Mortality COVID-19 in Jakarta and the Involvement of the Weather

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Abstract:- Weather conditions and the risk of coronavirus disease 2019 (COVID-19) have been connected in previous studies. The objective of this study was to assess the relationship between weather conditions (temperature, humidity, duration of sunlight, wind speed, and precipitation) and COVID-19 mortality in Jakarta, Indonesia. Using COVID-19 daily death data and ambient temperature data, the spearman rank correlation test was developed to assess the influence of ambient temperature on mortality COVID-19. Station measurements from May to August 2021. At that time, Indonesia experienced the second peak of COVID-19 infections. Temperature (minimum, maximum, and average) showed a negative correlation (p < 0.01). Low temperatures have the potential to be a fatality indicator. When developing policy to control and prevent the transmission of new chains of the coronavirus pandemic in tropical countries, these weather factors may be considered.

***Keywords**:- Temperature, COVID-19, Weather.*

I. INTRODUCTION

Since the first case of coronavirus disease 2019 (COVID-19) was in Wuhan, China, and, nearly three years have passed. Almost three years have passed, since the first case of coronavirus disease 2019 (COVID-19) was identified in Wuhan, China and the World Health Organization (WHO) declared a pandemic.[1] The spread of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has been global, including in Indonesia.[1], [2] As of November 13, 2022, there had been 6.5 million deaths and 632 million confirmed cases worldwide.[3] The increase in transmission is also related to virus variants. [4] The first case in Indonesia was found in Depok and has spread to all provinces.[2] Jakarta is the capital city of the country with the highest number of cases in Indonesia. Total cases 1,493,931 positive cases. There are 21.96% of all national cases and a mortality rate of 10% of national deaths.[5]

Understanding the causes of the disease's spread is essential since it will help determine how to impose restrictive measures. Climate is one of the extra-human elements that can have a significant impact on the transmission of the coronavirus.[6] The majority of previous studies since the COVID-19 pandemic started have demonstrated that environmental parameters, such as air ambient temperature, can be considered important factors in COVID-19 transmission and mortality.[7–9] Environmental factors such as temperature, humidity, water, air, sewage, food, insects, inanimate surfaces, and hand hygiene which may also contribute to COVID-19 transmission. The winter season is more prone to infections like SARS and influenza than summer.[10]

In addition, environmental factors including air pollution, temperature, and air humidity, differ between the many countries affected pandemic. Indonesia is a tropical country with only two seasons, summer and rainy season. The first pandemic peak in Indonesia occurred in January or February, when the nation was experiencing heavy rain. The second peak would then occur during the summer months of June and July 2021. Knowing how environmental factors affect viral transmission is crucial to spreading awareness about illness prevention as the seasons change and bring about more moderate weather is crucial. The association between the weather and COVID-19 mortality in Jakarta was studied in this article.

II. METHOD

➢ *Study area*

DKI Jakarta province consist of an area 661.5 km^2 and has a population of 10,609,681 as of the 2020 census. Astronomically, Jakarta lies between 6º12‘ south latitude and 106º48‘ east longitude. The weather in Jakarta is typically hot with the highest temperatures between 32.7 °C and 34 °C during the day and the lowest temperatures between 23.8 °C and 25.4 °C at night.[11]

➢ *Data collection*

The number of daily mortality cases of the COVID-19 was collected from the database of the Government of DKI Jakarta Province. Jakarta Smart City delivered the required COVID-19 data.[12] The meteorological data were obtained from Meteorological, Climatological, and Geophysical Agency (BMKG). Data were collected from May 1 until August 31, 2021. The data included of temperature minimum (°C), temperature maximum (°C), temperature average (°C), duration of solar radiation (hour), rainfall (mm), humidity average (%), wind speed average (m/s), wind speed maximum (m/s), and wind direction at maximum speed (°).

➢ *Statistical analysis*

The Shapiro-Wilk test was used to assess the data's normality. The Spearman rank correlation test was used to analyses the link between weather and COVID-19 death incidence because the data on daily cases of the COVID-19 exhibited non-normal distribution. The box-plot graph's median and quartiles were used to do a descriptive analysis of the data. The significance level was set at 0.01 using SPSS 24 software.

III. RESULT

During the 123 days of evaluation, it was seen that the highest daily mortality occurred in July 2021. A total of 268 deaths on 20 July and 251 deaths on 31 July. With an average death rate of 54 deaths/day during the period May-August 2021. Fig.1 shows the number of deaths and weather condition over time. The weather data showed highest minimum temperature of 28.0 °C (with the lowest minimum temperature of 22.0 °C), the highest temperature maximum of 34.8 °C (with the lowest temperature maximum of 27.6 °C), the highest average temperature of 30.2 °C (with the lowest average temperature of 26.09 °C), the highest humidity average of 92.0% (with the lowest humidity of 63.0%), and the highest rainfall of 92.2 mm (with the lowest of 0 mm), the highest duration of sunlight of 8.2 hour (with the lowest of 0 hour), the highest wind speed average of 2.0 m/s (with the lowest of 0 m/s), the highest wind speed maximum of 8.0 m/s (with the lowest of 3 m/s) and the highest wind direction at speed maximum of 360° (with the lowest of 10°).

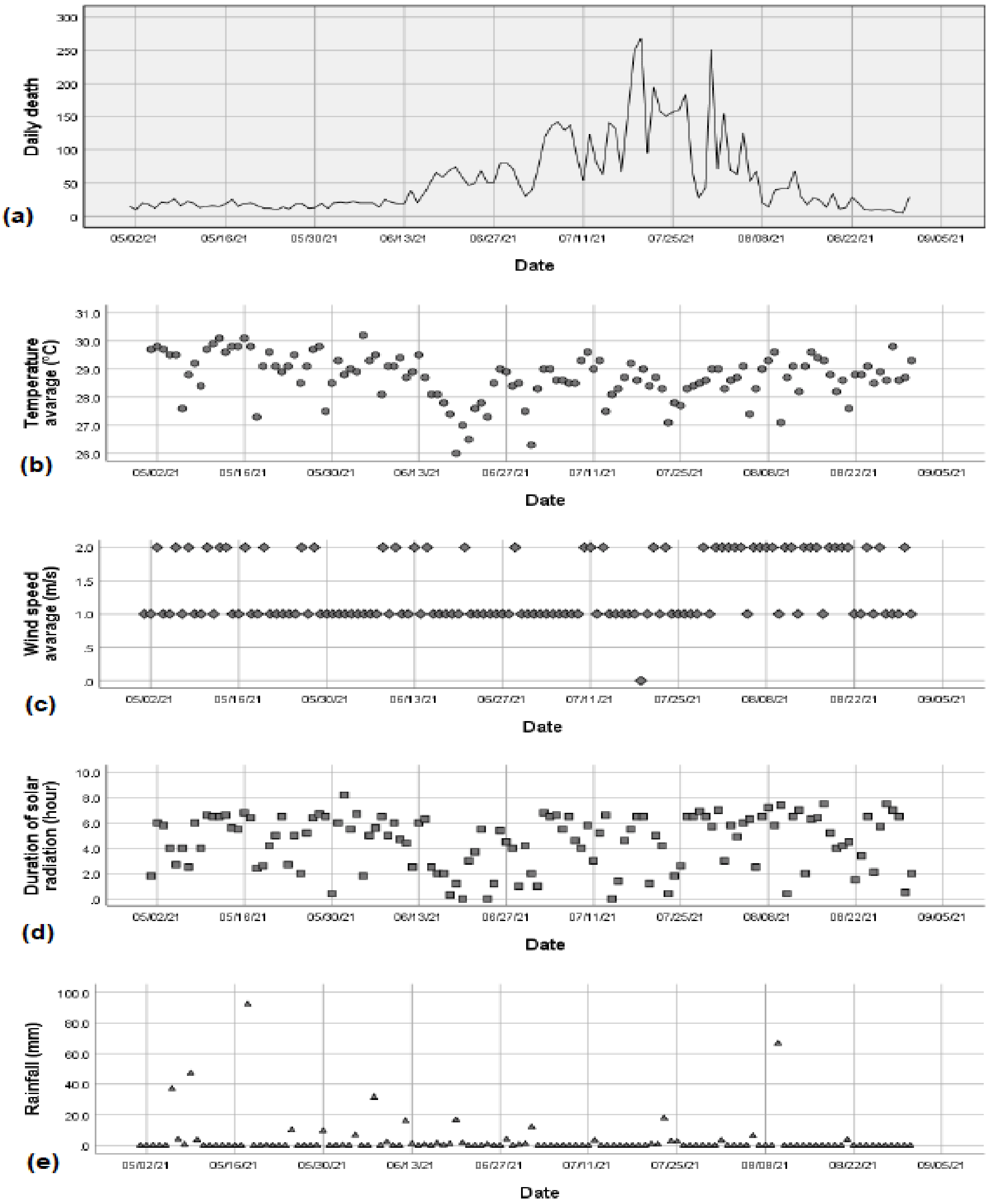

Fig. 1. Daily death of the COVID-19 (a), temperature average (°C) (b), wind speed average (m/s) (c), duration of sunlight (hour) (d), rainfall (mm) (e) in Jakarta between May 1, 2021 and August 31, 2021

According to descriptive analysis, The maximum temperature has a large proportion of high values and exhibited greater variability than other temperatures. (Fig. 2a) Greater data uncertainty is already predicted when COVID-19 mortality rates rise daily and exponentially. More often, there were higher wind speeds. The duration of sunlight showed high data homogeneity. (Fig. 2d)

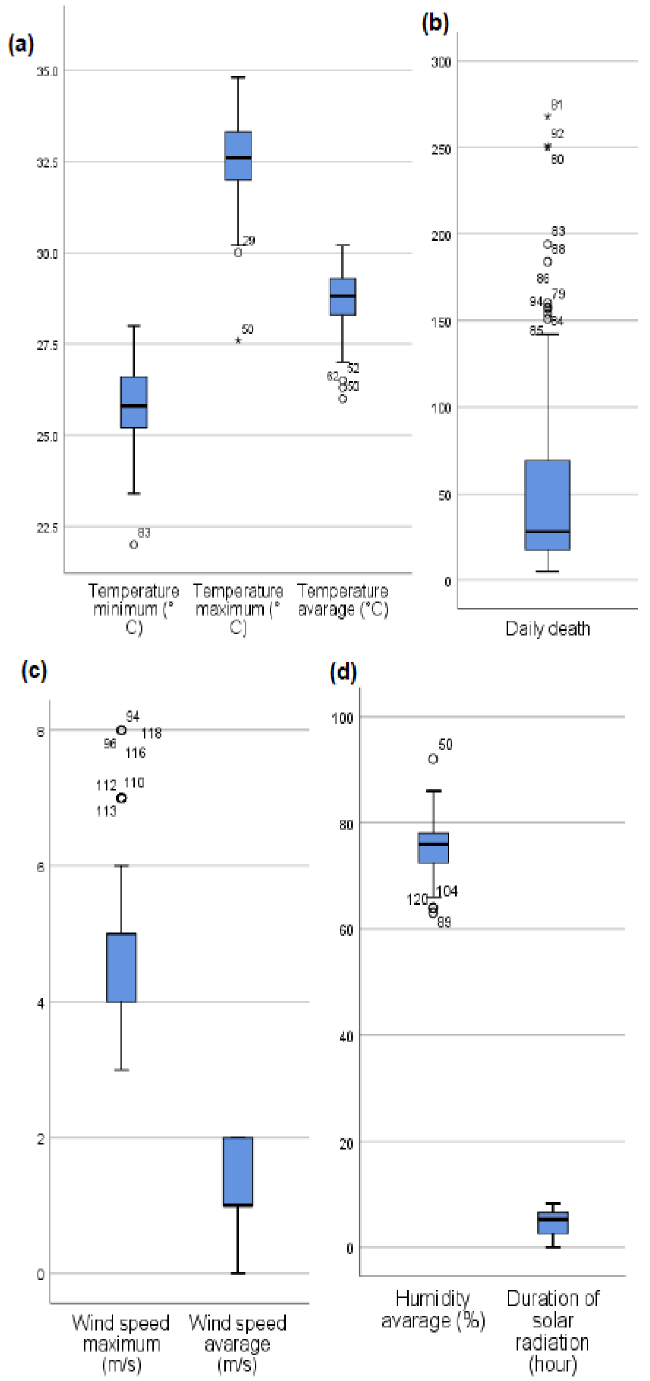

Fig. 2. Box-plot of the weather conditions in Jakarta for 123 days. (a) Temperature (°C), (b) daily death of COVID-19, (c) wind speed (m/s), (d) humidity (%) and duration of sunligt (hour)

Table 1 displays the Spearmann correlation coefficients. Three of the nine climate parameters in this study that were examined were significant correlation (temperature minimum, maximum and average). Other variables are not significant. Additionally, all significative variables show a negative correlation with the number of deaths. Evans categorized the correlation levels between 0.00–0.19 as “very weak”, 0.20–0.39 “weak”, 0.40–0.59 “moderate”, 0.60–0.79 “strong” and 0.80–1.0 “very strong”.[13] Correlation between average temperature and COVID-19 mortality was moderately negative. Temperature minimum and maximum a weak negative correlation.

Table 1. The Spearmann correlation test between mortaliy COVID-19 and weather variables.

Weather Variable	Spearman Correlation cofficient	p-value
Temperature minimum (°C)	- 0,372	0,000
Temperature maximum (°C)	- 0,235	0,009
Temperatur average (°C)	- 0,418	0,000
Humidity average (%)	0,033	0,718
Duration of sunligt (hour)	- 0,103	0,253
Rainfall (mm)	0,053	0,560
Wind speed average (m/s)	- 0,078	0,389
Wind speed maximum (m/s)	- 0,043	0,639
Wind direction at maximum speed (°)	- 0,022	0,805

IV. DISCUSSION

In this study, temperature plays an important role in mortality of COVID-19 in Jakarta, Indonesia. Temperature (minimum, maximum and average) showed negative correlation between the number of deaths of COVID-19. Previous studies described the relationship between weather parameters and the death of COVID-19. Meo et al. [14] study in 16 African countries found that a rise in relative humidity and temperature was correlated with a decline in the number of daily COVID-19 cases and deaths. In Bagdad and Kuwait, the correlation between temperature and daily new cases, daily new deaths, cumulative cases, and cumulative deaths was strongest positive. In Bagdad and Kuwait, the correlation between temperature and daily new cases, daily new deaths, cumulative cases, and cumulative deaths was strongest. A 1 °C increase in temperature was associated with an increase of 0.6%, 0.3% in daily new cases and an increase of 0.03%, 0.003% in daily new deaths.[15] Tapia-Munoz et al. [16] showed 1 °C increase in ambient temperature reduces the frequency of COVID-19 deaths and the likelihood of high-level COVID-19 mortality over time. Northern high-income nations experienced colder temperatures and had higher rates of COVID-19 and pre-COVID respiratory disease mortality.

In Brazil mortality COVID-19 during winter is increased. [17] Ogaugwu et al. [18] discovered a weakly negative correlation between temperature and the transmission of SARS-CoV-2 disease and mortality in Lagos, Nigeria. Similarly, in Rio de Janeiro, Brazil, maximum and average temperatures and wind speed had a negative correlation with weaker strength and sunlight was strongly negatively correlated with the incidence of COVID-19.[6] Yuan et al.[19] also founded that daily new cases of COVID-19 were negatively correlated with the mean temperature, wind speed, and relative humidity. Shi et al. [9] also discovered that the incidence of COVID-19 decreases as the temperature rises.

Tchicaya et al. [20] discovered strong correlations between temperature and the COVID-19 mortality rate in France. The COVID-19 mortality rate decreased by 1.0% for every 1.°C increase in average temperature, according to the negative binomial regression models, which corresponds to 9.7%, 13.3%, and 14.5% on November 1, 2020, December 1, 2020, and December 31, 2020, respectively. Despite the alleged relaxation of some social cues, the development of the second wave in France coincided with the progressive drop in temperatures, which appears to support the theory that there is a substantial relationship between temperature and the incidence and mortality rate of COVID-19.

In contrast, Sobral et al. [21] reported that there is no correlation between temperature and COVID-19 mortality rates. Karimi et al. reported that a minimum temperature increase of 18 degrees Fahrenheit was associated with a 1.9% (95% CI, 0.2% to 3.6%) increase in deaths 20 days after the initial infection with COVID-19. Holtman et al. [8] discovered that the ambient temperature plays an important role in the spread of COVID-19 by promoting the virus' survival in the environment at low temperatures.

Our study found that the low temperature effect on the rising of the number of deaths of COVID-19. Mortality COVID-19 decreases with increasing ambient temperature. Due to the increased virus inactivation brought on by high temperatures, the increase in temperature may lessen the deadly intensity of COVID-19. [22], [23] The SARS-CoV-2 may survive for about 9 days at 25°C, and life span may reduce if temperature increase to 30°C.[24] The temperature and the death risk of COVID-19 gradually reduced and then increased when the ambient temperature increased to approximately 10.0 °C and continued to rise, which is similar with the results for noncommunicable diseases.[25] Low temperatures have a significant impact on respiratory sickness fatalities. Humans who are exposed to cold temperatures may experience cardiovascular stress, which is influenced by conditions such red blood cell count, blood viscosity, peripheral blood vessel constriction, plasma cholesterol, plasma fibrinogen, and inflammatory response.[26]

In this study average humidity, duration of sunlight, wind speed, and rainfall are no significantly association. It is differed with Qi et al. [27] discovered that temperature and humidity are both negatively related to COVID-19 death. Halos et al. [15] also showed relative humidity was strong negatively correlated with daily new deaths and cumulative deaths. Reduction of 1% in relative humidity was associated with a 0.01%, 0.002% increases in daily new deaths. This study also is not consistent with study in Turkey, which demonstrates an inverse relationship between relative humidity and virus infections and may eliminate virus viability.[28] In Rio de Janeiro reported solar radiation and wind speed had corelation with incidence of COVID-19.[6] Similarly, Hachim et al.[29] described patients who needed admission in days with higher temperatures, less humidity, and higher solar radiation were associated with higher deaths. Solar radiation plays an crucial role in reducing viruses in tropical environments. On the other hand, solar radiation also plays an important role in the production of vitamin D which is useful in the prevention and treatment of COVID-19 infection.[6] Halos et al. [15] founded that wind speed has positive but weak correlation with daily new cases, daily new deaths, cumulative cases and cumulative deaths. Contrarily, Wind speed and daily COVID-19 cases were not significantly correlated, according to Zhu et al. [30] Abraham et al. founded no significant correlation was found for rainfall in Australia.[31] A similar result like this study. This study was conducted during the summer so that the possibility of variable like sunlight, wind speed and rainfall does not affect.

V. CONCLUSION

The weather has an effect on COVID-19 mortality in Jakarta, Indonesia. Temperature average was the contribute factor, presenting a significantly medium correlation with the number of deaths of COVID-19. Temperature minimum and maximum showed weak correlation. The possibility of high temperatures reducing the pandemic's effects over time is a weather factor. It is possible to pinpoint the causes of geographic disparities in COVID-19 mortality rates through analysis at the provincial level, which also enables policymakers, medical professionals, and public health professionals to comprehend the pandemic's spatial distribution and modify their intervention plans for either ongoing or upcoming pandemics. It remains possible that a third or fourth wave of SARS-CoV-2 will occur. Therefore, it is necessary to conduct additional study on the COVID-19 pandemic in order to comprehend the influence of weather on upcoming outbreaks and how this knowledge can aid in the implementation of preventative measures.

➢ *Declaration of competing interest*

There was no conflict of interest disclosed by the authors.

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