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Spatial Analysis of the Distribution of COVID-19 Vulnerable Groups to COVID-19 Cases in Brebes Regency

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ABSTRACT

The number of COVID-19 cases in Brebes Regency within a year is still quite high. The elderly, Hypertension and Diabetes Mellitus are the most important COVID-19 vulnerable groups and have the highest risk of death. The purpose of this study is to determine the distribution of COVID-19 vulnerable groups and their spatial relationship to COVID-19 cases in Brebes Regency. This study used a correlation or ecology study design. The data used is secondary data obtained from the Brebes Regency Health Office, namely the number of COVID-19 cases, the number of elderly, people with hypertension and diabetes mellitus in 2021. The data then analyzed using univariate, bivariate analysis and spatial analysis with the help of QuantumGIS software (QGIS). The results showed that the proportion of the elderly age group correlated with the number of COVID-19 cases (p value is 0.005), while the prevalence of hypertension and diabetes mellitus had no correlation with the number of COVID-19 cases (p value more than 0.05). The high-risk areas are Brebes, Wanasari, Banjarharjo and Bumiayu Districts. The existence of this study, the local government is expected to be able to optimize the Testing, Tracing and Treatment program (3T), posyandu for the elderly and achieve vaccination targets, especially in high elderly population areas, in order to detect and predict the spread of COVID-19 and the selection of appropriate treatment.

1. Introduction

Corona Virus Disease 2019 (COVID-19) is an infectious disease caused by a new type of corona virus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (Handayani et al., 2020; Ramadhan et al., 2022). Since the emergence of the first COVID-19 case at the end of 2019 in China, the number of COVID-19 cases has soared again in February 2022 due to a new variant of the COVID-19 virus called Omicron (WHO, 2022). The Omicron variantis known to have a faster transmission rate compared to the Delta variant (Menteri Kesehatan RI, 2021). Transmission of the COVID-19 virus occurs very quickly and can spread easily through droplets that come out when coughing or sneezing (Susilo et al., 2020). Some groups have a higher level of susceptibility to the COVID-19 virus. This is due to risk factors that cause a group to have a low immune system, making it easier forthe virus to infect humans (Pradana et al., 2020; Rani et al., 2020). Based on the Behavior Change Guidelines for Handling COVID-19, groups that are vulnerable to Covid- 19 infection are the elderly aged > 60, comorbid patients with hypertension, diabetes, heart disease, asthma and kidney failure, groups with low body resistance and obesity (Satgas Penanganan COVID-19, 2020).

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Age is a risk factor that has the most significant relationship to the incidence of COVID-19 (Siagian, 2020). The elderly tend to experience a decrease in endurance so that their immune system is weakened. People with advanced age and comorbidities can increase the risk of death from COVID-19 up to five times (Jordan et al., 2020). Hypertension and Diabetes Mellitus (DM) are the most important comorbidities of COVID-19 and the most common cause of death (Ejaz et al., 2020; Rahayu et al., 2021). Hypertension is the most common comorbid suffered by COVID-19 patients in several countries such as America, China, Italy and including Indonesia (Rahayu et al., 2021). The prevalence of comorbid hypertension in Indonesia in COVID-19 patients is the highest case, namely 52.1% (Karyono & Wicaksana, 2020). Diabetes Mellitus is the 2nd most common Covidcomorbid in Indonesia after hypertension, with a prevalence of 33.6% (Karyono & Wicaksana, 2020).

Vulnerable groups have a higher risk of being infected with COVID-19 than other groups so their existence is important to know. To find out the distribution of vulnerable groups, it is necessary to map groups based on regions/areas which can be done using spatial analysis. (Fadjarajani, 2020). Spatial analysis can be done using Geographic Information Systems (GIS). Geographic information system is a computer-based information system and was developed to work with data that has spatial information (Amaluddin et al., 2020). GIS not only transforms conventional maps into digital maps but this system has the ability to manage and analyze data into important, simple and easy to understand information. GIS can be used as a tool to solve spatially related problems, such as in evaluating location, potential, vulnerability, and even risk in various fields including health (Mubarak & Aryuni, 20219). With the application of GIS in the health sector, especially in the spatial analysis of infectious diseases, it can determine the distribution patterns and trends of a high-risk population. (Irwan, 2017).

Brebes Regency is one of the regencies in Central Java which consists of 17 sub-districts and 297 villages/sub-districts based on data from the Central Bureau of Statistics/BPS. (BPS, 2021). The area of Brebes Regency is 1,769.62 km^2 with a total population at the end of 2020 of 1,978,759 people (BPS, 2021). COVID-19 cases in Brebes Regency are still increasing. In 2021 the total number of positive cases was 13,976, this number increased dramatically from the previous year which was only 2,305 on December 20, 2020. COVID-19 cases then increased dramatically again in February 2022 with a total number of positive cases of 15,179 cases and continued to increase until now, recorded as of July 28, 2022 with a total number of 15,881 cases (Dinkes Kab. Brebes, 2022). In Brebes Regency, the number of elderly people is increasing every year. In 2020 the number reached 12.45% (BPS, 2020). In addition, based on data from the Brebes Regency Health Office, the number of people with hypertensionand DM in Brebes Regency is increasing every year, in 2021 the number of sufferers increased dramatically from the previous year, namely 164,548 cases to 272,251 cases and DM sufferers from 14,943 cases to 15,036. In addition, based on the Provincial Parliament report, the coverage of the second dose of COVID-19 vaccination in Brebes district as of March 4, 2022 is still low and even occupies the second lowest position in Central Java Province (DPRD Prov. Jateng, 2022).

Based on the above background, spatial analysis of the distribution of vulnerable groups needs to be carried out to determine the distribution of COVID-19 vulnerable groups and their spatial relationship to COVID-19 cases as part of area-based disease management, namely efforts to prevent the spread of COVID-19 and reduce the mortality rate due to COVID-19 (Yuhefizar et al., 2020). In addition, the available information related to COVID-19 in Brebes

Regency is in the form of graphs and is limited to the number of confirmed positive cases, death cases, recovered cases and active cases so that there has been no information and research related to regional mapping for vulnerable populations of COVID-19 in Brebes Regency. Therefore, it is necessary to research the regional mapping of the distribution of vulnerable groups of COVID-19 to COVID-19 cases in Brebes Regency. Thus, the description of the research results can be used as a basis for determining the priority targets of the COVID-19 prevention program in at-risk areas as an effort to break the chain of transmission of COVID-19 cases.

2. Method

This research used a correlation/ecological study design. The data used in this study were secondary data obtained from the Brebes District Health Office. This research was conducted at the Brebes District Health Office in February - May 2022. The subject of this research is COVID-19 disease. While the object of this research is the spatial data of the administrative map of the Brebes Regency area and attribute data in the form of the number of COVID-19 cases, the proportion of the elderly, and the number of people with hypertension and diabetes mellitus in 2021.

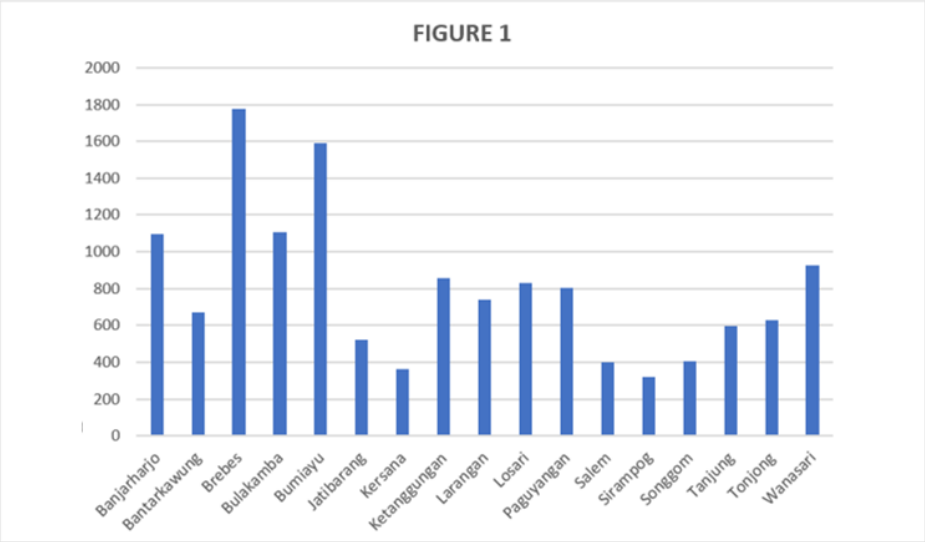
The instruments used in this study used research instruments in the form of documentation. The document is a report from the Brebes Regency Health Office in 2021, namely the number of COVID-19 cases, the number of people with hypertension, diabetes mellitus and the number of elderly people and population data from the 2021 Brebes Regency Central Statistics Agency (BPS) document. The data obtained were then analyzed using univariate, bivariate and spatial analysis. Spatial analysis was carried out with the help of QuantumGIS (QGIS) software to determine whether there is a spatial relationship between COVID-19 cases and the distribution of vulnerable groups.

The categorization of vulnerable group areas (hypertension and DM) was determined based on the National Non- Communicable Disease (NCD) target of the Directorate General of Disease Prevention & Control (Direktorat Jenderal Pencegahan dan Pengendalian Penyakit, 2015). Based on the National Non-Communicable Disease (NCD) Target, the target prevalence of hypertension is 23% and the target prevalence of diabetes mellitus is 6.2%. Red color for areas that have a high number of prevalence hypertension and diabetes mellitus, yellow color for areas that have a medium number of prevalence hypertension and diabetes mellitus and green color for areas with a small/low number of prevalence hypertension and diabetes mellitus. The labeling of old structure areas by BPS through color categorization (BPS, 2020). According to BPS, an area is said to be an old structured population if the proportion of the elderly in the area reaches 10% or more. Red color for areas that have a high number of elderly age groups, yellow color for areas that have a medium number of vulnerable groups and green color for areas with a small/low number of vulnerable groups. Then the use of dots/dots as a visualization of the prevalence of COVID-19 on the map, where the bigger the dot/dot, the higher the prevalence of COVID-19 in that area. In addition, Correlation analysis is carried out using the *Carl Pearson* test, but if the normality assumption is not met, the Spearman rho test is used to determine the correlation /relationship between variables.

3. Result and Discussion

The highest number of COVID-19 cases in 2021 in Brebes Regency was in Brebes sub-district with 1,775 cases and the lowest in Sirampog sub-district with 319 cases. Based on the concept of disease occurrence developed by John Gordon and La Richt, a disease arises when

there is an imbalance between 3 components, namely *agent, host* and *environment*. In the case of COVID-19, the agent of this disease is the COVID-19 virus. The COVID-19 virus can increase the number of cases through new virus mutations, such as the Corona virus which mutates from Alpha, Beta, Gamma, Delta and Omicron (PAMKI, 2021). The Omicron variant has a higher rateof infection and transmission, causing Indonesia, including Brebes Regency, to experience another spike in cases in February 2022 (Menteri Kesehatan RI, 2021). Figure 1 show the frequency chart of the number of COVID-19 cases in Brebes Regency in 2021.



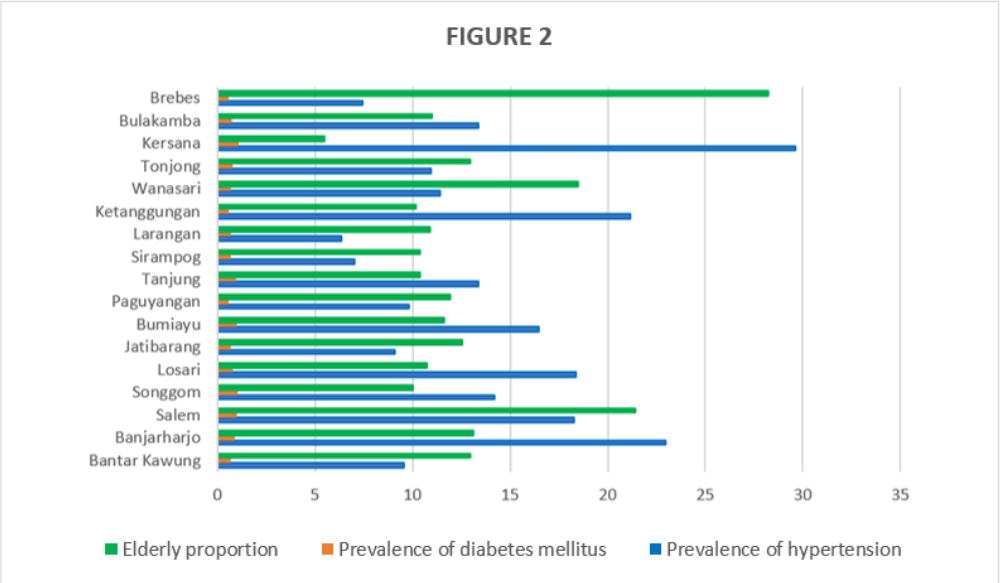
Source: Primary Data, 2022

Figure 1. Frequency Chart of the number of COVID-19 cases in Brebes Regency in 2021

The factors that cause an area to have high COVID-19 cases are very diverse. Sub-districts in Brebes Regency with high COVID-19 cases are Brebes, Bumiayu and Banjarharjo sub-districts. When viewed from the ecological situation, Brebes is the center of government in Brebes Regency, so a lot of social mobility occurs in the area. In addition, these 3 sub-districts are sub-districts that have the most public facilities such as hotels, shopping centers, tourism sites, etc. so that mobility in these three sub-districts is high (BPS, 2021). The high social mobility also contributes to the high number of COVID-19 cases in the region. In addition, vaccination coverage and community compliance in Brebes Regency with health protocols are still lacking so this can encourage the increase in COVID-19 cases (Nugroho & Rakhman, 2021). The number of cases is the least in Sirampog Subdistrict. The geographical condition of Sirampog Subdistrict is mostly mountainous and hilly. Sirampog Sub- district is included in an area with low population density in Brebes Regency. The low number of COVID-19 cases in Sirampog Sub-district may be due to the low population density in the area, this is in line with research conducted by Arif & Sengupta, (2020) which states that population density has a relationship with the increase in COVID-19 cases in an area (Arif & Sengupta, 2020).

Another component that affects the number of cases of a disease is the *host*. The hosts of COVID-19 disease are very diverse, ranging from bats, cats, to humans. This virus can only reproduce in *its host* cells. The most identified COVID-19 virus is in humans, especially in at-risk/vulnerable groups that have low immunity. Vulnerable groups are associated with a high risk of a group being infected with COVID-19 (Siagian, 2020). Vulnerable groups are groups of

people who have low health conditions so that they are easily exposed to disease (Pradana et al., 2020) Based on the COVID-19 Prevention and Control Guidebook 5th Revision, a group is said to be vulnerable to COVID-19 if a community group experiences more severe symptoms that can cause death when exposed to the COVID-19 virus (Kemenkes RI, 2020b). The elderly accounted for 15% of COVID-19 cases in Indonesia in June 2020 with the highest proportion of deaths at 17.69% (Karyono & Wicaksana, 2020). In addition, the most common comorbidities suffered by COVID-19 patients are hypertension (52.1%) and diabetes mellitus (33.6%) (Karyono & Wicaksana, 2020). Figure 2 show the prevalence chart of COVID-19 vulnerable groups in Brebes Regency.



Source: Primary Data, 2022

Figure 2: Prevalence Chart of COVID-19 Vulnerable Groups in Brebes Regency

According to the Law of the Republic of Indonesia Number 13 of 1998 concerning the Welfare of the Elderly, Elderly (Lansia) is a person who has reached the age of 60 years and over (Kemenkes RI, 2014). An area is said to have an *aging* population if the number of elderly people reaches ≥10% (BPS, 2020). The proportion of elderly people in Brebes Regency is highest in Brebes District at 28.23% and lowest in Kersana District at 5.48%. In old age, a person experiences a degenerative process or a process of declining body function which results in reduced/low immunity in the elderly group (Ouchetto & Bourhanbour, 2021). When the body's immunity is not optimal, the body will then be vulnerable to disease, makingit easier for disease-causing agents to enter the body tubuh (Irwan, 2017). The elderlyare included in a group that has a high risk of being infected with COVID-19 (Siagian, 2020). The aging process experienced by the elderly causes the elderly group to be one of the vulnerable groups that can experience the most severe effects when infected with COVID-19 (Pradana et al., 2020). Of the total number of COVID-19 cases in Indonesia, the number of elderly people infected with COVID-19 is 15% (Karyono & Wicaksana, 2020). However, the highest death rate due to COVID-19 is dominatedby the elderly.

Hypertension is one of the non-communicable diseases that is the highest cause of death in the world (Kemenkes RI, 2019). Hypertension is characterized by a systolic blood pressure

of >140 mmHg and a diastolic blood pressure of >90 mmHg (Gunawan et al., 2020). Hypertension is a type of disease that can appear suddenly, and is caused by various factors. Some people with hypertension show symptoms and some without showing certain symptoms or signs, so hypertension is often referred to as a *silent killer*. Hypertension sufferers usually complain of several symptoms such as headaches, heart palpitations, easy fatigue anddizziness and chest pain (Kemenkes RI, 2019). Hypertension as a comorbid COVID-19, ranks first in the comorbidities most suffered by COVID-19 patients. The highest prevalence of people with hypertension was 29.62% in Kersana sub-district and the lowest was 6.36% in Larangan sub-district.

Diabetes Mellitus (DM) is included in the 4 priority non-communicable diseases (Kemenkes RI, 2020a). DM is the fastest growing disease in the world, one person is diagnosed with DM every 8 seconds (Gayatri et al., 2019). Diabetes mellitus is a disease that occurs due to an increase in blood sugar levels (hyperglycemia) due to the pancreas not producing enough insulin or when the body cannot effectively use the insulin produced (Ozougwu et al., 2013). According to the 2011 American Diabetes Association (ADA) guidelines and the consensus of the Indonesian Endocrinology Society (PERKENI) 2011, the diagnosis of DM is established when fasting plasma glucose ≥126 mg/dl with accompanying classic symptoms, 2-hour post-loading glucose ≥200 mg/dl, and current plasma glucose ≥200 mg/dl if there are classic complaints of DM such as frequent urination (polyuria), frequent thirst (polydipsia), frequent hunger / desire to eat constantly and unexplained weight loss (Kemenkes RI, 2020a). DM as a comorbid of COVID-19 is the second most common comorbid in COVID-19 patients in Indonesia and in several countries such as China, the United States and South Korea (Rahayu et al., 2021). Diabetes sufferers are highest in Kersana District and lowest in Brebes District at 0.57%. The 2019 Non-Communicable Disease (NCD) targets in efforts to control hypertension and diabetes mellitusissued by the Directorate General of Disease Prevention and Control are ≤23.1% and ≤6.27%,respectively (Direktorat Jenderal Pencegahan dan Pengendalian Penyakit, 2015).

3.1 Bivariate Analysis

Table 1 show the results of the analysis of the relationship between vulnerable groups and COVID-19 cases in Brebes Regency.

Table 1. Results of Analysis of the Relationship between Vulnerable Groups and COVID-19 Cases

Vulnerable Group	Spearman's Rho	
	Sig Value.	Correlation Coefficient
Prevalence of Hypertension	0,708	0,098
Prevalence of Diabetes Mellitus	0,646	0,120
Proportion of Elderly	0,002	0,684

Source: Primary Data, 2022

The results of the *Spearman's Rho* correlation test found that there was a relationship between the proportion of the elderly (0.002) and the prevalence of COVID-19 cases in Brebes Regency with a strength of 0.684, which means that the correlation level is strong. This is in

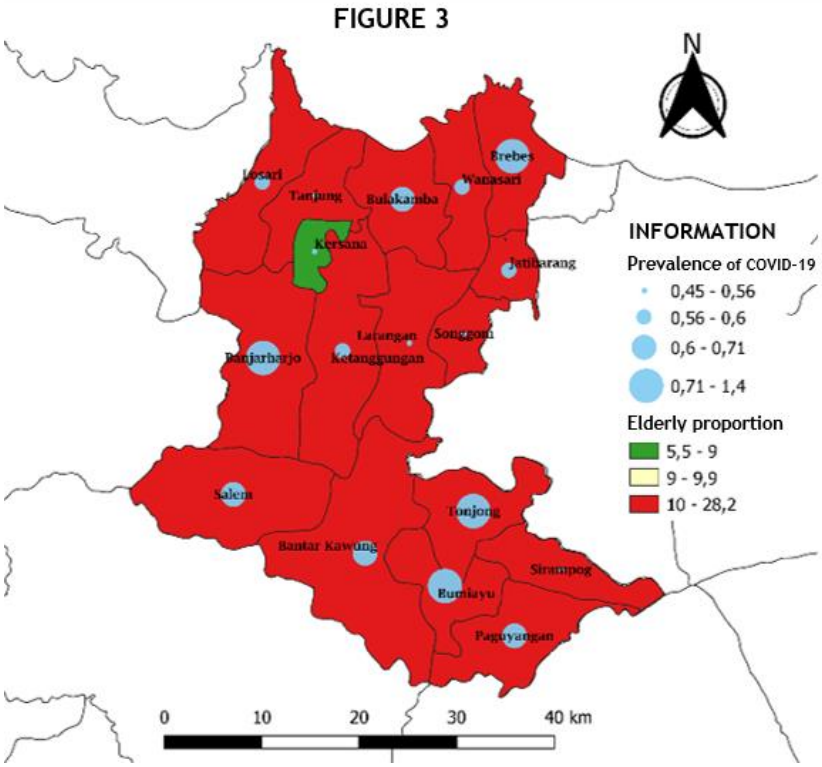
line with research conducted by Siagian, (2020) which states that the elderly group is a group that has a higher risk of being infected with the Corona virus than other groups (Siagian, 2020). The elderly group has a 2 times higher risk of contracting COVID-19, if an area has a higher elderly population, the confirmed COVID-19 cases will also be higher (Cortis, 2020). In addition, the high population of the elderly as a vulnerable group in an area will affect the achievement of herd immunity or group immunity in the area (Dong et al., 2021). The realization of herd immunity is related to the characteristics of the pathogen, population and behavior, if an area has a population that is sufficiently immune or has group immunity, the spread of COVID-19 cases can be controlled (Dong et al., 2021).

The prevalence of hypertension (0.708) and the prevalence of DM (0.646) have no relationship to the prevalence of COVID-19 in Brebes Regency. Several literature review studies conducted also stated that comorbid hypertension is not related to the incidence of COVID-19 but rather causes an increased risk of COVID-19 disease severity (Alkautsar, 2021; Gunawan et al., 2020). Research conducted by Ouchetto & Bourhanbour, (2021) also states that the elderly are more susceptible to COVID-19 while people with diabetes do not show significant correlation results with the incidence of COVID-19 (Ouchetto & Bourhanbour, 2021). Patients with comorbidities such as hypertension and diabetes mellitus are important to monitor their health conditions during the pandemic to remain stable. Health services for groups with comorbid patients must continue to run optimally to reduce the risk of severity and mortality due to COVID-19 (WHO, 2020).

Controlling NCDs during a pandemic is one of the ways to prevent and control COVID-19 (Oktaviani & Wahyono, 2022)**.** Based on data from the Brebes District Health Office in 2021, the coverage of health services in the hypertension and DM groups has been running well. (Dinkes Kab. Brebes, 2021). The coverage of health services for people with DM in2021 was 70.39%, which means that almost all people with DM have received health servicesand have an awareness of maintaining their health (Dinkes Kab. Brebes, 2021). Meanwhile, the coverage of services for people with hypertension is 40.83%, although it is still low, this number has increased from the previous year, which was only 25.63% (Dinkes Kab. Brebes, 2021). Groups of people with hypertension and DM if they are able to control comorbid diseases suffered, the body's immunity can stabilize and even increase so that the body is not easily infected with COVID-19. If in an area most of the population with comorbid diseases can control their health, then the possibility of the population being exposed to COVID-19 is low, this can also affect the number of cases in the area.

3.2 Spatial Analysis

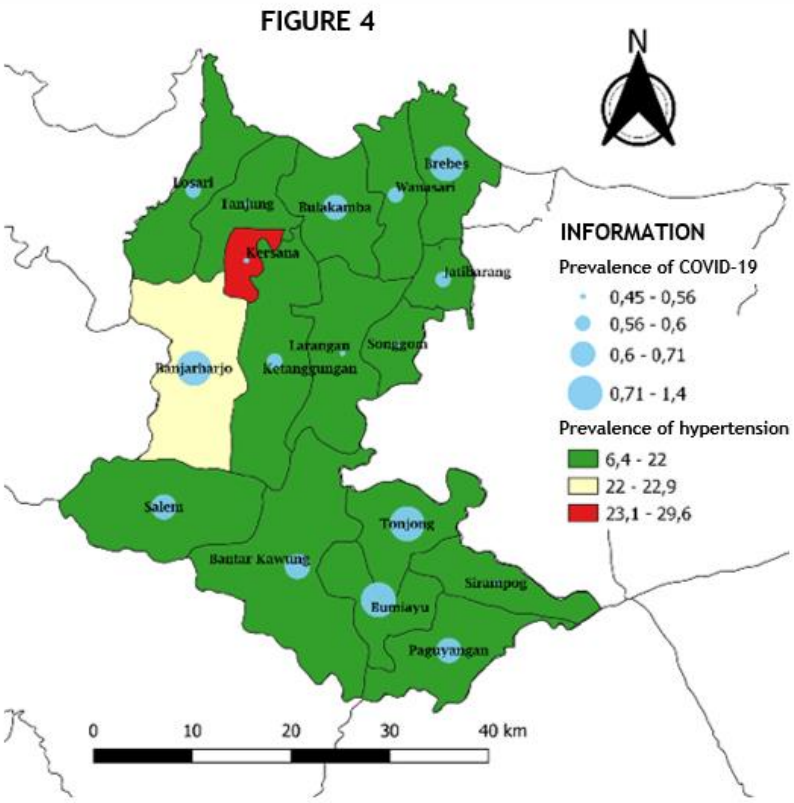
Spatial analysis is a collection of techniques used to explore and examine data from a spatial perspective, develop and test data and re-present it in the form of more communicative information. Spatial analysis will present a complete picture that is adjusted between the area and the specified parameters/criteria (Mahesa et al., 2020). Spatial patterns relate to the arrangement or placement of objects on the earth's surface, using mapping and descriptive analysis, for example, such as the use of points as a form of disease distribution. According to McGarigal and Marks "spatial pattern is a quantitative parameterization of the composition and confirmation of spatial objects" (Sukarna et al., 2020). Figure 3 shows the distribution of vulnerablegroups, namely the proportion of the elderly to the prevalence of COVID-19 cases in Brebes Regency.



Source: Primary Data, 2022

Figure 3. Map of the Distribution of the Proportion of Elderly to the Prevalence of COVID-19 Casesin Brebes Regency

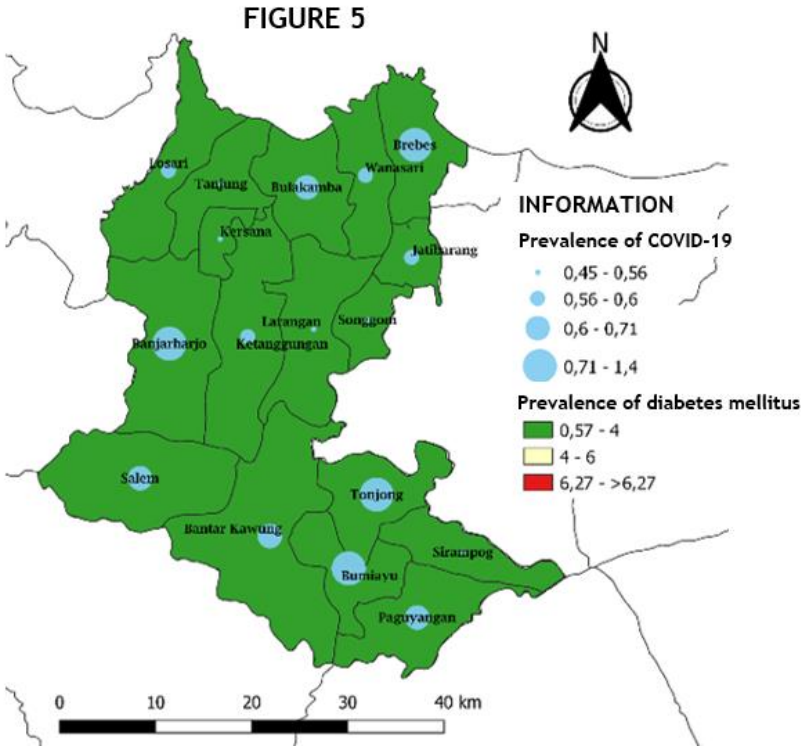
Based on the distribution of the elderly group, it shows that almost all sub-districts are in the red zone, which means that the number of elderly is high in the area. The sub-district with the highest proportion of elderly is Brebes Sub-district. Based on the spatial analysis of the number of COVID-19 cases with the distribution of the elderly group displays the same thing, namely the red zone/zone with high elderly the number of COVID-19 cases is also high in these areas, meaning that the relationship between the distribution of the elderly population is in line with the COVID-19 cases in Brebes Regency. This is in line with research conducted by Cortis (2020) and Chotib et al., (2021) which states that there is a positive relationship between the elderly population and COVID-19 cases. This can be interpreted that if an area has a higher elderly population, the confirmed COVID-19 cases will also be higher in that area (Chotib et al., 2021; Cortis, 2020). Figure 4 show the distribution of vulnerable groups, namely the prevalence of people with hypertension against the prevalence of COVID-19 in Brebes Regency in 2021.



Source: Primary Data, 2022

Figure 4. Map of Hypertension Prevalence Distribution against COVID-19 Case Prevalence in Brebes Regency

Based on the map of the distribution of the prevalence of hypertension groups, it shows that the distribution of hypertension vulnerable groups shows the opposite direction, where areas with hypertension red zones, namely Kersana District, have a low prevalence of COVID-19 casescompared to areas with other green zones. Although the prevalence of hypertension in Kersana Sub-district is high, the coverage of the Prevention and Control of Non-communicable Diseases (P2PTM) program for hypertension in the area is very good at 88.67% (Dinkes Kab. Brebes, 2021). This is in line with the coverage of the P2PTM program for hypertension in Banjarharjo District and Brebes District which is lower than Kersana District. The coverage of the P2PTM program for hypertensive disease in Brebes sub-district as a sub-district with a green zone of hypertension and the highest number of Covid- 19 cases in Brebes Regency is only 33.54%, good or bad health services in the hypertensive population can affect the spread of COVID-19 cases in Brebes Regency (Dinkes Kab. Brebes, 2021). Figure 5 shows a map of the distribution of the prevalence of diabetics against the prevalence of COVID-19 in Brebes Regency.



Source: Primary Data, 2022

Figure 5. Map of DM Prevalence Distribution against COVID-19 Case Prevalence in Brebes Regency

The map shows that all areas of Brebes Regency are in the green zone, which means that the prevalence of diabetes cases in Brebes Regency is low and not in line with the prevalence of COVID-19 in Brebes Regency. The achievement of the P2PTM program for diabetes in Brebes District is lower than that of Kersana District, which is 55.58% and 101.27%, respectively (Dinkes Kab. Brebes, 2021). In addition to the low coverage of the P2PTM program, areas with high COVID-19 casessuch as Brebes, Bumiayu, Banjarharjo and Tonjong sub-districts tend to be urban areas whichare the center of government, have many public facilities and higher population density compared to other sub-districts such as Sirampog and Kersana sub-districts which have low COVID-19 cases.

Monitoring the development of COVID-19 starting from active cases, death cases to cured cases among vulnerable populations is very important to do in order to develop appropriate interventions in each region. Various efforts have been made by the government in thePrevention and Control of COVID-19 such as physical distancing, lockdown, Large-Scale Social Restrictions (PSBB), vaccination, 3T (Testing, Tracing and Treatment), coughing/sneezing ethics education etc (Kemenkes RI, 2020b). However, in its implementation, there are still many obstacles, the implementation of 3T in Indonesia is still low, besides that the vaccination coverage that has not met the target is the next problem in overcoming the pandemic (Tiara et al., 2021). According to WHO standards, the Indonesian region should carry out a minimum of 38,500 tests per day, but the number of COVID-19 tests in Indonesia was still 31,000 as of September 23, the same thing happened to tracing and treatment whichwas not optimal (Tiara et al., 2021).

Testing and tracing can be used to determine the presence of patients with positive Covid as well as predict its spread in a population (Tiara et al., 2021). If the implementation of testing and tracing is low, the fewer COVID-19 cases found, this will affect the spread and handling related to COVID-19 which will certainly be more dangerous for vulnerable groups inthe region. The high number of COVID-19 cases in areas with high elderly groups needs to optimize the testing, tracing and treatment program to detect COVID-19 cases early on and predict the spread of the disease so as to protect elderly groups from the possible risk of exposure and risk of death due to COVID-19 and determine the appropriate treatment for COVID-19 confirmed patients. The achievement of the vaccination target program, especially in priority groups such as the elderly, is also important in the formation of group immunity in an area. The distribution of elderly groups can help local governments in implementing these programs considering the low coverage of the second dose of COVID-19 vaccination in Brebes district.

The elderly group is included in the vulnerable group who complain a lot about their health conditions, given the decline in organ function that occurs in old age. This is why the elderly also need more care and attention during the pandemic, therefore health services for the elderly are very important to do. The achievement of the elderly community health center in 2020 in Brebes Regency was only 20.48%. Therefore, in addition to optimizing the 3T program and accelerating vaccination in areas with a high elderly population, optimizing the elderly community health center is also very important to maintain and improve the health status of the elderly, so as to reduce the possibility of COVID-19 transmission in areas with high elderly groups in Brebes Regency.

Researchers recognize that there are limitations/weakness in this study, including the ecological study design in this study using population data so that it cannot be used to assess associations at the individual level. Correlation at the population or group level does not necessarily occur at the individual level. Therefore, further research is needed to conclude that there is a correlation at the individual level. However, this study is included in descriptive research so that it can develop preliminary hypotheses that tend to be relevant and useful for studying and determining interventions such as programs and policies in the population in an area. Such as a basis for taking in determining priority areas for vaccination programs and policies in determining COVID-19 regional zones in Brebes Regency.

4. Conclusion

Based on the research that has been conducted, it can be concluded that there is a relationship between the proportion of the elderly group and the prevalence of COVID-19 cases, while the prevalence of hypertension and the prevalence of diabetes have no significant relationship to the prevalence of COVID-19 cases in Brebes Regency. Spatially, areas that have a high elderly population tend to be in line with COVID-19 cases, namely the more elderly in an area, the higher the COVID-19 cases in that area. Areas with the highest proportion of elderly people are Brebes, Wanasari, Banjarharjo and Bumiayu sub-districts. It is hoped that with this research, the Brebes Regency Health Office is able to make areas with high elderly populations a priority target that must be given more attention, especially in efforts to prevent and control COVID-19 so that programs can be created to protect the elderly and reduce the incidence and risk of death due to COVID-19 in the elderly group in Brebes Regency. Optimizing the

implementation of 3T, optimizing the elderly posyandu and vaccination is important to detect cases early so as to protect other vulnerable groups.

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