ORIGINAL ARTICLE

Temporal pattern of dengue cases in central zones of Shah Alam: A retrospective study from 2013 to 2016

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Abstract:

Understanding on the temporal pattern of dengue is important in attempt to plan the strategy for controlling its occurance. Therefore, this study was designed to identify the temporal pattern of dengue cases in central zone of Shah Alam, Selangor. Four time series data were being divided into two periods to examine the corresponding weekly cumulative percentages of case numbers for each period. Then three cut-off points were evaluated by observing the trend behavior of DF for each year and was further analyzed using Pearson's correlation coefficient. The result obtainedimplied that the temporal pattern of dengue cases in 2013 was markedly different when compared to the other three years (2014, 2015 and 2016). It was found that the temporal pattern of dengue cases has changed from 2013 to 2016 as the number of dengue cases in 2013 was high during the end of the year while for the rest;the number of cases was low during end of the year but slightly higher during the first 26 epid week. This study showed that the temporal pattern of dengue cases in the central zone of Shah Alam are differ for the last 4 years of occurrence. However the numbers are still increasing from year to year and proper preventive measures should be carried out to break the chain of the transmission.

Keywords: Mean eggs per trap, neglected area, Positive ovitrap index, rural area

1. INTRODUCTION

Dengue fever (DF) or dengue haemorrhagic fever (DHF) is a mosquito-vectored viral disease [1] and *Aedes albopictus* (Skuse), also known as the Asian tiger mosquito and *Aedes aegypti* (Linnaeus) are the mosquitoes that responsible for the transmission of dengue fever and also implicated for chikungunya and Zika virus [2]. Nowadays, dengue is public health problem around the world especially in Malaysia and it is estimated that around 50-100 million cases of dengue infections has occured worldwide throughout the year [3]. Since there are no licensed vaccines or specific therapeutics for DF treatment, mosquito control practices are the most important way to diminish the prevalence of dengue infection [4].

Besides the identification of mosquito breeding sites, investigation on the temporal pattern of dengue cases throughout the year are also one of the intelligent method in order to predict and to plan a preventive measures for the upcoming trend of the DF cases [5]. Proper understanding on the temporal pattern and behavior of the dengue incidence are important in order to plan and perform preventive action to break the chain of transmission of the dengue cases [6]. Therefore, the aim of this study is to understand the temporal pattern and the behavior of the dengue incidence at the study location for the year from 2013 to 2016 consequently proper preventive measures can be carried out as we can predict the upcoming trend and behavior of the dengue cases which may be influenced by climatic, demographic, geographical and socioeconomic.

2. METHODOLOGY

This study an integrated epidemiological study design was used to investigate the temporal distribution of DF cases in central zones of Shah Alam. Retrospective cross-sectional study was conducted (2013 to 2016) to analyze several information gathered from vector control unit (VCU), Majlis Bandaraya Shah Alam (MBSA). This study comprised three major phases; (i) collection of epidemiological data, (ii) data processing and (iii) data analysis.

The data was gathered in order to scrutinize and understand the pattern of dengue prevalence rate in the study area from 2013 to 2016. The daily data was being aggregated into epidemiological week data for each year. The weekly data was used to calculate the cumulative percentage of total number of DF cases over the entire year. The data was used to identify the temporal pattern of DF cases in central zone of Shah Alam. In order to determine the behaviour of the DF outbreak in the study area, the four time series data were divided into two periods using the same cut-off point namely week 26, 32 and 40 and the corresponding weekly cumulative percentages of case numbers before and after the cut-off point were then examined [7].

Subsequently, Pearson's correlation coefficient between each pair of time series is conducted to identify the difference and similarity between the temporal patterns of the dengue cases in fourth year's period [8]. Doing this, the temporal pattern and behaviour for each dengue cases in each cut-off point could be determine whether it increase during which epid week. Same result could be used to identify the trend of dengue cases for every four years duration. This result may help us to predict the upcoming trend of dengue cases for upcoming year so that proper and suitable preventive action can be taken to control the DF outbreak in central zone of Shah Alam.

3. RESULTS AND DISCUSSION

3.1 Temporal Pattern of Dengue Cases in Central Zone of Shah Alam

The temporal patterns of four major outbreaks of dengue cases showed a classical sigmoidal shape or model for each outbreak despite the different in magnitude. The number of dengue cases indicated that the 2013 outbreaks were markedly different when compared to the other three years (2014, 2015 and 2016) (Figure 1A). It is difficult to describe the behaviour of the dengue cases as the line chart did not show any significant changes in the number of cases.

In order to understand the behaviour of the DF cases, cumulative number of DF cases by epidemic had been calculated and showed in Figure 1B. From the figure it shows clearly the increasing number of DF cases in every epid week for each year. It could be seen that the cumulative number of DF cases started to increase drastically from epid week 10 in year 2014, 2015 and 2016. It was different when compared to cumulative number of DF cases in 2013 where the number of cases started to increase dramatically from epid week 32.

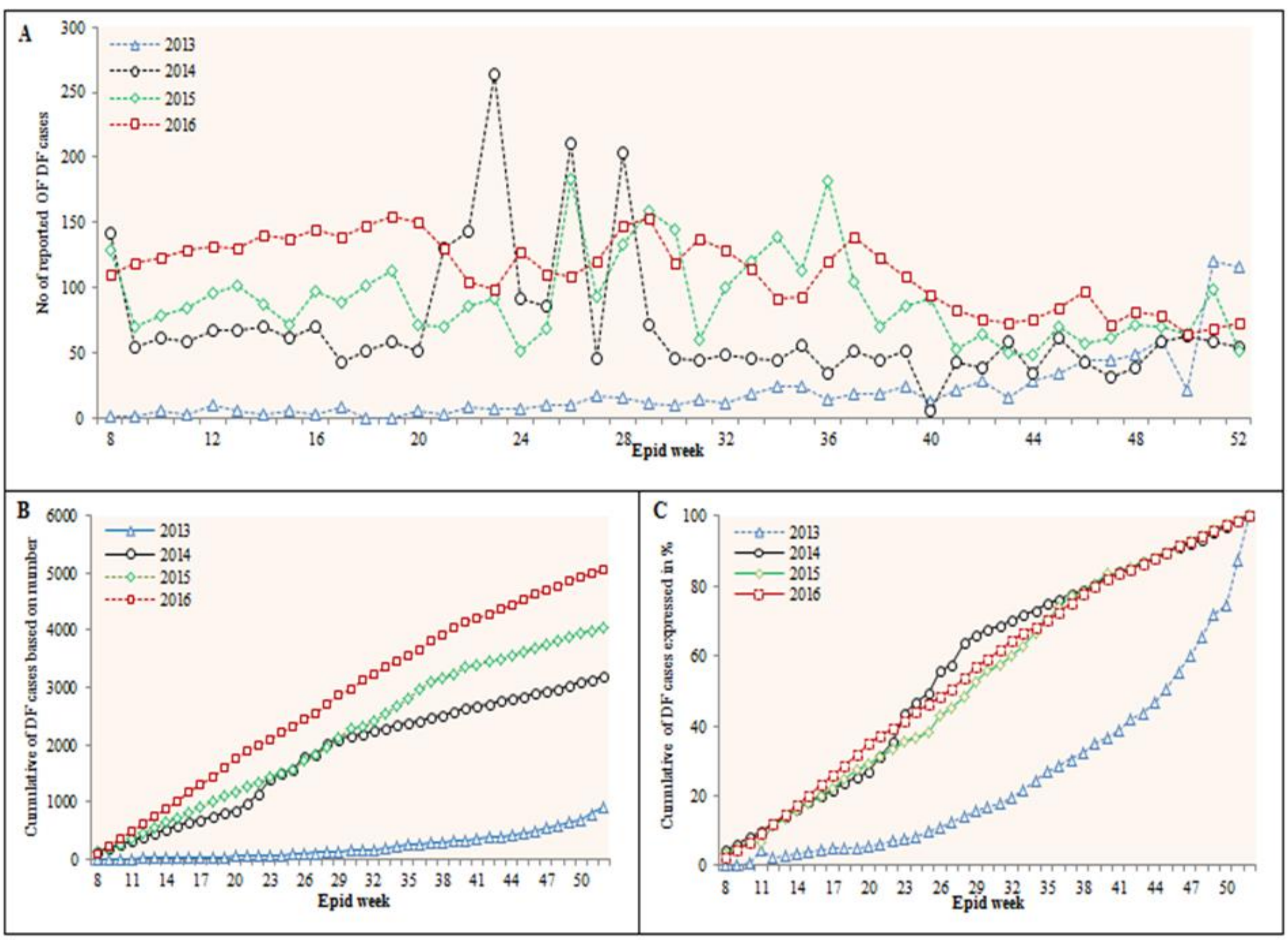

Figure 1: Temporal pattern of DF cases for Central Zone (CZ) of Shah Alam, Malaysia (2013-2016); (A) DF cases reported in CZ, (B) cumulative number of cases by epidemic; (C) Cumulative number of cases by epidemic, expressed as percentage of the total. *Note: The blue triangle, black circle, green diamond and red rectangular represent DF cases for 2013, 2014, 2015 and 2016 respectively.

3.1. Behaviour of DF Outbreak in Central Zone of Shah Alam

A bivariate Pearson's correlation coefficient (r) between each pair of the four years' time series data has been calculated to assess the linear relationship between the four outbreaks [9]. The result is given in Table 1A. Based on the table, it was found that the bivariate correlations between the weekly cumulative percentages of the number of cases in each three years (2014, 2015 and 2016) was positive and strong as the Pearson's (r) is close to 1 (2014; r=0.987; p=0.00, 2015; r=0.991; p=0.00, 2016; r=0.997; p=0.00). However, for 2013 the correlation between the weekly cumulative percentages of the number of cases slightly differed from three other years (2014; r=0.853; p=0.00, 2015; r=0.869; p=0.00, 2016; r=0.883; p=0.00).

The first cut-off point is week 26 or generally known as the first 6 month for every year. Examining the temporal pattern of DF cases reported up to and after week 26, it was found that the early behaviour of the 2014, 2015 and 2016 weekly cumulative percentage curve is quiet the same as it increased uniformly for each epid week. Meanwhile in 2013, weekly cumulative percentage was clearly less during the first 26 epid week where there were only 98 out of 916 cases were reported in the first 26 epid week which represented only 10.7% of the number of DF cases reported in 2013 (Table 1B). Sudden increase was clearly visible in between week 27 and 52 in 2013 as the number of DF cases reported was 818 which represented 89.3% of the number of DF cases reported in that year. On the other hand, the temporal behaviour of the outbreak from week 27 to 52 was very similar for all three years (2014, 2015 and 2016) as it increases without leaving any noticeable changes compared to in year 2013.

Another cut-off point of interest was week 32, where the temporal behaviour of 2013 started to increase rapidly from week 44 to 52. As shown in (Table 1C) it could be observed that the early behaviour of the cumulative number of DF cases from epid week 8 to 32 is higher for year 2014, 2015 and 2016 compared to 2013. For year 2013, the behaviour of the weekly cumulative number of DF cases is slightly low and inactive during the first 32 epid week as the number of reported cases was 178 out of 916. However, the number kept increase actively after week 33 where the number of cases that has been reported in epid week 33 to 52 for year 2013 were 738 out of 916 which represented 80.6% of the number of cases in that year. This shows that the numbers of reported cases in 2013 are increasing rapidly after epid week 32. It was different for another three years (2014, 2015 and 2016) as the number of reported cases in that year started to decrease after week 32 starting from week 33 to the end of the epidemic.

Finally, the last cut-off point was the weekly cumulative percentages of the number of cases reported up to and after week 40 for each year. After week 41, it could be seen that the early weekly cumulative percentage of DF cases in 2014, 2015 and 2016 is comparatively slower than those of 2013. This can be prove by the number of cases reported from week 41 to 52 in year 2014, 2015 and 2016 are markedly lower compared week 8 to 40. It showed that more than 80% of the number of DF cases reported occured from week 8 to week 40 in 2014, 2015 and 2016. Compared to year 2013, there was only 36.5% of the number of DF cases in the first 40 week and the remaining 63.5% of the number of DF cases occured after week 41.

Table 1: (A) Pearson's correlation coefficient (*r*) between 2013, 2014, 2015 and 2016 data. Each coefficient is calculated from the weekly cumulative percentage of the number of cases in Central Zone of Shah Alam. Percentages of the total number of cases based on cut of point; (B) Week 26, (C) Week 32 and (D) Week 41.

(A) Pearson's correlation coefficient (r) between 2013, 2014, 2015 and 2016 data

Year	2013	2014	2015	2016
2013	1.000			
2014	0.853	1.000		
2015	0.896	0.987	1.000	
2016	0.883	0.991	0.997	1.000

(B) Cut off point week 26

Year	Case week 8-52	No of DF cases w8-26	%	No of DF cases w27-52	%
2013	916	98	10.7	818	89.3
2014	3194	1764	55.2	1430	44.8
2015	4049	1740	43.0	2309	57.0
2016	5059	2439	48.2	2620	51.8

(C) Cut off point week 32

Year	Case week 8-52	No of DF cases 8-32	%	No of DF cases W33-52	%
2013	916	178	19.4	738	80.6
2014	3194	2274	71.2	920	28.8
2015	4049	2429	60.0	1620	40.0
2016	5059	3246	64.2	1813	35.8

(D) Cut off point week 40

Year	Case week 8-52	No of DF cases 8-40	%	No of DF cases W41-52	%
2013	916	334	36.5	582	63.5
2014	3194	2742	85.8	452	14.2
2015	4049	3246	80.2	803	19.8
2016	5059	4131	81.7	928	18.3

4 CONCLUSION

From this study, it was found that the trends and behaviour of the dengue occurrence in the study area are different from year to year. The year of 2013 recorded the highest cumulative number of dengue cases during the end of the year. As for 2014, 2015 and 2016 the trend of dengue cases were high during at the beginning of the year. This condition may be influenced by environmental and demographic changes that occur during the four years period. Proper understanding on the temporal pattern and behaviour is important especially for planning for the preventive and control measures of the dengue fever as an early prediction can be done based on the trend of the upcoming dengue occurrence (WHO 2009).

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REFERENCES

[1] Pathirana, S., et al., “Study of potential risk of dengue disease outbreak in Sri Lanka using GIS and statistical modelling,” *Journal of Rural and Tropical Public Health*, 8, 8.2010

[2] Hasnan, Siti Nur Anis, et al. "Surveillance of Aedes mosquitoes in different residential types in central zone of Shah Alam, Selangor." *Asian Pacific Journal of Tropical Disease*,7: 930-939, 2017

[3] World Health Organization. *WHO report on global surveillance of epidemic-prone infectious diseases*. No. WHO/CDS/CSR/ISR/2000.1. World Health Organization, 2000.

[4] Liu, Yang, Jianying Liu, and Gong Cheng. "Vaccines and immunization strategies for dengue prevention." *Emerging microbes & infections* 5.7 (2016): e77.

[5] Scott, Thomas W., and Amy C. Morrison. "Vector dynamics and transmission of dengue virus: implications for dengue surveillance and prevention strategies." *Dengue virus*. Springer, Berlin, Heidelberg, 2010. 115-128.

[6] Nazri, C. D., et al. "Impact of climate and landuse variability based on dengue epidemic outbreak in Subang Jaya." *2011 IEEE Colloquium on Humanities, Science and Engineering*. IEEE, 2011.

[7] Hsieh, Ying-Hen, Hector De Arazoza, and Rachid Lounes. "Temporal trends and regional variability of 2001–2002 multiwave DENV-3 epidemic in Havana City: did Hurricane Michelle contribute to its severity?." *Tropical Medicine & International Health* 18.7:830-838, 2013.

[8] Oliva, Jonàs, et al. "Concepts of epidemiology of forest diseases." *Infectious forest diseases. CABI, Oxfordshire, UK*: 1-28, 2013.

[9] Sanna, Mattia, and Ying-Hen Hsieh. "Temporal patterns of dengue epidemics: The case of recent outbreaks in Kaohsiung." *Asian Pacific journal of tropical medicine* 10.3: 292-298, 2017.