Original Research Article

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

ABSTRACT

Aim: The objectives of the study were: 1) to assess the knowledge regarding dengue virus among undergraduate healthcare professional (HCP) students 2) to evaluate the knowledge of dengue infection among undergraduate HCP students and 3) to investigate the association of socio-demographic factors towards dengue knowledge among study participants.

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

Place and Duration of Study: The study was conducted in AIMSTUniversity campus, Kedah state, Malaysia between January~~, 2017~~ andJune, 2017.

Method: The study was conducted among HCP students using pre-validated questionnairewith 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 wasany association between thevariables.

Results: Among the 636 participants, an overall good knowledge (≈90%) was observed regarding the cause of dengue, breeding sites of mosquitoes 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.

Comment [rev1]: Good is rather subjective. How was it determined?
I would phrase it different. Eg :
Among the 636 participants,the large majority (≈90%) had correct knowledge regarding the cause of dengue, breeding sites of mosquitoes and common clinical symptoms of dengue fever

Keywords: Knowledge,Dengue fever, Associated factors, Malaysia

1. INTRODUCTION

Mosquitoes are blood-sucking insects breeding on stagnant water ~~to reproduce~~, while female mosquitoes feed on blood and transmit ~~germs~~ pathogens when feeding ~~t~~on the host [1, 2]. Mosquito-borne diseases include malaria, filariasis and viral infections ~~such as dengue, chikungunya and zika~~ leading to annual death of over one million people, worldwide. The most important viruses include flaviviruses such as zika and dengue, and alphavirus chikungunya [3]. Dengue virus~~es~~, a virus of *flaviviridae* family with four distinct serotypes (DENV-1, DENV-2, DENV-3 and DENV-4)~~(DENV)~~ are transmitted to humans through the bites of infected female Aedes mosquitoes [4]. ~~Dengue causes a wide spectrum of diseases, ranging from sub-clinical disease (no symptoms) to severe flu-like symptoms. Some people develop severe dengue associated with severe bleeding, organ impairment and/or plasma leakage and has a higher risk of death when not managed appropriately. Severe dengue was first recognized in Philippines 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 the particular serotype only.~~ Dengue virus is often transported by infected ~~travellers~~travelers 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].~~ An infection with dengue virus, causes a wide spectrum of symptoms, ranging from sub-clinical (no symptoms), to severe disease. A vast majority of dengue cases are asymptomatic, mild, self-managed and/or misdiagnosed and hence mostly under-reported [6]. The severe disease is associated with severe bleeding, organ impairment and/or plasma leakage and has a higher risk of death when not managed appropriately. This severe dengue was first recognized in Philippines and Thailand during dengue epidemics in 1950s, which recently affects most Asian and Latin American countries [5]. Recovery provides lifelong immunity against the particular serotype only.

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 are 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 observed in 2019 in Australia, Malaysia, Philippines, Singapore, Vietnam etc [9].
The World Health Organization classifies dengue into two major categories: dengue (with or without warning signs) and severe dengue. 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 [10]. Severe dengue is potentially a fatal complication, due to 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 mosquito borne diseases ~~wa~~ere major healthcare issues that dr~~a~~ew attention from every individual, and thus awareness and knowledge requirement regarding dengue infection ~~were~~ are inevitable. Hence the need to evaluate the knowledge of future healthcare professionals (HCP~~) became~~ is important.

1.1 Outcome Measures

The outcome measures of the study were: 1) to assess the knowledge regarding dengue fever (DF)~~virus~~ among undergraduate healthcare professional (HCP) students 2) to evaluate the knowledge of dengue virus infection among undergraduate HCP students and 3) to investigate the association of socio-demographic factors towards ~~dengue~~ DFknowledge among study participants.

Comment [rev2]: The order of the intorduction was scattered. Further please distingues
-the pathogen (dengue virus) ,
-the infection with the pathogen (infection with dengue virus or degue virus infection.
- the disease (dengue or dengue fever or severe dengue)

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~~, 2017~~ and June, 2017.

2.2 Inclusion/ Exclusion criteria

Students, who have studied the courses like microbiology and/or pathology during their course of study (year-2 to year-4) among medicine, dentistry or pharmacy (HCP)~~courses~~ and those willing to participate in the study and signed the informed consent form, were included. Those involved in pilot study, year-1 students and year-5 medical students due to clinical ~~attachments~~assigments?, other HCP students with no UG level courses in University like nursing and physiotherapy and incomplete survey forms were excluded from the study.

2.3 Development and Validation 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; 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 indicates a better ~~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 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 groups of HCP students as per inclusion criteria was approximately 950 students. 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 signed informed consent forms was obtained 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. Spearman's correlation was used for inferential statistics. All percentages are displayed in text or parentheses with no decimal places [18].

3. RESULTS AND DISCUSSION

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-demographicdata 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~~ DENV~~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 KnowledgeItems (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

Presently DF is the most rapidly spreading viral infection globally and its outbreak have attained epidemic proportions 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 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 the knowledge of dengue ~~infection~~fevercontrol and prevention is justified in this study.

About 90% of the participants showed good knowledge towards DF, spread by ~~a~~Aedes mosquitoes, their breeding sites, the most common clinical symptoms, which could even be fatal. An Indonesian study reported 50% poor knowledge regarding DF which was much lower than the findings of this study [22] and another study done in Malaysia reported 55% good knowledge on DF prevention among orang asli [23]. Very poor knowledge was observed regarding transmission of dengue fever 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~~ Aedesmosquitoes bite (*P*=.58). A study in Ethiopia reported low knowledge (21%) among HCPs regarding~~aedes~~Aedes mosquito ~~feeding~~ biting 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~~Aedes mosquito [24, 25].

3.4 Association of Socio-demographic Factors towards Knowledge Score

Table 3 summarizes the cross tabulated results of the knowledge scores against the socio-demographic variables. There was no statistical significance (*P*>.05) observed among age, race 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)	.36
Indian	142 (22)	9 (6)	48 (34)	85 (60)	
Others	10 (2)	2 (20)	4 (40)	4 (40)	
Field of study					
Medicine	282 (44)	20 (7)	100 (36)	162 (57)	.05*
Dentistry	143 (23)	15 (11)	65 (45)	63 (44)	
Pharmacy	211 (33)	12 (6)	76 (36)	123 (58)	
Year of Study					
Year-2	208 (33)	25 (12)	84 (40)	99 (48)	.006*
Year-3	244 (38)	13 (5)	96 40)	135 (55)	
Year-4	184 (29)	9 (5)	61 (33)	114 (62)	

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

More than half ~~of all~~ age~~s groups~~ (≈57%) showed good ~~dengue~~ DF knowledge score. A study in Indonesia reported 45% had good knowledge regarding ~~dengue~~ DF [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 knowledge on dengue 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]. Amongthe field of study, over 50% ~~from of~~medicine and pharmacy students showed good knowledge scores ~~unlike~~ while only44% of dental students. This may be ~~probably~~ due to the differences in curriculum of the three ~~courses~~ groups 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.

Formatted: Font: Not Italic
Formatted: Font: Not Italic
Formatted: Font: Not Italic
Formatted: Font: Not Italic
Comment [rev3]: Significant?
Formatted: Font: Not Italic
Comment [rev4]: Grammatically incomplete
Formatted: Font: Not Italic
Formatted: Font: Not Italic
Formatted: Font: Not Italic
Formatted: Font: Not Italic
Formatted: Font: Not Italic
Formatted: Font: Not Italic

3.5 Correlation of Dengue Fever 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~~ DF 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)

Formatted: Font: Not Italic
Formatted: Font: Not Italic
Formatted: Font: Not Italic

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 0.01 level (2-tailed); [b]Correlation is significant at the 0.05 level (2-tailed).

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].

3.6 Comparison of Dengue Knowledge Scores among the Three Disciplines

The overall median knowledge score was found to be 12(3) ranging between 0-15 out of 15. 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.

Formatted: Font: Not Italic

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)		162 (57)		123 (58)	
Moderate	65 (45)	*P<.001	100 (36)	*P<.001	76 (36)	*P<.001
Poor	15 (11)		20 (7)		12 (6)	
Mdn. (IQR)	11 (2)		12 (2)		12 (3)	

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

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 privateUniversity, Malaysia.

4. CONCLUSION

~~The dengue knowledge of~~ HCP students are impetuous and likely to act without being careful as they only possess insufficient information due to passive learning. As future healthcare professionals, responsible to serve the community, it is important to improve the knowledge of all mosquito borne diseases including dengue among HCP students, which can reduce any additional burdens on national healthcare delivery system. Hence, emphasis should be made to enhance knowledge and understanding among the healthcare students regarding dengue ~~infection~~ fever through 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 due to mosquito borne diseases.

Comment [rev5]: Unnecessary long sentence

5. 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.

Comment [rev6]: 63% is not such a bad inbalance

Consent and EthicalApproval

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

COMPETING INTERESTS 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.

References

1. Jaeger Edmund C. A Source-Book of Biological Names and Terms. Springfield, Ill: Thomas.1959. ISBN 0-398-05179-3.
2. Kanzaria HK, Hsia RY. Mosquitoes and mosquito-borne diseases. Wilderness Medicine. 6th ed. Philadelphia, PA: Mosby Elsevier. 2012.
3. Muktar Y, Tamerat N, Shewafera A. Aedes aegypti as a Vector of Flavivirus. J Trop Dis. 2016;4(223):2. DOI: 10.4172/2329-891X.1000223.
4. World Health Organization. Dengue and severe dengue. World Health Organization. Regional Office for the Eastern Mediterranean; 2014.
5. World Health Organization. News room and fact sheets on dengue and severe dengue. World Health Organization. 2019. Available: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue.
6. Waggoner JJ, Gresh L, Vargas MJ, Ballesteros G, Tellez Y, Soda KJ, et al. Viremia and clinical presentation in Nicaraguan patients infected with Zika virus, chikungunya virus, and dengue virus. Clin. Infect. Dis. 2016;63(12):1584-90. PMID: 27578819; PMCID:PMC5146717; DOI: 10.1093/cid/ciw589.
7. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, et al. The global distribution and burden of dengue. Nature. 2013;496(7446):504-7. DOI: 10.1038/nature12060.
8. Brady OJ, Gething PW, Bhatt S, Messina JP, Brownstein JS, Hoen AG, et al. Refining the global spatial limits of dengue virus transmission by evidence-based consensus. PLoSNegl Trop Dis. 2012;6(8):e1760. DOI: 10.1371/journal.pntd.0001760.
9. World Health Organisation. Half of world population faces dengue risk: WHO. The Independent. 2019. Available: http://www.theindependentbd.com/post/210049.
10. World Health Organization, Special Programme for Research, Training in Tropical Diseases, World Health Organization. Department of Control of Neglected Tropical Diseases, World Health Organization. Epidemic, Pandemic Alert. Dengue: guidelines for diagnosis, treatment, prevention and control. World Health Organization; 2009. 1-147.
11. Nahida, A. Knowledge Attitude and Practice on Dengue Fever, Thesis for Masters in Public Health. College of Public Health Sciences: Chulalongkorn university.2007.
12. Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Vector-Borne Diseases (DVBD). Available: https://www.cdc.gov/dengue/index.html.
13. Tjaden NB, Thomas SM, Fischer D, Beierkuhnlein C. Extrinsic incubation period of dengue: knowledge, backlog, and applications of temperature dependence. PLoSNegl. Trop. Dis. 2013;7(6):5. DOI: 10.1371/journal.pntd.0002207.

14. Siler JF, Hall MW, Hitchens AP. Dengue: its history, epidemiology, mechanism of transmission, etiology, clinical manifestations, immunity, and prevention. Philipp. J. Sci. 1926;29(1-2):1-304.

15. Henson RK. Understanding internal consistency reliability estimates: A conceptual primer on coefficient alpha. Meas. Eval. Couns. Dev. 2001;34(3):177-189. DOI: 10.1080/07481756.2002.12069034.

16. Raosoft I. Sample size calculator. Available: http://www.raosoft.com/samplesize.html.

17. Kaliyaperumal KI. Guideline for conducting a knowledge, attitude and practice (KAP) study. AECS illumination. 2004;4(1):7-9.

18. Hole G. APA format for statistical notation and other things : Analysis of Covariance, Reporting Statistics in APA Style. 2012;1-4.

19. Institute for Medical Research. Malaysian dengue, zika and chikungunya scenario, 2017. Available: https://www.imr.gov.my/wolbachia/2017/01/16/malaysian-dengue-and-zika-scenario/

20. Ministry of human resources, Department of occupational safety and health, Puttrajaya, Malaysia. 2020. Available: https://www.dosh.gov.my/index.php/osh-info-2/occupational-health/1547-dengue.

21. Centers for Disease Control and Prevention. National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Vector-Borne Diseases (DVBD), 2017. Available: https://www.cdc.gov/dengue/prevention/dengue-vaccine.html.

22. Harapan H, Rajamoorthy Y, Anwar S, Bustamam A, Radiansyah A, Angraini P, et al. Knowledge, attitude, and practice regarding dengue virus infection among inhabitants of Aceh, Indonesia: a cross-sectional study. BMC Infect. Dis. 2018;18(1):96. DOI: 10.1186/s12879-018-3006-z.

23. Chandren JR, Wong LP, AbuBakar S. Practices of dengue fever prevention and the associated factors among the Orang Asli in Peninsular Malaysia. PLoSNegl. Trop. Dis. 2015;9(8):e0003954. DOI: 10.1371/journal.pntd.0003954.

24. Mohammed Yusuf A, Abdurashid Ibrahim N. Knowledge, attitude and practice towards dengue fever prevention and associated factors among public health sector health-care professionals: in Dire Dawa, eastern Ethiopia. Risk Manag. Healthc. Policy. 2019;12:91-104.DOI:10.2147/RMHP.S195214.

25. Huang HL, Chiu TY, Huang KC, Cheng SY, Yao CA, Lee LT. Travel-related mosquito-transmitted disease questionnaire survey among health professionals in Taiwan. J. Travel Med. 2011;18(1):34–38. DOI:10.1111/j.1708-8305.2010.00483.x

26. Castro M, Sanchez L, Perez D, Sebrango C, Shkedy Z, Van der Stuyft P. The relationship between economic status, knowledge on dengue, risk perceptions and practices. PLoS One. 2013;8(12):e81875. DOI: 10.1371/journal.pone.0081875.

27. Lynn R, Irwing P, Cammock T. Sex differences in general knowledge. Intelligence. 2001;30(1):27-39. DOI: 10.1016/S0160-2896(01)00064-2.

28. Al-Dubai SA, Ganasegeran K, Mohanad Rahman A, Alshagga MA, Saif-Ali R. 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. 2013;44(1):37-49. PMID:23682436.

29. Khun S, Manderson L. Community and school-based health education for dengue control in rural Cambodia: A process evaluation. PLoSNegl. Trop. Dis. 2007;1:e143. DOI: 10.1371/journal.pntd.0000143.

30. Ibrahim NK, Abalkhail B, Rady M, Al-Bar H. An educational programme on dengue fever prevention and control for females in Jeddah high schools. East. Mediterr. Health J. 2009;15:1058–1067. DOI: 10.26719/2009.15.5.1058.

31. Jayawardene WP, Lohrmann DK, YoussefAgha AH, Nilwala DC. Prevention of dengue fever: An exploratory school-community intervention involving students empowered as change agents. J. Sch. Health. 2011;81:566–573. DOI: 10.1111/j.1746-1561.2011.00628.x.

ABBREVIATIONS

CDC - Centre for Disease Control
CI - Confidence Interval
DF - Dengue Fever
HCP - Healthcare Professional
WHO - World Health Organization