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Research Article

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Relationship of Climate, Environmental Health Intervention with the Incident Rate (IR) of Dengue Hemorrhagic Fever Case in North Jakarta, 2017-2019

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Abstract

The issue of climate change has been hotly discussed considering its serious impact on various aspects of life, especially health. The negative potential or risk of climate change to health has been seen as a global challenge that can threaten human livelihoods. This climate change has resulted in changing disease patterns in society due to a changing climate and environment. The increase in temperature has the potential to be associated with a significant increase in cases of Dengue Hemorrhagic Fever (DHF). This research was a descriptive with an ecological time series design to describe the frequency and distribution of health problems or the correlation between disease and the factors that influence it. The purpose of this study was to determine the relationship between climate, environmental health interventions and the incidence of dengue fever. The results of climate conditions in North Jakarta in 2017 to 2019 average normal air temperature 28.480C, high humidity 74.94%, medium rainfall 136.37 mm, wind speed classified as low 1.30 knots, active waste bank environment 162.66, DHF incident rate 47.86 below national standards 49/100,000 inhabitants. The results of the bivariate factors associated with IR DHF were humidity p 0.006, larva free rate 0.003, waste bank 0.009, rainfall 0.190, and wind speed 0.474. The final model factors related to IR DHF were humidity p value 0.000, R0.741, R Square 0.550; Rainfall p value 0.005, R 0.407, R Square 0.165, Larvae Free Rate R 0.296, R Square 0.088. The conclusion of these three factors contributed to the incidence of DHF R 0.952 meaning that the relationship was very strong, R Square 0.906 (90.6%) contributed to the IR DHF in North Jakarta. Suggestions in the environment that the humidity was not high around 45%-60%, larvae free rate < 95%. Precipitation >100 mm DHF have alert.

Keywords: Climate, Environmental, DHF

Background

Changes in disease patterns in the community are caused by changing climate and environmental conditions, temperature increases are significantly associated with cases of Dengue Hemorrhagic Fever (DHF), apart from climate change, namely temperature, rainfall and relative humidity, but also caused by growth and distribution. population, urbanization, lack of sanitation, increased human movement, inappropriate vector control, and capacity to carry out surveillance [1].

An infectious disease caused by the dengue virus (DENV) is Dengue Hemorrhagic Fever (DHF) where the dengue virus (DENV) is from the Flaviviridae virus family where the virus is transmitted to humans through vector intermediaries, especially the Aedes aegypti mosquito [2]. Breeding places for Aedes aegypti mosquitoes are in tree holes or containers filled with water and humans as a source of blood for Aedes aegypti mosquito food, globally tropical and subtropical areas become human habitation and mosquito spread so that these areas are a source of dengue epidemics [3]. The development of dengue cases globally is increasing, from 980 cases in almost 100 countries in 1954-1959 to 1,016,612 cases in almost 60 countries in 2000-2009 [4].

In DKI Jakarta, the number of patients with Dengue Hemorrhagic Fever (DHF) in 2018 was 3,007 cases, with an incidence rate of 28.7 per 100,0000 populations, compared to the previous year's 3,333 cases (IR 32.13), DHF cases decreased. This is due to the increasing quality of the environment and people's lives in the DKI Jakarta area, public awareness to carry out the mosquito nets eradication program with source reduction (3M Plus) and the success of the DHF program in the DKI Jakarta area. In 2018, only one death from dengue was reported, namely from the South Jakarta area. In 2019, from 10,156 cases (CFR= 0.00) with number of larvae free as many as 89%.

DKI Jakarta Province has a tropical and wet climate with rainfall of 30-50 mm per day, temperatures ranging from 24° – 29° C, with an average temperature of 27° C, with an average humidity of 70% -90%. This climatic condition was in accordance with Prasetyo research (2013) that cases of Dengue Hemorrhagic Fever (DHF) will increase at air temperatures between 25.5oC - 28.5oC and rainfall between 3mm - 374mm [5].

DHF cases if not carried out in an integrated and consistent control will continue to increase from year to year [6]. Integrated control of dengue cases can be done with environmental intervention, because intervention is not possible on climate. Environmental intervention involves community components in its implementation, while in the implementation of implementation there are still problems in Indonesia, especially in DKI Jakarta, environmental health interventions are carried out, namely by reducing the density of larvae and pupae, the activities carried out are eliminating Aedes aegypti breeding grounds, waste management at the community level by managing as well as the use of insecticides/larvicides [7].

The Eradication of Dengue Hemorrhagic Fever (DHF) was a control activity and one of the environmental health intervention activities mandated in the Decree of the Minister of Health 581 of 1992 by implementing the Eradication of Mosquito Nets (source reduction of larvae breeding place), and efforts to increase community capacity continue to be improved in source reduction (drain of bathtub, bury used goods, closed of container) mobilization in an effort to reduce the Aedes mosquito population. aegypti and maintain a healthy environment [8]. In controlling mosquito breeding sites cannot be separated from trash and waste, so that good waste and waste management in households and the environment was one factor to reduce breeding and vector populations. The Ministry of Health has developed Community-Based Total Sanitation (STBM) which consists of 5 pillars, namely: Stop Open Defecation, Washing Hands with Soap, Drinking Water Management, Waste Management, and Liquid Waste Management. The pillars that are closely related to the Aedes aegypti mosquito breeding grounds are the pillars of waste and liquid waste management. In the North Jakarta City Administration area from 2009 to 2019 there was a decrease in dengue cases with climatic conditions in North Jakarta from 2009 to 2019 the average temperature was 28,480C with an average humidity of 60% to 89%. The condition of environmental quality management and community life in the North Jakarta area, increased public awareness to carry out mosquito nets eradication programs with source reduction(drain of bathtub, bury used goods, closed of container plus)

Method of Research

This research was an observational study with an ecological time series design that utilizes secondary data. This study was used because the Incidence Rate data for dengue fever cases and data on climatic factors, air temperature, rainfall, humidity and wind speed are aggregate data, so that the data analyzed is population data, not individual data. Sampling was carried out by observing the monthly report data of the North Jakarta Sub-department of Health for 3 years from 2017-2019. The unit of analysis was the reported community with dengue fever in the North Jakarta Sub-dept. The data used in this study was secondary data from monthly and annual reports. The data collected includes: data on DHF sufferers, climate data (air temperature, rainfall, rainy days, humidity, wind speed) and environmental health interventions in waste management at the community level in the North Jakarta City Administration during 2017-2019. The data obtained were then tested using parametric analysis, namely by simple linear regression for bivariate analysis, for multivariate analysis using multiple linear regression with a 95% confidence level.

Results of Research

Univariate Analysis

The results of research conducted in North Jakarta Administrative City informed that data on the incidence of DHF from 2017 to 2019 was an average of 47.86 cases which is described in table 1:

Table 1: Results of Univariate Analysis of DHF Incidence Rate Based on Climate Elements and Environmental Health Interventions in North Jakarta Administrative City in 2017-2019

Variable	Mean	Median	± SD	Min-Max
DHF IncidentRate	47,86	39,66	32,48	10,67-111,33
Rain Rate	136,37	109,75	114,49	11,20-407,37
Temperature	28,58	28,60	0,54	27,56-29,36
Moisture	74,94	74,77	3,90	69,37-81,62
Wind Speed	1,30	1,33	0,33	1-2
Active Trash Bank	162,66	158,16	20,80	129,33-199
Larva Free Rate	93,92	94,88	3,09	85,05-95,95

Judging from the distribution of Incidence Rate cases of dengue fever with the average value (mean) of cases in 2017-2019 was 47.86 cases, the median value (median) was 39.66, the value of the data distribution (standard deviation) was 32.48 while the minimum value of the Incidence Rate of fever cases bleeding amounted to 10.67 and a maximum of 111.33 cases. Analysis of rainfall that occurred in the Administrative City of North Jakarta in 2017-2019 the average (mean) rainfall was 136.37 mm, the median value was 109.75 mm, the data distribution value (standard deviation) was 114.49 while the minimum rainfall value was rain of 11.20 mm and a maximum of 407.37 mm. The results of the analysis of air temperatures that occurred in the Administrative City of North Jakarta

obtained information in 2017-2019 the average (mean) air temperature was 28.58oC, the median value (median) was 28.60oC, the data distribution value (standard deviation) was 0.54 while the minimum value of air temperature is 27.56oC and maximum was 29.36oC. The results of the humidity analysis in the North Jakarta Administration City obtained information in 2017-2019 the average value (mean) of humidity was 74.94%, the median value (median) was 74.77%, the data distribution value (standard deviation) was 3.90 while the minimum value of air temperature of 69.37% and a maximum of 81.62%. For wind speeds that occur in North Jakarta Administrative City with the average (mean) wind speed in 2017-2019 is 1.30 knots, the median value was 1.33 knots, the data distribution value (standard deviation) is 0.33 while the minimum value is 0.33 knots. wind speed of 1 knot and a maximum of 2 knots. The results of the analysis of active waste banks in North Jakarta Administrative City obtained information that in 2017-2019 the average value (mean) of active waste banks was 162.66 waste banks, the median value was 158.16 waste banks, the data distribution value (standard deviation) was 20.80 while the minimum value of air temperature was 129.33 waste banks and a maximum of 199 waste banks. From the results of the analysis, it was obtained information that the larva-free rate in the North Jakarta Administrative City obtained information in 2017-2019 the average value (mean) of the larva-free number was 93.92%, the median value was 94.88%, the data distribution value (standard deviation) was 3.09 while the minimum value of air temperature was 85.05% and the maximum was 93.92%.

Bivariate Analysis

Bivariate analysis was used to determine the relationship between two variables, namely the independent and dependent variables. The relationship analyzed was determined between climatic factors including air temperature, rainfall, rainy days, humidity, and wind speed with Incidence Rate cases of dengue fever and environmental health intervention factors which include source reduction of larvae, waste management with Incidence Rate cases of dengue fever in the North Jakarta Administrative Region. The results of the bivariate analysis were as follows:

Table 2: The Relationship Between Climate Elements & Environmental Health Interventions with the Incidence Rate of DHF in North Jakarta Administrative City in 2017-2019

Variables		R	R Square	P-value.	95% Confidence Interval for B	
					Lower Bound	Upper Bound
1	(Constant)	.713[a]	.508	.002	102.325	355.349
	Waste Bank			.009	-1.885	-.341
2	(Constant)	.296[a]	.088	.431	-909.456	420.098
	Number of Larvae Free			.350	-3.960	10.189
3	(Constant)	.349[a]	.122	.232	-485.504	1779.65
	Temperature			.266	-60.588	18.65
4	(Constant)	.741[a]	.550	.011	-709.100	-119.044
	Humidity			.006	2.232	10.096
5	(Constant)	.407[a]	.165	.049	.169	64.080
	Rainfall			.190	-.067	.298
6	(Constant)	.229[a]	.052	.655	-71.548	108.770
	Wine Speed			.474	-44.693	89.502

The results of the statistical test of the relationship explained that the relationship between waste banks and the incidence rate of dengue fever cases was significant with a p value of 0.002, the relationship was strong with a value of R 0.713 with the contribution of waste banks to the incidence rate of dengue fever cases was 50.8%. The relationship between the larvae-free rate and the incidence rate of dengue fever cases was not significant with a p value of 0.431, the relationship was weak with a value of R 0.296, while the contribution of the larvae-free rate to the incidence rate of dengue cases was 8.8%. The relationship between air temperature and the incidence rate of dengue fever cases was not significant with a p value of 0.232, the relationship was moderate with a value of R 0.349, while the contribution of air temperature to the incidence rate of dengue fever cases was 12.2%. The relationship between humidity and the incidence rate of dengue fever cases was significant with p value 0.011, the relationship was strong with R 0.741 while the contribution of humidity to the incidence rate of dengue fever cases was 55.0%. The relationship between rainfall and the incidence rate of dengue fever cases was significant with p value 0.049, the relationship was moderate with R 0.407 while the contribution of rainfall to the incidence rate of dengue fever cases was 16.5%. The relationship between wind speed and the incidence rate of dengue fever cases was not significant with p value 0.655, the relationship was weak with R 0.229 while the contribution of wind speed to the incidence rate of dengue fever cases was 5.2%).

Multivariate Analysis

Multivariate analysis, this analysis aims to see the most significant independent variable with the dependent variable. Multivariate analysis used is by using multiple linear regression analysis with 95% confidence level. The results of the analysis are as follows.

Table 3: Final Multivariate Analysis between Climate Variables, Public Health Interventions with Incidence Rate cases of dengue fever in the North Jakarta Administrative City Region in 2017-2019

Model	R	R Square	Unstandardized Coefficients		Stand. Coeff	t	Sig.	95% Confidence Interval for B	
			RR	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)			-1279.977	171.267		-7.474	.000	-1674.920	-885.034
Free Larva Rate	.296	.088	4.797	1.157	.456	4.145	.003	2.129	7.466
Moisture	.741	.550	12.096	1.666	1.455	7.262	.000	8.255	15.937
Rain Rate	.407	.165	-.215	.056	-.756	-3.804	.005	-.345	-.084
Relationship rate combination (R): 0.952 Coefficient rate combination (R Square): 0.906 (90,6%)									

The results of the final multivariate analysis showed that there were 3 variables that contributed to the incidence of DHF, namely that humidity was 12 times more related to the incidence of DHF, with a value of p value 0.000, with a contribution of R 0.741, while the linear relationship was very strong with a contribution to the Incidence Rate of dengue cases in the region. the administrative city of North Jakarta by 55.0%. Less rainfall contributed to the incidence of DHF by 40.7%. while the larva-free rate with a value of p value 0.003 correlated 4 times more for the incidence rate of DHF. Of these three factors when carried out together, the relationship is very strong with the Incidence Rate of dengue fever cases with R 0.952 and these three variables contribute 90.6%, the rest are other factors not examined.

Discussion

Relationship between Rainfall and Incidence Rate of DHF

Rainfall in North Jakarta Administrative City in 2017-2019 the average (mean) rainfall is 136.37 mm, the median value is 109.75 mm, the data distribution value (standard deviation) is 114.49 while the minimum rainfall value is 11.20 mm and a maximum of 407.37 mm. The statistical test results of the relationship between rainfall and the incidence rate of dengue fever cases were significant with p value = 0.049, the relationship was moderate with r = 0.407 while the contribution of rainfall to the incidence rate of dengue fever cases was 16.5%. The results of this study are in accordance with research conducted in the city of Semarang where the results of the correlation test show that rainfall has a moderate relationship strength and the direction of the relationship is positive and significant with R 0.438 and p value 0.000 [9]. However, there are differences from research conducted in the city of Ternate where rainfall correlates with the incidence of DHF with a weak correlation [10]. In an international study, it was stated that rainfall showed that the prevalence of dengue infection in Thailand may depend on rainfall with R 0.780 and significant with p<0.05 [11]. During 2017-2019 in the North Jakarta Administrative City Area the average rainfall was 136.37 mm, this condition is a suitable rainfall condition for the breeding of dengue fever mosquitoes, namely rainfall between 100-300 mm [12].

Relationship of Air Temperature with Incidence Rate of DHF

The air temperature that occurred in the Administrative City of North Jakarta obtained information in 2017-2019 the average (mean) air temperature was 28.58oC, the median value (median) was 28.60oC, the data distribution value (standard deviation) was 0.54 while the minimum value air temperature of 27.56oC and a maximum of 29.36oC. The results of the bivariate test of the relationship between air temperature and Incidence Rate of dengue fever cases were not significant with p value 0.232, the relationship was moderate with r = 0.349 while the contribution of air temperature to the incidence rate of dengue fever cases was 12.2%. This is in line with research conducted in Palu City where temperature with the incidence of DHF has a weak strength with r = 0.145 and has a positive pattern with no significant relationship (p = 0.270) [13]. Research conducted internationally shows that there is a significant correlation between the incidence of DHF with a value of p value 0.007 and has a moderate correlation of r = 0.426, as well as those conducted in China, the relationship between air temperature and the incidence of DHF has positive relationship with p value 0.008 and significantly affect the value of p = 0.0001 [1]. The optimum temperature for average mosquito growth ranges from 25°C to 27°C. And mosquitoes will stop to grow and develop at temperatures less than 10 ° C or more than 40 ° C [14]. For temperatures that match the case of dengue fever, it can be said that all cases of dengue fever occur in the temperature range of 22.5 - 29.5oC, and the optimal temperature when the peak of dengue cases occurs is 25.5 - 27.5oC [15]. For temperatures in the North Jakarta Administration area, the average in 2017-2019 was 28.58oC so that at this temperature the growth of mosquitoes may be able to develop, but not optimally.

Relationship of Humidity with Incidence Rate of DHF

The results of the humidity analysis in the North Jakarta Administration City obtained information in 2017-2019 the average value (mean) of humidity was 74.94%, the median value (median) was 74.77%, the data distribution value (standard deviation) was 3.90 while the minimum value of air temperature of 69.37% and a maximum of 81.62%. The relationship between humidity and the incidence rate of dengue fever cases was significant with p value 0.011, the relationship was strong with R 0.741 while the contribution of humidity to the incidence rate of dengue fever cases was 55.0%. This was in line with research conducted in Semarang City where humidity has a moderate correlation with R 0.548 and p value0.000 where air humidity is proven to have a significant effect on dengue cases, but this is not in line with the results research conducted in Palu City which resulted in a weak correlation with the incidence of DHF (-0.81) and a negative pattern and there was

no significant relationship (p value 0.538) [9, 13]. The results of research conducted internationally there was a significant relationship between humidity and DHF with a value of p value 0.001 and has a negative correlation strength with a value of R-0.151 [16]. Humidity less than 60% will affect the lifespan of mosquitoes. Mosquito lifespan will be short and cannot be a vector because there is not enough time to transfer the virus from the stomach to the salivary glands. The average humidity ranges from 83% -88% while the maximum for mosquito life ranges from 70% - 90% [14]. Effect of temperature and relative humidity on dengue virus propagation in mosquitoes as one of the contributing factors to dengue hemorrhagic fever (DHF) outbreaks [17]. The average humidity in the administrative area of North Jakarta was 74.94% seen from the maximum humidity in the life of the mosquito 70-90%, so it can be concluded that humidity has a significant relationship with the incidence of dengue fever.

Relationship between Wind Speed and Incidence Rate of DHF

The wind speed that occurred in the North Jakarta Administration City with the average (mean) wind speed in 2017-2019 was 1.30 knots, the median value was 1.33 knots, the data distribution value (standard deviation) was 0.33 while the minimum value for the speed was 0.33 knots. wind of 1 knot and a maximum of 2 knots. The relationship between wind speed and the incidence rate of dengue fever cases was not significant with p value 0.655, the relationship was weak with R 0.229 while the contribution of wind speed to the incidence rate of dengue fever cases was 5.2%. This is in line with research conducted in Bitung City which has an insignificant relationship with the incidence of DHF with a p value of 0.722 [18]. However, it was different from research conducted in Cilacap Regency where the results of the analysis are that there was a relationship between wind speed and the incidence of DHF (p = 0.001) [19]. Research conducted in China also found that wind speed is an important variable in the incidence dengue fever with p value 0.004 [20]. Indirectly, wind speed affects the evaporation of water and air temperature and the spread of passive mosquitoes, the development of mosquitoes will be hampered by wind speeds of 11-14 m/second (22-28 knots) so that the spread of vectors/mosquitoes will be limited because the wind greatly affects the flying direction of mosquitoes. and the mating of mosquitoes in the air due to mosquitoes with small bodies [21]. The speed of the wind direction affects the flying distance of the mosquito. Wind speeds of 11-14 km/hour can affect the flying distance of mosquitoes [22]. In the North Jakarta Administration area, the average wind speed is 1.30 knots, so that there will be no obstacles for mosquitoes to fly and be able to mate in the air. From the results of the appropriate analysis that wind speed does not have a significant relationship in the incidence rate of DHF.

The Relationship of Active Waste Banks with the Incidence of Dengue Fever Rate

The results of the analysis of active waste banks in North Jakarta Administrative City obtained information that in 2017-2019 the average value (mean) of active waste banks was 162.66 waste banks, the median value was 158.16 waste banks, the data distribution value (standard deviation) was 20.80 while the minimum value of air temperature was 129.33 waste banks and a maximum of 199 waste banks. The relationship between waste banks and the incidence rate of dengue fever cases was significant with a p value of 0.002, the relationship was strong with a value of R 0.713 with the contribution of waste banks to the incidence rate of dengue fever cases was 50.8%. This is in line with research conducted in Hegarsari Village, Pataruman District, Banjar City where from the analysis results obtained a p value 0.000 this shows that environmental health risk factors in terms of solid waste management have a relationship with the incidence of dengue fever [23]. This was different from the research conducted in Semarang where the results of the analysis showed no relationship between waste disposal practices (p value 0.091) and the incidence of dengue fever [24]. From international research specifically on waste management with the existence of a waste bank there has been no research, where there was waste that is managed directly without any collection it can reduce 50% of the House Index (HI) and Bruteau Index (BI) and to 73% for the PPI while for the Incidence Rate of dengue fever cases there has been no direct research done [25]. Thus, with the existence of an active waste bank in the North Jakarta Administrative City area, places that have the potential to collect rainwater will be well controlled because there is already a centralized waste management with the result that there is a relationship between active waste banks and dengue fever incident rate.

Relationship between larva free rate and incidence of dengue fever rate

From the results of the analysis, it was obtained information that the larva-free rate in the North Jakarta Administrative City obtained information in 2017-2019 the average value (mean) of the larva-free number was 93.92%, the median value was 94.88%, the data distribution value (standard deviation) is 3.09 while the minimum value of air temperature is 85.05% and the maximum is 93.92%. The relationship between larva free rate and Incidence Rate of dengue fever cases is not significant with p value 0.431 the relationship is weak with R 0.296 while the contribution of numbers free of larvae against the Incidence Rate of cases of dengue fever was 8.8%. This is in line with research conducted in Yogyakarta where there was no significant relationship between larva free rate and the incidence of DHF with p value 0.77 and 0.04 [26]. However, this was different from research in the Kedurus Village, Surabaya City, where the calculation of mosquito larvae density was carried out by calculating several indicators of larva density, namely the larva free rate with the results of the analysis that there was a relationship between the presence of larvae and the incidence of dengue fever (p value 0.000) [27]. An international study conducted in Thailand found that a high larvae density index in containers was associated with DHF disease with a p value 0.0016, but if the larvae density was low the density was not associated with DHF disease with p 0.207, but specifically research related to mosquito nets eradication activities by looking at the larva-free rate has not been found in any research [28]. The success of source reduction of larvae activities can be measured by the presence of vectors, namely the larva free rate. If the larvae free rate was 95%, it was expected that dengue transmission can be prevented or reduced [29]. The larva-free rate in the North Jakarta City Administration area was the highest at 95.95% and the lowest at 85.05% with the average larva-free rate in 2017-2019 being 93.92%, this is still possible for mosquito breeding.

Climate Model and Environmental Health Intervention on DHF Incidence Rate

The final result of multivariate analysis there were 3 variables that contribute to the incidence of DHF, namely humidity was12 times more related to the incidence of DHF, with a value of p value

0.000, with a contribution of R 0.741, while the linear relationship is very strong with a contribution to the Incidence Rate of dengue cases in the region. the administrative city of North Jakarta by 55.0%. Less rainfall contributed to the incidence of DHF by 40.7%. while the larva-free rate with a value of p value 0.003 correlated 4 times more for the incidence rate of DHF. Of these three factors when carried out together, the relationship is very strong with the Incidence Rate of dengue fever cases with R 0.952 and these three variables contribute 90.6%, the rest are other factors that were not studied. From the results of research conducted in Kendari City with predictive models obtained from the regression analysis the average air temperature and humidity affect the incidence of DHF together with a p value 0.000 [30]. The studies that have been carried out are only climatic variables that were combined together to affect the incidence of DHF, these studies have not observed together for climate variables with larvae free numbers. In the administrative city of North Jakarta, with an average rainfall of 136.37 mm, this was likely to greatly affect the Incidence Rate of dengue cases where the rainfall corresponding to dengue fever ranges from 100-300 mm [12]. where the humidity in the administrative city of North Jakarta on average in 2017-2019 is 74.94% which was the average humidity that can affect the age of mosquitoes ranging from where mosquitoes will affect the age of mosquitoes between 83%-88% while the maximum the mosquito life ranges from 70% - 90%, while for the larva-free rate in the North Jakarta administration area, the average larva-free rate in 2017-2019 was 93.92%, the results of this study are similarities with areas outside DKI Jakarta which for the climate was almost the same as DKI Jakarta, especially the North Jakarta Administrative City area [14]. From the three factors of rainfall, humidity and larvae free rate when modeling together, the results of the relationship are very strong with the Incidence Rate of dengue fever cases with R 0.952 and these three variables contribute 90.6%, the rest are other factors not studied.

Conclusion

Based on the results of research and discussion, the following conclusions can be summarized:

From the results of the Incidence Rate study of dengue fever cases in North Jakarta in 2017-2019, data on the incidence of DHF from 2017 to 2019 was an average of 47.86 cases. The climate in the North Jakarta Administrative City Region in 2017-2019 is the average rainfall is 136.37 mm where this condition is in accordance with the appropriate rainfall for the breeding of dengue fever mosquitoes, the average humidity is 74.94% this condition is the maximum condition for mosquito life dengue fever, the average air temperature was 28.58oC in this condition mosquitoes can breed but not optimally, and the average wind speed was 1.30 knots, this condition allows no obstacles for mosquitoes to fly and can mate in the air. Environmental health interventions in community-level waste management and eradication of mosquito nests on the Incidence Rate of dengue fever cases in North Jakarta in 2017-2019 there is a significant relationship between waste banks and the Incidence Rate of dengue fever cases with a value of p value 0.002 where the relationship was strong with a value of R 0.713 while the contribution of waste banks to the incidence rate of dengue fever cases is 50.8%. Meanwhile, the relationship between the larval free rate and the incidence rate of dengue fever cases was not significant with a p value of 0.431, the relationship was weak with a value of R 0.296, while the contribution of the larval free number to the incidence rate of dengue fever cases was 8.8%. From the final modeling results between climate, environmental health interventions with the incidence rate of dengue fever cases with multiple linear regression analysis with 95% confidence, humidity is 12 times more related to the incidence of dengue fever, with a p value 0.000, while the linear relationship is very strong with R 0.741, with a contribution to the Incidence Rate of dengue fever cases in the North Jakarta administration area of 55.0%. Rainfall showed a significant relationship with p value 0.005 but did not contribute to the incidence of DHF by 40.7%. while the larva-free rate with a value of p value 0.003 was 4 times more related to the incidence rate of dengue fever cases. Of these three factors when carried out together, the relationship is very strong with the Incidence Rate of dengue fever cases with R 0.952 and these three variables contribute 90.6%, the remaining other factors are not examined. Furthermore, in a 3-year study, it turned out to be sufficient for analysis material in climate relations research, environmental health interventions with the Incidence Rate of dengue fever cases.

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