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Correlational study of climate factor, mobility and the incidence of Dengue Hemorrhagic Fever in Kendari, Indonesia☆

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Abstract
Objective: The DHF is an endemic in Kendari, Southeast Sulawesi province, Indonesia. The Incidence Rate (IR) of DHF in Kendari had decreased since 2016, 372 per 100,000 to 25.1 per 100,000 in 2017. Thus, this study aimed to examine the correlation of climate factors, including average temperatures, relative humidity, wind speed, and mobility on the incidence of Dengue Hemorrhagic Fever (DHF) in Kendari.
Method: This study used an ecological study or correlational study design conducted in Kendari, Southeast Sulawesi Province. The population was the aggregate data of monthly DHF incidence recorded in the Health Department of Kendari in 2014–2018. The data were analyzed using Pearson and Rank Spearman correlation tests.
Results: The present study showed a positive correlation between average ($p = 0.048$, $r = 0.257$), relative humidity ($p = 0.001$, $r = 0.413$), mobility ($p = 0.045$, $r = 0.586$) with the incidence of DHF in Kendari in 2014–2018 meanwhile, the wind speed ($p = 0.589$, $r = -0.071$) did not show a significant correlation with the incidence of DHF.

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Conclusion: The climate pattern, especially the average temperature, relative humidity, and mobility, should be monitored to control the DHF disease.

Introduction

Dengue Hemorrhagic Fever (DHF) is an infectious disease due to the dengue virus and transmitted by Aedes aegypti mosquitoes.[1,2] The incidence of DHF is correlated with the potential for rainfall, temperature, and humidity. The incidence rate of DHF also tends to increase.[3,4] Based on the data by the World Health Organization (WHO), it is predicted about 390 million Dengue infections each year. The DHF cases in America, Southeast Asia, and W Pacific in 2015 was more than 3.2 million cases.[5] It is predicted that DHF will reach its peak by 2080. About 6 billion people are at risk of DHF due to climate change.[6] The dengue viruses are found in tropical and subtropical areas such as Indonesia. meanwhile, the serotype of the dengue virus varies in each area.[7]

The DHF disease is an endemic in Kendari, Southeast Sulawesi Province. The Incidence Rate (IR) of DHF in Kendari had decreased since 2016, 372.8 per 100,000 to 25.1 per 100,000 in 2017. However, the Case Fatality Rate (CFR) had increased from 0.64% in 2016 to 3.22% in 2017.[8] The increase and transmission of DHF can be due to the host, the environmental factors such as geographical conditions (altitude, rainfall, wind, humidity, and season), demographical condition (population density, mobility, social behavior, and social-economics of the population), and the agent.[9]

Numerous studies show that climate factors such as temperature, humidity, wind speed, and mobility are correlated with the incidence of DHF in an area. Temperature is complexly related to the incidence of DHF by influencing the life of Aedes mosquitoes. The ideal temperature range for the survival of Aedes mosquitoes is between 20 °C and 30 °C.[10] A study by Xu in Thailand showed that relative humidity significantly influences the occurrence of severe dengue cases in Northeast and Central Thailand.[11] Strong winds reduce mosquito density and result in difficulty in finding a host. However, the wind also helps expand the reach of mosquitoes.[12] A study by Ehelepola showed that wind correlates with the incidence of dengue in Kandy City, Sri Lanka.[13] Meanwhile, a study by Suyasa showed a relationship between population mobility and the presence of DHF vectors.[14]

Therefore, this present study aimed to examine the correlation between average temperature, relative humidity, wind speed, and mobility with the incidence of dengue fever in Kendari in 2014–2018.

Method

This study used an ecological study or correlational study design. The study was conducted in Kendari, Indonesia, in 2014–2018. Kendari was selected as the study area since it is an endemic place of DHF and has good relatively good data available regarding the record and DHF case report as well as the climate data. Meanwhile, the population of the study was the aggregate data of monthly DHF incidence recorded in the Health Department of Kendari. The data were analyzed using Pearson correlation, denoted by correlation coefficient (r), to examine the correlation between the average temperatures, relative humidity, wind speed, and mobility with the incidence of dengue fever, the direction the correlation, and correlation degree. The Spearman test is a nonparametric test used as an alternative when the study variables do not satisfy the assumptions of the Pearson correlation test or when the samples are less than 50.

Results and discussion

Table 1 shows that on average in 2014–2018, the monthly incidence of DHF cases was 6 cases, the average temperature in Kendari in was 27.2 °C, the relative humidity was 83.9%, the wind speed was 0.55 m/d, and the average monthly mobility of DBD cases was 0.92 in 2018 or at least 1 case had mobility each month.

Table 2 shows the Pearson correlation test results where the average temperature and the incidence of DHF showed a p value = 0.048 and r = 0.257, indicating a significantly weak correlation between the average temperature and the incidence of DHF in Kendari in 2014–2018. The relative humidity and the incidence of DHF showed a p value = 0.001 and r = 0.413, indicating a significantly weak correlation between the average temperature and the incidence of DHF. Meanwhile, the Spearman Rank correlation test showed no significant correlation between wind speed and the incidence of DHF in Kendari in 2014–2018 (p = 0.589). In contrast, there was a significant correlation between the mobility and the incidence of DHF in Kendari in 2018 (p = 0.045 < 0.05) dan, and the correlation coefficient (r = 0.586) indicated a moderate positive correlation.

Discussions

Average temperatures

This present study shows a weak positive correlation between the average temperature and the incidence of DHF in Kendari in 2014–2018. The positive correlation means the increased average temperature is followed by an increased incidence of DHF. A study by Choi showed that the average temperature is significantly related to the incidence of DHF, but the incidence of DHF does not correlate with maximum temperature and minimum temperature.[15] The minimum temperature for Aedes aegypti breeding is 16 °C, while 34 °C is the upper limit. At lower temperatures of 8 °C, larvae do not move and die within a few days.[16] Higher temperatures can also shorten the duration of virus replication, and increase mosquito reproduction and human

Table 1 Study variables.

Study variables	Min	Max	Mean	Median
The monthly incidence of DHF	0	326	23.43	5.50
Average temperature	25.1	28.9	27.22	27.35
Relative humidity	76.2	91.5	83.91	83.91
Wind speed	0.0	1.6	0.69	0.55
Mobility	0	2	0.92	1.00

Table 2 The Pearson correlation test between climate factors and mobility with the incidence of DHF in Kendari in 2014–2018.

Independent variables	The incidence of DHF in 2014–2018		
	n	*r*	*Sig. (2-tailed)*
Average temperatures	60	0.257	0.048
Relative humidity	60	0.413	0.001
Wind speed	60	0.071	0.589
Mobility	12	0.586	0.045

contact.[17] Warmer temperatures can increase the transmission of dengue fever in various ways. This allows vectors to survive and reach maturity much faster than at lower temperatures. In addition, it can also reduce the size of mosquito larvae which results in smaller adult mosquitoes to have high metabolic rates, need more blood to eat and need to lay eggs more often.[18]

Relative humidity

The result of this study shows a moderate positive correlation between relative humidity and the incidence of DHF in Kendari in 2014–2018. A positive correlation indicates that the increase in relative humidity is followed by an increased incidence of DHF. This present study is in line with the study by Siregar and Sudipta that showed a significant positive correlation between relative humidity and the incidence of DHF. The higher the humidity, the higher the incidence of DHF.[19,20]

Humidity has been identified as a consistent and substantial weather factor to provide favorable conditions for dengue vectors.[21] Humidity supports the life span of mosquitoes; with increasing humidity, the days of mosquito life increase, which then leads to the completion of the dengue virus extrinsic incubation period in Aedes.[22] When the humidity is quite high, it is likely to cause mosquitoes to be endophilic and to have a dominant nature of resting inside the house or settlement with appropriate humidity.[1]

Wind speed

Wind speed was not significantly correlated with the incidence of DHF in Kendari in 2014–2018 ($r = -0.071$). The negative correlation means that high wind speed leads to a low incidence of DHF. A study by Handayani showed that wind speed and the incidence of DHF in Jakarta in 2008–2011 had a negative pattern, which means that the increase in one variable will be followed by a decrease in the other variable. The insignificant effect of wind in this present study is due to the behavior of Aedes sp. mosquitoes that tend to be inside the house (in-house), and thus the effect of wind in transmitting the vectors is relatively small.[23]

Aedes aegypti mosquitoes fly a distance of about 30–50 meters per day, but the distance depends on the availability of places to lay eggs. If the spawning grounds are at home or around the house, mosquitoes will not fly far. Ability to fly female mosquitoes on average 40 m and a maximum of 100 m, but passively, for example, due to wind or carried by vehicles, the mosquitoes can move further.[24]

The wind speed will trigger the reach of flying Aedes aegypti mosquitoes. The wider the reach of mosquitoes, the more opportunities for contact with humans so that the age and reproduction period of mosquitoes will be longer.[19] However, the higher the wind speed, the more difficult it is for vectors to fly. Therefore, it is difficult for mosquitoes to move places with great distances, so that the possibility of mosquitoes transmitting is slight.[25]

The average wind speed in Kendari in 2014–2018 is a wind speed that does not affect mosquito flying activities. The absence of a statistically significant correlation between wind speed and the incidence of DHF is due to other factors that are more dominant such as the number of breeding places available around the house so that mosquitoes will not fly away to look for a place to lay eggs.

Mobility

The average mobility of monthly DHF cases in 2018 was 0.92, or at least 1 case had mobility. As many as 102 respondents suffered from hemorrhagic fever in 2018 were interviewed regarding their mobility in 1–2 weeks before positively diagnosed with hemorrhagic fever. Of 102 respondents, 11 respondents had mobility outside Kendari within 1–2 weeks before positively acquiring hemorrhagic fever. The test result showed a moderate positive correlation between mobility and the incidence of DHF in Kendari in 2018 ($r = 0.586$).

This present study is also in line with a study by Suyasa that showed an association between mass mobility and the existence of DHF vectors. Respondents who had mobility during a minimum 2-week-period before acquiring DHF had a higher risk than those who had no mobility before acquiring DHF.[14] The population mobility can facilitate the transmission of diseases among places and often the disease will transmit from the disease center following the population mobility. Therefore, the higher the mobility, the bigger the chance of transmitting disease.[26]

A study by Istiqomah and Syahrul explained that people who have the mobility to a high endemic place of DHF do not necessarily have a high risk of acquiring DHF. This can be due to the existence of the breeding places of Aedes aegypti in that place. If the place visited by the respondent does not have Aedes aegypti mosquito breeding sites, the density of mosquito larvae in that place is also low. Consequently, the presence of female Aedes aegypti mosquitoes as DHF vectors are also low, so it is less likely to be bitten by the mosquito.[27]

Conclusion

It can be concluded that the highest noise level on Sunday was 88.8 dB. This value exceeds the maximum quality standard that is the designation of the school area, which is 55 dB, offices are 65 dB, and the allotment of public facilities is 60 dB. (the noise quality standard of Minister of Environment Decree No. 48 of 1996 applies). The impact of traffic noise on the people who live along the road is a psychological disturbance by 80%, physiological disturbance by 35.7%, and the highest is a communication disturbance by 84.3%. The results need to be socializing by the government to the people who live along highways that have high noise and impacts and find solutions for handling noise problems such as planting trees or making noise barriers.

Conflict of interest

The authors declare no conflict of interest.

References

1. Arsin AA. Epidemiologi Demam Berdarah Dengue (DBD) di Indonesia. Makassar: Masagena Press; 2013.
2. Halstead SB, Lan NT, Myint TT, Shwe TN, Nisalak A, Kalyanarooj S, et al. Dengue hemorrhagic fever in infants: research opportunities ignored. Emerg Infect Dis. 2002;8.
3. Zamli MS, Palutturi S, Suriah, Arsin AA, Hatta, Amiruddin R. Potential of rainfall, humidity and temperature, against the increasing of larvae in Makassar City, Indonesia. Int J Innov Technol Explor Eng. 2019;9:1485–7.
4. Yamanaka A, Tabuchi Y, Mulyanto KC, Susilowati H, Hendrianto E, Soegijanto S, et al. Dengue virus infection-enhancing and neutralizing antibody balance in children of the Philippines and Indonesia. Microbes Infect. 2012;14.
5. World Health Organization (WHO). Dengue and Severe Dengue. WHO. Available from: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue.
6. Colón-González FJ, Fezzi C, Lake IR, Hunter PR. The effects of weather and climate change on dengue'. PLoS Neglected Trop Dis. 2013;7.
7. Taslim M, Arsin AA, Ishak H, Nasir S, Usman AN. Diversity of dengue virus serotype in endemic region of South Sulawesi Province. J Trop Med. 2018.
8. The Health Department of Southeast Sulawesi. The health profile of southeast Sulawesi Province in 2017. Kendari: The Health Department of Southeast Sulawesi; 2018.
9. Zulkoni. Parasitologi. Yogyakarta: Nuha Medika; 2011.
10. Brady OJ, Johansson MA, Guerra CA, Bhatt S, Golding N, Pigott DM, et al. Modelling adult Aedes aegypti and Aedes albopictus survival at different temperatures in laboratory and field settings. Parasit Vectors. 2013;6:351.
11. Xu Z, Bambrick H, Yakob L, Devine G, Lu J, Frentiu FD, et al. Spatiotemporal patterns and climatic drivers of severe dengue in Thailand. Sci Total Environ. 2019;656:889–901.
12. Gama ZP, Nakagoshi N. Climatic variability and dengue haemaorrahgic fever incidence in Nganjuk District, East Java, Indonesia. Acta Biol Malays. 2013;2:31–9.
13. Ehelepola NDB, Ariyaratne K, Buddhadasa W, Ratnayake S, Wickramasinghe M. A study of the correlation between dengue and weather in Kandy City Sri Lanka (2003–2012) and lessons learned. Infect Dis Poverty. 2015;4:42.
14. Suyasa ING, Putra NA, Aryanta IWR. The association between environmental factors and social behavior with the existence of Dengue HAemorrhagic Fever (DHF) vectors in the working area of South Denpasar I Health Center. ECOTROPHIC. 2012;3:1–6.
15. Choi Y, Tang CS, McIver L, Hashizume M, Chan V, Abeyasinghe RR, et al. Effects of weather factors on dengue fever incidence and implications for interventions in Cambodia. BMC Public Health. 2016;16:241.
16. Reinhold JM, Lazzari CR, Lahondère C. Effects of the environmental temperature on Aedes aegypti and Aedes albopictus mosquitoes: a review. Insects. 2018;9:158.
17. Tong MX, Hansen A, Hanson-Easey S, Xiang J, Cameron S, Liu Q, et al. Perceptions of capacity for infectious disease control and prevention to meet the challenges of dengue fever in the face of climate change: a survey among CDC Staff in Guangdong Province, China. Environ Res. 2016;148:295–302.
18. Promprou S, Jaroensutasinee M, Jaroensutasinee K. Climatic factors affecting dengue haemorrhagic fever incidence in Southern Thailand; 2005.
19. Siregar FA, Aulia D. The influence of sociocultural environmental factor and aedes larvae density on transmission of dengue hemorrhagic fever in North Sumatera Province. In: 1st public health international conference (PHICo 2016). Atlantis Press; 2016.
20. Poddar S, Sengupta P, Chandra G, Hati AK. Effects of the weather on dengue infections in Kolkata, India. J Mosq Res. 2016;6.
21. Descloux E, Mangeas M, Menkes CE, Lengaigne M, Leroy A, Tehei T, et al. Climate-based models for understanding and forecasting dengue epidemics. PLoS Negl Trop Dis. 2012;6.
22. Bisht B, Kumari R, Nagpal BN, Singh H, Kumar S, Gupta AK, et al. Influence of environmental factors on dengue fever in Delhi. Int J Mosq Res. 2019;6:11–8.
23. Handayani P. The relationship between climate factors and the occurrence of dengue fever (DHF) in the DKI Jakarta in 2008–2011. University of Indonesia; 2012.
24. Makkatenni, Atjo N. Analysis of Aedes aegypti mosquito larvae (vector of dengue hemorrhagic fever) in Bungoro District, Pangkep Regency. Universitas Terbuka; 2014.

25. Dini AMV, Fitriany RN, Wulandari RA. Climate factors and incidence rate of dengue fever in Serang District. Makara Kesehat. 2010;14:37–45.
26. Dinata A, Dhewantara PW. Characteristics of the physical biological and social environment in the endemic area of dengue fever in 2011. J Ekol Kesehat. 2012;11: 315–26.
27. Istiqomah M, Syahrul F. Risk factors for activity mobility, and hanging clothes against dengue fever occurrence in children. J Keperawatan Muhammadiya. 2016;1.

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5	Choi, Youngjo, Choon Siang Tang, Lachlan McIver, Masahiro Hashizume, Vibol Chan, Rabindra Romauld Abeyasinghe, Steven Iddings, and Rekol Huy. "Effects of weather factors on dengue fever incidence and implications for interventions in Cambodia", BMC Public Health, 2016. Publication	%1
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9	N D B Ehelepola, Kusalika Ariyaratne, W M N P Buddhadasa, Sunil Ratnayake, Malani	%1

	Wickramasinghe. "A study of the correlation between dengue and weather in Kandy City, Sri Lanka (2003 -2012) and lessons learned", Infectious Diseases of Poverty, 2015 Publication	
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