Open Access Health Scientific Journal
https://oahsj.org/index.php/oahsj Vol. 6 No. 1 February 2025, pp. 34-41
Research article

Spatial Analysis of Risk Factors for Dengue Fever in Delta Pawan District, Ketapang Regency

Khairul Rasyid*, Mursid Raharjo, Nurjazuli

Universitas Diponegoro Semarang, Indonesia
*Corresponden Author: Khairul Rasyid (arl0681@gmail.com)

ARTICLE INFO

Keywords:
Dengue Fever,
Risk Factors,
Spatial Analysis.

ABSTRACT

Background: Delta Pawan District in 2023, there were 388 cases of DHF (IR 424,3/100.000 population) with a mortality rate of 2 cases (CFR 0,25%). Dengue fever is still a public helath problem in Delta Pawan District every year. Comprehensive control effort are needed to control dengue fever, one of which is by identifying risk factors for dengue fever in The Delta pawan District area. This study aimed to identify relationships between the existence of positive breeding places for mosquito larvae and the habit of cleaning water reservoirs with the incidence of dengue fever.
Method: This study uses an analytical observational approach with a method Cross Sectional, using Geographic Information System (GIS) to identify and analyze the occurrence of dengue fever and risk factors. The number of samples used was 142 samples (71 case samples and 71 control samples).
Results: Based on statistical analysis, it was found that there was a relationship between the existence of positive breeding places for larvae and
the incidence of DHF in Delta Pawan District, P-value 0.000 OR 6.462. There was a relationship between the habit of cleaning water reservoirs and the incidence of DHF P-value 0.002 OR 3.044. There was no relationship between the habit of hanging used clothes and the incidence of DHF in Delta Pawan District. The distribution pattern of DHF cases in Delta Pawan District in 2024 based on Moran's I autocorrelation analysis is random
Conclusion: There is a relationship between the existence of positive breeding places for mosquito larvae and the habit of cleaning water reservoirs with the incidence of dengue fever.

INTRODUCTION

Dengue fever is a disease transmitted by mosquitoes. Aedes (Aedes Aegyptiand Aedes Albopictus) which has spread to various tropical countries over the past six decades and has become a health problem for more than half of the global population. The geographic scope of dengue fever is predicted to expand further due to ongoing global phenomena, such as climate change and urbanization (Messina et al., 2019).

It is estimated that there are around 390 million cases of dengue fever each year, with 96 million of them showing various clinical symptoms. The number of cases reported to WHO increased from 505,430 cases in 2000 to 5.2 million cases in 2019. More than 3.9 billion people in 129 countries are at risk of dengue infection with an estimated death toll of 40,000 people each year (WHO, 2020). The burden of global dengue infection is mostly in Asia, where around 1.3 billion people live in dengue endemic areas in 10 countries in South Asia to East Asia (Yuniartika, 2022). In early 2020 WHO categorizes dengue fever as one of the world's health threats along with ten other diseases.

Received 10 January 2025; Accepted 30 January 2025; Published 1 February 2025
 DOI: https://doi.org/10.55700/oahsj.v6i1.63

The first case of dengue fever was reported in Indonesia in 1968. Since that first discovery, the number of dengue fever cases has tended to increase every year. Over the past six years, dengue fever cases have been reported in all provinces in Indonesia, with more than 80% of districts/cities reporting dengue fever cases in their respective areas. In 2022, dengue fever cases were reported in 34 provinces with 484 (94.2%) districts/cities infected, an increase compared to 2021, which recorded 467 (90.8%) districts/cities infected with DHF (Ministry of Health of the Republic of Indonesia, 2023).

Ketapang Regency is an area located in the southern part of West Kalimantan Province. Cases of dengue fever in Ketapang Regency in 2023 were recorded at 1,143 cases (IR 211/100,000 population) with 5 deaths (CFR 0.4%). Delta Pawan District is one of the endemic areas for dengue fever in Ketapang Regency. In 2023, 388 cases of dengue fever were recorded in Delta Pawan District with an IR of 424.3/100,000 population and a CFR of 0.25%.

The occurrence of dengue fever is caused by the interaction of various factors, including host factors, disease-causing agents and environmental factors. Risk factors for dengue fever include dengue virus as the causative agent, humans and mosquitoes as hosts, and the environment that contributes to the occurrence of dengue fever. Each of these factors influences and is influenced by each other, so that dengue fever is difficult to control if not controlled comprehensively (Suwandono, 2019).

This study aimed to identify relationships between the existence of positive breeding places for mosquito larvae and the habit of cleaning water reservoirs with the incidence of dengue fever.

METHODS

This type of research is analytical observational with a method Cross Sectional. Using Geographic Information Systems (GIS) to identify and analyze dengue fever incidents and their risk factors, so that it can provide a visual explanation of the situation. The population studied in this study includes the entire population in the Delta Pawan District, Ketapang Regency. What was analyzed were all cases of DHF that occurred in the Delta Pawan District in 2024. The number of samples used in this study was 142 samples, consisting of 71 samples for cases and 71 samples for controls. The Chi square test was conducted to study the relationship between the independent variable and the influenced variable.

The tools used in this study were a map of the Delta Pawan District area, a data sheet of DHF sufferers in 2024, a tool for mosquito larvae surveys, a research questionnaire, a global positioning system (GPS) test tool and Archgis software.

RESULTS

Delta Pawan District consists of 9 villages/sub-districts, namely: Kantor Village, Sukaharja Village, Tengah Village, Mulia Baru Village, Sampit Village, Sukabangun Village, Kalinilam Village, Paya Kumang Village and Sukabangun Dalam Village. Delta Pawan District has an area of 74 km^2, the population in 2023 will be 92,755 people with a population density of 1,253 people/km^2 (Ketapang, 2024)

Table 1. Population Density Distribution of Delta Pawan District in 2023

Village/Sub-district	Population (People)	Area (km^2)	Population Density (People/km^2)
Kantor	5.955	6,46	922
Sukaharja	18.120	23,08	785
Tengah	7.134	7,08	1.008
Mulia Baru	12.719	9,39	1.355
Sampit	15.819	8,81	1.796
Sukabangun	8.416	3,76	2.238
Kalinilam	13.405	7,63	1.757
Paya Kumang	6.972	2,16	3.228
Sukabangun Dalam	4.215	5,63	749
Total	92.755	74	1.253

In 2024 in Delta Pawan District, there were 56 cases of dengue fever with an Incident Rate (IR) of 61.4/100,000 population. This IR figure is still far above the national target of 49/100,000 population

Table 2. Distribution of Dengue Fever cases in Delta Pawan District 2024

Village/Sub-district	DHF Cases	Percentage (%)	IR
Kantor	2	3,57	21,8
Sukaharja	13	23,21	87,8
Tengah	7	12,5	55,2
Mulia Baru	9	16,07	71
Sampit	13	23,21	76,9
Sukabangun	2	3,57	20,9
Kalinilam	2	3,57	16,4
Payakumang	5	8,92	59,1
Sukabangun Dalam	3	5,35	66,8
Total	56	100	

Spatial Analysis

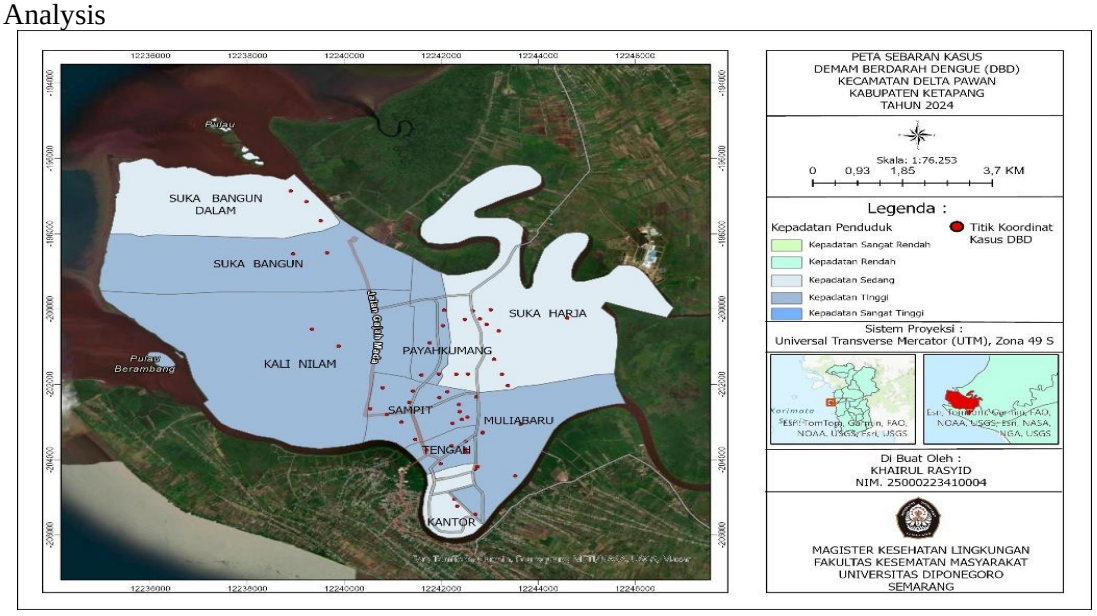

Figure 1. Map of the distribution of dengue fever cases in Delta Pawan District in 2024

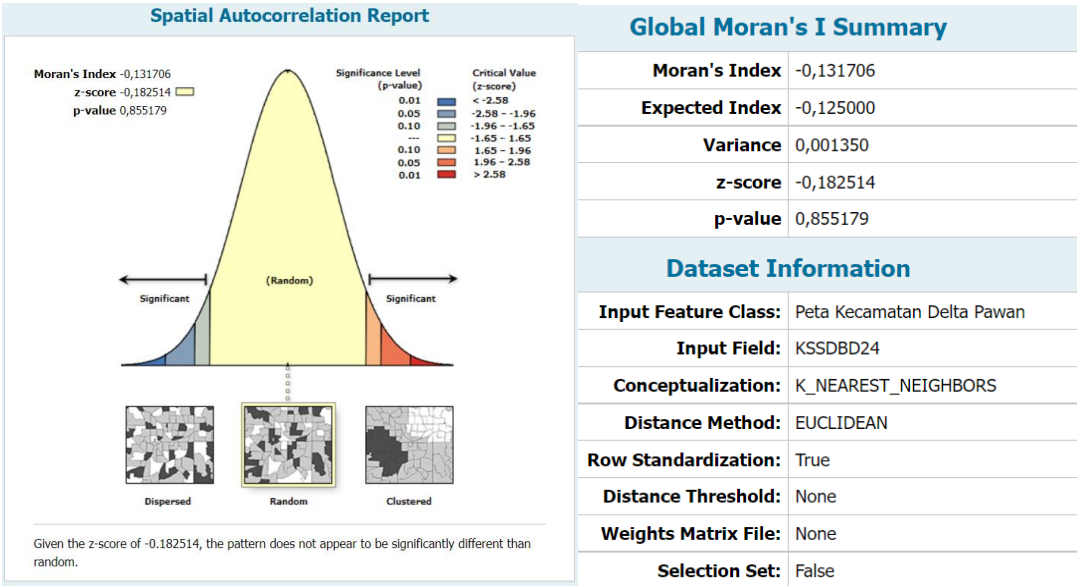

Figure 2. *Moran's spatial auto corelation I* Distribution of DHF cases in Delta Pawan District Year 2024

In 2024, dengue fever cases in Delta Pawan District were recorded at 56 cases, down compared to DHF cases in 2023 which were recorded at 388 cases. The distribution of dengue fever cases in Delta Pawan District can be seen in Figure 1 above, where cases are spread across all villages/sub-districts with the following number of cases: Sampit Village 13 cases, Payakumang Village 5 cases, Sukaharja Village 13 cases, Tengah Village 7 cases, Kantor Village 2 cases, Mulia Baru Village 9 cases, Kalinilan Village 2 cases, Sukabangun Village 2 cases and Sukabangun Dalam Village 3 cases.
Based on spatial analysis using *moran's I* As seen in Figure 2 above, the following values are obtained:

- *Moran's Index*-0.131706 which shows a tendency towards negative autocorrelation, where areas with high dengue fever cases tend to be surrounded by areas with low dengue fever cases, and vice versa.
- Z-Score -0.182514 which shows that the results are not statistically significant, it could be that the observed spatial pattern occurred by chance.
- *P-value*of 0.855179 > 0.05 so it is considered statistically insignificant.

From the data above, it can be concluded that there is no significant spatial autocorrelation in DHF cases in Delta Pawan District in 2024 and the distribution of cases is random.

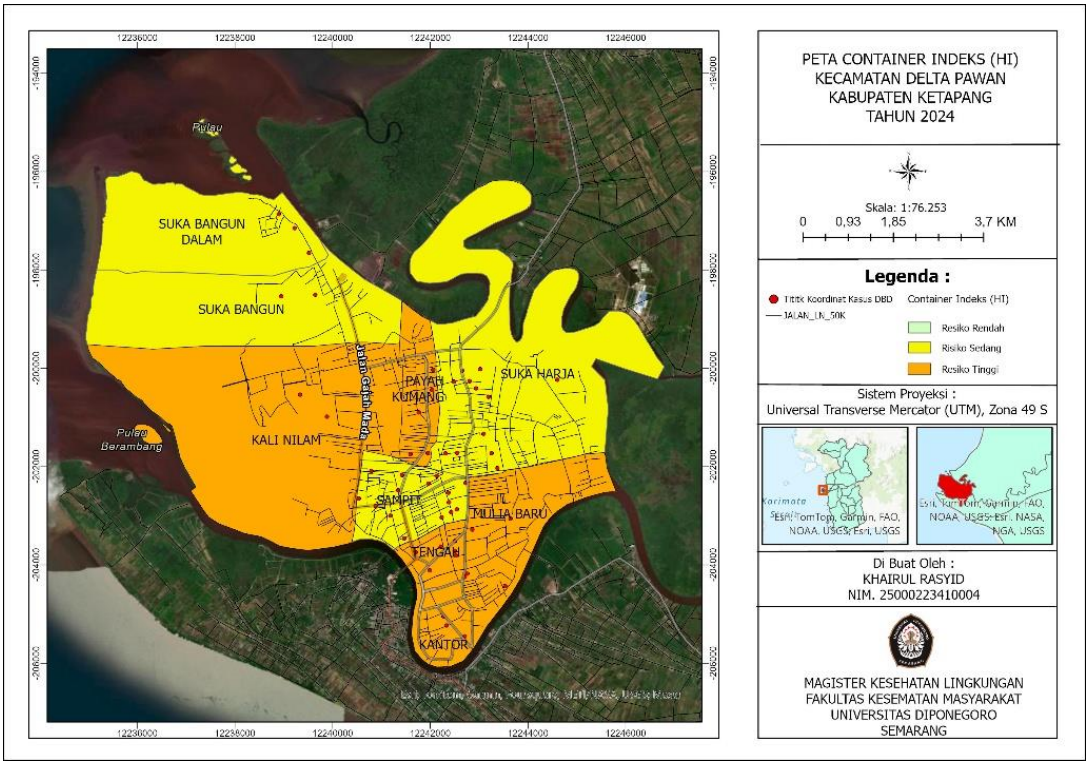

Figure 3. Container Index (CI) Map and distribution of DHF cases in Delta Pawan District in 2024

An examination was conducted on 630 water reservoirs in the Delta Pawan District area, where 135 water reservoirs were found to contain Aedes larvae with a CI value of 21.4%. Classification*Container index (CI)*done by using indicators *Stegomyia* which has been recognized by WHO, the classification is as follows: high risk CI > 20, medium risk CI 3-20 and low risk CI <3 (World Health Organization, 2013). Figure 3 above shows the distribution *index container*in the Delta Pawan District area, where of the nine villages/ sub-districts, five villages/sub-districts are classified as*index container*high risk, namely: Kalinilam Village, Paya Kumang Village, Tengah Village, Kantor Village and Mulia Baru Village. There are four villages/sub-districts with the category*index container* medium risk. The absence of a single village/sub-district that falls into the low-risk category is an indicator that dengue fever will still be a health problem in the Delta Pawan District.

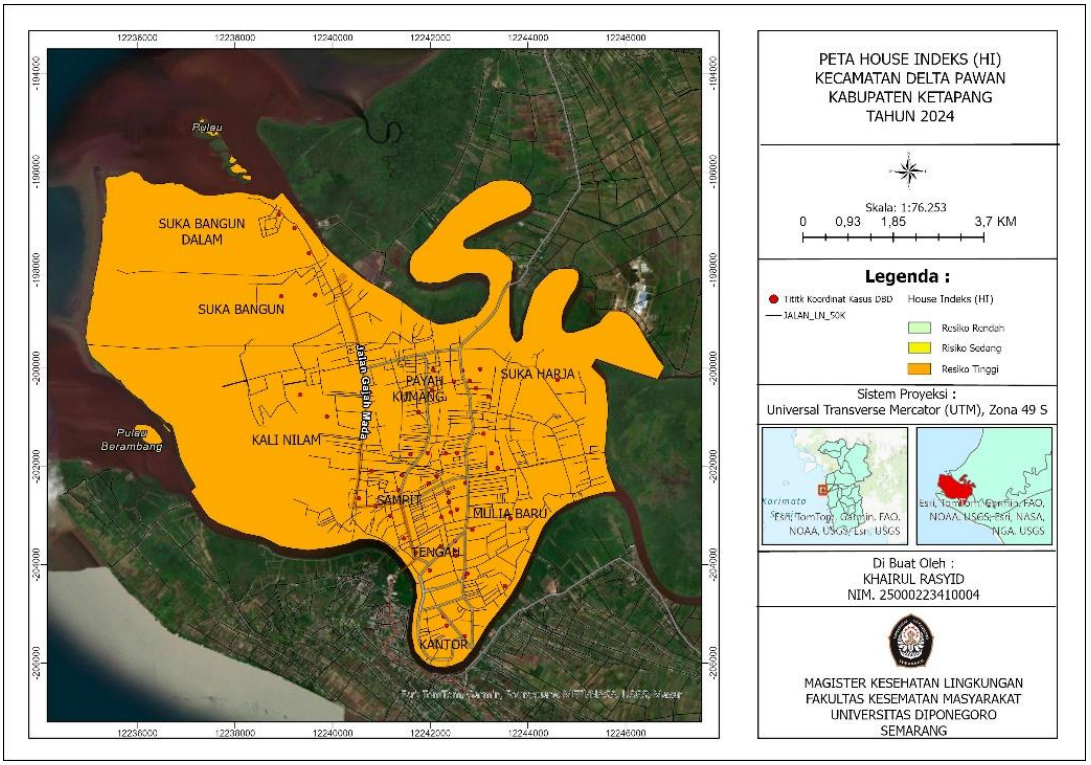

Figure 4 Map of House Index (HI) and Distribution of Dengue Fever Cases in Delta Pawan District in 2019

Larvae examination was conducted in 142 houses (71 case houses and 71 control houses), and 82 houses were found to be positive for larvae, with the House Index percentage being 56.7%. Classification *House index (HI)*done by using indicators *Stegomyia* which has been recognized by WHO, the classification is as follows: high risk HI > 37, moderate risk HI 4-37 and low risk HI <3. Of the nine villages/sub-districts in Delta Pawan sub-district, all are included in the category *House index* high risk.

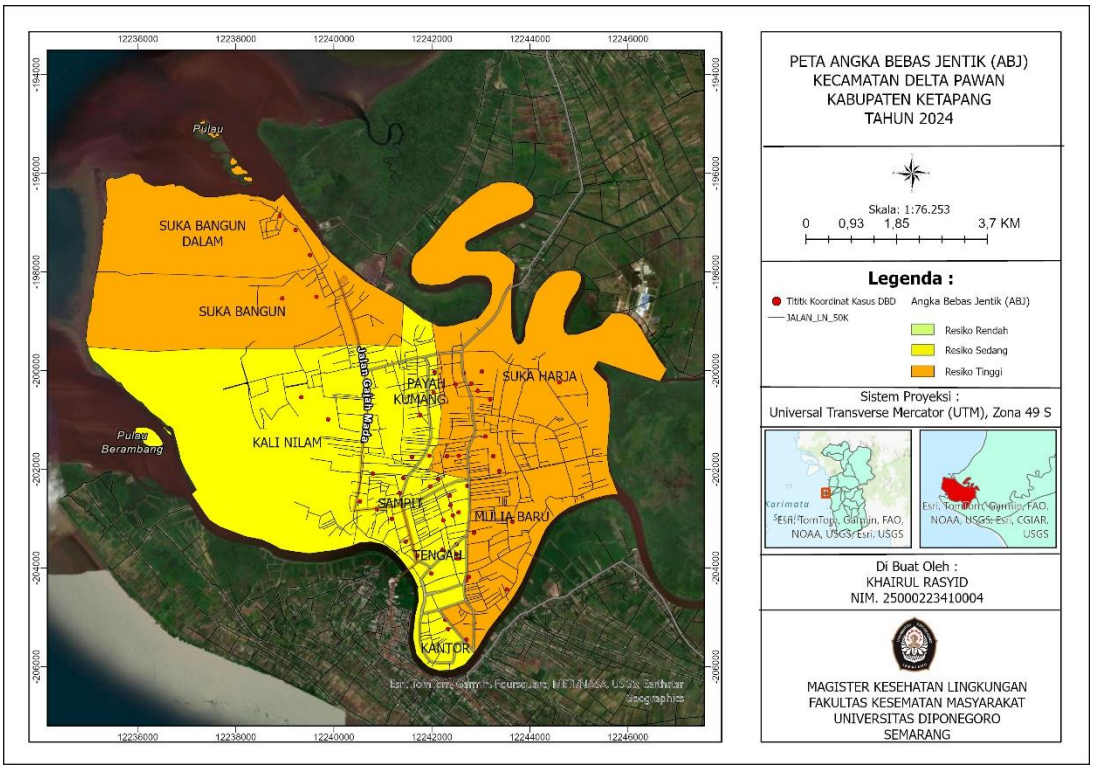

Figure 5 Map of Larvae Free Rate (ABJ) and Distribution of Dengue Fever Cases in Delta Pawan District in 2024

The 2024 Delta Pawan District Larvae Free Rate is 78.57%, this figure is still far from the national larval free rate target of > 95%. The larval free rate is classified into low risk ABJ > 95%, medium risk ABJ 80-95% and high risk ABJ (Larvae Free Rate) <80%.

Bivariate Analysis

Table 3. Distribution of habits of hanging used clothes with DHF incidents

The habit of hanging used clothes	DHF incident				Total	P-Value	OR (95%CI)
	Yes	%	No	%			
Yes	62	87,3	56	78,9	118	0,263	1,845 (0,749-4,547)
No	9	12,7	15	21,1	24		
Total	71	100	71	100	142		

From the test results *Chi-Square*get value *P-value* 0.263 and OR 1.845. So it can be concluded that there is no significant relationship between the habit of hanging used clothes and the incidence of DHF in Delta Pawan District.

Table 4. Distribution of the existence of positive breeding places for larvae with DHF incidents

The house is located breeding place	DHF incident				Total	P-Value	OR (95%CI)
	Yes	%	No	%			
Yes	56	78,9	26	36,6	82	0,000	6,462 (3,062-13,636)
No	15	21,1	45	63,4	60		
Total	71	100	71	100	142		

Test Results *Chi-square* obtained value *P-value* 0.000 with an OR value of 6.462, so it can be concluded that there is a significant relationship between the existence of *breeding place* positive larvae *Aedes* with the dengue fever incident in Delta Pawan District, where the house is located *breeding place* 6.462 times greater risk of dengue fever transmission compared to houses without dengue fever *breeding place* positive larvae *Aedes*.

Table 5. Distribution of habits of cleaning water reservoirs with DHF incidents

The habit of cleaning water reservoirs	DHF incident				Total	P-Value	OR (95%CI)
	Yes	%	No	%			
Yes	41	57,7	22	31	63	0,002	3,044 (1,528-6,063)
No	30	42,3	49	69	79		
Total	71	100	71	100	142		

Test results *Chi-Square* got it *P-value* of 0.002 with an OR of 3.044, so it can be concluded that there is a significant relationship between the habit of cleaning water reservoirs and the incidence of DHF in Delta Pawan District, where houses that do not routinely clean water reservoirs at least once a week have a 3.044 times greater risk of contracting DHF compared to houses that routinely clean water reservoirs at least once a week.

DISCUSSION

The incidence of DHF in Delta Pawan sub-district in 2024 was 56 cases with an IR of 61.4/100,000 population, down compared to 2023 with 1,143 cases with an IR of 434.7/100,000 population. The most DHF cases in Delta Pawan sub-district occurred in Sukaharja Village with 13 cases (IR 87.8/100,000 population) and Sampit Village with 13 cases (IR 76.9/100,000. Of the 9 villages/sub-districts in Delta Pawan Sub-district, there are 6 villages/sub-districts with IR above the national minimum service standard (IR 49/100,000 population). The still high IR rate in villages/sub-districts in Delta Pawan Sub-district indicates that Delta Pawan Sub-district is an endemic area for dengue fever in Ketapang Regency. Based on the analysis *Moran's I spatial correlation* The distribution pattern of DHF cases in Delta Pawan District is random.

The high number of dengue fever cases in Delta Pawan District is partly due to the dense population in Delta Pawan District with a population density of 1,253/km^2. Areas with high population density are ideal places for the spread of dengue fever (DHF) cases. Mosquitoes *Aedes*as a vector, it is easier to find hosts in densely populated areas because there are more food sources (human blood) and suitable breeding grounds for laying eggs. Inadequate sanitation, poor waste management and large amounts of untreated puddles are ideal places for mosquitoes to lay eggs. A dense population is also associated with the ability of mosquitoes to fly in transmitting dengue fever, the denser the population, the easier it is for dengue fever to spread because the estimated flight distance of mosquitoes is around 50-100 m. (Masrizal & Sari, 2016)

The 2024 Delta Pawan District larvae-free rate was 78.57%, House Index 57.7% and CI 21.4%. The ABJ rate is still below the national target of >95%. The HI and CI figures are also above the low-risk category. The larvae-free rate is one of the indicators used in controlling dengue fever vectors. The larvae-free rate measures the percentage of houses or places that are inspected and found to be free of mosquito larvae *Aedes aegypti* which is the main vector of DHF, ABJ data helps determine areas that require further intervention (Rizaldi et al., 2022). The still high HI and CI numbers can be an indicator of the high vector density in this case the Aedes aegypti mosquito in the Delta Pawan District area, resulting in high cases and morbidity rates of DHF that occurred in 2024. One of the risk factors for DHF transmission is vector density, the higher the vector density in an area, the higher the risk of transmission and even DHF in that area (Yuanita et al., 2019). Based on the results of statistical tests using chi-square, it was found that there was no significant relationship between the habit of hanging used clothes and DHF cases in Delta Pawan District with a P-value of 0.263. Research conducted by Istiqomah (2016) showed that the habit of hanging used clothes in children's rooms is not a risk factor for DHF in the age group <15 years. (Istiqomah & Syahrul, 2016). The presence of used clothes hanging can be a resting place for Aedes aegypti mosquitoes, but this is also influenced by the activity patterns of the occupants of the house and the hours when Aedes aedgypti mosquitoes actively bite. Aedes mosquitoes actively bite in the morning at 07 am - 1 pm and in the afternoon at 3 pm – 5 pm.

There is a relationship between positive breeding places for larvae and DHF in Delta Pawan District with a P-Value of 0.000 and OR 6.262. The still high HI, CI numbers and low larva-free numbers in Delta Pawan District indicate that in this area there are still many potential breeding places for mosquitoes to lay eggs and breed, thus increasing the risk of DHF transmission. Research conducted by Shinta Anggraini found a relationship between the presence of larvae and the incidence of DHF in Kedurus Village, Surabaya City, the existence of water reservoirs that are positive for Aedes Aegypti larvae can be a breeding ground for mosquitoes that can spread the dengue virus from one person to another, so that the spread of DHF cases can spread quickly. (Anggraini, 2018).

The results of statistical tests showed a relationship between the habit of cleaning water reservoirs and the incidence of DHF in Delta Pawan District with a p-Value of 0.002 and OR 3.004. The habit of people collecting rainwater or well water using drums, jars, buckets and bathtubs that do not have covers has the potential to become a breeding ground for mosquitoe. (Yuniar et al., 2024). The habit of cleaning water reservoirs regularly at least once a week can break the chain of development of Aedes aegypti mosquitoes, especially in uncovered water reservoirs such as buckets and bathtubs.

CONCLUSION

Delta Pawan District is an endemic district for dengue fever in Ketapang Regency with a dengue fever morbidity rate in 2024 of 61.4/100,000 Population. The still high Containet Index and House Index numbers and the still low Larvae-free Number in the area indicate a high vector population and many breeding places as breeding grounds for Aedes aegypti mosquitoes.

The distribution of dengue fever cases in Delta Paan District in 2024 is random, where all villages/sub-districts have dengue fever cases in 2024. Based on statistical analysis, it was found that there was a relationship between the existence of positive breeding palaces for larvae and the habit of cleaning water reservoirs with the incidence of dengue fever in Delta Pawan District in 2024, while the habit of hanging used clothes was not proven to be statistically significant in having a relationship with the incidence of dengue fever

ACKNOWLEDGMENTS:

Thank you to all parties who have participated in this research.

CONFLICTS OF INTEREST

The authors declare that this study is free from any conflicts of interest

REFERENCES

Anggraini, S. (2018). Hubungan keberadaan jentik dengan kejadian dbd di Kelurahan Kedurus Surabaya. *Jurnal Kesehatan Lingkungan*, *10*(3), 252–258. https://docplayer.info/129027797-Hubungan-keberadaan-jentik-dengan-kejadian-dbd-di-kelurahan-kedurus-surabaya.html

Istiqomah, M., & Syahrul, F. (2016). Faktor Resiko Aktivitas, Mobilitas, Dan Menggantung Pakaian Terhadap Kejadian Demam Berdarah Pada Anak. *Keperawatan Muhammadiyah*, *1*(2), 17.

Kementrian Kesehatan Republik Indonesia. (2023). *Profil Kesehatan Indonesia 2022* (F. Sibuea (ed.)). Kementerian Kesehatan Republik Indonesia. https://www.kemkes.go.id/id/indonesia-health-profile-2022

Ketapang, B. (2024). *Delta pawan dalam angka 2024* (Vol. 15). https://ketapangkab.bps.go.id/id/publication/2024/09/26/d12326d4d2ab6b3c4be7bd0c/kecamatan-delta-pawan-dalam-angka-2024.html

Masrizal, & Sari, N. P. (2016). Analisis Kasus DBD Berdasarkan Unsur Iklim dan Kepadatan Penduduk Melalui Pendekatan GIS di Tanah Datar. *Jurnal Kesehatan Masyarakat Andalas*, *10*(2), 166–171.

Messina, J. P., Brady, O. J., Golding, N., Kraemer, M. U. G., Wint, G. R. W., Ray, S. E., Pigott, D. M., Shearer, F. M., Johnson, K., Earl, L., Marczak, L. B., Shirude, S., Davis Weaver, N., Gilbert, M., Velayudhan, R., Jones, P., Jaenisch, T., Scott, T. W., Reiner, R. C., & Hay, S. I. (2019). The current and future global distribution and population at risk of dengue. *Nature Microbiology*, *4*(9), 1508–1515. https://doi.org/10.1038/s41564-019-0476-8

Rizaldi, M. T. H., Murtilita, & Herman. (2022). Hubungan Angka Bebas Jentik Dengan Kejadian Demam Berdarah Dengue Di Wilayah Kerja Upk Puskesmas Perumnas 2 Pada Tahun 2021. *Program Studi Keperawatan Fakultas Kedokteran Universitas Tanjungpura Pontianak*, *7*(2), 1–18.

Suwandono, A. (2019). *Menilik Perjalanan Dengue Di Jawa Barad* (A. Suwandono (ed.)). LIPI Pres.

Who. (2020). *Vector-borne diseases*. Vector-borne diseases account for more than 17%25 of all infectious diseases, causing more than 700 000 deaths annually. They can be caused by either parasites, bacteria or viruses

Word Health Organization. (2013). *Guidelines For Dengue Surveillance And Mosquito Control* (Second).

Yuanita, Y. N., Setiani, O., & Wahyuningsih, N. E. (2019). Spatial Analysis of Breeding Place and Larva Density Existence with DHF (Dengue Hemorrhagic Fever) Incidence Rate in Pringsewu District, Indonesia. *International Journal of English Literature and Social Sciences*, *4*(5), 1357–1364. https://doi.org/10.22161/ijels.45.17

Yuniar, V. T., Raharjo, M., Martini, M., & Nurjazuli, N. (2024). Hubungan Pengetahuan Dengan Kejadian Demam Berdarah Dengue di Kota Lubuklinggau Sumatera Selatan. *Jurnal Kesehatan Lingkungan Indonesia*, *23*(2), 234–240. https://doi.org/10.14710/jkli.23.2.234-240

Yuniartika, M. D. (2022). National Guideline for Clinical Management of Dengue 2022. In *Who* (Issue 8.5.2017). www.aging-us.com