

Original article:

Factors associated with dengue fever patients attending primary health clinics in Kota Kinabalu

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Abstract

Background: Dengue fever infection has become a major public health concern in Malaysia with frequent epidemics occurring in urban areas. In Sabah, Dengue fever is among the 5 most reported communicable diseases and the district of Kota Kinabalu is among the top 3 districts with the highest number of dengue cases with 563 cases recorded in 2016. **Aims and Methodology:** This study aimed to determine the factors contributing or associated with dengue fever occurrence in Kota Kinabalu. A cross-sectional study was conducted among the primary health care clinic attendees in Kota Kinabalu. Data was collected via a set of structured questionnaires focusing on socio-demographic characteristic of participants, environmental characteristic of households, history of previous exposure to dengue fever, knowledge towards dengue fever and its vector, awareness on dengue fever and mosquito control and dengue fever prevention practices. **Results and Recommendations:** Among the 350 individual's that participated in the interview, 53 were dengue fever cases. Subsequently, the prevalence of Dengue fever cases among the study population was calculated with prevalence in percentage concluded as 15.1%. Further analysis revealed that factors such as aged group by years, number of household occupants, staying at dengue outbreak areas, self – reported history of recent mosquito bites, indoor and outdoor storage of open water containers, installed house window screens, knowledge on dengue fever and its vector, practices of wearing protective clothing outdoor and usage of mosquito repellent ointment or creams showed significant association with dengue fever outcomes. However, further studies would need to be conducted to determine if these factors possess a higher threat or risk for dengue fever.

Keyword: Dengue; Sabah; environmental factor; vector control; prevention

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Introduction

Prior to 1970, there was only 9 countries whom had experienced severe dengue epidemics however now dengue is endemic in more than 100 countries in the WHO regions of Africa, the Americas, the Eastern Mediterranean, South East Asia and Western Pacific with an estimate of 2.5 billion populations at risk. More than 70 % of the population (1.8 billion) at risk for dengue worldwide reside in members state of the WHO South- East Asia Region and Western Pacific region and carries an estimate of nearly 75% of global disease burden due to dengue²⁰. Globally, the incidence of dengue fever has increased dramatically pass few decades with recent estimates indicating 390 million dengue infections per year and of which 96 million manifest the disease clinically².

Dengue is a national health problem with a huge burden on the national health care system. In Malaysia, the highest number of dengue cases ever reported was 120,836 cases in 2015 with the incidence rate was of 396.4/ 100, 000 populations. In that same year a total of 336 dengue deaths was reported with a national case fatality rate of 0.28⁸. The burden of dengue fever is high in the state of Sabah, Malaysia. Severe dengue cases do occur and related to increasing mortality especially in children, infection with mixed serotype, and cases from the east coast area are the biggest contributors^{12,13}. Sabah is in needs for an innovative approach in delivering sustainable healthcare services across the state for its people, especially in the context of communicable diseases¹¹

The factors associated or responsible for dengue fever varies and are complex. Certain factors such as population density, inadequate water supply and waste management, housing conditions ineffective control and prevention programs, climate change, socio-cultural practices and poor socio-economic status, have been associated with dengue¹⁸. A nationwide survey in Malaysia was carried out from 2012 to 2013 on factors affecting dengue prevention factors revealed that household with low income, unemployed, unskilled workers conducted more dengue prevention practices in comparison to middle to higher income earners whom most live in urban areas²¹.

Environmental characteristic of households has been associated with dengue cases and dengue outbreaks. Factors such as blocked drains filled with rain water support the breeding of mosquitoes and indirectly

contribute to the spreading of dengue⁵. Other factors like lack of proper water supply via closed piping system and storing of rain water for household use also contribute to dengue cases especially at the rural areas. The frequency of disposal of garbage of less than once per 7 days had significant association with dengue haemorrhagic incidences¹⁹. The same study also found residents that is often stored water in containers, provided a breeding place for Aedes mosquitoes and subsequently this increased the risk of dengue fever infection. However, practice of storing water with infrequent changed of stored water or covering stored water is still a culture practiced especially at rural areas in Malaysia⁷.

This research is to close the gap in the knowledge regarding factors associated with dengue occurrence in Kota Kinabalu. The purpose of this study is to determine factors (such as sociodemographic, environmental characteristics, previous exposure, knowledge and awareness on prevention practices) associated with dengue among primary health care clinic attendees in Kota Kinabalu.

Methodology

This was a cross- sectional study design involving individuals residing in the district of Kota Kinabalu as it has the highest reported number of dengue cases in Sabah for the past 3 years (2014-2016). Four major health clinics having high patient to doctor burden in Kota Kinabalu are chosen as the study site. Period of study was conducted from early of October 2017 to end of June 2018. Permission to conduct the study was obtained from the the Kota Kinabalu District Health Office as well whom has jurisdiction over the 4 clinics as well as the Family Medicine Specialist (FMS) in-charge of each clinic participating in the study.

For those patients with acute febrile illness with 2 or more of the following symptoms: headache, joint pains, rashes, arthralgia, myalgia, retro-orbital pain, haemorrhagic manifestation or leukopenia accompanied with positive laboratory diagnosis findings of (NS-1 or IgG or IgM antibodies) for dengue fever will be noted and grouped together to determine prevalence of dengue fever attending the clinics. Subsequently, comparison was made between dengue fever patients and non-dengue fever clinic attendees. Respondents included any individuals visiting the primary health clinics for health screening purposes and patients seeking medical attention or treatment. The inclusion criteria were individuals aged 13 years old and above visiting the

primary health clinic for health screening purposes and patients seeking medical attention or treatment. Individuals aged 13 above (adolescents and older) was selected in order to gain in-depth information from interview rather than interviewing only the guardian/ parent.

Convenient sampling was conducted and clinic attendees that met the inclusion criteria was invited to participate in the study during the period of data collection. Data was collected via questionnaires during the visit to the doctor subsequently, interviews was carried out by trained medical personnel working in the health facilities under the jurisdiction of Kota Kinabalu District Health Office. The researcher supervised the interviewer and random checking of data collected was done

The questionnaire used was modified based on National Health Morbidity Survey report¹². Questionnaire consisted of 47 divided into 5 sections consisting of (1) Socio-demographics characteristic (age, gender, nationality, race, education, marital status, occupation and total household income); (2) Previous exposure to dengue fever infection (history of household members with recent dengue infection and history of recent stay at known dengue outbreak areas); (3) Environmental characteristic of households, (presence of open water storage containers indoor and outdoor of household, frequency of garbage disposal; presence of clogged drains and presence of installed house windows screens); (4) Knowledge on dengue fever and its vector (mode of transmission of dengue fever, signs and symptoms of dengue fever, characteristic of Aedes mosquito (breeding sites, peak biting period), protective measures when having fever during a dengue outbreak at residential area and mortality risk if contracted with dengue fever); (5) Awareness on dengue fever and mosquito control; and (6) Dengue fever prevention practices (types or methods of mosquito control practiced, frequency of practice of mosquito control, practice of disposing rubbish properly and responsibly, usage of protective clothing when doing outdoor activities and usage of mosquito repellent cream and ointment).

It was pretested among students studying in a public university and employees at a local law firm with different socio-demographic background residing in Kota Kinabalu mainly for context and post language translation. The questionnaires were translated from English to Bahasa Malaysia. No reliability test was conducted. The level of knowledge regarding dengue fever among participants was assessed in which the

respondents were asked to choose the correct answers based on their knowledge of dengue fever, its mode of transmission, signs and symptoms, characteristic of the vector Aedes (indoor and outdoor breeding sites), protective measures if ill with fever during a dengue outbreak at residential area and mortality risk if contracted with dengue fever. One mark was given for each correct answer and the maximum mark was 25 and subsequently transformed into a percentage. Knowledge was categorised as good when more than 80% of answers were correct, moderate 50-80% and poor when less than 50% of answers were correct.

Completed questionnaires were collected and were double-checked and verified for completeness and consistency. The data analysed using Statistical Package for Social Science version (22.0). Statistical analysis included means, proportions testing (between dengue and non-dengue clinic attendees) and association testing by chi squared method.

All data collected was kept confidential and further analysis of the data was done by the researcher. A written consent was obtained for adults prior to participation of the study and in the case of minors a written consent was first obtained from their parents (father or mother) or the accompanying guardian and then from all adolescent participants.

Ethical Clearance: The ethical approval for the study protocol was obtained from the Ethical Review Board of University Malaysia Sabah and the Medical Research and Ethics Committee, Ministry of Health Malaysia. The study protocol was registered under the National Medical Research Registry, Ministry of Health Malaysia (NMRR-18-497-40489).

Results

A total of 350 respondents participated and 53 (15.1%) participants were dengue fever cases clinic attendees. Among the positive Dengue fever cases, majority 47 (88.7%) cases were positive for NS1. Majority 343 (98.0%) participants were of Malaysian nationality and 226 (64.6%) were females. Their mean age was 34.5 (15.13SD+/-) years and were married 231 (66.0%). Further sociodemographic characteristic of the study population is included in Table 1.

Among the dengue fever patients, a total of 33 (62.3%) was staying at areas known to have recent dengue fever outbreak prior to being interviewed and only 9 (17.0%) had household members with recent dengue fever infection. Majority of the dengue fever respondents 40 (75.5%) had their garbage collected by the municipal council less than every

7 days, 49 (92.5%) of participants had proper water supply at home and only 17 (32.1%) had problems of clogged drains at their residential area. In this same group 27 (51.0%) had indoor storage of open water containers in which two-thirds cleaned the containers and change the water often less than every 7 days. A total of 22 (41.5%) of dengue fever patients had outdoor storage of open water containers with 18(33.9%) cleaned the containers and change the water less than every 7 days. Majority of these cases also did not install house windows house screens 49 (92.5%). The majority of them also had a self – reported history of recent mosquito bites 39 (73.6%).

Between the dengue fever respondents, majority also knew dengue was transmitted by the bites of mosquitoes 50(94.3%) and knew the vector-borne mosquito *Aedes* transmits dengue fever 49 (92.5%). Most respondents also knew fever could not be transmitted via person to person contact 36 (67.9%) and through food and water consumption 38 (71.7%). However, 30 (56.6%) of respondents were not sure if dengue fever could be transmitted by blood transfusion. Majority of the dengue fever patients knew more than 1 sign or symptoms of dengue fever and all 53 patients chose to seek immediate medical attention or treatment if had fever during a dengue outbreak. Most respondents also knew *Aedes* mosquitoes breeds in standing water 48 (90.6%) and knew more than 1 breeding sites indoor and outdoor. Majority also chose water containers for indoor mosquito breeding (43 participants) and abandoned tyres (48 participants) for outdoor breeding of mosquitoes. However, only 3 respondents (5.7%) knew that *Aedes* mosquito where day time feeders and 2 of the respondents (3.8%) did not know that dengue fever could be fatal. Overall, 11.3% of respondents had good knowledge, 71.7% moderate level of knowledge and 17.0 % had poor level of knowledge.

Among the dengue fever patients, majority (84.9%) were aware that dengue fever is considered a community problem and there is a risk of being infected with dengue fever (92.4%) and dengue fever can be prevented (88.7%). Most respondents were also aware that stagnant water in discarded tyres, broken pots and open bottles were breeding places for *Aedes* mosquitoes (92.4%) and controlling breeding places was a good strategy to prevent dengue (81.1%). Only 1 respondent (1.9%) was not sure that community participation is required to control dengue fever. Most respondents would

allow the health authorities to do fogging inside and outside the house (50 respondents). Overall, among the dengue fever patients 62.3% of participants had good level of awareness, 22.6% had moderate level of awareness and 15.1% had poor awareness.

Among the dengue fever patients, majority also practiced some form mosquito control (90.6%) on a daily basis (67.9%). Majority of these patients also practice more than 1 method of control (62.3%) and 49.1% would conduct this controls on more than 1 room in the house. Control methods such as using insecticide aerosol spray, electric plug- in emitter and mosquito repellent were among the popular choice among these participants. Majority of dengue fever patients did not wear protective clothing to prevent from mosquito bites when outside of homes (69.8%) and did not use apply any mosquito repellents cream or ointments while outdoors (94.3%). Among the patients, 85% did practiced disposing of household garbage properly and responsibly.

Using Chi-square test to determine the association of socio-demographic variables, exposure to dengue fever infection variables, environmental household variables, knowledge on dengue fever and its vector variables, awareness on dengue fever and mosquito control variable and practice of dengue fever prevention variables with the study population which included dengue fever patients and non- dengue fever clinic attendees. At $\alpha = 0.05$ level of significance, the p –value for aged group by years, number of household occupants, stay at dengue outbreak areas, self – reported history of recent mosquito bites, indoor and outdoor storage of open water containers, installed house windows screens, knowledge on dengue fever and its vector, practices of wearing protective clothing outdoor and usage of mosquito repellent ointment or creams showed statistically significant in the proportion among dengue fever patients and non- dengue fever clinic attendees.

Table 1 Socio-demographic characteristic of the study population

Socio demographic characteristic	Total n (%)	Dengue fever patients n (%), n= 53	Non- dengue fever clinic attendees n (%), n=297
Gender			
Male	124 (35.4)	20 (37.7)	104 (35.0)
Female	226 (64.6)	33 (62.3)	193 (65.0)
Age grouping in years			
13-17	41 (11.7)	22 (41.5)	19 (6.4)

Socio demographic characteristic	Total n (%)	Dengue fever patients n (%), n= 53	Non- dengue fever clinic attendees n (%), n=297
18-40	209 (59.7)	21 (39.6)	188 (63.3)
>41	100 (28.6)	10 (18.9)	90 (30.3)
Nationality			
Malaysian	343 (98.0)	53 (100)	290 (97.6)
Non Malaysian	7 (2.0)	0 (0.0)	7 (2.4)
Ethnicity			
Malay	41 (11.7)	4 (7.5)	37 (12.5)
Chinese	23 (6.6)	5 (9.4)	18 (6.1)
Indian	3 (0.9)	1 (1.9)	2 (0.6)
Indigenous Sabah	235 (67.1)	36 (68.0)	199 (67.0)
Others	48 (13.7)	7 (13.2)	41 (13.8)
Marital status			
Married	231 (66.0)	26 (49.1)	205 (69.0)
Divorced	5 (1.4)	0 (0.0)	5 (1.7)
Separated	3 (0.9)	0 (0.0)	3 (1.0)
Single	111 (31.7)	27 (50.9%)	84 (28.3)
Occupation			
Professional	27 (7.7)	5 (9.4)	22 (7.4)
Skilled	78 (22.3)	6 (11.3)	72 (24.2)
Semi- skilled / unskilled	60 (17.1)	4 (7.5)	56 (18.9)
Retiree	12 (3.4)	5 (9.4)	7 (2.4)
Housewife	100 (28.6)	9 (17.1)	91 (30.6)
Student/ unemployed	73 (20.9)	24 (45.3)	49 (16.5)
Education level			
Degree	33 (9.4)	5 (9.4)	28 (9.4)
Diploma	39 (11.1)	2 (3.8)	37 (12.5)
STPM/ A level (GCE)	18 (5.1)	5 (9.4)	13 (4.4)
SPM/ O level (GCE)	108 (31.0)	12 (22.6)	96 (32.3)
Lower secondary assessment	65 (18.6)	15 (28.3)	50 (16.8)
Primary Level	60 (17.1)	11 (20.8)	49 (16.5)
No formal education	27 (7.7)	3 (5.7)	24 (8.1)
Total household income (Ringgit Malaysia)			
≤500	1 (0.3)	0 (0.0)	1 (0.3)
501-1000	74 (21.1)	8 (15.0)	66 (22.2)
1001-2000	131 (37.4)	19 (36.0)	112 (37.7)
2001-2500	69 (19.7)	12 (22.6)	57 (19.2)
>2500	75 (21.4)	14 (26.4)	61 (20.5)

Table 2. Association between socio-demographic and environmental characteristic of households with study population

Variables	Dengue fever patients n (%), n= 53	Non- dengue fever clinic attendees n (%), n=297	p- value
Age group (years)			
13-17	22 (41.5)	19 (6.4)	< 0.01
18-40	21 (39.6)	188 (63.3)	
≥ 41	10 (18.9)	90 (30.3)	
Number of household occupants			
Living alone	1 (1.9)	18 (6.1)	0.01
2-4 Occupants	7 (13.2)	108 (36.4)	
More than 4 occupants	45 (84.9)	171 (57.5)	
Stay at dengue fever outbreak area or with known dengue cases			
Yes	33 (62.3)	25 (8.4)	<0.01
No	20 (37.7)	272 (91.6)	
Indoor storage of open water containers			
Yes	27 (51.0)	77 (26.0)	<0.01
No	26 (49.0)	220 (74.0)	
Outdoor storage of open water containers			
Yes	22 (41.5)	58 (19.5)	<0.01
No	31 (58.5)	239 (80.5)	
Installed house window screens			
Yes	4 (7.5)	56 (18.9)	0.04
No	49 (92.5)	241 (81.1)	
History of recent mosquito bites			
Yes	39 (73.6)	27 (9.1)	<0.01
No	14 (26.4)	270 (90.1)	

Table 3. Association between knowledge and dengue prevention practices with the study population

Variables	Dengue fever patients n (%), n= 53	Non- dengue fever clinic attendees n (%), n=297	p- value
Knowledge			

Variables	Dengue fever patients n (%), n= 53	Non- dengue fever clinic attendees n (%), n=297	p- value
Good	6 (11.3)	53 (17.8)	0.05
Moderate	38 (71.7)	159 (53.5)	
Poor	9 (17.0)	85 (28.6)	
Usage of protective clothing outdoors			
Yes	16 (30.2)	157 (52.9)	0.02
No	37 (69.8)	140 (47.1)	
Apply mosquito repellent outdoors			
Yes	3 (5.7)	84 (28.3)	<0.01
No	50 (94.3)	213 (71.7)	

Discussion

During the study, the prevalence of dengue fever among clinic attendees was 15.1%. The study had showed that the female gender has a higher incidence of getting dengue fever compared to males and the prevalence of dengue was also higher in the age group between 13 to 17 years old and the predominant race was Indigenous Sabah. This finding however was not consistent with other dengue studies done in Malaysia in which was found the prevalence of dengue fever was higher among young adults with the predominant race being Malay^{1,4}. Although a study in Singapore revealed Malay ethnicity was protective against dengue disease²³.

In this study, factors such as aged group and household occupants had association with dengue fever outcome. However, factors such as monthly household income did not have an association with dengue fever outcome. The prevalence of dengue was similar among those with family income of less than RM2000 (low income) and those with family income of more than RM 2000. In contrast other study showed that low income was a dominant risk for both recent and past dengue infection³. Individuals in low income groups were more susceptible to infectious disease compared to those in high- or middle-income groups and poverty is a representative for many risk factors involving communicable diseases. Whereas, study done in Brazil found high income and higher education were a risk factor for dengue⁶.

In this study, staying at outbreak areas or areas known to have dengue cases had shown an association with dengue fever outcomes. The probability of being infected with dengue fever is higher in populations

residing in localities reported to have an outbreak of dengue or having recurrent dengue outbreaks. In crowded areas, many people living within the short flight range of the vector from its breeding source could be exposed to transmission even if the Aedes indices are low.

A large number of households had proper water supply (88.3%), however there were still some households with indoor storage of open water containers (29.7%) and outdoor storage of water containers (22.9%) with further analysis showing significant association between storage of open indoor and outdoor containers with dengue fever outcomes. Similar findings were also shown in a study which residents that often-stored water in containers, provided a breeding place for Aedes mosquitoes and subsequently this increased the risk of dengue fever infection¹⁹. Notably, practice of storing water with infrequent changed of stored water or covering stored water is still a culture practiced especially at rural areas in Malaysia⁷.

Other environmental household factors such a frequency of garbage collection, proper water supply and presence of clogged drains showed no association with dengue fever outcomes. In contrast, a study done in Pakistan showed factors such as blocked drains filled with rainwater support the breeding of mosquitoes and indirectly contribute to the spreading of dengue⁵. A study conducted in the North Sumatera Province in Indonesia also revealed that frequency of disposal of garbage of less than once per 7 days had significant association with dengue haemorrhagic incidences¹⁹.

In this study, most participants had moderate level of knowledge of dengue fever (56.2%) and its vector and this is possible as majority of participants had obtained education up till form 5 secondary school (SPM). Similarly, among the dengue fever patients, majority had some form of formal education with a large number of them (74.0%) having obtained the Lower Secondary Assessment Certificate (Penilaian Menengah Rendah).

Analysis also showed there was significant association between knowledge and dengue fever outcomes (p-value= 0.05). Surveys done in Malaysia had revealed that knowledge on dengue had positive association to dengue prevention^{9,21,24}. However, other studies showed contrasting evidence where good knowledge does not necessarily lead to good practice^{7,10,13,16-17,22}.

Majority of the dengue fever patients had good (62.3%) and moderate (22.6%) level of awareness. This shows that the majority of people had a perceived risk of dengue fever. As both dengue fever patients and non-dengue clinic attendees had good awareness level further analysis confirmed there was no association in between awareness on dengue fever and mosquito control with dengue fever outcomes. This could be due to intensified dengue awareness campaign efforts of the Sabah State Health Department to raise the people's level of awareness and knowledge on dengue.

Majority of the participants including those diagnosed with dengue fever considered dengue fever as a community problem (87.1%) and agreed that communities should actively participate in controlling dengue. For example, participating in mass cleaning activities (aktiviti pembersihan secara bergotong-royong). This finding contradicts with the findings in the National and Health Morbidity Survey 2015 on dengue conducted by Ministry of Health Malaysia in 2015, in which only 58.3% of their respondents would participate in mass cleaning activities such as (gotong-royong) even though dengue fever is considered a community problem¹⁵.

A nationwide survey also showed that only (11.3%) of their participants used mosquito repellent and one-third (35.7%) reported to wear bright coloured clothing to avoid mosquito bites. Similarly, based on the National and Health Morbidity Survey 2015 on dengue conducted by, the Ministry of Health Malaysia it was found low prevalence of preventive measures taken to prevent mosquitos bites among adults such as using hand lotion (5.9%), use of repellent (11.5%), and wearing protective clothing such long pants and long-sleeved shirts (15.1%)¹⁵. The low numbers of people practising self-protection against dengue could be associated with the high incidences of dengue in Malaysia.

The study has its sets of limitations mainly the possibility of recall bias during the interview sessions and the drawbacks of convenience sampling. The study was also conducted in the district of Kota Kinabalu which is largely an urban area and the information observed may be only true for the study population and cannot be generalized to other groups of people belonging to different socio-economic

backgrounds such as those residing in the rural regions of Sabah. It is, therefore, recommended to expand the study to other areas in Sabah.

Conclusion

Factors such as aged group, number of household occupants, staying at dengue outbreak areas, self-reported history of recent mosquito bites, indoor and outdoor storage of open water containers, installed house window screens, knowledge on dengue fever and its vector, practices of wearing protective clothing outdoor and usage of mosquito repellent ointment or creams showed significant association with dengue fever outcomes. The dissemination on in depth knowledge on dengue fever and prevention practices need to be given more emphasis by the local stakeholders. Thus, to reduce and control dengue fever, health promotion regarding dengue fever should be enhanced.

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