Analysis of Temperature and Relative Humidity towards the Dispersion of CoVid-19 in Indonesia

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Abstract. The research purpose is to analyze how the temperature and humidity affect the development of CoVid-19 in Indonesia. The data used is secondary data from BMKG and official CoVid-19 data based taken from May 2-8, 2020. The data analysis techniques use the violin plots and the jitter plots with the assistance of software R. Based on the research can conclude that the temperature has a positive correlation of 0.3 and that humidity has a positive correlation of 0.2. That means the temperature and humidity are not the main factors in the development of CoVid-19 in Indonesia. High temperatures and humidity do not cause the virus to grow slower.

1. Introduction

The world is currently grieving the CoVid-19 pandemic. This pandemic has resulted in a tremendous health crisis for almost all countries in the world. Corona virus is a single-bonded DNA virus with a size between 60 and 220 nm that can infect birds and mammals (humans) through transmission. Coronavirus is a single-stranded RNA virus with a size of between 60 and 220 nm that can infect birds and mammals (humans) through aerosols or the fecal-oral route [1]. Corona that is present now is a new type of coronavirus (novel coronavirus) SARS-Cov-2 which is called Corona virus disease 19 (CoVid-19). Which is thought to have come from Wuhan-China [2]. This virus is a new type of virus that has not been previously identified in humans and is zoonotic in nature or transmitted by animals to humans [3].

Actually, corona is not a new term in the world of viruses. The virus was suspected of causing the flu in 1960 and then developed in Saudi Arabia in 2012 and continues to spread to Asia, Africa, Europe and America. The corona virus was initially considered a non-dangerous, relatively simple, and non-fatal virus [4]. But in its development, the coronavirus became the most deadly virus and claimed the lives of up to hundreds of thousands of people in a relatively short time span. Yuliana [2] explains that the corona virus is sensitive to heat, and can be effectively deactivated with a disinfectant containing chlorine, a lipid solvent with a temperature of 56°C for 30 minutes, ether, alcohol, perioxyacetic acid, non-ionic detergents, formalin, oxidizing agent, and chloroform.

Temperature and humidity are two important variables that influence virus development [5]. As stated by Casanova et al [6], some viruses can survive for days at room temperature and humidity. Based on this statement, it indicates that the spread of the corona virus is also influenced by temperature and humidity. Inactivation can be carried out more rapidly in the high temperature range [7]. If the temperature increases, the survival rate of the virus decreases or is low [8].
The term pandemic continues to develop along with the increasing number of casualties in almost all countries in the world due to exposure to the Corona virus. As of March 2, 2020, there have been 65 countries infected with the Corona virus with the number of sufferers reaching 90,308 people and as of May 9, 2020, corona cases reached 4,010,571 cases with the number of deaths reaching 275,959 and patients recovering reaching 1,382,333 people (https://www.worldometers.info/coronavirus/).

Figure 1. Map of the distribution of CoVid-19 in Indonesia on 8 May 2020

Indonesia is one of the countries that has the largest victims of the CoVid-19 pandemic in Southeast Asia. The number of victims who died was relatively high when compared to other countries. Based on data from https://covid19.go.id at the end of April, there were 10,118 positive cases of CoVid-19 with 792 people dying and 1,522 people being declared cured. This figure is not as high as the numbers in other countries that have experienced the CoVid-19 pandemic. However, the trend of people who are indicated as positive and the number of deaths continues to cause unrest in the community.

According to research by experts published on the official website of the Meteorology, Climatology and Geophysics Agency (BMKG), it is stated that there are indications of the influence of weather and climate on the spread of the CoVid-19 outbreak. In addition, these researchers also stated that the ideal air conditions for the coronavirus are temperatures around 8-10 °C and humidity of 60-90%. This means that an open environment that has high temperature and humidity is an environmental condition that is less than ideal for the spread of CoVid-19 cases. The researchers concluded that the combination of temperature and relative humidity had an influence on the spread of CoVid-19 transmission. Furthermore, there are also other researchers who have found a negative correlation between temperature (above 1°C) and the number of suspected CoVid-19 cases per day. They showed that CoVid-19 has an optimum dispersion at very low temperatures (1-9°C). This means that the higher the temperature, the lower the probability of daily CoVid-19 cases.

Indonesia has a greater chance of controlling the spread of CoVid-19 compared to other countries exposed to the Corona virus. This condition is based on the reason because Indonesia is a tropical country which at present (May) has started to enter the dry season where the average temperature and relative humidity in Indonesia are high. Based on previous theoretical studies, it can be ascertained that the spread of the Corona virus will decrease from time to time. However, based on the results of the data study, this was not proven. This requires an analysis of the CoVid-19 data distribution in relation to daily temperature and relative humidity of cities in Indonesia.

In this research, the researcher wants to prove the results of previous research related to the effect of temperature and humidity on the development of CoVid-19 cases in Indonesia. From the results of this study, it is hoped that it will be able to provide information for the public and the government regarding policy making in an effort to reduce the spread of the CoVid-19 virus which is increasingly widespread.

2. Method

This research is a quantitative descriptive study using secondary data. The method used to process the data is by using a violin plot to determine the progress of positive patient cases every day for 1 week and using a jitter plot to determine the effect of temperature and humidity in each province on the
development of CoVid-19 cases in Indonesia, as well as R software for knowing the correlation between each variable.

The type of data used in this study is secondary data. Secondary data is data that are not obtained directly by researchers, but data obtained from other parties. Secondary data used in this research is daily case development data from CoVid-19 positive patients accessed from (https://covid19.go.id/peta-sebaran) and data on average temperature and average humidity for each. Provinces in Indonesia accessed daily from (https://www.bmkg.go.id/cuaca/prakiraan-cuaca-Indonesia.bmkg). The data were taken within a span of 7 days, from May 2, 2020 to May 8, 2020. The researchers considered taking data from that date range because the data was presented in real time.

In this study, the analysis steps were carried out as follows:
1. Collect secondary data from the official CoVid-19 and BMKG websites in 2-8 May 2020
2. Conducting consultations and discussions with the lecturers concerned
3. Visualize the data using the violin plot to see the progress of CoVid-19 positive cases
4. Visualize the data using a jitter plot to see the relationship between variables X and Y
5. Make a correlagram to find out the relationship between variables
6. Visualize the data using an animated plot to see the movement of the data
7. Explore data for further analysis

Violin plot is a combination of two methods, namely boxplot and Kernel Density Estimation (KDE). KDE itself is a useful way to analyze non-parametric data by calculating the probability density function of a random variable. The purpose of the violin plot is to make it easier for users to analyze the continuous distribution of data for each category. In accordance with KDE, the more convex the graph of the violin plot data is visualized, the greater the chance of data density. On the other hand, the flatter the graph of the violin plot data is visualized, the less likely the data density is. Both quartile and whisker values were entered into the violin plot.

3. Results and Discussion
The spread of the CoVid-19 virus is increasingly concerning. The number of patients infected with Corona is increasing. This indicates that the temperature and humidity have no effect on viral activity. This research begins by identifying the data to be analyzed using R software. This data includes data on temperature, humidity, and the number of positive cases. The data display related to the number of positive cases is presented in Figure 1.

Based on Figure 2. It can be seen that the number of positive CoVid-19 cases in all provinces in Indonesia shows an increasing trend with varying numbers. The highest number of cases was DKI Jakarta with 3687 cases as of 8 May 2020, East Java with 933 cases, West Java 1133 cases, and Central Java with 707 cases.

![Figure 2. Number of positive cases of CoVid-19 in all provinces in Indonesia in 2-8 May 2020.](image-url)
Based on information from the government, it is known that positive cases of CoVid-19 are increasing every day. In May 2020 it was informed that a relatively sharp increase. To clarify this information, it can be seen on the violin plot which is presented in Figure 3.

![Violin Plot Positive Case CoVid-19](image)

**Figure 3.** Violin The number of positive patients with Covid-19 in Indonesia on 2-8 May 2020

The relationship between variables was analyzed using regression analysis with the help of Minitab software. The analysis results are presented in Tables 1 and 2.

| Term     | Coef  | SE Coef | T-Value | P-Value | VIF |
|----------|-------|---------|---------|---------|-----|
| Constant | -7264 | 2022    | -3.59   | 0.000   |     |
| Temperature | 182.3  | 57.1    | 3.19    | 0.002   | 1.05 |
| Humidity | 30.4  | 12.0    | 2.55    | 0.012   | 1.05 |

**Table 1.** Coefisien variable

| Source       | DF   | Adj SS     | Adj MS  | F-Value | P-Value |
|--------------|------|------------|---------|---------|---------|
| Regression   | 2    | 4856134    | 2428067 | 6.93    | 0.001   |
| TEMPERATURE  | 1    | 3563251    | 3563251 | 10.18   | 0.002   |
| HUMIDITY     | 1    | 2268191    | 2268191 | 6.48    | 0.012   |
| Error        | 133  | 46575119   | 350189  |         |         |
| Lack-of-Fit  | 47   | 30872828   | 656869  | 3.60    | 0.000   |
| Pure Error   | 86   | 15702291   | 182585  |         |         |
| Total        | 135  | 51431253   |         |         |         |

**Table 2.** Anova test

Based on Tables 1 and 2, it can be seen that the VIF value of each predictor variable tends to be small, which is less than 10. This means that there is no linear relationship between the predictor variables. P value <10%, then Ho was decided to reject. The conclusion is that there is at least 1 variable that has a significant effect on the number of positive cases.

Based on the results of the analysis presented in the form of a violin plot graph (Figure 3), it can be concluded that if CoVid-19 positive patients in Indonesia are increasing every day. This can be seen from the length of the violin, which continues to increase every day. Starting on May 2, 2020 there were...
7584 patients, which had an average of 223 patients, median (middle value) of 59 patients, had a minimum value of 5 patients from Aceh province and a maximum value of 3433 patients, causing the emergence of outliers originating from the province of DKI Jakarta. On the second day on May 4, 2020 there were 8,531 positive patients with an average of 251 patients, a median (middle value) of 60 patients, a minimum value of 5 patients from Aceh province and a maximum value of 3456 patients from DKI province. Jakarta. Then on the third day, namely May 6, 2020, there were 8981 positive patients who had an average of 264 patients, the median (middle value) was 62 patients, the minimum value of 5 patients came from Aceh province and the maximum value was 3574 patients from the DKI Jakarta province. And the last day on the fourth day on May 8, 2020 there were 9527 patients who had an average of 280 patients, a median (middle value) of 76 patients, a minimum value of 9 patients came from Aceh province and a maximum value of 3687 patients from the province DKI Jakarta.

The spread of the Corona virus is more aggressive with the source of transmission being humans which can be done through touch, droplets that come out of coughs, sneezing and others. The ability of the virus to be transmitted to a patient is largely determined by the patient's condition. The weaker the patient's condition, the easier it is to contract the Corona virus. Based on information from the CoVid-19 Handling Acceleration Task Force, it was informed that a number of male patients were more susceptible to exposure to the Corona virus. Of the total number of positive cases, 56.2% were male. The number of CoVid-19 positive patients who died 43.6% were those aged over 60 years who on average had congenital diseases, such as hypertension (20.7%), diabetes mellitus (15.8%), and heart disease (10 %). The rest are kidney disease, respiratory problems, cancer, liver disease and tuberculosis with a percentage of less than 5%.

Temperature is one of the factors that influence viral activity. At low temperatures, viruses are very easy to reproduce and spread. Regarding the temperature factor, Indonesia is currently entering the dry season with temperatures reaching 34-36°C. Based on the statements of experts, Indonesia has a very good chance of being free from the Corona virus because it is currently entering the dry season. However, in reality this has not been proven.

![Figure 4. Jitterplot Effect of Temperature on Number of positive patients CoVid-19](image)

Based on the plot in Figure 4, it can be seen that there are outlier data, which is the data for the highest number of positive cases in Indonesia. The highest number of positive cases was in the Jakarta province with a temperature of 29 °C. In addition, it can also be seen that the largest amount of data is at a temperature between 27-29 °C. The highest temperature, reaching 29.5 °C, was found in the provinces of Jakarta, East Java and South Kalimantan. Meanwhile, the lowest temperature, namely 24.5
6°C, was found in the provinces of Papua and West Sumatra. When viewed from the trend line, the plot has an upward, meaning that there is a positive correlation between the average temperature and the number of positive cases. The positive correlation means that the higher the average temperature, the higher the number of positive cases.

Temperature plays an important role in viral development activities. The higher the temperature the slower the activity of the virus. However, based on the results of data analysis on the effect of temperature on the number of cases, it can be seen that for the range of data accessed on 2-8 May 2020, the temperature factor has not yet influenced the spread of the CoVid-19 virus. This is an interesting new fact to put forward.

Different viruses have different heat stability [9]. This means that it is very possible that certain viruses will be able to survive at high temperatures. This concern may apply to the Corona virus which is identified as the Novel Corona Virus from the results of previous influenza virus mutations. This is based on the results of research on the relationship between positive cases and an increase in temperature. It was found that the higher the temperature so the higher the spread of the Corona virus.

Based on the results of the analysis conducted by experts, it was suggested that temperature and humidity could affect viral activity outside the body. However, once the virus has entered a person's body, the temperature and humidity factors no longer have an effect. Temperature and humidity have a positive correlation with the spread of CoVid-19 cases in Indonesia. This means that temperature and humidity are not the main factors in the development of the CoVid-19 virus in Indonesia. Due to the fact that high temperature and humidity do not cause the development of the virus to slow down. It can be assumed that there are other factors that are thought to cause the development of CoVid-19 during the current dry season to spread rapidly. The results of this study are very much in accordance with the observation of experts who say that the frequency of social contact has a high chance of spreading the corona virus [10].

4. Conclusion

Based on the research results it can be concluded that temperature and humidity have a positive correlation with the spread of CoVid-19 cases in Indonesia. This means that temperature and humidity are not the main factors in the development of the CoVid-19 virus in Indonesia. Due to the fact that high temperature and humidity do not cause the development of the virus to slow down. It can be assumed that there are other factors that are thought to cause the development of CoVid-19 during the current dry season to spread rapidly. The results of this study are very important to be taken into consideration for the government and society in making policies to reduce the spread of CoVid-19. The characteristics of the CoVid-19 virus need to be studied in more detail, so that it can be treated appropriately to control it. In the meantime, it cannot be expected that the CoVid-19 virus can be controlled through temperature and humidity, even for people living in tropical areas.

In dealing with the increasing spread of the CoVid-19 virus over time, what is needed is self-conditioning to stay healthy with a well-maintained body immunity. Complying with the steps to break the CoVid-19 distribution chain, stay at home, maintain environmental cleanliness and maintain personal health by diligently exercising, diligently washing hands and eating healthy and nutritious food are the best choices in reducing the rate of spread of the Corona virus at this moment.

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