ORIGINAL ARTICLE

KNOWLEDGE AND PRACTICE REGARDING DENGUE FEVER AND ACCEPTANCE TOWARDS *WOLBACHIA* AMONG UNIVERSITI KEBANGSAAN MALAYSIA MEDICAL CENTRE HEALTHCARE STAFF

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ABSTRACT

Field trials of Wolbachia-transinfected mosquitoes, as a biological approach to curb dengue transmission, have been initiated. This study aimed to determine the knowledge regarding dengue fever (DF), practice of vector control, and acceptance of Wolbachia as a dengue control method among Universiti Kebangsaan Malaysia Medical Centre (UKMMC) healthcare staff. A questionnaire assessing knowledge regarding DF, vector control practices, and acceptance of Wolbachia was conducted among 330 UKMMC healthcare staff via convenience sampling. More than 70% of the respondents had good knowledge regarding DF, good vector control practice, and good acceptance of Wolbachia. Being female and having household income >MYR3000 had higher odds of having good knowledge regarding DF [(aOR 2.40; 95%CI 1.13, 5.12) and (aOR 3.86; 95%CI 1.91, 7.80)]. Having household income >MYR3000 had higher odds of having good vector control practice (aOR 2.33; 95%CI 1.20, 4.54) while academicians were three times (1-0.24) less likely to have good vector control practice than non-academicians (aOR 0.24; 95%CI 0.13, 0.48). Good acceptance of Wolbachia was associated with being academicians (aOR 8.83; 95%CI 2.60, 29.96) and having good knowledge regarding DF (aOR 6.07; 95% CI 2.89, 12.74). Gender, different income level and type of occupation have significant association with either good knowledge regarding DF or practice on vector control. Different type of occupation and level of knowledge also were notably significantly associated with good acceptance on Wolbachia as dengue biological control. These factors may be the focus for future plan to enhance the knowledge, acceptance and practice regarding DF and its control.

***Keywords**: Wolbachia, Dengue, Aedes, Knowledge, Practice, Acceptance, Questionnaire, Healthcare staff*

INTRODUCTION

Dengue remains the highest reported mosquito-borne disease in Malaysia. The number of case fatality rate due to dengue in 2015 increased for more than two-fold of that in 2013[1]. Since vaccine is not made available yet, control of vector population and prevention from mosquito bites are the main strategies in preventing dengue. National strategies of vector control rely heavily on the usage of insecticides and source reduction, which may prove ineffective in certain situations due to challenges such as insecticide resistance and lack of community participation[2]. Recently, genetically modified (GM) mosquitoes[2,3] had been trialed in Malaysia. Theoretically, this intervention will help to reduce the population of dengue vectors[3]. However, unresolved ethical issues regarding mass releases of GM mosquitoes have arisen[4]. Thus, a natural method, *Wolbachia*-transinfected mosquitoes, is being considered instead.

Wolbachia is a gram-negative bacteria naturally found in some insects and is maternally inherited (i.e. mother to offspring). *Aedes albopictus* were known to naturally harbor *Wolbachia*[5,6], while *Ae. aegypti* were not naturally infected with the bacteria. *Wolbachia* strains namely *w*Mel and *w*MelPop, originally from *Drosophila melanogaster* (a fruit fly), were artificially transferred into *Ae.*

aegypti eggs via embryonic microinjection. Laboratory-bred *Ae. aegypti* containing these strains are then crossed with wild caught mosquitoes. Resultant generations are then used for mass releases into the environment. Both strains have the potential to block transmission of dengue viruses. Promising results from field trials performed in other countries[7] have encouraged the release of the mosquitoes in Malaysia which was pioneered in Keramat in March 2017, followed by Shah Alam[8].

Previous studies focused on knowledge, attitude and practice regarding dengue fever (DF)[9-11]; and the degree of acceptance towards *Wolbachia* as a biological control for dengue is yet to be reported in Malaysia. To the best of our knowledge, this is the first study that reports on acceptance towards such approach among healthcare personnel. In addition, there is no study done among local healthcare staff regarding knowledge and practice regarding DF. Healthcare workers are relied upon by the public as a primary source of information on dengue and health in general[12]. Thus, early engagement and updated knowledge on a *Wolbachia* strategy among them are desirable for preparing themselves to tackle any health issues and queries arising from it[12]. Furthermore, to overcome resistance, such as faced by the GM mosquito approach[4], and to ensure the sustainability of *Wolbachia* strategy, acceptance of stakeholders should be explored further. Thus, this study was conducted to assess the knowledge regarding DF and practice of vector control among healthcare staff in UKMMC as well as to discover their acceptance towards *Wolbachia*-based control method.

METHODS

A cross sectional study was conducted among purposively selected healthcare staff of UKMMC from various departments from June until August 2016; 9 months before the field releases in Keramat. This explained why the *Wolbachia* strategy was unfamiliar to the respondents. Hence a brief information sheet about the strategy was distributed with the questionnaire. Ethical approval for this study was obtained from the Ethic Research Committee of UKM (research code: FF-2016-218). Written consent was obtained from each healthcare staff. Sample size was calculated using Epi Info™ StatCalc version 7.1[13] and in reference to previous studies[14,15], a minimum of 330 was needed for this study.

Data was collected using a set of self-administered questionnaire consisted of two sections.

Section A : Socio-demographic characteristics which include gender, age, occupation, marital status, race, living area, number of household members, household monthly income and their previous experience with dengue.

Section B : A questionnaire on knowledge regarding DF (i.e. prevention & control, vectors, transmission and clinical manifestations), vector control practices and acceptance of *Wolbachia* as dengue biological control was developed from literature reviews[14-17]. Each of knowledge and practice domains consists of 23 and 10 items respectively. The acceptance of dengue biological control domain consists of 11 items, including 8 items related to *Wolbachia*. All items were measured using Likert's scale and scrutinized for content validity by epidemiologist, clinical psychologist and entomologist. For knowledge, we used the following scale: 5 = 'Strongly agree', 4 = 'Agree', 3 = 'Undecided', 2 = 'Disagree', 1 = 'Strongly disagree'. For practice, we used the following scale: 5 = 'Often', 4 = 'Sometimes', 3 = 'Rarely', 2 = 'Not at all', 1 = 'Not applicable'. For acceptance, we used the following scale: 5 = 'Very acceptable, 4 = 'Acceptable', 3 = 'Undecided', 2 = 'Unacceptable', 1 = 'Not acceptable at all'. A cut-off point of 70% of the total score from each domain was applied as healthcare staffs are assumed to have higher knowledge, practice and acceptance on these issues as compared to the general population. Total score of ≥70% indicates good knowledge, practice and acceptance while lower total score indicates otherwise. The questionnaire was administered in English (with Malay translation) and face validity was conducted among 30 healthcare staff. The reliability measured with Cronbach α showed satisfactory internal consistency of each domain (Knowledge, Practice and Acceptance: Cronbach α; 0.74, 0.86 and 0.79 respectively.

Statistical analyses were conducted using SPSS version 20.0. Frequency (n) and percentage (%) were used to describe the categorical data. Multiple logistic regression analysis was used to test all independents variables association with each domain. Significant level was set at $p < 0.05$.

RESULTS

A total of 330 healthcare staff consented to participate in this study. Of these, two were excluded due to missing information/incomplete questionnaire forms.

(a) Socio-demographic characteristics of staff

Table 1: ***Socio-demographic characteristics of staff (n=328)***

Characteristics	n (%)
Gender	
Male	75 (22.9)
Female	253 (77.1)
Age (years)	
18 - 30	112 (34.1)
31 - 40	160 (48.8)
>41	56 (17.1)
Race	
Malay	297 (90.5)
Non-Malay	31 (9.5)
Occupation	
Academician (clinicians & scientists)	66 (20.1)
Non-academician	262 (79.9)
-Nurses	151 (46.0)
-Other non-academicians	111 (33.9)
Household members	
≤3	107 (32.6)
4 - 6	198 (60.4)
>6	23 (7.0)
Household income (n = 276)	
≤MYR3000	75 (22.9)
>MYR3000	199 (60.7)

Table 1 shows that, majority of the staff were female (77.1%) and approximately half were in the 31-40 years category (48.8%). Most of them were Malay (90.5%) and worked as non-academicians (79.9%). Almost half of them (46%) were nurses. More than half of the staff had 4 - 6 household members and earned >MYR3000 monthly (60.7%).

(b) The prevalence of knowledge regarding DF, practice of vector control & acceptance of *Wolbachia* as a dengue biological control

The prevalence of good knowledge regarding DF and practice of vector control among the staff were 84.1% and 75.6% respectively. In addition, 71.6% of the staff showed good acceptance towards *Wolbachia* as a dengue biological control.

(c) Factors associated with knowledge regarding DF, practice of vector control and acceptance towards *Wolbachia*

Table 2: Factors associated with knowledge regarding DF, practice of vector control and acceptance towards Wolbachia

	Factors	χ^2(df)	*p* value	aOR*	95% CI
Good knowledge regarding DF	***Gender***				
	Male			1	
	Female	5.14(1)	0.023	2.40	1.13,5.12
	Household income				
	≤MYR3000			1	
	>MYR3000	14.16(1)	<0.001	3.86	1.91,7.80
Good practice on dengue vector control	***Household income***				
	≤MYR3000			1	
	>MYR3000	6.17(1)	0.013	2.33	1.20,4.54
	Occupation				
	Non-academician			1	
	Academician	16.78(1)	<0.001	0.24	0.13,0.48
Good acceptance on *Wolbachia* as dengue biological control	***Occupation***				
	Non-academician			1	
	Academician	12.20(1)	<0.001	8.83	2.60,29.96
	Knowledge regarding DF				
	Poor			1	
	Good	22.65(1)	<0.001	6.07	2.89,12.74

*aOR: adjusted odds ratio with multiple logistic regression (Backward LR)

Muliple logistic regression analysis demonstrated that being female and having household income >MYR3000 had higher odds of having good knowledge regarding DF [(aOR 2.40; 95%CI 1.13, 5.12) and (aOR 3.86; 95%CI 1.91, 7.80)]. Having household income >MYR3000 had higher odds of having good vector control practice (aOR 2.33; 95%CI 1.20, 4.54) while academicians were three times (1-0.24) (aOR 0.24; 95%CI 0.13, 0.48) less likely to have good vector control practice than non-academicians. Good acceptance of *Wolbachia* was associated with being academicians (aOR 8.83; 95%CI 2.60, 29.96) and having good knowledge regarding DF (aOR 6.07; 95% CI 2.89, 12.74).

(d) Responses based on individual domains

Knowledge

Overall, more than 60% of the staff answered most of the items in the Knowledge domain correctly, including items enquiring about dengue prevention and control: vaccine, Abate (larvicide), insecticidal sprays and repellents. More than 60% of them knew that dengue is transmitted from human to human via mosquito bite and not by direct blood contact. Almost 90% of the staff identified fever as a symptom of dengue whilst almost all staff (98.2%) agreed that headache, joint and muscle pain are symptoms of dengue. Pain behind the eyes and abdominal pain were only identified by 70.4% and 64% of them respectively. Two questions on rash were answered correctly by only 36.6% and 29.9% of them respectively. When asked about low white blood cell counts observed after the third day of fever, only 53.4% answered correctly.

Acceptance

The acceptance of chemical control (i.e. the use of insecticides to kill mosquitoes and other insects) is considerably higher than biological control. Out of 328 respondents, 257 (78.4%) think that insecticide spraying is acceptable in contrast to biological

control which are considered acceptable by only 30.5% - 52.1% of them. The least accepted biological control method is the use of GM mosquitoes. About 40% of the staff agreed that the introduction of insect bacteria (i.e. *Wolbachia*) will potentially prevent dengue transmission. Opinions were also sought on the effect of *Wolbachia* on humans, insects (other than mosquitoes) and animals. Approximately 60% of them think that *Wolbachia* should not affect or be able to spread to the aforementioned organisms. More than half of the respondents (54.6%) feel that the biological agent should not be able to spread outside of Malaysia. The introduction of a parasite to mosquito breeding containers is found suitable by approximately half of the respondents. The majority of them agreed that the public should be provided with information on the science behind the biological control program (92.1%), and that they should be consulted about such programs (89.6%).

Practice

To reduce or kill mosquitoes, the majority of the respondents (80.5%) used insecticide sprays and employed the following source reduction actions: drainage of water from potential containers (84.5%), elimination of stagnant water (88.7%) and cutting down of bushes in the yard (84.1%). The least practiced mosquito control methods are the use of mosquito eating fish (51.2%), professional pest control (52.7%) and mosquito coils (58.2%).

DISCUSSION

The prevalence of good knowledge regarding DF for this present study (84.1%) was slightly lower than a similar study amongst interns in a tertiary care hospital in India (95.4%)[18]. This may due to the diverse socio-demographic and education background of our respondents as compared to theirs which was more homogenized. Surveys that targeted community yielded lower prevalence of good knowledge on DF and its vectors as shown by two Malaysian studies[9, 10]. The former study reported a prevalence of 68.5% for rural communities in Kuala Kangsar[9]. Only 14.3% of the respondents in the latter study, which involved an urban Malay community in Kuala Lumpur, have good knowledge of DF and its vectors[10]. Both of the studies used an arbitrary cut-off point to classify good and poor knowledge. Hairi et al. (2003)[9] did not state the cut-off point in their report. Whereas Wan Rozita et al. (2006)[10] used 75% as the cut-off point (>75% = good knowledge); which was slightly higher than present study and probably explained the lower prevalence in their study. Another Malaysian study used 50% as the cut-off point for a nationwide telephone survey[15]. Taking these into consideration and also involvement of our respondents in healthcare services, we opt for a higher cut-off point (≥70%) to classify good and poor levels of knowledge.

This study shows that good knowledge is associated with being female and having a household income of more than MYR3000. Having higher household income puts the individual in a higher socio-economic status. Itrat and colleagues (2008)[19] surveyed on adult patients visiting two tertiary care hospitals in Pakistan and found that individuals with higher income (>$500) were more likely to have sufficient knowledge about dengue. They concluded that individuals in higher socio-economic status have easy access to printed and electronic sources, and are easier to grasp the information being delivered to them[19]. In their study, females showed a higher percentage of individuals having sufficient knowledge as compared to males, albeit not formally analysed in the findings. It is also worth mentioning that, the majority of our study population was female, non-academicians and with higher household income which may influence the statistical significance of findings from this study.

The present study revealed good practice of vector control in 75.6% of the staff, which is much higher compared to studies involving communities. For instance, Hairi et al. (2003)[9] and Wan Rozita et al. (2006)[10] who reported a prevalence of good practice of only 51.5% and 49.6% respectively. We found that respondents with a monthly income of more than MYR3000 have higher odds of practicing good vector control. Respondents with higher income are at an advantage as compared to those with household income of less than MYR3000 because they are more capable to purchase vector control chemicals such as larvicides, insecticides and mosquito repellents or encounter fogging more frequently as they are more likely to live/own a house in urban residential area. Therefore, they have higher odds of engaging themselves in vector control activities. Thus, they have better level of practice than those with household income <MYR3000. In the study by Wan Rozita et al. (2006)[10], respondents who owned a house showed better practice of dengue control compared to those who rented, suggesting that ownership of a property could act as a cue for control actions.

In previous studies involving general populations, individuals having higher level of education had been found to have better practise[20, 21] as compared

to those with lower level of education. However, based on our study, academicians who can be considered as individuals with higher level of education as compared to non-academicians were less likely to have good level of practice. Academic workload might have reduced their time to be involved in preventive actions either at home or in the community. Such phenomenon is worsened for personnel working in teaching hospitals where working hours are frequently extended[22] and working during weekends are sometimes unavoidable. Issue on working hours is an on-going debate and research[23]. However, these factors were not elicited and maybe the focus for future studies. On top of this, the finding of current study should be interpreted cautiously as there was only 66 academicians (20.1%) involved. Furthermore, the practice measured in present study was pertaining to certain individual level dengue vector control activities only. Future study conducted should also try to achieve proportionate sample population and which practice would be more appealing to certain group of people. As earlier findings showed acceptance on *Wolbachia* as biological control is high among academicians, it would be a challenge to measure an individual level practice. As this control, upon granted approval for full scale application to the community, it would be conducted by the health authorities.

Although significant association has been demonstrated between knowledge and practice[10,19,24], the former does not necessarily translate into the latter. For example, in the Kuala Kangsar study, storing of water is still practiced regardless of the respondents knowing that it could breed mosquitoes[9]. As in our study, no association was found between knowledge and practice. In contrast, knowledge has been found to influence the acceptance towards biological control methods, including *Wolbachia*. We found that good acceptance towards *Wolbachia* was significantly associated with good knowledge regarding DF. Respondents who have good knowledge presumably obtain more information from the mass media and could be interested to search for more information. Thus they are more aware of the problems and limitations in current dengue control, such as insecticide resistance in *Aedes* mosquitoes. As a result, they understand the need for a new intervention better; especially the ones that do not rely on chemicals to kill the mosquitoes and are much more likely to accept them. In a Vietnam study, *Wolbachia* was more acceptable than GM mosquitoes (86% versus 64% of householders). Community leaders' concerns regarding *Wolbachia* diminished after repetition of visits to the study site[12].

In general, fever, headache, myalgia and arthralgia[25,26] are known as some of the common symptoms. Several other symptoms including nausea and vomiting[25,27], rash, petechiae and bleeding tendencies are less commonly recognized[25] as manifestations of DF. Our respondents answered poorly on questions about rash probably because it is a less common symptom. The question on low white blood cell count after the third day of fever has conflicting answers from the literature[14, 25,26]. Hence failure of more than half of the respondents to answer correctly is in part justified. A lack of knowledge on the clinical manifestations[14,28] and management of dengue among physicians is noted[28]. These findings emphasize on the importance of updating the evidence-based knowledge and practice of health-care professionals.

This present study is not without limitation. The non-probability sampling method applied made these findings unsuitable for generalization to other population. However, the results can be used as baseline data for future research, especially in designing educational health modules to educate the staff and further expanded to the community in general.

CONCLUSIONS

Healthcare staff at UKMMC have good knowledge regarding DF and good practice of vector control. They also have good acceptance towards *Wolbachia* as a dengue control method. Gender, different income level and type of occupation have significant association with either good knowledge regarding DF or practice on vector control. Different type of occupation and level of knowledge also were notably significantly associated with good acceptance on *Wolbachia* as dengue biological control. These factors may be the focus for future plan to enhance the knowledge, acceptance and practice regarding dengue fever and its control.

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