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Efectivity Evaluation among Dengue Control Programs in Semarang City, Indonesia

Sri Maharsi[1] ✉, Oktia Woro Kasmini Handayani[2], Yuni Wijayanti[3]

[1,2,3]Magister of Public Health Program, Universitas Negeri Semarang, Semarang Indonesia

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Abstract

Increased dengue case occurs throughout Southeast Asia. Semarang Health Office held some programs to control dengue. They were rainfall monitoring, Routine Mosquito Larvae Monitoring program (Pemeriksaan Jentik Berkala or PJB), One House One Larvae Observer Movement (Satu Rumah Satu Jumantik or SRSJ), and Students Search for Mosquito Larvae Movement (SICENTIK or Siswa Cari Jentik). This study aimed to assess whether the programs reducing Dengue Hemorrhagic Fever (DHF) cases were effective. The method used were correlation analysis. Data obtained from every subdistrict in Semarang and reported to Semarang Health Office. The average of DHF cases was 79.5 ± 13.69. Correlation test results between dengue cases with rainfall was r=0.951 (p=0.049); Larvae Absence Rate (LAR) from PJB program was r=0.648 (p=0.352); LAR from SRSJ was r=0.804 (p=0.196); LAR from SICENTIK Movement was r=0.961 (p=0.039). Correlation between rainfall and LAR from Students Search for Mosquito Larvae Movement with DHF case were significant and had positive strong correlation. Correlation test results of LAR from routine larvae program and one house one larvae observer movement had strong correlation but were not significant.

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is one of the infectious diseases that can cause an outbreak, caused by the dengue virus, and transmitted by the *Aedes spp*. Dengue virus infection occurs as many as 390 million people each year. DHF is an endemic disease that appears in tropical and subtropical regions, especially during the rainy season and mostly occurs in urban areas also suburban area. Based on data from World Health Organitation (2017), the proportion of dengue incidence in the Asia Pacific occupies a total of 75 percent of all existing incidents worldwide, while Indonesia is an endemic country with the second largest incidence.

DHF is one of the public health problems due to the ever-increasing incidence accompanied by a very rapid and extensive spread. Based on 2017 data, the number of dengue cases that occurred in Indonesia was 68,407 cases. Central Java ranked third with a total of 7,400 cases. The death rate due to DHF in 2017 was 493 deaths and Central Java ranked the second highest death rate with 92 deaths. Incidence rate of dengue cases in Semarang was 17.01. This number ranked 22nd in Central Java, but Case Fatality Rate (CFR) of DHF in Semarang is ranked number 2 in Central Java with 2.7 percent. This showed that DHF was still a dangerous and fatal disease in Semarang.

✉ Corespondence Address:
Magister of Public Health Program,
Universitas Negeri Semarang, Semarang Indonesia
E-mail: srimaharsi72@yahoo.com

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Efforts have been made by the government including making a DHF control programs focused on vector control based on community empowerment, that was stated on Semarang City Regulation No. 5 2010. The program was the provision of rainfall monitoring, Larvae Absence Rate (LAR) from Routine Mosquito Larvae Monitoring (*Pemeriksaan Jentik Berkala* or *PJB*), Larvae Absence Rate (LAR) from One House One Larvae Observer movement (*Satu Rumah Satu Jumantik* or *SRSJ*), and Larvae Absence Rate (LAR) from Students Search For Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) which were declared in by Semarang Health Office in 2019. Several studies conducted from 1991 to 2012 showed that the spread of dengue virus has a close correlation with climate conditions, especially temperature, rainfall, and humidity. The pattern of dengue virus transmission associated with climate change, can be achieved through recording long-term climate data change to explain the risk of dengue virus transmission associated with climate change (Johansson et al., 2009; Nash et al., 2014)

Community empowerment on a health sector is carried out by focusing on psychological and community feeling. Community empowerment on controlling DHF can be done by using a group of people as volunteer routinely checking mosquito larvae or referred to as Larvae Observer Technician (*Juru Pemantau Jentik* or *Jumantik*). Larvae Absence Rate (LAR) of Routine Mosquito Larvae Monitoring (*Pemeriksaan Jentik Berkala* or *PJB*) is carried out by health cadres and Larvae Observer Technician volunteers (*Juru Pemantau Jentik* or *Jumantik*) once a week (Sokunna et al., 2017; Tana et al., 2012)

Larvae Absence Rate (LAR) of One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) was formed with the aim of increasing family-based community participation in prevention. This activity is carried out by appointing one family member to monitor larvae at home every week. This movement is carried out not only in residential areas but also in workplaces, airports, and ports (Health Ministry of Indonesia, 2016; Sokunna et al., 2017).

Empowering school students to become health volunteers can also be done. The program is carried out through Students Search for Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) because children are part of the community. Children are trained and equipped with sufficient knowledge also skills, to be able to carry out their duties as a little larvae observer (Sukesi et al., 2016; Tana et al., 2012).

We can conclude the aim of the study is to know the correlation between of rainfall, Larvae Absence Rate (LAR) of Routine Mosquito Larvae Monitoring (*Pemeriksaan Jentik Berkala* or *PJB*), Larvae Absence Rate (LAR) of One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*), and Larvae Absence Rate (LAR) of Students Search For Mosquito Larvae Movement with (*SICENTIK* or *Siswa Cari Jentik*) the ammount of DHF case in Semarang.

METHOD

Research design used in this study is correlation analysis. This design is used because this study will study the correlation of more than two variables. The dependent variable of this study is the number of cases of DHF and the independent variables were rainfall, Routine Mosquito Larvae Monitoring (*Pemeriksaan Jentik Berkala* or *PJB*), One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) and Students Search For Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*). This study was conducted at the Semarang Health Office and carried out from January 2019 - April 2019.

Data collection techniques used in this study were observation and documentation. Observation was done by observing the regularity of the data that goes to the Semarang Health Office and reviews if there was data that has not been entered. Documentation was done by using primary documents, namely reports from the Health Surveillance Officer regarding the implementation of DHF prevention programs in Semarang.

This research used secondary data. Data was obtained from the survey conducted by Health Surveillance Officer consists of coverage of the One House One Larvae Observer movement (*Satu Rumah Satu Jumantik* or *SRSJ*), Routine Mosquito Larvae Monitoring (*Pemeriksaan Jentik Berkala* or *PJB*), and Students Search For Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) that was reported to Semarang Health Office. Rainfall data was obtained from Meteorology and Geophysics Office which was reported to the Semarang Health Office every month, as one of the High Early Warning System Component.

The tool used in this study was Microsoft Excel software to record observations and IBM SPSS 24 software to analyze the data that has been collected. So, as to provide a description of the correlation of the independent variables to the dependent variable. The collected data was analyzed use ratio scale. After processing using Microsoft Excel, the data was analyzed using IBM SPSS Statistics 24 program. Data distribution was assessed using the Shapiro-Wilk method. After obtaining the normality value of data distribution, a Correlation test was conducted.

Data was processed and analyzed by uni-

variate also bivariate. Univariate analysis was conducted to see the average rainfall and the coverage rate of the One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*), Routine Mosquito Larvae Monitoring (*Pemeriksaan Jentik Berkala* or *PJB*), and Students Search for Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) in Semarang. Bivariate analysis was carried out using IBM SPSS 24 software to determine the correlation between rainfall, One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*), Routine Mosquito Larvae Monitoring (*Pemeriksaan Jentik Berkala* or *PJB*) and Students Search for Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) on the DHF case in Semarang.

Correlation tests were conducted using the Pearson test to test hypotheses and get p values. If the value of p <0.05, there was a significant correlation, between the dependent variable and the independent variable assessed. But, if the value of p> 0.05, there was no significant correlation between the dependent variable and the independent variable assessed.

If there was a significant correlation in the Pearson test, the test was continued with regression analysis. Regression analysis was done to test the extent of the influence of independent variables on the dependent variable. Requirements for regression analysis were data must be interval scale or ratio and data must be normally distributed.

RESULTS AND DISCUSSION

The data in this study were obtained from secondary data from the Semarang Health Office from January to April 2019. Descriptive analysis was done to analyze the data range and the variance of the variable. The descriptive analysis results can be seen below on Table 1. The lowest number of dengue cases during the period of January - April 2019 was 82 cases, and the highest was 92 cases with an average of 79.5 cases. The standard deviation value of 13.69 cases can be concluded to be smaller than the average value indicating, that the distance between the lowest value and the highest was narrow also the data does not vary meaningfully in Semarang, during the period January - April 2019 in the range of average values (Table 1.).

The lowest rainfall during the period January - April 2019 was 178 mm and the highest was 224 mm with an average of 205.5 mm. The standard deviation value of 19.76 mm. Can be concluded that it was smaller than the average value indicating that the distance between the lowest value and the highest was narrow and the data does not vary, meaning rainfall in Semarang during the period January - April 2019 was in the range of average values (Table 1.).

The lowest Larvae Absence Rate (LAR) from Routine Mosquito Larvae Monitoring Program (*Pemeriksaan Jentik Berkala* or *PJB*) during January - April 2019 was 89.03% and the highest was 93.72% with an average of 91.26%. The standard deviation value of 2.02% mm can be concluded was smaller than the average value. Indicating that the distance between the lowest value and the highest was narrow. The data does not vary, means that the Larvae Absence Rate (LAR) from Routine Mosquito Larvae Monitoring Program in Semarang during January - April 2019 was in the range of average values (Table 1.).

The lowest Larvae Absence Rate (LAR) from One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) during January - April 2019 was 89.32% and the highest was 93.72% with an average of 90.76%. The standard deviation value of 1.07% mm can be concluded was smaller than the average value. Indicating that the distance between the lowest value and the highest was narrow, also the data does not vary means that Larvae Absence Rate (LAR) from One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) in Semarang during January - April 2019 was

Table 1. Descriptive Analysis Results of DHF Case, Rainfall, and The Government DHF Control Program

	Mean	Median	Std. Deviation
Total Dengue Hemorrhagic Fever Case	79,50	83	13,699
Rainfall	205,50	210	19,76
Larvae Absence Rate from Routine Mosquito Larvae Monitoring Program	91,26	91,15	2,02
Larvae Absence Rate from One House One Larvae Observer Movement	90,76	90,90	1,07
Larvae Absence Rate from Students Search For Mosquito Larvae Movement	85,6	87,00	4,97

in the range of average values (Table 1.).

The lowest Larvae Absence Rate (LAR) from Students Search for Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) during January - April 2019 was 78.80% and the highest was 89.60% with an average of 85.60%. The standard deviation value was 4.96%. It can be concluded that it was smaller than the average value. Indicating that the distance between the lowest value and the highest was narrow, also the data does not vary authentically in Semarang during January - April 2019 in the range of average values (Table 1.).

The normality test in this study was used to determine the distribution of research data whether or not it was normally distributed, and it was shown in the Table 2. From the Table 1. all variables were normally distributed with $p = 0.085$ ($p > 0.05$), so the parametric test used was Pearson correlation.

Correlation between rainfall and the number of dengue cases can be concluded based on the Table 3. The results of r = 0.951 which means that it has a linear correlation. Value $p = 0.049$ can be concluded that there was a significant correlation between rainfall and the number of dengue cases in Semarang.

High rainfall will naturally increase the number of mosquito breeding places outdoors such as cans, used bottles, leaves that can collect rainwater. High rainfall also caused air temperature decreased and humidity increased. That condition caused the incidence of dengue tends to increase (Wirayoga, 2013). The correlation between rainfall and the number of dengue cases has a significant positive correlation. On the conclusion, increasing rainfall was followed by increasing number of dengue cases and the change of peak rainfall are in line with the change in peak dengue cases (Hii et al., 2012a; Johansson et al., 2009; Wijegunawardana et al., 2019; Iriani, 2012).

In this transmission case, rainfall cannot be directly caused the increased of dengue case. The bad environmental sanitation systems in an area can cause waterway clogs and flood. Therefore, there is a need for government programs and community participation in effort to reduce dengue cases. The DHF control programs will succeed if the community participations and behaviors are well (Kusumo et al., 2014).

The Larvae Absence Rate (LAR) from Routine Mosquito Larvae Monitoring program (*Pemeriksaan Jentik Berkala* or *PJB*) shows the value of r = 0.648 (Table 3.) which means it has a linear correlation. It means the number of dengue cases will increase if the Larvae Absence Rate (LAR) increases. The value of $p = 0.352$ (Table 3.) indicates that there was no significant correlation between Larvae Absence Rate (LAR) from Routine Mosquito Larvae Monitoring program and the number of dengue cases in Semarang.

Larvae Absence Rate (LAR) shows larvae density in a certain area. Low value of Larvae Absence Rate (LAR) shows the high larvae density and population of *Ae. aegypti* in the region. Low value of Larvae Absence Rate (LAR) plays an important role in the transmission and spread of dengue disease (de Melo et al., 2012; Honorio at al., 2009; Sugumaran et al., 2009).

The Correlation between Larvae Absence Rate (LAR) from Routine Mosquito Larvae Monitoring program (*Pemeriksaan Jentik Berkala* or *PJB*) and the case of Dengue Hemorrhagic Fever shows the strength of a weak Correlation and the direction of a positive Correlation.

Table 3. shows that the higher level of larvae density will be increased by the incidence of Dengue Hemorrhagic Fever. The strength of the weak Correlation between Larvae Absence Rate (LAR) and the case of Dengue Hemorrhagic Fever can be caused by the fact that mosquito larvae will turn into infective mosquitoes. Implementation of Dengue Hemorrha-

Table 2. Normality Test Results DHF Case, Rainfall, and The Government DHF Control Program

	Mean	*p value*
Total Dengue Hemorragic Fever Case	79,50	0,362
Rainfall	205,50	20,15
Larvae Absence Rate from Routine Mosquito Larvae Monitoring Program	91,26	2,02
Larvae Absence Rate from One House One Larvae Observer Movement	90,76	1,07
Larvae Absence Rate from Students Search For Mosquito Larvae Movement	85,60	4,98

*Data considered normal if *p* value >0,05

Table 3. Pearson Correlation Test Results of DHF Case, Rainfall, and The Government DHF Control Program

	Total DHF Case	
	r	*p value*
Rainfall	0,951	0,049
Larvae Absence Rate from Routine Mosquito Larvae Monitoring Program	0,648	0,352
Larvae Absence Rate from One House One Larvae Observer Movement	0,804	0,196
Larvae Absence Rate from Students Search For Mosquito Larvae Movement	0,961	0,039

*Value considered significant when *p value* < 0,05

gic Fever control programs such as routine larvae will affect changes in larvae to mosquitoes and increase Larvae Absence Rate (Rosidi & Adisasmito, 2009).

Larvae Absence Rate (LAR) from One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) variable shows r = 0.804 which means it has a linear correlation. Value of $p = 0.196$ shows there was no significant correlation between Larvae Absence Rate (LAR) from One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) and the number of Dengue Hemorrhagic Fever cases in Semarang. The Correlation between Larvae Absence Rate (LAR) from One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) and the case of Dengue Hemorrhagic Fever shows the strength of a weak Correlation also the direction of a positive Correlation. The application of One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) can reduce dengue cases (Nursalim et al., 2019).

Variable show r = 0.961 in Larvae Absence Rate (LAR) from Students Search for Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*), which means it has a perfect linear correlation. The value of $p = 0.039$. It can be concluded that there was a significant correlation between the frequency and the number of dengue cases in Semarang. The correlation between Larvae Absence Rate (LAR) from Students Search For Mosquito Larvae Movement and the case of Dengue Hemorrhagic Fever shows the strength of a weak correlation and the direction of a positive correlation (Hii et al., 2012b; Ellis et al., 2011; Aik et al., 2019). There are differences in the presence of larvae before and after the existence of Students Search For Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*), and there are differences between schools that have Students Search For Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) and not (Andini, 2014).

Dengue Hemorrhagic Fever (DHF) has a relation with the environmental problems that involved humans in managing their environmental. Implementation of Dengue Hemorrhagic Fever control programs can do successfully if there is collaboration between government and community. The community must be involved in the process of planning, monitoring and evaluation in DHF programs, at household and regional level (Sukesi et al., 2018).

CONCLUSION

The Pearson correlation test results between rainfall and the number of dengue cases had significant correlation. High rainfall will naturally increase the number of breeding places for mosquitoes. Correlation test result between Larvae Absence Rate (LAR), Routine Mosquito Larvae Monitoring Program (*Pemeriksaan Jentik Berkala* or *PJB*), and total Dengue Hemorrhagic Fever cases in Semarang had no significant correlation even it had moderate positive correlation. Correlation test result between the Larvae Absence Rate (LAR) from One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*) and total Dengue Hemorrhagic Fever cases in Semarang had no significant correlation even it had strong positive correlation. Correlation test result between Larvae Absence Rate (LAR) from Students Search for Mosquito Larvae Movement and (*SICENTIK* or *Siswa Cari Jentik*) total Dengue Hemorrhagic Fever cases in Semarang had strong significant correlation. Suggestions that researchers recommend for community was that controlling the environment by reducing the breeding place of *Ae. aegypti* in the home environment. The method that could be done was by conducting "*3M Plus PSN*" activities routinely such as draining and brushing water reservoirs (bathtubs, drums, etc.) at least once a week, so that, breeding places of *Ae. aegypti* could be eliminated and the risk of dengue at Semarang could be lowered. Further research with a longer research period, about the effectivity of rainfall monitoring, Routine Mosquito Larvae Monitoring Program (*Pemeriksaan Jentik Berkala* or *PJB*), One House One Larvae Observer Movement (*Satu Rumah Satu Jumantik* or *SRSJ*), Larvae Absence Rate (LAR) from

Students Search For Mosquito Larvae Movement (*SICENTIK* or *Siswa Cari Jentik*) on reducing Dengue Haemorragic Fever case in Semarang, needs to be done in another region.

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