

HASIL

CEK_Sulistyawati1432023AJRID

107595

by Universitas Ahmad Dahlan Yogyakarta 40

Submission date: 16-Oct-2023 04:52PM (UTC+0700)

Submission ID: 2195220403

File name: Sulistyawati1432023AJRID107595_1.pdf (480.24K)

Word count: 3219

Character count: 18185



6
Spatial Analysis of DHF Cases in Yogyakarta City Based on Population Density and Altitude (2017-2018)

Ayu Elma Sandi^a, Ajeng Rahastri^a and Sulistyawati Sulistyawati^{a*}

16 3
^a Faculty of Public Health, Universitas Ahmad Dahlan, Yogyakarta, Indonesia.

Authors' contributions

This work was carried out in collaboration among all authors. Author AES contributed to the study design, data collection, and writing first draft of the article. Author AR contributed to the writing and reviewing the draft. Authors SS and AE³ contributed to the study design and reviewing the article. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRID/2023/v14i3299

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/107595>

Original Research Article

Received: 04/08/2023

Accepted: 09/10/2023

Published: 14/10/2023

ABSTRACT

Aims: This study aims to determine the relationship between population density and altitude of the territory and DHF incidence in Yogyakarta City 2017-2018.

Study Design: The study was designed as an observational cross-sectional study.

Place and Duration of Study: This study was conducted in Yogyakarta from 2017 to 2018.

Methodology: This quantitative study employs an analytic observational cross-sectional design. Moran's I and LISA tests were used to analyze the data.

Results: Based on bivariate Moran's Scatterplot analysis, the density of residents with dengue incidence showed negative spatial autocorrelation ($I=-0.308$), and the altitude with dengue incidence showed negative spatial autocorrelation ($I=-0.128$), indicating that the majority of the sub-district was scattered in quadrants II and IV. The LISA density bivariate test results on residents with dengue incidence revealed that the Gondomanan Sub-district has positive autocorrelation ($I=$

14
*Corresponding author: E-mail: sulistyawati.suyanto@ikm.uad.ac.id;

0.30) with a Low-Low quadrant and statistical significance (P-Value=0.040.05). In contrast, Kotagede Sub-district has negative autocorrelation ($li=-2.31$) with a Low-High quadrant and statistical significance (P-Value=0.000.05). Gondomanan Sub-District has positive autocorrelation ($li=0.67$) at the Low-Low quadrant and statistical significance (P-Value=0.03 0.05), whereas Kotagede Sub-District has negative autocorrelation ($li=-2.86$) at the Low-High quadrant and statistical significance (P-Value=0.000.05).

Conclusion: Density residents have a negative autocorrelation with the incidence of DHF in Yogyakarta City. Local spatial density residents with DHF cases were found in the Gondomanan Sub-District with positive spatial autocorrelation. At the same time, Kotagede Sub-District had negative spatial autocorrelation in contrast to an altitude with a global spatial connection toward DHF incidence in Yogyakarta with negative autocorrelation.

Keywords: Population density; altitude; DHF Incidence; Yogyakarta.

1. INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is an issue spreading throughout Indonesia's provinces. Incidence rate (IR) DHF in Indonesia in 2015 was 50.75 per 100 people, growing to 78.85 per 100 in 2016. The experience fell to 26.10 per 100,000 people in 2017 before declining to 24.75 per 100,000 in 2018 [1]. Yogyakarta Province has an incidence rate (IR) of 43.65 per 100,000 people, which is higher than the national average of 26.12 per 100,000 people, according to the Indonesia Data and Information Center's 2017 report on the situation in Indonesia [2]. Incidence rate (IR) DHF in the Yogyakarta Special Region (DIY) in 2017 was 81.36 per 100,000 population [3].

Yogyakarta City is becoming a DHF-endemic location, according to DHF data from 2018, even though there were 414 cases and two fatalities in 2017 and 113 cases and two deaths in 2018. However, the incidence rate (IR) of DHF increased from the previous year; in 2018, it was 27 per 100,000 people, up from 10 per 100,000 people in 2017. Additionally, rising the prior year, the DHF Case Fatality Rate (CFR) was 1.8 percent in 2018 compared to 0.5 percent in 2017 [4]. Dengue transmission in a crowded place spreads more rapidly because of the density of residents, the higher risk of transmission caused by dengue fever, and the distance between 50-100 meters. Residents' density is divided into three categories: low (1000 people/km²), moderate (1,000–2,000 people/km²), and high (>2000 inhabitants/km²) [5]. Yogyakarta City has a population density of (14,350 people/km²), which is a possible danger for dengue illness transmission.

Aedes aegypti mosquito may live at a height of 100 meters above sea level. *Aedes Aegypti*'s

deployment is constrained to 1000–1500 meters above sea level in Southeast Asia [6]. Given that Yogyakarta City is generally 128.5 meters above sea level, it follows that there is a chance that dengue cases could spread there. This study aims to comprehend the relationship between population density and altitude of the area where dengue hemorrhagic fever (DHF) incidents occur in the City of Yogyakarta.

2. METHODOLOGY

This quantitative study uses an analytic observational and *cross-sectional* design in which every object is observed once at a particular time [7]. The Yogyakarta City Health Profile for 2018–2019, Yogyakarta City in Figures for 2018–2019, and regional elevation data based on the City of Yogyakarta in Figures for 2020 were utilized to generate the study's data. This study uses both spatial univariate and spatial bivariate data analysis. Total sampling was used as the retrieval technique sample in this study. Total sampling is a measurement method in which the entire population is used as a sample [8]. People being studied The Yogyakarta City Health Profile 2018-2019 contains data on all DHF cases in the locality from 2017 to 2018.

3. RESULTS AND DISCUSSION

3.1 Univariate Spatial Analysis

The fourth quantile (highest) incident of dengue hemorrhagic fever extended in the Gondokusuman and Umbulharjo subdistricts. In contrast, the Pakualaman and Danurejan Sub-District experienced the lowest dengue incidence rates (Fig. 1).

The Ngampilan, Gedongtengen, and Danurejan Sub-District have the most prominent density residents (4th quantile). As opposed to this, the

Umbulharjo, Gondokusuman, and Kotagede Sub-District had the highest density of residents in the first quantile (lowest) (Fig. 2).

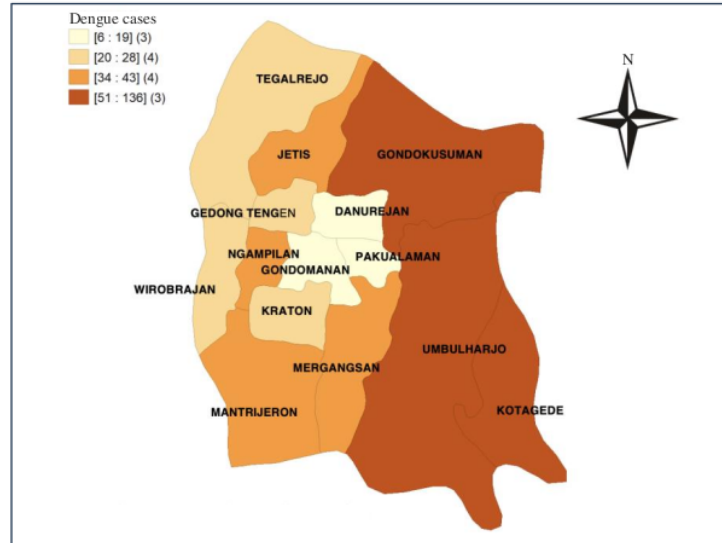


Fig. 1. Distribution of dengue Hemorrhagic fever in Yogyakarta City

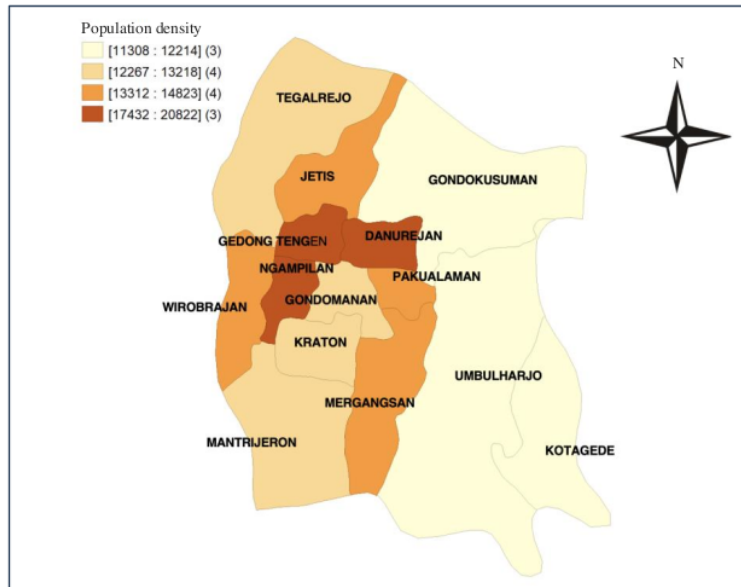


Fig. 2. Distribution of population density in the Yogyakarta City

The highest altitude area covered the Danurejan, Gedongtengen, and Pakualaman Sub-District. In contrast, the Gondomanan and Kotagede Sub-District was the altitude area with the first quantile's (lowest) distribution (Fig. 3).

3.2 Bivariate Spatial Analysis

According to the findings of the bivariate test, the Moran's Scatterplot between altitude and population density has a negative spatial autocorrelation or is inversely proportional to the incidence of dengue fever (Moran's $I = -0.128$) and (Moran's $I = -0.308$) for altitude and population density respectively (Figs. 4 and 5).

Based on the LISA bivariate test between density residents with incident dengue hemorrhagic fever showed that Gondomanan and Kotagede Sub-District own ($P\text{-Value} \leq 0.05$), thus H_0 is rejected, which means significant or has spatial autocorrelation, the Gondomanan Sub-District showed positive autocorrelation ($I_i = 0.30$), is in the quadrant Low-Low (LL) and significant at ($P\text{-Value} = 0.04 \leq 0.05$), which indicates that low-density residents in Gondomanan Sub-District own spatial connection to low number dengue incidence in the around Gondomanan Sub-District (*neighbors*). While, Kotagede Sub-District has negative autocorrelation ($I_i = -2.31$), placed in Low-High (LH) quadrant and significance at ($P\text{-Value} = 0.00 \leq 0.05$), which indicates that low-density residents in Kotagede Sub-District and own spatial connection to number dengue incidence in the location around Kotagede Sub-district (*neighbors*) (Fig. 5).

According to the findings of the spatial Moran's I bivariate analysis of the variable's density resident and dengue incidence, density residents have a negative spatial autocorrelation (Moran's $I = -0.308$) or a reverse association with dengue incident. Based on the spatial LISA bivariate analysis findings on the variable's density of residents with dengue incidence, the Gondomanan and Kotagede Sub-District had a robust spatial link. The sub-district with the lowest density of residents is surrounded by the sub-district with the lowest incidence of DHF, which means that the sub-district with the lowest density of residents has a spatial relationship with the sub-districts with the lowest number of dengue incidence in the vicinity ($P\text{-Value} = 0.040.05$). Gondomanan Sub-District has a low population density, while Danurejan and Pakualaman Sub-District and the sub-districts nearby have low dengue incidence rates.

Meanwhile, Kotagede Sub-District showed the spatial connection density resident with the incidence of DHF ($P\text{-Value} = 0.00 \leq 0.05$) with adequate connection and negative directed ($I_i = -2.31$) placed in Low-High quadrant (a district with density resident low surrounded subdistrict with number high incidence of DHF), meaning low-density residents in Kotagede Sub-District own spatial connection to height number dengue incidence in the area around Kotagede Sub-District. Kotagede Sub-District has a lower population density than Umbulharjo and Gondokusuman Sub-Districts, which have higher dengue prevalence.

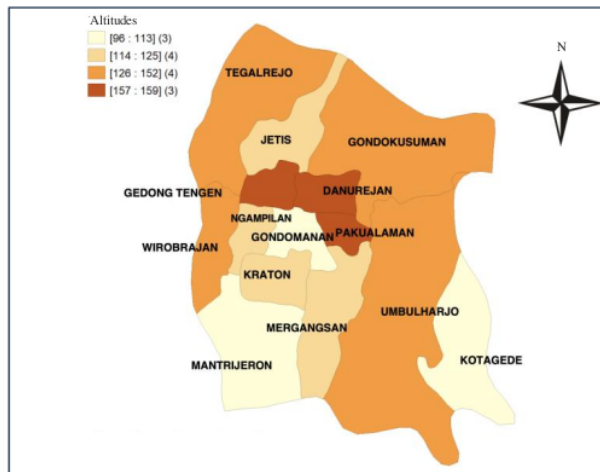


Fig. 3. Distribution Regional Altitude in the City of Yogyakarta

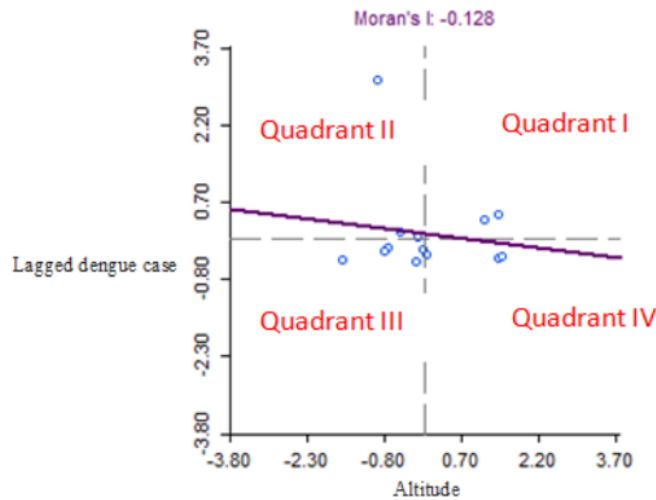


Fig. 4. Moran's Scatterplot altitude with dengue case

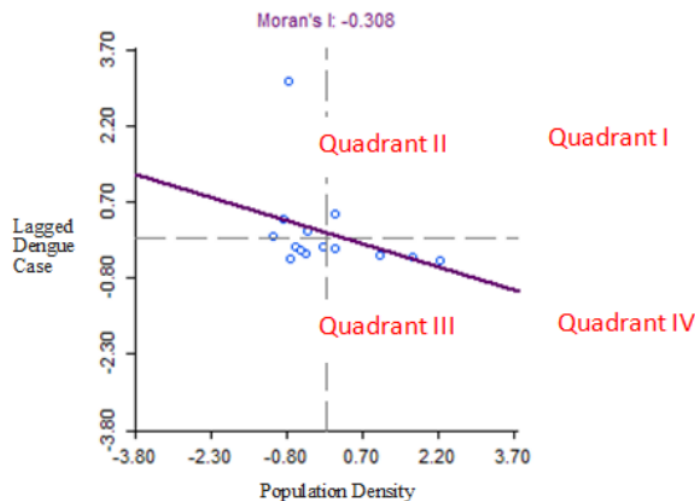


Fig. 5. Moran's Scatterplot population density with dengue case

Based on LISA bivariate test results between altitude area with incident DHF showed that Gondomanan Sub-District and Kotagede Sub-District own ($P\text{-Value} \leq 0.05$), that stands for H_0 is rejected which means significant or has spatial autocorrelation spatial toward the sub-district. Gondomanan Sub-District has positive autocorrelation ($I_i = 0.67$), and the Low-Low (LL) quadrant has significant at ($P\text{-Value} = 0.03 \leq 0.05$), which indicates that the low height of Gondomanan Sub-District owns spatial

connection to low number dengue incidence in the area around Gondomanan Sub-District (*neighbors*). While, the Kotagede Sub-District has negative autocorrelation ($I_i = -2.86$), placed in the Low-High (LH) quadrant with significance at ($P\text{-Value} = 0.00 \leq 0.05$), which indicates the low height of the area in the Kotagede Sub-District has a spatial connection to number dengue incidence in the area around Kotagede Sub-District (*neighbors*) (Fig. 6).

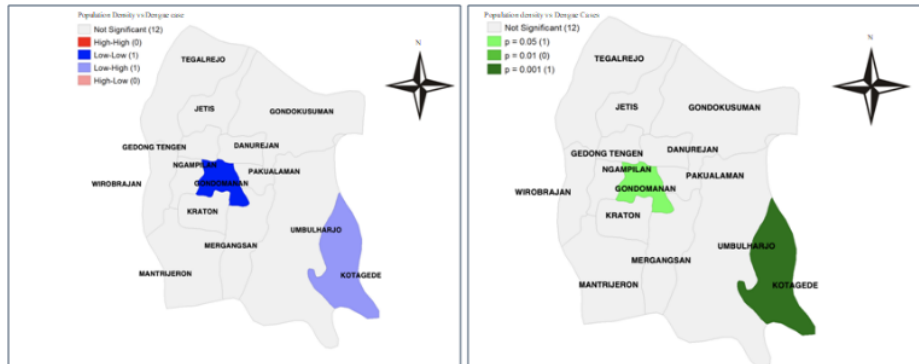


Fig. 6. LISA density bivariate significance test and cluster between population density and dengue case

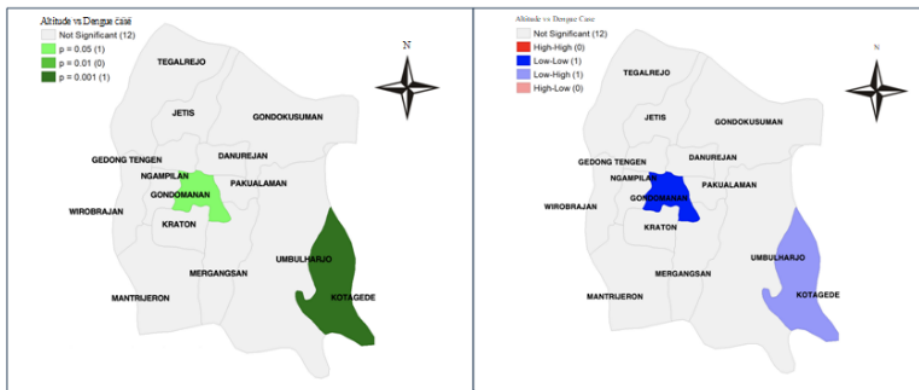


Fig. 7. LISA Altitude Bivariate Test Significance Map with Dengue Incident

Since mosquitoes can travel up to 50 meters in the air, this is where dengue fever could spread. There is a higher chance of dengue fever transmission in heavily populated places [8]. According to previous research, the relationship between resident density and DHF is modest and positively directed ($r = 0.13$); the higher the resident density, the more dengue incidents there were [9]. Like that study, Bis & Sukei (2017) discovered a weak, positively directed link between the density of residents and DHF ($r = 0.336$). It shows that the number of dengue incident cases increases with resident density [10]. Our results in the Gondomanan Sub-District are consistent with the findings of these two studies, but the Kotagede Sub-District shows different results.

Since altitude affects air temperature and humidity, which in turn affects the development

of vector mosquitoes and dengue viruses, altitude is a crucial component that might affect the existence of vector mosquitoes [11]. In a region with an altitude of more than 1,000 masl, no dengue mosquitoes are found, hence, the risk of getting infected with dengue is low [12]. Increasing altitude in a particular area will cause a standard temperature change [13]. Based on spatial Moran's I, bivariate analysis on altitude variables showed that the altitude area has negative spatial autocorrelation ($Moran's I = -0.128$) or inversely with dengue incident. Based on the results, spatial LISA bivariate analysis on altitude area variables with dengue incidence shows that two significant areas have spatial connections, including the sub-district Gondomanan and Kotagede Sub-District. The Gondomanan Sub-District shows the spatial association between altitude area and the incidence of DHF ($P-Value = 0.03$) with adequate

connection and positive directed ($I_i=0.67$) in quadrant *Low-Low* quadrant (district with low altitude area surrounded sub-district with number low incidence of DHF), meaning altitude in the Gondomanan Sub-District has spatial connection to low number of dengue incidence in the area around Gondomanan Sub-District. Gondomanan Sub-District has a low altitude area, and the sub-districts located around Gondomanan Sub-District are Pakualaman and Danurejan Sub-District; they have a low incidence of dengue.

Meanwhile, Kotagede Sub-District shows the spatial connection ($P\text{-Value} = 0.00 \leq 0.05$) with adequate connection and negative direction ($I_i=-2.86$) in the *Low-High* quadrant (area with low altitude area surrounded sub-district with number high incidence of DHF), meaning low altitude in Kotagede Sub-District owns spatial connection to number dengue incidence in the sub-district around Kotagede Sub-District. Kotagede Sub-District owns a low altitude area, and the sub-districts located around Kotagede Sub-District, such as Umbulharjo and Gondokusuman Sub-District, have high incidence amount of dengue. Research from Tamengkel *et al.* (2020) shows that the connection between altitude area and DHF ($P\text{-Value}=0.001<0.05$) has a weak link and negative directional ($r=-0.295$), the highest altitude the lowest dengue incident [6]. Likewise, a study by Paomey *et al.* (2019) shows a larger scale of DHF cases occurred with the low plain category (49 cases), moderate plains category (23 cases), and high plains category (12 cases) [14]. Our result shows that the Kotagede Sub-district has similar findings to this previous research but different results found in the Gondomanan Sub-district. The rising temperature impacted ecosystem degradation and mosquito reproduction. From the altitude area, Gondomanan is a sub-district with the lowest elevation area in the city of Yogyakarta (96 masl) and less than 1,000 meters above sea level, which limits the deployment of vector mosquitoes in Southeast Asia. Altitude 1,000-1,500 meters above sea level is the limit for deployment of mosquito *Aedes aegypti*. However, it is still possible for *Aedes* to live in the region with an altitude > 1,000 meters above sea level. A temperature of around 25^o -27^o C is suitable for breeding mosquitoes to increase DHF cases [15][16]. The average temperature in Yogyakarta in 2017 was 26.75^o C. In 2018, it was 26.00^o C, which means the development of breeding vector mosquitoes and the spread of the dengue virus can increase dengue cases [17] [18].

4. CONCLUSION

There is a positive spatial autocorrelation between population density and dengue fever incidence in Gondomanan Sub-District and a negative spatial autocorrelation in Kotagede Sub-District. With a negative autocorrelation, regional altitude has a global spatial relationship with the incidence of dengue fever in Yogyakarta City. Locally, there is a positive spatial autocorrelation between restricted height and the incidence of dengue fever in the Gondomanan Sub-District and a negative spatial autocorrelation in the Kotagede Sub-District. We recommend that local authorities provide sufficient education to residents that population density is related to dengue transmission. Apart from that, environmental cleanliness through the movement to clean mosquito nests must be reactivated after the pandemic.

7 CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

ACKNOWLEDGEMENT

We thank the Yogyakarta Health Office for the data and communication during the research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ministry of health republic of Indonesia, Indonesia health profile in 2018. Jakarta: Ministry of Health Republic of Indonesia; 2019.
2. [Ministry of Health Republic of Indonesia, Situation of Dengue Hemorrhagic Fever at Indonesia in ;2017. [Online]. Available:<https://www.kemkes.go.id/article/view/19011500007/situasi-penyakit-demam-berdarah-di-indonesia-tahun-2017.html>
3. Health Office of Yogyakarta City, Health Profile in 2017 (Data in 2016). Yogyakarta: Health Office of Yogyakarta City; 2017.

4. Health office of Yogyakarta city, health profile in 2019 (Data in 2018). Yogyakarta: Health Office of Yogyakarta City; 2019.
5. Kusumawati N, Sukendra DM, Spatiotemporal dengue hemorrhagic fever based on house index, population density and house density, Higeia Journal Of Public Health Research And Development. 2020;4(2):168–177
6. Tamengkel HV, Sumampouw OJ, Pinontoan OR, Altitude and Dengue Hemorrhagic Fever Incidence, Indonesian Journal Of Public Health and Community Medicine. 2020;1(1):12–18.
7. Notoatmodjo, Health Research Methodology. Jakarta: Rineka Cipta; 2012.
8. Masrizal, Sari NP, Analysis Of Dhf Cases Based On Climatic Factors And Population Density Using Gis Approach In Flatlands, Andalas Public Health Journal. 2016;10(2):166–171.
9. Chandra E, The influence of climate factors, population density, and larval breeding index (Lbi) On Dengue Hemorrhagic Fever Incidence, J Sustain Dev. 2019;1(1):1-15.
10. Biis NA, Sukesi TW, The Relationship Between Rainfall and Population Density with the Incidence of Dengue Hemorrhagic Fever (DHF) in the Work Area of Gamping I Community Health Center (Village of Balecatur) in Sleman Regency from 2015 to 2017," Ahmad Dahlan University, 2019.
11. WHO, Comprehensive guidelines for prevention and control of dengue and dengue haemorrhagic fever, Revised an., India: World Health Organization. 2011;2(2). DOI: 10.26555/eshr.v2i2.2245
12. Istiqamah SNA, Arsin AA, Salmah AU, and Mallongi A, Correlation study between elevation, population density, and dengue hemorrhagic fever in Kendari city in 2014–2018, Open Access Maced J Med Sci. 2020;8(T2):63–66
DOI: 10.3889/oamjms.2020.5187
13. Hertanto M, Characteristics of ARI and DHF in Toddlers Related to Topography and Climate Conditions (Case: Bogor District), Bogor Agricultural Institute, 2014.
14. Paomey VC, Nelwan JE, Kaunang WPJ, Distribution of dengue hemorrhagic fever based on altitude and population density in the Malalayang Subdistrict Of Manado City In 2019. J Public Health (Bangkok), 2019; 8(6):521–527.
15. Fitriana BR, Yudhastuti R, Relationship between temperature factor and dengue hemorrhagic fever (dbd) cases in Sawahan District, Surabaya," The Indonesian Journal of Public Health. 2018;13(1): 83–94.
DOI: 10.20473/ijph.v13i1.2018.85-97
16. Rasjid A, Yudhastuti R, Notobroto HB, R. Hartono, Climate change: An overview of the prevalence of dengue hemorrhagic fever in the South Sulawesi Province of Indonesia, Indian J Public Health Res Dev. 2019;10(8):1982–1986
Doi: 10.5958/0976-5506.2019.02143.0.
17. BPS, Yogyakarta municipality in figures 2018. Yogyakarta: Central Bureau of Statistics of Yogyakarta City; 2018.
18. BPS, Yogyakarta municipality in figures 2019. Yogyakarta: Central Bureau of Statistics of Yogyakarta City; 2019.

© 2023 Sandi et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/107595>

ORIGINALITY REPORT

15%

SIMILARITY INDEX

13%

INTERNET SOURCES

6%

PUBLICATIONS

7%

STUDENT PAPERS

PRIMARY SOURCES

1

Submitted to Padjadjaran University

Student Paper

5%

2

Siti Nurul Ainun Istiqamah, Arsunan A. Arsin, Andi Ummu Salmah, Anwar Mallongi. "Correlation Study between Elevation, Population Density, and Dengue Hemorrhagic Fever in Kendari City in 2014–2018", Open Access Macedonian Journal of Medical Sciences, 2020

Publication

2%

3

repository.uki.ac.id

Internet Source

2%

4

Yulianti, Wuri Ratna Hidayani. "The Relationship between Environmental Sanitation and the Incidence of Dengue Hemorrhagic Fever (DHF) in Indonesia", Journal of Public Health Sciences, 2022

Publication

1%

5

www.readkong.com

Internet Source

1%

6	www.sdiarticle5.com Internet Source	1 %
7	Submitted to Napier University Student Paper	1 %
8	www.researchgate.net Internet Source	<1 %
9	eprints.unram.ac.id Internet Source	<1 %
10	www.ncbi.nlm.nih.gov Internet Source	<1 %
11	dspace.aua.gr Internet Source	<1 %
12	adfawk3023.s3.ap-southeast-1.amazonaws.com Internet Source	<1 %
13	ejournal.unisba.ac.id Internet Source	<1 %
14	www.ajtmh.org Internet Source	<1 %
15	www.getfilings.com Internet Source	<1 %
16	www.journal2.uad.ac.id Internet Source	<1 %

17

Dila Hening Windyaraini, Fanuel Triaswanto, Yahya Mustangin, Titi Marsifah, Soenarwan Hery Poerwanto. "Characterization of Aedes spp. (Diptera: Culicidae) breeding sites in endemic areas of DHF in Yogyakarta City, Indonesia", AIP Publishing, 2020

Publication

<1 %

18

Risky Ramadhan, Azhari Syarief. "Distribution Mapping and Typology of Slum Area Based on Spatial Autocorrelations in Padang City", Journal of Physics: Conference Series, 2021

Publication

<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On