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Mapping Dengue Fever Cases Using Average Nearest Neighbor Analysis in the Umbulharjo Area, Yogyakarta City

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ABSTRACT

Objective: *Dengue fever cases increase in Umbulharjo is influenced by population density, community behavior, environmental conditions, and influence of rainy season, which increases number of mosquito breeding sites. PHBS and PSN remains a major challenge. Case reporting system has been implemented electronically through SILANTOR application, and control activities are carried out through 3M+ PSN, abatization, fishization, and fogging, adjusted according to results of epidemiological investigations. This study aims to identify dengue fever case recording and reporting system, map spatial distribution of dengue cases, and analyze influencing factors.* ***Method:*** *This quantitative study used a cross-sectional design. Data on dengue fever cases in 2025 in Umbulharjo I and II Community Health Centers areas, was 69 cases. Supporting interviews with dengue fever epidemiological surveillance officers and general practitioners were conducted. Quantum GIS 3.34 application was used for dengue case mapping. Data analysis used plotting mapping, kernel density, and average nearest neighbor (ANN) techniques.* ***Result:*** *Dengue fever surveillance data management process utilizes a combination of manual excel methods and digital application SILANTOR 2.0. There were 32 dengue cases in productive age/adult group (18-59 years old), and males 45 cases. Spatial analysis using ANN yielded a nearest neighbor index (NNI) of 0.703 with a z-score of -4.712, demonstrating a clustered pattern in distribution of dengue cases. Environmental factors include high rainfall, which contributes to increase in cases.* ***Novelty:*** *Demographic conditions indicate that Tahunan Village has highest risk (incidence rate = 1.84 per 1,000 population). Interpretation of results from supporting interview data revealed that main obstacles include low awareness of independent community behavior in routine PSN, habit of rarely draining bathtubs, and urban socioeconomic conditions that affect the quality of physical sanitation in homes.*

INTRODUCTION

Indonesia has the highest *dengue* burden in Southeast Asia and the second highest in the world, with around 17% of total *global dengue* deaths occurring in Indonesia by 2025. Indonesia's contribution to the global burden of infectious diseases in 2025 is 17.2% [1]. The update of the national action plan for *dengue fever* control 2026 - 2029 aims to achieve zero deaths by 2030. The four main strategies are early detection and diagnosis, management, prevention, surveillance, and rapid response.

Data from 2023 recorded 114,720 cases of *hemorrhagic fever* (DBD) with 894 deaths, but this number surged drastically in 2024 to 257,271 cases and 1,461 deaths, indicating a significant increase in the disease [2]. DBD cases in the Umbulharjo area have increased. DBD cases in the Umbulharjo I Health Center area were recorded at 36 cases, with the highest cases in Sorosutan Subdistrict at 24 cases. At Umbulharjo II Health Center, 33 DBD cases were recorded, with the highest cases in Tahunan Subdistrict at 17 cases. Overall, there are 69 dengue cases in the two working areas of Umbulharjo Health Center in 2025 [3].

The increase in DHF cases in the Umbulharjo area is influenced by various factors,

including population density, community behavior, environmental conditions, and the influence of the rainy season which increases the number of mosquito breeding sites. Interview results show that the implementation of clean and healthy living behavior (PHBS) and mosquito nest eradication (PSN) that is not yet optimal remains the main challenge. The case reporting system has been carried out electronically through the vector and disease-carrying animal surveillance information system application (SILANTOR). Control activities are carried out through PSN 3M+, abatization, fishization, and *fogging* adjusted to epidemiological investigation results.

In the competency standards for medical recorders and health information (PMIK) listed in [4], these include the process of collecting health program data, processing health service data, analyzing health service data, preparing health program reports, and disseminating useful information for planning and decision making. This study aims to identify the system for recording and reporting dengue cases, map the spatial patterns of dengue case distribution, and analyze the influencing factors.

RESEARCH METHOD

This is a quantitative study with *a cross-sectional design*. The population consists of dengue case data in 2025 in the working areas of Umbulharjo I and II Community Health Centers, totaling 69 cases, as well as dengue epidemiology surveillance officers and general practitioners who are program holders. The sample was determined using *total sampling technique*.

DHF case data and demographic data from SILANTOR database extraction and *Microsoft Excel* in 2025, rainfall and population density data from the Yogyakarta City Central Statistics Agency in 2025, community behavior data and economic conditions from primary data (interviews) and the health profile of Yogyakarta City in 2025. Supporting interviews with DHF epidemiology surveillance officers and general practitioners. Quantum GIS 3.34 application for DHF case mapping. Data analysis was conducted using *plotting mapping techniques, average nearest neighbor* (ANN), and *kernel density*.

The stages include data *input*, location attributes, *spatial statistics tools, analyzing patterns,* ANN features (*toolbox* in *processing*). *The output* consists of interpretation of observed *mean distance* (the real average distance between nearest neighboring points), *expected mean distance* (the expected average distance if the points are randomly scattered), and *the nearest neighbor index* (NNI) value as well as the statistical significance level (*z-score*). The value < 1 indicates a *clustered* distribution pattern, the value = 1 indicates a random distribution pattern, and the > value 1 indicates a scattered or regular distribution *pattern*.

RESULTS AND DISCUSSION

Results

Dengue fever case recording and reporting system

The system for recording and reporting dengue fever (DBD) cases uses *Microsoft*

Excel and the vector and animal carrier surveillance information system application (SILANTOR). Case data in *Microsoft Excel* is then*entered* into the SILANTOR application by epidemiological surveillance officers.

NO	NAMA	L	P	ALAMAT	KELURAHAN	PUSKESMAS	RS	TGL MULAI SAKIT	TGL DIRAWAT	TGL DILAPORKAN	RMH	RMH POS	BAK	BAK POS.	JML PE	TGL FOGGING 1	DIPERIKSA LAB / TDK
1	NIHIL																
2	-																
3	-																
4	-																
5	-																
6																	
7																	
8																	
9																	

Figure 1. Display of DBD data recording using *Microsoft Excel*



Figure 2. SILANTOR 2.0 application display

Spatial pattern of dengue fever case distribution

The map shows the distribution of DD cases with 46 cases, DHF with 69 cases, and DSS with 1 case. World *Geodetic System 1984* (WGS 84) with geographic coordinates of latitude and longitude in degree units.

The *kernel density map (heatmap* or *kernel density estimation (KDE)),* as a spatial visualization map *(raster surface),* visualizes the incidence points of dengue cases in the Umbulharjo subdistrict area. Visually, it shows where the densest dengue cases are located (hotspot map). *Universal transverse mercator* (UTM) in zone 49S. The data location is at lane section number 49 (Yogyakarta), and the location is south of the equator, S *(south).*

Nearest *neighbour analysis* (ANN) showed a spatial distribution pattern of dengue fever cases based on distance between points, with the distribution results being *clustered,* indicating that this grouping pattern is significant.

Rainfall in Yogyakarta City is high at the beginning and middle of the year, then decreases. Regarding community behavior, it shows that dengue fever control programs

have been implemented in Yogyakarta City.

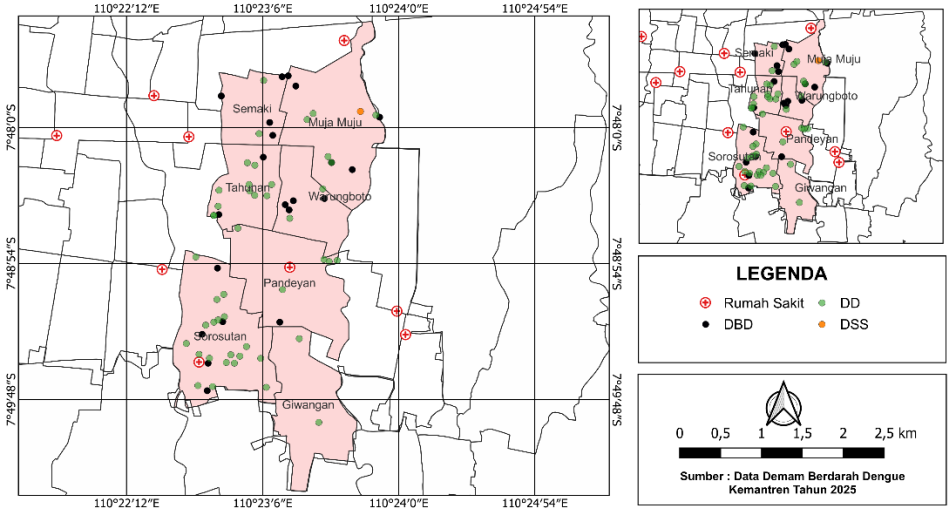

Figure 3. Coordinate map of dengue fever cases in Umbulharjo District

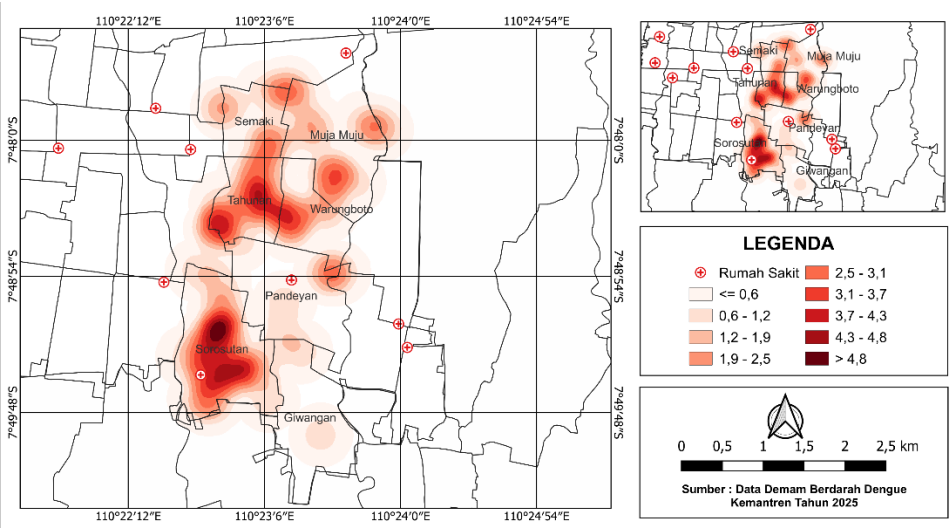

Figure 4. Kernel density map of dengue cases in Umbulharjo District

Table 1. Hasil *analysis nearest neigbhour* (ANN)

Parameter	Value	Description
Observed mean distance	133.28 meters	Average distance between dengue fever case points
Expected mean distance	189.47 meters	Mean distance if points are randomly scattered
Nearest neighbor index	0,703	Lustered C pattern indicator
Z-Score	− 4,712	Signifikansi statistics
Number of points (N)	69	Points

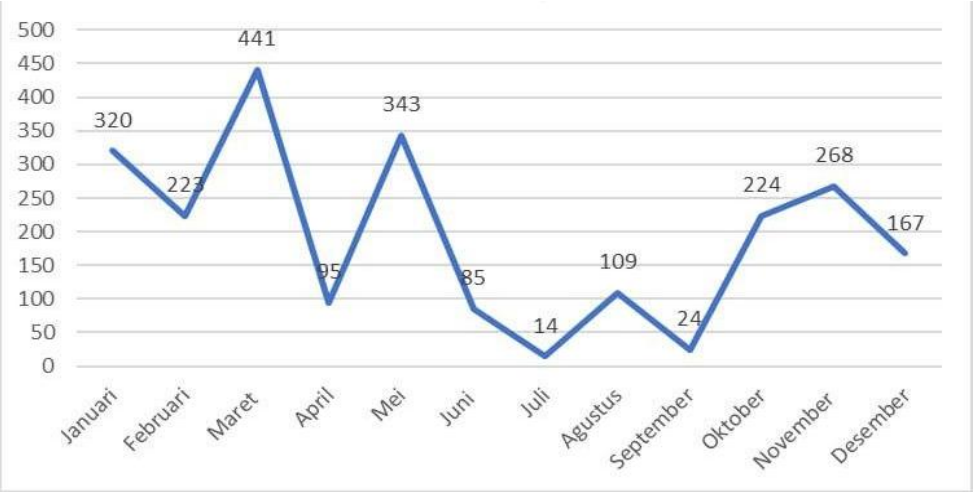

Figure 5. *Rainfall data trend* in Yogyakarta City

Discussion

Early detection capacity in healthcare facilities is crucial for quickly identifying DHF infections. Gaps in early diagnosis increase the risk of treatment delays and severe cases, and there is still a need to strengthen healthcare facilities. *Real-time* and responsive surveillance systems are needed. Integration between surveillance data and response mechanisms remains a challenge. Community involvement in promotion and prevention actions, promotion, and prevention efforts face challenges due to low active community participation and limited public awareness. DHF prevention requires the involvement of various stakeholders outside the health sector.

Integrated efforts to control DHF from environmental, vector, and human factors. Environmental interventions (environmental modification), namely reducing larval habitats (building water pipes). Environmental manipulation, namely drying, cleaning, and recycling water containers through PSN activities, 1 house 1 jumantik (G1R1J). Interventions on mosquitoes *(vectors),* chemicals that kill larvae (larvicidation), chemicals that kill adult mosquitoes (fumigation, use of mosquito repellent, self-spraying of houses), and Wolbachia mosquito technology. Interventions on humans *(hosts),* behavioral and human habitat changes (communication for behavioral impact (COMBI)), and DHF vaccination.

Dengue fever case recording and reporting system

The recording and reporting system for dengue fever cases uses both manual and digital methods. This process begins with data collection sourced from community health center reports, health service networks, and community reports through digital communication media. All this data is first documented in *Microsoft Excel* format as initial data for verification. After all data is accurately verified in *the Excel table*, the DHF epidemiological surveillance officers enter the data into the vector and disease-causing animal surveillance information system application (SILANTOR).

Tables in *Microsoft Excel* are used by dengue epidemiology surveillance to record dengue case data based on the month of occurrence. The data recorded include patient identity, gender, address, urban village, community health center working area, hospital

where treatment is located, date of onset of illness, date of hospitalization, and date of case reporting. In addition, epidemiological investigation activities are also recorded such as the number of houses inspected, the number of houses positive for larvae, as well as control actions such as *fogging*.

The SILANTOR 2.0 application is used as a digital-based disease surveillance reporting system. Case data that has been previously recorded in *Microsoft Excel* is then *entered* into the SILANTOR application by epidemiology surveillance officers. This system is used to monitor the development of disease cases as well as a reporting tool to the health office.

The case data collection process comes not only from records at community health centers but also from reports from health service and community networks (Surveillance I). Dengue cases are collected using the SIMPUS application and then entered into the SILANTOR application (Surveillance II). The diagnosis of Dengue is based on the guidelines of the Minister of Health Regulation (PMK) on Dengue, which consists of clinical symptoms with laboratory examination (Doctor I). Dengue case management is carried out through observation of anamnesis, followed by physical examination and supporting examinations; if fever symptoms appear, blood tests are performed to detect platelets, hematogenous blood levels, and NS1 (Triangulation I).

The reporting system is carried out from reports from health service networks and after observation and examination to ensure data accuracy. The recording and reporting system for dengue cases is done manually and digitally. At the community health center level, case data is initially documented using *Microsoft Excel*, which includes patient identity, epidemiological investigation (PE) results, and larvae status around the patient's home environment. The data collection process is not only from the health center's working area but also utilizes health service networks through WhatsApp groups and the SIMPUS application to be verified and confirmed to the relevant hospital (Surveillance I and II). Data accuracy is the top priority, where case determination is based on observation of clinical symptoms, anamnesis, physical examination, and supported by supporting laboratory tests such as platelet checks, hematocrit, and NS1 tests (Triangulation I and II). After the data is verified, officers enter data into digital applications such as SILANTOR 2.0 to ensure reporting and monitoring for surveillance. This digital reporting system aligns with the development of the SIJENTIK DBD application, which is designed to overcome manual recording limitations.

The transition from manual systems to digital applications like SIJENTIK not only facilitates *data input*; with the SIJENTIK DBD application, the data is recorded faster, more accurate, data can be input directly digitally, report *updates* at any time, and intervention actions become faster and more targeted [5]. Surveillance digitalization, both through SILANTOR and SIJENTIK, plays a crucial role in accelerating the flow of epidemiological information, so decision-making for control actions such as *fogging* or mosquito nest eradication can be done more quickly, precisely, and accurately.

Surveillance can improve detection, monitoring, counseling, and information socialization through digital health literacy innovations, as well as pay attention to the

completeness and accuracy of data entry in the application [6].

Characteristics of the distribution of dengue fever cases

Sorosutan Subdistrict, which is within the working area of Umbulharjo I and II Health Centers, has the highest number of cases at 24 cases (34.8%), Tahunan Subdistrict with 17 cases (24.6%), Muja Muju with 10 cases (14.5%), Pandeyan and Semaki Subdistricts each have 6 cases (8.7%), Warungboto Subdistrict with 4 cases (5.8%), while the fewest cases are in Giwangan Subdistrict with 2 cases (2.9%). This distribution shows that most DHF cases in the Umbulharjo Subdistrict area are concentrated in Sorosutan and Tahunan Subdistricts.

The subdistrict with the highest number of cases is Sorosutan with 24 cases (34.8%), while the lowest number of cases is in Giwangan with 2 cases (2.9%). Each area has different characteristics in terms of population density, area size, and environmental conditions. Sorosutan Subdistrict has the highest number of DBD cases with 24 cases. However, when viewed from the incidence *rate* (IR), Tahunan Subdistrict has the highest value of 1.84. This shows that high population density is not the only factor influencing the increase in DBD cases. Other factors such as environmental conditions, community behavior towards water management, waste, and mosquito nest eradication are still not optimal, which can cause an increase in DBD cases.

The adult age group (18-59 years) had the highest number of cases at 32 cases, the adolescent age group (10-18 years) 16 cases, the children group (5-10 years) 14 cases, and the toddler group (0-5 years) 7 cases; the elderly age group (≥ 60 years) did not find any dengue fever cases in 2025 in the working areas of Umbulharjo I and II Health Centers. These results indicate that dengue fever incidence in 2025 occurred more frequently in the adult and adolescent age groups compared to other age groups.

The age groups of children, toddlers, and adults also have vulnerability to DHF (Surveillance I and II). DHF cases in the Umbulharjo area are often found in children to adults, and it is mentioned that children often come directly to the health center because parents are concerned about their child's condition (Triangulation I and II). The highest number of cases is found in adults and toddlers; toddlers are vulnerable to DHF cases due to a weakened immune system.

In terms of adult age, toddlers are the highest group; their immune system vulnerability is still low. There are differences in behavior during treatment. Cases in children tend to arrive at the community health center earlier due to parents' high concerns, while adult groups often do not immediately come to health services despite having the same risk (Triangulation I and II).

The distribution of DHF cases by gender in the working areas of Umbulharjo I and II Health Centers in 2025 is 45 males and 24 females. The sub-districts with the highest number of cases are Sorosutan with 14 males and 10 females, Tahunan sub-district with 12 males and 5 females, Muja Muju sub-district with 7 males and 3 females, Pandeyan and Semaki sub-districts with 3 males and 3 females respectively, Warungboto sub-district with 4 males and no females, Giwangan males with 2 males and no females.

Dengue fever cases occurred more frequently in males than females in the working

areas of Umbulharjo I and II Health Centers in 2025. The gender groups most frequently experiencing dengue cases in the working areas of Umbulharjo I and II Health Centers are males, who have higher outdoor activities and have a higher risk due to mosquito bites.

Spatial pattern of dengue fever case distribution

The severity level of *dengue* virus infection is divided into 3 types: *dengue fever* (DD), dengue hemorrhagic fever (DHF), and *dengue shock syndrome* (DSS). DD is a mild fever that can heal on its own. DHF is a severe form that causes plasma leakage and bleeding. DHS is the most fatal complication caused by blood circulation failure or shock. The map shows the number of DD cases at 46 cases, DHF at 69 cases, and DSS at 1 case.

The *kernel density map* shows a visualization of the concentration or density of dengue case incidence points in the Umbulharjo District area. This method converts dengue case data points into a raster map in the form of color gradients that show the most to the most dispersed areas. This is to map the epicenter of dengue fever case spread in determining the target areas for public health interventions in the Umbulharjo District area.

In the *average nearest neighbor* (ANN) method calculation for 69 dengue fever case points in the Umbulharjo area, the observed *mean distance* between cases was 133.28 meters. This value is smaller compared to the *expected mean distance* of 189.47 meters. This calculation is supported by the *nearest neighbor index* (NNI) of 0.703, because the NNI value < 1, which proves that the case distribution pattern tends to be *clustered* or cases are relatively close together. The *resulting z-score* value is -4.712, indicating that this clustering pattern is statistically significant and very unlikely to occur by chance. Thus, it can be concluded that the distribution of DHF cases in the Umbulharjo District area forms a clustered pattern. DHF disease in one area is influenced by occurrences in adjacent areas, where spatial patterns tend to form *clustering* [7].

The applied tiered overlay *modeling* shows the categories of vulnerable, moderate, and safe zones. The main factors influencing the vulnerability level are land use, distance to rivers, and the number of dengue cases [8]. The K-Means algorithm was successfully used to cluster dengue-prone areas using patient data based on attributes such as age, gender, and address [9]. The integration of spatial analysis and microclimate factors is effective in predicting dengue incidence, thus supporting more targeted vector control efforts in densely populated urban settlements [10]. The integration of entomological indicators in the form of *container indexes* with spatial analysis in mapping dengue fever cases. This forms the basis for strengthening environment-based surveillance as well as more targeted vector control intervention planning [11].

Environmental factors

The increase in DHF cases is greatly influenced by environmental factors, especially high rainfall and lack of community participation in PSN activities, resulting in high larval breeding in water reservoirs (Surveillance I and II). Environmental conditions, especially in uncleaned water reservoirs, can become mosquito breeding grounds (Triangulation I and II).

Rainfall data in Yogyakarta City in 2025 shows that rainfall is high at the beginning and middle of the year, namely January (320 mm), March (441 mm), and May (343 mm), while rainfall decreases in April, June, July, August, September, and December. The annual total is 2,313 mm. This classification shows that the environment in Yogyakarta City, especially the Umbulharjo area, has a fairly high potential for breeding formation, particularly during rainy months above 300 mm, contributing to 69 dengue fever cases found in the Umbulharjo area.

The distribution of 69 DHF cases in the Umbulharjo area is closely related to environmental conditions, especially rainfall. The accumulated annual rainfall of 1,981.0 places Yogyakarta City in the category of areas supporting the development of *the Aedes aegypti* mosquito vector. This is reinforced by interview results stating that the increase in DHF cases with high rainfall results in water pooling on used goods and water storage containers that are not cleaned by the community. This condition is worsened by the lack of PSN activities during the rainy season, causing mosquito larvae to breed rapidly (Surveillance I and II). This one-way correlation occurs because increased rainfall is directly proportional to the availability of *Aedes aegypti mosquito breeding sites* [12]. Thus, the 1,981.0 mm rainfall in Yogyakarta City became an environmental factor triggering the high 69 dengue fever cases through an increase in *the population of the Aedes aegypti* mosquito vector.

Population density also affects the transmission of DHF. Population density is one of the factors that can influence the spread of DHF. Areas with high population density have distances between houses, making it easier for mosquitoes to spread from one house to another. The distribution of population and DHF cases in seven urban villages in the Umbulharjo subdistrict show that Tahunan Subdistrict has the highest population density reaching 11,824 people/^{km2}, while the lowest density is in Giwangan Subdistrict with 6,577 people/km2.

Sorosutan Urban Village recorded the highest number of DBD cases, with 24 cases. However, when looking at the incidence *rate* (IR), Tahunan Urban Village has the highest value at 1.84. This shows that although the population in Tahunan Urban Village is smaller compared to Sorosutan, the risk of disease spread per population unit in the area is higher.

The population density calculation for Semaki Subdistrict is with 6 dengue fever cases, total population 5,163 people, constant 1,000, so IR = 6/5,163 ×1,000 = 1.16. The population density calculation for Pandeyan Subdistrict is as follows: 12,482 people, area 0.050 km^2, population density = 12,483/1.38 = 9,045 people/km^2.

There is a close relationship between population density and the risk of DHF transmission in the Umbulharjo District area. Areas with high population density, such as Tahunan Subdistrict reaching 11,824 people/km2, show the highest transmission risk or *incidence rate* (IR) of 1.84 per 1,000 population. This aligns with interview results stating that the very close distance between houses in densely populated settlements facilitates the mobility of *Aedes aegypti* mosquitoes to transmit the virus quickly from one house to another. Increasing population density can affect the high number of DHF cases

occurring in these areas [13]. However, population density does not always correlate directly with the high number of dengue cases. In some areas with high population density, the incidence rate of dengue fever can still be suppressed due to community awareness. The incidence rate can still be reduced due to community awareness of environmental cleanliness and the implementation of routine PSN activities [14]. The factors causing the high number of dengue fever cases are rainfall, temperature, humidity, and altitude, while population density and population mobility have no effect [15].

Community behavioral factors

Programs that have been implemented for DBD control in Yogyakarta City include community behavior and health systems and management (facilities and officers). In the community behavior category, there are aspects of PSN actions and compliance, such as activities through PSN with the 1 house 1 jumantik movement (G1R1J) and periodic larva monitoring (jumantik cadres). In the cooperation aspect, activities include *community deals* with DBD at the RW and sub-district levels and the implementation of focused fogging SOPs (counseling, PSN, larvicidation, *community deal* DBD).

In the health system and management category (facilities and staff), there are aspects of epidemiological surveillance, types of activities through hospital surveillance networks involving 18 hospitals in Yogyakarta City, hospital-based passive surveillance, and rapid response by sub-district surveillance and the community health center rapid response team (TGC) to determine the presence of transmission. In the medical and clinical facility aspect, activities include *providing dengue duo rapid tests* (NS1, IgG, IgM at community health centers and hospitals), *refreshing* dengue *management in* children and adults for community health center doctors, and death audits of dengue cases. In terms of technological innovation and cross-sectoral aspects, the type of activity involved the release of *Wolbachia-infected* Aedes aegypti *mosquitoes* in collaboration with *the World Mosquito Program* (WMP) UGM Yogyakarta, and cross-sector involvement (RT, RW, PKK, community leaders).

Public awareness and consistency in carrying out PSN 3M Plus activities are still low, and the implementation tends to be reactive or only carried out when there are visits from community health center officers and health cadres. The role of medical personnel is focused on handling sick patients through medical education and the implementation of PHBS, while prevention and environmental monitoring efforts are entrusted to surveillance programs.

Community behavior in PSN through the 3M Plus program is the main determining factor in DHF disease control [16]. Community behavior is closely related to disease incidence, where respondents with poor 3M Plus behavior have a 4.421 times greater chance of developing DHF compared to respondents with good behavior. Although environmental factors support the presence of mosquitoes, the risk of transmission can be prevented by the community if they are disciplined in independently carrying out prevention efforts.

The 3M actions, which include draining, covering, and recycling used items, are key

to breaking the life cycle of *Aedes aegypti* mosquitoes. Besides the basic 3M actions, the Plus aspect in community behavior also makes an important contribution to protecting individuals from mosquito bites. Additional behaviors such as using mosquito repellent (burning, electric, or spray), installing wire mesh on ventilation, and using mosquito nets have been proven effective in reducing transmission risk. One specific behavior often found is the habit of hanging clothes inside the house. Hanging clothes become a *resting place for* Aedes aegypti *mosquitoes*, increasing the risk of contact between mosquitoes and household occupants [16]. The community needs to improve knowledge and implement a healthy lifestyle through literacy media, health literacy, confidence and care for healthy living, as well as self-efficacy [6]. Community behavior still requires improvement through education and active involvement of health workers. Awareness to implement PHBS and boost immunity; the success of control programs greatly depends on the community's consistency in turning knowledge into concrete actions to maintain environmental cleanliness sustainably.

Activities to encourage the community to regularly change dengue prevention behavior remain a significant challenge, especially due to factors such as education level and age. This is reflected in the elderly habit of rarely cleaning the bathroom, so larvae are still frequently found in household environments.

The community tends to only carry out preventive activities when officers visit, and prevention efforts often stall. In addition, the condition of urban communities, which from social, economic, and educational aspects, causes environmental cleanliness practices, such as draining bathtubs, to still be rarely done consistently, resulting in a high number of larvae detection. Behavioral factors, namely the lack of public awareness to carry out PSN activities, are identified as the main causes of dengue fever problems. To overcome these behavioral obstacles, innovative interventions involving active citizen participation are needed through the "Gerak Si Jumantik" program. The program, which includes training for community cadres "Si Jumanis" and school cadres "Gen Jumbo," has been proven to significantly increase participants' knowledge about the dangers of dengue fever and prevention methods. The success of the intervention showed a significant difference in knowledge values between *the pre-test* and *post-test* with *a p-value* of 0.002 among community cadres and 0.000 among school cadres. Through collaboration among various parties such as village governments, community health centers, and schools, it is hoped that the community can independently and sustainably carry out PSN to increase the larva-free rate (ABJ) in their environment [17]. Active community involvement is an important factor in reducing the incidence of dengue fever [18].

Demographic data from BPS Yogyakarta City as of March 2026 shows that poor households have an average larger number of family members (4.26 people) compared to non-poor households (3.23 people). The percentage of female heads of households is higher in the non-poor group (17.62%) compared to the poor group (10.65%). The average length of schooling of poor household heads is only 8.2 years (equivalent to junior high school), while the non-poor group reaches 10.57 years (equivalent to senior high school). The education level of poor heads of households is dominated by high school graduates

(31.03%) and elementary school (25.47%), with a fairly high rate of not completing elementary school (17.53%), and only 3.26% having university degrees. Conversely, the non-poor group has a much higher number of university graduates, namely 18.17%. The majority of poor households' sources of income rely on agriculture (34.85%) and industry (27.9%). Meanwhile, the majority of non-poor households work in other sectors (47.57%), and only 19.63% work in agriculture.

Socioeconomic status and education level of the community play an important role in the transmission of dengue fever. People with low education levels tend to have limited understanding of health threats. Differences in economic status affect household sanitation facilities, where the lower-middle economic group still uses old-model bathtubs that risk becoming mosquito larvae breeding sites, while the upper economic group mostly uses facilities such as showers or disposable containers that do not allow water to pool (Surveillance I and II).

The socioeconomic status and education level of the community play an important role in the transmission of dengue fever. People with low education levels tend to have limited understanding that threatens health. This is proven by data from BPS Yogyakarta City, which shows that the average length of schooling for poor household heads is only 8.2 years, with a percentage of 17.53% not completing elementary school, and only 3.26% in higher education. This limited education level is directly proportional to the low understanding of mosquito nest risks in the surrounding environment. Besides education, differences in economic status significantly affect the condition of household sanitation facilities. BPS data records that the majority of poor households work in the agricultural sector (34.85%) and industry (27.9%) with limited income, so this group tends to still use old-model bathtubs, which are at high risk of becoming mosquito larvae breeding sites. The upper-middle group, which mostly work in other sectors (47.57%) and are able to use facilities such as *showers* or disposable containers.

The social condition of the community, most of whom are aged 30-50, shows that almost 50% have not yet enjoyed adequate and healthy basic sanitation. The economic condition of the community who work as farmers with limited income affects the fulfillment of quality of life such as health and education. Household expenditure has a significant effect on sanitation availability. If household expenditure from each household's income increases, it is likely that household sanitation availability will also increase [19].

Surveillance integrates environmental data (rainfall, temperature, humidity) and community behavior data for more comprehensive risk analysis and develops GIS-based early warning systems for DHF prevention [20]. The integration of remote sensing data, climate reanalysis data, and *analytical hierarchy process* (AHP) methods within geographic information systems (GIS) frameworks has proven effective in supporting the identification of priority areas for spatially based DHF control [21].

CONCLUSION

Fundamental Finding : The recording and reporting system for DHF cases in the

epidemiological surveillance system at Umbulharjo I and II Community Health Centers has implemented the integration of manual and digital methods. The initial data processing from the health service network and hospital was carried out using Microsoft Excel, which was then entered into the SILANTOR 2.0 digital application to ensure accuracy, speed of information, and facilitate actions. The characteristics of case distribution show that in 2025, there were 69 dengue fever cases recorded in the working areas of Umbulharjo I and II Health Centers. The highest cases were in Sorosutan Subdistrict with 24 cases (34.8%). Based on the adult age group (18-59 years) there were 32 cases and the male group 45 cases, which is closely related to the high mobility of outdoor activities. The spatial pattern of case distribution, based on spatial analysis using a quantum GIS application with the average nearest neighbor (ANN) method at 69 patient locations, yielded a nearest neighbor index (NNI) value of 0.703 with a z-score of -4.712. This significantly proves that the pattern of dengue fever disease distribution in Umbulharjo Subdistrict forms a clustered pattern. **Implication :** Priority for DHF prevention and control is in areas with the highest cases. Health promotion activities focus on productive age groups and communities with high mobility, through education on self-protection from mosquito bites and the implementation of PHBS. GIS is used as part of routine surveillance to monitor the spread of DHF cases. Cluster pattern information is used as the basis for determining priority areas in epidemiological investigations, PSN, fogging, and resource allocation. The implementation of health education models such as intergenerational programs like "Gerak Si Jumantik" (community cadres of Si Jumanis and Gen Jumbo school cadres) needs to be tried. **Limitation :** Environmental factors and community behavior, such as high rainfall, trigger the emergence of puddles as breeding grounds for Aedes aegypti mosquitoes. This condition is worsened by the community's still reactive behavior (PSN 3M Plus only runs consistently when there are visits from officers or cadres), as well as risky habits such as hanging used clothes inside the house, which serve as a resting place for adult mosquitoes. **Future Research :** The implementation of health education models such as intergenerational programs like "Gerak Si Jumantik" (community cadres of Si Jumanis and Gen Jumbo school cadres) needs to be tried.

REFERENCES

[1] WHO and Kemenkes, “Profil beban penyakit dengue global dan nasional tahun 2025,” 2025.
[2] Kementerian Kesehatan Republik Indonesia, “Profil kesehatan Indonesia,” 2024.
[3] Dinas Kesehatan Kota Yogyakarta, “Profil kesehatan Kota Yogyakarta,” 2026.
[4] Kementerian Kesehatan Republik Indonesia, “Peraturan Menteri Kesehatan Nomor 1423 Tahun 2022 tentang pedoman variabel dan metadata pada penyelenggaraan rekam medis elektronik,” 2022.
[5] A. A. Perdana, D. D. Nuryani, A. B. Santoso, M. P. Pratama, and M. Kartini, “Penerapan aplikasi SIJENTIK DBD dalam pencegahan demam berdarah dengue,” *Journal of Public Health Concerns*, vol. 5, no. 9, pp. 591–598, Nov. 21, 2025, doi: 10.56922/phc.v5i9.1584.
[6] H. Rohman, N. Rapikha Anggraini, and I. Mawardi, “Pencatatan dan pemetaan persebaran pasien tuberkulosis serta faktor sosial di Kapanewon Depok, Gamping dan Mlati,” *Jurnal Ilmu Kesehatan Bhakti Setya Medika*, vol. 10, no. 2, Oct. 31, 2025, doi: 10.56727/bsm.v10i2.155.

[7] N. A. Pascawati, S. Sahid, S. Sukismanto, and H. Yuningrum, "Faktor yang berhubungan dengan pola pengelompokkan kasus demam berdarah dengue (DBD) di Temanggung, Jawa Tengah," *BALABA: Jurnal Litbang Pengendalian Penyakit Bersumber Binatang Banjarnegara*, pp. 65–78, Jul. 31, 2022, doi: 10.22435/blb.v18i1.5957.

[8] G. Nurlaila, T. Anasi, L. Manditya, and H. Christanto, "Pemodelan overlay berjenjang menggunakan sistem informasi geografis sebagai penentu daerah rawan demam berdarah," vol. 11, no. 1, 2026.

[9] E. S. Putri, A. Triyono, and K. I. Santoso, "Klasterisasi daerah rawan demam berdarah dengue (DBD) menggunakan algoritma K-Means di Purwodadi Grobogan," *Router: Jurnal Teknik Informatika dan Terapan*, vol. 4, no. 1, pp. 26–36, Mar. 31, 2026, doi: 10.62951/router.v4i1.846.

[10] I. Permatasari and J. Kusuma Wardana, "Analisis spasial dan pemodelan prediktif kejadian demam berdarah dengue (DBD) berbasis faktor iklim mikro di permukiman padat perkotaan," *Jurnal Ilmiah Ilmu Kesehatan & Medis (MURAKES)*, pp. 47–59, 2026, doi: 10.64365/murakes.v2i2.285.

[11] J. Allenfaza, A. A. Perdana, K. Amirus, and F. Ekasari, "Pengaruh container index dan analisis spasial terhadap kejadian demam berdarah dengue di wilayah kerja Puskesmas Pagelaran," *Jurnal Medika Malahayati*, vol. 10, no. 1, pp. 67–73, Apr. 9, 2026, doi: 10.33024/jmm.v10i1.22475.

[12] F. Virdayanti and P. E. M. Erawan, "Studi korelasi faktor lingkungan dengan kejadian demam berdarah dengue (DBD) di Kota Kendari tahun 2019–2023," *Tropical Public Health Journal*, vol. 4, 2025.

[13] N. H. A. Rafi, A. L. Nugraha, and M. A. Yusuf, "Pemetaan incidence rate (IR) demam berdarah dengue (DBD) di Kecamatan Tembalang tahun 2018–2022," *Jurnal Geodesi Undip*, Jan. 2024.

[14] F. A. D. Pamuncak, "Analisis spasial kasus demam berdarah dengue dan hubungannya dengan kepadatan penduduk di Kabupaten Bogor tahun 2024," vol. 4, 2024. [Online]. Available: https://jurnal.jomparnd.com/index.php/jkj

[15] H. Rohman, A. R. Abdillah, and A. R. Qhoiriyah, "Analisis informasi kesehatan melalui pemetaan demam berdarah dengue (DBD) di wilayah Prambanan, Gamping dan Mlati, Sleman, Yogyakarta," *Tropical Public Health Journal*, Faculty of Public Health, 2021.

[16] N. H. Nasywa, A. Yusuf, and H. Nurhendriyana, "Hubungan perilaku 3M Plus dengan kejadian demam berdarah dengue di wilayah kerja Puskesmas Plered Kabupaten Cirebon," vol. 24, no. 1, 2025.

[17] M. N. Alfariza, S. Muliasari, A. D. Putri, A. D. Fitri, H. S. Dewi, S. N. Wahidah, *et al*., "Intervensi masalah kesehatan DBD di Dusun Karangsari Desa Batulawang Kecamatan Pataruman Kota Banjar tahun 2025," 2025.

[18] M. Fardilla, H. Istigfarini, E. Barlian, E. Yuniarti, and L. Handayuni, "Pemetaan penyebaran demam berdarah dengue di Kota Padang tahun 2025," *Jurnal Kesehatan Lingkungan Universitas Halu Oleo*, vol. 6, no. 4, pp. 69–76, Jan. 31, 2026, doi: 10.37887/jkl-uho.v6i4.148.

[19] E. R. Budi, "Analisis kondisi sosial ekonomi masyarakat terhadap ketersediaan sanitasi," *Economics Development Analysis Journal*, 2017. [Online]. Available: http://journal.unnes.ac.id/sju/index.php/edaj

[20] M. K. Muzzaki, A. B. Herlambang, and A. K. Anam, "Sistem informasi geografis persebaran tren kejadian demam berdarah dengue (DBD) di Kabupaten Semarang tahun 2023 dan 2024," *Jurnal Multidisiplin Ilmu Akademik*, vol. 3, no. 1, pp. 774–781, 2026, doi: 10.61722/jmia.v3i1.8191.

[21] A. A. Kurniawan, "Pemetaan risiko demam berdarah dengue menggunakan AHP berbasis data penginderaan jauh dan reanalisis iklim di Kabupaten Bantul," 2025.

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