Original Research

The Indonesian Journal of Public Health
Vol 19. No. 3 December2024
p- ISSN 1829-7005 e- ISSN 2540-8836

DENGUE PREVENTION AND PUBLIC PERCEPTION OF BARRIERS TO ELIMINATE MOSQUITO BREEDING SITES AMONG MALAYSIANS

Noorlaile Jasman[1*], Siti Nur Farhana Harun[2], Kamarul Zaman Saleh[3], Norrafizah Jaafar[4], Zanariah Zaini[5], Manimaran a/l Krishnan Kaundan[6], Albeny Joslyn Panting[7]

[1]Institute for Health Behavioural Research, National Institute of Health, Ministry of Health Malaysia, Setia Alam, Selangor, Malaysia
[2]Institute for Health Behavioural Research, National Institute of Health, Ministry of Health Malaysia, Setia Alam, Selangor, Malaysia
[3]Hospital Sultanah Nur Zahirah, Ministry of Health, Malaysia
[4]Institute for Health Behavioural Research, National Institute of Health, Ministry of Health Malaysia, Setia Alam, Selangor, Malaysia
[5]Institute for Health Behavioural Research, National Institute of Health, Ministry of Health Malaysia, Setia Alam, Selangor, Malaysia
[6]Institute for Health Behavioural Research, National Institute of Health, Ministry of Health Malaysia, Setia Alam, Selangor, Malaysia
[7]Institute for Health Behavioural Research, National Institute of Health, Ministry of Health Malaysia, Setia Alam, Selangor, Malaysia
Correspondence address: Noorlaile Jasman
Email: noorlaile@moh.gov.my

ABSTRACT

Introduction: Malaysia reported a 150.7% increment in dengue cases in 2022 compared to 2021. Aim of this study was to evaluate the respondent's involvement in dengue prevention initiatives and public perceptions of barriers to eliminating mosquito breeding sites among Malaysian residents. **Methods:** A cross-sectional survey employing a population-based approach and a sophisticated survey design, carried out from August to October 2020. Respondents in this study must be 13 years of age or older from the selected households and live in non-institutionalized living quarters (LQ) units in Malaysia, regardless of citizenship. A pretested and structured Self-administered questionnaire (SAQ) was used. SPSS Version 23.0 was used to analyse the data. **Results:** Out of 4,522 participants, only 1,642 (36.7%) people carried out individual "Search and Destroy" mosquito breeding site practices at home once a week as recommended by the Malaysian Ministry of Health (MOH). Most respondents (n = 3,831, 94.3%) said they cleared their homes' clogged drains and cleaned their rain gutters. There is a significant association between compliance of 'Search and Destroy' practicing and type of house (p-value = 0.001). In order to avoid getting bitten by mosquitoes, 89.9% of the respondents (n=4,047) stated that they stay indoors when Aedes mosquito are active. The perceived barriers to dengue prevention activities are high for 22.6% of the participants. **Conclusions:** Addressing public perception of barriers to dengue prevention is an important step in controlling the spread of this disease in Malaysia.

Keywords: Dengue Prevention, Barriers, Breeding sites

INTRODUCTION

Dengue has become a public health concern worldwide. According to the WHO, approximately 50% of the global population is vulnerable to dengue, with 100-400 million infections occurring each year (World Health Organization, 2023). Dengue is an infectious viral disease transmitted by mosquitoes that presents a serious threat to public health in Malaysia, with thousands of cases reported each year. Prevention measures are crucial in controlling the spread of dengue, and public perception of barriers to prevention can help identify areas for improvement. Dengue has remained a public health threat in Malaysia during the COVID-19 pandemic (Mashudiet al., 2020).

Malaysia reported 66,102 dengue cases in 2022, an increase of 39,737 cases (150.7%) from 26,365 cases in 2021. While the number of deaths as a result of reported dengue complications was 56,

Cite this as: Jasman, N., Harun, S.N.H., Saleh, K.Z., Jaafar, N., Zaini, Z., Kaundan, M.A.K., and Panting, A.J, (2024). Dengue Prevention And Public Perception Of Barriers To Eliminate Mosquito Breeding Sites Among Malaysians. The Indonesian Journal of Public Health, 19(3), 406-418s. https://doi.org/10.20473/Ijph.v19i3.2023.406-418

Received 16 November 2023, received in revised form 24 June 2024, Accepted 29 June 2024, Published online: December 2024. Publisher by Universitas Airlangga

compared to 20 for the same period in 2021, this represents a 180% increase (Ministry of Health Malaysia, 2023).

Insufficient efforts to prevent dengue are a factor contributing to the ongoing occurrence of dengue cases, despite the government's various aggressive initiatives (Said, Abdullah and Abdul Ghafar, 2018). Notwithstanding its severity, dengue is a preventable disease. Controlling vector mosquito breeding sites is the only way to prevent dengue virus transmission. Sufficient knowledge, an optimistic outlook, and appropriate dengue prevention measures are crucial for eradicating the disease (Selvarajoo et al., 2020). Some common prevention measures for dengue include avoiding mosquito breeding, using insect repellent, clothing in protective gear, and using mosquito nets. However, there may be barriers to implementing these measures, such as lack of knowledge, limited access to resources or cultural beliefs. According to a study conducted in Vietnam, one of the barriers to implementing effective dengue prevention is a lack of community awareness and readiness (Nguyen-Tien, Probandari and Ahmad, 2019).

According to a Tamil Nadu study, there are additional obstacles to dengue prevention, including inadequate awareness (30%), low government assistance (25%), budgetary limitations (16.9%), and low motivation (7.5%) (Sahithyaa et al. 2019).

To encourage residents to participate in dengue prevention activities, the Malaysian Ministry of Health (MOH) has launched a "Search and Destroy" campaign in which residents are encouraged to inspect Aedes breeding grounds for 10 minutes once a week and to keep their homes clean both inside and outside. Thus, this study was conducted to evaluate the individual's involvement in activities aimed at controlling dengue among Malaysian residents.

The MOH uses the National Health and Morbidity Survey (NHMS), a community-based survey, to evaluate the country's health priorities and policies. The NHMS 2020 concentrated on the extent of infectious diseases. Dengue prevention has been included in the Cognitive, Affective and Behavioral (CAB) component of this survey. The sample is nationally representative and includes the whole population of Malaysia residing in non-institutionalized living quarters (LQs), irrespective of nationality. The survey was conducted in every state, including the federal territories, in Malaysia. (Institute for Public Health Malaysia, 2021).

According to the CAB survey conducted as a component of the NHMS 2020, 58.5% of people thought dengue posed a health risk. Around 60.6% of residents in Malaysia thought that their efforts in dengue prevention effectively managed the disease, whereas 22.6% found it challenging to carry out dengue control activities independently. Roughly 34.5% were of the opinion that the government had successfully managed dengue control. In terms of behavior, 36.7% of Malaysians claimed that they have carried out "Search and Destroy" on a weekly basis in their homes and surroundings was practiced by a majority, while 37.5% of them participated in neighborhood "gotong-royong" to stop dengue.

METHODS

Study Design

This study was part of the NHMS, a cross-sectional survey conducted nationwide with a complex survey design. Without taking citizenship into account, the sample consists of all Malaysians residing in non-institutionalized Living Quarters (LQ) units. The survey did not include individuals residing in institutional accommodations such as hotels, hostels, hospitals, correctional facilities, boarding houses, and nursing homes. The survey is open to all residents of the selected houses who are 13 years of age or older.

Sample Size

The Malaysian Department of Statistics (DOSM) provided the sampling frame for this survey. Malaysia's geographic region is subdivided into Enumeration Blocks (EBs), and the DOSM classifies each EB as either urban or rural. A locality is considered urban if its total population exceeds 10,000, whereas a rural area has a total population of less than 10,000. To estimate the frequency, the sample size was computed with a formula designed for a single proportion. Based on the population sizes of the various states, urban, and rural areas, samples were allocated proportionately among them. The survey received 5,564 eligible responses, but only 4,588 were analyzed. The response rate was 82.46%.

This survey employed a two-stage stratified random sampling technique to ensure national representativeness. The states of Malaysia, including the Federal Territories, make up the primary stratum. Within the primary stratum are the urban and rural strata. The EBs served as the primary sampling unit (PSU) and the LQs within each sampled EB served as the secondary sampling unit (SSU) in the two stages of the sampling procedure. Based on the designated sample size, DOSM chose the PSU and SSU at random. In all, 113 EBs were chosen from throughout Malaysia; 83 of these were chosen from Peninsular Malaysia, 13 from Sabah, and 17 from Sarawak. Randomly, 20 Living Quarters (LQs) were selected from each of the chosen Enumeration Blocks (EBs).

Survey Instrument

Based on the survey scope, structured questionnaires were utilized for data collection. Malay and English versions of the validated self-administered questionnaire (SAQ) were offered. This includes questions on socio-demographic characteristics, containing the age, gender, level of education, marital status, and employment status of the respondent, as well as questions about their involvement in dengue control activities. This section of the questionnaire included a question about the prevalence of individuals carrying out "search and destroy" activities in their homes to find mosquito breeding grounds. A total of eight questions necessitating responses of 'yes,' 'no,' or 'not applicable' were asked about methods used to eliminate mosquito breeding sites, and six questions necessitating responses of 'yes,' 'no,' or 'not applicable' were asked about methods used to prevent Aedes mosquito bites. Perceived barriers to not participating in dengue control activities have eight questions on a five-point Likert scale and are included in the dengue control activities: "strongly disagree," "disagree," "uncertain," "agree," and "strongly agree." Each scale will be assigned numerical marks of 1, 2, 3, 4, and 5, respectively. It will be redefined that the scores for negative phrase items will be 5, 4, 3, 2, and 1, respectively. Each outcome's cumulative score was calculated using Bloom's cut-off point (Bloom et al., 1956). Printed copies of the SAQs were sent to all qualified respondents (13 years of age and up).

Data Collection

The survey took place from August through October 2020. SAQs were used to collect data. Owing to the COVID-19 pandemic, in-person interviews with households were not conducted for this survey. A modification was made to the data collection procedure to reduce extended direct contact. During the house-to-house visits, questionnaires were given to the eligible respondents and they were requested to fill up the SAQs themselves. During pilot testing, the CAB tools were identified as appropriate for community self-administration during field data collection. Questionnaire booklets were returned to the research team members once completed.

Statistical Analysis

The data underwent analysis utilizing SPSS Version 23.0, which was then used to obtain population estimates through complex sample analysis to account for weights. The survey's findings were presented as prevalence with 95% confidence intervals, considering the estimated population, unweighted counts, and design effect. Analysis of the selected socio-demographic data for evaluating respondents' questionnaire responses was performed using frequencies and percentages. To explore the association between categorical variables, the Chi-Square test was employed. This study received approval from the Medical Research and Ethics Committee (MREC) of the Ministry of Health and was registered in the National Medical Research Registry (NMRR-19-867-47973(IIR)).

RESULT

Demographic Data

All in all, 4,588 respondents took part in the survey consisting of 2,161 (47.1%) males and 2,427 (52.9%) females. Most respondents fall within the age range of 20 to 29 (19.5%) and 30 to 39 (19.1%), with those aged 70 and above having the lowest percentage (4.5%). Malay ethnics were the most represented in this survey (65.6%), other Bumiputera groups (comprising Bumiputera Sabah, Sarawak, and Orang Asli) accounted for 14.7%, followed by the Chinese at 8.5%, other ethnicities at 6.8%, with Indians being the least represented at 4.4%. Marital status distribution among respondents revealed that 60.4% were married, 32.1% were single, and 7.5% were either widowed or had undergone divorce. In relation to educational background, 44.0% of respondents had achieved secondary education, 27.6% had attained tertiary education, 15.0% had finished primary education, and 13.4% had not acquired any formal education (Table 1).

Table 1. Socio-demographic: Respondents (N=4588)

Socio-demographic Characteristics	Unweighted Count	Percentage %
MALAYSIA		
Site		
Bandar	2,507	54.6
Kampung	2,081	45.4
Gender		
Male	2,161	47.1
Female	2,427	52.9
Age Group		
13 – 19	696	15.2
20 – 29	893	19.5
30 – 39	876	19.1
40 – 49	747	16.3
50 – 59	679	14.8
60 – 69	490	10.7
70 and above	207	4.5
Ethnicity		
Malay	2983	65.6
Chinese	387	8.5
Indian	199	4.4
Other	670	14.7
Others	311	6.8
Education Level (n=3186)		
No Formal	599	13.4
Primary	667	15.0
Secondary	1960	44.0
Tertiary	1232	27.6
Marital Status [b]		
Single	1433	32.1
Married	2702	60.4
Widow(er) /	335	7.5
Occupation [c]		
Government	505	22.4
Private	1054	46.8
Self Employed	646	28.7
Unpaid worker/	49	2.2

[a] Other Bumiputera encompasses Bumiputera from Sabah, Bumiputera from Sarawak, and the Orang Asli.
[b] Marital status for individuals aged 13 and older.
[c] Occupation for individuals aged 15 and above.

Prevalence of Individuals Engaging in "Search and Destroy" of Mosquito Breeding Sites at Home

The prevalence of individuals engaging in "Search and Destroy" for mosquito breeding sites at home (once a week) among the surveyed population (n = 4,522) was 36.7%; 49.6% of respondents are less compliant while 13.7% are not compliant in carrying out search and destroy activities to eliminate Aedes mosquitoes' breeding grounds once a week as recommended by MOH (Table 2).

Table 2. Prevalence of Individuals Engaging in "Search and Destroy" of Mosquito Breeding Sites at Home

Search and Destroy Activities	n	Percentage (%)
Compliant (Once a week)	1642	36.7
Less Compliant - 2–3 times per month. - Once per month. - Once every 2-3 months.	2382	49.6
Not-Compliant (Never Do)	498	13.7
Total	**4522**	**100**

As many as 35.5% respondents from rural and 37.1% from urban claimed that they eliminate mosquito breeding sites in their homes on a weekly basis. Females (39.0%) were more likely than males (34.6%) to take part in personal dengue prevention efforts (Search and Destroy Once a Week). Among all ethnic groups, individuals of Chinese ethnicity were the most inclined to conduct "search and destroy" activities for mosquito breeding sites at home once a week (40.4%), followed by Other Bumiputera (38.5%), Others (36.9%) and Malay (35.3%).

Respondents with primary education were the most probable to engage in "Search and Destroy" activities for mosquito breeding sites at home on a weekly basis (40.7%), with those possessing secondary education ranking second (37.3%), tertiary education (35.0%), and those with no formal education (31.8%). Widows(er)/divorcees exhibited the highest prevalence of practicing "Search and Destroy" for mosquito breeding sites at home on a weekly basis (48.3%), followed by married respondents (38.0%) and single respondents (32.6%). Table 3 shows a significant association between compliance of 'Search and Destroy' practicing and type of house using univariate analysis. The Pearson Chi-Square coefficient was 0.001 [$p<0.001$].

Table 3. Relationship between Practicing "Search and Destroy" of Mosquito Breeding Sites with Type of House

Type of House	Total (n=4389) (%)	Compliant	Less Compliant	Not-Compliant	P-value
Flat, apartment, condo	527 (12%)	184	270	73	0.001
Detached house, bungalow, traditional house	1810 (41.2%)	648	967	195	

Type of House	Total (n=4389) (%)	Compliant	Less Compliant	Not-Compliant	P-value
Townhouse, Terrace, link house, cluster	1544 (35.2%)	576	802	166	
Semi-D	239 (5.4%)	78	140	21	
Shop house	50 (1.1%)	18	29	3	
Water house	52 (1.2%)	23	25	4	
Squatters	62 (1.4%)	41	19	2	
Longhouse	105 (2.4%)	36	54	15	

Methods Used to Eliminate Mosquito Breeding Sites

Table 4. Methods employed by respondents to eradicate mosquito breeding sites

Methods Used to Eliminate Mosquito Breeding Site	n	Percentage (%)
Change the water and clean the container (such as a flower vase).	3558	89.2
Put mosquito larvicide in non-drainable water containers.	3559	89.3
When not in use, keep water-holding containers in storage.	2648	61.0
Water containers must be tightly closed	3300	80.0
The flower vase base's water is drained and thoroughly cleaned.	3732	92.1
Discarding any water-holding containers (such as glass, plastic, or tin cans) when not in use	3260	80.9
Clean rain gutters and clogged drains	3831	94.3
To avoid standing water, prune overgrown trees and branches that obstruct rain gutters.	3530	84.2
Total	**4522**	**100**

According to Table 4, most responders (n = 3,831, 94.3%) claimed to have cleared clogged drains and rain gutters at their homes, while 92.1% (n=3,732) said they emptied water from flower vases and scrubbed the base clean.

Most of them also claimed to have used mosquito larvicide in non-drainable water containers (n = 3,559, 89.3%), while 89.2% (n=3,558) claimed that they had consistently changed the water and cleaned the container (e.g. flower vase). Additionally, it was found that 84.2% (n=3,530) of respondents said they had pruned overgrown tree branches that were obstructing rain gutters in order to avoid standing water, while 80.9% (n=3,260) said they demolished water-holding containers (tin cans, plastic containers, glass containers, etc.) if they were no longer needed. Meanwhile, a total of 80.0% of respondents said they securely seal water containers at home, while 61.0% said they keep water-holding containers in proper storage when not in use.

Methods Used to Prevent Aedes Mosquito Bites

Table 5 depicts participants' self-reported methods to prevent Aedes mosquito bites. To avoid mosquito bites, 89.9% (n=4,047) of respondents said they avoided being outside when the Aedes mosquito was active. Up to 86.8% (n=3,871) reported using electric mosquito killers, coils, and other kinds of insect repellent. A total of 85.7%(n=3,878) of the respondents indicated the use of aerosol insecticide spray while 79.0% (n=3,496) claimed that they used repellents (devices or materials to ward off mosquitoes). A total of 70.0% (3,148) of the respondents stated that, in order to avoid getting bitten by mosquitoes, they wore long sleeves and long trousers in vibrant colors, while 62.3% (2,686) stated that, in order to protect them from mosquito bites, they put mosquito nets on windows and doors.

Prevalence of Perceived Barriers to Dengue Prevention Activities Among Respondents

Among respondents (n = 4,432), 22.6% reported having high perceived barriers to dengue prevention activities. Another 62.8% perceived moderate barriers to dengue prevention activities, while 14.6% perceived low barriers. Of all the dengue prevention activity barriers, 77.0% of respondents said that doing dengue prevention activities at home was not hindered by time. As many as 75.4% of those surveyed believed that putting mosquito larvicide in water was bad for people's health, while up to 63.3% of respondents said that the additional expense did not discourage them from participating in dengue prevention activities at home.

Table 5. Method(s) Employed to Prevent Aedes Mosquito Bites Among Respondents

Method(s) Used to Prevent Aedes Mosquito Bites	n	Percentage (%)
Applying a repellent (item or substance that keeps mosquitoes away)	3496	79.0
Using insecticide aerosol spray	3878	85.7
Wearing bright-colored long pants and long-sleeved shirts	3148	70.0
Steer clear of the outdoors during Aedes mosquito activity	4047	89.9

Method(s) Used to Prevent Aedes Mosquito Bites	n	Percentage (%)
putting in mosquito nets for doors and windows	2686	62.3
Employing insect repellent devices such as electric mosquito killers or coils	3871	86.8

Table 6. Prevalence of Perceived Barriers on Dengue Prevention Activities Among Respondents

Prevalence of Perceived Barriers on Dengue Prevention Activities Among Respondents	Unweighted Count	Prevalence (%)
Time is not a deterrent to do dengue prevention activities at home	3,740	77.0
Less extra cost does not stop people from practicing dengue prevention at home	3,019	63.3
Putting mosquito larvicide in water is not good for health	3,298	75.4
There is no need to do dengue prevention activities because there is no dengue case reported in my housing area	1,008	23.7
I did not participate in communal work (gotong-royong) with my community since I feel that I am not accountable for it	650	17.2
Not open the doors and windows during fogging because I think that fogging is harmful to my health	2,546	60.1
Not open the doors and windows during fogging since I believe that fogging makes the house dirty	1,820	44.6

Prevalence of Perceived Barriers on Dengue Prevention Activities Among Respondents	Unweighted Count	Prevalence (%)
Not go out of the house during fogging in the evening because I think that it is the time of rest	1,658	42.4

It is interesting to learn, though, that 23.7% of respondents have the perception that, since there haven't been any cases of dengue fever reported in their neighborhood, dengue prevention measures are unnecessary. A total of 17.2% of respondents acknowledged that they did not participate in gotong-royong (community work) because they felt it was not their duty. As many as 60.1% of respondents indicated they refrain from opening doors or windows during fogging due to concerns about its potential harm to their health. Almost half of the respondents (44.6%) mentioned they avoid opening doors and windows during fogging because they perceive that it will soil their houses, while 42.4% of respondents insisted that they opt not to leave the house during evening fogging as they consider it a time for rest (Table 6).

DISCUSSION

The majority of respondents rated dengue prevention activities carried out by individuals as highly effective, such as "Search and Destroy" mosquito breeding sites once a week. They also have a low perceived barrier to performing such activities. MOH has introduced a "10 minutes a week" campaign to urge the community to search and destroy Aedes' breeding grounds in their homes and premises. This activity should be carried out once a week as recommended by WHO, to destroy the mosquitoes' egg-laying sites and to stop the life cycle of mosquitoes, which takes as few as 7 to 10 days (Cogan, 2020). However, the community's participation in these activities is still lacking. According to the findings of this study, only 37% of Malaysians engage in search and destroy activities once a week, and 14% have never engaged in search and destroy activities in their homes. The rest do perform search and destroy activities but not as recommended by MOH, which is once a week. It is important to ensure that there is no stagnant water, especially in the home area, to prevent the breeding of Aedes mosquitoes. It is important to properly dispose of any container that has the possibility of becoming a breeding site for Aedes mosquitoes.

In this study, more than three-quarters of the respondents practiced prevention of Aedes mosquito breeding by ensuring that there was no stagnant water in their home area. Most have also taken precautionary measures to eliminate all potential breeding grounds of Aedes mosquitoes by replacing water and washing containers (e.g., flower vase making certain that the water in the bases of flower vases is drained and cleaned, destroying containers that can hold water (cans, plastic containers, glass containers, etc.) if it is not needed, closing water containers tightly and placing mosquito larvicide in containers in which the water cannot be drained out.

A study conducted in Curacao found that people acknowledge that managing water resources is an effective means of diminishing mosquito breeding grounds, and they regularly practice it (Elsinga et al., 2017; , Forsyth et al., 2020). This fact is supported by a study conducted in Yemen which found that the majority of respondents consistently

practiced closing their water containers after use (Saied et al., 2015). Similarly, a study in northern Thailand found that roughly half of the participants stated that, in order to lower the chance of Aedes mosquito reproduction, they routinely sealed their water containers. (Van Benthem et al., 2002). Several studies in Hong Kong and Guatemala, Honduras and El Salvador also suggest targeting behavior to clean the water container every week and cover the water container to reduce the transmission of Aedes (Chan et al., 2021; Pinchoff et al., 2021).In a research carried out by Dieng et al. (2010) they discovered immature Aedes mosquito eggs in indoor containers, signifying the adaptation of Aedes mosquitoes to indoor breeding facilitated by the convenient access to blood sources. Hence, it is crucial to take precautions against mosquito bites both outdoors and indoors to prevent the transmission of dengue fever (Dieng et al., 2010).

The practice of combating mosquito bites has also been considered in this study. Respondents used a variety of methods to avoid being bitten by mosquitoes. Almost 90% of the respondents said that they remain inside when Aedes mosquitoes are active. To prevent mosquito bites while indoors, they use electric mosquito killers, coils, and other kinds of insect repellent, aerosol sprays of insecticides, and some even install mosquito nets on windows and doors. They will also wear long sleeve shirts and brightly colored long pants outside, as well as use repellents to keep mosquitoes away. The findings are similar to the study in Hong Kong, showing that people wear light-colored long cloths to avoid mosquito bites (Chan et al., 2021).

The most common bite prevention method used in this present study was using electric mosquito killers, coils, and other kinds of insect repellent (86.8%), which was similar to the findings of studies carried out in Sri Lanka and South India (Snehalatha et al., 2003; Babu et al., 2007; Surendran and Kajatheepan, 2007, Chan et al., 2021). However, in several other studies done in Rajkot, India (Patel et al., 2015) and in Delhi, India (Anand et al., 2014), liquid repellents were the most frequently used method.

Despite the fact that fogging is one of the most successful ways to avoid dengue, many people believe it is dangerous. This study's findings are consistent with those of another survey conducted in Jempol, Negeri Sembilan. One-third of those surveyed (39.5%) believe that ULV thermal and fumigation are hazardous to their health. (Rahman et al., 2014). Furthermore, they felt that the timing of the fogging activities was inconvenient to them, which was similar to a previous study that found fogging faced poor reception within the community due to several factors, including the inconvenient timing of fogging (in the evening), which coincided with prayer or meal time (Zawaha et al., 2010; Usuga , 2019).

The strength of this study was that the data presented in it are representative of national dengue prevention data in Malaysia for people aged 13 and above. However, this study's limitation is that it only includes respondents who are literate in Malay and English. Misinterpretation of questions may occur among respondents, affecting the quality of the answers**.**

CONCLUSIONS

One of the key elements of the dengue control program is to encourage the community to implement preventive behaviors to eliminate breeding grounds for Aedes mosquitoes, including measures to prevent mosquito bites. The community should be emphasized to adopt "search and destroy" breeding places of Aedes mosquitoes as a weekly activity that needs to be done, and that it is easy as it takes just 10 minutes per week to do.

To address these barriers, it is important to enlighten the public regarding

successful measures for preventing dengue and provide resources to support their implementation. This could include community outreach and education programs, as well as policies to ensure that mosquito breeding sites are properly managed and controlled. Overall, addressing public perceptions of barriers to dengue prevention is an important step in limiting the dissemination of this disease in Malaysia.

This research's findings can be used to plan and implement a more effective dengue prevention campaign, with particular emphasis on individual self-prevention measures. Future campaigns should emphasize on aggressive health education methods with the active involvement of health care providers and community representatives. Ideally, health education programs must not only impart knowledge and raise community awareness, but also ensure that this knowledge is put into action.

REFERENCES

Anand, T., Kumar, R., Saini, V., Meena, G. and Inkle, G (2014). Knowledge and use of personal protective measures against mosquito borne diseases in a resettlement colony of Delhi. *Annals of Medical and Health Sciences Research*, 4(2), p. 227. https://doi.org/10.4103/2141-9248.129048

Babu, B. V., Mishra, S., Mishra, S. and Swain, B.K.. (2007). Personal-protection measures against mosquitoes: A study of practices and costs in a district, in the Indian state of Orissa, where malaria and lymphatic filariasis are co-endemic. *Annals of Tropical Medicine and Parasitology*, 101(7), pp. 601–609. https://doi.org/10.1179/136485907X193897

Bloom, B.S., Englehart, M.D., Furst, E.J., Hill, W.H. and Krathwohl, D.R. (1956). *Taxonomy of educational objectives, handbook I: the cognitive domain*' New York: David McKay Co

Chan, E.Y.Y., Lo, E.S.K., Huang, Z., Lam, H.C.Y., Yeung, M,P, Kwok K., Hung, K.K.C. and Tse, S. L-A. (2021). Sociodemographic predictors of knowledge, mosquito bite patterns and protective behaviors concerning vector borne disease: The case of dengue fever in Chinese subtropical city, Hong Kong. PLoS Neglected Tropical Diseases, 15(1), e0008993. https://doi.org/10.1371/journal.pntd.0008993

Cogan, J.E. (2020). *Dengue and Severe Dengue*, WHO..

Dieng, H., Saifur, R. G., Hassan, A. A., Salmah, M. R., Boots, M., Satho, T., Jaal, Z. and AbuBakar, S. (2010). Indoor-breeding of Aedes albopictus in northern peninsular Malaysia and its potential epidemiological implications. *PLoS ONE*, 5(7). https://doi.org/10.1371/journal.pone.0011790

Elsinga, J., van der Veen, H.T., Gerstenbluth, I., Burgerhof, J.G. M., Dijkstra,A., Grobusch, M.P., Tami, A. and Bailey, A. (2017). Community participation in mosquito breeding site control: An interdisciplinary mixed methods study in Curaçao. *Parasites and Vectors*, 10(1), pp. 1–14. https://doi.org/10.1186/s13071-017-2371-6

Forsyth, J.E., Mutuku, F.M., Kibe, L., Mwashee, L., Bongo, J., Egemba, C., Ardoin, N.M. and LaBeaud, A.D.. (2020). Source reduction with a purpose: Mosquito ecology and community perspectives offer insights for improving household mosquito management in coastal Kenya. PLoS Neglected Tropical Diseases 14(5), e0008239.

https://doi.org/10.1371/journal.pntd.0008239

Institute for Public Health (2020). *NHMS 2020 (Communicable Diseases): Cognitive, Affective and Behaviour*.

Mashudi, D.N., Ahmad, N. and Mohd Said, S. (2020).Level of dengue preventive practices and associated factors in a Malaysian residential area during the COVID-19 pandemic: A cross-sectional study. PLoS One. 29;17(4), e0267899. https://doi.org/10.1371/journal.pone.0267899

Ministry of Health Malaysia (2023). *Press statement regarding situation of Dengue in Malaysia for year 2022*.

Nguyen-Tien, T., Probandari, A. and Ahmad, R.A. (2019). Barriers to engaging communities in a dengue vector control program: An implementation research in an urban area in Hanoi city, Vietnam., *American Journal of Tropical Medicine and Hygiene*, 100(4), pp. 964–973. https://doi.org/10.4269/ajtmh.18-0411

Patel, A.B., Rathod, H., Shah, P., Patel, V., Garsondiya, J. and Sharma, R. (2011). Perceptions regarding mosquito borne diseases in an urban area of Rajkot city. *National Journal of Medical Research*. 1(2) .

Pinchoff, J., Silva, M., Spielman, K. and Hutchinson. P.(2021). Use of effective lids reduces presence of mosquito larvae in household water storage containers in urban and peri-urban Zika risk areas of Guatemala, Honduras, and El Salvador. *Parasites Vectors*, 14, p.167. https://doi.org/10.1186/s13071-021-04668-8

Rahman, A.A. Zainuddin, H., Minhat, H.S., Juni, M.H. and Mazeli, M.I.. (2014). Community perception towards Dengue and Dengue Prevention Program among residents of a rural settlement in Jempol, Negeri Sembilan. *International Journal of Public Health and Clinical Sciences*, 1(1), pp. 13–23.

Sahithyaa, J., Suguna, A., Surekha, A. and Ankitha, S. (2019). Barriers to dengue preventive activities in rural Cuddalore, Tamil Nadu: a study using health belief model.*International Journal Of Community Medicine And Public Health*, 6(12), p. 5241. https://doi.org/10.18203/2394-6040.ijcmph20195478

Said, M.F.F., Abdullah, H. and Abdul Ghafar, N. (2018). Dengue prevention practices among community in dengue hotspot area. *International Journal Of Community Medicine And Public Health*, 5(11), p. 4664. https://doi.org/10.18203/2394-6040.ijcmph20184553

Saied, K.G., Ahmed, W. A. M., Dhaiban, M. M. A., Osman, M. E. and Abduljabbar, N. I. (2015).Knowledge, attitude and preventive practices regarding dengue fever in rural areas of Yemen. *International Health*, 7(6), pp. 420–425. https://doi.org/10.1093/inthealth/ihv021

Selvarajoo, S., Liew, J. W. K., Tan, W., Lim, X. Y., Refai, W. F., Zaki, R. A., Sethi, N., Wan Sulaiman, W. Y., Lim, Y. A. L., Vadivelu, J. and Vythilingam, I. (2020). Knowledge, attitude and practice on dengue prevention and dengue seroprevalence in a dengue hotspot in Malaysia: A cross-sectional study. *Scientific Reports*, 10(1), pp. 1–13. https://doi.org/10.1038/s41598-020-66212-5

Snehalatha, K.S., Ramaiah, K. D., Vijay Kumar, K. N. andDas, P. K.

(2003). The mosquito problem and type and costs of personal protection measures used in rural and urban communities in Pondicherry region, South India. *Acta Tropica*, 88(1), pp. 3–9. https://doi.org/10.1016/S0001-706X(03)00155-4

Surendran, S.N. and Kajatheepan, A. (2007). Perception and personal protective measures toward mosquito bites by communities in Jaffna District, northern Sri Lanka. *Journal of the American Mosquito Control Association*, 23(2), pp. 182–186. https://doi.org/10.2987/8756-971X(2007)23[182:PAPPMT]2.0.CO;2

Usuga, A.F., Zuluaga-Idárraga, L.M., Alvarez, N., Rojo, R., Henao, E. and Rúa-Uribe, G.L. (2019). Barriers that limit the implementation of thermal fogging for the control of dengue in Colombia: a study of mixed methods. *BMC Public Health* 19, p. 669. https://doi.org/10.1186/s12889-019-7029-1

Van Benthem, B.H.B.. Khantikul, N., Panart, K., Kessels, P.J., Somboon, P. and Oskam, L. (2002).Knowledge and use of prevention measures related to dengue in northern Thailand. *Tropical Medicine and International Health*, 7(11), pp. 993–1000. https://doi.org/10.1046/j.1365-3156.2002.00950.x

World Health Organization (2023). *Dengue - Global situation*..

Zawaha, H.I., Siti Sa'adiah, H.N., Sulaiman, C.R., Suraya, S.M. and Mohd Nasir, A. (2010). Dilemma of dengue control: in the eyes of public health professionals. *Institut Penyelidikan Tingkahlaku Kesihatan* [Preprint].