ISSN. 2338-7475
E-ISSN. 2620-7869
Hearty
Jurnal Kesehatan Masyarakat
Beriman, Tulus, Sepenuh Hati,Berbesar Hati, Jujur, Sehat dan Kuat
Vol. 14 No. 2, April 2026, Hal. 368-372

SPATIAL ANALYSIS OF DENGUE HEMORRHAGIC FEVER CASES IN RELATION TO POPULATION DENSITY IN BANDAR LAMPUNG CITY

Kurnia Ramayudha *, Agung Aji Perdana, Nurhalina Sari, Dina Dwi Nuryani
Faculty of Health Sciences, Universitas Malahayati
Jl. Pramuka No.27, Kemiling Permai, Kec. Kemiling, 35152, Bandar Lampung City, Indonesia
Email: *yudharama29_@gmail.com*

Abstract

Dengue Hemorrhagic Fever (DHF) remains a significant public health burden in Indonesia, particularly in densely populated urban areas. Bandar Lampung City is classified as an endemic region, with fluctuating case numbers each year. This study aims to analyze the relationship between population density and the distribution of DHF cases using a spatial analysis approach. A cross-sectional ecological design was employed. Secondary data were obtained from the Lampung Provincial Health Office regarding DHF cases and from the Central Bureau of Statistics regarding population density. The analysis involved Pearson's correlation test to examine the association between population density and case numbers, as well as spatial mapping using QGIS 3.4.11 to illustrate distribution patterns. The findings revealed that DHF cases occurred not only in highly populated areas but also in subdistricts with moderate population density, particularly where the larva-free index (LFI) was low. Correlation tests demonstrated a significant negative relationship in 2022 ($r = –0.341$; $p = 0.049$) and 2023 ($r = –0.327$; $p = 0.043$), while the result for 2021 was not statistically significant ($r = –0.276$; $p = 0.061$). This study concludes that population density is not the primary determinant of DHF incidence. Environmental conditions, sanitation, and community behavior appear to play a more substantial role in disease transmission within Bandar Lampung City.

Keywords: Dengue Hemorrhagic Fever, Population Density, Spatial, QGIS

Introduction

Dengue Hemorrhagic Fever (DHF) is an infectious disease that continues to pose a public health threat, particularly in tropical regions with high population density. Global data indicate a significant upward trend, with more than 14 million cases and over ten thousand deaths reported worldwide in 2024. Indonesia is among the countries with a substantial disease burden, and Lampung Province is identified as an endemic area.

Bandar Lampung City holds a critical position due to its relatively high incidence of cases compared to other regions in the province. Its geographical characteristics and increasing population density heighten the risk of transmission, particularly in areas where the larva-free index (LFI) remains below the national target. Previous studies have identified a strong association between population density and the distribution of dengue cases; however, spatially based investigations at the local level, especially in Bandar Lampung City, remain limited.

Based on these considerations, this study was conducted to analyze the spatial distribution of dengue cases in relation to population density in Bandar Lampung City in 2024. The findings are expected to provide scientific evidence to support the development of more targeted vector control programs, particularly in densely populated areas.

Submitted: September-2025 Received: February-2026 Available Online: April-2026

Methods

This study employed a cross-sectional design with a spatial ecological approach. The research was conducted in Bandar Lampung City, with data collection carried out from February to June 2025. All data were obtained from secondary sources, consisting of dengue case reports from the Lampung Provincial Health Office and population density data from the Central Bureau of Statistics.

The unit of analysis in this study was the subdistricts within Bandar Lampung City. The independent variable was population density, while the dependent variable was the number of dengue cases. Descriptive analysis was performed to illustrate the distribution of cases, followed by Pearson's correlation test to examine the relationship between population density and dengue incidence. In addition, spatial analysis was conducted using QGIS version 3.4.11 to map the distribution patterns of cases in relation to variations in population density.

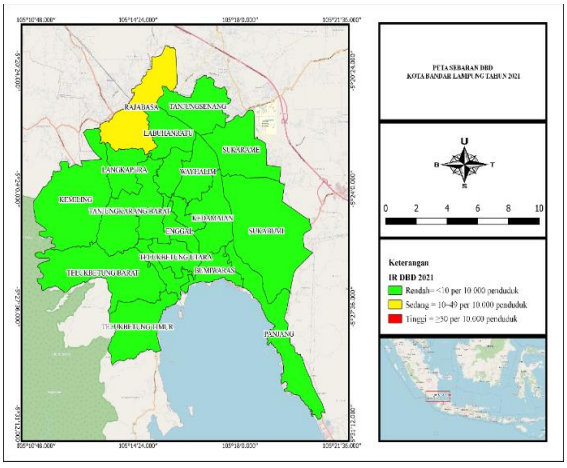
Results

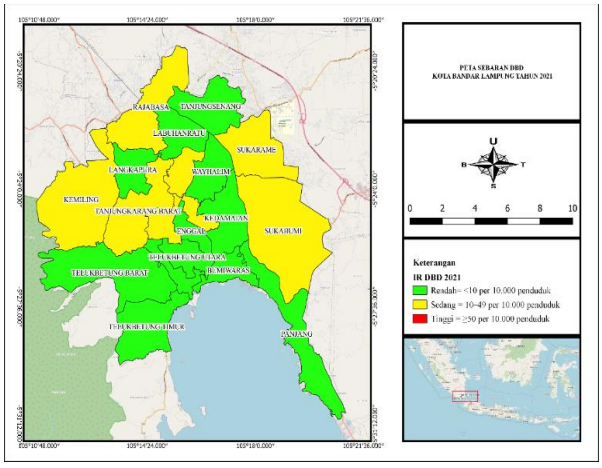
Based on data from the Lampung Provincial Health Office and the Central Bureau of Statistics, the population of Bandar Lampung City increased from 2021 to 2023, with an average population density exceeding 9,800 inhabitants per km². During the same period, dengue cases exhibited a fluctuating trend, with the highest incidence recorded in 2022.

Table 1. Distribution of Population Density and Dengue Cases in Bandar Lampung City (2021–2023)

Year	Total Population	Population Density (inhabitants/km²)	Dengue Cases	Incidence Rate per 100,000 Population
2021	1.051.500	9.870	412	39,2
2022	1.078.200	10.104	527	48,8
2023	1.102.800	10.326	501	45,4

Spatial mapping using QGIS demonstrated that dengue cases were not always concentrated in areas with the highest population density. Several clusters were instead identified in subdistricts with moderate density but low larva-free index (LFI) values.





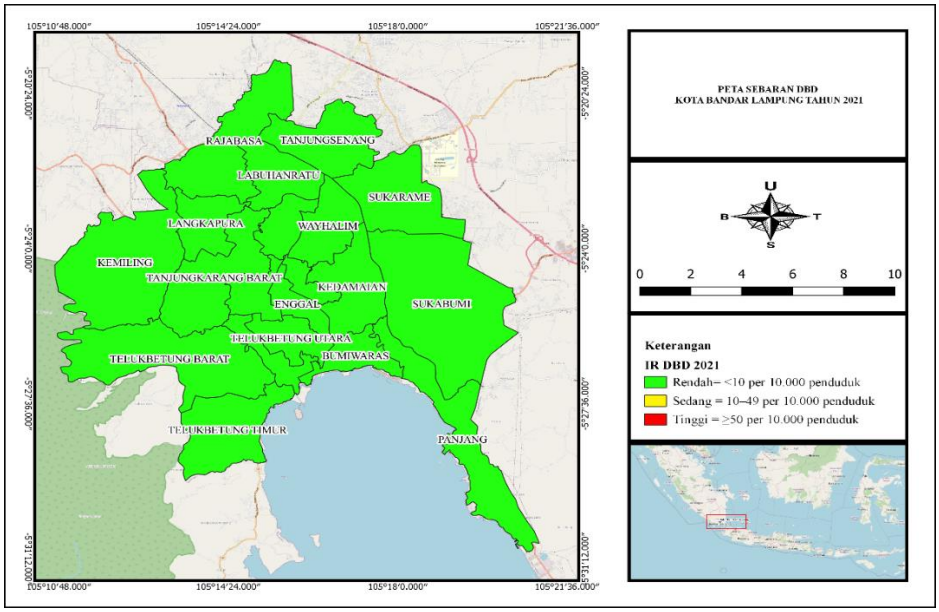


Figure 1. Spatial Distribution Map of Dengue Cases in Bandar Lampung City, 2021–2023

The results of Pearson's correlation test between population density and the number of dengue cases over the three-year observation period are presented in Table 2.

Table 2. Pearson's Correlation Test of Population Density and Dengue Incidence

Year	r (Correlation Coefficient)	p-value	Description
2021	–0,276	0,061	Inverse correlation, not significant
2022	–0,341	0,049	inverse correlation
2023	–0,327	0,043	inverse correlation

Based on the results of the correlation test, the relationship between population density and dengue incidence tended to be negative across the three years of observation. Statistical significance was observed in 2022 and 2023 ($p < 0.05$), indicating that higher population density was not necessarily associated with an increase in dengue cases. This condition suggests that other factors, such as the larva-free index, sanitation quality, and community behavior in mosquito breeding site eradication, play a more substantial role in influencing case distribution.

Discussion

This study demonstrates that population density is not always directly proportional to the number of dengue cases. The results of Pearson's correlation test revealed a negative relationship between population density and dengue incidence across the three years of observation, with statistical significance in 2022 and 2023. This indicates that highly populated areas do not necessarily experience an increase in cases, whereas moderately populated areas may, in fact, record higher case numbers.

These findings differ from several previous studies. Kusuma and Sukendra (2016) as well as Masrizal and Sari (2016) reported that population density was positively correlated with higher dengue incidence, particularly in densely populated and slum areas. They argued that the denser the area, the

greater the likelihood of human interaction with the Aedes aegypti vector, thereby increasing the risk of transmission.

However, the findings of this study suggest the opposite. Environmental factors and community behavior appear to play a more dominant role than population density alone. Subdistricts with a low larva-free index (LFI) exhibited higher incidence rates despite having only moderate population density. This is consistent with the studies of Meliyana et al. (2024) and Pandora (2023), which emphasized that entomological indicators, such as the Container Index and LFI, are critical determinants of dengue incidence.

In addition to vector-related factors, climatic conditions such as rainfall and humidity also play a significant role. Areas with abundant breeding sites, poor drainage systems, and community practices that do not support mosquito control remain at high risk, even when population density is not elevated. Thus, population density should not be considered a standalone determinant but rather evaluated in conjunction with environmental conditions and community behavior.

These findings carry important implications for dengue control programs. Interventions should not be limited to densely populated areas but must also target regions with environmental conditions conducive to vector breeding, particularly where the larva-free index (LFI) falls below the national standard.

Conclusion

This study demonstrates that the distribution of dengue cases in Bandar Lampung City during the 2021–2023 period was not entirely influenced by population density. Spatial analysis revealed that case clusters also emerged in moderately populated areas, particularly in subdistricts with a low larva-free index (LFI).

The results of Pearson's correlation test indicated a negative relationship between population density and dengue incidence. This relationship was statistically significant in 2022 and 2023, while in 2021 it remained negative but was not significant. These findings highlight that environmental factors, sanitation, and community behavior in mosquito breeding site eradication play a more decisive role in determining dengue incidence than population density alone.

Dengue control efforts in Bandar Lampung City should be directed toward improving the larva-free index (LFI), enhancing environmental sanitation, and strengthening community engagement in sustainable mosquito breeding site eradication activities.

References

Astuti, E. P., Ipa, M., Wahono, T., Prasetyowati, H., Fuadzy, H., Widawati, M., Hendri, J., Ruliansyah, A., Fuadiyah, M. ezza A., Pradani, F. Y., Nurindra, R. W., & Yuliasih, Y. (2019). Dengue Update Menilik Perjalanan Dengue di Jawa Barat (A. Suwandono (ed.)).https://repository.badankebijakan.kemkes.go.id/id/eprint/3832/1/Dengue Update_Menilik Perjalanan Dengue di Jawa Barat.pdf

Kusuma R, Sukendra DM. Hubungan kepadatan penduduk dengan kejadian Demam Berdarah Dengue di Kota Semarang. Media Kesehatan Masyarakat Indonesia. 2016;15(1):23–31.

Masrizal, Sari RP. Faktor-faktor yang berhubungan dengan kejadian DBD di wilayah perkotaan. Jurnal Kesehatan Masyarakat. 2016;10(2):112–9.

Meliyana D, Pratama A, Lestari F. Hubungan Container Index dengan kejadian Demam Berdarah Dengue di Kota Bandar Lampung. Jurnal Epidemiologi Kesehatan Indonesia. 2024;8(1):55–64.

Pandora P. Analisis spasial angka bebas jentik dan kasus DBD di Provinsi Lampung. Jurnal Kesehatan Lingkungan Indonesia. 2023;22(3):201–10.

World Health Organization. Dengue and severe dengue. Geneva: WHO; 2024.
Kementerian Kesehatan RI. Profil kesehatan Indonesia tahun 2023. Jakarta: Kemenkes RI; 2024.
Dinas Kesehatan Provinsi Lampung. Laporan kasus Demam Berdarah Dengue Kota Bandar Lampung 2021–2023. Bandar Lampung: Dinkes Provinsi Lampung; 2024.
Badan Pusat Statistik Kota Bandar Lampung. Kota Bandar Lampung dalam angka 2023. Bandar Lampung: BPS; 2023
Marlena, Rinidar, Rusdi, M., Farida, Ferasyi, T. R., & Nurlina. (2020). Hubungan Kepadatan Permukiman Dengan Luas Permukiman Terhadap Sebaran Demam Berdarah Dengue. Jurnal Sain Veteriner, 38(2), 112. https://doi.org/10.22146/jsv.47774