Social Vulnerability towards Covid-19 Cases in Palembang City: A Spatial Analysis in Indonesia

Kerentanan Sosial Terhadap Kasus Covid-19 di Kota Palembang: Analisis Spasial di Indonesia

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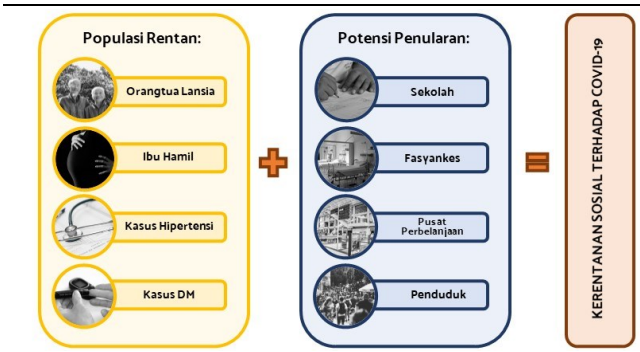
ABSTRACT

Social vulnerability is defined as a characteristic of groups that can threaten their ability to prevent, cope with or recover from the impact of a hazard. By linking social conditions with risk exposure, social vulnerability is useful for looking at the inequality of the social effects experienced by society from health crises such as the Covid-19 pandemic. The purpose of this study was to spatially analyze the vulnerability to Covid-19 in the Palembang City sub-district in 2021 by using the social characteristics of the region. This type of research was descriptive with an ecological study design. The population group studied was 18 sub-districts in the city of Palembang. The study used secondary data such as the Covid-19 variable and the vulnerable population received from the Palembang City Health Office, and the rest of the variable from the government's official website and Google Maps. The analysis process was done through Spatial Multi-Criteria Evaluation (SMCE) using Microsoft Excel and spatial analysis in weighted overlays using QGIS. For the final social vulnerability status, sub-districts with high vulnerability were Sukarami, Ilir Barat I, Plaju, and Ilir Timur I, respectively. For sub-districts with low vulnerability were Bukit Kecil and Sematang Borang. One way to reduce the level of vulnerability in an area was by taking preventive measures in the community whose needs needed to be further considered and maximizing the implementation of 3T activities and vaccinations.

ABSTRAK

Kerentanan sosial adalah karakteristik suatu kelompok yang dapat mengancam kemampuannya untuk mencegah, mengatasi atau memulihkan diri dari dampak suatu bahaya. Dengan mengaitkan kondisi sosial dengan eksposur risiko, kerentanan sosial berguna untuk melihat ketimpangan dampak sosial yang dialami masyarakat dari krisis kesehatan seperti pandemi Covid-19. Tujuan penelitian ini adalah menganalisis secara spasial kerentanan terhadap Covid-19 di Kecamatan Kota Palembang tahun 2021 dengan menggunakan karakteristik sosial wilayah. Jenis penelitian ini adalah deskriptif dengan desain studi ekologi. Kelompok populasi yang diteliti adalah 18 kecamatan di Kota Palembang. Penelitian ini menggunakan data sekunder berupa variabel Covid-19 dan penduduk rentan yang diterima dari Dinas Kesehatan Kota Palembang, dan variabel selebihnya dari website resmi pemerintah dan Google Maps. Proses analisis yang digunakan adalah analisis Spatial Multi-Criteria Evaluation (SMCE) menggunakan Microsoft Excel dan analisis spasial secara *weighted overlay* menggunakan QGIS. Untuk status kerawanan sosial terakhir, kecamatan dengan kerawanan tinggi adalah Sukarami, Ilir Barat I, Plaju, dan Ilir Timur I. Untuk kecamatan dengan kerawanan rendah adalah Bukit Kecil dan Sematang Borang. Untuk mengurangi tingkat kerawanan di suatu daerah, salah satunya dengan melakukan tindakan preventif di masyarakat yang perlu diperhatikan lebih lanjut dan memaksimalkan pelaksanaan kegiatan 3T dan vaksinasi

GRAPHICAL ABSTRACT



Keyword
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INTRODUCTION

Covid-19 was officially reported to emerge in Indonesia on March 2, 2020, when the government announced the first positive case (Mas'udi & Winanti, 2020). According to the case progression, Indonesia is one of the Southeast Asian countries that has not been able to control Covid-19 optimally. According to WHO data reports, Indonesia has been declared with the second -highest number of confirmed cases and new deaths, with 36,214 new confirmed cases and 917 new deaths (World Health Organization, 2021). Meanwhile, on the island of Sumatra, South Sumatra has the fourth-highest cumulative confirmed case of Covid-19 (17,443 cases), and Covid-19 has the third-highest cumulative death case (837 cases) (Kementerian Kesehatan RI, 2021b). Palembang City has the second-highest number of positive Covid-19 cases (524.8 per 100,000 population) among the 17 districts and cities in South Sumatra Province (Dinas Kesehatan Provinsi Sumatera Selatan, 2021). The sub-district with the most suspected and probable Covid-19 cases in Palembang City is Ilir Barat I District, which has 3,117 suspected cases and eight probable cases (Dinas Kesehatan Kota Palembang, 2021). As a result of these findings, the researchers chose Palembang as the research site.

Area-based spatial analysis is one method that can be used in disease management. Spatial analysis is an analysis that can explain disease data geographically in terms of social, economic, population distribution, environmental risk factors, ecosystems, and the analysis of the relationship between these variables. Spatial analysis can explain where and when the disease spreads and how it may reappear in the future. Visualization methods such as mapping can provide the government with information about the location and timing of disease occurrence. As more geographical information becomes available, public awareness of disease risk rises (Delmelle & Kanaroglo, 2016). Geospatial techniques (such as mapping) proved useful in detecting COVID-19 disease patterns during the pandemic (Fatima et al., 2021).

When dealing with Covid-19 cases, social vulnerability plays an important role. According to Kim and Bostwick's research, social vulnerability is useful for examining the inequality of impacts experienced by society from health crises such as the Covid -19 pandemic by linking social conditions with risk exposure. Uneven health conditions can also increase social vulnerability (Kim & Bostwick, 2020). Further research into social vulnerabilities in a Covid-19 area is required to protect public health as a whole.

A real-time assessment of the impact of social vulnerability at the community level on the occurrence of Covid-19 is also required. According to Nayak et al., social vulnerability is associated with higher Covid-19 case mortality (Nayak et al., 2020). This assessment can help policymakers decide on public health policies and allocate effective and efficient health resources to Covid-19 cases. As a result, additional research into locations prone to spreading the Covid-19 disease is required.

Researchers have used various meth-

ods to deal with Covid-19 in their respective countries since the spread of Covid-19 cases, one of which is the spatial analysis method. Previous research, such as Kim and Bostwick's (2020), has linked social vulnerability and racial inequality to the occurrence of Covid-19 deaths in Chicago, Illinois. De Souza et al. (2020) used a spatial method to assess the relationship between Covid-19 cases and human development and social vulnerability indicators in Brazil. In their study, Neelon et al. (2021) investigated the relationship between spatial and temporal trends in social vulnerability and the death rate from Covid-19 in the United States. This research is indeed a continuation of a previous study conducted by Bamweyana et al. (2020) in Uganda's capital city of Kampala. The study found that areas with a high population density and a high density of shopping centers had a high Covid-19 exposure index. Low vulnerability areas are located on the outskirts, where there is a low population and a limited number of shopping centers. Knowing which areas have high social vulnerability allows policymakers to determine which areas need to be focused on channeling resources and imposing social restrictions on the most vulnerable. The researchers were thus interested in conducting a study titled Spatial Analysis of Social Vulnerability to Covid-19 Cases in Palembang City, Indonesia, based on the description above.

METHODS

This research was conducted using a descriptive study with an ecological design (the unit of analysis is the population). It was because the researcher's ecological study aimed to observe the characteristics of population groups based on place (district). Thus, this research was included in an ecological study of the type of multi-group comparison. After reviewing the available data, the researchers determined that the population groups that could be used as research subjects were sub-districts. After considering the needs of the Palembang City Health Office at the time, they decided that the subject under study was the sub-district area. The study population consisted of 18 sub-districts in the city of Palembang. The variables studied in this study were social characteristics of vulnerability based on vulnerable populations (sub-variables namely number of elderly parents, number of pregnant women, cases of hypertension, cases of diabetes mellitus), vulnerability based on potential transmission (sub-variables namely population, number of schools, health service facilities, and shopping centers) which was descriptively related to the area's vulnerability to Covid-19 (sub-variables namely number of schools, health service facilities, and shopping centers.

Secondary data, including spatial and attribute data, were used by the researchers. Spatial data were obtained from the Palembang City Bappeda, including a digital map of the administrative area of Palembang City per sub-district and a digital map of the Palembang City road network. The Palembang City Health Office provided attribute data such as the Covid-19 variable and the vulnerable population, while the data for the variable potential for transmis-

sion was obtained from the government's official website and Google Maps. The data on Covid-19 cases used in this study were collected by the Palembang City Health Officers from the time cases first appeared in Palembang until February 16, 2021.

In this research, two analyses were done, namely attribute data analysis and spatial data analysis. The researchers determined the vulnerability status using the Spatial Multi-Criteria Evaluation (SMCE) method during the attribute data analysis process. Researchers discovered three criteria for the social vulnerability that could affect Covid-19: vulnerable populations, transmission potential, and regional vulnerability to Covid-19. Weighting and simple scoring analysis were the stages of SMCE (scoring analysis). First, the researchers determined the vulnerability criterion's score and weighting criteria (variable, definition, score, vulnerable weight, and range of weights). The researchers used previous research to determine the weight of each sub-variable (Bamweyana et al., 2020; Roy et al., 2021). The researchers used statistical data to determine the weight range of each sub-variable of the susceptible population and the potential for transmission, while previous studies were used to determine the weight range of the sub-variable susceptibility of the area (Xie et al., 2020; Roy et al., 2021).

The researchers then applied a weighting to each sub-district, yielding a score for each sub-variable. The scores for each sub-variable were then added together to produce the results of the social vulnerability status in each vulnerability variable. The sum of these scores was classified into vulnerability classes using the Sturges formula: scores in the range of 1-1.67 indicated low vulnerability, scores in the range of 1.68-2.35 indicated moderate vulnerability, and scores in the range of 2.35-3 indicated tall vulnerability.

The researchers created a table of the social vulnerability status of each subdistrict in the final stage of the analysis to see the status of vulnerability in all regions. The method for creating the table was as follows: after completing the SMCE process and obtaining the vulnerability status of each vulnerability variable, the researchers combined the final scores of the three variables by adding them up, and then the median value (mean) was calculated from the summation results, and the final score results were re-categorized in the vulnerability class (follows a predefined class). The Microsoft Excel application was used to carry out the SMCE process.

Furthermore, the researchers used the weighted overlay technique to perform spatial analysis. Researchers entered pre-processed data into the QGIS Desktop application (Version 3.10.10), from which three vulnerability status maps were generated, namely maps for vulnerability based on vulnerable populations, the potential for transmission, and regional susceptibility to Covid-19. This study adhered to the Health Research Ethics Commission of Sriwijaya University, Public Health Department, with a code of health ethics (No:039/UN9.FKM/TU.KKE/2021).

Table 1
Social Vulnerability Status for each District in Palembang City

District	Vulnerability Category			
	Covid-19	Vulnerable population	Infection Potential	Vulnerability Status
Gandus	Low	Middle	Middle	Moderate vulnerability
Alang-Alang Lebar	Middle	Middle	Middle	Moderate vulnerability
Seberang Ulu I	Low	Middle	High	Moderate vulnerability
Seberang Ulu II	Middle	Middle	Middle	Moderate vulnerability
Sematang Borang	Low	Low	Low	Moderate vulnerability
Ilir Timur I	Middle	Middle	Middle	Moderate vulnerability
Ilir Timur II	Middle	Middle	High	High vulnerability
Ilir Timur III	Middle	Middle	Low	Moderate vulnerability
Plaju	Middle	High	High	High vulnerability
Ilir Barat I	Middle	High	High	High vulnerability
Ilir Barat II	Low	Middle	Low	Moderate vulnerability
Bukit Kecil	Low	Low	Low	Low vulnerability
Sako	Middle	High	Low	Moderate vulnerability
Kalidoni	Middle	Middle	High	Moderate vulnerability
Kertapati	Low	High	Middle	Moderate vulnerability
Sukarami	Middle	High	High	High vulnerability
Kemuning	Middle	Middle	High	Moderate vulnerability
Jakabaring	Middle	High	Middle	Moderate vulnerability

RESULTS

Ilir Barat I District had been reported with the most confirmed cases of Covid-19 as of February 16, 2021, with 1,080 cases, whilst the Kertapati sub-district had the fewest, with 146 cases. In Palembang City, the average number of confirmed Covid-19 cases was 411.8.

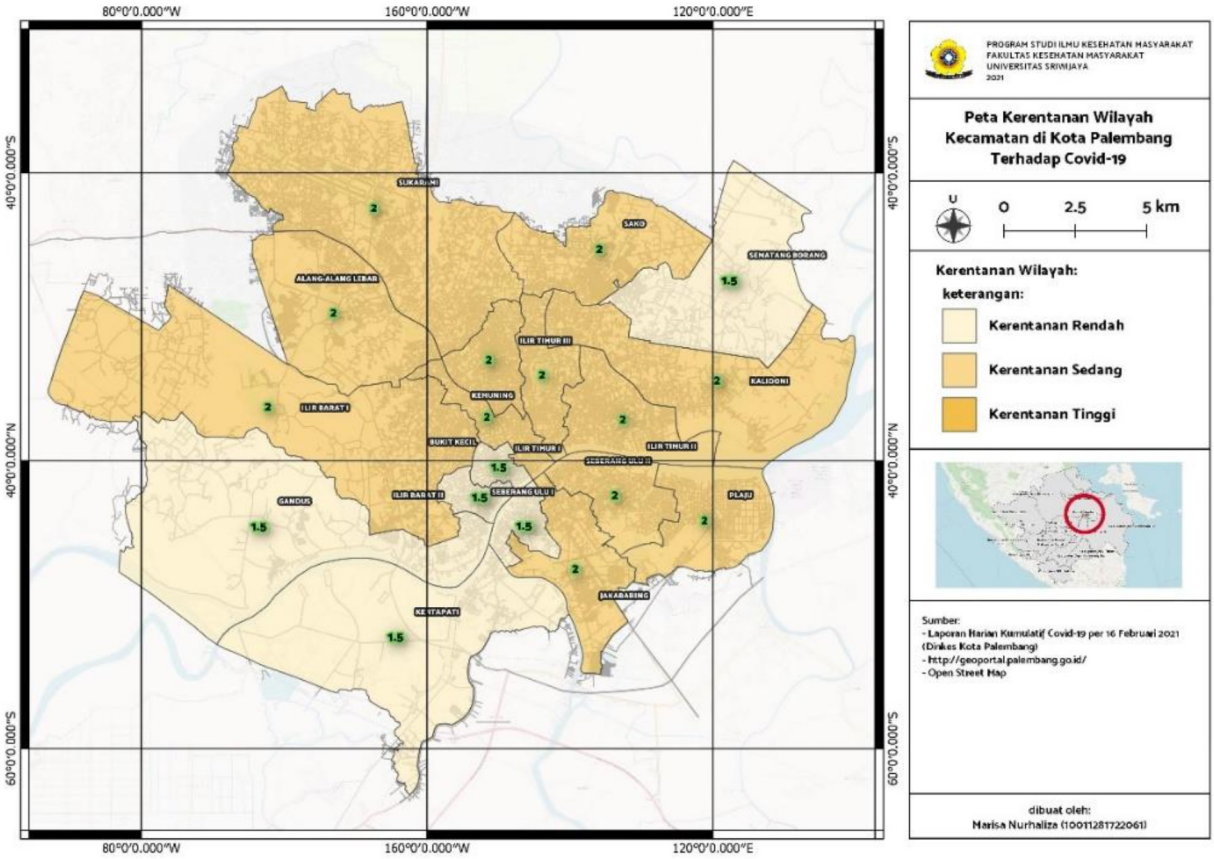
Ilir Barat I sub-district had the most cumulative death cases of Covid-19 as of February 16, 2021, with 39 cases, while Gandus sub-district has the fewest, with 3 cases. In Palembang City, the average number of Covid-19 deaths was 17.7.

Figure 1 shows sub-vulnerability districts to Covid-19. There was no sub-district in Palembang City with a high vulnerability status to Covid-19, which was possible because the number of Covid-19 death cases in each sub-district in Palembang City did not exceed 50 cases as of February 16, 2021. The highest was in the sub-district of Ilir Barat I. Furthermore, there were six sub-districts with low vulnerability status, such as Gandus and Kertapati, including areas with low vulnerability status, one of which could be because the sub-district had a cumulative number of Covid-19 cases (both confirmed and fatal).

Sukarami sub-district had the highest population of elderly parents in Palembang City in 2019, with 13,005 people, while Bukit Kecil sub-district had the lowest population with 2,398 people. In 2019, the average number of older adults in Palembang City was 6,959.2.

Sukarami sub-district had the highest number of pregnant women in Palembang City in 2019, with a total of 2,533 people, while the Bukit Kecil sub-district had the lowest number, with 588 people. In 2019, Palembang had a total population of 1,435,4 pregnant women.

Figure 1
Map of District Area Vulnerability in Palembang City to Covid-19



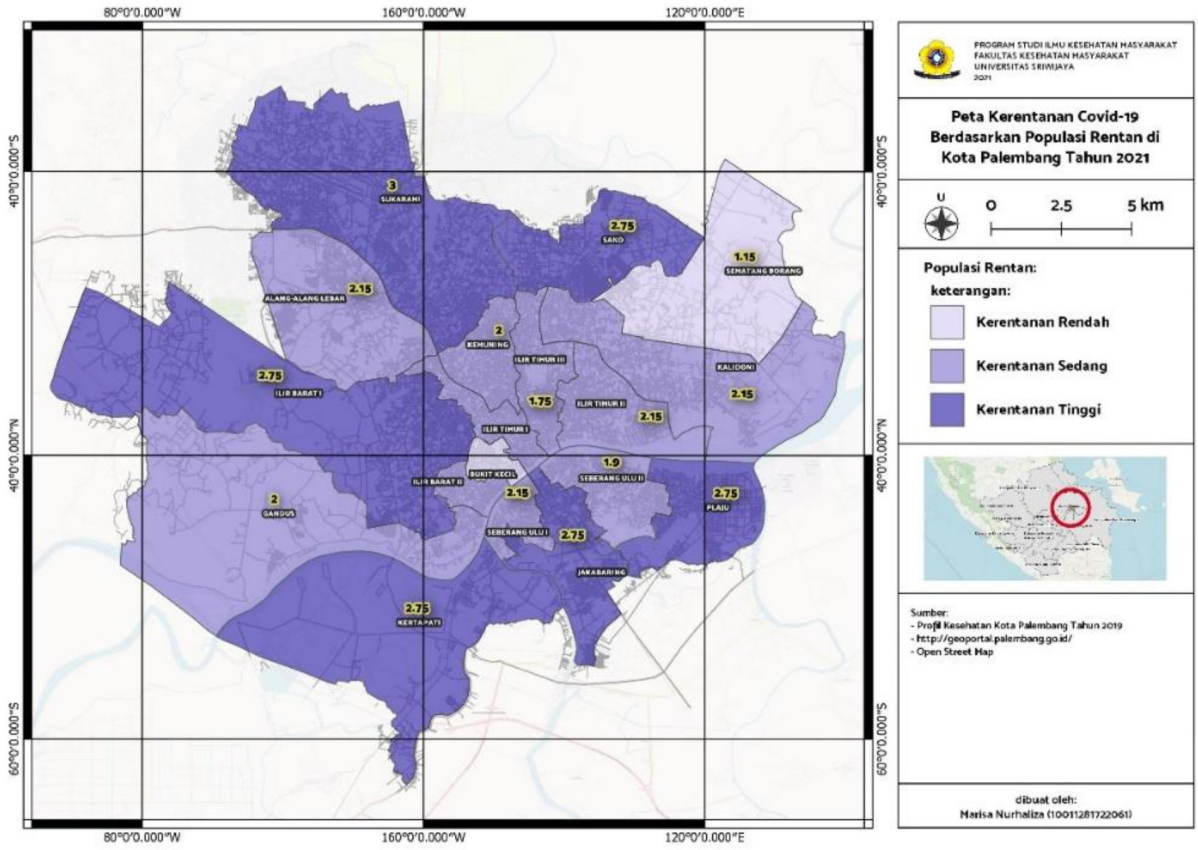
Furthermore, whilst the Sukarami sub-district had the most hypertension sufferers in Palembang City in 2019 with 26,092 people, the Sematang Borang sub-district had the fewest, with 4,949 people. In 2019, the average number of hypertensive people in Palembang City was 13,637.1.

Sukarami sub-district, in addition, had the highest number of people with diabetes mellitus in Palembang City in 2019 with 1,115 people, while Sematang Borang sub-district had the lowest number of sufferers with 211 people. In Palembang City, the average number of people with diabetes was 582.4 in 2019.

Figure 2 illustrates how the vulnerability status of a sub-district area was determined by the state of the vulnerable population. Covid-19, from 18 sub-districts in Palembang City, six sub-districts with high vulnerability status, including Sukarami, could occur because these sub-districts are included in the number. Diabetes patients, hypertension patients, pregnant women, and elderly parents were the most cases in Palembang City. Furthermore, there were two sub-districts with low vulnerability status. Sub-districts with low vulnerability status, such as Bukit Kecil, could be influenced by the lowest number of vulnerable populations compared to other sub-districts.

In terms of school distribution in Palembang City in 2021, Ilir Barat I sub-district has the most schools, precisely 96

Figure 2
Map of Vulnerability Based on Characteristics of Vulnerable Population



schools, while Sematang Borang sub-district has the fewest schools, namely 10 schools. Palembang City will have 56.7 schools on average by 2021.

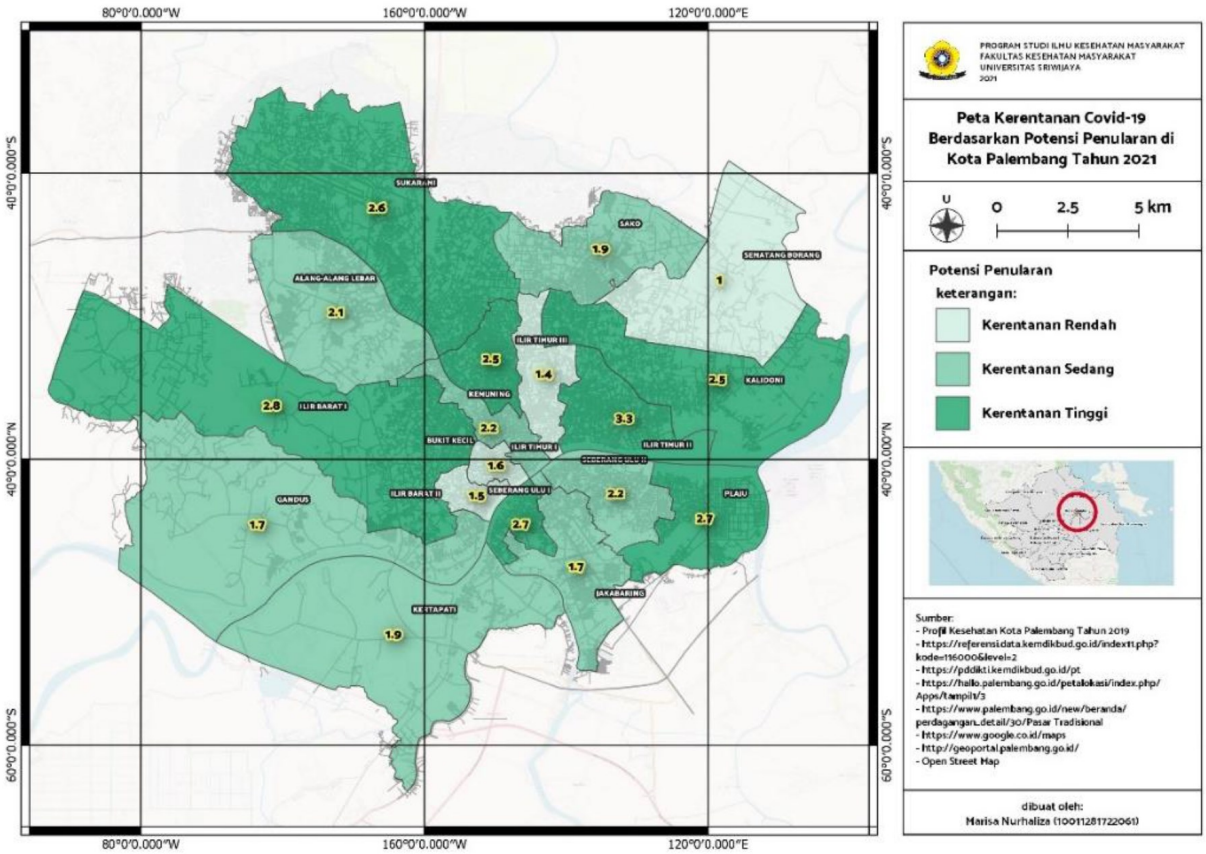
In terms of the distribution of health service facilities in Palembang City in 2019, Ilir Barat I sub-district has the most, with 12 health service facilities, while Ilir Barat II sub-district has the fewest, with one health service facility. In 2019, Palembang City had an average of 4.1 health care facilities.

In terms of shopping center distribution in Palembang City in 2021, Ilir Timur I and Seberang Ulu I sub-districts had the most, with nine shopping centers, while Ilir Timur II and Ilir Timur III sub-districts did not. Palembang City will have an average of 3.8 shopping centers by 2021.

In terms of population distribution in Palembang City in 2019, the Sukarami sub-district had the highest population of 158,246 people, while the Sematang Borang sub-district had the lowest population of 36,445 people. In 2019, Palembang City had an average of 92,382.9 healthcare facilities.

Figure 3 showed how the vulnerability status of a sub-district area was based on the potential for Covid-19 transmission from 18 sub-districts in Palembang City, seven sub-districts with high vulnerability status, sub-districts such as Ilir Timur II with high vulnerability status which could occur because the sub-district has a large population, more public places, and health

Figure 3
Map of Vulnerability Based on Characteristics of Potential Transmission



service facilities than other sub-districts. Furthermore, there were four sub-districts with low vulnerability status. Sub-districts with low vulnerability status, such as Sematang Borang, were influenced by fewer residents, public places, and health care facilities than other sub-districts.

Table 1 shows the status of Palembang City sub-districts based on their vulnerability variables. There were no sub-districts with a high vulnerability to Covid-19 in terms of the regional vulnerability variable. There were six sub-districts with high vulnerability for the vulnerable population variable (Sukarami, Ilir Barat I, Plaju, Sako, Kertapati, and Jakabaring). There were seven sub-districts with high susceptibility to the variable of potential transmission (Seberang Ulu I, Ilir Timur II, Plaju, Ilir Barat I, Kalidoni, Sukarami, and Kemuning). Sukarami, Ilir Barat I, Plaju, and Ilir Timur I were the sub-districts with the highest vulnerability in Palembang City, while Bukit Kecil and Sematang Borang were the sub-districts with the lowest vulnerability.

DISCUSSION

Vulnerability of the Palembang City District Area to Covid-19

The level of vulnerability of a region to Covid-19 is determined by the number of confirmed cases and deaths that have occurred in the area. According to Hammad et

al. (2020), four major factors can influence the rate of confirmed Covid-19 cases and deaths: population characteristics, health policies, geographic or environmental factors, and virus-related factors. Age, gender, population density, social lifestyle factors, and the number of homes with elderly parents are among the population characteristics in question. Health policies include low case reporting, social distancing, timely government response, diagnostic testing work and scale, physical resources, and health workers. Geographical factors include the intensity of travel, pollution, and climate (such as temperature and humidity). Age, genetics, and medical conditions must all be considered, but according to Hammad et al. (2020), research areas that implement 3T or Testing-Training-Treating activities follow strict regulations in implementing social distancing or lockdowns and always ensure that these steps continue to run, especially in critical situations proven to be able to control the increasing spread of disease.

Furthermore, when implementing regional lockdowns, the government must consider the economic impact, and how difficult it will be for the region to implement it, so there is a need for research that further investigates the community's economic vulnerability to Covid-19 (Hammad et al., 2020). The researchers' study findings aim to show the level of cumulative confirmed cases and cumulative death cases in a descriptive manner. Because there are numerous factors that have the potential to influence the number of confirmed Covid-19 cases and deaths, more research is required to investigate the relationship between these factors and the number of confirmed Covid-19 cases and deaths.

Vulnerability to Covid-19 using vulnerable population characteristics.

Vulnerable populations, such as the elderly and pregnant women, are among the factors that could influence the number of confirmed Covid-19 cases and deaths. According to Alshogran et al. research, the higher the percentage of the elderly (>60 years) in a population, the higher the incidence of Covid-19 death (Alshogran et al., 2021). Early Covid-19 cases reported in China also show that the elderly (>60 years) are more susceptible to infection with Covid-19 (Hammad et al., 2020). The elderly's vulnerability to Covid-19 conditions, which can be worse than in other age groups, can be caused by the elderly's general disease burden (multi-morbidity) (Arajo et al., 2021). Furthermore, Li et al. research explain why the elderly are more susceptible to Covid-19 infection. This is because: first, the elderly with a compromised immune system are likely to have a less coordinated, slower, and less efficient immune response in responding to Covid-19 infection; second, the elderly may experience a higher risk of exposure to Covid-19 and problems with access to health services; and third, the elderly with comorbid conditions (Li et al., 2021). As a result, precautions must be taken to protect the elderly from the harmful effects of Covid-19. This preventive step can begin by addressing conditions that can still be managed in the elderly, such as the immune

system. Changes in the immune response of the body can occur as a result of an unbalanced nutritional condition (overweight, obesity, or malnutrition). Morais et al. explained in their research that one way to prevent Covid-19 in the elderly was to monitor their nutritional status as needed (De Araújo Morais et al., 2021).

Pregnant women are also vulnerable to Covid-19 because, according to Siegel and Mallow's research, pregnant women have an increased risk of both physical and mental complications (Siegel & Mallow, 2021). Vulnerability in pregnant women can also occur as a result of immune conditions and body anatomy (Abdelbadee & Abbas, 2020). According to Akgor et al. (2021), the mental health of pregnant women deteriorates in the form of anxiety and depression, allegedly as a result of the many uncertainties that occurred at the start of the Covid-19 pandemic. Several preventive measures can be taken to reduce Covid-19 susceptibility in pregnant women, including providing prevention information that can be done during the prenatal, postpartum, breastfeeding, and neonatal periods; encouraging pregnant women to seek psychiatric consultations; and health care facilities maintaining communication with pregnant women and attempting to prioritize routine antenatal care. According to the findings of this study, the sub-district with the highest number of elderly people and pregnant women (Sukarami District) has a high social vulnerability and a high regional vulnerability to Covid-19. The Sukarami sub-district also has the second-highest number of cumulative confirmed cases (795 cases). - Palembang City sub-district As a result, it is critical to prioritize preventive measures for the elderly and pregnant women in Palembang city.

People with comorbidities such as hypertension, diabetes, asthma, cardiovascular disease, and others, in addition to the elderly and pregnant women, are vulnerable populations that require additional attention. Sun et al. (Sun et al., 2020) found that the elderly with comorbidities such as hypertension were more severely affected by Covid-19. According to Gazzaz (2021), patients infected with Covid-19 who also have diabetes may have a poor prognosis. Diabetes mellitus is another risk factor for death from Covid-19. To reduce the vulnerability of people with comorbidities, they must be treated according to the diseases they have. According to Nsanzabera (2021), hypertension prevention includes the following: patient screening and identification of antihypertensive drugs consumed; monitoring the patient's condition to identify the potential for other comorbidities; and providing health promotion (raising awareness, education, counseling, and immune-boosting mechanisms). According to Lim et al. (2021) people with diabetes mellitus should follow the guidelines for managing diabetes mellitus more strictly. Some of the guidelines include health workers being more cautious with the drugs prescribed to patients and patients complying with doctor recommendations. According to the findings of this study, the Ilir Barat I sub-district has 25,772 people with hypertension and 1,101 people with diabetes mellitus, with the highest cumulative death cases, namely

39 cases. As a result, preventive measures must be taken against people in Palembang who have comorbidities in order to avoid the occurrence of Covid-19 infection, which can result in severe.

Vulnerability based on potential transmission characteristics.

Public places are another vulnerability factor that can lead to Covid-19 transmission in a given area. According to Zhao, Zhang, and Li's research, the SARS-CoV-2 virus has been reported to spread in a variety of locations (Zhao et al., 2020). According to Pan et al., public places have the potential to aid in the spread of SARS-CoV-2 due to their dense population, increased contact opportunities, and high personal mobility (Pan et al., 2021). As happened in the early days of the Covid-19 outbreak in China, one of the public places that can be a potential place of transmission is health care facilities. This is alleged because; first, there was a central issue that occurred in the early days of the pandemic, namely a lack of personal protective equipment and few health workers who understood the conditions of the outbreak at the time; second, health workers who were exposed to infected patients for an extended period of time; (Wang et al., 2020). Shopping centers and schools are the next potential locations (Cai et al., 2020) and schools (Doyle et al., 2021). There are several things that can be done to control the spread of Covid-19 in public places, namely: 1) Increase vaccination rates in all regions; 2) It is necessary to have good cooperation between sectors and integration across various disciplines (e.g., public health, economy, environment) in order to formulate technical guidelines for disease control that are on target; 3) The government must strengthen health protocols and always encourage individual protection (Pan et al., 2021). According to the findings of this study, the sub-district with the most cumulative confirmed cases was Ilir Barat I, with 1,080 cases, and the social vulnerability category based on the potential for transmission was high vulnerability. As a result, while the Covid-19 pandemic is still ongoing, an effective response strategy in public places is urgently needed to protect the general public while also maintaining normal community life and minimizing economic losses as much as possible.

A region that is possibly prone to Covid-19 transmission is affected by the number of residents in addition to public areas. This is because high population density, poverty, and insufficient health care systems, according to Kanga et al., make locations with high population numbers substantially more susceptible to disease (Kanga et al., 2021). Bhadra et al. discovered a moderate relationship between Covid-19 spread and population density (Bhadra et al., 2021). There are several things that can be done to control the spread of Covid-19 in densely populated areas, including 1) implementing social restrictions that take into account how dense an area is; 2) encouraging the public to follow health protocols (Wong & Li, 2020); 3) improving the implementation of 3T activities; and 4) providing broad assistance to vulnerable communities (Kok &

Woo, 2021). According to the findings of this study, the Sukarami sub-district has the largest population and the second-highest cumulative number of confirmed cases in Palembang City. As a result, the general public must remain vigilant and follow health protocols.

According to Birkmann et al. (2013), there are several approaches to managing health risks such as Covid-19, including reducing exposure, reducing vulnerability, and increasing an area's resilience. However, a region's lack of resilience in the face of Covid-19 risk can result from a lack of capacity to anticipate, deal with, and recover from the situation. According to Kandel et al. (2020) findings, after measuring regional readiness in terms of prevention, detection, response, availability of supporting facilities, and operational readiness, it was determined that many regions were not prepared to face the Covid-19 pandemic. The availability of appropriate health data and information is an important factor in assessing an area's readiness because the data is critical for health care facilities and the government, particularly when designing policies during difficult times. According to Januraga & Haryana (2020), an open data collection system to quickly and accurately access health information is a solution in dealing with a pandemic because this information can be a reference for the government in dealing with the ongoing pandemic, after the pandemic ends, or preparing for the next pandemic. Suggestions for the Indonesian government include optimizing Covid-19 data management and being open by allowing public and academic access to information.

There were undeniable limitations to this research because it was conducted in 2021 when Indonesia's readiness conditions were different from those in 2022. On January 13, 2021, the Indonesian government began procuring vaccinations for the community (Kementerian Kesehatan RI, 2021a), and on March 2, 2021, Palembang City began vaccination activities for the public service officers and the elderly (Dinas Kesehatan Kota Palembang, 2021). In comparison to the beginning of 2022, new Covid-19 virus variants have begun to emerge (World Health Organization, 2021), and the status of vaccination achievements in Indonesia has reached 280 million doses, with the majority of provinces have reached the target of 70% vaccination (Covid-19 Task Force). -19, 2022), as well as in Palembang City, which has begun to prepare, a booster vaccination will be held (Dinas Kesehatan Kota Palembang, 2022).

However, the researchers believe that there are still lessons to be learned from how Indonesia deals with Covid-19 cases, from the beginning of the case until early 2021, namely the importance of remaining prepared and not ignoring current conditions. Ignorance of a condition should make the government more vigilant rather than dismissing existing problems simply to appease the public because the public has the right to open, accurate, and up-to-date information. According to Mas'udi & Winanti (2020), statements by public officials that are not based on adequate knowledge and there is no urgency in taking action to anticipate the early emergence of Covid-19 cases

in Indonesia have an impact on Indonesia's unpreparedness in dealing with the surge in Covid-19 cases (for example, the lack of equipment). Tests, unclear referral hospital information, insufficient personal protective equipment (PPE), and non-uniform policy determination. Given this situation, the government must demonstrate a strong willingness to work together to solve this problem while focusing on fulfilling the right to health for the community in a situation that is still not improving.

Although Covid-19 could currently attack people with any characteristics, and more and more variants of the virus are developing and spreading, social vulnerabilities in the community must still be identified and addressed. This is useful for anticipating the impact, especially on vulnerable people, who tend to have a more severe impact if infected with Covid-19.

CONCLUSIONS

Sukarami, Ilir Barat I, Plaju, and Ilir Timur I are concluded as the sub-districts with the highest vulnerability in Palembang City, while Bukit Kecil and Sematang Borang are the sub-districts with the lowest vulnerability. This research could be used to make a decision and plan health programs to reduce the number of Covid-19 cases in Palembang City in the future, as well as a reference for the development of future Covid-19 spatial research. The importance of this research is that by presenting health data spatially, parties who need health data to make decisions and policies can understand it more easily and quickly. The disadvantage of this study is that certain attribute variables still use data sources from 2019, whereas Covid-19 cases first appeared in Palembang City in March 2020, so there may be changes in the data (for example, increasing or decreasing the number of vulnerable populations, triggering factors for potential Covid-19 transmission) that can be investigated further.

The researchers could make the following recommendations to the Palembang City Government: 1) taking such preventive measures in communities that require additional attention to their needs; 2) maintaining vigilance and do not underestimate the current situation; 3) making open, precise, and up-to-date data and health information about Covid-19 available; 4) carrying out as many vaccination and 3T (Tracing, Testing, and Treatment) activities as possible; and 5) strictly enforcing health protocol and PPKM regulations (Enforcement of Tightening Community Activities).

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