



(RESEARCH ARTICLE)



## Relationship between Larva Free Index (LFI) and healthy house with DHF incidence rate in Banyuwangi Regency, 2022

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### Abstract

Dengue hemorrhagic fever is one of society's most frequent health issues, causing various health issues. DHF is the most frequent infectious illness in Indonesia, with many cause variables, such as LFI and healthy households, influencing the frequency of DHF cases. This study was conducted to determine the relationship between the Larvae Free Index and healthy houses with the incidence rate of DHF in Banyuwangi Regency in 2022. This research is a cross-sectional study using secondary data obtained from relevant agencies. Variables included dengue incidence rate (DHF IR), Larvae Free Index (LFI), and healthy houses in Banyuwangi Regency in 2022. Data analysis was conducted using the Pearson Correlation Test to determine the relationship between variables. Mapping and descriptive analysis were also performed on the data to provide an overview of case conditions. The results showed that ABJ (p-value = 0.506) had no significant relationship with DHF IR. Similarly, healthy houses (p-value=0.992) also did not have a relationship with the DHF IR in the Banyuwangi regency in 2022. This condition may occur because there is a possibility that the variables studied do not directly affect the DHF IR, but there are also other variables that support it. Despite the lack of a significant association, it is vital to continue monitoring activities connected to LFI and healthy houses to enhance health status and DHF prevention in the community.

**Keywords:** Dengue; Larvae; Healthy Home; Vector Diseases

### 1. Introduction

Dengue hemorrhagic fever is one of society's most common health issues, causing various health issues. This occurrence might happen every year and impact people of all ages. According to Ministry of Health figures for 2020, there were 71,700 cases of Dengue Hemorrhagic Fever (DHF) in Indonesia as of July. West Java reported the most cases (10,772 cases), Bali 8,930 cases, East Java 5,948 cases, NTT 5,539 cases, Lampung 5,135 cases, DKI Jakarta 4,227 cases, NTB 3,796 cases, Central Java 2,846 cases, Yogyakarta 2,720 cases, and Riau 2,255 cases (1). In contrast, the number of cases in 2019 was higher at 112,954.

Furthermore, the total number of deaths in Indonesia has reached 459. However, the number of cases and fatalities this year is still lower than in 2019, with 459 compared to 751 in 2019 (1). The high number of dengue fever cases in Indonesia is attributable to a lack of community engagement in numerous activities and programs to eliminate dengue fever and many programs that are still not operating efficiently. As a result, to prevent dengue fever, health education relevant to this program must be generalized to the community.

Banyuwangi Regency, located in East Java Province, is one of the areas/cities in East Java that experiences DHF cases yearly. Based on data from the East Java Provincial Health Profile, DHF cases in Banyuwangi Regency increased from 2.11 to 13.77 cases per 100,000 population in 2018-2020 and decreased to 5.70 cases per 100,000 population in 2021

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(2–5). The number of cases will increase significantly in 2022, with 522 cases and an incidence of 30.14 cases per 100,000 population.

The dengue virus, transmitted by the *Aedes* mosquito (6). The Larva Free Index is an important metric in *Aedes* mosquito management because it indicates *Aedes* breeding locations in a given area. Several studies have looked at the association between the Larva Free Index and the occurrence of dengue hemorrhagic fever in healthy houses (7). Furthermore, the presence of containers or water reservoirs in the home environment enhances the density of *Aedes* mosquito larvae and raises the risk of infection with the dengue virus. As a result, a higher LFI indicates the presence of more breeding sites for *Aedes* mosquitoes, resulting in a denser mosquito population and a faster spread of dengue disease.

Furthermore, the vector entomology index of Dengue Fever is an important indication for determining the possibility of developing Dengue Fever cases each year. Ambient variables, including physical, chemical, and biological elements, can alter DHF transmission. Because mosquitoes are cold-blooded organisms that rely on temperature and the environment to carry out their metabolism, the physical environment directly impacts vector species composition, mosquito breeding habitat, population, lifespan, and transmission (7). Aside from that, the quality and cleanliness of the house or dwelling are other elements that influence mosquito breeding.

The prevalence of the problem requires attention, especially in terms of adopting healthy homes in the community to prevent an increase in dengue fever cases in Indonesia. The rise in dengue cases in Banyuwangi Regency in 2022 also requires immediate prevention so that dengue cases do not increase again next year. Therefore, this study was conducted to determine the relationship between the Larvae Free Index and healthy houses with the incidence rate of DHF in Banyuwangi Regency in 2022. It is hoped that the results of this study can be a reference for policymakers in making dengue prevention interventions.

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## 2. Material and methods

### 2.1. Research design and location

A cross-sectional approach was used in this study with descriptive analysis. The location of the study was in Banyuwangi Regency, which covers 25 districts. Banyuwangi Regency is located at the eastern end of Java Island in East Java Province, Indonesia. This location was selected based on Banyuwangi Regency being one of the DHF endemic areas and increasing cases in 2022. The population used is the entire population of Banyuwangi Regency in 2022. The sample in this study was obtained from data on the number of DHF patients in Banyuwangi Regency 2022 recorded at the Banyuwangi Regency Health Office.

### 2.2. Data source

The data on the variables used in this study are secondary. Data on DHF cases and the Larvae Free Index (LFI) came from the Disease Prevention and Control section of the Banyuwangi Regency Health Office. The same agency was also the source for healthy house data from the Environmental Health, Occupational Health and Sports section of the Banyuwangi Regency Health Office. Data from the Health Office was obtained after submitting a request and approval. Other supporting data is in the form of population data obtained from the Banyuwangi Regency Statistics Central Agency. This population data results from interim population projections for 2020-2023 (mid-year/June) and is used to calculate the dengue incidence rate. Population data were obtained in Banyuwangi Regency in Figures 2023 and published on the website of the Banyuwangi Regency Statistics Central Agency.

### 2.3. Research variables

The research variables consisted of two variables, namely the independent variable and the dependent variable. The dependent variable is the incidence rate of DHF in Banyuwangi Regency in 2022 per district. DHF incidence rate is DHF cases per district divided by the total population per district multiplied by 100,000 population. The independent variables in this study consisted of the Larvae Free Index (LFI) and healthy houses. Both are percentages for each district in Banyuwangi Regency in 2022. The LFI percentage is obtained from calculating houses or buildings free of larvae from the inspection results divided by the number of houses or buildings inspected. Healthy houses are the percentage of houses that meet health requirements to the total number of houses inspected.

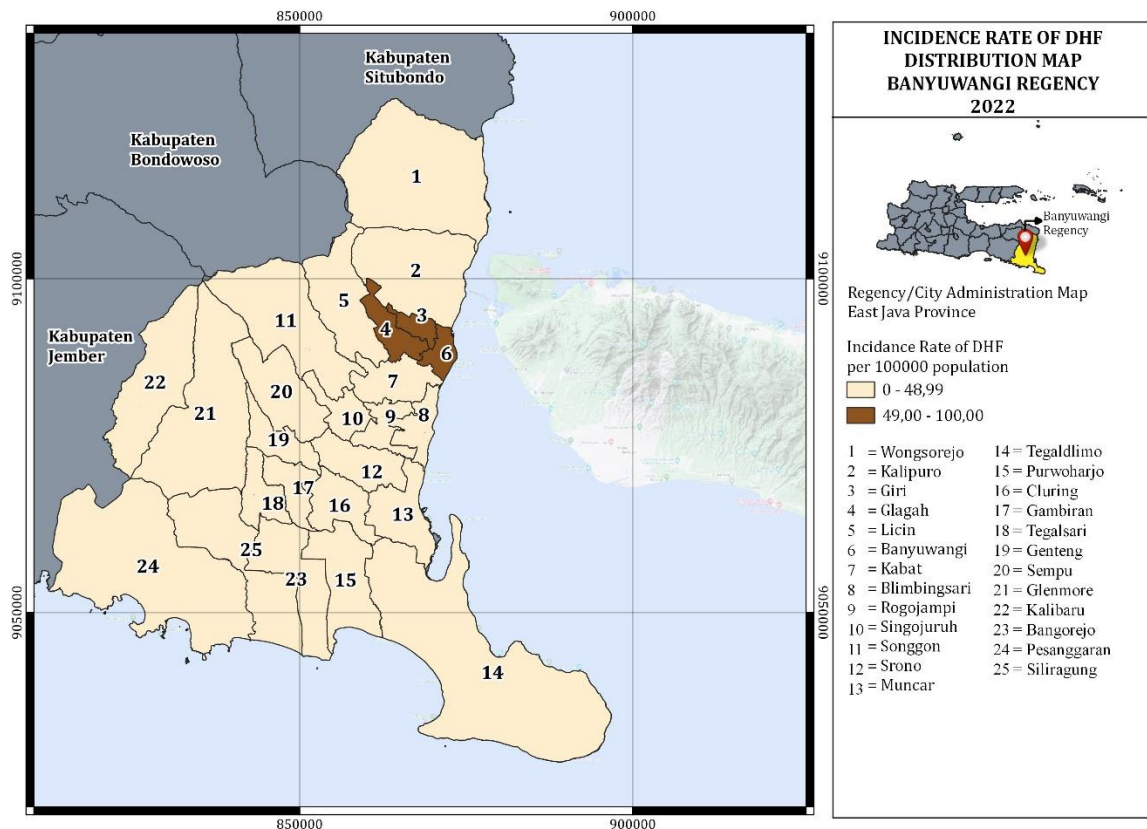
### 2.4. Data analysis

Data were analyzed univariate and bivariate. Univariate analysis was descriptive of each variable. Univariate analysis was conducted to obtain an overview of cases. A map of the distribution of DHF cases in Banyuwangi Regency was also created using QGIS 3.22.16 64-bit to provide an overview of the distribution of DHF cases. Bivariate analysis was conducted using the Pearson-Correlation test to determine the relationship between the independent and dependent variables studied. The analysis was conducted by first collecting and cleaning the data in Microsoft Excell. Statistical analysis was performed using SPSS 18.

## 3. Results and discussion

### 3.1. Overview of dengue incidence rate in Banyuwangi Regency in 2022

DHF cases are still found in Banyuwangi Regency every year. DHF IR cases are monitored using indicators set by the Ministry of Health of the Republic of Indonesia as a form of vigilance and early prevention of an increase in DHF cases. The DHF IR indicator target is listed in the Strategic Plan of the Health Ministry, which is <49 per 100000 population (8). An overview of the distribution of DHF cases in Banyuwangi Regency in 2022 based on these indicators can be seen in Figure 1. Based on this figure, most districts have met the DHF IR target of <49 per 100000 population. However, some districts still have a high DHF IR exceeding the indicator. These districts are Banyuwangi, Giri, and Glagah districts. The three districts are geographically close to each other. This condition can occur because DHF cases are contagious diseases, so areas close to each other can potentially have a similar magnitude of cases (9).



**Figure 1** Distribution map of DHF incidence rate

The DHF IR in Banyuwangi Regency is 99.78, found in Banyuwangi district. At the same time, the lowest DHF IR is 0.00 in the Kalibaru district. This figure can be seen in Table 1. Reviewing DHF cases in Banyuwangi Regency in the previous year, 2021, the highest DHF IR was found in the Giri district (25.13), and all districts had DHF IRs below the dengue indicator (49 per 100000 population) (10). This indicates an increase in DHF IR in Banyuwangi Regency.

**Table 1** Incidence Rate of DHF, LFI, and Healthy House in Banyuwangi Regency, 202

District Name	IR DHF	LFI (%)	HH (%)
Wongsorejo	28.18	90.00	83.92
Kalipuro	44.80	96.00	61.30
Giri	90.40	95.00	45.85
Glagah	56.83	91.00	69.45
Licin	23.53	88.00	69.48
Banyuwangi	99.78	89.67	79.92
Kabat	34.54	94.00	65.00
Blimbingsari	26.98	98.00	82.34
Rogojampi	47.84	95.50	77.29
Singojuruh	17.57		2.58
Songgon	13.78	99.00	22.18
Srono	31.52	95.33	79.14
Muncar	19.60	97.25	50.15
Tegaldlimo	16.27	91.50	54.63
Purwoharjo	38.44	91.50	73.63
Cluring	22.93	81.00	55.76
Gambiran	17.83	96.00	78.15
Tegalsari	9.39	96.00	86.27
Genteng	39.44	95.50	53.66
Sempu	20.07	97.33	62.76
Glenmore	5.24	95.50	78.82
Kalibaru	0.00	97.00	68.23
Bangorejo	6.00	86.00	72.08
Pesanggaran	3.70	98.50	83.77
Siliragung	18.24	92.00	80.00

Source: Banyuwangi Regency Health Office

### 3.2. Overview of LFI and healthy houses in Banyuwangi Regency in 2022

The LFI in Banyuwangi Regency in 2022 was highest at 99.00% and lowest at 81.00%, reviewed in Table 2. Table 1 shows that the Songgon district achieved the highest LFI in 2022. LFI data was unavailable in the Singojuruh district because there was no inspection. Referring to the national vector control quality standard, the LFI of the dengue control standard is 95% (11). Based on this indicator, in Banyuwangi Regency, districts still have not reached 95%. Ten districts like Banyuwangi and Licin have not reached this indicator.

The coverage of houses that meet health requirements in Banyuwangi Regency is highest at 86.27% and lowest at 2.58%. At Table 1, Tegalsari district has the highest percentage of healthy houses, and Singojuruh district has the opposite condition.

**Table 2** Descriptive Statistic of IR DHF, LFI, and Healthy Houses in Banyuwangi Regency, 2022

	N	Mean	Std. Deviation	Minimum	Maximum
IRDHF22	25	29.3169	24.45633	0.00	99.78
LFI22(%)	24	93.6076	4.36903	81.00	99.00
HH22(%)	25	65.4544	19.84592	2.58	86.27

Source: Output of SPSS 18 Analysis

### 3.3. Relationship between LFI and healthy houses with DHF incidence rate

The relationship between LFI and healthy houses with DHF incidence rate can be seen from the results of the Pearson Correlation Test in Table 3. Based on this table, LFI and healthy houses do not significantly affect the DHF IR in Banyuwangi Regency in 2022. LFI has a p-value of  $0.506 > 0.05$ , and healthy houses have a p-value of  $0.992 > 0.05$ .

**Table 3** Correlation-pearson results of Larvae Free Index, Healthy Houses, and Incidence Rate of DHF

		Incidence Rate of DHF	
Larvae Free Index	Pearson Correlation	-0.143	
	p-value	0.506	
	N	24	
Healthy Houses	Pearson Correlation	0.002	
	p-value	0.992	
	N	25	

Source: Output of SPSS 18 Analysis

Dengue fever is caused by the dengue virus transmitted through the *Aedes aegypti* mosquito. The presence of mosquito larvae is significant in dengue transmission. The larva-free rate (LFI) is one of the indicators set by the Ministry of Health of the Republic of Indonesia to determine a risk area of DHF. Areas with a low percentage of LFI have a high risk of DHF cases (12). However, the Pearson Correlation Test in this study showed that LFI was not significantly associated with the incidence rate of DHF.

This result aligns with research conducted in Blitar District using data from 2013-2017. The study showed the results of the Spearman Correlation Test that there was no significant relationship between LFI and DHF incidence rate (13). Research conducted on data from 2010-2014 in Makassar City also supports this result. Spearman correlation test showed no significant relationship between LFI and DHF incidence rate (14). This condition may occur due to other factors, such as the behaviour of mosquitoes with high mobility (12). Mosquitoes that have high mobility will easily bite and move around. Therefore, few mosquitoes can lead to high dengue cases in an area. Population density and housing environment can also encourage high dengue transmission. In addition, non-representative LFI results are possible because not all cadres assessing the presence of larvae in an area are active (15).

The presence of *Aedes aegypti* mosquitoes is also influenced by environmental hygiene and community behaviour. Lack of environmental hygiene and community behaviour leads to more breeding sites for the *Aedes aegypti* mosquito (16). Physical house conditions such as low lighting and high humidity affect the breeding of *Aedes aegypti* (17). Thus, it can be said that maintaining the cleanliness and health of the home environment is one of the efforts that can be made to prevent dengue transmission.

The Ministry of Health also assesses monitoring of the house condition through the healthy house assessment. Houses that meet the parameters of a healthy house are said to be suitable for habitation and can minimize the spread of disease. The parameters assessed include the house's physical condition, sanitation facilities, and occupant behaviour (18). A healthy house can affect the spread of DHF because the mosquito, as a vector of DHF, is an anthropophilic mosquito and experiences development in a residential environment (17). However, the Pearson Correlation Test results generated in this study showed that the percentage of healthy houses in an area does not significantly affect dengue cases.

Research conducted in the Jombang district with data from 2014-2018 supports these results. The absence of a relationship between healthy housing and DHF incidence rate was found in the spatial regression results with the Ordinary Least Square Test (19). The study also revealed no relationship between healthy houses and DHF incidence rate due to the possibility of less than optimal measurement of healthy house parameters such as lighting and humidity. The absence of a relationship between healthy housing and the DHF incidence rate may also be because some measured parameters do not directly affect the DHF incidence rate. For example, a study in Semarang City in 2017 showed that house humidity did not affect dengue cases (7). Research in the exact location and year also found no relationship between the number of residents in one house and DHF cases (20). This result can happen because housing density is not a causative factor of DHF but a risk factor along with other factors such as environmental sanitation.

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#### 4. Conclusion

According to the research, there is no significant association between LFI and healthy houses and DHF incidences. However, numerous preventative activities are still needed to prevent increased DHF cases in Indonesia. This research is anticipated to help readers raise awareness about DHF prevention efforts.

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#### Compliance with ethical standards

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##### *Disclosure of Conflict of interest*

The data used in this study have received permission to be used to publish scientific articles. This article has also never been issued by other publishers. So this article has no potential conflict of interest.

##### *Statement of ethical approval*

This research does not use humans or animals as research subjects. Secondary data was used as the unit to be analyzed in this study. The relevant agencies have authorized the data used. So this research allows no violation of ethical approval.

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