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ORIGINAL RESEARCH

AN OVERVIEW OF DENGUE HEMORRHAGIC FEVER CASES AND ENVIRONMENTAL FACTORS IN SUMENEP DISTRICT IN 2018

Gambaran Kasus Demam Berdarah Dengue dan Faktor Lingkungan di Kabupaten Sumenep Tahun 2018

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ABSTRACT

Background: Dengue Hemorrhagic Fever (DHF) has been occurring in Indonesia for more than 50 years, and there were 65,602 cases of it in 2018 alone. Sumenep District reported the 12th highest number of DHF cases (292) in East Java Province in 2018. **Purpose:** This research aims to describe DHF in Sumenep District in 2018. **Methods:** This research is a descriptive study employing a cross-sectional design. The data used in this research were secondary data gathered from the Sumenep Health Office in 2018. The variables observed in this research were the epidemiological characteristics included in the epidemiological triangle—people, place (region), and time. Descriptive analysis was conducted to examine the DHF case distribution, using a frequency table, among the people, place (region), and time variables. **Results:** Sumenep District is home to 1,085,227 citizens, with a population density of 518 people/km^2. The number of DHF cases in Sumenep District was 292, with the highest concentration of cases in the age range of 5–14 years (47.30%); the most cases were also male (57.19%). DHF often occurred in sub-districts with high population density, and more commonly in January. **Conclusion:** Most of the Sumenep District's DHF cases in 2018 were males in the age group of 5–14 years old.

ABSTRAK

Latar Belakang: *Demam Berdarah Dengue (DBD) telah terjadi di Indonesia lebih dari 50 tahun dan pada tahun 2018 kasus DBD di Indonesia mencapai 65.602 kasus. Kabupaten Sumenep merupakan wilayah ke-12 di Jawa Timur dengan kasus DBD yang tinggi pada tahun 2018, yakni dengan total kasus sebanyak*

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*292. **Tujuan:** Penelitian ini bertujuan untuk memberikan gambaran tentang kasus DBD yang ada di Kabupaten Sumenep pada tahun 2018. **Metode:** Penelitian ini merupakan studi deskriptif dengan menggunakan rancang bangun cross-sectional. Data yang digunakan adalah data sekunder yang didapatkan dari data program pemberantasan penyakit DBD di Dinas Kesehatan Kabupaten Sumenep tahun 2018. Variabel yang diteliti merupakan karakteristik epidemiologi berdasarkan segitiga epidemiologi yang meliputi variabel orang, tempat (wilayah), dan waktu. Analisis deskriptif dilakukan dalam penelitian ini untuk melihat distribusi kasus DBD dengan menggunakan tabel frekuensi berdasarkan variabel orang, tempat, dan waktu. **Hasil:** Kabupaten Sumenep pada tahun 2018 memiliki penduduk sebanyak 1.085.227 jiwa dengan kepadatan penduduk sebesar 518 jiwa per km^2. Total kasus DBD di Kabupaten Sumenep berjumlah 292 kasus dengan jumlah penderita paling banyak adalah kelompok usia 5-14 tahun (47,30%) dengan penderita laki-laki lebih banyak dari perempuan (57,19%). Kasus DBD sering terjadi di kecamatan dengan tingkat kepadatan penduduk yang tinggi dan paling banyak terjadi pada bulan Januari. **Kesimpulan:** Kasus DBD di Kabupaten Sumenep pada tahun 2018 paling banyak terjadi pada laki-laki dan kelompok usia 5-14 tahun.*

INTRODUCTION

Dengue hemorrhagic fever (DHF) is a disease transmitted by mosquitoes that have spread to inhabit all parts of the world in recent years. The dengue virus is transmitted by female mosquitoes, usually of the Aedes aegypti species but sometimes also of the Aedes albopictus species. Tropical and subtropical countries tend to see the most cases of DHF, especially in urban areas. DHF was first discovered in 1950 during the dengue epidemic in the Philippines and Thailand. At present, dengue fever is prevalent in several countries in Asia and Latin America. This disease has the potential to cause death in children and adults (WHO, 2019).

Several factors can affect the incidence of DHF, some of which are environmental factors such as air humidity, larvae density, the presence of larvae at a water storage site (TPA), the use of anti-mosquito repellent (repellent), and the habit of hanging used clothes (Sucipto, Raharjo, & Nurjazuli, 2015). High humidity helps mosquitoes breed more easily, while low humidity raises the rate of evaporation, leading to conditions that are not preferred by mosquitoes. The higher the percentage of air humidity in an area, the higher the chances of the incidence of DHF. A climate-related factor that can influence the incidence of DHF is rainfall—the higher the rainfall, the higher the incidence of DHF (Paramita & Mukono, 2017).

Ae. aegypti has been declared endemic to 174 countries or territories, while Ae. albopictus is endemic to 88 countries or territories. There are 154 countries or territories that are reported to host both DHF epidemics and endemic populations of dengue vectors, Indonesia has been declared such a country (Furuya-Kanamori et al., 2016). Harapan, Michie, Mudatsir, Sasmono, & Imrie (2019) have found a significant increase in the incidence rate (IR) of DHF in Indonesia over the last 50 years, from 0.05 per 100,000 people in 1968 to 77.96 per 100,000 people in 2016. The IRs for DHF demonstrate a cyclical pattern, with cases peaking every approximately six to eight years. As of 1968, the peak incidence of DHF cases have been recorded in 1973, 1988, 1998, 2009, and 2016. The incidence of DHF decreased dramatically in 2017, with 68,407 cases, an IR of 26.12 per 100,000 people, and a crude fatality rate (CFR) of 0.72% (Ministry of Health RI, 2018). This decline in 2017 was also accompanied by a further decrease in cases and IR in the following

year. In 2018, there were 65,602 cases with an IR of 24.75 per 100,000 people and 467 deaths, bringing the CFR down to 0.71% (Ministry of Health RI, 2019).

Sumenep District had the 12th highest number of DHF cases in the East Java region in 2018, with a total of 292 cases (Figure 1). The IR of the DHF cases in Sumenep District in 2018 reached as high as 26.90 per 100,000 people, with a CFR of 0% (Sumenep District Health Office, 2019). No research has been conducted in the last five years to describe Sumenep District's dengue cases or their environmental factors. This study aims to provide an overview of Sumenep District's 2018 dengue cases in order to help control DHF there.

METHODS

This research was of the descriptive variety, employing a cross-sectional design. The data utilized were secondary data obtained from the Sumenep District Health Office and its program for eradicating dengue fever. These data were supported by interviews with officials of the program at the Sumenep District Health Office and the Public Health Center. The variables studied were epidemiological characteristics based on the epidemiological triangle, which includes the variables of people, place (region), and time. Descriptive analysis was conducted to determine the distribution of dengue cases, using frequency tables, across the people, place, and time variables. The variables of the DHF cases are described based on age group and gender. The placed-dependent distribution of DHF cases is classified as the number of DHF cases that occurred at the sub-district level in Sumenep District. The time-based distribution is illustrated by the number of cases that occurred in each month of 2018. This research has been conducted with ethical approval' number 462/HRECC.FODM/VII/2019 issued by the Faculty of Dentistry, Universitas Airlangga.

RESULTS

Sumenep District was home to 1,085,227 citizens, with a population density of 518 people per km2 in 2018. Sumenep District's 2018 population increased by around 0.40% from the previous year. Males numbered 516,322, and females numbered 568,905. The highest percentage of the population was aged between 45 and 49 years. The areas of highest population density were in urban areas, such as the Sumenep City sub-district, the Kalianget sub-district, and the Pragaan sub-district.

Sumenep District, located in the tropics, is a potential breeding ground for vectors. It includes 126 islands, which increases the probability of disease transmission due to the number of migrants living on them. Based on a 2019 Sumenep District Health Office report, its level of Free Larvae Index (ABJ) was still far below the standard of 78.83%.

People-Based Overview of Dengue Hemorrhagic Fever Cases in Sumenep District

The 5–14-years age group had the most cases (138; 47.30%), followed by the 15–44 years age group with (111 cases). The 5–14- and 15–44-years age groups each had over 100 DHF cases, whereas the other age groups had less than or equal to 20 cases. The fewest cases occurred in the <1-year age group (4; 1.37%). The majority of Sumenep District's 2018 DHF cases involved males (167; 57.19%), while females with DHF numbered 125 (Table 1).

Table 1
Distribution of 2018 Sumenep District DHF cases by age and gender

Variable	n	%
Age (Years Old)		
< 1	4	1,37
1-4	19	6,51
5-14	138	47,30
15-44	111	38,00
≥ 45	20	6,85
Gender		
Male	167	57,19
Female	125	42,81
Total	292	100,00

Place-Based Overview of Dengue Hemorrhagic Fever Cases in Sumenep District

Based on mapping the DHF cases in Sumenep District in 2018 across 22 sub-districts, the majority occurred in the Sumenep City sub-district (70 cases), followed by the Bluto sub-district (31 cases) and the Dungkek sub-district (30 cases). The Sumenep City sub-district has two Public Health Center units, namely the Pamolokan Public Health Center, which contributed 34 cases, and the Pandian Public Health Center, which contributed 36 cases. The Sumenep City sub-district is the second most narrow area after the Batuan sub-district; it is also a flood-prone area. The five sub-districts of Sumenep District that remained unaffected by DHF in 2018 were Sapeken, Ra'as,

Gayam, Nonggunong, and Masalembu. These seven sub-districts are located outside Madura Island (Figure 1).

Time-Based Overview of Dengue Hemorrhagic Fever Cases in Sumenep District

Cases of dengue fever occurred every month in Sumenep District in 2018. The number of dengue cases that occur tends to fluctuate with the highest number of cases found in January, which—in 2018—was about 14% of the total cases for the year (42 cases), followed by February (38 cases) and April (35 cases). The lowest number of cases occurred in June (11 cases). Therefore, the number of DHF cases that occurred in Sumenep District in the first four months of 2018 (January–April), July, and December reached ≥ 30 (Figure 2). The earlier months of 2018 comprise the rainy season in Sumenep District. Based on the overall data of dengue cases in Sumenep District in 2018, none ended in death.

The Bluto and Dungkek sub-districts were the two after the Sumenep City sub-district with the most dengue cases in Sumenep District (Figure 1). The vast areas of the Bluto and Dungkek sub-districts, which are dominated by vacant land, lead to them having relatively low population densities. They are also surrounded by the sea, and their land is used for plantations. The Bluto sub-district has the potential for medicinal chili plantations and Dungkek Sub-district has the potential for coconut plantations. Upland fields are also still commonly found in these two districts. These upland fields are usually planted with banana trees and other plants such as cassava and green beans. In terms of topography, the Bluto sub-district consists of hilly and sloping areas, while the Dungkek sub-district consists of non-hilly sloping lands. The Dungkek sub-district's proximity to the sea makes it prone to experiencing tidal waves, while the Bluto sub-district, which is also close to the sea, tends to experience heavy winds.

DISCUSSION

People-Based Overview of Dengue Hemorrhagic Fever Cases in Sumenep District

This study revealed that the majority of people who suffered from DHF were in the 5–14-year age group. These results are consistent with studies that were conducted several years prior. Research conducted in Surabaya found that out of 148 patients with suspected dengue, 101 (around 68%) were children (<15 years old). The majority of dengue cases reported (around 95) in the study were patients under the age of 10 years (Wardhani et al., 2017). The age range of 5–14 years covers school children who may potentially become infected with DHF via two environmental sources, namely the school environment and the home environment. Children in that age range have weaker immune systems than adults (Kurniawati & Yudhastuti, 2016). This study is also in line with research conducted in Colombia over eleven years (from 2000 to 2010) that showed that the age trend of DHF sufferers tends to fluctuate, peaking in the 5–14-year age group (Villar, Rojas, Besada-Lombana, & Sarti, 2015).

Based on research conducted at the Regional General Hospital of Buleleng District, there were 51 pediatric DHF patients, of whom 26 (51%) were male. As many as 22 patients (43.10%) were included in the middle childhood group (6–11 years) (Pranata & Artini, 2017). This current research shows that the majority of the DHF sufferers in Sumenep District in 2018 were male (167; 57.19%). Similar results were found in a study conducted in Pasuruan that showed that more males (54%) suffered from DHF than females (Ali & Ma'rufi, 2016). Research on the spread of dengue conducted in the city of Banjarmasin found that as many as 147 sufferers were male, and 98 sufferers were female. Briefly, the level of mobility for males is higher than for women, leading to them spending more time outside the house; therefore, males are more likely to be bitten by mosquitoes (Kasman & Ishak, 2018).

One of the factors that can influence the incidence of DHF is the host factor, which includes gender. As research conducted in Cipayung, East Jakarta found, there was a significant relationship (p = 0.02 and OR = 1.76%) between sex/gender and the incidence of DHF with 95% CI: 1.10–2.81. In theory, female Aedes aegypti mosquitoes prefer to bite men, thus DHF is more common in men because, after bathing, men rarely use perfume (Windiyaningsih & Nurhastuti, 2018). Global research on dengue has found that 54.50% of sufferers are male. Meta-analysis has indicated a significant relationship between dengue infection with two variables, one of which is gender with OR= 1.10% (95% CI: 1.01–1.20). This study also showed that 23.20% of dengue infections were DHF (Guo et al., 2017).

Figure 1. Map of DHF case distribution by sub-district in Sumenep District in 2018

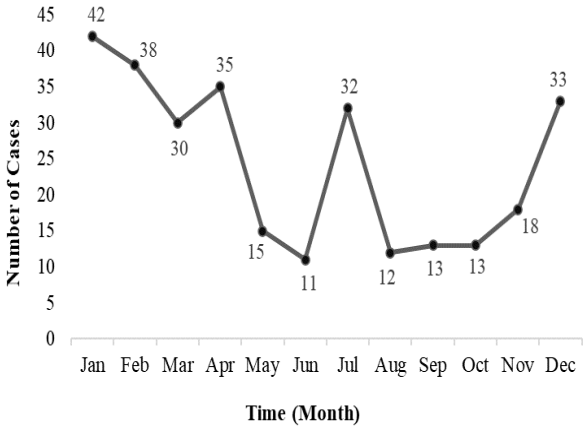

Figure 2. Time-based overview of DHF cases in Sumenep District in 2018

Place-Based Overview of Dengue Hemorrhagic Fever Cases in Sumenep District

It has been recorded that Sumenep District had a population of 1,085,227 in 2018 with an average population density of 518 people per km2. Furthermore, the Sumenep City sub-district had the highest population density (2,649.30 people per km2) of all of its sub-districts. A potential risk factors for DHF is occupancy density with OR = 2.63% (95% CI: 0.63–11.08), which is also closely related to population density (Ratri, Wahyuningsih, & Murwani, 2017).

This study shows that in addition to having high population density, the Sumenep City sub-district also had the highest incidence of DHF in 2018, with as many as 70 people (23.97%) affected. As research conducted in Semarang has shown, there is a significant correlation between population density and DHF—the more dense the population, the more conducive the area becomes to acting as a breeding ground for mosquitoes (Angelina & Windraswara, 2019). A study in Thailand also showed that one of the four factors associated with DHF incidence is population density; the three other factors are the number of households, the residential area, and the existence of artificial reservoirs (Chaiphongpachara, Pimsuka, Ayudhaya, & Wassanasompong, 2017).

Sociodemographically, the coincidence of DHF and population density fluctuates, but the peak incidence of DHF occurs when population density reaches its highest point. Based on this, there is a significant correlation between the incidence of DHF and population density (Nuryunarsih, 2015). Based on the explanation given by one of the Public Health Center officers in Sumenep District, another factor that also has the potential to cause DHF in addition to population density is that DHF sufferers are attacked when visiting relatives' houses outside their villages, sub-districts, or districts. This is consistent with research conducted in West Aceh. DHF patients contract DHF when visiting relatives in villages that are likely to contain a lot of Aedes aegypti mosquito larvae, which then bite them (Nurdin & Zakiyuddin, 2018). There is additionally a high incidence of DHF in highly densely populated areas in Sri Lanka, namely

Colombo, Kandy, and Jaffina. These three regions are the three main areas that have a high population density (Sirisena, Noordeen, Kurukulasuriya, Romesh, & Fernando, 2017).

Time-Based Overview of Dengue Hemorrhagic Fever Cases in Sumenep District

The most DHF cases in Sumenep District in 2018 occurred in January (42 patients). According to the DHF program in Sumenep, the pattern of DHF events in Sumenep can be predicted to repeat at the beginning of the year (January), which is when the rainy season falls. This is also consistent with research conducted in Tanah Datar District, West Sumatra; dengue cases in this area increased during the period spanning from October to January (Masrizal & Sari, 2016). Similar research conducted in Ternate found that the incidence of DHF increased on average in January, reaching a peak in March with several related factors such as temperature and climate being highly influential in the previous month (Tomia, Hadi, Soviani, & Retnani, 2016). Another study conducted in Semarang stated that, in January 2015, DHF occurred in 133 people. This was more than twice the amount of people who had been infected during the same month of the previous year—only 53 (Sucipto, Raharjo & Nurjazuli, 2015).

The monthly trend of DHF incidence spanning five years (from 2012 to 2016) in Banjarmasin revealed that the incidence of DHF began to increase in January, February, and March (Ishak & Kasman, 2018). Research conducted in Surabaya also found, during the time spanning from 2009 to 2017, that the incidence of DHF began to increase in January, peaking in March. Incidence is influenced by several climatic factors, including rainfall and humidity. There is both a significant correlation and a positive value between rainfall and the incidence of DHF ($p = 0.01$ and $r = 0.41$, respectively). Humidity also had a significant, positive correlation with the incidence of DHF in Surabaya from 2009 to 2017 ($p = 0.01$ and $r = 0.70$). Similar results were garnered from research conducted in Sleman District, which showed a correlation between rainfall and DHF incidence in the Depok ($p = 0.021$) and Sleman ($p = 0.014$) sub-districts (Kesetyaningsih, Andarini, Sudarto, & Pramoedyo, 2018).

January saw the highest level of rainfall of the year in Sumenep District for 2018, reaching up to 13.48 mm (Figure 3) with a minimum humidity of 81% and a maximum humidity of 94% (Figure 4) (Sumenep' Central Bureau of Statistics, 2018). Generally, normal rainfall is high at the beginning of the year, with the distribution of each season zone being different from fluctuating patterns. Research in Yogyakarta found a relationship between climate variables and the incidence of DHF in several season zones only due to different levels of rainfall in each zone (Ayumi, Iravati, & Umniyati, 2016). Research conducted in Tasikmalaya also found that rainfall was one of the factors affecting the incidence of DHF during the time spanning from 2006 to 2015. The highest number of cases in Tasikmalaya reached up to 91.33, with 7.92 mm of rainfall .

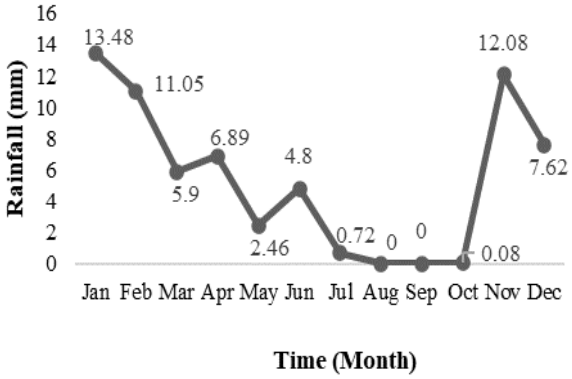

Figure 3. Graphic of Sumenep District rainfall in 2018

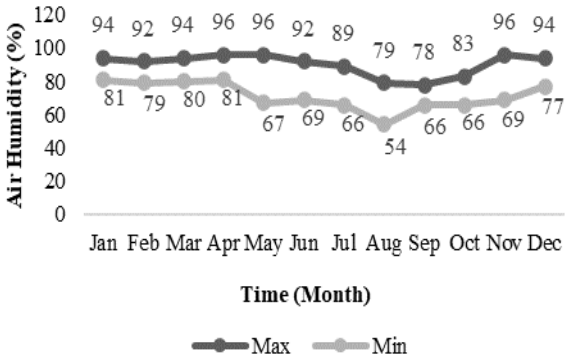

Figure 4. Graphic of Air Humidity in Sumenep District in 2018

Research Limitation

This study used data obtained from the Sumenep District Health Office, which is population data. This research was therefore limited to describing only the trends and patterns of DHF events; it was not able to test the relationships between these variables.

CONCLUSION

Based on the "people" variable, most of the DHF patients in Sumenep District in 2018 were in the age group of 5–14 years, and the majority of patients were male. When reviewed with regard to the "place" variable, the DHF cases were mostly found in districts with high population density. Based on the "time" variable, the highest number of cases was found in January.

CONFLICT OF INTEREST

The authors declare no conflict of interest in the publication of this study.

AUTHOR CONTRIBUTION

All authors participate actively in this article and are responsible for the content of the article. AJ has a duty for making concept, taking and processing data, and also write research. CUW guides and gives some advices along these process of research to the first author.

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