The Effect of Climate on the Outbreak of Covid-19: A Review

Candra Kirana¹, Samsul², Hesty Yariska Hapsir³, Fitria Nurnala⁴, Ramadhan Tosepu⁵

¹,²,³,⁴,⁵Postgraduate Program of Public Health, University of Halu Oleo, Kendari, Indonesia
⁶Department of Environmental Health, Faculty of Public Health, University of Halu Oleo, Kendari, Indonesia

*Correspondence Ramadhan Tosepu: e-mail: ramadhan.tosepu@uho.ac.id

Abstract COVID-19 causes various kinds of life problems, including the occurrence of a global health crisis, social, psychological problems, and a prolonged economic crisis. Climate-related dynamics have an impact on patterns of human health and disease. This study aimed to investigate the effect of climate on the outbreak of COVID-19. This study used a literature review approach on research on climate and Covid-19, using the Google Scholar, Scienceirect. The article taken was original research in the recent year. It was found that the effect of climate change had a significant relation to the increase in Covid-19 cases. Therefore, it can be concluded that climate is a risk factor for increasing the outbreak of the Covid-19 Virus. However, one previous study predicted that with a mathematical model that included human demographic conditions and mobility, it was concluded that a tropical climate could help inhibit the outbreak of the virus because tropical climatic condition could make the virus more volatile.

1. Introduction

The emergence of this infectious disease outbreak was first discovered in Wuhan, China, at the end of 2019 [1]. The initial discovery of this disease was caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [2]. SARS-CoV-2 has also infected many people around the world. The initial symptoms of SARS-CoV-2 virus infection are prolonged coughing, high fever, asthma; if this situation continues, it will cause kidney damage and lung damage that will lead to death [3]. As of May 28, 2020, there were 3,419,184 confirmed cases of the disease due to SARS CoV-2, named COVID-19 [4]. There are approximately 200 countries that have been infected with this virus from the most, namely the United States with approximately 186,046 corona positive people, then Italy with 105,792 cases, and Spain with 95,923 cases [5].

The Corona Virus pandemic in Indonesia firstly appeared in early March 2020. Covid 19 caused tremendous shocks. This virus has a major impact that not only attacks health problems, but this corona virus also has an impact on social and economic life in a region or country and society [6]. Currently, society is increasingly restless because the number of infected patients continues to grow and spread, including in Indonesia. Based on data from the Indonesian Ministry of Health in Indonesia on April 10, 2020, there were 3,512 positive cases, 282 recovered and 306 people died with a death rate of 9.1% [5].

The criteria for a disease called a Corona virus pandemic is that the first is that the virus can cause illness or death in the data; it can be seen a significant number of deaths from time to time, such as the
number of Covid-19 worldwide reaching 2 million people; the second is person-to-person transmission of the virus occurs rapidly; the third is the virus has spread to almost all corners of the world. There are several pandemic diseases that are very deadly in the last 24 hours from 210 countries that told them that they were exposed to the Corona virus; there were an accumulation of 79,936 new problems [7].

This disease is transmitted through droplets (splashes) when speaking, coughing and sneezing from people infected with the Corona virus. In addition, this disease can also be transmitted through physical contact (touch or handshake) with sufferers and touching the face, mouth, and nose by hands exposed to the Corona virus [8]. Clinical symptoms that arise due to infection with this virus include common cold symptoms (fever, cough, runny nose, sore throat, muscle aches, headaches) to serious complications (diarrhea and pneumonia) to death [8]. This virus is also a virus that attacks the respiratory system. This is because Indonesia has a very different weather and climate from where the disease started. An uncertain climate, both too cold and too hot, is extremely susceptible to exposure to someone having a low immune system. Increased pollutants and pathogenic microorganisms will affect the respiratory system. Too cold temperature can reduce the immune system so that a person is susceptible to an infection, which will cause respiratory system disorders. Respiratory tract infections are prone to appear in conditions of too cold temperature; low temperature can disrupt the immune mechanism. Respiratory tract infections are more common during cold and low humidity conditions. Previous studies have made it clear that viruses are more stable in cold and dry conditions, because low temperature can affect virus replication and transmission [9].

This review aimed to summarize previous research to analyze the effects of weather and climate on the spread of the Covid-19 pandemic. This study used secondary data analysis in the form of Covid-19 surveillance data from the Ministry of Health of the Republic of Indonesia and several prominent articles.

2. Method
   1) Searching Strategy
      Google and Google Scholars are used as the main source of the database, accessed on October 27, 2020, published in English and discussing the context of abroad. The combination keywords: "Climate, Covid-19, SARS-CoV-2" were used to search for articles. We looked at several studies published during 2019-2020. Titles, keywords and abstracts were screened in the first step of relevant articles and full studies that met the inclusion criteria were included in this analysis.
    2) Inclusion Criteria
       1. Articles evaluating the effects of weather and climate on the spread of covid-19.
       2. The article discusses the influence of weather on the spread of covid-19 with a publication year between 2019 - 2020

3. Results
   50 articles were collected from Google Scholar and Sciencedirect in the first step. Among all articles, 36 articles were excluded because they did not fulfill the title and keywords, while 14 articles were included in full research terms. Five articles were included at the final stage and met the inclusion criteria.

| Studies and Language | Research Location and Point | Data Collection | Statistical Method          |
|----------------------|----------------------------|-----------------|----------------------------|
| Zohair Malki, et al  | Italy (2020)              | Temperature and humidity | Developing machine learning models |
| Lucian Sfica, et al  | Hubei, China (2019-2020) | Weather factor and ultraviolet radiation | Spearman Test, Student Test, and Mann-Whitney |
4. Discussion

The Effect of Climate on the spread of Covid-19

The COVID-19 (Corona Virus Disease 2019) infection was first discovered in Wuhan, China, at the end of December 2019 [1]. This virus spreads so quickly and infects almost all countries, even in the last few months it has spread outside to all cities in Indonesia. Coronavirus disease (COVID-19) was originally caused by Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); this virus can cause mild disorders of the respiratory system, severe lung infections, and even death. [10]. Various studies have explained that the outbreak of COVID-19 can be influenced by many factors, including climate (Qi et al., 2020; Tosepu et al., 2020). Although the number of cases of viral infection outbreak due to the effect of climate in tropical countries is still limited [11]. According to the findings of cases that occurred in 130 cities in China, outside the city of Wuhan, between January 20 and March 2, 2020, it illustrated that too low temperature is extremely vulnerable to transmission of the COVID-19 virus [11]. Based on the finding, it reveals that the survival of the SARS-CoV-2 virus is influenced by climate. Therefore, the correlation between the current pandemic and global warming should not be ignored, as climate change is expected to increase the incidence of infectious diseases [12]. Previous researches in the Latin America and Caribbean (LAC) region also showed that unstable temperature with high humidity was strongly associated with an increase in the outbreak of COVID-19 infection. [14]. Then, the relatively high humidity during the southeastern Chinese winter indicates environmental conditions that can be the viability of the virus to survive [12]. Not only that, studies conducted in countries with high temperatures showed a decrease in daily cases compared to results conducted in countries with low temperature [9].

5. Conclusion

This SARS-COV-2 virus infection can cause cough, fever, shortness of breath, and at an advanced stage, it can damage the kidneys, cause pneumonia, and death. Based on the finding, it revealed that the survival of the SARS-CoV-2 virus is influenced by climate. Then, findings made in countries with high temperature showed a decrease in daily cases compared to results carried out in countries with low temperature.

Reference
[1] S. SanJuan-Reyes, L. M. Gómez-Oliván, and H. Islas-Flores, "COVID-19 in the environment," Chemosphere, p. 127973, 2020.
[2] S. Cheval, C. Mihai Adamescu, T. Georgiadis, M. Herrnegger, A. Piticar, and D. R. Legates, "Observed and Potential Impacts of the Covid-19 Pandemic on the Environment," *International Journal of Environmental Research and Public Health*, vol. 17, p. 4140, 2020.

[3] M. Mofijur, I. Rizwanul Fattah, A. Saiful Islam, M. Uddin, S. Ashrafur Rahman, M. Chowdhury, *et al.*, "Relationship between Weather Variables and New Daily Covid-19 Cases in Dhaka, Bangladesh," *Sustainability*, vol. 12, p. 8319, 2020.

[4] R. A. A. Neto and G. C. Melo, "Correlation between weather, population size and Covid-19 pandemic: a study of Brazilian capitals," *Journal of Health & Biological Sciences*, vol. 8, pp. 1-5, 2020.

[5] S. M. Ilpaj and N. Nurwati, "Analisis Pengaruh Tingkat Kematian Akibat Covid-19 Terhadap Kesehatan Mental Masyarakat di Indonesia," *Focus: Jurnal Pekerjaan Sosial*, vol. 3, pp. 16-28, 2020.

[6] F. N. Arafa and N. Nurwati, "Pengaruh Covid 19 Terhadap Mortalitas Dan Ketenagakerjaan Di Indonesia," *Jurnal Ilmu Kesejahteraan Sosial HUMANITAS*, vol. 2, pp. 12-32, 2020.

[7] D. Setiyadi, S. Roﬁah, and J. Suriadi, "Pengukuran Indeks Kebersamaan Masyarakat Dalam Menghadapi Pandemi Covid-19," *Jurnal Kajian Ilmiah*, vol. 1, pp. 49-60, 2020.

[8] A. Y. Zukmadini, B. Karyadi, and K. Kasrina, "Edukasi Perilaku Hidup Bersih dan Sehat (PHBS) dalam Pencegahan Covid-19 kepada Anak-anak di Panti Asuhan," *Jurnal Pengabdian Magister Pendidikan IPA*, vol. 3, 2020.

[9] S. Meo, A. Abukhalaf, A. Alomar, I. Al-Beeshi, A. Alhowikan, K. Shafi, *et al.*, "Climate and COVID-19 pandemic: effect of heat and humidity on the incidence and mortality in world's top ten hottest and top ten coldest countries," *Eur Rev Med Pharmacol Sci*, vol. 24, pp. 8232-8238, 2020.

[10] Z. Malki, E.-S. Atlam, A. E. Hassanien, G. Dagnew, M. A. Elhosseini, and I. Gad, "Association between weather data and Covid-19 pandemic predicting mortality rate: Machine learning approaches," *Chaos, Solitons & Fractals*, vol. 138, p. 110137, 2020.

[11] A. Auler, F. Cássaro, V. da Silva, and L. Pires, "Evidence that high temperatures and intermediate relative humidity might favor the spread of Covid-19 in tropical climate: A case study for the most affected Brazilian cities," *Science of The Total Environment*, p. 139090, 2020.

[12] L. Sfîcă, M. Bulai, V.-A. Amihăesei, C. Ion, and M. Ștefan, "Weather conditions (with focus on UV radiation) associated with COVID-19 outbreak and worldwide climate-based prediction for future prevention," *Aerosol and Air Quality Research*, vol. 20, pp. 1862-1873, 2020.

[13] M. Kato, T. Sakihama, Y. Kinjo, D. Itokazu, and Y. Tokuda, "Effect of Climate on Covid-19 Incidence: A Cross-Sectional Study in Japan," *Available at SSRN 3612114*, 2020.

[14] T. R. Bolaño-Ortiz, Y. Camargo-Caicedo, S. E. Puliafito, M. F. Ruggeri, S. Bolaño-Diaz, R. Pascual-Flores, *et al.*, "Spread of SARS-CoV-2 through Latin America and the Caribbean region: a look from its economic conditions, climate and air pollution indicators," *Environmental research*, vol. 191, p. 109938, 2020.