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Artikel

Spatial Distribution of COVID-19 Related to the Potential for Spreading Outbreaks and Vulnerability of a Region in Bengkulu Province on 2020

***Naurah* Shafa Putri CAHYANGI[1], *Dessy* TRIANA[*], *Liya* Agustin UMAR[3], *Nikki* Aldi MASSARDI[4], *Utari* Hartati SURYANI[5], *Riry* AMBARSARIE[6]**

1 Medical Study Program, Faculty of Medicine and Health Sciences, Universitas Bengkulu, Jalan WR. Supratman, Kandang Limun, Kota Bengkulu 38371

2 Department of Parasitology, Faculty of Medicine and Health Sciences, Universitas Bengkulu, Jalan WR. Supratman, Kandang Limun, Kota Bengkulu 38371

3 Department of Medical Biology and Immunology, Faculty of Medicine and Health Sciences, Universitas Bengkulu, Jalan WR. Supratman, Kandang Limun, Kota Bengkulu 38371

4 Department of Anatomical Pathology, Faculty of Medicine and Health Sciences, Universitas Bengkulu, Jalan WR. Supratman, Kandang Limun, Kota Bengkulu 38371

5 Department of Microbiology, Faculty of Medicine and Health Sciences, Universitas Bengkulu, Jalan WR. Supratman, Kandang Limun, Kota Bengkulu 38371

6 Department of Medical Education, Faculty of Medicine and Health Sciences, Universitas Bengkulu, Jalan WR. Supratman, Kandang Limun, Kota Bengkulu 38371

* Corresponding author: dessy.triana@unib.ac.id

Abstract: Coronavirus disease 2019 (COVID-19) was declared a pandemic on March 11, 2020, by the World Health Organization (WHO). The spread of COVID-19 increases with different conditions and situations in each region. Spatial distribution plays a role in identifying the vulnerability of an area. This study aimed to determine the differences in COVID-19 cases from one area to another in 10 regions in Bengkulu Province in 2020. This study is a descriptive study with an observational study through a cross-sectional approach using an epidemiological investigation form as a data source. Sampling was carried out from July to December 2020 and obtained from 3044 respondents who met the inclusion criteria. The total sampling technique did sampling. The relationship between the population density of an area and the severity of COVID-19 cases was statistically analyzed using the Spearman rank test. The results showed that areas with higher density levels, such as Bengkulu City, caused a wider spread of cases, causing the number of COVID-19 cases to increase compared to other areas with lower population densities in Bengkulu Province. There is no significant relationship between population density and the severity of COVID-19

Keyword: Coronavirus disease, Distribution, Bengkulu

1. Introduction

Coronavirus disease 2019 (COVID-19) was declared a pandemic on March 11, 2020 by the World Health Organization (WHO) [1]. The city of Wuhan, Hubei Province, China, was the country that announced the first occurrence of COVID-19 on December 31, 2019. World Health Organization gave the name of the virus in Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). This virus can be contracted through splashes of body fluids from the mouth, nose, and eyes. It is known that the incubation period after infection is 5.2 days on average, with a period of 2 to 14 days with general complaints of high fever, dry cough, sore throat, muscle pain, sneezing, and respiratory problems [2], [3].

The incidence of COVID-19 spread in Bengkulu Province, which has one city with nine districts [4]. As of December 31, 2020, in Bengkulu Province, there were 3601 positive cases of COVID-19, with 2496 patients reported to be healthy and 116 people died from COVID-19 [5]. The spread of COVID-19 increases with different conditions and situations in each region. There is a pattern known to have a role in identifying an area's vulnerability to an event with the following risk factors. The pattern is analyzed in the form of spatial mapping [6]. Spatial analysis is used to explore a global or local distribution activity that has a role in analyzing an incident [7]. The study of the spatial distribution of COVID-19 conducted in Beijing from June 11 to July 5, 2020, concluded that differences in spatial distribution positively influence the spread of the virus by involving population density as an important factor [8]. Based on research in the United States on 2020, the spatial distribution method can determine a significant correlation to the imbalance between cities in the United States. It affects the vulnerability and severity of cases in each region [6].

Population density is also considered to have an important role in increasing COVID-19 cases in an area. It was proven by research in Brazil on 2020 using the spatial distribution method involving the Geographic Information System (GIS) application. Based on this research, it is known that the population density has a significant difference related to the spread of the virus and the number of COVID-19 cases from each region in Brazil [9]. A similar study was according in China using a spatial distribution analysis method involving 31 provinces and cities to be grouped based on the level of COVID-19 infection to get an overview of population density against the spread of the virus. The study concluded that the uncontrolled spread was in the city of Wuhan, Hubei province. Because Wuhan was the first area identified with supporting factors in the form of a high population and low level of population awareness. It had the most significant risk of increasing COVID-19 cases compared to other areas in China [10].

2. Materials and Methods

The type of research in this study is an observational study with a cross sectional approach using an epidemiological investigation form as a data source from geographic information on COVID-19 patients in Bengkulu Province with a time span of July to December 2020. The sampling technique was carried out using the non-probability sampling method with the following technique: total sampling.

3. Results and Discussion

The incidence of COVID-19 spreads in 10 areas of Bengkulu Province. From July to December 2020, it is known that the city of Bengkulu has the most data on COVID-19 sufferers compared to other regions. This data is related to the population density in an area. Based on the definition according to the Bengkulu Province BPS in 2020, population density is the ratio of the number of people per square kilometer. Bengkulu City occupies a very dense population density level than the other nine regions. The population density in

Bengkulu City affects the increase in COVID-19 cases than nine other areas in Bengkulu Province. The incidence of COVID-19 has been confirmed to increase first in areas with high population density, followed by areas with medium and low population density [11]. An area's vulnerability to virus transmission can be caused by behavioral, environmental, and ecological factors.

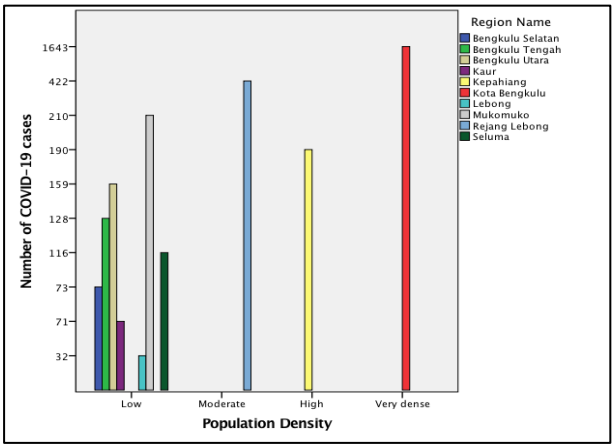

Fig. 1. Population Density Chart with Number of COVID-19 Cases.

Bengkulu City is a very densely populated area with more COVID-19 cases (1.643 cases) than other areas with fewer residents. Areas with a medium density of Rejang Lebong had more cases (422 cases) than areas with a high density of Kepahiang (190 cases). The low-population area group in Mukomuko had higher cases (210 cases) than Kepahiang. Lebong has the lowest rate of COVID-19 cases (32 cases). It is known that there is a significant relationship ($p = 0.018$) between population density and the number of COVID-19 cases in Bengkulu Province in 2020, with the correlation coefficient (0.723) at a strong level. High population density causes relatively high contact between individuals [12].

One of the influencing factors is the presence of the most COVID-19 referral hospitals in Bengkulu City, namely four hospitals, followed by one hospital in North Bengkulu, Mukomuko, Rejang Lebong, and South Bengkulu [5]. A study related to the high transmission rate of COVID-19 stated that the COVID-19 referral hospital was a causative factor. One of the reasons was the lack of special attention given by the COVID-19 referral hospital to limit hospital visits to patients in treating chronic diseases, such as hypertension and diabetes [13]. Areas with a higher population density have a higher morbidity rate than areas with a lower population density [14].

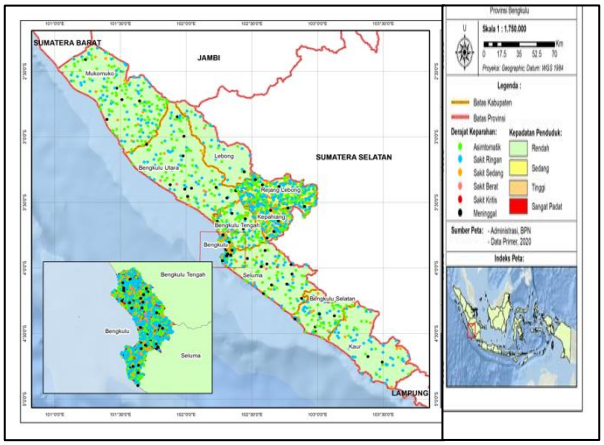

Fig. 2. COVID-19 Spatial Distribution Map for July to December in Bengkulu Province in 2020.

An area's vulnerability to virus transmission can be caused by behavioral, environmental, and ecological factors [15]. Behavioral factors include human activities such as population movement and social distance, which are the key to the vulnerability of disease transmission. Environmental factors such as wind speed were a significant factor in the spread of the epidemic [8]. The wind speed in Bengkulu City has an average speed of 3.13 (m/sec) with a maximum wind speed of 16.96 (m/sec). Bengkulu City has a faster wind speed than Kepahiang, which occupies a high level of population density, which has an average wind speed of 3.04 (m/sec) with a maximum speed of 7.20 (m/sec) [4].

The number of COVID-19 cases per month in July to December period on 2020 has increased every month. This study found that the area with the most COVID-19 cases was occupied in Bengkulu City, Rejang Lebong, and followed by Mukomuko. Rejang Lebong has the most universities after Bengkulu City, and this is believed to be a potential in the spread of COVID-19 due to contact between individuals. One study stated that universities caused the spread of COVID-19 significantly, especially students living in dormitories who could transmit the infection to close contacts. Universities also cause a high number of student contacts, so that when the patient is infected and without symptoms, the spread will be more widespread, especially to the community [16]. Mukomuko has a low population but has higher COVID-19 cases (210 cases) than Kepahiang (190 cases). This reason is that the population's level of compliance regarding health protocols in Mukomuko was low before intervention related to counseling was carried out [17]. Mukomuko has the third-highest number of COVID-19 cases, with Mukomuko being the lowest population density area in Bengkulu Province. Based on research on 2020, one of the influencing factors concluded that the spread of COVID-19 in Indonesia did not occur randomly but was determined by interconnected neighboring provinces. Mukomuko's neighboring province, West Sumatra, has a much higher spread of COVID-19 than Bengkulu Province [18]

4. Conclusions

A spatial distribution map is depicted by the coordinates of the patient's address and the degree of severity to find out prevalence data and differences between regions related to the incidence of COVID-19 in Bengkulu Province on 2020. There is a relationship between population density and the number of COVID-19 cases in Bengkulu Province from July to December 2020. There is no relationship between one area's population density and the severity of COVID-19 cases in Bengkulu Province on 2020.

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