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Factors Related with Dengue Hemorrhagic Fever Incidence in 2008-2017

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Abstract

The number of cases of DHF in Indonesia from year to year tends to increase and the area of spread is increasingly widespread. The incidence of DHF in the city of Semarang over the past 10 years (2008-2017) experienced fluctuations. The purpose of this study was to determine the factors that correlated with data on DHF incidents in Semarang City in 2008-2017. This research is a quantitative descriptive study with correlation study by using a type of time series analysis design. Data analysis was performed in univariate, bivariate by using Spearman correlation test, and multivariate by using Multiple Linear Regression test. The results showed that rainfall (r = 0.201; p = 0.028) and population density (r = -0.761; p = 0,000) correlated with DHF incidence data. Air temperature (r = -0,150; p = 0,103) and air humidity (r = 0,171; p = 0,062) did not correlate with DHF incident data. Rainfall, air temperature, air humidity, and population density had an effect of 62.8% on DHF incident data and the most influential factor is air humidity. The conclusion of this study is that rainfall and population density correlate with DHF incidence data, the most influential factor on DHF incidence data is air humidity.

Abstrak

Jumlah kasus DBD di Indonesia dari tahun ke tahun cenderung meningkat dan daerah penyebarannya semakin luas. Angka kejadian DBD di Kota Semarang selama 10 tahun terakhir (2008-2017) mengalami fluktuasi. Tujuan dari penelitian ini adalah untuk mengetahui faktor yang berhubungan dengan data kejadian DBD di Kota Semarang tahun 2008-2017. Penelitian ini merupakan penelitian kuantitatif deskriptif dengan studi korelasi menggunakan jenis desain analisis seri waktu. Analisis data dilakukan secara univariat, bivariat menggunakan uji korelasi Spearman, dan multivariat menggunakan uji Regresi Linier Berganda. Hasil menunjukkan bahwa curah hujan (r=0,201; p=0,028) dan kepadatan penduduk (r=-0,761; p=0,000) berhubungan dengan data kejadian DBD. Suhu udara (r=-0,150; p=0,103) dan kelembaban udara (r=0,171; p=0,062) tidak berhubungan dengan data kejadian DBD. Curah hujan, suhu udara, kelembaban udara, dan kepadatan penduduk berpengaruh sebesar 62,8% terhadap data kejadian DBD dan faktor yang paling berpengaruh adalah kelembaban udara. Simpulan dari penelitian ini adalah curah hujan dan kepadatan penduduk berhubungan dengan data kejadian DBD, faktor yang paling berpengaruh terhadap data kejadian DBD adalah kelembaban udara.

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INTRODUCTION

Dengue hemorrhagic fever (DHF) is an infectious disease caused by the dengue virus and its transmission through the bite of the Aedes aegypti mosquito. Dengue hemorrhagic fever can affect everyone and can cause death, especially in children. This disease also often causes outbreaks. Dengue hemorrhagic fever can be called dengue fever, dengue fever, and dengue shock syndrome. Based on Indonesia's health profile in 2016, dengue hemorrhagic fever (DHF) was first discovered in the 1950s, but in 1975 until now dengue hemorrhagic fever was the leading cause of death in children in Asian countries. According to the World Health Organization (WHO), the highest cases of dengue hemorrhagic fever occur in eight countries in Asia. These countries are Indonesia, Myanmar, Bangladesh, India, Maldives, Sri Lanka, Thailand and Timor Leste.

Data on the health profile of Indonesia in 2017 showed that the number of cases in Indonesia from year to year tends to increase and the area of spread is increasingly widespread. Cases of dengue hemorrhagic fever in Indonesia in 2016 increased compared to the number of cases in 2015, from 204,171 cases to 129,650 cases. The number of deaths from dengue hemorrhagic fever in 2016 also increased from 2015, from 1,071 people to 1,598 people. Incidence Rate (IR) or dengue hemorrhagic fever morbidity in 2016 also increased from 2015, which was 50.75 to 78.85 per 100,000 population. However, the Case Fatality Rate (CFR) has decreased from 0.83% in 2015 to 0.78% in 2016.

2016 Central Java health profile data shows that dengue hemorrhagic fever disease is still a serious problem in Central Java Province, as evidenced by 35 districts/cities infected with dengue hemorrhagic fever. Incidence Rate (IR) of dengue hemorrhagic fever in Central Java Province in 2015 amounted to 47.9 per 100,000 population, an increase compared to 2014 which was 36.2 per 100,000 population. Case Fatality Rate (CFR) in Central Java in 2015 was 1.6 percent, a slight decrease compared to the 2014 CFR of 1.7 percent. This condition is still higher than the national target and *RPJMD* (*Rencana Pembangunan Jangka Menengah Daerah* or Regional Midterm Development Plan), which is <1%.

Data from the Semarang City Health Service obtained from the 2018 DHF HEWS online data stated that Semarang is one of the endemic areas of dengue hemorrhagic fever. The trend of cases over the past 10 years from 2008 to 2017 can describe fluctuations or ups and downs of dengue hemorrhagic fever cases. Cases of dengue hemorrhagic fever in 2008, namely 5,249 patients (IR = 361.0/ 100,000 population). In 2009 there was a decrease in cases, namely as many as 3,883 patients (IR = 262.1/100,000 population). In 2010 there was an increase in cases from the previous year as many as 5,556 people (IR = 368,7/100,000 population). Then in 2011 there were 1,303 cases of decline in cases (IR = 73.87/100,000 population). In 2012 the case also decreased to 1,250 patients (IR = 70.90/100,000 population). But in 2013 there was an increase in cases, namely as many as 2,364 patients (IR = 134.09/100,000 population). The decline in cases from the previous year occurred in 2014 as many as 1,628 patients (IR = 92.43/100,000 population). In 2015 there was an increase in cases to 1,737 patients (IR = 98.61/100,000 population). Then in 2016 there was a decline in cases that were very drastic, as many as 448 patients (IR = 25.2 / 100,000 population). The last year in 2017 also decreased to 299 patients.

Based on these data, the fluctuating incidence of dengue hemorrhagic fever is influenced by several factors. According to research by Zambrano et al. (2012), climate variability greatly affects dengue fever. According to research conducted by Wirayoga (2013) in Semarang City, climate factors such as air temperature, rainfall, and air humidity have a significant relationship with the incidence of dengue hemorrhagic fever. The weather cycle has been shown to increase the likelihood and risk of vector-borne-based diseases, especially dengue hemorrhagic fever caused by the dengue virus. This dengue virus is very sensitive to climate change because changes in average temperature, humidity, and rainfall that increase will affect the life cycle and breeding of Aedes aegypti mosquitoes that carry the virus. The spread of adult female Aedes aegypti mosquitoes is influenced by several factors including the availability of eggs and blood, but it appears to be limited to a distance of 100 meters from the location of appearance. The spread of the mosquito population is not far from the breeding place, its resting place, and the place of prey so that the population is a cluster and does not form a homogeneous population. Passive transportation can take place through eggs and larvae in reservoirs (WHO, ___). The Semarang City Health Office in 2018 stated that this phenomenon made Semarang City vulnerable to dengue hemorrhagic fever, especially in areas that had high population density. The results of the study conducted by Kusuma & Sukendra (2016) in the city of Semarang, explained that the distribution of cases of dengue hemorrhagic fever has a spatial relationship with population density.

Efforts to control dengue hemorrhagic fever in Indonesia are based on 7 main activities in the Decree of the Minister of Health number 581/MENKES/SK/VII/1992 concerning the Eradication of Hemorrhagic Fever. Therefore, to achieve integration of controlling dengue hemorrhagic fever disease,

it requires involvement of community participation and financial support. But based on the results of the study of Pujiyanti et al. (2010) in Semarang City, community active participation in the implementation of *PSN* (*Pemberantasan Sarang Nyamuk* or Mosquito Nest Eradication) is very difficult to form to become a habit, it is shown by the high cases of dengue hemorrhagic fever in 2008-2009 and Larvae Absence Rate (LAR) or *Angka Bebas Jentik* (*ABJ*) that have not met national indicators of 95%. The community feels that *PSN* cannot prevent dengue hemorrhagic fever. The study of Trapsilowati et al. (2015) also explained that the participation of dengue hemorrhagic fever cadres in conducting larva monitoring in people's houses showed a tendency for ABJ to increase, and indicators in the form of house index (HI), container index (CI), and breteu index (BI) tended to decline. Based on research conducted in Semarang City by Rahmawati et al. (2016) stated that in carrying out efforts to control dengue hemorrhagic fever, not all were carried out in accordance with the Semarang City Regional Regulation number 5 in 2010. The purpose of this study was to determine the factors related to dengue hemorrhagic fever data in Semarang City in 2008-2017.

METHODS

This research is a quantitative descriptive study with a correlation study by using a time series analysis design type. The place of research is in Semarang City, Central Java Province. The population of this study were all data reports on cases of dengue hemorrhagic fever, rainfall, air temperature, air humidity, and population density in the city of Semarang. The research sample used was a report on data on cases of dengue hemorrhagic fever, rainfall, air temperature, air humidity, and monthly population density in the city of Semarang from January 2008 to December 2017.

This study used secondary data. Data sources were obtained from Semarang City Health Office, Semarang City Climatology Station, and Semarang City BPS. Data collection was performed by making necessary notes with both recording sheets and stationery as well as assisted with computer programs based on data provided by the relevant agencies. Data analysis was performed by using univariate, bivariate analysis with Spearman correlation test, and multivariate with Multiple Linear Regression test on SPSS 16.

RESULTS AND DISCUSSION

Correlation between Rainfall and Incidence of Dengue Hemorrhagic Fever

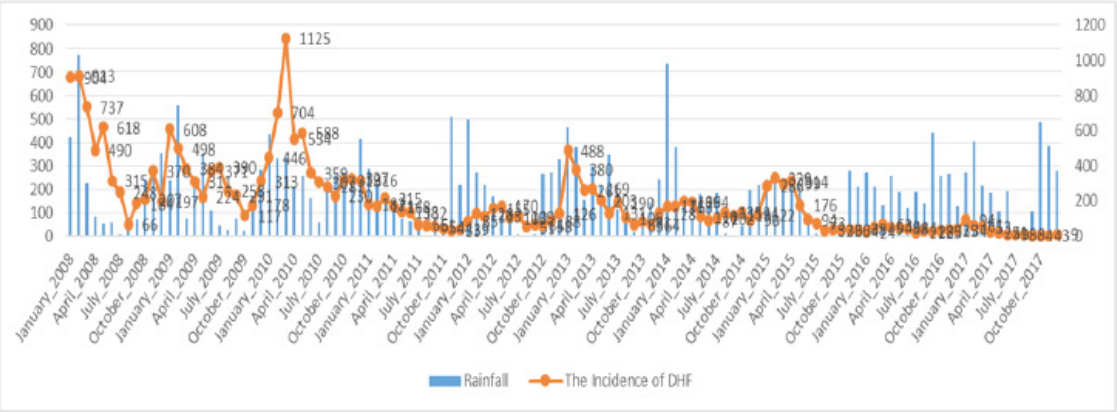
The results of the correlation analysis between rainfall and dengue hemorrhagic fever incident data by using a correlation test obtained a correlation coefficient of 0.201 which showed a positive correlation or in line with a weak correlation strength, which means that the higher the rainfall, the higher the incidence of dengue hemorrhagic fever. The results of statistical tests obtained a significance value of 0.028, this means that the p-value is smaller than α (0.05), so it can be concluded that there was a significant correlation between rainfall and dengue hemorrhagic fever incident data in Semarang City in 2008-2017.

The result of this study is in line with the research of Paramita & Mukono (2017) which explained that there was a weak correlation that in line with a positive correlation (r = 0.230 and p = 0.042) bet-

Table 1. Results of Correlation Analysis of Rainfall, Air Temperature, Air Humidity, Population Density with Incidence of Dengue Hemorrhagic Fever in Semarang City in 2008-2017

Variable	Dengue hemorrhagic fever Data			
	Correlation Coefficient (r)	Significance (p)	Total (n)	Description
Rainfall	0.201	0.028	120	Positive correlation, there is a significant correlation
Air Temperature	-0.150	0.103	120	Negative correlation, there is no significant correlation
Air Humidity	0.171	0.062	120	Positive correlation, there is no significant correlation
Population Density	-0.761	0.000	120	Negative correlation, there is a significant correlation

Figure 1. Graphic of Correlation Between Rainfall and Dengue Hemorrhagic Fever Incidence



ween rainfall and the incidence of DHF in Gunung Anyar Health Center Surabaya. A similar study conducted by Azhari et al. (2017) also showed that there was a weak correlation that in line with a positive correlation (r = 0.278 and p = 0.018) in Pandeglang District (Azhari et al., 2017). Jahja et al. (2016) stated that there was a significant correlation between rainfall and cases of dengue hemorrhagic fever, cases of dengue hemorrhagic fever tend to peak in January each year where rainfall tends to decrease.

From Figure 1 above, from January 2008 to June 2015 there was a correlation between rainfall and data on dengue hemorrhagic fever incidence. However, from July 2015 to December 2017 it can be seen that there was no correlation at all between rainfall and dengue hemorrhagic fever incidence data. Therefore, the researchers conducted two analyses of the correlation of rainfall with the dengue hemorrhagic fever incident data.

The correlation test results between rainfall and dengue hemorrhagic fever incident data during the period of January 2008 to June 2015 showed r-value of 0.353 which showed a positive correlation or in line with a weak correlation strength, which means that the higher the rainfall, the higher the incidence of dengue hemorrhagic fever. The statistical test results obtained p = 0.001, this means that the p-value is smaller than α (0.05), so it can be concluded that there was a significant correlation between rainfall and dengue hemorrhagic fever incident data in Semarang City during the period of January 2008 to June 2015.

The correlation test results between rainfall and dengue hemorrhagic fever incident data during the period of July 2015 to December 2017 showed r-value of -0.060 which showed a negative correlation or not in line with a very weak correlation strength, which means that the higher the rainfall, the lower the incidence of dengue hemorrhagic fever. The statistical test results obtained p = 0.752, this means that the p-value is greater than α (0.05), so it can be concluded that there was no significant correlation between rainfall and dengue hemorrhagic fever incident data in Semarang City during the period July 2015 to December 2017.

Based on the two analyzes in that period, it can be seen that the ups and downs of the incidence of dengue hemorrhagic fever cannot be attributed to rainfall only. Based on the results of the annual report from the P2P Sub-Section of the Semarang City Health Office, which is one of the determining factors for the high incidence of dengue hemorrhagic fever, intervention programs are made as an effort to prevent and eradicate DHF disease. In the research of Savargaonkar et. al (2018) explained that the epidemiological and entomological surveillance needs to monitor trends in DHF distribution are urgently needed as an effort to control DHF activities. DHF control programs in the city of Semarang can be seen in table 2 below.

During the period of January 2008 to June 2015, rainfall correlated with dengue hemorrhagic fever incident data because the programs implemented had not significantly reduced the incidence of dengue hemorrhagic fever. However, in the period of July 2015 to December 2017 rainfall did not correlate with the incidence of dengue hemorrhagic fever because the programs carried out were always evaluated and there was always an improvement in the surveillance system. There was a decrease in the number of DHF cases in the mid months of 2015, this was because in 2015 the Semarang City Health Office budgeted funding for the Health Surveillance Officer (*Gasurkes*) which aims to assist efforts to control DHF through community empowerment efforts. *Gasurkes* have two functions, namely Control of DHF and Decreasing Death of Pregnant Women. Some of the main tasks of *Gasurkes* are larva monitoring, counseling, advocacy and coordination. In the period July 2015 to December 2017 also involved many communities to participate in the intervention programs made. So, community participa-

Table 2. Semarang City DHF Control Program Activity

Year	Program
2008	Epidemiological Investigation (*Penyelidikan Epidemiologi* = *PE*) of DHF Fogging DHF Coordination Meeting of Operational Working Group (*Pokjanal* = *Kelompok Kerja Operasional*) Making Academic Manuscripts DHF Clinical Lecture Behavior Survey Enhancing Surveillance Performance
2009	Epidemiological Investigation of DHF Fogging DHF Coordination Meeting of Operational Working Group Management Information System of DHF
2010	Epidemiological Investigation of DHF Fogging DHF Coordination Meeting of Operational Working Group Increased Coordination Increased Intervention Speed and Accuracy of Interventions HR Improvement
2011	Epidemiological Investigation of DHF Fogging DHF Coordination Meeting of Operational Working Group Meeting with Hospital
2012	Epidemiological Investigation of DHF Fogging DHF Coordination Meeting of Operational Working Group Routine Larval Monitoring (*Pemeriksaan Jentik Rutin* = *PJR*) Coordination Meeting of DHF Outbreak DHF Clinical Lecture
2013	Epidemiological investigation of DHF Fogging DHF Coordination Meeting of Operational Working Group Synchronization of DHF Control DHF Coordination Meeting of Outbreak DHF Clinical Lecture Evaluation of the Animal Source Disease Eradication Program at *Puskesmas* (*Pusat Kesehatan Masyarakat* or Public Health Center) Meeting for program evaluation and hospital reporting SOP
2014	Epidemiological investigation of DHF Fogging Larva Monitoring in collaboration with Kodim 0733 BS (army officers) Larva Monitoring by Cadres Periodic larva monitoring by *Puskesmas* officers DHF Coordination Meeting of Operational Working Group Research on the Effectiveness of Vector Control Health Surveillance Officer (*Gasurkes* = *Tenaga Survailens Kesehatan*) Synchronization of DHF Control Routine Larval Monitoring Evaluation of DHF Death Cases Evaluation of the Animal Source Disease Eradication Program at *Puskesmas* Coordination Meeting of DHF Outbreak Recording and Reporting of DHF
2015	Epidemiological investigation of DHF Fogging Health Surveillance Officer (*Gasurkes*) Monitoring of larva monitoring program by Health Surveillance Officer (*Gasurkes*) DHF Coordination Meeting of Operational Working Group
2016	Epidemiological investigation of DHF Fogging DHF Health Surveillance Officer (*Gasurkes*) DHF counseling by DHF Health Surveillance Officer (*Gasurkes*) DHF Coordination Meeting of Operational Working Group DHF Control Campaign Enforcement of Regional Regulation on DHF with *Satpol PP* (*Satuan Polisi Pamong Praja* or Civil Service Police Unit) One House One *Jumantik* (*Juru Pemantau Jentik* or Larvae Monitoring Cadre) Use Long Sleeve Uniforms in Elementary School Students
2017	Epidemiological investigation of DHF Fogging DHF Health Surveillance Officer (*Gasurkes*) One House One *Jumantik* (*Juru Pemantau Jentik* or Larvae Monitoring Cadre) Student Program for Searching Larvae (*SICENTIK=Siswa Cari Jentik*) Monitoring of larva monitoring program by DHF Health Surveillance Officer DHF counseling by DHF Health Surveillance Officer Monitoring Evaluation of *Gasurkes* (*Tenaga Surveilens Kesehatan* or Health Surveillance Officer) DHF Coordination Meeting of Operational Working Group

tion also greatly influences the level of effectiveness of the programs implemented and the incidence of dengue hemorrhagic fever.

The high intensity of rainfall during the period of 2008 to 2017 in the city of Semarang occurred in January and February. Rainfall cannot be directly correlated with the incidence of DHF because there are several factors that cause the case to arise. Rain with high intensity will cause puddles to appear in water reservoirs around the house and in hollows to become breeding grounds for mosquitoes and mosquitoes will breed. Rainwater channels that often accumulate water usually also function as breeding grounds for larvae and resting places of Aedes aegypti mosquitoes (Paploski et al., 2016). Mosquitoes that carry the dengue virus will bite humans so that they transmit dengue hemorrhagic fever. However, with the intervention program made by the Semarang City government aimed at preventing and overcoming the incidence of DHF and community awareness and participation, the incidence of DHF can be minimized. While the intensity of rain is high, but there is no program that is carried out intensively and effectively, and there is no awareness and participation from the community, the incidence of DHF will continue to increase. Based on the research of Kusumo et al. (2014), explained that community participation has a very important role, because the program to control dengue hemorrhagic fever will succeed if the community behaves well.

Correlation between Air Temperature and Dengue Hemorrhagic Fever Incidence

The results of the correlation analysis between air temperature and dengue hemorrhagic fever incident data using a correlation test obtained a correlation coefficient of -0,150 which showed a negative correlation or not in line with a very weak correlation strength, which means that the lower the air temperature the higher the incidence of dengue hemorrhagic fever. The statistical test results obtained a significance value of 0.103, this means that the value of p is greater than α (0.05), so it can be concluded that there was no significant correlation between air temperature and dengue hemorrhagic fever incident data in Semarang City in 2008-2017. An illustration of the correlation between air temperature and DHF incidence data can be seen in Figure 2.

The results of this study are in line with the research of Azhari et al. (2017) which explained that there was no correlation between air temperature and the incidence of DHF (p = 0.133) in Pandeglang District. Similar research was also explained by Mattar et. al (2013) that there was no correlation between air temperature and the incidence of DHF (p = 0.147) in Colombia, Cerete. The optimum temperature for mosquito growth is 25-30°C. At low temperatures (10°C) the mosquito can survive, but its metabolism will decrease or even stop when the temperature drops below the critical temperature of 4.5°C. At temperatures higher than 35°C can also experience changes, namely the slower physiological processes (Hoedojo & Sungkar, 2008). Although the lower the air temperature, the higher the incidence of DHF, but the air temperature did not have a significant correlation with the incidence of DHF.

Correlation between Air Humidity and Dengue Hemorrhagic Fever Incidence

The results of the correlation analysis between air humidity and dengue hemorrhagic fever incident data by using a correlation test obtained a correlation coefficient of 0.171 which showed a positive correlation or in line with a very weak correlation strength, which means that the higher the humidity, the higher the incidence of dengue hemo-

Figure 2. Graphic of Correlation Between Air Temperature and Dengue Hemorrhagic Fever Incidence

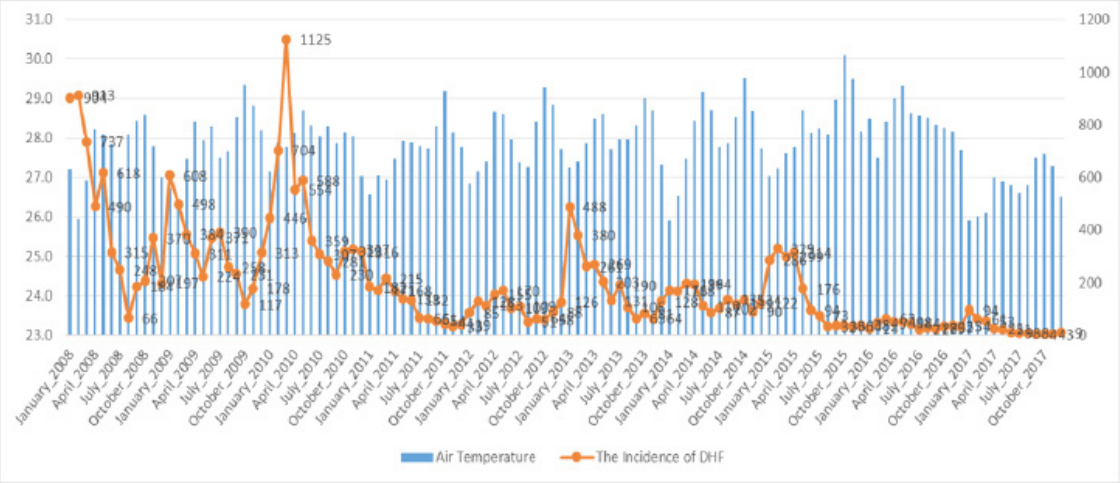
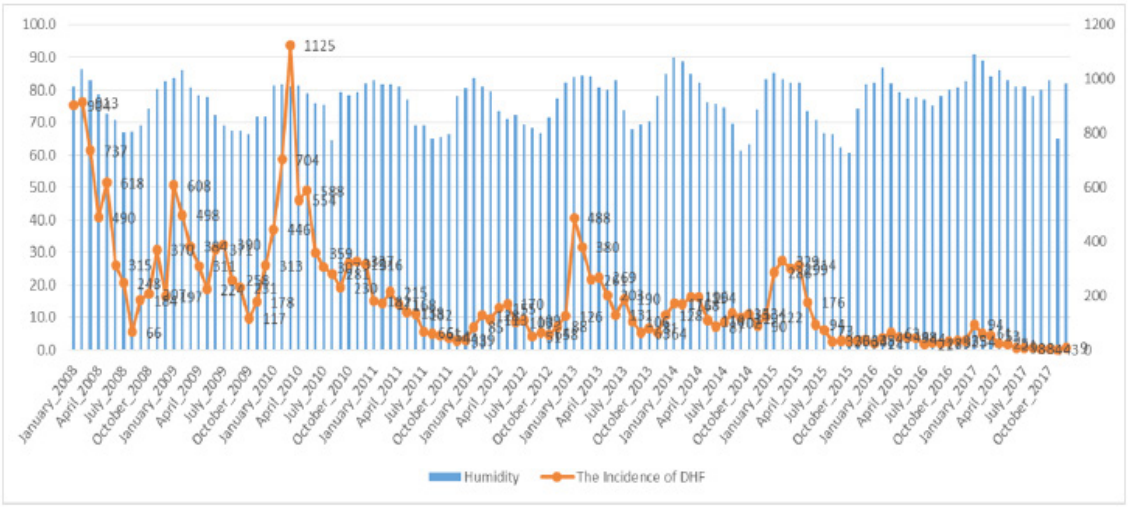


Figure 3. Graphic of Correlation Between Air Humidity and Dengue Hemorrhagic Fever Incidence



rrhagic fever. The statistical test results obtained a significance value of 0.062, this means that the p-value is greater than α (0.05), so it can be concluded that there was no significant correlation between air humidity and dengue hemorrhagic fever incident data in Semarang City in 2008-2017. An illustration of the correlation between air humidity and DHF incident data can be seen in Figure 3.

A similar study was also explained by Tomia et al. (2016) that there was no correlation between air humidity and the incidence of DHF (p = 0.543) in Ternate City. When low humidity can cause evaporation of water from the body of the mosquito, it causes dryness of the fluid in the body of the mosquito. Evaporation is one of the enemies of mosquitoes (Hoedojo & Sungkar, 2008).

Correlation between Population Density and Dengue Hemorrhagic Fever Incidence

The results of the correlation analysis between population density and dengue hemorrhagic fever incident data by using a correlation test obtained a correlation coefficient of -0.761 which showed a negative correlation or not in line with a strong correlation strength, which means that the lower population density the higher the incidence of dengue hemorrhagic fever. The results of statistical tests obtained a significance value of 0.000, this means that the p-value is smaller than α (0.05), so it can be concluded that there was a significant correlation between population density and dengue hemorrhagic fever incident data in Semarang City in 2008-2017. An illustration of the correlation of population density with DHF incidence data can be seen in Figure 4.

The results of this study are in line with the research conducted by Kasman & Ishak (2018) which explained that there was a very strong correlation and in line with population density and the incidence of DHF (r = 0.892 and p = 0.042) in North Banjarmasin District. According to research conducted by Kusuma & Sukendra (2016), population density factors influence the process of transmission or transfer of disease from one person to another.

Figure 4. Graphic of Correlation Between Population Density and Dengue Hemorrhagic Fever Incidence

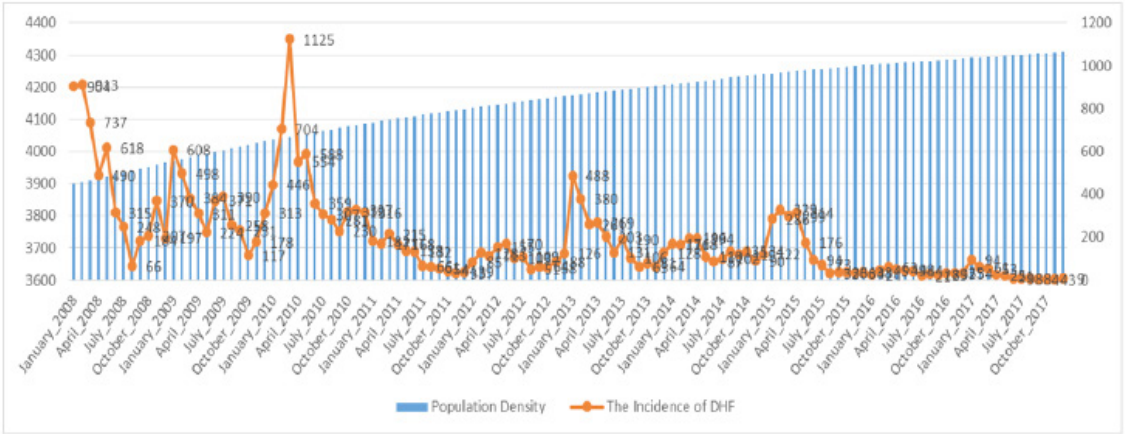


Table 3. Results of Multiple Linear Regression on the Influence of Rainfall, Air Temperature, Air Humidity, Population Density on DHF Incident data in Semarang City, 2008-2017

No.	DHF incident factor	Multivariate Test Fcalculation (p value)	R Square	Beta Coefficient
1.	Rainfall	48.529 (0.000)	0.628	0.053
2.	Air Temperature			0.080
3.	Air Humidity			0.308
4.	Population Density			-0.773

If there are no adequate preventative measures, the more densely populated the more conducive to the proliferation of dengue virus. This can lead to an increase in cases of dengue hemorrhagic fever.

Based on the results of statistical analysis, population density has a significant correlation with the incidence of DHF and population density increases significantly each year. The spread of adult female Aedes aegypti mosquitoes is affected by the availability of spawning and blood sites, but the limitation of flying distance is only 100 meters from the location of appearance. The spread of the mosquito population is not far from the nesting place, the resting place, and the place of prey so that the more densely populated, the easier the spread (WHO, ___). However, it can be seen from Figure 4, population density did not have a correlation with the DHF incident data. This is because the program in the prevention and eradication of DHF is always evaluated and improved. One of the government programs is the Health Surveillance Officer (*Gasurkes*). Gasurkes has a big role in decreasing DHF cases in Semarang City. Based on the results of the annual report from the P2P Sub-Department of the Semarang City Health Office, in 2015 the Health Office budgeted funding for the Health Surveillance Officer (*Gasurkes*) which aimed to assist efforts to control DHF through community empowerment efforts. Gasurkes has two functions, namely controlling DHF and Decreasing Death of Pregnant Women. Some of the main tasks of Gasurkes are larva monitoring, counseling, advocacy and coordination.

Influencing Factors of Dengue Hemorrhagic Fever Incidence

Based on the results of statistical tests by using multiple linear regression tests, the F calculation value obtained is 48,529 with a p-value of 0,000. Obtained p-value <0.05, it can be concluded that rainfall, air temperature, air humidity, and population density affect the DHF incident data in Semarang City in the period of 2008-2017. The results of statistical tests also show that the value of R Square or R^2 is 0.628, so it can be concluded that there was influence of independent variables (rainfall, air temperature, air humidity, and population density) of 62.8%, while the remainder was 37.2 % influenced by other factors not examined.

Beta coefficients can be used to find out which variables have the greatest influence on the independent variable. The greater the beta value, the greater the influence of the independent variable. Air humidity has the highest beta value (= 0.308), so it can be concluded that the variable air humidity has the most influence (dominant) on dengue hemorrhagic fever incident data. A similar study also explained that air humidity had a significant effect on the incidence of DHF with a p value of 0,000 (Kasetyaningsih et al., 2018).

CONCLUSION

Based on the results and discussion in the study, it can be concluded that there was a significant correlation between rainfall and dengue hemorrhagic fever incident in Semarang City in 2008-2017, there was no significant correlation between air temperature and dengue hemorrhagic fever incident in Semarang City in 2008 -2017, there was no significant correlation between air humidity and dengue hemorrhagic fever incident in Semarang City in 2008-2017, there was a significant correlation between population density and dengue hemorrhagic fever incident in Semarang City 2008-2017. There was an influence of rainfall, air temperature, air humidity, and population density of 62.8% on dengue hemorrhagic fever incident in Semarang City in 2008-2017. The most influential factor for dengue hemorrhagic fever incident is air humidity.

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