Original Research Article

The Comparison of Environmental Conditions between Hotspot and Non Hotspot Areas of Dengue Outbreak in Selangor, Malaysia

Nurul Akmar Ghani[1], Shamarina Shohaimi[1], Alvin Kah Wei Hee[1], Chee Hui Yee[2], Oguntade Emmanuel[3], Lamidi Sarumoh Alaba Ajibola[4]

[1]Department of Biology, Faculty of Science, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia
[2]Department of Microbiology and Parasitology, Faculty of Medicine, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia
[3]Institute for Mathematical Research, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia
[4]Department of Mathematics, Faculty of Science, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

Corresponding Author: Nurul Akmar Ghani

ABSTRACT

Dengue fever is one of the most killer vector-borne disease in the world and Malaysia has recorded increases in number of dengue cases and deaths since 2012. For several years, Selangor state recorded the highest number of cases and deaths in Malaysia due to dengue fever. Most of the dengue infections occur among people who live in hotspot areas of dengue, and less likely to occur among people who live in non-hotspot areas. This study aims to compare the difference of environmental conditions between hotspot and non-hotspot areas of dengue. 20 hotspot and 20 non-hotspot areas in Selangor were chosen in this study and 10 variables were checked and given scale according to their conditions. Total marks of each area were then calculated and difference in means between hotspot and non-hotspot areas was compared using Independent T-test. Result shows that there was significant mean difference of marks of environmental conditions between both areas (*p* value: <0.001; 28.30 vs 22.90). The result of this study shows that non-hotspot areas were cleaner and more hygienic than hotspot areas, which suggests public health education and routine hygiene inspection to be done more frequently in hotspot areas to ensure their cleanliness in order to fight dengue outbreak, which consequently helps reduce the number dengue cases and deaths.

Keywords: Dengue, Dengue environment, Dengue Incidence, Dengue Hotspot, Dengue Outbreak

INTRODUCTION

Dengue affects 40% of worldwide population and becomes the most killer vector-borne disease in the world. [1] In Asia, high dengue incidences were reported, and in Southeast Asia, the tropical and warmer part of Asia, mortality and morbidity rate of dengue were continuously reported at higher incidence annually. [2] Two most well-known mosquitoes that spread dengue virus are *Aedes aegypti* and *Aedes albopictus.* [3]

Malaysia, a country located in Southeast Asia also experiences high number of dengue incidence which reaches high peaks once every few years. In 2013 the number of dengue incidence was 43,436 cases and in 2014 and 2015, the number increased to 108,698 and 120,836, respectively. In 2016, the number of dengue incidence in Malaysia slightly decreased with 101,357 cases. Nevertheless, the number was still high compared to a few years before that. [4] Selangor recorded the highest dengue incidence among all states in Malaysia, with total number of 62,867 and 51,652 cases in 2015 and 2016 respectively. [5]

Selangor is a state with high population density in Malaysia compared to other states and the behaviour of its citizens has high influence on dengue spread and transmission. [6] Most dengue cases usually occur in urban area, favourable for its high density population and rapid development

that help the process of dengue transmission to be faster. [4] The condition of surrounding areas affects dengue spread too, where institutional, workshops and agriculture areas presented more dengue vector habitat especially after rainy seasons, while areas with systematic and cleaner surroundings showed to have less habitats suitable for *Aedes.* [5]

In Malaysia, hotspot dengue is characterized by an area which has dengue outbreak for more than 30 days, while non-hotspot is an area free from dengue outbreak for a month or more. [4] This study aims to compare environmental conditions between hotspot and non-hotspot areas of dengue outbreak.

METHODS

A self-completed assessment was conducted from November 2015 to October 2016 in selected 20 hotspot and 20 non-hotspot areas in Selangor. Status of hotspot and non-hotspot dengue areas were chosen

based on their current status in iDengue portal website supervised by Malaysia Ministry of Health and Ministry of Science, Technology and Innovation which is updated on a weekly basis.

The assessment comprised of 9 categories; building colour, building condition, cleanliness, parking area, playground, presence of possible *Aedes* breeding sites, disposal system, sanitary and drainage system, and presence of tires or cans or bottles. Each categories were evaluated using Likert scale of 1 to 5, where low value meant dirtier and high value were given to cleaner environment. Total marks of all categories were calculated and compared between hotspot and non-hotspot areas.

Student's t-test was used to compare significant difference of marks of both areas and statistical significance was set at $p < 0.05$. This study obtained ethical approval from Ministry of Health, Malaysia via National Medical Research Registry.

RESULTS

Table 1: Total score of each areas according to their level of cleanliness

District	Area	Total score	Mean (SD) for district	Mean (SD) for hotspot/non-hotspot
Petaling	Taman Sri Serdang	17.00	22.63 (6.09)	22.90 (4.77)
	Taman Universiti Indah	24.00		
	Taman Sg Besi Indah	18.00		
	Pangsapuri Enggang	14.00		
	Pangsapuri Putra Permai	23.00		
	Pangsapuri Damai Utama	33.00		
	Taman Lestari Putra	26.00		
	Taman Pinggiran Putra	26.00		
Hulu Langat	Pangsapuri Suakasih	24.00	26.01 (1.90)	
	Taman Kajang Mulia	27.00		
	Seksyen 3 Bandar Baru Bangi	28.03		
	Pangsapuri Cempaka	25.00		
	Seksyen 16 Bandar Baru Bangi	28.00		
	Taman Taming Jaya	24.00		
Gombak	Taman Sunway Bt Caves 7	23.00	20.17 (3.19)	
	Taman Sunway Bt Caves 9	23.00		
	Taman Sri Gombak	23.00		
	Flat Pinggiran Bt Caves	16.00		
	Flat Selasih	18.00		
	Flat Samudera	18.00		
Gombak	Taman Wahyu	28.00	28	28.30 (2.7)
	Taman Tasik Indah	28.00		
Petaling	Taman Lestari Permai	27.00	31.4 (4.16)	
	Kota Perdana	27.00		
	Pangsapuri Mayang	36.00		
	Kondo Desaminium	33.00		
	Taman Puncak Jalil 6	34.00		
Hulu Langat	Taman Saujana Impian	29.00	27.40 (0.89)	
	Seksyen 4 Bandar Baru Bangi	27.00		
	Seksyen 7 Bandar Baru Bangi	27.00		
	Taman Kantai Permai	27.00		
	Taman Damai Mewah	27.00		
Kuala	Taman Iram Perdana	27.00	27	

Table 1 to be continued...			
Langat	Taman Panglima	27.00	
Hulu	Taman Anggerik	27.00	27
Selangor	Taman Kemboja	27.00	
	Taman Seroja	27.00	
Kuala	Taman Serindit	27.00	27
Selangor	Taman Melawati Jaya	27.00	
	Taman Rhu Permai	27.00	

Table 1 shows total score of each area of hotspot and non-hotspot with respect to their level of cleanliness, presence of *Aedes* breeding sites, pond, forest and other hotspots nearby. The higher the marks, the better the overall environment condition of the areas. Most hotspot areas scored less than 27 marks with lowest value at 14, while for non-hotspot areas most of them scored more than 27 marks with 36 as the highest value. Hotspots areas in Gombak showed the lowest average, 20.17 while non-hotspot areas in Petaling showed highest average value, 28.

Table 2: Comparison of mean marks of environmental condition between Hotspot and Non-hotspot Areas

Variables	Hotspot (n=20) Mean (SD)	Non Hotspot (n=20) Mean (SD)	Mean difference (95% CI)	T-statistic (df)	*P* value
Environment	22.90 (4.77)	28.30 (2.70)	5.40 (2.90, 7.90)	38	<0.001

Table 2 illustrates results of T-test comparing mean difference of environmental conditions total marks between hotspot and non-hotspot areas. Result shows that there was significant difference of total marks of environmental condition between hotspot and non-hotspot areas, where mean of overall environmental condition for non-hotspot areas was higher than hotspot areas (22.90 vs 28.30). The mean difference was reported to be 5.40 (95% CI 2.90, 7.90), with *p* value of less than 0.001.

The results indicate that non-hotspot areas had better, cleaner and more comfortable environmental conditions to live in with less risk exposure to dengue outbreak.

DISCUSSION

The result of this study shows that the dirtier the environment of an area is, the higher the risk of the area to have dengue outbreak. Until today, the control of vector, which is *Aedes* mosquitoes for dengue, plays important part in increasing or decreasing dengue infection in an area. In order to control the vector, preventive measures should be done at household level. [7] Furthermore, mean larval numbers as well as population of *Aedes aegypti* and *Aedes albopictus* were found significantly higher in hotspot areas. [7] Previous studies in Ecuador demonstrated that the abundance presence of *Aedes* mosquitoes were highly correlated with poor housing conditions, poor sanitary system, low income, housing type and cost to buy vector control. [8]

According to the survey, people living in non-hotspot areas had better careers, higher average household income, higher education level and smaller household numbers than people living in hotspot areas. Education level does affect people's knowledge, attitude and practices on control on vector, where people with better literacy level show more responsibility on taking care of their homes and surrounding. [9] People with smaller households, and with children show more concern to maintain cleanliness and safety of their environment than people with more household and with no children. [10]

Knowledge of dengue fever is still inadequate among people of lower socioeconomic class and knowledge is reported to have significant association with education and socioeconomic status. [11] Educational campaign should be targeted to those with lower income and education as dengue knowledge and attitude were highly associated with dengue prevention practice.

[12] People who had been infected by dengue fever or had family member infected demonstrated better knowledge, attitude and practice towards dengue fever control. [11] People who live in hotspot areas showed less awareness of taking care of their surroundings to be free from dengue infection. It is reported that people seldom perform precaution to prevent dengue outbreak, such as covering water containers with lids, change water containers weekly, use of fish to eat larvae and change water in small vases and potted plants, so this issue should be highlighted more by health personnel and village health volunteers. [13] In terms of management of the housing areas, hotspot rarely have proper management persons in charge, while non-hotspot areas usually have good management system, either the residents appoint an organization to work or their developers provide one for them. The personals working in the management will make sure their housing areas to be clean, collect resources to pay for cleaners and remind the residents to always keep their environment clean. [14]

In Kaohsiung, Taiwan, as well as other parts in the world, people still believe that government role is vital to prevent dengue rather than taking the precaution by themselves and this contradicts with real situation because for an area to be free from dengue outbreak, it requires all individuals to play their parts and responsibilities. [15] Knowledge about dengue fever was reported to be highly associated with dengue preventive behaviour in the condition that self-efficacy of the people is strong, and this shows that giving public health education that provides knowledge together with improving people's self-efficacy is essential to make sure dengue preventive measures succeed. [16] Good cooperation between local government and community aids in promoting successful dengue prevention programmes, which leads to lower household risk behaviour, reduction of environmental risk and effects on mosquitos' number. [15]

CONCLUSION

Findings from this study showed that hotspot areas of dengue outbreak were dirtier and less hygienic compared to non-hotspot areas. Communities living in hotspot areas showed less awareness in taking care of their environment, besides having poor management of their areas. Health education should be done to communities in hotspot areas of dengue to educate them about the importance of taking care of their surrounding in order to fight dengue outbreak and transmission. Moreover, routine hygiene inspection should be done more frequently in hotspot areas compared to non-hotspot areas to make sure their places to be clean and free from mosquitoes breeding sites. Communities in hotspot areas must also organize communal works more often to ensure their places to be uncontaminated and clean always so they can have more quality life as their environment will be free from hotspot status and is more conducive to live in.

Competing Interest
None declared
Ethical Approval
Ministry of Health, Malaysia via National Medical Research Registry.

REFERENCES

1. World Health Organization. Dengue and Severe Dengue. [Internet]. 2018 [updated 2018 Sep. 13; cited 2018 Dec 3]. Available from http://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue
2. Harapan, H., Samsul, A., Abdul Malek, S. & Tedjo Sasmono, R. Dengue vaccine acceptance and associate factors in Indonesia: A community survey cross sectional based in Acheh. Vaccine. 2016; 34: 3670 - 3675.
3. Wilson, M.A., Celestin, M., Maung, A. & Pauline, E.J. Knowledge, Atttude and Practices Regarding Vector Borne Disease

in Western Jamaica. Annals of Global Health. Elsevier Inc. 2015

4. Malaysia Ministry of Health (MMOH). Management of Dengue Infection in Adults (revised 2nd edition). Clinical Practice Guidelines (CPG). 2010.

5. Sarfaz, M.S., Tripathi, N.K., Tipdecho, T., Thongbu, T., Kerdthong, P. & Souris, M. Analyzing the spatio-temporal relationship between dengue vector larval density and land-use using factor analysis and spatial ring mapping. BMC Public Health. 2012; 12: 853.

6. Department of Statistics Malaysia (DOSM). Statistics, Malaysia at a Glance, Selangor. [Internet]. 2018 [cited 2018, Dec 3]. Available from https://www.dosm.gov.my/v1/index.php?r= column/cone&menu_id=eGUyTm9RcEVZS llmYW45dmpnZHh4dz09

7. Naveed, H., David, A. L., Marco, N., Efrain, B. A., Prissila, F., Jefferson, A., Rosemary, R. & Anna, M. S. I. Household Dengue Preventive Interventions, Expenditures, and Barriers to Aedes Aegypti Control in Machala, Ecuador. International Journal of Environmental Research and Public Health. 2017.

8. Chen, C. D., Benjamin, S., Saranum, M.M., Chiang, Y. F., Lee, H.L., Ahmad, N. W. & Sofian-Azirun, M. Dengue vector surveillance in urban residential and settlement areas in Selangor, Malaysia. Tropical Biomedicine. 2005; 22 (1): 39-43.

9. Wilson, M.A., Celestin, M., Maung, A. & Pauline, E.J. Knowledge, Attitude and Practices Regarding Vector Borne Disease in Western Jamaica. Annals of Global Health. Elsevier Inc. 2015.

10. Taksande, A., Pat, K. & Pathak, C. What is the knowledge, attitude and practice (KAP) level of the residents who are living in rural area of central India? International Journal of Infectious Disease. 2012; 16S: e2 – e157.

11. Wan Rozita, W. M., Yap, B. W., Veronica, S., Muhammad, A. K., Lim, K. H. & Sumarni, M. G. Knowledge, Attitude and Practice (KAP) Survey on Dengue Fever in an Urban Malay Residential Area in Kuala Lumpur. Malaysian Journal of Public Health Medicine. 2006; Vol 6 (2): 62-67.

12. Luqova, H. & Wallis, S. Cross Sectional Survey on the Dengue Knowledge, Attitudes and Preventive Practices among Students and Staff of a Public University in Malaysia. Journal of Community Health. 2017; Apr 42 (2): 413 – 420.

13. Chanthalay, S., Jiraporn, C., Somsak, W. & Cheerwith, R. Knowledge, attitudes and preventive behaviours related to dengue vector breeding control measures among adults in communities of Vientiane, capital of Lao PDR. Journal of Infection and Public Health. 2015; 8: 466 – 473.

14. Toledo, M. E., Vanlerberghe, V., Baly, A., Ceballos, E., Valdes, L., Searret, M., Boelaert, M. & Van der Stiyft, P. Towards active community participation in dengue vector control: results from action research in Santiago de Cuba, Cuba. Transactions of the Royal Society of Tropical Medicine and Hygience. 2007; 101: 56 – 63.

15. Tung, T.H., Huang, H.L., Ho, C.K., Chen, C.D., Chan. T. C., Li, T., Wang, C.Y., Yang, M. F., Chen C. Y. & King, C. C. The knowledge, attitude, and practice on dengue in Kaohsiung. International Journal of Infectious Disease. 2012; 16S: e2 – e157.

16. Affendi, I., Yoon, K. L., Jane, R. S., Alexia, P. & Paul, R. H. Mediational Effects of Self-Efficacy Dimensions in the Relationship between Knowledge of Dengue and Dengue Preventive Behaviour with Respect to Control of Dengue Outbreaks: A Structural Equation Model of a Cross-Sectional Survey. PLOS Neglected Tropical Diseases. 2013; September (Vl 7): 9-e2401.

******