Sunan Kalijaga Journal of Applied Mathematics ISSN 1234-5678 (print)
October 2025, Vol. 3, No. 2, 42 – 50 ISSN 9876-5432 (online)

STATISTICAL ANALYSIS OF DENGUE FEVER CASES IN BALI PROVINCE IN 2024

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Abstract

Dengue Fever remains a significant public health problem in Bali Province, with cases distributed unevenly across regions. High population mobility, tropical environmental conditions, and community behavior factors contribute to the dynamics of disease transmission. Although case data is routinely available, systematic statistical analysis is needed to identify patterns of distribution and levels of disparity between districts/cities as a basis for evidence-based policy formulation. This study aims to analyze the distribution of DHF morbidity rates in Bali Province in 2024 using a descriptive quantitative approach. Secondary data were obtained from official publications of the Central Statistics Agency and analyzed through the calculation of measures of central tendency and dispersion, including the mean, maximum value, minimum value, and range. The results showed that the DHF morbidity rate in Bali Province in 2024 was 319.17 per 100,000 population with significant interregional variation. Gianyar Regency had the highest morbidity rate of 840.94 per 100,000 population, while Jembrana Regency had the lowest rate of 101.76 per 100,000 population. The range value of 739.18 indicates a considerable disparity in incidence between districts/cities. These findings underscore the importance of region-based dengue fever control strategies and the use of statistical analysis as a decision-making tool in planning.

Keywords: Bali Province; Dengue fever; Regional disparities; Public health; Descriptive statistics.

1. INTRODUCTION

Dengue Fever is one of the most significant public health challenges in tropical and subtropical regions around the world. This disease is caused by the dengue virus, which is transmitted through the bite of the Aedes aegypti and Aedes albopictus mosquitoes (Arsyad, 2020). “Dengue fever is an acute febrile illness caused by the dengue virus transmitted by mosquitoes (DENV), which consists of four serotypes (DENV 1 to 4), which are members of the flaviviridae family, genus flavivirus.” (Yudhastuti & Lusno, 2020). Indonesia, as an archipelagic country with a humid tropical climate, consistently reports a high number of DHF cases each year.

Dengue Fever is a major public health problem that causes extraordinary events in Indonesia. DHF is transmitted to humans through the bite of Aedes aegypti mosquitoes infected with the dengue virus. DBD can occur every year and can affect all age groups (Suwandi, 2017) in (Susilowati & Cahyati, 2023)

The burden of this disease not only affects the health sector, but also causes significant economic losses due to loss of productivity and high medical costs. In Bali Province, dengue fever is an endemic disease that shows fluctuations in the number of cases from year to year,

with several districts/cities recorded as having incidence rates that far exceed the national target (< 100 cases per 100,000 population) (Iskandar et al., 2022). Bali has even been among the top three provinces with the highest DHF morbidity rates in Indonesia in recent years, based on the provincial epidemiological health profile (Fitri, 2022).

The province of Bali had the highest prevalence of dengue fever in Indonesia in 2010. There were 12,490 recorded cases with a case fatality rate (CFR) of 0.28 and an incidence rate of 320.96 per 100,000 inhabitants of Bali. This figure is above the national average of 65.57 per 100,000 population (Bali Provincial Health Office, 2010). As a tourist destination, it is very important to maintain public health, because dengue fever is classified as a traveler disease that is also a global concern. Tourists visiting Bali need health insurance so that they are not at risk of contracting diseases that can endanger their health.

Denpasar City is one of the endemic areas in Bali Province. Based on a report from the Bali Provincial Health Office, in Denpasar City in 2007 there were 3,264 cases and 10 deaths (CFR: 0.31). In 2008, there were 2,709 cases and 14 deaths (CFR: 0.52), in 2009 there were 2,190 cases and 2 deaths (CFR: 0.09), and in 2010 there were 4,426 cases with 24 deaths (CFR: 0.54) and an incidence rate of 561.36 per 100,000 population (Denpasar City Health Office, 2011). Denpasar District is one of the areas with the highest number of DHF cases compared to other districts. In 2010, there were 1,562 cases in South Denpasar District, 1,331 cases in West Denpasar, 831 cases in North Denpasar, and 704 cases in East Denpasar (Dinkes Kota Denpasar, 2011).

Various efforts have been made to combat dengue fever, such as mosquito breeding site elimination (PSN), health education, and the use of insecticides through fumigation and abatement, but the results obtained are still less than optimal. The Denpasar area has a fairly dense population with high population mobility and a large number of migrants. The population of South Denpasar District is 186,330. Based on data from the Central Statistics Agency (Badan Pusat Statistika) in 2008, the population density of Denpasar City reached 5,085 people per km², while the population density in South Denpasar District was 3,727 people per km² with a total of 46,240 households (Badan Pusat Statistika, 2009). Population density and mosquito vector density greatly influence the spread of dengue fever (Nahla et al., 2009).

Information obtained by the community regarding handling, hazards, mosquito breeding sites, and dengue fever control will influence attitudes and actions in eradicating the disease (Flor et al., 2009). The larval index in Denpasar City in 2010 was 93.4%, still below the national standard of 95%. The incidence of dengue fever and the ecological conditions of the vector are closely related to human behavior. Therefore, evaluating the knowledge, attitudes, and actions of the community is very important to improve integrated vector control efforts (Degallier, 2000).

During the rainy season, many mosquito breeding sites are difficult to monitor, such as used cans, used tires, unused drums, tree holes, and others (WHO, 2009). The Balinese Hindu community also uses many open containers of holy water placed in temples, which have the potential to become mosquito breeding sites. The community's behavior in cleaning mosquito breeding sites is not yet carried out routinely, and there are still many containers that can hold water, especially during the rainy season. This condition increases the risk of dengue fever spreading in the community. Therefore, this study plays an important role in determining the role of knowledge, attitudes, and behaviors related to mosquito breeding site elimination (MBSE) in the occurrence of dengue infection in South Denpasar District.

The province of Bali is one of the regions in Indonesia that is prone to the spread of dengue fever. Based on the latest data from the BPS (2018), the dynamics of dengue fever cases in this region continue to show a pattern that requires serious attention until 2024. Spikes in cases often occur in line with extreme climate change and the full recovery of the tourism sector, which triggers a massive increase in population mobility. This high mobility has a direct impact

on the spread of the virus throughout the regencies and cities of Bali. On the other hand, intensive tourism activities can also affect environmental dynamics, such as increased waste production and spatial changes, which can indirectly create new habitats for mosquitoes. Population density in economic centers creates major challenges in efforts to control mosquito vectors effectively and evenly.

Statistical data from 2019 to 2024 shows that the distribution of cases is not evenly spread across the nine districts and cities in Bali. Areas such as Denpasar and Bandung Regency consistently record a much higher case load than other areas. This indicates a strong correlation between human activity, population density, and urbanization characteristics and the rate of dengue virus transmission. On the other hand, several regions with different geographical characteristics show stable trends, but monitoring is still needed to prevent unexpected outbreaks in the future.

Based on public health reports, dengue fever cases in Bali show fluctuating trends from year to year. An increase in cases generally occurs during the rainy season when there are many puddles of water that become breeding grounds for mosquito vectors. This seasonal pattern shows that environmental factors play an important role in determining the incidence of dengue fever. High rainfall, temperature, and humidity have been shown to contribute to an increase in the mosquito population and accelerate the dengue virus transmission cycle (Yudhastuti et al., 2022). Thus, the dynamics of Bali's tropical environment and climate are important determinants in the pattern of disease spread.

In addition to environmental factors, community behavior also plays a role in increasing the risk of transmission. The habit of leaving standing water, poor waste management, and low consistency in implementing clean and healthy living behaviors can increase the potential for mosquito breeding. These conditions cause dengue fever to remain endemic in various regions of Indonesia, including Bali (Fitri, 2022).

Health data analysis serves not only as statistical documentation, but also as a basis for formulating policies and prevention programs. Through systematic data processing, the government and health workers can identify areas with high risk levels and determine intervention priorities. Epidemiological data can also be used to evaluate the effectiveness of control programs that have been implemented, such as mosquito breeding site eradication (PSN) and the 3M Plus campaign. In this context, the morbidity rate per 100,000 population is an important indicator for describing the burden of disease and objectively comparing incidence rates between regions (Badan Pusat Statistik Provinsi Bali, 2024).

In addition to epidemiological and environmental aspects, improving public health literacy also plays an important role in dengue prevention efforts. Higher education institutions have a strategic contribution to make in building data-based awareness through educational activities and community service. Students, particularly those in the fields of education and health, serve as agents of change who can bridge the gap in conveying scientific information to the public in a more systematic and evidence-based manner. Therefore, understanding current epidemiological data is essential to ensure that the education provided is accurate and contextual.

Based on this description, this study was conducted to analyze dengue fever case data in Bali Province in 2024. A review based on official data from the Central Statistics Agency is crucial to understanding the latest epidemiological characteristics so that anticipatory measures can be designed more precisely. Statistical analysis plays a role in transforming raw data into information that can be acted upon by policy makers. Without proper descriptive analysis, it would be impossible to comprehensively identify areas with high vulnerability in Bali Province in 2024. The use of statistical methods allows for an objective comparison of incidence rates between regions and provides a more structured overview of case distribution patterns.

The purpose of this study is to conduct a statistical analysis of the distribution of dengue fever cases in Bali Province in 2024 to map the variations and characteristics of the affected areas as a basis for formulating more targeted disease control policies.

2. MATERIALS AND METHODS

2.1. Study Area

This study was conducted in Bali Province, Indonesia, which is astronomically located at 8°03'40"-8°50'48" South Latitude and 114°25'53"-115°42'40" East Longitude. The study area covers nine districts and cities, including Jembrana, Tabanan, Badung, Gianyar, Klungkung, Bangli, Karangasem, Buleleng, and Denpasar City. This location was chosen based on Bali's characteristics as a tourism center with high population density and mobility, which influence the dynamics of infectious disease transmission. In accordance with the manuscript requirements, a map of the study location is included as a visual aid for statistical data distribution.

The data used is secondary data sourced from the Bali Provincial Statistics Agency through the statistical table "Number of Disease Cases by Regency/City in Bali Province 2019-2024" (Badan Pusat Statistik Provinsi Bali 2024). The focus of this study is the incidence rate of dengue fever per 100,000 population in 2024.

2.2. Procedures

This study was conducted through several systematic steps to ensure accurate and consistent results. First, the researchers collected secondary data relevant to the research topic. The data was then examined and processed in preparation for analysis. Quantitative descriptive analysis was used to clearly illustrate the data. Finally, the results were explained based on the basic principles of health statistics data processing.

2.3. Data Collection

In the data collection stage, this study used secondary data obtained from the official report of the BPS in 2024. The data collected included the number of dengue fever cases in each district/city in Bali Province and the population in the same year. The population data was used to calculate the incidence rate in each administrative area. Secondary data was chosen because it came from an official government agency, meaning it had undergone a verification process and was reliable. In addition, the use of BPS data helped to keep the research results objective and enabled comparison with other studies in the future. The DHF incidence rate per 100,000 population in 2024. In aggregate, the incidence rate of dengue fever in Bali Province in 2024 is 319.17 per 100,000 population (Badan Pusat Statistik Provinsi Bali 2024).

Table 1. Incidence of Dengue Fever per 100,000 Population in Bali Province in 2024

No.	District	Number of Cases
1	Jembrana	101,76
2	Tabanan	333,48
3	Badung	329,94
4	Gianyar	840,94
5	Klungkung	593,33
6	Bangli	531,68
7	Karangasem	205,16
8	Buleleng	232,82
9	Denpasar	126,01

Source: Badan Pusat Statistik (2024)

2.4. Data Processing

The raw data obtained was then tabulated using PC-based Microsoft Word software in accordance with the table format in the research manuscript. All data was arranged in the form of distribution tables based on administrative districts/cities. Fractions in the calculations were expressed as decimals to facilitate statistical interpretation. Next, the incidence rate was calculated by comparing the number of dengue cases to the population in each region. The results of the calculation were then used to identify differences in case loads between regions and to observe the spatial distribution pattern of dengue in Bali Province in 2024. The data was compiled in distribution tables and analyzed using descriptive statistics to obtain the mean, maximum value, minimum value, and range.

2.5. Data Analysis

Data analysis was performed using descriptive and comparative statistical methods. Descriptive analysis was used to describe the distribution of dengue cases in each district/city in the form of tables and percentages. Comparative analysis was performed to compare the case load between regions in order to identify areas with the highest incidence rates. The stages of analysis included: (1) calculating the percentage contribution of cases in each district/city to the total number of cases in Bali Province, (2) comparing morbidity rates between regions to see differences in risk levels, and (3) analyzing data distribution patterns in 2024 to identify certain trends or anomalies in the distribution of dengue fever cases.

Data analysis was performed using quantitative descriptive statistics. The average was calculated using the formula:

$$\bar{x} = \frac{\sum x_i}{n}$$

$\bar{x}$ = average dengue fever morbidity rate
x_i = dengue fever morbidity rate in each district/city
n = number of districts/cities (9 regions)

In addition, the range is calculated using the formula:

$$\text{Range} = X_{max} - X_{min}$$

This analysis aims to determine the level of variation in the distribution of dengue fever cases between regions in Bali Province.

3. RESULTS AND DISCUSSION

3.1. Distribution of Dengue Fever Cases in 2024

Based on data from the BPS (2024), the incidence of dengue fever in Bali Province in 2024 shows significant variation between districts/cities. The region with the highest incidence rate is Gianyar at 840.94 per 100,000 population, while the region with the lowest incidence rate is Jembarana at 101.76 per 100,000 population.

The data range is: 840.94 – 101.76 = 739.18

This shows a significant disparity in the incidence of dengue fever between regions in Bali Province.

Table 2. Incidence of Dengue Fever per 100,000 Population in Bali Province in 2024

No.	District	Number of Cases
1	Jembrana	101,76
2	Tabanan	333,48
3	Badung	329,94
4	Gianyar	840,94
5	Klungkung	593,33

No.	District	Number of Cases
6	Bangli	531,68
7	Karangasem	205,16
8	Buleleng	232,82
9	Denpasar	126,01

Source: Badan Pusat Statistik (2024)

Based on Table 2, the distribution of dengue fever cases in each district/city in Bali Province in 2024 can be seen. To clarify the pattern of comparison between regions visually, the data is then presented in graph form in Figure 2.

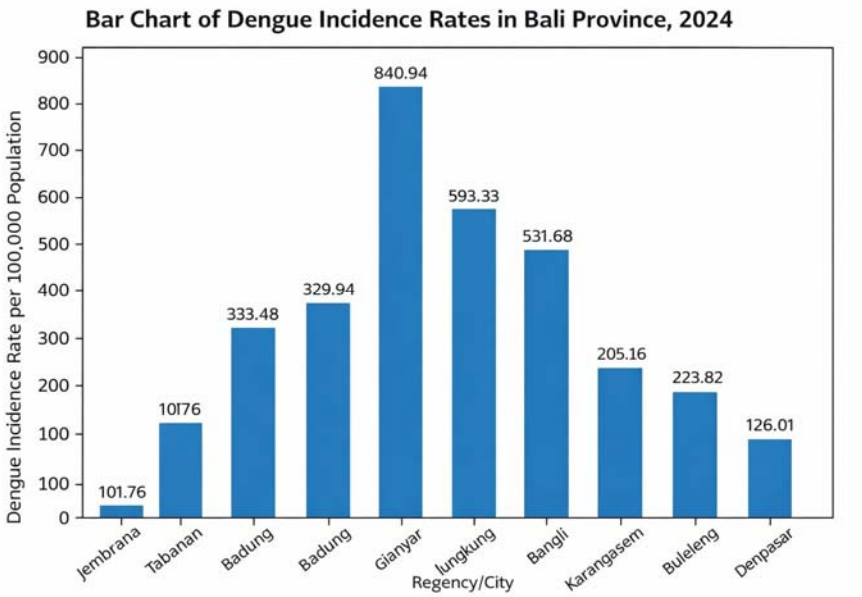

Figure 2. Distribution of Dengue Fever Incidence Rates per 100,000 Population in Bali Province 2024

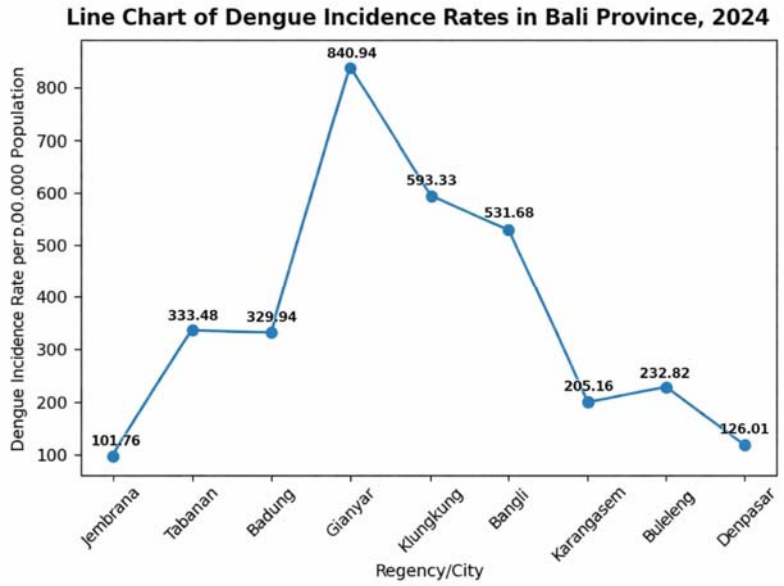

Figure 3. Distribution of Dengue Fever Incidence Rates per 100,000 Population in Bali Province 2024

Figures 2 and 3 show the distribution of dengue fever cases per 100,000 population in Bali Province in 2024. There are significant differences between districts/cities. Gianyar District has the highest morbidity rate (840.94), far exceeding other regions. Meanwhile, Jembrana District (101.76) and Denpasar City (126.01) show relatively low morbidity rates compared to other regions.

The Klungkung (593.33) and Bangli (531.68) regions are also in the high category, while Tabanan (333.48) and Badung (329.94) are in the medium category. Karangasem (205.16) and Buleleng (232.82) are in the lower-middle category.

This significant difference indicates variations in risk factors between regions, such as environmental conditions, population density, and the effectiveness of dengue control programs. The high rate in Gianyar suggests the possibility of certain environmental factors or population density increasing the risk of transmission. The large disparities between regions underscore the importance of area-based interventions.

3.2. Descriptive Statistical Analysis

The results of descriptive statistics show that the simple average of dengue fever morbidity rates in districts/cities is 365.01 per 100,000 population. The maximum value of 840.94 was found in Gianyar District, while the minimum value of 101.76 was found in Jembrana District. The distribution range of 739.18 indicates high variation between regions.

The simple average for regencies/cities (365.01) is higher than the provincial figure (319.17). This difference indicates that the provincial figure has taken into account weighting based on the population of each region. The regencies of Gianyar, Klungkung, and Bangli have morbidity rates above the provincial average, while Jembrana and Denpasar are below the provincial average.

3.3. Discussion

The simple average for regencies/cities (365.01) is higher than the provincial figure (319.17). This difference indicates that the provincial figure has taken into account weighting based on the population of each region. The regencies of Gianyar, Klungkung, and Bangli have morbidity rates above the provincial average, while Jembrana and Denpasar are below the provincial average.

The high incidence of illness in Gianyar Regency indicates the need to evaluate and strengthen dengue fever prevention and control programs, including mosquito breeding site eradication, regular larval monitoring, and public education on clean and healthy living practices.

The large disparities between regions indicate that dengue fever control policies need to be tailored to the local characteristics of each region. A region-based intervention approach is important to reduce morbidity more effectively.

4. THE PHILOSOPHICAL BATIK MOTIF

Figure 4 is the philosophical batik:

a. Risk Fluctuations: The ups and downs of the graph reflect the dynamics of dengue fever spread in each district/city in Bali in 2024.
b. Epidemiological Inequality: Differences in values, such as the highest peak in Gianyar (840.94) and the lowest in Jembrana (101.76), indicate that the disease burden is uneven across regions.
c. Reflection and Regional Interconnection: The process of mirroring the graph into a batik motif symbolizes that each region reflects the conditions of the others. Disease spread does not occur in isolation but is interconnected within a single system.

d. Symmetry as a Symbol of Balance: The mirrored result forms a symmetrical pattern that represents efforts to create balance in the public health system.
e. Collective Harmony, The average value of 319.17 symbolizes a common point of balance, that Bali's health conditions are the result of contributions from all regions.
f. Solidarity and Joint Control, The batik motif shows that controlling dengue requires collective cooperation and integrated intervention between regions.

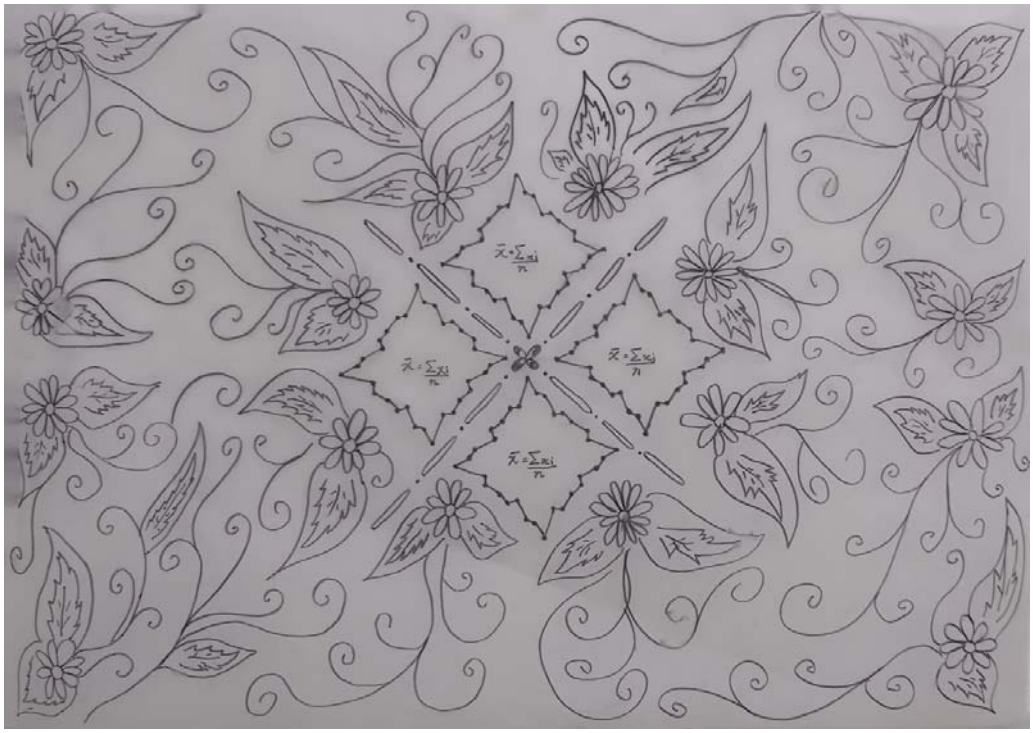

Figure 4. Batik Philosophy in Dengue Fever Modeling

Mathematically, batik motifs derived from line graphs reflect the concepts of data fluctuation, symmetry, geometric transformation, and statistical variation in the analysis of dengue fever cases in Bali Province in 2024. Medically, these motifs symbolize the dynamics of dengue fever spread, epidemiological factors that influence the increase in cases, and the importance of vigilance and public health interventions.

5. CONCLUSION

Based on descriptive statistical analysis of data from the BPS in 2024, the incidence of dengue fever in Bali Province was 319.17 per 100,000 population, with considerable variation between districts/cities. Gianyar Regency had the highest incidence, while Jembrana Regency had the lowest. Significant disparities between regions indicate the need for dengue fever control strategies that are more focused on areas with high incidence rates, as well as the strengthening of statistics-based health policies in regional health development planning.

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