Jurnal Berkala Epidemiologi
Volume 11 No 3. September 2023. 215- 223
p-ISSN: 2301-7171; e-ISSN: 2541-092X

DOI: 10.20473/jbe.v11i32023.215-223
https://e-journal.unair.ac.id/JBE/
Email: jbe@fkm.unair.ac.id / jbepid@gmail.com

JBE Jurnal Berkala EPIDEMIOLOGI

Jurnal Berkala
EPIDEMIOLOGI
PERIODIC EPIDEMIOLOGY JOURNAL

ORIGINAL ARTICLE

AN EPIDEMIOLOGICAL OVERVIEW OF DENGUE HEMORRHAGIC FEVER (DHF) CASES IN KEDIRI REGENCY DURING 2017-202

Gambaran Epidemiologi Kasus Demam Berdarah Dengue (DBD) di Kabupaten Kediri Tahun 2017-2021

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ARTICLE INFO

Article History:
Received, February, 9th, 2023
Revised form, February, 22th, 2023
Accepted, May, 13th, 2023
Published online, September, 15th, 2023

Keywords:
dengue;
dengue hemorrhagic fever;
communicable disease;
tropical disease;
epidemiology of DHF

Kata Kunci:
dengue;
demam berdarah dengue;
penyakit menular;
penyakit tropis;
epidemiologi DBD

ABSTRACT

Background: Dengue Hemorrhagic Fever (DHF) is a communicable disease with rapid spread and the potential to cause death. In 2019, Kediri District had the fourth-highest number of DHF cases in East Java Province and was reported to have experienced a DHF outbreak. **Objective:** This study aimed to describe dengue cases in Kediri District in 2017-2021 under non-pandemic and COVID-19 pandemic conditions. **Methods:** Using a total sampling technique, descriptive research with a case series design was conducted using secondary data from the Health Profiles and the Central Bureau of Statistics of Kediri District in 2017-2021. The studied variables included the number of dengue cases, sex, age, area, population, population density, morbidity rate, Lateral Flow Immunoassay (LFI), and rainfall. Data were analyzed using an epidemiological approach based on people, places, and times and visualized with tables and diagrams. **Results:** The majority of DHF cases occurred in males and the 5-14 years age group in both the COVID-19 non-pandemic (52.88%; 55.96%) and COVID-19 pandemic conditions (51.14%; 58.56%). The incidence rate (IR) increased with population density and the number of dengue cases in the non-COVID-19 pandemic. It decreased with a decrease in dengue cases when the population density increased during the COVID-19 pandemic. Under all conditions, high dengue cases were found in months with high rainfall. **Conclusion:** The pattern of DHF incidence in Kediri District in 2017-2021 is mostly in males and the age group of 5-14 years, when there is an increase in population density, and in January.

How to Cite: Febrianti, F. A., Qurniyawati, E., Isfandiari, M. A., & Nasr, N. M. G. (2023). An epidemiological overview of dengue hemorrhagic fever (DHF) cases in Kediri Regency during 2017-202. *Jurnal Berkala Epidemiologi, 11*(3), 215-223. https://dx.doi.org/10.20473/jbe.v11i32023.215-223

ABSTRAK

Latar Belakang: Demam Berdarah Dengue **(**DBD) menjadi salah satu penyakit menular dengan penyebaran begitu cepat dan berpotensi menyebabkan kematian. Pada tahun 2019, kasus DBD di Kabupaten Kediri menjadi kasus tertinggi ke-4 di Provinsi Jawa Timur dan dilaporkan mengalami KLB DBD. **Tujuan:** Penelitian ini bertujuan untuk memberikan deskripsi kasus DBD di Kabupaten Kediri tahun 2017-2021 pada kondisi non pandemi dan pandemi COVID-19. **Metode:** Penelitian deskriptif dengan rancang bangun *case series* menggunakan data sekunder dari Profil Kesehatan dan Badan Pusat Statistik Kabupaten Kediri tahun 2017-2021, dengan teknik total sampling. Variabel yang diteliti meliputi jumlah kasus DBD, jenis kelamin, umur, luas wilayah, jumlah penduduk, kepadatan penduduk, angka kesakitan, serta curah hujan. Data dianalisis secara naratif dengan pendekatan epidemiologi berdasarkan orang, tempat, dan waktu serta divisualisasikan dengan tabel dan diagram. **Hasil:** Kasus DBD mayoritas terjadi pada laki-laki dan kelompok umur 5-14 tahun baik pada kondisi non pandemi COVID-19 (52,88%; 55,96%) maupun pandemi COVID-19 (51,14%; 58,56%). *Incidence Rate* (IR) meningkat seiring peningkatan kepadatan penduduk dan jumlah kasus DBD pada kondisi non pandemi COVID-19 dan menurun seiring penurunan jumlah kasus DBD pada kepadatan penduduk yang tetap meningkat saat pandemi COVID-19. Pada seluruh kondisi, kasus DBD yang tinggi ditemukan pada bulan dengan curah hujan yang tinggi. **Kesimpulan:** Pola kejadian DBD di Kabupaten Kediri tahun 2017-2021 banyak pada laki-laki dan kelompok umur 5-14 tahun, saat terjadi peningkatan kepadatan penduduk, dan pada Bulan Januari.

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is a viral infection transmitted to humans through the bite of infected vectors of female Aedes aegypti mosquitoes and is a serious public health problem worldwide, including Indonesia. The disease spreads widely and rapidly, causing potential death in a short time (1). DHF is the most common and widespread among tropical and subtropical regions worldwide, most of which are found in urban and semi-urban areas (2). The global incidence of DHF has increased significantly to the point where it is noted that approximately half of the world's population is now at risk of DHF, and it is estimated to be 100-400 million. Severe form of dengue virus infections occur annually (3). Dengue fever is a major life-threatening condition, causing serious bleeding, organ impairment, and plasma leakage in the severity form, leading to a higher risk of fatality in several Asian and Latin American countries. The disease incidence is increasing dramatically, affecting 75% of the global population; however, the severity rate in the Asia-Pacific region is 18 times higher than that in America (4)

Indonesia is a DHF-endemic region in Southeast Asia, located in the equatorial region, and has a tropical climate; thus, it has the potential to become a breeding ground for the mosquito vector of dengue viruses, which is principally transmitted by *Aedes aegypti* (5). Incidence cases in Indonesia are classified as fluctuating, but tend to experience improvement (1). At the end of 2018, Indonesia reported a dengue hemorrhagic outbreak in 34 provinces and 514 regencies (6).

Kediri Regency is one of the largest endemic areas in East Java Province with a new case of DHF every year (7), and the disease is also fluctuating cases in Kediri Regency. In 2019, there were 1,298 incident cases of DHF in Kediri Regency, which became the fourth highest in East Java Province, and an outbreak was declared (8). The number of cases in Kediri Regency increased from 2017 to 2019, reaching almost 1,298 people before decreasing to 274 during the COVID-19 pandemic.

The incidence of DHF can be influenced by several factors, including population (density, human mobility, knowledge, attitude and practice), water storage, and climate. Population density is one of the factors that influence the high incidence of DBD (9). Climate factors, including rainfall, air temperature, and humidity, simultaneously affect the incidence of DBD (10). Many other factors can also affect DHF cases if not handled properly; consequently, mortality due to DHF increases. Therefore, efforts to control the incidence and prevalence of DHF are urgently needed thoroughly and vastly, especially in areas with high transmission rates (6).

This study aimed to provide an epidemiological overview of DHF cases in the Kediri Regency in 2017–2021 under different conditions, including the non-COVID-19 and COVID-19 pandemics. The description of epidemiological cases based on person, place, and time can be used as a basis for policy formulation, while the development of public health interventions is based on scientific evidence and as a basis for targeting public health interventions (11).

METHODS

A descriptive study was conducted focusing on a case-series study design using secondary data from the Kediri Regency Health Profile and Kediri Regency Central Statistics Agency in 2017–2021. All consecutive patients with DHF recorded in the Kediri Regency Health Profile were included in the study. The variables studied included demographic characteristics such as age, sex, population (size and density), morbidity rate, larva-free index (LFI), and rainfall. A narrative descriptive analysis was performed to provide an overview of DHF cases in Kediri Regency from 2017 to 2021 during the non-COVID and COVID-19 pandemic, using an epidemiological approach based on person, place, and time, and the results were visualized through tables and diagrams. This study was approved by the Universitas Airlangga, Faculty of Public Health Research Ethical Clearance Commission (letter number 35/EA/KEPK/2023).

RESULTS

Pattern of Dengue Hemorrhagic Fever (DHF) Cases Based on Person

The pattern of *Dengue* Hemorrhagic Fever (DHF) based on people can be seen in the results (Table 1), which show that in 2017–2021, before and after the COVID-19 pandemic, most DHF cases occurred in men. In the non-pandemic condition of COVID-19: there were 1,091 men (52.88%) experienced DHF; however, 313 men (51.14%) were infected during the COVID-19 pandemic. Children were the most commonly affected group, age group–5-14 years in 2017–2021, with a total of 1,211 cases (55.96%) in non-COVID pandemic conditions and 359 cases (58.56%) in COVID-19 pandemic conditions. DHF incidence increased in the age group of 5-14 years, then decreased until the age group of ≥45 (Table 1).

Pattern of Dengue Hemorrhagic Fever (DHF) Cases Based on Place

The pattern of Dengue Hemorrhagic Fever (DHF) based on location can be seen in the results, which show that during the non-COVID pandemic conditions, the incidence rate (IR) of DHF in Kediri Regency increased (17.71 per 100.000 population in 2017 to 89.15 per 100.000 population in 2019). During the COVID-19 pandemic, the IR rate of DHF decreased (21.39 per 100.000 population in 2020 to 17.26 per 100.000 population in 2021). In 2019, the IR rate of DHF was high (89.15 per 100.000 population) because it was above the limit set by the Indonesian Ministry of Health (<49 per 100.000 population. Before the COVID-19 pandemic, there was an increase in population density and DHF cases, but during the COVID-19 pandemic, there was a decrease in the number of DHF cases despite an increase in population density (Table 2).

During non-pandemic COVID-19 conditions, the value of the Larva-Free Index (LFI) in Kediri Regency declined in 2019 (75%) as opposed to 2017–2018 (78%). The value of LFI increased to 77% during the COVID-19 pandemic (2020–2021), but remained below the LFI value in 2017–2018. Following a high IR, there is low (Figure 1).

Table 1
Distribution of DHF Cases Based on People in Kediri Regency During 2017-2021

Variable	Case								
	Non- COVID-19 Pandemic			n	%	COVID-19 Pandemic		n	%
	2017	2018	2019			2020	2021		
Sex									
Man	147	256	688	1,091	52.88	173	140	313	51.144
Woman	132	230	610	972	47.12	165	134	299	8.86
Age (years)									
≤1	8	15	42	65	3.00	23	19	42	6.85
1-4	28	49	140	217	10.03	51	49	100	16.31
5-14	156	272	783	1,211	55.96	201	158	359	58.56
15-44	81	141	405	627	28.97	57	43	100	16.31
≥45	6	10	28	44	2.03	6	6	12	1.96

Table 2
Distribution of Cases and Overview of *Incidence Rate* (IR) for DHF Kediri Regency during 2017-2021

Year	Area (km^2)	Total Population	Population Density (person/km^2)	Case	IR per 100.000 Population
Non-COVID-19 Pandemic					
2017	1,386.05	1,561,392	1,126.50	279	17.71
2018	1,386.05	1,568,113	1,131.35	486	30.99
2019	1,386.05	1,574,272	1,135.80	1,298	89.15
COVID-19 Pandemic					
2020	1,386.05	1,580,092	1,140.00	338	21.39
2021	1,386.05	1,673,158	1,207.14	274	17.26

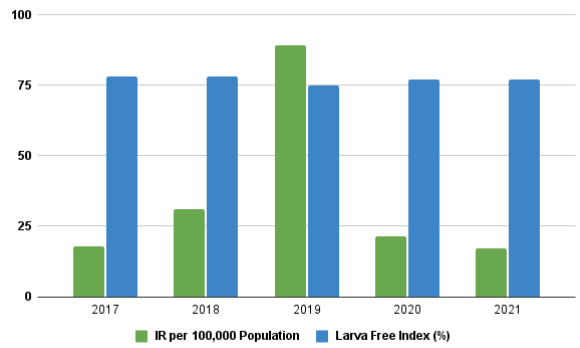


Figure 1. The Annual Larva Free Index (LFI) and Incidence Rate of DHF Cases in Kediri Regency During 2017-2021

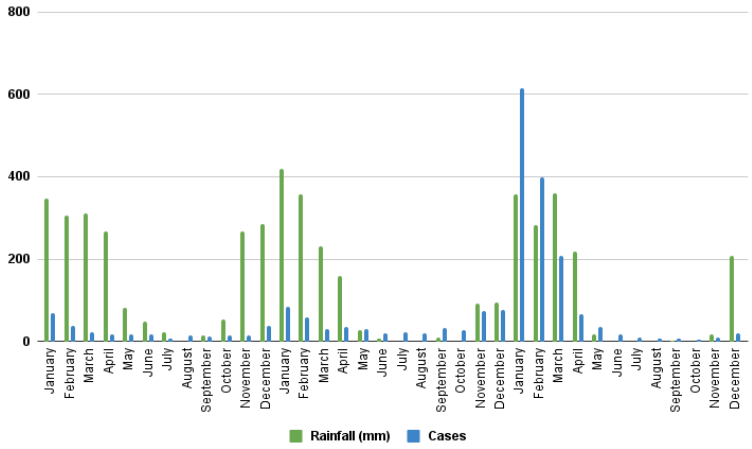
Pattern of Dengue Hemorrhagic Fever (DHF) Cases Based on Time

The results showed a pattern of DHF based on time, revealing that the most common cases were registered in January, with the highest number of cases in the non-COVID-19 pandemic conditions that occurred in the new year, with as many as 68 cases in 2017, 85 cases in 2018, and 615 cases in 2019. During the COVID-19 pandemic, the highest number of DHF cases was recorded in January and February. In 2020, 69 cases were reported in February, and in 2021, were 39 cases found in January.

In January, the rainfall in Kediri Regency during 2017–2019 was highest before the COVID-19 pandemic; specifically, in 2017 and 2018, January had the highest rainfall compared to other months; in 2019, January had the second largest rainfall after March, reaching 360 mm. During the COVID-19 pandemic, in January 2020, rainfall was also the highest; however, in 2021, January had the third highest rainfall after May and March. The DHF pattern in 2017–2021 indicated that

before and after the COVID–19 pandemic, the greatest numbers of DHF cases were found in months with high rainfall, even at the peak of the highest rainfall in that year (Figure 2).

Non-COVID-19 Pandemic (2017-2019)



COVID-19 Pandemic (2020-2021)

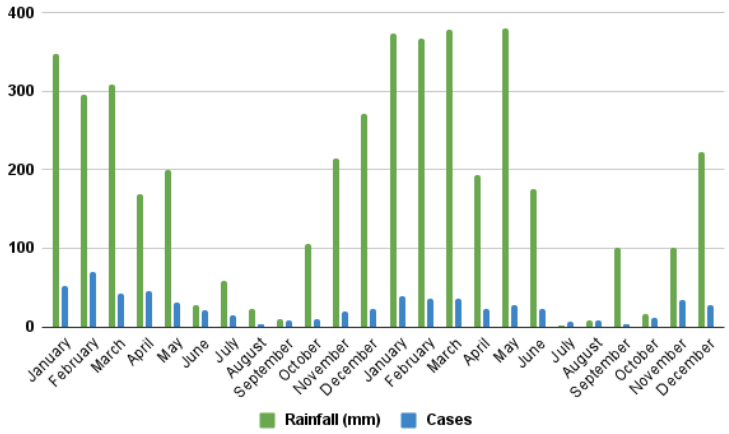


Figure 3. Distribution of DHF Cases and Average of Rainfall Based on Time in Kediri Regency during 2017-2021

DISCUSSION

Pattern of Dengue Hemorrhagic Fever (DHF) Cases Based on Person

This study shows that men were registered with the highest number of DHF cases annually, both in non-COVID and COVID-19 pandemic conditions. The results of this study are consistent with several previous studies, which showed that in 2009-2018 in Ternate City, there were more DHF sufferers among men (507 people) than among women (411 people) (12). Another study conducted in Banjarmasin in 2012-2016 also stated that more DHF cases were found in men (147 subjects) than in women (98 subjects) (13).

There was a difference in the number of DHF cases found between men and women, one of which was due to the mobility factor. Men are more active and spend more time outside the home, so the risk of being bitten by mosquitoes is also higher (13). A study conducted by Kesetyaningsih showed different results, indicating that the highest cases of DHF occurred among adult subjects (≥15 years), while the incidence of DHF tends to be higher in men than in women because it is possibly associated with higher male mobility; however, the sex and the

incidence of DHF cases among children (<15 years) are still polemic (14). Another study also reported that men and women have the same potential for dengue infection (15). The results of this study indicate that most dengue cases occur in the age group of 5-14 years. This study was similar to other studies that showed that DHF cases in Blitar City in 2015-2017 mostly affected the age group of 5-14 years (16), subjects in the age group of <15 years were more likely to be infected than those aged ≥15 years, because the age group of <15 years had low body resistance and vigilance against mosquito bites (17).

The incidence of DHF increased significantly among the age group of 5-14 years suffers from DHF because of the activity pattern of this age group, which was similar and matched with the peak pattern of Aedes aegypti mosquito activity, which is on 08.00-09.00, when children are doing activities in school, and on 16.00-17.00, when children are doing activities around the house (18). Low body resistance and high activity increases the risk of being bitten by mosquitoes (12).

Pattern of Dengue Hemorrhagic Fever (DHF) Cases Based on Place

According to the study's findings, an increase in population density in the Kediri Regency from 2017 to 2019 during the non-COVID-19 pandemic was always followed by an increase in DHF cases. This study supports previous research that linked population density to the prevalence of DHF, which was reported based on the low category (r=0.15) and has a positive correlation, which indicated that when the population density was increased in a specific place/area, there was a higher probability of an increase in the incidence of DHF among these groups (19). Other studies also showed that there was a significant relationship (p=0.05) between population density and the incidence of DHF, with a positive correlation, where is the density of the population, the higher the incidence of DHF (20).

In 2020-2021 or during the COVID-19 pandemic, there was a decrease in DHF cases even though population density continued to increase. This can be influenced by various factors that may lead to a decrease in the number of DHF cases. The sharp decline in DHF cases during the COVID-19 pandemic is probably due to administrative delays in case reporting (21). In addition, this might be due to the implementation of the social distancing policy, which limits all social activities and leads to a decrease in DHF cases. This is in accordance with a study stating that lockdowns and social restrictions during the COVID-19 pandemic have also led to a decrease in dengue transmission in Sri Lanka (22) and Brazil (23).

In connection with the rising number of DHF cases and the overall population, the Kediri Regency is included in the DHF endemic area. In 2018–2019, the Kediri Regency was included in the medium- and high-dengue endemic areas. This is because the IR value in that year was more than 30 per 100,000 people, and the number of cases in that year increased significantly, accompanied by an increase in the population. This is in accordance with the research by Ngadino, who also stated that in 2018–2020, DHF cases always occurred in Kediri Regency, where almost all sub-districts in Kediri Regency were included in DHF endemic areas and only one sub-district was included in sporadic areas (7).

The LFI is a national vector control indicator utilized by the Ministry of Health of Indonesia. In Indonesia, the minimum national target for LFI is greater than 95%. Theoretically, the value of LFI will have an opposite effect on the high incidence rate of dengue fever cases, and the incidence rate of dengue fever cases will be high if the value of LFI tends to be low (24).

According to this study, the overall LFI value had no effect on the incidence of DHF. However, there is one circumstance in which the incidence of DHF increases as the LFI value decreases. These results are in line with earlier research carried out in the Blitar District between 2013 and 2017, which found no correlation between the incidence rate of DHF and LFI (p=0.06) (25). On a nationwide level in Indonesia, other similar studies also showed no significant correlation between the incidence rate of DHF and LFI (p=0.42)(25). Research in the East Lombok District revealed contradictory findings; a high incidence rate of DHF was associated with a low LFI value (26). One of the risk indicators for an increase in DHF incidence is a larva-free index (LFI) below 95% (27).

Pattern of Dengue Hemorrhagic Fever (DHF) Cases Based on Time

The results of this study indicated that in 2017-2021, there was an increase in DHF cases, always followed by high rainfall before and after the COVID-19 pandemic, and the average rainfall was positively correlated with the timing of DHF

incidents and contributed to an increase in the incidence of DHF. Thus, high rainfall is an ideal condition where rainwater can cause puddles or flooding in a natural or artificial medium, so it has the potential to become a mosquito breeding site (10). A study conducted in Karanganyar showed that rainfall was not correlated with the incidence of DHF ($p = 0.78$) (24).

The peak of DHF cases in the Kediri Regency occurs during the rainy season, which has high rainfall. In Kediri Regency, the rainy season occurs for to 4-5 months, from December to April each year (28). The DHF cases in the Kediri Regency showed the same pattern in 2017-2019. The peak of dengue cases always occurs in January, when the annual rainfall is high. However, in 2020-2021, the peak of DHF cases will not only be registered in January, but also in February with high rainfall. These results were consistent with a study in Temanggung, Central Java, which showed that the peak of DHF cases occurred in January and February, which have high rainfall (29).

During 2017-2021, both during the COVID-19 pandemic and the non-COVID-19 pandemic, apart from rainfall, climate elements in Kediri Regency, including temperature, air humidity, and wind velocity, have been relatively stable and normal every year (28). With this in mind, it is known that climate change, specifically variations in monthly rainfall, can affect DHF cases in the Kediri Regency in 2017–2021, where a high number of DHF cases occur under conditions of high rainfall.

Research Limitation

As no comparison was made between cases and non-cases in this type of research, the study could not test for the existence of a causal relationship because it was a descriptive case *series* study design that used a population unit instead of individuals. Because of insufficient data, the analysis options were also limited.

CONCLUSION

The pattern of Dengue Hemorrhagic Fever (DHF) in Kediri Regency in 2017 to 2021 before and after the COVID-19 pandemic conditions based on person revealed that male children age group–5-14 years were the most commonly infected cases, and the incidence rate (IR) of DHF in Kediri Regency has increased every year when the population density has also increased. Every year, the pattern of DHF incidents is based on higher rainfall; consequently, the number of incident DHF cases will also increase, and common cases occur almost in January.

CONFLICT OF INTEREST

There is no conflict of interest in this research.

AUTHOR CONTRIBUTION

FAF: Conceptualization, methodology, data visualization, analysis, writing–original draft, writing–review, and editing. EQ: Data Visualization, Analysis, Manuscript review and Proofreading, Final approval of this study. MAI: Final approval of this study. NMGN: Manuscript review and proofreading.

ACKNOWLEDGMENTS

Acknowledgements are extended to the Kediri Regency District Health Office and the Kediri Regency Central Statistics Agency for providing the data used in this study.

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