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Dengue Hemorrhagic Fever (DHF) Incidence in the Aur Duri Health Center Work Area in 2024

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Abstract. *Background: Dengue Hemorrhagic Fever is a health problem that is very rapidly transmitted, especially in endemic areas in Indonesia, one of which is in Jambi City. Indicators of DHF control activities are measured by the incidence rate per 100,000 population (IR) and the mortality rate (CFR). IR in 2018 was 23.28 per 100,000 population and CFR in 2018 was 0.36%. Although there has been a decrease in CFR every year, the incidence of DHF cases and deaths due to DHF still occur every year in 11 districts/cities in Jambi Province. Method: This study aims to analyze the determinants of the incidence of Dengue Hemorrhagic Fever (DHF) in the Aur Duri Health Center Working Area in 2024. The case control study design, the study was conducted from February to September 2024. This study used primary data from 2024 with a sample of 68 respondents. The variables used are Gender, Residential Density, House Condition, Hanging Clothes Habits, 3M Plus Behavior and Cleaning Water Reservoirs. Conclusion: This study found that the variables related to the incidence of DHF in the Aur Duri Health Center work area in 2024 were the variable of hanging clothes (p-value = 0.012); 3M Plus Behavior (p-value = 0.001); and the habit of cleaning water reservoirs (p-value = 0.007). For the community, it is necessary to always increase self-protection efforts and for the Aur Duri Health Center, it can provide training or movements to eradicate or stop the transmission of DHF.*

Keywords: *Behavioral Factors, Characteristic Factors, Dengue Hemorrhagic Fever, DHF.*

1. INTRODUCTION

Indonesia, India, Myanmar, Sri Lanka and Thailand are 5 countries that are included in the 30 countries with the highest endemic levels in the world. The incidence of dengue fever is increasing worldwide with data seen from WHO showing the number of cases as many as 505,430 in 2000 to 5.2 million in 2019 (*A Global Brief on Vector-Borne Diseases* , nd) . Several factors that cause the increasing spread of dengue fever include changes in the distribution of virus-carrying vectors, namely *the Aedes aegypti* and *Aedes albopictus mosquitoes* , especially in countries that have never been affected by dengue fever outbreaks, climate change which usually results in changes in temperature and high rainfall and humidity, as well as political and financial instability in countries facing complex humanitarian crises and high population displacement (*A Global Brief on Vector-Borne Diseases* , nd) .

DHF cases have increased every year in all cities in Indonesia which also have relatively high mortality rates. In 2022, it was recorded in the Indonesian health profile that there were 143,266 cases of DHF with a death toll of 1,237 cases. And it was noted that there was an increase when compared to 2021 (PK Indonesia, 2022) .

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Based on RISKESDAS (Basic Health Research) data in 2024 Jambi City, as of July, 424 cases were found, an increase from 312 cases in 2023. The highest dengue fever cases were in Jambi City, which occurred in Alam Barajo and Kota Baru Districts. Jambi City is one of the endemic areas in Jambi Province. Aur Duri Health Center is a Health Center located in Jambi City, in the working area of Aur Duri Health Center which is also one of the endemic areas for *dengue fever* in Jambi City, data obtained in early 2024 (January-September) showed that there were 25 cases that occurred, which when compared to 2023 only found 9 recorded cases.

dengue fever is to control the dengue fever vector itself. One of the policies that the government has issued is the 3M Plus behavior and PSN (Mosquito Nest Eradication) activities (Implementation, Control, & Fever, 2024) . Vector control is an effort made to suppress or reduce the population of vectors carrying dengue fever to prevent the spread of diseases transmitted through vectors. Control activities require an important role from the community, because Mosquito Nest Eradication (PSN) activities have a very big influence if carried out routinely which will reduce breeding grounds or breeding places for the *Aedes Aegypti mosquito vector* (Hikmawa, Km, Epid, Huda, & Si, 2021) .

Based on the initial survey and initial observations conducted during February 2024 in the Aur Duri Health Center work area of Jambi City, it was found that the cause of the high number of *dengue fever cases* was seen from the lack of community behavior in carrying out 3M PLUS activities and the many open water reservoirs on the grounds that they are rainwater reservoirs which are one of the breeding grounds for mosquitoes in these water reservoirs such as (buckets, drums and also used tires that are not used as places for rainwater to pool). The community's habit of storing water is due to the difficulty or sometimes it is difficult for clean water to enter the community's settlements. The efforts made are also still very small, such as the irregular draining of bathtubs, burying used items that have the potential to collect rainwater and cleaning the environment close to the river. This will affect environmental conditions and cause disease problems for mosquito breeding grounds.

Based on facts, data, theories, previous research and initial survey results, then by looking at the conditions in the working area of the Aur Duri Health Center, Jambi City as one of the endemic areas of DHF, researchers are interested in conducting research related to DHF, with the aim of finding out the relationship between factors of residential density conditions, house conditions, hanging clothes behavior and 3M Plus behavior and the habit of cleaning water reservoirs.

2. LITERATURE REVIEW

DHF is an infectious disease caused by the dengue virus which is usually transmitted by the mosquito vector of *the Aedes aegypti type* . In 1968, it was the first time that cases of *Dengue Hemorrhagic Fever* (DHF) were found in Indonesia, and cases have always increased every year (PK Indonesia, 2022) . DHF often occurs in tropical and subtropical areas with the vector carrying the disease being the *Aedes Aegypti type of mosquito* (Hikmawa et al., 2021) .

The type of mosquito that carries the *dengue virus* is a type of mosquito that can breed in areas with tropical climates, high rainfall and humidity. Another characteristic is that the *aedes aegypti mosquito* likes puddles or clean water reservoirs as a breeding ground (PK Indonesia, 2022) . The spread and increase in the mosquito population causes the virus to become endemic in temperate climates. High rainfall in an area makes the area a place for mosquitoes to lay eggs and breed which will have an impact or influence on the incidence of dengue fever (Hikmawa et al., 2021) . With these characteristics that cause an increase in cases, especially in endemic areas, prevention efforts are issued through 3M PLUS activities (draining, closing, utilizing, maintaining fish that eat larvae, using mosquito repellent, installing wire mesh on every house vent, not hanging clothes behind the door/piling clothes and using *abate*) (PK Indonesia, 2022) .

There are 2 methods of transmission of *Dengue Hemorrhagic Fever* (DHF), namely vertically and horizontally. Vertical, namely infected mosquitoes will bite healthy humans and healthy humans will be infected and sick. Horizontal, namely healthy mosquitoes will bite sick (infected) humans then the mosquitoes will carry the virus from the sick human body then the infected mosquitoes will fertilize the egg cells until the eggs reproduce and the mosquitoes have directly carried the virus from the mosquitoes developing eggs-larvae-pupae-adult mosquitoes and will bite healthy humans again.

Dengue Hemorrhagic Fever (DHF) can occur due to internal and external factors; Internal factors are seen from those related to the human immune system itself. If you have a high immune system, you can fight infections from the *dengue virus* and avoid getting *Dengue Hemorrhagic Fever* (DHF). Therefore, it is very important for people in endemic areas to maintain their immune system during the high rainfall season which is one of the factors that the *aedes aegypti mosquito* carrying the *dengue virus* can breed and spread the *dengue virus* (Kejadian et al., 2021) . External factors can occur due to the presence of mosquito larvae, vector density, housing density, the habit of hanging clothes, the presence of Water Reservoirs (TPA) and so on.

According to Rhis Quatrin Palupy in the working area of the Tangkit Health Center UPT (2021) , it shows that there is a relationship between population knowledge regarding the practice of 3M PLUS and the incidence of DHF and the relationship between respondent behavior and the behavior of closing TPA (Water Reservoirs) to the incidence of DHF (Kejadian et al., 2021) . The results of other researchers, namely Pepti Herlin in the working area of the Peumnas Lahat Health Center UPT (2021), show that there is a relationship between knowledge and the incidence of DHF and there is a relationship between community behavior in maintaining the environment around the house and 4M Plus behavior towards DHF incidents (Lahat, 2021) .

According to Setiawan (2022), there was a relationship between the behavior of hanging clothes in the house and the incidence of dengue fever. This bad habit will increase the risk of dengue fever infection. According to the Indonesian Ministry of Health (18), the habit of hanging used clothes will increase the mosquito population which will be used as a resting place in the house (Benyamin & Nisari, 2023) .

3. METHOD

This study uses a *quantitative method* using a case control design *which* is an analytical epidemiological research design to analyze whether or not there is a relationship between a particular disease and a particular factor and to make a comparison between the case group and the control group based on their exposure status (KKR Indonesia, 2017) . The sample used in this study was 68 samples consisting of 34 cases and 34 controls. In the case population, the total number of respondents affected by DHF from early 2023 to 2024 as of September was taken. The test to be carried out in this study uses the *Chi-Square test* .

4. RESULTS

Relationship of Gender to Dengue Fever Incidence in the Aur Duri Health Center Work Area in 2024

Table 1. Relationship between Gender and DHF Incidence in the Aur Duri Health Center Work Area in 2024

Gender	Dengue Fever Incident				Total		OR	P
	Case		Control					
	n	%	n	%	n	%	(95% CI)	Value
Woman	16	47.1	27	79.4	43	63.2	0.514	0.391
Man	18	52.9	7	30.6	25	36.8		

Amount	34	100	34	100	68	100	0.163-1.624	

Based on the results of the analysis in table 1, it is known that the incidence of DHF in the characteristics of case respondents was 16 (47.1%) female respondents and more than half of them were 18 (52.9%) male respondents, while in the control group there were 27 (79.4%) female respondents and 7 (20.6%) male respondents.

the Chi-Square statistical test analysis obtained *a p-value* = 0.012 > (α = 0.05) so that the hypothesis (Ha) was rejected, which means that there is no relationship between residential density and the incidence of dengue *fever* .

The absence of a relationship between gender and the incidence of DHF could be due to the small number of research samples which do not fully meet or represent the population.

Relationship between Residential Density and Dengue Fever Incidence

Table 2. Relationship between Residential Density and DHF Incidence in the Aur Duri Health Center Work Area in 2024

Residential Density	**Dengue Fever Incident**				**Total**		**OR**	**P**
	Case		**Control**					
	N	**%**	**n**	**%**	**n**	**%**	**(95% CI)**	**Value**
Dense (<1 Person/8m ^{2})	6	17.6	10	29.4	16	23.5	0.514 0.163-1.624	0.391
Not Congested (≥1 person/8m ^{2})	28	82.4	24	70.6	52	76.5		
Amount	34	100	34	100	68	100		

Based on the results of the analysis in table 2, it is known that the incidence of DHF in the case group was 6 (17.6%) respondents who had dense housing density and the majority of respondents 28 (82.4%) had non-dense housing density, while in the control group there were 10 (29.4%) respondents who had dense housing density and 24 (70.6%) respondents with non-dense housing density.

the Chi-Square statistical test analysis obtained *a p-value* = 0.391 > (α = 0.05) so that the hypothesis (Ha) was rejected, which means that there is no relationship between residential density and the incidence of dengue *fever* .

The absence of a relationship between residential density and dengue fever incidence could be due to the small or limited number of research samples which do not fully meet or represent the population.

Relationship between House Conditions and Dengue Fever Incidence

Table 3. Relationship between House Conditions and Dengue Fever Incidents in the Aur Duri Health Center Work Area in 2024

House Condition	Dengue Fever Incident				Total		OR	P
	Case		Control					
	n	%	n	%	n	%	(95% CI)	Value
Not Permanent	17	50.0	16	47.1	33	48.5	1.125 0.434-2.913	1,000
Permanent	17	50.0	18	52.9	35	51.5		
Amount	34	100	34	100	68	100		

Based on the results of the analysis in table 3, it is known that the incidence of DHF in the case group was 17 (50.0%) respondents who had non-permanent housing conditions and 17 (50.0%) respondents who had permanent housing conditions, while in the control group there were 16 (47.1%) respondents who had non-permanent housing conditions and more than half of the respondents 18 (52.9%) had permanent housing conditions.

the Chi-Square statistical test analysis obtained *a p-value* = 1,000 > (α = 0.05) so that the hypothesis (Ha) was rejected, which means that there is no relationship between home conditions and the incidence of dengue *fever* .

The absence of a relationship between housing conditions and the incidence of DHF could be due to the small number of research samples which do not fully meet or represent the population.

The Relationship Between Hanging Clothes Habit and Dengue Fever Incidents

Table 4. The Relationship Between Hanging Clothes Behavior and Dengue Fever Incidence in the Aur Duri Health Center Work Area in 2024

Hanging Clothes Behavior	Dengue Fever Incident				Total		OR	P
	Case		Control					
	n	%	N	%	n	%	(95% CI)	Value
Bad habit of hanging clothes	15	44.1	30	88.2	45	66.2	0.105 0.030-0.65	0.000
Good habit of hanging clothes	19	55.9	4	11.8	23	33.8		
Amount	34	100	34	100	68	100		

Based on the analysis results in table 4. It is known that the incidence of DHF in the case group was 15 (44.1%) respondents who had bad habits in hanging clothes and more than

half of the respondents 19 (55.9%) had good habits in hanging clothes, while in the control group there were most of the respondents 20 (88.2%) who had bad habits in hanging clothes and only 4 (11.8%) respondents who had good habits in hanging clothes.

the Chi-Square statistical test analysis obtained *a p-value* = 0.000 < (α = 0.05) so that the hypothesis (Ha) is accepted, which means that there is a relationship between the habit of hanging clothes and the incidence of *dengue fever* .

Relationship between 3M+ Behavior and Dengue Fever Incidents

Table 5. Relationship between 3M Plus Behavior and Dengue Fever Incidents in the Aur Duri Health Center Work Area in 2024

3M Plus Behavior	Dengue Fever Incident				Total		OR	P
	Case		Control					
	N	%	N	%	n	%	(95% CI)	Value
Bad behavior 3M+	11	32.4	25	73.5	36	52.9	0.172 0.060-0.491	0.001
Good Behavior 3M+	23	67.6	9	26.5	32	47.1		
Amount	34	100	34	100	68	100		

Based on the results of the analysis in table 5, it is known that the incidence of DHF in the case group was 11 (32.4%) respondents who had bad behavior in 3M Plus behavior and most of the respondents 23 (67.6%) had good behavior in 3M Plus behavior, while in the control group there were most of the respondents 25 (73.5%) had bad behavior in 3M Plus behavior and there were 9 (26.5%) respondents who had good behavior in 3M Plus behavior.

Chi-Square statistical test analysis obtained *a p-value* = 0.001 < (α = 0.05) so that the hypothesis (Ha) is accepted, which means that there is a relationship between 3M Plus behavior and the incidence of *dengue fever* .

Relationship between Landfill Cleaning Habits

Table 6. Relationship between TPA Plus Cleaning Habits and Dengue Fever Incidents in the Aur Duri Health Center Work Area in 2024

Landfill Cleaning Habits	Dengue Fever Incident				Total		OR	P
	Case		Control					
	n	%	n	%	n	%	(95% CI)	Value
Bad habits of cleaning landfills	13	38.2	25	73.5	38	55.9	0.223	0.007

Good habits of cleaning landfills	21	61.8	9	26.5	30	44.1	0.08-0.624	
Amount	34	100	34	100	68	100		

Based on the results of the analysis in table 6, it is known that the incidence of DHF in the case group was 13 (38.2%) respondents who had bad habits in cleaning water reservoirs (TPA) and more than half of the respondents 21 (61.8%) had good habits in cleaning water reservoirs (TPA), while in the control group, most of the respondents 25 (73.5%) had bad habits in cleaning water reservoirs (TPA) and there were 9 (44.1%) respondents who had good habits in cleaning water reservoirs (TPA).

the Chi-Square statistical test analysis obtained *a p-value = 0.007 < (α = 0.05) so that the hypothesis (Ha) is accepted, which means that there is a relationship between the habit of cleaning water reservoirs (TPA) and the incidence of dengue* fever .

5. DISCUSSION

Relationship of Gender to Dengue Fever Incidence in the Aur Duri Health Center Work Area

The gender of respondents is grouped into 2 categories, namely male and female. Male respondents numbered 25 respondents with more than half of them being DHF sufferers 18 (52.9%) and in the control group the number of male respondents was found to be 7 (30.6%), in female respondents there were 43 respondents, of whom 16 (47.1%) were DHF sufferers and more than half 27 (79.4%) were controls.

Based on the results of the research analysis obtained, it was found that there was no relationship between gender and the incidence of DHF with a p value of 0.012.

The results of this study are not in line with the research of Herlina Susmaneli (2021) (Susmaneli, 2011) which shows that there is a relationship between gender and the incidence of DHF, the p value = 0.613 is influenced or supported by research analysis which states that there are more of one characteristic (male respondents) in the research area so that respondents with these characteristics are more at risk of contracting DHF.

The results of this study are in line with the research of Erika Amelia Idris, et al. (2021) (Idris & Zulaikha, 2021) who said that this is in line with the characteristics recorded in Indonesian society that women are more numerous than men. In terms of data processing, this could be because the number of samples used was relatively small (few) and could also occur due to randomization that did not match the characteristics of the recorded DHF cases.

Relationship between Residential Density and Dengue Fever Incidence in the Aur Duri Health Center Work Area

Based on the results of the research analysis obtained, it was found that there was no relationship between residential density and the incidence of DHF with a p value = 0.391.

The results of this study are not in line with Agung Setiawan, et al. (2020) (Study, Health, & University, 2020) who stated that there is a relationship between residential density and the incidence of DHF with a p value = 0.027, with dense housing conditions being a major risk factor for rapid spread within the home.

The results of the study are in line with the research of Andre Utama Saputra, et al. (2023) who also produced a study stating that residential density has no effect on the incidence of DHF with a p value = 0.128. Thus, it can be concluded that the results of previous studies obtained the same thing as the researchers obtained that residential density is not related to the incidence of DHF. This can happen because the number of samples used is relatively small (few) which does not meet or is not representative of the existing population.

Relationship between House Conditions and Dengue Fever Incidents in the Aur Duri Health Center Work Area

Based on the results of the research analysis obtained, it can be seen that there was no relationship between residential density and the incidence of DHF with a p value = 1,000.

The results of this study are in line with Nur Purwoko Widodo's research, also producing research that states that the habit of home conditions affects the incidence of DHF with a p value = 0.279. Thus it can be concluded that the results of previous studies found the same thing as the researchers found that home conditions are not related to the incidence of DHF.

This incident can occur due to supporting factors from the habits of mosquitoes that prefer dark, damp, closed resting places and rarely have direct contact or are touched directly by humans such as clothes hangers behind doors or untidy folds of clothes and also bathtubs that are rarely cleaned as resting places and also as places for *aedes aegypti mosquitoes* to lay their eggs.

The Relationship between the Habit of Hanging Clothes and the Incidence of Dengue Fever in the Work Area of the Aur Duri Health Center

The results of the study on the variable of the habit of hanging clothes with the incidence of DHF in the working area of the Aur Duri Health Center in 2004 showed the results of p =

0.000. By saying the results that the p value < (α = 0.05) indicates that there is or there is a relationship between hanging clothes and the incidence of DHF. From the results of these respondents, it can be said that the community has a great opportunity or great chance of suffering from DHF.

The results of this study are in line with the research of Enggar Prasety, et al. (2023), regarding the determinants that influence the incidence of DHF in the work area of the PALI Regency Health Office with a p value = 0.012 (Prasetyo et al., 2023) . The research of Mohamad Ilham Maulana Latif, et al. (2019) also found that the habit of hanging clothes influenced the incidence of DHF in Banyumas Regency with a p value = 0.027 (Ilham, Latif, Anwar, & Cahyono, 2019) . Thus, it can be concluded that the results of previous studies found the same thing as the researchers found that hanging clothes influenced the incidence of DHF.

Based on the research results, it shows that the behavior of respondents who hang clothes or put clothes carelessly occurs due to bad behavior such as not immediately folding clothes after they are dry and always reusing clothes that have been used once and not immediately taking action to wash clothes that have been worn.

Bad hanging clothes behavior will potentially make mosquitoes use hanging clothes as a resting place because it is dark and damp after sucking human blood. Therefore, the bad habit of hanging clothes must be stopped so that it does not become a resting place for mosquitoes to nest and breed which will ultimately have a negative impact on society. It is better to immediately put new clothes in a container that has a lid or wash them immediately and clothes that have dried can be immediately folded and put into the closet so that they do not become a resting place for mosquitoes.

Relationship of 3M+ Behavior to Dengue Fever Incidents in the Aur Duri Health Center Work Area

The results of the study on 3M+ behavior with the incidence of DHF in the Aur Duri Health Center work area in 2024 showed a result of p = 0.001. Finding a conclusion in the form of a result of p < (α = 0.05) which states that there is or there is a relationship between 3M+ behavior and the incidence of DHF. From the results of these respondents, it can be said that the community has a great opportunity or great chance of suffering from DHF.

The results of this study are in line with the research of Mohamad Ilham Maulana Latif, et al. (2019) who also found that 3M+ behavior influenced the incidence of dengue fever in Banyumas Regency with a p value of 0.015 (Ilham et al., 2019) . Research by Novia Hendayani, et al. (2022) also said something similar that 3M+ behavior was related to the incidence of

dengue fever with a p value of 0.010 (Fever, Dengue, Di, & Work, 2022) . Thus, it can be concluded that the results of previous studies found the same thing as the researchers found that 3M+ behavior was related to the incidence of dengue fever.

Based on the research that has been conducted, it shows that the behavior of respondents who are lacking in 3M Plus actions is due to having a habit of storing used goods until they accumulate a lot, then those that can be used will be reused and if they cannot be reused, they will be thrown away or sold, for the behavior of burying used goods due to the lack of land that respondents have and taking action if they are not reused, they will be thrown away or sold, then on the attitude of using lotion to avoid mosquito bites, some respondents also prefer to use mosquito repellent or even not use both because they think that there are no mosquitoes in the respondent's house.

Dengue fever can occur due to people's behavior that does not pay attention to small things around them. People still have little understanding that self-participation is the main thing that must be applied to eradicate mosquito nests, one method is the application of 3M+ either through physical, chemical or biological means. 3M+ behavior is behavior that is applied to control mosquito breeding places and avoid direct contact of the human body with mosquito bites as a form of breaking the chain of dengue fever transmission which is expected to reduce and suppress the incidence of dengue fever.

The Relationship between the Habit of Cleaning Water Reservoirs (TPA) and the Incidence of Dengue Fever in the Work Area of the Aur Duri Health Center

The results of the study on cleaning water reservoirs with the incidence of DHF in the Aur Duri Health Center work area in 2024 showed a result of p = 0.007. With the conclusion that $p < (\alpha = 0.05)$ says there is or there is a relationship between cleaning water reservoirs and the incidence of DHF. From the results of these respondents, it can be said that the community has a great opportunity or great chance of suffering from DHF.

The results of this study are in line with the research of Andre Utama Saputra, et al. (2023) who also produced a study stating that the habit of cleaning water reservoirs affects the incidence of dengue fever with a p value of 0.000 (Saputra, Ariyani, & Dewi, 2023) . Research by Rhis Quartin (2021) also said something similar that the habit of cleaning water reservoirs is related to the incidence of dengue fever with a p value of 0.001 (Kejadian et al., 2021) . Thus, it can be concluded that the results of previous studies found the same thing as the researchers found that the habit of cleaning water reservoirs is related to the incidence of dengue fever.

Based on the results of the research that has been done, it was found that the bad behavior of respondents occurred because of the water storage facilities owned or the water storage facilities that respondents had, the behavior of cleaning water storage facilities within a minimum period of 1 time a week did not occur because it was influenced by the water storage facilities themselves, for example only having buckets and drums. In the use of abate, there was also a great lack of respondents' use of water storage facilities because abate itself would only be facilitated if there was a case encountered or taken directly to the health center.

Draining water reservoirs (containers) is very important to be done routinely at least once a week to prevent mosquitoes from laying their eggs in the water reservoir or to prevent mosquitoes from breeding. If the cleaning of water reservoirs is carried out routinely by the community, it will potentially suppress the population of *aedes aegypti mosquitoes* which will have a good impact and break the chain of spread or transmission of dengue fever.

6. CONCLUSION

The research conducted by the researcher led to the following conclusions: There is no relationship between residential density and dengue fever incidence in the Aur Duri Health Center Working Area in 2024. Similarly, no relationship was found between housing conditions and dengue fever incidence in the same area. However, a significant relationship exists between the habit of hanging clothes and the incidence of dengue hemorrhagic fever (DHF). Additionally, 3M Plus behavior is associated with DHF incidents in the Aur Duri Health Center Working Area. Furthermore, the habit of cleaning water reservoirs (TPA) also shows a relationship with the incidence of dengue fever in the area.

LIMITATIONS

The research conducted had several limitations, including the reliance on data collected through interviews and observations using questionnaires and observation sheets, making the success of the data dependent on the respondents' understanding and honesty in answering each statement and question. Additionally, there was a possibility of information bias due to the random sampling of controls without considering characteristics similar to the cases. Furthermore, bias may have occurred in the information provided by respondents, as interviews and observations depended on the accuracy and truthfulness of their responses.

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