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Mapping Of Tuberculosis Areas In West Java Province In 2023

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ABSTRACT

Tuberculosis is infectious disease caused by the bacteria Mycobacterium tuberculosis that spreads through the air. Mapping the distribution of tuberculosis cases in West Java through the use of Geographic Information System (GIS) applications, by classifying the variables of tuberculosis cases and their risk factors at the provincial level in 2023. This research is a descriptive qualitative study using secondary data from the health profile of West Java Province and population data from the West Java Central Bureau of Statistics. Data management and map making will use the Quantum GIS application version 3.34. In analysing and interpreting the data, classification will be carried out on each variable to be studied. In classifying the data, natural breaks jenks will be used. In the results of the research in West Java province, there are 3 areas with very high TB susceptibility categorised as Bogor, Cimahi City and Bandung City. And there are 6 regions with very low susceptibility categories Purwakarta, Subang, Sumedang, Ciamis, Banjar City and Pangandaran. The limitations of the data and variables studied affect the results of the analysis and are not comprehensive, therefore in future studies other variable factors can be classified to obtain a more comprehensive picture of tuberculosis vulnerability.

***Kata Kunci**: Tuberculosis, geographic information system, mapping*

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INTRODUCTION

Tuberculosis is an infectious disease caused by Mycobacterium tuberculosis bacteria that spreads through the air, based on the Global TB report in 2022 Indonesia is the country with the second highest tuberculosis patients in the world after India (1). Indonesia has a death rate caused by tuberculosis of 136,000 thousand deaths each year with an estimated 1 million cases of tuberculosis in Indonesia (2). In the Indonesian Health Survey (SKI) of 2023 Tuberculosis is one of the diseases of concern with a prevalence of 0.30% (3).

West Java is the province with the highest tuberculosis cases in Indonesia, based on the results of the Indonesian Health Survey (SKI) in 2023, West Java has a prevalence of 0.47% and 156,977 cases, which is the highest in Indonesia (3). West Java in 2023 has made efforts in the control of tuberculosis disease by conducting case finding on suspected tuberculosis reaching 718,704 suspects obtained 211,959 cases of tuberculosis found. There was an increase in case finding compared to 2022, reaching 31.9% (4).

Based on previous research, population density in Surabaya in 2018 to 2020 has a strong correlation with the incidence of tuberculosis, sub-districts where there is a decrease in population density there will be a decrease in tuberculosis cases (5). In addition to population density, poverty is also a risk factor for tuberculosis, in India tuberculosis cases increase linearly with the economic status of the community, in the rich group tuberculosis cases occur 201 per 100,000 population, while in the poor group tuberculosis cases increase to 1105 per 100,000 population (6). The availability of health facilities is a factor in the occurrence of tuberculosis, based on previous research in Ethiopia the presence of health facilities can increase the access of patients to get diagnosis and treatment of tuberculosis in rural populations (7).

To be able to see the distribution of risk factors and mapping of tuberculosis cases that occur in West Java Province can utilise Geographic Information System (GIS)

mapping applications. Previous research to see the distribution of tuberculosis risk factors using GIS has been done, such as research conducted by Icka Irma in 2022 with Geographic Information System to see the distribution of tuberculosis risk factors in Kuningan Regency, the results of the study produced a map of the distribution of risk factors and tuberculosis cases in Kuningan Regency sub-districts with their level of vulnerability (8).

There have been many studies using geographic information systems, but the studies used different variables and locations. The purpose of this study is to map vulnerable areas with risk factors of population density, poverty and availability of health facilities for TB incidence in West Java Province in 2023, by classifying TB case variables and risk factors.

METHOD

This research is a descriptive qualitative study using secondary data from the West Java health profile in 2023 which has been published through the official website of the West Java Provincial Health Office and population data from the West Java Central Bureau of Statistics. The variables used in the mapping are tuberculosis cases in each city district in West Java Province in 2023, population density in each city district in West Java Province in 2023, poverty in each city district in West Java Province in 2023 and number of health facilities in each city district in West Java Province in 2023. Data management and map creation using Quantum GIS version 3.34.

In analysing and interpreting the data, classification is carried out on each variable studied. In classifying data, natural breaks jenks are used in the Quantum GIS version 3.34 application, a classification method by classifying data naturally to determine class values (9). from the classification results will be formed in 5 groups, namely very low, low, medium, high and very high.

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RESULT

West Java Province is a province consisting of 18 regencies and 9 cities with a total area of 3,710,061 hectares. West Java Province borders Jakarta and Banten to the west, East Java to the east, the Java Sea to the north and the Indian Ocean to the south (4).

Tuberculosis Cases

The prevalence rate of tuberculosis in West Java Province is 0.47% with 211,595 cases in 2023 out of 718,704 suspected tuberculosis cases, which is the highest tuberculosis case in Indonesia. In making the distribution map of tuberculosis cases, the data was classified using the natural breaks jenks method and 5 categories of data calcification were obtained (very low, low, medium, high and very high). Based on the results of management using the geographic information system, 1 region with very high tuberculosis cases (>18400 cases) in West Java was found in dark green colour, namely Bogor Regency. The category for areas with high tuberculosis cases (11000 - 18400 cases) contained 5 areas, namely Bandung, Bandung City, Karawang, Bekasi Regency and Bekasi City. Then for the medium category (5800 - 11000 cases) there are 6 regions namely Sukabumi, Cianjur, Garut, Depok City, Bogor City and Cirebon. Furthermore, for the low category (1200 - 5800 cases) there are 13 regions namely Sukabumi City, Purwakarta, Cimahi City, West Bandung, Subang, Sumedang, Majalengka, Indramayu, Cirebon City, Kuningan, Ciamis, Tasikmalaya City and Tasikmalaya. Very low category (<1200 cases) there are 2 regions namely Pangandaran and Banjar City.

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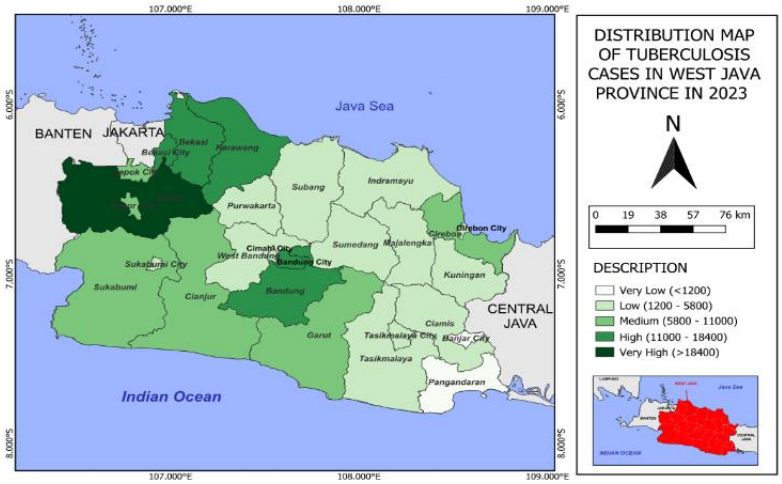
Figure 1.

Distribution map of tuberculosis cases in West Java in 2023



Population Density

Population density is a variable used to determine the presence of population in one area, with the unit used being people per square KM. In classifying data using natural breaks jenks on population density variables, the results obtained 5 categories (very low, low, medium, high and very high). Based on the results of data management, it is found that areas with very high categories (> 12200 people per square KM) of population density are 2 areas, namely Bandung City and Cimahi City. Furthermore, the high category (8600 - 12200 inhabitants per square kilometre) has 3 areas, namely Bekasi City, Bogor City and Depok City. The category of medium population density areas (4000 - 8600 people per square kilometre) only has 1 area, namely Cirebon City. Then for the category of areas with low population density (1300 - 4000 people per square KM) there are 8 areas, namely Bogor Regency, Sukabumi City, Bekasi Regency, Bandung, West Bandung, Tasikmalaya City, Banjar City and Cirebon. Then the area with low population density category (<1300 people per square KM) there are 13 areas namely Sukabumi, Cianjur, Garut, Tasikmalaya, Pangandaran, Ciamis, Kuningan, Majalengka. Sumedang. Indramayu, Subang, Purwakarta and Karawang.

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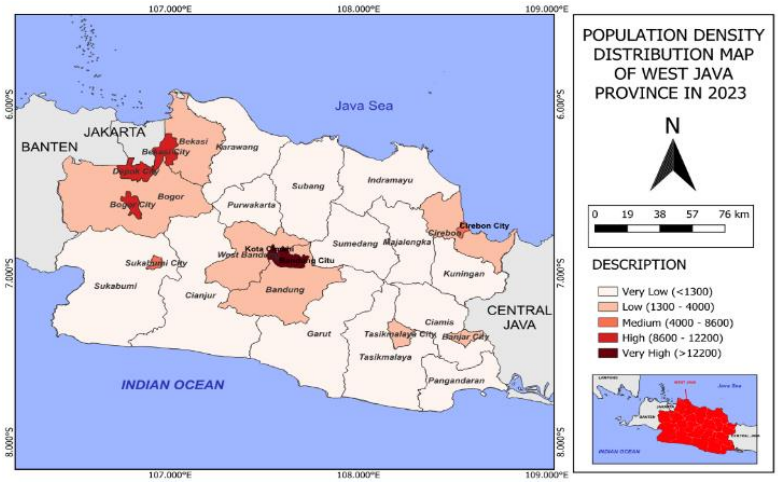
Figure 2

Population density distribution map of West Java province in 2023



Total population poverty

The population poverty variable is a variable that measures the number of people living in the poor category in the city districts in West Java Province. In classifying the data using natural breaks jenks on the population density variable, the results obtained 5 categories (very low, low, medium, high and very high). Based on the results of data management, it is found that there is one region with a very high category (> 260000 population), namely Bogor Regency. The category of high population poverty (190000 - 260000 population) has 6 regions, namely Bekasi, Indramayu, Cirebon, Cianjur, Garut and Bandung. Furthermore, for the category of areas with moderate population poverty (110000 - 190000 population) there are 8 regions, namely Sukabumi, Karawang, Bekasi City, Subang, West Bandung, Majalengka, Kuningan and Tasikmalaya. Then for the number of population poverty with a low category (40000-110000 population) there are 7 regions, namely Bogor City, Depok City. Purwakarta, Sumedang, Bandung City, Ciamis and Tasikmalaya City. There are 5 regions with a very low poverty rate (<40000), namely Sukabumi City, Cimahi City, Pangandaran, Cirebon City and Banjar City.

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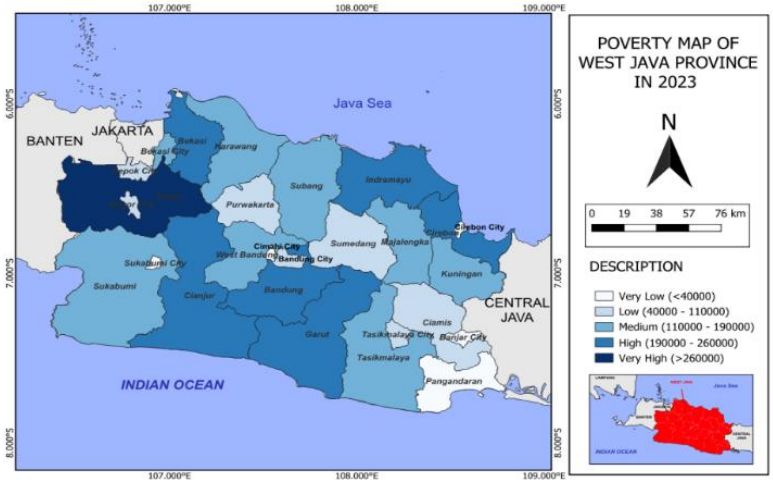
Figure 3.

Poverty map of West Java provnice in 2023

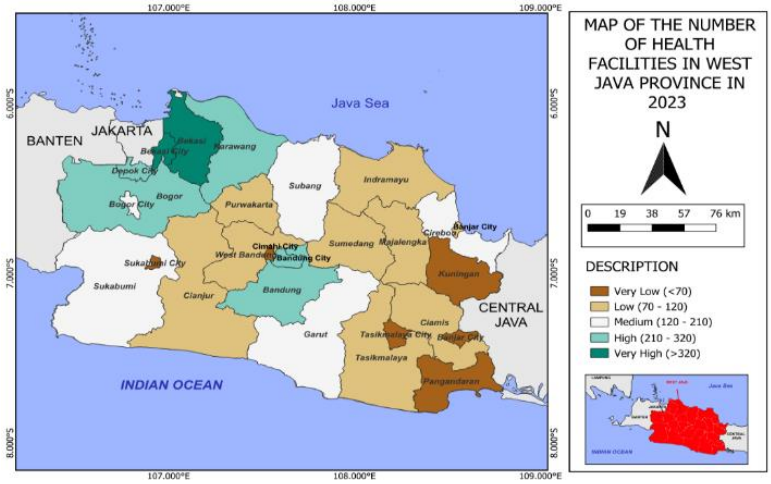


Health Facilities

Health facility variable is a variable to determine the number of health facilities located in one area, including hospitals, health centres and private clinics. In classifying data using natural breaks jenks on population density variables, the results obtained 5 categories (very low, low, medium, high and very high). Based on the results of the analysis, it was found that the category of very high health facilities (>320 health facilities) was found in 2 areas, namely Bekasi City and Bekasi Regency. The category of areas with a high number of health facilities (210 - 320 health facilities) has 5 areas, namely Bogor Regency, Bandung, Depok City, Bandung City and Karawang. Furthermore, there are 5 areas with a medium number of health facilities (120 - 210 health facilities), namely Bogor City, Sukabumi, Garut, Subang and Cirebon. Then the area with a low number of health facilities (70-120 health facilities) there are 10 areas namely Cianjur, West Bandung, Purwakarta, Sumedang, Indramayu, Majalengka, Cirebon City, Ciamis, Tasikmalaya City and Tasikmalaya. The category of areas with very low number of health facilities (<70 health facilities) there are 5 areas namely Cimahi City, Sukabumi City, Pangandaran, Banjar City and Kuningan.

Figure 4.

Map of the number the number of health facilities in West Java province in 2023



After the classification of the mapping, each variable will be scored and then summed up. The variable classification will give a weight value of 1 to 5 depending on the risk, for the variable of tuberculosis cases, population density and population poverty weight 1 will be low and weight 5 will be high. As for the health facility variable, the weight of 1 will be high and the weight of 5 will be low.

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Table 1

Variable scoring for classification

Variabel	Klasfikasi	Skoring
Tuberculosis cases	Very Low (<1200)	1
	Low (1200 - 5800)	2
	Medium (5800 - 11000)	3
	High (11000 - 18400)	4
	Very High (>18400)	5
Population Density	Very Low (<1300)	1
	Low(1300 - 4000)	2
	Medium (4000 - 8600)	3
	High (8600 - 12200)	4
	Very High (>12200)	5
Population poverty	Very Low (<40000)	1
	Low (40000 - 110000)	2
	Medium (110000 - 190000)	3
	High(190000 - 260000)	4
	Very High (>260000)	5
Health Facilities	Very Low (>70)	5
	Low (70 - 120)	4
	Medium (120 - 210)	3
	High (210 -320)	2
	Very High (<320)	1

Based on the classification results, there are 5 categories of very low vulnerability, low vulnerability, moderate vulnerability, high vulnerability and very high vulnerability. Based on the results of the analysis in the category of very high vulnerability there are 3 areas namely Bogor Regency, Bandung City and Cimahi City. Furthermore, there are 5 areas that have high vulnerability, namely Cianjur, Bogor City, Bekasi City, Bandung and Cirebon. There are 6 areas categorised as medium vulnerability, namely Depok City, Bekasi Regency, Garut, Bandung, Kuningan and Indramayu. Furthermore, there are 7 areas categorised as low vulnerability, namely Sukabumi, Sukabumi City, Karawang, Tasikmalaya, Cirebon City, Tasikmalaya City and Majalengka. Then there are 6 areas categorised as very low vulnerability, namely Purwakarta, Subang, Sumedang, Ciamis, Banjar City and Pangandaran.

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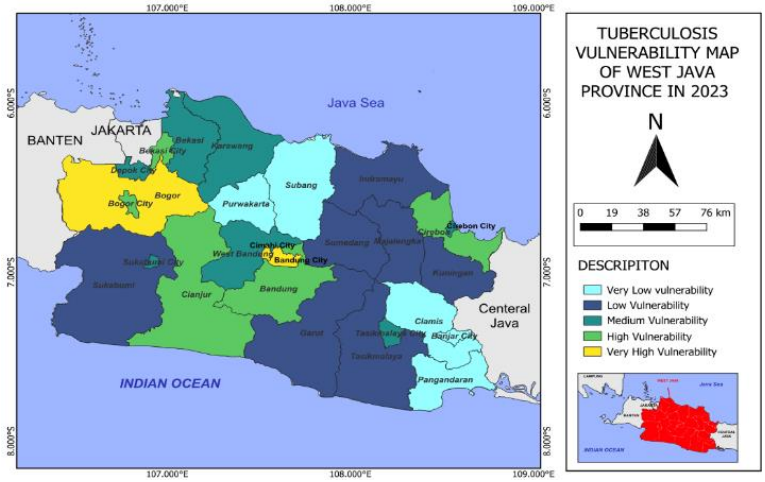
Figure 5.

Tuberculosis vulnerability map of West Java province in 2023



DISCUSSION

Tuberculosis is a disease that is not only caused by one factor, but there are other factors that influence the occurrence of tuberculosis cases, one of which is population density. Population density can accelerate the transmission and movement of diseases, especially airborne diseases such as tuberculosis (10). In addition to accelerating the transmission of diseases, high population density in an area tends to describe inadequate housing, environment, cleanliness and poor nutrition of an area so that if there are cases of tuberculosis, it will accelerate transmission (11). In the results of the study, Bandung City and Cimahi City are areas with a very high population density category (>12200 people per square KM) in West Java, and Bandung City is an area with a high category of tuberculosis cases. This is in line with research conducted by Dimpal Pathak in India where population density has a strong correlation with the incidence of tuberculosis (12). Similarly, in a study conducted by Laura Nadya, the population density of Surabaya City from 2018 to 2020 had a strong correlation with the incidence of tuberculosis, the sub-districts with the highest population density had a high number of tuberculosis cases (5).

Poverty is a bi-directional variable. Tuberculosis can cause poverty indirectly because individuals who experience illness will affect their productivity and economy,

while poverty can cause tuberculosis indirectly by making them vulnerable to the disease (13). Households with low income are vulnerable to tuberculosis, which can cause psycho-social stress, resulting in income instability that leads to unhealthy behaviour, malnutrition, and tuberculosis treatment costs that can burden the household (14). This is in line with the results of the research that Bogor Regency is the area with the highest poverty rate in West Java (>260000 people) as well as an area with a very high category (>18400 cases) of tuberculosis cases in West Java. This is in line with research conducted by Dimpal Pathak in India, where the prevalence of tuberculosis was high among the poor and the prevalence among the poor reached 480 per 100,000 population (12). Similarly, in a study conducted by Olivia Oxlade in India, poverty was a risk factor for tuberculosis, with low-income households being the largest tuberculosis cases that could lead to other tuberculosis risk factors such as nutritional status, smoking, and air quality (6).

Tuberculosis is a disease that must be found and treated immediately. The role of health facilities is important in screening and treatment, with the quantity of facilities available in a region improving the tuberculosis prevention programme. The availability of adequate health facilities and access to health services make it easy to conduct screening, treatment and other tuberculosis prevention efforts, in addition to the ease of access to health facilities and the existence of adequate health facilities also makes it easier for people who have financial problems to be able to access tuberculosis services (15). In a study, patients who travelled up to 10 km to a health facility were more likely to experience treatment delays than those who travelled closer, with differences in rural or urban location and travel infrastructure determining the distance and time to reach a health facility (7). In the results of the study, Bekasi City and Bekasi Regency are areas with a very high category of health facilities (>320 health facilities) and a high category of tuberculosis cases. This is in line with research conducted by Lili Amaliah on health facilities associated with case finding and treatment of tuberculosis, which includes the availability of tuberculosis services, health workers and government health facilities in the sub-district (16). In addition to government-owned health facilities, private health

facilities such as clinics must be improved in TB prevention programmes, because clinic facilities are an option for the community but still have a low contribution in reporting cases (17).

From the results of classification and mapping of TB vulnerability areas in West Java, Bogor Regency, Cimahi City and Bandung City are areas with high vulnerability status based on risk factors and TB cases. The results of classification and mapping analysis can be useful to add information and area-based insights for tuberculosis control in West Java, with regional mapping that can explain and describe disease patterns, health disparities and access to map-based health facilities.

CONCLUSION

Tuberculosis cases in West Java province with Bogor district is an area with a very high category. Mapping of tuberculosis risk factors, the areas with the highest population density are Cimahi City and Bandung City, the areas with the highest poverty rate are Bogor Regency, and the areas with the highest number of health facilities are Bekasi City and Bekasi Regency. After data classification and analysis, areas with very high vulnerability were found in Bogor Regency, Cimahi City and Bandung City. The limitations of the data and variables studied affect the results of the analysis and are not comprehensive, therefore in future studies, other variable factors can be classified to obtain a more comprehensive picture of tuberculosis vulnerability.

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