Race	-.05	-.08[b]	-			
4.	Field of study	-.02	-.14[a]	-.05	-		
5.	Year of study	.23[a]	-.12[a]	-.07	.05	-	
6.	Knowledge score	.12[a]	.13	-.07	-.11[a]	.15[a]	-

[a.]Correlation is significant at the .01 level (2-tailed); [b.]Correlation is significant at the .05 level

(2-tailed).

3.6 Comparison of Dengue Knowledge Scores among the Three Disciplines

Table 5 summarizes the median knowledge score among the three HCP disciplines participated in the study. Pharmacy students scored the better off the three with 58% good score, but medicine was not far behind (57%). However, dentistry was comparatively low with 45% moderate score. There was a statistically significant difference (*P* <.001) in dengue knowledge scores observed among all the three disciplines.

Table 5: Knowledge Score Vs. Disciplines

Dengue Knowledge Score	**Dentistry (N=143)**		**Medicine (N=282)**		**Pharmacy(N=211)**	
	N (%)	***P* value**	**N (%)**	***P* value**	**N (%)**	***P* value**
Good	63 (44)	**P* <.001	162 (57)	**P* <.001	123 (58)	**P* <.001
Moderate	65 (45)		100 (36)		76 (36)	
Poor	15 (11)		20 (7)		12 (6)	
Mdn. (IQR) Score	11 (2)		12 (2)		12 (3)	

*Chi square test, *P* <.05 is significant.

4.0 DISCUSSION

This study did not consider the nursing and physiotherapy students as there were no graduate courses offered in the University level. Only diploma courses were offered and they did not satisfy the inclusion criteria, thus excluded.

4.1 General Considerations of Dengue infection

Recently DF was the most rapidly spreading viral infection globally and its outbreak have attained epidemic proportions since 2016 causing significant public health impact with high morbidity and mortality [19]. DF is one of the most important viral diseases and an important public health issue in terms of human morbidity and mortality in Malaysia [19, 20].

Though an effective, live-attenuated, dengue tetravalent vaccine (Dengvaxia(®); CYD-TDV) is approved for the prevention of dengue, the WHO recommends the vaccine to only those persons with confirmed prior dengue infection [21]. The public commitment and involvement is of paramount importance to combat the viral infection through public education and 'COMmunication for Behavioural Impact' (COMBI), through sustained breeding site reduction. Thus the study on knowledge of dengue infection control and prevention is justified in this study.

4.2 Knowledge towards Dengue Virus

About 90% of the participants showed good knowledge towards DF, spread by *Aedes* mosquitoes, their breeding sites, the most common clinical symptoms which could even be fatal. An Indonesia study reported 50% poor knowledge regarding DF which was much low than the findings of this study [22] and another study done in Malaysia reported 55% good knowledge on DF prevention [23]. Very poor knowledge was observed regarding transmission of DF through contact with body fluids or person to person. Another Malaysian study reported ≈45% knowledge regarding the dengue virus transmission [24]. However, poor knowledge (51%) was observed regarding the time (between dawn to dusk) of dengue mosquitoes bite (*P*=.58). A study in Ethiopia reported very low knowledge (21%) among HCPs regarding *Aedes* mosquito feeding time [24] whereas, a study conducted in Taiwan reported only 14% of knowledge [25]. However, in all cases, the knowledge level was low and reflects a significant knowledge gap among HCPs towards the *Aedes* mosquito [24, 25].

4.3 Association of Socio-demographic Factors towards Dengue Knowledge Score

More than half of all ages (≈57%) showed good dengue knowledge score. A study in Indonesia reported 45% had good knowledge regarding dengue [22] whereas, a study in Ethiopia reported 49% moderate knowledge score among 21-40 years old participants regarding dengue [24]. Another study in Cuba reported only 12% had fairly good dengue knowledge in the age group of 16 to 29 years [26]. Among the gender category, males (51%) showed a marginal better good score when compared to females (49%). A psychology study proved that males have shown better knowledge than females because males have a tendency towards systematising (understanding the principles behind how things work), whereas

females have a tendency towards empathising (understanding how people think and feel in a particular situations) [27]. Among the race category, 60% of Indians showed good knowledge score than Chinese. A study in Malaysia supported our findings that Indian respondents have higher knowledge compared to Chinese [28]. Among the field of study, over 50% from medicine and pharmacy showed good knowledge scores unlike 44% of dental students. This may be probably due to the differences in curriculum of the three courses of study which eventually shows a significant effect on the performance of participants. According to a study in Ethiopia, among HCPs, 49% demonstrated moderate level of knowledge towards DF prevention. The primary reason was attributed to lack of training towards the subject matter [24]. Among the year of study, year-3 and year-4 students showed good knowledge score. Higher the order of education, better was the knowledge score.

4.4 Correlation of Dengue Knowledge Score

A statistically significant association between the knowledge score and socio-demographic factors were observed only among field of study ($P < .05$) and year of study ($P < .006$). Further, a weak positive correlation was observed between year of study and age categories for dengue knowledge scores respectively. The results revealed a positive association between age, education and knowledge towards dengue, which was highlighted by a large number of studies [29, 30, 31].

4.5 Comparison of Dengue Knowledge Scores among the Three Disciplines

In a nutshell, this study has shown that the HCP students were aware about DF. However, there was still a lack of concern about the importance of dengue infection control and the consequence of dengue outbreak among the HCP students of the private University, Malaysia. Few studies have reported that the medical students had a better knowledge regarding the signs and symptoms [32] whereas, a study in Vietnam reported the medical students knowledge of signs and symptoms were low [33].

5. CONCLUSION

The dengue knowledge of HCP students are impetuous and likely to act without being careful as they only possess inadequate information due to passive learning. As future healthcare professionals, responsibility to serve the community is important. Thus, to improve the knowledge of all mosquito borne diseases including dengue among HCP students can reduce any additional burdens on national healthcare delivery system. Quality of education plays the key determinant of knowledge acquisitions. This study supports the need for educational institutions to implement intervention projects through emphasis made to enhance knowledge and understanding among the healthcare students regarding dengue infection by conducting workshops, presentations and problem based learning. Strategies regarding educational interventions need to be tailored and delivered through repeated measures so that the future HCPs are well knowledgeable and sufficiently skilled to handle adverse situations that may arise in future.

6. Study Limitation

The limitation which restricted this survey include: most of the responders were females, distribution of ethnicity was not even, absenteeism of students during the time of survey and honesty of genuine response is suspected. Most importantly, this was a cross sectional study design which does not allow causation to be implied. Further, the study location was a University campus which limit the findings to be extrapolated to other settings.

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Competing interests

Authors have declared that no competing interests exist.

Consent and Ethical Approval

The research proposal along with the study instrument and informed consent form (ICF) was submitted to the Institutional Review Board (IRB), AIMST University Human Ethical Committee (AUHEC) and the ethical clearance was obtained before initiation of the study. Signed informed consent forms were also obtained from each participant before distribution of the survey forms.

DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

Authors' Contributions

Conceptualization, proposal, ethical clearance, final draft and overall supervision: ANA; Data collection, curation & validation: PA and CJI; Formal analysis: CHY; Methodology: ANA and PA; Software: NZA; Writing - review & editing, CHY and NZA. All authors read and approved the final manuscript.

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ABBREVIATIONS

CDC - Centre for Disease Control
CI - Confidence Interval
DF - Dengue Fever
DENV - Dengue virus
DHF - Dengue haemorrhagic fever
DSS - Dengue shock syndrome
HCP - Healthcare Professional
WHO - World Health Organization