Article

Prediction of Dengue Cases in Kupang, East Nusa Tenggara, Indonesia

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Abstract:

With the pandemic of Corona Virus [Covid-19], another infectious disease such as dengue neglected In Indonesia. Since the majority of resources, both human and capital, are focusing more on Covid-19, it is still essential to also manage dengue as it is still becoming a threat to the community. This paper aims to predict the number of cases of dengue in Kupang, East Nusa Tenggara, which can help the government to plan for dengue program activities. The result shows the forecast that dengue will remain high for the whole year. With the stay at the home approach to preventing COVID19, chances to get dengue virus increased. Maintaining a clean environment, reduction of breeding sites, and other protective measurements against dengue transmission is very important to perform.

Keywords: Covid-19, dengue cases, Kupang city prediction.

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1 Introduction

During Corona Virus [Covid-19] Pandemic almost all other diseases suffer from neglection both from health officials and from the community. In Indonesia, from the first confirmed cases of Covid-19 in early March until 29th April 2020 it already recorded 9,511 cases with 773 fatalities.[1] Governments and hospitals continue to increase the allocation of personnel and medical devices for handling Covid-19 and as a result, the handling of other diseases such as dengue is neglected [2]. Simultaneously, The Indonesian Ministry of Health recorded that from January to the second week of March 2020 there were around 40 thousand cases of dengue nationally with 254 fatalities [3] .

East Nusa Tenggara was one of the Provinces with the highest number of cases together with East Java and until March 2020, there were 3,731 dengue cases in all of East Nusa Tenggara, with 43 fatalities [4]. Dengue is still a very important public health threats that need attention

 doi:10.20944/preprints202004.0539.v1

[3][5]. Researchers concerned about Dengue fever and COVID-19 that are difficult to distinguish because they share clinical and laboratory features [5]. Some cases of Covid-19 diagnosed as dengue already reported in some hospitals. New strain of this virus will probably contribute to a more complicated human-endemic transmission [6].

Dengue hemorrhagic fever is transmitted by peri-domestic mosquitoes through *Aedes aegypti* and *Aedes albopictus* as the vectors. Especially in developing countries, the development related activities, particularly with regard to water storage, increase the mosquito habitats and the risk of disease [5][8][9]. Identifying the cause of a disease is a major factor in its control [10]. There are multifactor effects that are highly dynamic and change over time.[7][8][11] In a study, the failure to achieve an intervention program objectives is usually due to the program not being designed comprehensively and not taking a whole of system perspective [7] [14]. Studies found that dengue prevention and control program was the most decisive factor in disease prevention [8][15] [16][17]. Program to eradicate dengue in Indonesia started since the beginning of the first cases, however all effort to suppress the spread of dengue for decades are now threatened by Covid-19.

East Nusa Tenggara government already conducted some program to control dengue. Some activities were fogging to control the Aedes Aegypti mosquito, distribution of anti-mosquito lotions for free, and distribute abate powder to cut off the regeneration of infectious mosquitoes. Although studies stated that fogging is not effective to eradicate mosquitos [14][18]. The local government has also distributed anti-mosquito drugs to schools. Some regions open 24-hour Posts for dengue infection detection services with rapid test kits such as the Elisa test. The challenge for the government is as the management of Covid-19 resorb the majority of sources both human and capital, it is still important to manage dengue as its still becoming the threat to the community.

It is very important especially for government and community to stay alert to dengue. This paper aims to predict the number of cases of dengue in Kupang, East Nusa Tenggara which can help the government to plan for dengue program activities.

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2. Methods

Study area. Kupang is the capital city in East Nusa Tenggara, Indonesia located at 10 ° 36 '14 "-10 ° 39 '58" South Latitude and 123 ° 32 '23 "- 123 ° 37 '01" East. ; It covers an area of 180.27 Km2. The average temperature in Kupang City ranges from 23.8 ° C to 31.6 ° C. Average air humidity ranges from 73 percent to 99 percent. Rainfall was 1,720.4 mm, and rainy days were 152 days. The highest rainfall occurred in January with 598.3 mm, while the highest rainy day occurred in December with 28 rainy days. Geographic and weather condition makes Kupang city ideal for dengue [17].

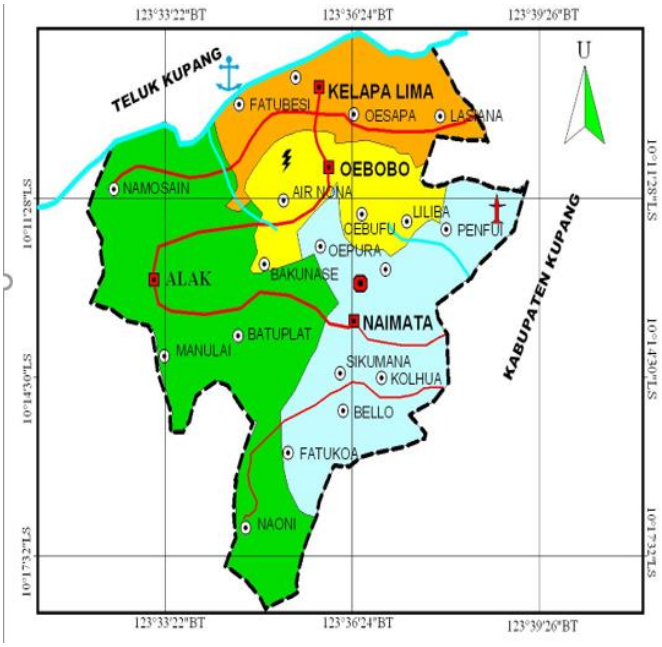

Figure 1. Map of Kupang City

Data regarding monthly dengue reported cases by months from January 2010 – December 2019 in Kupang City, East Nusa TenggaraIndonesia, were collected from various relevant governmental departments. Data analysis used for describing the temporal patterns of dengue cases in Kupang City by plotting monthly and year incidence for the study period. This data analysis evaluated the overall features of the data using the graphical approach: trends [increase, decrease], seasonality, and outliers. We estimate the parameter using The Box-Jenkins approach to fit the Auto-Regressive Integrated Moving Average [ARIMA] models. This model will predict monthly dengue cases for the year 2020 [12 months]. Data analyzed using the Minitab program version 18.0.

3. Results

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Reported monthly dengue case data in Kupang City, East Nusa TenggaraIndonesia [Figure 1]

Figure 1 found in the city of Kupang the yearly incidence of dengue varied from 351 cases in 2010 to 609 cases in 2019, during the study period [2010-2019]. The higher incidences were registered in the years: 2012 [n=890] and 2019 [609].

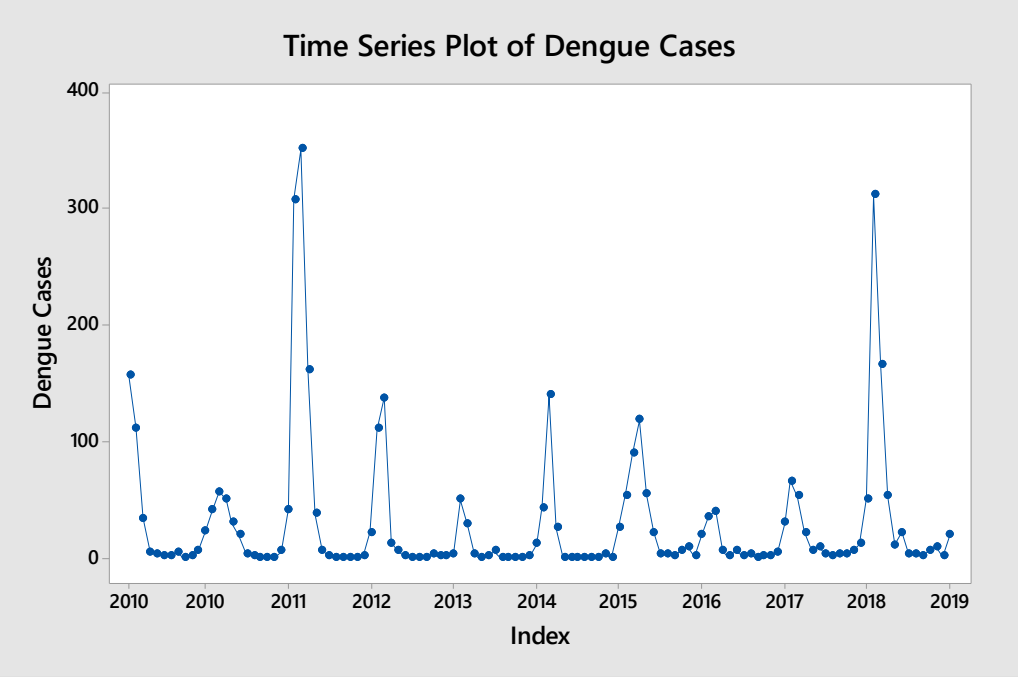

Figure 1. Reported monthly dengue case data in Kupang City, East Nusa TenggaraIndonesia [2010-2019]

Seasonal box-plot distribution of monthly dengue cases [ln data] in Kupang City [Figure 2]

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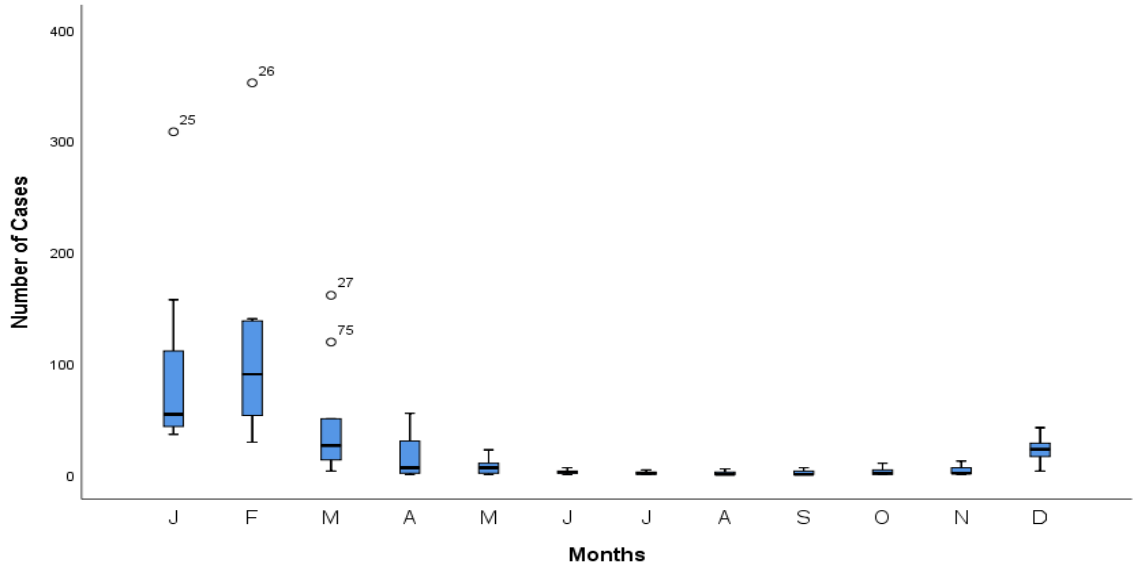

Figure 2. Seasonal box-plot distribution of monthly dengue cases [ln data] in Kupang City, East Nusa TenggaraIndonesia [2010-2019]

Figure 2 showed considering that seasonality was an important component for the Kupang City, that performed exploratory analysis of dengue incidence [ln data] for the period 2010-2019. The analysis showed that highest incidence was registered from December to February with four outlier of 308 and 352 dengue cases registered in January and February 2012, 161 and 119 dengue cases in March 2012 and 2016, and lowest incidence from May to November.

Trend analysis plot for dengue cases based on linear trend model [Figure 3].

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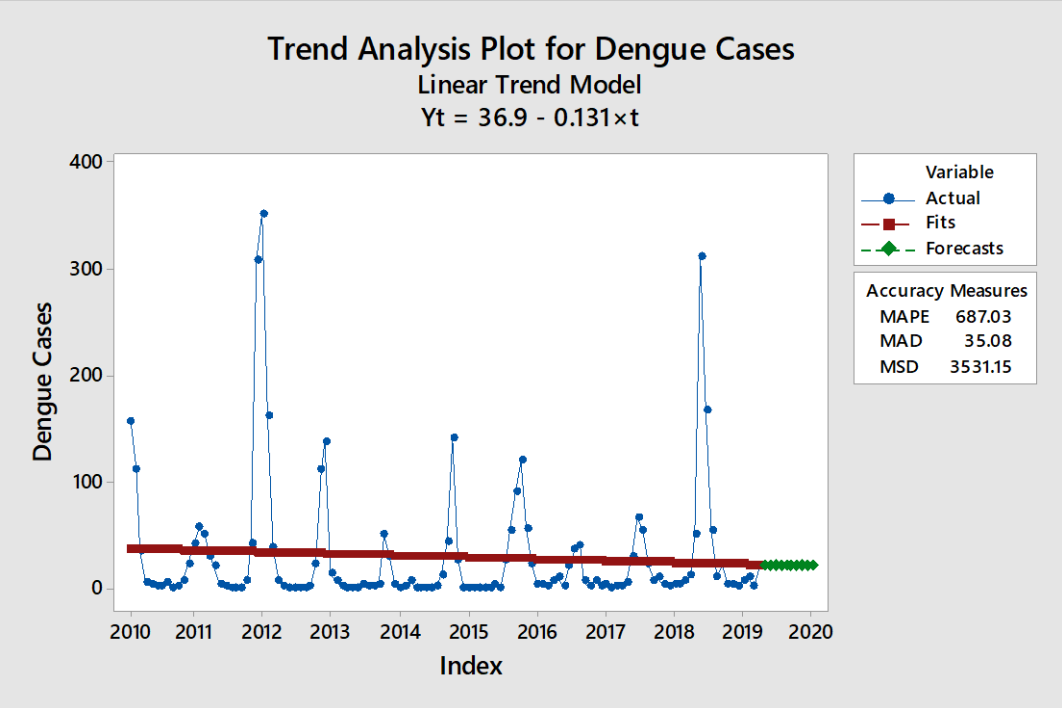

Figure 3 showed linear trend model to prediction of dengue cases in 2020 was Yt = 36.9 – 0.131 x t.

Table 1. Forecasted monthly dengue cases for Kupang City, East Nusa TenggaraIndonesia in 2020

Period	Months [2020]	Predicted Cases
109	January	23
110	February	23
111	March	22
112	April	22
113	May	22
114	June	22
115	July	22
116	August	22
117	September	22
118	October	21
119	November	21
120	December	21
Total		**263**

Table 1 shows the monthly forecast of dengue cases according to the model in 2020 for Kupang City the model predicted total number of dengue cases for 2020 was 263 varying from 23

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dengue cases in January and February, 22 dengue cases in March to September and 21 cases dengue cases in October to December.

4. Discussion

Dengue, caused by infection with any of the four dengue virus [DENV] serotypes [1–4], is one of the most important mosquito-borne viral diseases as a major public health concern. Since its first report in 1968, Indonesia is still vulnerable to the dengue outbreak. The outbreak pattern in Indonesia roughly recorded every 6-8 years, since 1973, 1988, 1998, 2009, 2016, and now in 2019 [5] [17]. The country vulnerability to dengue outbreak due to many factors such as sifting of dengue serotype, environment condition and people behavior, programmatic factors for prevention, control, and case management and government commitment [12]. One study of the Dengue outbreak in 1998 reveals that DENV-3, which generally associated with the Dengue outbreak in Indonesia, had a newly isolated genotype within DENV-3 that never reported in Indonesia before 1998. This new isolated DENV-3 genotype commonly circulated in Thailand. The finding indicated that these new viruses have been imported into Indonesia and established its local transmission and associated with the increases of DHF cases. [17]

As Dengue viruses transmitted through the bite of infected Aedes aegypti and Aedes albopictus female mosquitoes, the available water for breeding places is an essential factor for an outbreak. Our recent observation in West Java and Timor shows that some standing water, including puddles, water tanks, containers, and old tires are still the main Aedes breeding sites. [5][14][18] Then a lack of community participation and government commitment to provide better and reliable sanitation and regular garbage collection also contribute to the spread of the mosquitoes.[5] [7]

Our data shows that dengue incidences were peak in the rainy season, from December to April. The rainy season was easier for the mosquito to breed in lots of newly created standing water. So, during this period, the number of possible new cases, depending on how regions prevent the spread of the disease, by controlling their surrounding environment, with better sanitation measures, regular garbage collection, and prevention of newly created standing water for mosquitoes to breed.

Although Indonesia Government has made efforts, during the dengue outbreak, both the incidence and case-fatality rates are still high and not showing significant changes. In our

observation from the programmatic review, a dengue surveillance system is not capable enough to provide a timely alert for anticipating the outbreak. Many outbreak events were realized by the authority when lots of cases and deaths published on the news [9][7]. Community knowledge, awareness, and involvement against dengue play crucial roles in preventing dengue outbreaks [15]. During the recent dengue outbreak, government attention to anticipate the COVID19 pandemic put the cost on more dengue cases and deaths in East Nusa Tenggara. This condition is worsening by the unavailability of adequate laboratory capacity to detect and diagnose dengue.

Central Government has to send specialist and laboratory equipment to support East Nusa Tenggara during the dengue outbreak [17]. A similar condition also reflected by the limited capacity of the East Nusa Tenggara government to perform adequate and timely COVID19 sample testing. All sample COVID19 sample has to send to referral laboratories for COVID19, and it takes 7-14 days for the results to come. Not to mention the difficulties of sending the sample out from East Nusa Tenggara to Jakarta due to travel retractation during the regional lockdown and domestic travel ban[18][4].

As dengue claimed more live compare to COVID19 in East Nusa Tenggara, the local government concerns more on how to overcome this outbreak. However, the global domino effects of COVID19 pandemic has put more burden to local government – which has limited resource to focus on both Dengue and COVID19 at the same time [19]. Community and government have to be informed that the stay at the home approach to preventing COVID19 increases chances to get dengue virus if there is not enough effort to maintain a clean environment, reduction of breeding sites, and other protective measurements against dengue transmission.

Author Contributions: All the authors listed contributed equally to the production of this manuscript.

Funding: This research received no external funding

Acknowledgments: Authors would like to thank the Health Office of Kupang City and East Nusa Tenggara.

Conflicts of Interest: The authors declare no conflict of interest

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