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January 19-22, 2020 | Kyoto, Japan
ICPS
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2020 10th International Conference
on Bioscience, Biochemistry and Bioinformatics

CONFERENCE ABSTRACT

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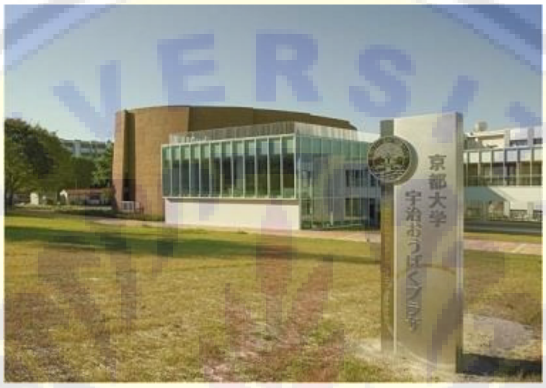

1. How to Get Here?

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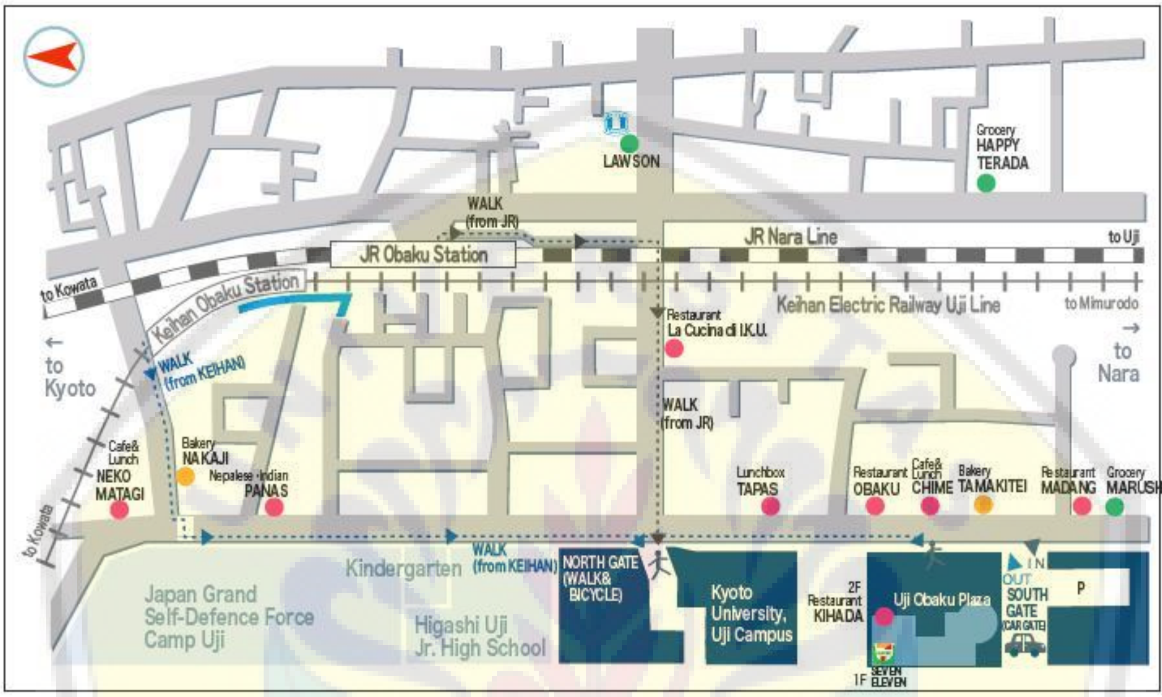

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Poster Session on January 21, 2020

Poster Session 2: Systematic Biology

Introduction

Welcome to 2020 10th International Conference on Bioscience, Biochemistry and Bioinformatics (ICBBB 2020). It is organized by Biology and Bioinformatics Society (BBS) under Hong Kong Chemical, Biological & Environmental Engineering Society (CBEES) and supported by Kyoto Prefecture, Kyoto Convention & Visitors Bureau, Tokai University and Conference Partner.

ICBBB 2020 will be held in Kyoto University, Kyoto, Japan during January 19-22, 2020 for celebration of its 10th anniversary with participants. Previously, ICBBB 2019 in Singapore, ICBBB 2018 in Tokyo, Japan, ICBBB 2017 in Bangkok, Thailand, ICBBB 2016 in Pattaya, Thailand, ICBBB 2015 in Taipei, Taiwan, ICBBB 2014 in Melbourne, Australia, ICBBB 2013 in Rome, Italy, ICBBB 2012 in Chennai, India and ICBBB 2011 in Singapore had been successfully held.

ICBBB conference series held annually to provide an interactive forum for presentation and discussion on Bioscience, Biochemistry and Bioinformatics and related fields. The conference welcomes participants from all over the world who are interested in developing professional ties to and/or exploring career opportunities in the region. The conference should serve as an ideal forum to establish relationships from within Japan and other regions of the world.

Papers will be published in the following conference proceedings or journal:

ACM Conference Proceedings (ISBN: 978-1-4503-7676-1), archived in ACM Digital Library, indexed by Ei Compendex and Scopus, and submitted to be reviewed by Thomson Reuters Conference Proceedings Citation Index (ISI Web of Science).

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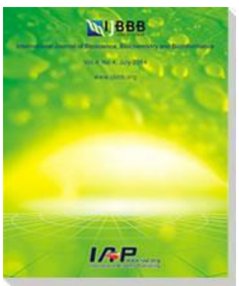

International Journal of Bioscience, Biochemistry and Bioinformatics (IJBBB, ISSN: 2010-3638), and will be included in the Engineering & Technology Digital Library, and indexed by WorldCat, Google Scholar, Cross ref, ProQuest.

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Variability of Local Weather as Early Warning for Dengue Hemorrhagic Fever Outbreak in Indonesia

Khaidar Ali
Universitas Gadjah Mada
Sleman, Yogyakarta, Indonesia
alikhaidar15@gmail.com

Isa Ma'rufi
The University of Jember
Jember, Indonesia
isa.marufi@gmail.com

Wiranto
Universitas Gadjah Mada
Sleman, Yogyakarta, Indonesia

Anis Fuad
Universitas Gadjah Mada
Sleman, Yogyakarta, Indonesia

ABSTRACT
The incidence of Dengue Hemorrhagic Fever (DHF) is related to the alternation of environment condition, particularly weather, in which global warming may elevate the DHF case. The objective of study is to analyses the relationship between local weather and DHF, and to create prediction model by using big data in Surabaya Municipally. Employing quantitative method, monthly time series data was used during 2012-2016. Univariate, bivariate and multivariate analysis was performed in Stata 13. Local weather (mean humidity, maximum humidity, minimum humidity, rainy days and rainfall) correlates to the incidence of DHF ($p < 0.05$), in which minimum humidity lag 1 month and rainy days lag 2 month had strong correlation ($r > 0.7$). In addition, prediction model in the study recognize the occurrence of four peak epidemic of DHF cases in Surabaya Municipally. Therefore, utilizing local weather to create prediction model may contribute as early warning for DHF incident in order to handle the disease in Surabaya Municipally.

CCS Concepts
•**Social and professional topics**

Keywords
Local weather; Global warming; Prediction; Early warning

1. INTRODUCTION
Dengue fever is one of neglected tropical disease (NTDs) that caused 50-100 million infections in 100 endemic countries annually [1]. The US Centre for Disease Control and Prevention (CDC) describe NTDs is infectious disease that affected one hundred percent of low-income countries, and causing disfiguring, debilitating, and mortality among society [2]. NTDs are commonly found in society with low prosperity, such as low-and middle- income countries in Asia, Africa, and Latin America [3]. In the recent decade, dengue incidence is increasing dramatically. Ferreira [4] estimated that over 50% of populations (2.5 to 3.6 billion people) are at risk with dengue virus infection worldwide, in which 390 million infection of dengue virus was reported annually [5]. In addition, CDC noted that there is 400 million of dengue cases reported annually, and dengue is one of leading cause of morbidity and mortality among communities in tropical and sub-tropical region [6].

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Dengue fever, caused by dengue virus and transmitted by *Aedes aegypti* as principal vector, is causing severe headache, severe eye pain, join pain, muscle and/or bone pain, rash, mild bleeding manifestation [1], [7], and it is often causing lethal complication by severe dengue or dengue hemorrhagic fever (DHF) [5]. The first cases of DHF was reported at Manila in 1954, DHF cases then spread to other Southeast Asian countries, namely Thailand (1962), Vietnam (1960), Singapore (1962), Srilanka (1965), and Myanmar (1968) [8]. In Indonesia, the first case of DHF was reported on 1968 in Surabaya and Jakarta [9], and DHF cases is reported annually in Indonesia. The DHF case on 2016 is reported high with 204,171 cases, and causing 1,598 deaths in Indonesia [10]. Nevertheless, the DHF case on 2017 declined to 68,407 cases [11]. East Java, one of provinces of Indonesia, has the highest DHF cases in Indonesia after West Java with 30,138 cases on 2015 [12]. However, the DHF case in East Java is declining on 2018 with 8,449 cases [13]. In Surabaya Municipally, the DHF case on 2016 is reported 25,339 cases [14].

According to Health Office of East Java [9], [10], [13], the incidence of DHF is related to population density, mobility, urbanization, economic growth, social behavior, sanitation, and clean water availability, in which climate change also affect the DHF incidence among society. Climate change correlated to global warming, in which the high level of greenhouse gases is increasing the temperature of both atmosphere and earth [15]. Human activities such as fossil oil combustion, land use changed, coal mining, agriculture elevated the concentration of greenhouse gases [15], [16]. Watson [16] estimates the global temperature is raising about 1.0-3.5^{0}C by 2100, and it may create favorable environment for *Aedes aegypti*, principal vector for dengue fever or dengue hemorrhagic fever, to spread and grow [17], [18].

Gubler [19] noted that climate change contribute to the high incidence of disease related to vector such as dengue fever. In addition, Reiter [20] noted that communities' activities and their impact through ecology may affect the mosquito-borne disease; whilst Patz [21] describes that warm temperature may affect the transmission of dengue fever. Furthermore, Hopp [22] also noted that climate variation could affect the modelled of *Aedes aegypti*, where climate change is increasing the area that is suitable for dengue transmission [23]. Picard [24] reported that dengue is also significant with sea surface temperature. Therefore, the study of climatic condition and dengue hemorrhagic fever is needed.

The aim of study is to analyze the relationship between local weather such as temperature (min, max, and mean), rainy days, rainfall, humidity (min, max, and mean), wind velocity, sunshine duration with the incidence of DHF, and also to create prediction model of DHF incidence by using big data during 2012-2016 in Surabaya Municipally as early warning for the epidemic of DHF.

2. MATERIAL AND METHOD

2.1 Study Area and Subject

This study was conducted in Surabaya Municipally, East Java, Indonesia. Surabaya Municipally is located in 07 21 South Latitude and 112 36 and 112 54 East Longitude, in which most of the regions are in lowland (3-6 masl) [25]. Surabaya Municipal's range is about 326.81 km^2, and 31 sub-districts were registered in Surabaya Municipally [25].

The subject of this study is monthly time series data of Dengue Hemorrhagic Fever (DHF) and Local Weather during 2012-2016. The data of DHF was retrieved from Department of Arbovirus of Health Ministry of Indonesia. On the other hand, the local weather of Surabaya Municipally was retrieved from Data Bank provided by Statistics of Surabaya Municipality (www.surabayakota.bps.go.id). The local weather data was consisting of relative humidity (%), temperature (^{0}C), sunshine duration (%), wind velocity (knot), rainy days (days), and rainfall (mm). Both DHF and local weather data was presented in monthly during 2012-2016.

2.2 Method

Employing quantitative study, monthly time series data of DHF and local weather of Surabaya Municipally was used to analyze the relationship between DHF and local weather and to create prediction model of DHF incidence using big data. Data cleaning of DHF and local weather was performed before data analysis, in which there is no missing data recorded.

2.3 Analysis

This study was using univariate, bivariate and multivariate analysis. Univariate analysis was performed to acknowledge the frequency or distribution of DHF and local weather, in which the data was presented in mean, standard deviance, Interquartile range (IQR), and etc. The relationship between DHF case and local weather in Surabaya Municipally was analyzed by bivariate using Spearman test, after normality test was performed. Normality test of data was performed with Shapiro-Wilk normality test, where the data was not normal ($p \leq 0.05$). In this study, the author also conducted correlation for time lag of each predictor variables (0-3 month).

Multivariate analysis was performed to create prediction model, in which either poisson regression or negative binomial regression was used to create prediction, since the dengue case was count variable [26]. The data of DHF case is over dispersed (variance > mean). Therefore, negative binomial regression was selected. Before the author started the multivariate analysis, the author identified the multicollinearity of each predictor variable by using variance inflation factor (VIF) corrected with spearman's rank test, in which there was multicollinearity for several predictors, namely: 1) mean humidity and max humidity, 2) mean humidity and rainy days, 3) max humidity and rainy days, and 4) rainy days and rainfall. Therefore, the author excluded mean humidity, max humidity and rainy days within multivariate analysis.

The best fit model from negative binomial regression was assessed by Aikaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) from each model, in which the lowest score of AIC and BIC was estimated to have fit prediction model. In addition, the incidence rate ratio (IRR) was presented in this study to consider the relative risk of DHF incidence related to local weather condition [26]. Moving average analysis was also used to acknowledge the smoothness pattern of DHF case and predicted value from fit model. The significant level was 5% (α=0.05), and the confidence interval was 95%. This analysis was performed in Stata version 13 (College Station,TX).

3. RESULT AND DISCUSSION

3.1 Dengue Hemorrhagic Fever and Local Weahter

The incidence of Dengue Hemorrhagic Fever (DHF) during 2012-2016 in Surabaya Municipally was presented by Figure 1. Based on Figure 1, the incidence of DHF is reported annually. The total of DHF case in Surabaya is reported 5,607 cases during 2012-2016, in which the highest cases occurred on April 2013 with 526 cases.

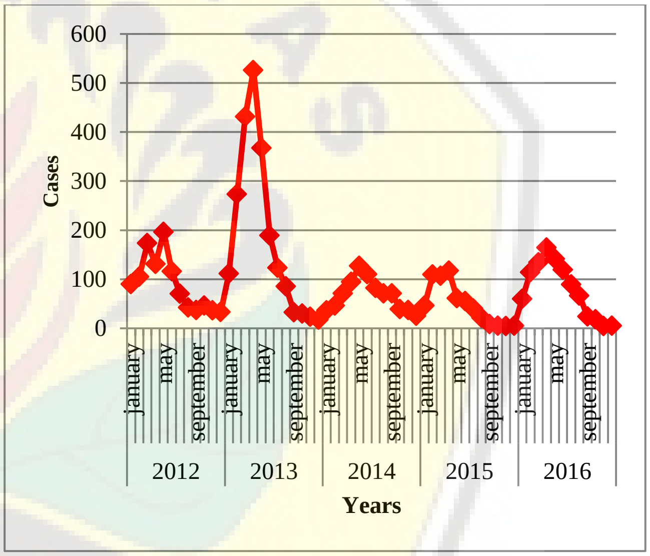

Figure 1. The DHF case in Surabaya Municipally during 2012-2016

The distribution of local weather predictor was showed by Table 1. Based on Table 1, the average of mean humidity, max humidity, min humidity, mean temperature, max temperature, min temperature, sunshine duration, wind velocity, rainy days, and rainfall is 76.88%, 94.28%, 47.90%, 27.98^{0}C, 33.87^{0}C, 22.80^{0}C, 89.54%, 19.55 knot, 13.65 days, and 177.42 mm, respectively.

Table 1. The distribution of local weather

Variable	Mean	SD	Min	Max	IQR
Mean humidity	76.88	5.79	65	92	9.50
Max humidity	94.28	4.05	83	100	6
Min humidity	47.90	7.47	26	62	12
Mean temperature	27.98	1.13	24.4	30.5	1.69
Max temperature	33.87	1.67	25.4	37.6	1.85
Min temperature	22.80	1.22	20.4	24.8	1.85

Sunshine duration	89.54	113.30	18.1	780	39.05
Wind velocity	19.55	4.35	10	31	5
Rainy days	13.65	9.34	0	28	17
Rainfall	177.42	160.79	0	590	226

3.2 The Relationship between Local Weather and Dengue Hemorrhagic Fever

Based on Spearman test, the local weather, namely DHF cases lag 1, mean humidity lag 0-3, max humidity lag 0-3, min humidity lag 0-3, max temperature lag 1 and 3, min temperature lag 2, sunshine duration lag 1-3, wind velocity lag 3, rainy days lag 0-3, and rainfall lag 0-3 is significant with the incidence of DHF in Surabaya Municipally ($p \leq 0.05$). However, the highest coefficient of spearman test was showed by Table 2, in which mean humidity, min humidity, rainy days and rainfall of lag 0-3 month had strong correlation with the incidence of DHF.

Table 2. The correlation between DHF and local weather

Variables	lag time	r	p-value
DHF cases	1	0.8466*	0.0000
Mean humidity	0	0.4767*	0.0002
	1	0.6707*	0.0000
	2	0.6545*	0.0000
	3	0.4539*	0.0004
Max humidity	0	0.2834*	0.0327
	1	0.4364*	0.0007
	2	0.4325*	0.0008
	3	0.3082*	0.0197
Min humidity	0	0.6180*	0.0000
	1	0.7199*	0.0000
	2	0.6212*	0.0000
	3	0.3491*	0.0078
Rainy days	0	0.3588*	0.0061
	1	0.6430*	0.0000
	2	0.7149*	0.0000
	3	0.6141*	0.0000
Rainfall	0	0.3664*	0.0051
	1	0.5741*	0.0000
	2	0.5945*	0.0000
	3	0.5185*	0.0000

3.3 Fit Prediction Model

The best fit prediction model from negative binomial regression was showed by Figure 2, in which the predictor variables of model are DHF lag 1 month, minimum humidity lag 1 month, maximum temperature lag 3 month, minimum temperature lag 3 month, sunshine duration lag 2 month, wind velocity lag 3 month, and rainfall lag 2 month.

DHF	B	Incidence Rate Ratio (IRR)	Standard Error	P > |z|	95% Confidence Interval	
					Lower	Upper
DHF lag 1	.0047889	1.0048	.0007718	0.000	1.003289	1.006314
Min_humid lag 1	.029394	1.02983	.0113908	0.008	1.007745	1.0524
Max_temp lag 3	.0728933	1.075616	.0369772	0.034	1.00553	1.150587
Min_temp lag3	.1214756	1.129162	.0664994	0.039	1.006066	1.267318
Sunshine lag2	-.0034991	.996507	.0008038	0.000	.9949328	.9980837
Wind velocity lag 3	.0153619	1.015481	.0152024	0.305	.9861172	1.045718
Rainfall lag 2	.0005717	1.000572	.0005195	0.271	.9995541	1.001591
_cons	-3.041249	.0477752	.0692122	0.036	.0027929	.8172283

Figure 2. Best fit model predictor of negative binomial regression

Based on Figure 2, the incident rate ratio (IRR) of DHF was a 1.005%, 1.030%, 1.076%, 1.129%, 1.015%, 1.0001% increase in DHF lag 1, Minimum humidity lag 1, maximum temperature lag 3, minimum temperature lag 3, wind velocity lag 3, rainfall lag 2 respectively, holding other predictor variables constant. Meanwhile, for every unit increase in sunshine lag 2, the percent change in the IRR of DHF cases decreased by 0.997%. Furthermore, the AIC and BIC of this model is reported 552.9197 and 571.3071, respectively, in which it is the lowest score than other models.

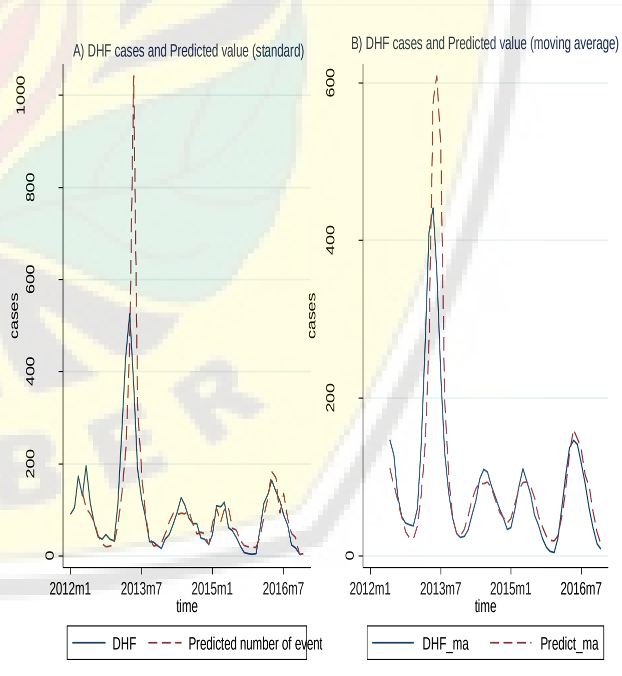

Figure 3. The pattern of DHF cases and predicted value of model (A. standard data analysis; B. moving average analysis)

The pattern of DHF case and predicted value from best fit model was showed by Figure 3, in which Figure 3A presented standard data analysis. Meanwhile, moving average analysis of DHF cases and predicted value was showed by Figure 3B. Based on Figure 3, the pattern of DHF cases and predicted value was clearly showed in moving average analysis data, in which the model was appropriate to recognize the occurrence of 4 peak epidemic of DHF cases in Surabaya Municipally.

Dengue Hemorrhagic Fever (DHF) is communicable disease that is caused by dengue virus and transmitted by infected *Aedes aegypti* and *Aedes albopictus* [27] [28]. Population density, mobility, urbanization, economic growth, environmental sanitation, the availability of clean water [9], [10], [13], [29], population growth, and air travel [30], [31] are the risk factor of DHF case among community, in which the alternation of weather pattern contribute the high incidence of DHF among community [19].

The study of relationship between climate variability and DHF incidence is well-documented. Based on Chakravarti [32], the climate aspect such as rainfall, temperature, and humidity is risk factor of DHF outbreak. The study of DHF in Bangkok showed that the cyclic pattern of DHF epidemic is related to temperature-induce variation in vector efficiency of *Aedes aegypti* [33]. Therefore, environmental aspect is related to the incidence of DHF.

Based on Spearman test, DHF lag 1 month and local weather predictor (mean humidity, max humidity, min humidity, rainy days, and rainfall) lag 0-3 month are significant with DHF incidence in Surabaya Municipally. In addition, max temperature lag 0 and 3, min temperature lag 2, sunshine duration lag 1-3 month, and wind velocity lag 3 is also significant ($p < 0.05$). Based on statistical test, DHF lag 1 month, min humidity lag 1 month, and rainy days lag 2 had strong correlation with 0.8466, 0.7199, and 0.7149, respectively. Therefore, local weather, except mean temperature, correlated to DHF incidence in Surabaya.

Perwitasari [34] argued that rainfall (>200 mm) and rainy days period (>20 days) are elevating the DHF case. Wu [35] reported that there are association between temperature (>18^0C per year) and urbanization with dengue fever in Taiwan. The study conducted by Lu [36] in Guangzhou-China noted that there is association between minimum temperatures and humidity with dengue incidence. In Indonesia, Djati [37] describes that there is no correlation between temperatures with DHF incidence in Gunung Kidul. This result is suitable with study of Hidayati related to DHF case in Sukabumi Municipally, Indonesia [38].

Based on rainy days and rainfall, those climatic aspects are related to DHF cases in Surabaya. This finding agrees with Djati [37]. Besides, Tomia [39] noted that there is no correlation between rainfall and humidity with DHF incidence. Thammapalo [40] conducted study of DHF on 73 provinces in Thailand, where rising temperature is related to high DHF incidence in 9 provinces, while there is relationship between high rainfalls with decreasing DHF incidence in 7 provinces. Thu [41] also noted that temperature and relative humidity of rainy season is related with DHF epidemic by increasing the favor of dengue virus propagation. Therefore, disease transmitted by vector is vulnerable to climatic variability.

Figure 3 presented the pattern of predicted value of best model from negative binomial regression toward DHF cases in Surabaya Municipally, in which negative binomial regression (known as gamma-poisson regression) is appropriate to create the best fit model to predict over dispersed discrete data [42], [43]. Hilbe [44] describe that parameter such as deviance goodness-of-fit test, likelihood-ratio test, and AIC – BIC value is appropriate to recognize the fit model. In this study, fit model from negative binomial regression was formed by DHF lag 1 month, min humidity lag 1 month, max temperature lag 3 month, min temperature lag 3 month, sunshine lag 2 month, wind velocity lag 3 month, and rainfall lag 2 month, in which Figure 3B showed the clear pattern of predicted value of fit model toward DHF cases in Surabaya Municipally.

Disease related to public health issue is contributed by environmental ecosystem [45]. Githeko [46] describe that the alternation of temperature, rainfall, rainy days, and relative humidity affects biological and ecological aspect of vector and the intermediate host, in which climate change takes important role at the risk of dengue transmission among community. *Aedes aegypti* is sensitive vector to the alternation of climate condition, particularly temperature. Immature stage of *Aedes aegypti*, larvae stage, may need short time to become adult mosquito when the temperature is increasing [47], [48]. Githeko [46] also reported that increasing temperature will elevate the feeding activity of *Aedes aegypti*, in which global warming may increase the intensity of dengue virus transmission.

This study found that local weather contributed to the incidence of DHF in Surabaya Municipally, in which the data of local weather could be develop to create early warning system that is simple, accurate and efficient. Utilization of local weather to predict the DHF incidence may take important role within: 1) controlling the DHF outbreak, 2) low finance investment needed [49]. Therefore, prediction of DHF incidence by using local weather data may reduce the morbidity or mortality caused dengue virus.

The limitation of this study is the study cannot describe the effect of local weather toward sub-district area. Therefore, further study is needed to create prediction model by using local weather based on sub-district area in order to reduce the DHF incident in specific area.

4. CONCLUSION

Local weather such as mean humidity, maximum humidity, minimum humidity, rainy days and rainfall correlate with the incidence of Dengue Hemorrhagic Fever in Surabaya Municipally ($p < 0.05$), in which minimum humidity lag 1 month and rainy days lag 2 month had strong correlation ($r > 0.7$). In addition, fit model from negative binomial regression using local weather for predictor variable showed that the prediction model could recognize the occurrence of four peak epidemic of DHF cases in Surabaya Municipally. Therefore, utilization of local weather for early warning is needed to implement by government to reduce the morbidity and mortality caused by DHF.

5. CONFLICT OF INTEREST

The authors declare no conflict of interest.

6. ACKNOWLEDGMENTS

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