Knowledge, Awareness, and Perception of Community Pharmacists to Zika Virus Infection in Klang Valley, Malaysia

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ABSTRACT

BACKGROUND: Zika fever is a mosquito-borne disease with global health concern. It has been underreported or misdiagnosed due to its unspecific clinical manifestations, including mild-influenza like and subclinical symptoms. However, its associated serious complications which include fetal microcephaly and Guillain-Barré syndrome remained a challenge to the public health sectors. This research aimed to evaluate the knowledge, awareness, and perception toward Zika virus infection among community pharmacists in the Klang Valley of Malaysia and to determine the association between the knowledge of Zika virus infectious disease and years of community practice experience among community pharmacists in this region.

METHODS: This survey research was conducted from August to December 2018 through a pre-tested, self-administration, and cross-sectional random convenient sampling at various districts in the Klang Valley. A total of 275 registered community pharmacists were involved in this study by completing a pilot-tested questionnaire. Descriptive analysis, Mann-Whitney U test, and Kruskal-Wallis H test were used to analyze the data.

RESULTS: The knowledge toward Zika virus infection of respondents was classified into "poor" (5.1%), "basic" (70.9%), and "broad" (24.0%). Most of the participants (n = 195, 70.9%) presented with basic knowledge toward Zika virus infection. A total of 268 (97.5%) participants presented with high awareness toward Zika virus infection. The mean score of respondents' knowledge and awareness was 15.88 ± 3.61 (maximum score = 28) and 13.96 ± 1.60 (maximum score = 16), respectively. There was a statistically significant difference between the years of practice of community pharmacists and the level of knowledge toward Zika virus infection.

CONCLUSIONS: In conclusion, our respondents demonstrated a basic level of knowledge and high awareness toward Zika virus infection. Also, we highlighted some possible pitfalls in the knowledge of Zika virus infection, including the virus transmission, symptoms, diagnosis, treatment, prevention, and complications of the disease.

KEYWORDS: Zika virus, knowledge, awareness, perception, community pharmacists, Klang Valley, survey

Introduction

In 1947, Zika virus was originally discovered in rhesus monkey in Uganda where the identified virus vector was *Aedes africanus* mosquito.[1] The first human infection case about Zika was documented in Africa in 1953.[2] In Malaysia, Zika virus was first isolated from mosquitoes in 1966. Although Zika fever is not an endemic in Malaysia, there is a potential risk of transmission due to its tropical weather and growing number of foreign visitors over the past few years.[3]

In September 2016, Malaysia's first case of Zika fever was reported. A woman from Klang, Selangor was admitted to hospital after experiencing a facial rash and fever for a week. She was tested positive for Zika virus infection after returning from Singapore.[4] The first local infection was detected soon after, when a 61-year-old man from Kota Kinabalu was tested positive for the disease.[5] The third confirmed case was a 27-year-old pregnant woman from Johor Bahru.[5]

Zika virus (genus: *Flavivirus*, family: Flaviviridae) carries positive single-stranded RNA as the genome. Its transmission happens mainly from the bite of an infected mosquito to an unaffected individual. Daytime biting *Aedes aegypti* and *Aedes albopictus* mosquitoes are the main vector species for Zika virus transmission.[6] While other modes of transmission of Zika virus may also occur, either through infected mother to child during pregnancy, accidental exposure of blood or body fluids, sexual intercourse, or blood transfusion.[7-9]

Up to 80% of patients infected by Zika virus are asymptomatic, while 20% presented with mild and self-limited clinical symptoms which include rash, nonpurulent conjunctivitis, headache, fever, malaise, myalgia, and arthralgia.[10,11] Although Zika virus infection has been associated with the development of an autoimmune disorder such as Guillain-Barré syndrome in adults and microcephaly which is a neurological disorder that occur in newborns.[12,13] Nevertheless, a recent finding by Bautista[14] reported that there was a lack of evidence to link Zika virus infection to Guillain-Barré syndrome.

Working at the front line of public health care sectors, the level of knowledge, awareness, and perception of community
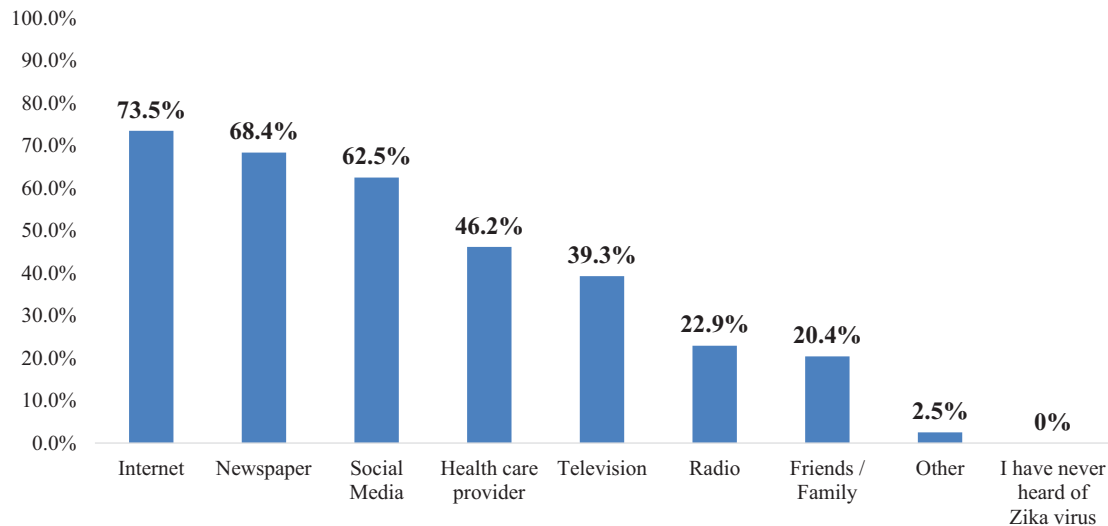
Figure 1. The sources of information to gain understandings regarding Zika virus. All the participants have heard of Zika virus. Internet (n = 202, 73.5%) was the most common information source for respondents who have heard about Zika virus, followed by newspaper (n = 188, 68.4%), social media (n = 172, 62.5%), health care provider (n = 127, 46.2%), television (n = 108, 39.3%), radio (n = 63, 22.9%), friends/family (n = 56, 20.4%), and other sources (n = 7, 2.5%).

pharmacists in relation to Zika virus infection is vital. It also enables the government and nongovernment organizations to gauge the needs in providing training courses to community pharmacists so that they possess sufficient knowledge regarding the causes, signs and symptoms, complications, and epidemiological information of Zika fever. In addition, community pharmacists should be able to advise how a carrier of Zika virus is diagnosed and assist in creating awareness to the public. Therefore, in this research, we aim to measure the level of knowledge, awareness, and perception of community pharmacists in the Klang Valley, Malaysia in regard to Zika virus infections.

Materials and Methods
Study design

A cross-sectional paper-based random convenient sampling survey was conducted from August to November 2018 at several districts in the Klang Valley, Malaysia.

Study participants

The estimated total population size of registered community pharmacists in Klang Valley was 920,[15] with recommended sample size of 272 (Raosoft®, 95% confidence level, 5% margin of error). The inclusion criteria of the participants were (1) Malaysian, (2) registered community pharmacist, and (3) working in community pharmacy residing in the Klang Valley, Malaysia.

Design of questionnaires

The validity of questionnaire was established through face and content validity. Items in the questionnaire were adapted from various published articles and divided into 4 sections.[16-19] Section 1 (5 questions) consisted of demographic information of participants; section 2 (16 questions) was designed to assess the respondents' knowledge; section 3 (16 questions) measured awareness; whereas section 4 (22 questions) evaluated the perception of respondents toward Zika virus infection. In addition, a question testing the respondents' sources of information regarding Zika virus was also included. All items were carefully reviewed for readability, clarity, and comprehensiveness before finalization of the questionnaire.

The reliability of questionnaire was estimated via Cronbach alpha index (coefficient alpha index) through a pilot study, which was conducted with 10% (n = 28) of the total sample size. The printed questionnaires were distributed to 28 community pharmacists prior to actual data collection. All the 28 respondents were encouraged to comment on the design of the questionnaire. All amendments were made as appropriate based on the feedbacks received. These responses from the pilot study were not included in the final analyses of the study.

Data collection. The questionnaires were distributed by-hand to 300 community pharmacists located in different districts of the Klang Valley. A total of 275 questionnaires were completed face-to-face and received. The recommended number of community pharmacists for each district was calculated using the following formula:

$$\text{Recommended sample size in each district} = \frac{\substack{\text{Number of community} \\ \text{pharmacists in each district} \\ \times \text{Recommended sample size} \\ \text{of total population size}}}{\substack{\text{Total population size} \\ \text{of community} \\ \text{pharmacists in Klang Valley}}}$$

Statistical analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS, version 23). Descriptive analysis (frequencies and percentage) was used to analyze the demographic data in this research. Mann-Whitney *U* test and Kruskal-Wallis *H* test were used to determine the correlations between these sections to demographic data. In this study, a *P* value of <.05 was considered statistically significant.

Ethical consideration. This study was approved by the SEGi Ethics Committee, with project number SEGi/RIMC/FOP/30/2018. The names, phone numbers, and identity card numbers of participants were excluded to ensure anonymity and confidentiality of the survey. Before the survey, individual verbal and written consent was obtained. Sufficient time was given to each participant in answering the survey. All participants were informed that their participation in this survey was voluntary.

Results

The response rate of the survey was 91.67%. A total of 275 questionnaires were included in our statistical analyses. Internet (n = 202, 73.5%) was the most common source of information for our respondents to gain information regarding Zika virus infection, followed by newspaper (n = 188, 68.4%), social media (n = 172, 62.5%), health care provider (n = 127, 46.2%), television (n = 108, 39.3%), radio (n = 63, 22.9%), friends or family (n = 56, 20.4%), and other sources (n = 7, 2.5%; Figure 1). The reliability test showed internal consistency with Cronbach alpha values of 0.716, 0.720, and 0.574 for knowledge, perception, and awareness sections, respectively.

Demographic information

Table 1 tabulates the demographic data of the study respondents. More than half of the respondents were women (n = 168, 61.1%), while 38.9% of respondents were men (n = 107). For age groups, participants below 30 years old constituted the highest proportion (n = 132, 48%), followed by age group of 30 to 39 years (n = 91, 33.1%), 40 to 49 years (n = 36, 13.1%), 50 to 59 years (n = 12, 4.4%) and 60 years or above (n = 4, 1.5%). For ethnicity, most of respondents were Chinese (n = 217, 78.9%). Most of the community pharmacists had community practice experience of more than 5 years (n = 116, 42.2%), followed by those with less than 3 years of experience (n = 96, 34.9%) and 3 to 5 years of experience (n = 63, 22.9%). In terms of the proportion of respondents by districts, most of the responses received were attained from the pharmacists working in Kuala Lumpur (n = 114, 41.5%), followed by Petaling (n = 87, 31.6%), Hulu Langat (n = 40, 14.5%), Klang (n = 19, 6.9%), and Gombak (n = 15, 5.5%).

Knowledge to Zika virus infection

Correct responses to each question were summarized by using frequencies and percentages. In addition, survey responses were

Table 1. Demographic information of the respondents.

	VARIABLE	N	%
Sex	Male	107	38.9
	Female	**168**	**61.1**
Age (years)	Below 30	**132**	**48**
	30-39	91	33.1
	40-49	36	13.1
	50-59	12	4.4
	60 or above	4	1.5
Ethnicity	Malay	37	13.5
	Chinese	**217**	**78.9**
	Indian	17	6.2
	Other	4	1.5
Community practice experience	<3 years	96	34.9
	3-5 years	63	22.9
	>5 years	**116**	**42.2**
Working district	Petaling	87	31.6
	Kuala Lumpur	**114**	**41.5**
	Klang	19	6.9
	Gombak	15	5.5
	Hulu Langat	40	14.5

Data in bold print refer to most of the participants in the option.

given a total score of 28 based on the number of questions that were correctly answered. There were some questions consisted multiple-choice answers; therefore, the participants were allowed to select more than one option (eg, question 6).

Knowledge was evaluated by giving a score of "1" to each correct answer and "0" to each incorrect answer, including "not sure." Therefore, the highest possible score for each respondent was 28. A score of <10 was considered as poor knowledge, 10 to 18 as basic knowledge, and >18 as broad knowledge.[20]

As shown in Table 2, all respondents have heard of Zika virus prior to this study. More than half (62.5%) of the participants knew that Zika virus infection occurred in Malaysia. Furthermore, most of the participants (88.4%) were aware that dawn and dusk being the active period of Aedes mosquitoes. All the respondents knew that Zika virus could be spread through the bite of an infected mosquito. In terms of Zika virus transmission, 157 (57.1%) respondents were aware of vertical transmission from a pregnant mother to child, 117 (42.5%) for sexual contact, 95 (34.5%) for blood transfusion, and 65 (23.6%) for accidental exposure of blood or body fluids. Surprisingly, some respondents agreed that Zika virus can be transmitted through coughing and sneezing (n = 16, 5.8%),

Table 2. Total and percentage of respondents' answers pertaining to knowledge of Zika virus infection.

NO.	ITEMS	ANSWERS	N	%
1	Have you heard of Zika virus?	Yes	**275**	**100**
		No	0	0
		Not sure	0	0
2	Has anyone been infected with Zika virus in Malaysia?	Yes	**172**	**62.5**
		No	33	12.0
		Not sure	70	25.5
3	Who is susceptible to Zika virus infection?	Restricted to certain population	55	20.0
		All population (√)	**220**	**80.0**
4	What is the active period of Aedes mosquitoes?	Dawn and dusk (√)	**243**	**88.4**
		Afternoon	13	4.7
		Night	19	6.9
5	Where is the common breeding site for mosquito to spread Zika?	Salt water	1	0.4
		Running water	3	1.1
		Standing water (√)	**271**	**98.5**
6	How is Zika virus transmitted?	Infected mosquito bite (√)	**275**	**100**
		Drinking polluted water	11	4.0
		Eating contaminated food	8	2.9
		Mother to child transmission (√)	**157**	**57.1**
		Sexual contact (√)	117	42.5
		Coughing/sneezing	16	5.8
		Accidental exposure of blood /body fluids (√)	65	23.6
		From blood transfusion (√)	95	34.5
7	Do all Zika fever patients show symptoms?	Yes	69	25.1
		No (√)	**153**	**55.6**
		Not sure	53	19.3
8	What percentage of an individual infected with Zika will experience symptoms?	20% (√)	21	7.6
		40%	19	6.9
		60%	26	9.5
		80%	13	4.7
		100%	8	2.9
		Not sure	**188**	**68.4**
9	What is/are the common symptom(s) of Zika fever?	Fever (√)	**270**	**98.2**
		Conjunctivitis (√)	100	36.4
		Pneumonia	20	7.3

(Continued)

Table 2. (Continued)

NO.	ITEMS	ANSWERS	N	%
		Muscle and joint pain (√)	**241**	**87.6**
		Headache (√)	**193**	**70.2**
		Rash (√)	**185**	**67.3**
10	Which of the following sample(s) can be used to diagnose Zika fever?	Blood (√)	**272**	**98.9**
		Urine (√)	63	22.9
		Saliva (√)	24	8.7
		Semen (√)	21	7.6
		Cerebrospinal fluid (√)	27	9.8
		Amniotic fluid (√)	37	13.5
11	I know what is microcephaly.	Yes	**222**	**80.7**
		No	18	6.5
		Not sure	35	12.7
12	Can Zika fever cause microcephaly in newborns?	Yes (√)	**229**	**83.3**
		No	1	0.4
		Not sure	45	16.4
13	I know what is Guillain-Barré syndrome.	Yes	101	36.7
		No	71	25.8
		Not sure	**103**	**37.5**
14	Zika fever has been found related to Guillain-Barré syndrome.	Yes (√)	81	29.5
		No	8	2.9
		Not sure	**186**	**67.6**
15	If a pregnant woman is infected with Zika, her baby/fetus has high risk of getting this infectious disease.	Yes (√)	**236**	**85.8**
		No	7	2.5
		Not sure	32	11.6

Poor: Score <10, Basic: 10 to 18, Broad: > 18; (√) indicates correct answers.
Questions 6, 9, and 10 are multiple-choice questions as shown in the table above.
Data in bold print refer to the most selected options.

drinking polluted water (n = 11, 4%), and eating contaminated food (n = 8, 2.9%). Fever, muscle and joint pain, headache, and rash were each recognized as typical clinical presentation of Zika virus infection by over 67% of participants, while less than 40% identified conjunctivitis as part of the common symptom. Although not a classical presentation of Zika virus infection, 7.3% of participants agreed that pneumonia can be caused by Zika virus infection. Nearly all the respondents identified that blood (98.9%) as the sample which could be used for Zika virus diagnostic test, followed by urine (n = 63, 22.9%), amniotic fluid (n = 37, 13.5%), cerebrospinal fluid (n = 27, 9.8%), saliva (n = 24, 8.7%), and semen (n = 21, 7.6%).

Most of the participants (n = 222, 80.7%) indicated that they understand microcephaly, with most of the respondents (n = 229, 83.3%) aware of the connection between Zika fever and microcephaly in newborns. For another complication of Zika fever, Guillain-Barré syndrome, most of the participants did not know or unsure about the disorder (n = 174, 63.3%). Similarly, 194 (70.5%) participants were not aware of the association between Zika fever and Guillain-Barré syndrome, with a minority of participants (n = 81, 29.5%) were able to identify. In addition, most of the respondents (85.8%) understood the risk of a fetus being infected by Zika virus through vertical transmission by an infected mother during pregnancy.

Table 3. Pairwise comparison between age groups and knowledge level to Zika virus infection.

AGE GROUP (YEARS)	*P* VALUE
60 or above vs Below 30	1.000
60 or above vs 50-59	1.000
60 or above vs 40-49	1.000
60 or above vs 30-39	.862
Below 30 vs 50-59	1.000
Below 30 vs 40-49	.867
Below 30 vs **30-39**	**.005**
50-59 vs 40-49	1.000
50-59 vs 30-39	1.000
40-49 vs 30-39	1.000

Data in bold print refer to significant difference between 2 age groups in knowledge level to Zika virus infection (*P* < .05).
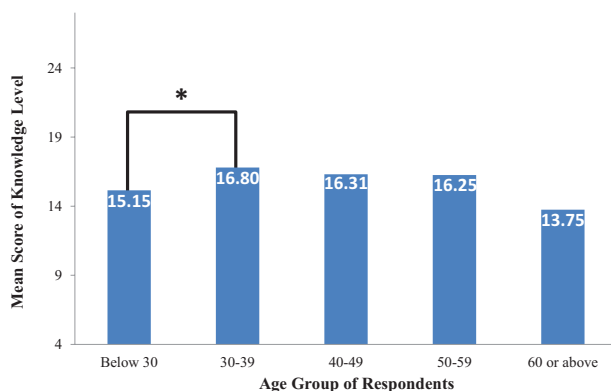

Figure 2. The mean score of knowledge level to Zika virus infection in respondents categorized under different age groups. The mean score difference between "Below 30" and "30 to 39" was statistically significant (*P* = .005, labeled in asterisk).

There was a significant difference in the knowledge to Zika virus infection between respondents aged below 30 and aged 30 to 39 years (*P* = .005, Table 3, Figure 2). Also, in terms of the knowledge level and years of community practice experience, the correlation was reported as statistically significant (*P* = .001), with spearman correlation coefficient recorded at 0.202. However, no significant correlation was found between knowledge toward Zika virus infection and sex, race, as well as location of pharmacy.

Awareness to Zika virus infection

Awareness was evaluated by giving a score of 1 for "yes" and 0 for "no" and 0.5 for "not sure." Thus, the highest possible score for each respondent was 16. Score of ⩽5 was considered as low awareness, 5.1 to 10 as moderate awareness, and >10 as high awareness.[21]

As shown in Table 4, more than three-quarters of the respondents (n = 212, 77.1%) were aware of the recent global Zika fever outbreaks. Similarly, 77.5% (n = 213) of the participants were concerned about the spread of Zika virus in Malaysia. About two-thirds of the respondents (n = 179, 65.1%) were aware of the unavailability of a certified antiviral treatment specific to Zika fever. More than half of the participants (53.1%) knew that a licensed vaccine is currently not available. Nearly all the respondents (97.1%) believed that the medications used to relieve symptoms such as pain and fever were available for those with Zika fever, only few participants (n = 8, 2.9%) were not sure or not aware. In terms of prevention for Zika, most of the study populations were aware that using insecticides (n = 227, 82.5%) and wearing long-sleeved shirt (n = 235, 85.5%) could help in preventing Zika virus infection. Among the 275 respondents, 85.8% were aware that Zika may lead to serious neurological complications.

Similar to knowledge, the mean awareness to Zika virus infection was statistically significant between the participants aged below 30 and 30 to 39 years (*P* < .001, Table 5, Figure 3). In addition, experience of community practice also contributed significantly to the level of awareness to Zika virus infection (*P* < .005), with spearman correlation coefficient of 0.229. However, there was no significant difference in the level of awareness between Zika fever and sex, race, as well as location of pharmacy.

Perception to Zika virus infection

Respondents' perception to Zika virus infection were evaluated using 5-point Likert-type scale ranging from 1 to 5 with scoring 1 for "strongly disagree" (SD), 2 for "disagree" (D), 3 for "not sure" (NS), 4 for "agree" (A), and 5 for "strongly agree" (SA) in this study (Table 6). Of a maximum score of 5 for perception to Zika virus infection, respondents obtained a median score of 4. Thus, the respondents tend to agree with the statements in the questionnaire.

Referring to Table 6, more than one-third of the respondents (n = 98, 35.7%) were confident that they have sufficient knowledge pertaining to Zika virus infection. Among 275 participants, more than half (n = 159, 57.8%) did not believe or unsure about the risk of them being infected by Zika virus. About half of the study population (n = 139, 50.5%) perceived that Zika fever was rare in Malaysia. More than half of the respondents (n = 161, 58.5%) believed that Zika fever was an important issue in Malaysia, with minority (n = 35, 12.8%) of the respondents disagree with this statement. Approximately two-thirds of the participants (n = 181, 65.8%) perceived that *A aegypti* mosquitoes, the main vector for Zika virus, were widely distributed in Malaysia. Almost three-quarters of the respondents (n = 198, 72%) mentioned that there were medications available in a pharmacy which could effectively relieve the symptoms of a Zika-infected individual. More than half of the

Table 4. Total and percentage of respondents' answers pertaining to awareness of Zika virus infection.

NO.	QUESTIONS	ANSWERS	N	%
1.	I am aware of the recent global Zika fever outbreaks.	Yes	**212**	**77.1**
		No	33	12.0
		Not sure	30	10.9
2.	I am concerned about the spread of Zika virus in Malaysia	Yes	**213**	**77.5**
		No	38	13.8
		Not sure	24	8.7
3.	I am living in a tropical region where Aedes mosquito is the most active.	Yes	**245**	**89.1**
		No	20	7.3
		Not sure	10	3.6
4.	I am at a higher risk of being bitten by Aedes mosquito during dawn and dusk.	Yes	**220**	**80.0**
		No	37	13.5
		Not sure	18	6.5
5.	I should not keep stagnant water for up to 5 days unattended.	Yes	**264**	**96.0**
		No	8	2.9
		Not sure	3	1.1
6.	Zika is transmittable from infected mosquito to human.	Yes	**274**	**99.6**
		No	0	0
		Not sure	1	0.4
7.	Zika is transmittable from affected human to unaffected human through sexual intercourse.	Yes	**123**	**44.7**
		No	84	30.5
		Not sure	68	24.7
8.	An approved antiviral treatment specific to Zika fever is currently not available.	Yes	**179**	**65.1**
		No	14	5.1
		Not sure	82	29.8
9.	An approved vaccine is currently not available for Zika.	Yes	**146**	**53.1**
		No	34	12.4
		Not sure	95	34.5
10.	There are medications to relieve symptoms such as fever and pain for those infected with Zika.	Yes	**267**	**97.1**
		No	1	0.4
		Not sure	7	2.5
11.	Using insecticides reduces the prevalence of Zika fever.	Yes	**227**	**82.5**
		No	18	6.5
		Not sure	30	10.9
12.	Wearing long-sleeved shirt can help to prevent Zika.	Yes	**235**	**85.5**
		No	21	7.6
		Not sure	19	6.9

(Continued)

Table 4. (Continued)

NO.	QUESTIONS	ANSWERS	N	%
13.	I should restrict my travel to Zika endemic countries.	Yes	**244**	**88.7**
		No	17	6.2
		Not sure	14	5.1
14.	If I travel to Zika endemic countries, I should take protective measures to prevent mosquito bite.	Yes	**271**	**98.5**
		No	0	0
		Not sure	4	1.5
15.	If a patient had a fever after returning from Zika endemic countries, I should advise him/her to have a test for Zika.	Yes	**256**	**93.5**
		No	6	2.2
		Not sure	12	4.4
16.	I am aware that Zika may lead to serious complications such as microcephaly in newborns and Guillain-Barré syndrome.	Yes	**236**	**85.8**
		No	5	1.8
		Not sure	34	12.4

Data in bold print refer to the most selected options.

Table 5. Pairwise comparison between age groups and awareness to Zika virus infection.

AGE GROUP (YEARS)	*P* VALUE
60 or above vs below 30	1.000
60 or above vs 50-59	1.000
60 or above vs 40-49	1.000
60 or above vs 30-39	1.000
Below 30—50-59	1.000
Below 30—40-49	.512
Below 30—30-39	**.000**
50-59—40-49	1.000
50-59—30-39	.386
40-49—30-39	1.000

Data in bold print refer to significant difference between 2 age groups in awareness level to Zika virus infection ($P < .05$).
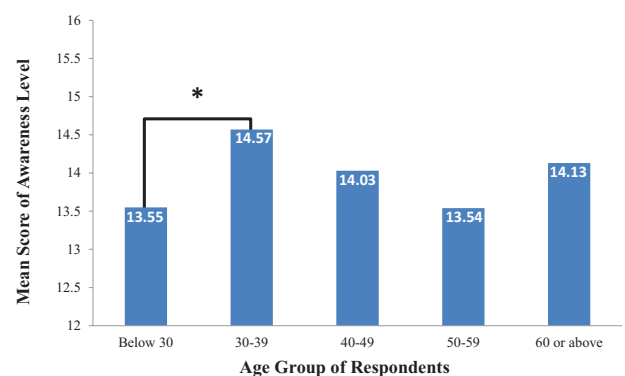

Figure 3. The mean score of awareness level to Zika virus infection in respondents categorized under different age groups. The mean score difference between "Below 30" and "30 to 39" was statistically significant ($P < .001$, labeled in asterisk).

study population (n = 144, 52.4%) reported that using a condom during sexual intercourse helped in reducing the risk of contracting Zika virus infection.

This study did not detect any significant difference between the perception to Zika virus infection and age, race, sex, location of pharmacy, as well as community practice experience.

Discussion

This survey study aimed to evaluate the knowledge, awareness, and perception to Zika virus infection among community pharmacists in the Klang Valley of Malaysia. The results revealed that most of the participants were aware of Zika virus infection and had basic knowledge of Zika virus infection. As only sporadic cases of Zika fever were reported in Malaysia, community pharmacists responded to this study may have less interest in understanding Zika virus infection.[19] However, the results presented that all participants have heard of Zika infection. Additional efforts are required for community pharmacists to further enhance their knowledge related to Zika virus transmission, common symptoms of Zika fever, nonavailability of approved antiviral treatment and vaccine, types of body fluids for Zika diagnosis, and prevention and complications of Zika fever. The lack of knowledge and awareness pertaining to these areas are the concerns which confer to potentially fatal nature of the infectious disease.

Table 6. Total and percentage of respondents' responses pertaining to perception of Zika virus infection.

NO.	VARIABLES	SD	D	NS	A	SA	MEDIAN
		N (%)	N (%)	N (%)	N (%)	N (%)	
1.	I have enough knowledge regarding Zika virus infection.	9 (3.3)	61 (22.2)	**107 (38.9)**	94 (34.2)	4 (1.5)	3
2.	I am at risk of being infected with Zika virus.	22 (8.0)	60 (21.8)	77 (28.0)	**111 (40.4)**	5 (1.8)	3
3.	I can control my exposure to Zika virus.	3 (1.1)	17 (6.2)	43 (15.6)	**187 (68.0)**	25 (9.1)	4
4.	The thought of Zika making me feel worried/anxious.	23 (8.4)	83 (30.2)	60 (21.8)	**93 (33.8)**	16 (5.8)	3
5.	Zika is rare in Malaysia.	3 (1.1)	50 (18.2)	83 (30.2)	**121 (44.0)**	18 (6.5)	4
6.	Zika fever is an important issue in Malaysia.	4 (1.5)	31 (11.3)	79 (28.7)	**143 (52.0)**	18 (6.5)	4
7.	*Aedes aegypti* mosquitoes (primary vector for Zika) are widely distributed in Malaysia.	1 (0.4)	15 (5.5)	78 (28.4)	**146 (53.1)**	35 (12.7)	4
8.	The clinical symptoms for Zika and dengue fever are almost similar.	1 (0.4)	3 (1.1)	34 (12.4)	**203 (73.8)**	34 (12.4)	4
9.	Zika fever is usually self-limited.	6 (2.2)	33 (12.0)	**113 (41.1)**	110 (40.0)	13 (4.7)	3
10.	Zika infection can occur without symptoms.	3 (1.1)	23 (8.4)	66 (24.0)	**167 (60.7)**	16 (5.8)	4
11.	Zika fever can be diagnosed.	0 (0.0)	7 (2.5)	43 (15.6)	**196 (71.3)**	29 (10.5)	4
12.	Zika can be prevented.	0 (0.0)	4 (1.5)	19 (6.9)	**203 (73.8)**	49 (17.8)	4
13.	I think a pharmacy has medication that can effectively relieve the symptoms of a person infected with Zika virus.	10 (3.6)	27 (9.8)	40 (14.5)	**177 (64.4)**	21 (7.6)	4
14.	It is necessary to take preventive measures for Zika in Malaysia.	0 (0.0)	5 (1.8)	22 (8.0)	**188 (68.4)**	60 (21.8)	4
15.	It is convenient to purchase mosquito repellent products in Malaysia.	0 (0.0)	1 (0.4)	8 (2.9)	**171 (62.2)**	95 (34.5)	4
16.	Using condom during sexual intercourse can help to reduce the risk of contracting Zika fever.	2 (0.7)	22 (8.0)	107 (38.9)	**118 (42.9)**	26 (9.5)	4
17.	Drinking plenty of fluids is important for Zika infected individuals.	3 (1.1)	3 (1.1)	39 (14.2)	**187 (68.0)**	43 (15.6)	4
18.	Exposure of Zika virus infection often results in sickness.	1 (0.4)	17 (6.2)	46 (16.7)	**189 (68.7)**	22 (8.0)	4
19.	Zika can be fatal.	0 (0.0)	20 (7.3)	39 (14.2)	**165 (60.0)**	51 (18.5)	4
20.	All pregnant women should be tested for Zika.	3 (1.1)	60 (21.8)	66 (24.0)	**115 (41.8)**	31 (11.3)	4
21.	Public campaign is needed to increase public awareness toward Zika fever.	2 (0.7)	2 (0.7)	6 (2.2)	**189 (68.7)**	76 (27.6)	4
22.	Legislation and regulation are needed to monitor Malaysian citizens traveling to Zika endemic regions.	3 (1.1)	10 (3.6)	22 (8.0)	**178 (64.7)**	62 (22.5)	4

Abbreviations: NS, not sure; SA, strongly agree; SD, strongly disagree.
Data in bold print refer to the most selected options.

In 2017, a study conducted among general public in the state of Selangor aimed to assess the knowledge and attitudes toward Zika virus and its prevention. Surprisingly, the residents of Selangor showed good overall knowledge toward Zika virus. While this is encouraging, the public in Selangor has to further improve their knowledge pertaining to the unavailability of Zika virus vaccine, the risk of microcephaly in fetus born to mother infected with Zika, and the potential forms of Zika virus transmission via sexual intercourse.[3] In contrast, several studies revealed a poor knowledge level to Zika virus infection in their respondents. These studies were conducted in various countries including dental practitioners in India,[22] medical students in Saudi Arabia,[20] and health care workers in Indonesia.[23]

We found that more than half (58.5%) of the participants perceived Zika fever as an important issue in Malaysia. This finding was supported by Arief et al[3] that nearly all the

participants welcomed preventive measures against Zika fever in Malaysia. The contributing factors to this positive finding may be due to Zika outbreaks in surrounding countries of Malaysia and the association of Zika fever to serious neurological defects in the patients, especially newborns.

More than half of the participants perceived that they were not at risk of being infected by Zika virus. This finding was surprising as Zika fever outbreak was declared as a Public Health Emergency of International Concern by World Health Organization (WHO), which has drawn attention of the people across the globe.[24] Besides that, a health alert related to Zika virus infection also has been disseminated by Malaysian authorities to all private facilities and public.[25] This highlights some possible communication failures existing between the authorities and the community pharmacists. An opposing view, this may also due to the generally low awareness to Zika virus infection as a low number of confirmed cases were reported in Malaysia.

The Aedes mosquitoes are known to be active during the dawn and dusk[6]; 11.6% of the respondents were unable to recognize this unique feeding behavior of the vector. This finding was also supported by another study in which participants incorrectly mentioned that Aedes mosquito bites mainly at night.[26] It is crucial to bridge this knowledge gap in the design of educational interventions to ensure that all the community pharmacists achieve a full understanding on personal protective measures against mosquitoes and therefore able to educate the public.

This study also demonstrated that all participants were aware of Zika virus transmission via the bite of an infected mosquito. The number was slightly higher than a few studies conducted among public in Malaysia (85.8%)[3] and future health care providers in United Arab Emirates (75.4%).[27] The dissimilarities may be due to the difference in target participants, in which only community pharmacists were recruited in this study. However, other modes of Zika virus transmission were less well known. In this study, 57.1% of respondents were aware of the possibility of Zika virus transmission from an infected pregnant mother to a child. These results were consistent with the surveys conducted among future health care providers in United Arab Emirates (64.2%)[27] and medical students in Saudi Arabia (50.5%).[20] According to health officials report, a sexually transmitted Zika case was reported in Texas.[7] However, our findings revealed that only less than half of the respondents were aware of Zika virus transmission through sexual contact (42.5%), blood transfusion (34.5%), and accidental exposure of blood or body fluids (23.6%). As such, authorities should actively promote the forms of Zika virus transmission to the community pharmacists through education programs. In Columbia, >90% of the participants were able to identify the modes of transmission of Zika virus, given the intensive public education in the country and most regions of the Latin American during 2016 when Zika outbreaks were declared.[28]

Another concern to be highlighted in this study is the false understanding of respondents regarding the availability of antiviral treatment and Zika-related vaccines. This finding was similar to the results published in some previous studies conducted among health care sectors in United Arab Emirates,[27] Saudi Arabia,[20] India,[22] and Indonesia.[23] In addition, although it is important to recognize the common symptoms of Zika fever during an outbreak, most of our respondents were not able to correctly identify all of the common clinical manifestations of Zika fever. This finding was supported by a Rajiah et al[29] reporting the lack of preparedness and perceived response to Zika outbreak among community pharmacists in Malaysia. We also agree to Rajiah et al[29] that all health care professionals in Malaysia should attend training or seminar given by Ministry of Health Malaysia as a continuing education as part of their professional career paths.

In addition, the findings suggested that almost half of the pharmacists were uncertain or did not consider the need of using condom if the male partner is suspected of acquiring Zika. According to Centers for Disease Control and Prevention (CDC), using condom or abstain from sexual intercourse for at least 6 months to a couple, in which the male partner was infected by Zika virus, is recommended as a precautionary measures. Although there are studies underway to better understand this aspect of disease transmission, it is important to educate the community pharmacists about the potential transmission of Zika virus through sexual contact and highlight the protective measures suggested by CDC.[30]

Based on the findings of this survey, participants were more familiar with microcephaly compared to Guillain-Barré syndrome, signaling that future health interventions should clearly communicate that, despite the severe neurological consequences in babies, Zika may lead to autoimmune complication in adults as well.[17]

In the perspective of legislation, 87.2% of the sample population was agreeable with the implementation of proper regulations in monitoring Malaysian citizens traveling to regions with Zika endemic. Once an approved Zika-related vaccine is available, the government should impose a regulation to allow all Malaysian citizens who are traveling to high-risk countries to receive the vaccination.

This survey also revealed that the levels of knowledge and awareness pertaining to Zika virus infection were enhanced significantly as the year of community practice experience progressed. Similarly, the level of knowledge and awareness toward Zika of the participant aged 30 to 39 years is significantly higher than those aged below 30 years. In accordance with previous studies, these findings may be attributed to the fact that the participants with longer community practice experience or greater age group have gained more exposure and has better awareness regarding newly emerging infection.[27]

Although a selection bias may have been occurred due to the self-administered and cross-sectional random convenience

sampling nature of this survey research, this survey study has shown a basic knowledge and high awareness to Zika virus infection among community pharmacists in the Klang Valley. The levels of knowledge and awareness increased with proceeding years of practice experience in community pharmacy.

Conclusions

This study reported the level of knowledge and awareness among community pharmacists reside in the Klang Valley, Malaysia. The finding also demonstrated that the levels of knowledge and awareness increased with proceeding years of practice experience in community pharmacy setting. In terms of perception to Zika infection, most of the participants are agreeable to the statements and suggestions stated in the questionnaires. Our findings also revealed some important information gaps, including the need for community pharmacists to update their knowledge regarding Zika virus infection as and when needed. In addition, the findings highlight the need of community-based health education program for disease risk mitigation in Malaysia, in response to areas where awareness lacked such as the unavailability of antiviral and vaccines to Zika virus infection, feeding behavior of *Aedes* mosquitoes, and the status of public health emergency during Zika fever outbreak. We also recommend the incorporation of such programs into the Human Resource Development Fund (https://www.hrdf.com.my/) under the Ministry of Human Resources Malaysia.

Author Contributions

H-WT founded the research project; KYL conducted the research project; KYL and H-WT prepared the manuscript for publication.

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