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Environmental Analysis of the COVID-19 Climate

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Abstract: The most-high matter of COVID-19 in West Sumatera Province was found in Padang City. Some researchers argue that the environment greatly influences contagion of COVID-19. This research aims to anatomize the COVID-19 climate environment in Padang City in the period March 16th 2020 – May 20th 2022. The study used secondary data in the form of COVID-19 surveillance data, namely the number of patients who were confirmed positive for COVID-19 from the Padang City Health Office and the climate from the Meteorology and Climatology Agency of Padang City. Weather elements include maximum temperature (°C), minimum temperature (°C), average temperature (°C), humadity (%), and rainfall (mm). Data analysis used pearson correlation. The result of the study indicated that minimum temperature and rainfall had a significant relationship to positive matters of COVID-19 in Padang City which were marked with p-values of 0.004 and 0.

Keywords: COVID-19; Climate; Environmental

Introduction

COVID-19 is a fast-dispersing broad pandemic, which as of April 14th 2020 has affected around 2,1 million people and revealed more than 126,000 deaths broadly (Hopkins, 2020). In Indonesia, on March 2nd 2020, Indonesia has declared 2 fixed cases of COVID-19. As of March 29th 2020, there have been 1,285 cases in 30 provinces. The raise in the number of cases occurred fast enough and has been dispersing between countries (Cohen & Kupferschmidt, 2020; Li et al., 2020; Phelan et al., 2020). In reaction to this, WHO has declared COVID-19 as a pandemic (Cucinotta & Vanelli, 2020).

The common sign that is felt when exposed to COVID-19 infection is the presence of symptoms of acute respiratory distress. Symptoms include fever, cough and shortness of breath. On average, the incubation period is 5 – 6 days and the longest incubation period is 14 days. COVID-19 can cause pneumonia, acute respiratory syndrome, kidney failure and even death in severe cases. The report found in most cases was clinically symptomatic with fever, with some cases difficulty breathing, and X-ray showing extensive pneumonia infiltrates in both lungs (Holshue et al., 2020; Perlman, 2020).

There are several factors that influence the incidence of disease, namely environmental factors, sociodemographic factors and behavioral factors. Climate change is considered as one of the environmental factors. With the occurrence of respiratory diseases such as SARS, it is suspected that the main predictor of respiratory disease is certain climatic conditions (Oliveiros et al., 2020) It is suspected that the direct cause of the biological interaction between SARS-CoV and humans is climate variables. variables that can determine the survival and transmission of the SARS virus are optimal temperature, humidity, and wind speed (Babin, 2020; Shahzad et al., 2020). Weather changes significantly correlated with changes in pneumonia mortality (Huh et al., 2020) Several factors such as climatic conditions (such as temperature and

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humidity), and population density, can make the virus more transmissible (Poole, 2020; Zu et al., 2020)

Several studies (Kampf et al., 2020; Susilo et al., 2020) claim that the viability time of the coronavirus on superficies relies on the increase or decrease in temperature; Therefore, temperature can impress the hazard of transmitting the virus (Sajadi et al., 2020). So far this is relevant to the hypothesis that differences in annual mean temperature can significantly affect contagion of the virus. Predominance researches on the connection between virus contagion and temperature have been carried out for non-tropical countries (30° north latitude and above) where temperatures range from 20°C to a maximum of 20°C.

This deteriorating situation needs the study of appearing proof and patterns about the disease in order to effectively prevent it, as well as prepare for forthcoming outbreaks. Modern studies have shown that the dispersion of COVID-19 is intended to be more prevalent in cold and temperate climates than in warm and tropical climates, in accordance with the behavior of seasonal respiratory flu viruses (Haque & Rahman, 2020; Shi et al., 2020) Several viruses from the Coronaviridae family, including SARS CoV-1 and MERS CoV, also show seasons and a preference for low temperature and humidity (Kudo et al., 2019; Park et al., 2020). In the types of inanimate surfaces under certain weather conditions, the stability of SARS CoV-2, which is responsible for COVID-19, was reported to be similar to that of SARS CoV-1 (van Doremalen et al., 2020).

Based on this background, this COVID-19 Climate Environmental Analysis study in Padang City was carried out as a reference for further research on the pandemic in Padang City.

Method

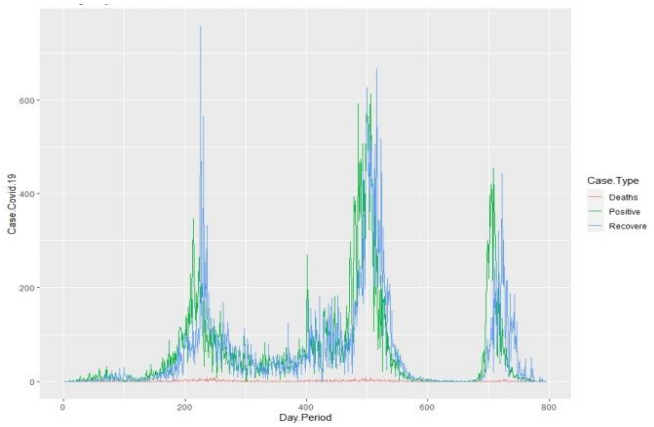
Location and research design at the Padang City, is the capital of West Sumatra province which geographically, is located at longitude 100º05'05'– 100º34'09'' E and latitude 00º44'00''- 01º08'35'' South Latitude, it has an area of 69,496 ha. Based on the 2010-2035 Indonesian population projection by the Central Statistics Agency, then cultivated by the Data and Information Center of the Ministry of Health of the Republic of Indonesia and the Padang City Health Office, in 2019, the target population is 950,871 people, the male population is more than the female population with an average the average number of people is 4.5 people.

This research was arranged in Padang City, West Sumatra Province, Indonesia. This type of research is descriptive quantitative by conducting a systematic data search. In this study, several variables were used, namely: minimum temperature, maximum temperature, average temperature, humidity, rainfall and the number of confirmed positive patients, death and recovery of the Covid-19 incident in Padang City, West Sumatra. The research analysis unit is the administrative area according to the district. This data was obtained from the Padang City Health Office and the weather from the Padang City Meteorology and Climatology Agency from March 2020 – May 2022.

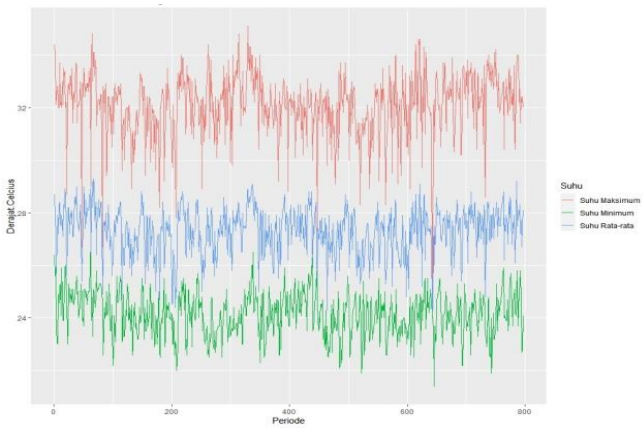
Research data processing using correlation analysis methods, regression and ANOVA with R studio. The difference is stated to be significant if the p-value <0.05 is obtained.

Result and Discussion

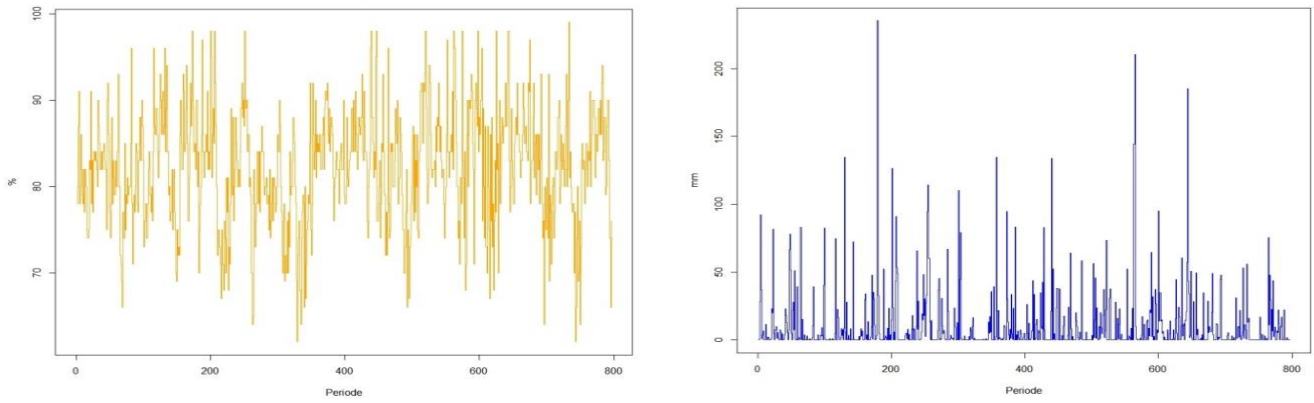
Padang City in the epicenter of the dispersion of COVID-19 in West Sumatera with the highest number of COVID-19 cases of all districts/cities in West Sumatra Province. A daily overview of COVID-19 cases in Padang City from 16 March 2020 – 20 May 2022 can be seen in Figure 1.



(a)



(b)



(c) (d)

Figure 1. (a) COVID-19 case, (b) maximum temperature, minimum temperature and average temperature, (c) humidity, (d) rainfallin Padang City on March 2020 - May 2022.

Based on Figure 1, graph of COVID-19 cases March 16th 2020 – May 20th 2022, it can be analyzed that the positive and cured cases of COVID-19 in Padang City experienced three waves of significant increase. Wave 1 started in August 2020 to October 2020, and experienced a significant decline in November 2020. Wave 2 began in June 2021 to September 2021, and experienced a significant decline in October 2021. Wave 3 began in January 2022 to March 2022, and experienced a significant decline in April 2022.

The connection between climate and COVID-19 matters in Padang City was analyzed through correlation and regression analysis with the variable maximum temperature, minimum temperature, average temperature, humidity and rainfall on COVID-19.

According to the Table 1 above, it may be concluded that there is a negative and weak connection between climate and positive cases of COVID-19. However, only minimum temperature and humidity have a significant relationship with positive cases of COVID-19 which are marked with p-values of 0.004498 and 7.931e-05, respectively.

Tabel 1. Results of climate pearson correlation analysis with COVID-19

Weather Variabel	Pearson's Correlation	p-value
Minimum Temperature	-0.1005973	0.828
Maximum Temperature	-0.0070700	0.004
Average Temperature	-0.0114500	0.747
Humidity	-0.1394100	0.000
Rainfall	-0.0503900	0.156

In this study the dependent variable (Y), namely positive cases of COVID-19, is linked by more than one independent variable (X), namely maximum temperature (X_1), minimum temperature (X_2), average temperature (X_3), humadity (X_4), and rainfall (X_5) were analyzed with multiple linear regression, so a multiple linear regression model was obtained. Based on the results of the analysis, the equation for the multiple linear regression model is as follows: $Y = 1150.6532 - 11.1698X_1 - 3.7355X_2 - 11.1698X_3 - 3.9879X_4 - 0.3496X_5$

Based on the model equation above, a constant of 1150.6532 can be obtained, which stated that when the maximum temperature, minimum temperature, average temperature, humidity and rainfall were ignored, the positive cases of COVID-19 are 1150.6532. The Maximum temperature regression coefficient is 11.1698, which stated that for every increase in the maximum temperature by one unit and the other variables were constant, positive cases of COVID-19 will decrease by 11.1698. The minimum temperature regression coefficient is 3.7355, which stated that for every increase in the minimum temperature of one unit and the other variables were constant, positive cases of COVID-19 will decrease by 3.7355. The average temperature regression coefficient is 11.2602, which stated that for every increase in average temperature by one unit and other variables were constant, positive cases of COVID-19 will decrease by 11.2602. The air humidity regression coefficient is 3.9879, which stated that for every increase in air humidity temperature by one unit and the other variables were constant, positive cases of COVID-19 will decrease by 3.9879. The rainfall regression coefficient is 0.3496, which stated that for every one unit increased in rainfall and the other variables were constant, positive cases of COVID-19 will decrease by 0.3496.

The COVID-19 pandemic is known to have dispersed to over than 200 countries, including Indonesia (Ghiffari, 2020). The spread of the COVID-19 virus continues to undergo mutations which produce new variants with different phenotypes, transmission patterns and virulence (Susilo et al., 2022). Big cities that have been appointed as local dispersion, such as Padang City, are the epicenter of the spread of COVId-19 in west Sumatera Province.

Precaution and management of COVID-19 cannot be separated from environmental trims (Hesti, 2020). One of the influential ecological factors is climate change. The climate parameters analyzed were maximum temperature, minimum temperature, average temperature, humidity and rainfall for COVId-19. (Shahzad et al., 2021) Based on the result of Pearson's correlation analysis, there is a significant relationship among minimum temperature and humidity and positive cases of COVID-19. Meanwhile, the maximum temperature, average temperature, and rainfall have no significant relationship with positive cases of COVID-19 in Padang City.

The results of a study conducted by Tosepu et al. (2020), inspected the relationship among the weather and the COVID-19 pandemic in Jakarta and discovered that the average temperature (°C) correlative with the COVID-19 pandemic (Ma et al., 2020). Investigated the impact of variations in temperature and humidity on COVID-19 mortality and stated that these parameters affect COVID-19 mortality. In line with Wang et al. (2020) analyzes the impact of temperature and claims that temperature can significantly influence the transmission of COVID-19. Chen et al., (Chen et al., 2020) stated that wind speed, temperature and relative humidity are effective factors and analyzed the relationship between meteorological parameters and the severity of the spread of COVID-19 on a world scale. Climatic factors that affect the differences in the correlation results obtained are temperature variations, length of time the data is used, and differences in the number of COVID-19 cases in a city (Sarwar et al., 2021). Based on the explanation above, it can be concluded that each region with a different climate produces a different correlation between variables with COVID-19 cases.

Conclusion

Environmental analysis of the climate of the COVID-19 case in padang city which is significantly related is the minimum temperature and humidity with p <5% and a multiple linear regression model is obtained from the relationship between climate and COVID-19 cases in Padang City $Y=1150.6532 - 11.1698X_1 - 3.7355X_2 - 11.1698X_3 - 3.9879X_4 - 0.3496X_5$

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