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CASES OF PULMONARY TUBERCULOSIS AND POPULATION DENSITY (WITH SPATIAL ANALYSIS APPROACH)

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ABSTRACT

Tuberculosis (TB) is a disease caused by the bacterium microbacterium tuberculosis. Mycrobacterium tuberculosis belongs to gram-positive, rod-shaped bacilli with a length of 1-10 microns, a width of 0.2-0.6 microns. Mycobacterium tuberculosis is transmitted by a person through coughing and sneezing, people affected by TB if not treated can die. The purpose of the study is to determine the relationship between the incidence of pulmonary tuberculosis cases and population density in North Sumatra Province per district/city with a spatial analysis approach. The study design used is an ecological study using aggregate analysis units. The data used is new cases of Pulmonary TB per district/city sourced from the North Sumatra Province BPS website in 2022. Population density data (the number of people per city district divided by the area of the area) is sourced from the North Sumatra Province BPS website in 2022. The districts/cities with the largest number of TB cases in North Sumatra province are dominated by districts/cities with a high population density, namely Medan city with 2697 cases, Simalungun district with 1178 cases, Binjai city with 1457 cases, Deli Serdang Regency with 2967 cases. Population density based on the administrative area in each district/city in North Sumatra province cannot be used as an indicator of the high incidence of TB in the area.

Keywords: Tuberculosis, Density, Case, Spatial

INTRODUCTION

Tuberculosis (TB) is a disease caused by the microbacterium tuberculosis(Sari et al., 2022). Mycrobacterium tuberculosis belongs to gram-positive, rod-shaped bacilli with a length of 1-10 microns, a width of 0.2-0.6 microns. Mycobacterium tuberculosis is transmitted by a person through coughing and sneezing, people affected by TB if not treated can experience death(Nopita et al., 2023).

To this day tuberculosis remains one of the top 10 causes of death in the world. Based on the 2018 Global Tuberculosis Report, the incidence of TB is increasing from year to year(Girsang, Simbolon, et al., 2023).

The World Health Organization (WHO) estimates that about a third of the world's population has been infected by mycobacterium tuberculosis germ with a death rate of 1.8 million from this disease(Rahmawati & Rahmaniati, 2020).

Delays in establishing the diagnosis of pulmonary TB may be an important contributor to the high mortality rate. WHO states that 60% of the total TB cases in the world come from 6 countries, namely China, India, Indonesia, Nigeria, Pakistan, and South Africa. This makes it a case of global emergency in 2017(Rahmawati & Rahmaniati, 2020).

The WHO report states that Indonesia is among the 30 countries that have a large burden of pulmonary TB cases(Rahmawati & Rahmaniati, 2020). This can also be seen in Indonesia's health profile data and information in 2018, which states that Indonesia has a new number of tuberculosis cases of 203,348. The provinces with the largest number of new cases of tuberculosis in a row are West Java (31,074 cases), East Java (25,662 cases), Central Java (21,775 cases), North Sumatra (13,568 cases), Banten (8,736 cases) and South Sumatra (8,147 cases)(Nopita et al., 2023).

In 2016 in North Sumatra, the discovery of pulmonary TB cases amounted to 17,798 cases, the number of new cases of pulmonary TB patients amounted to 11,771. Based on gender in North Sumatra, the number of pulmonary TB patients with male sex is 7,764 people and female is 4,007, CNR all cases are 126 and CNR is 83(Girsang, Halawa, et al., 2023)

The losses due to pulmonary TB disease are huge, not only from health aspects but also from social and economic aspects. TB affects poorer households more and about 75% of TB patients are in the productive age group between 15-50 years. Adult TB patients will lose an average of 3-4 months of working time, resulting in a loss of about 20–30% of annual household income. If you die from TB, you will lose your income for about 15 years. TB can cause economic losses and also stigmatize the sufferer, and can even be ostracized by society(Diantara et al., 2022).

The Millennium Development Goals (MDGs) make pulmonary TB disease one of the diseases that are targeted to be reduced, pulmonary TB is one of the diseases that can be prevented by immunization, and is one of the priorities in the prevention and eradication of infectious diseases(Girsang, Halawa, et al., 2023)

METHOD

This type of research is a quantitative research using spatial analysis aimed at finding and obtaining an overview of the distribution of pulmonary TB with population density in North Sumatra. The study design used is an ecological study design based on place or location. This study can use the aggregate unit of analysis, namely population, as the unit of analysis. So that the research with this design uses secondary data obtained from BPS data of North Sumatra Province. The unit of analysis used in this study is each regency/city in the province of North Sumatra which totals 33 regencies/cities seen for 1 year, namely in 2022.

In this study, the author looked at data on the distribution of pulmonary TB cases and population density in each

regency/city in North Sumatra Province based on secondary data taken from 2022 data from BPS North Sumatra Province.

This spatial analysis is carried out using the *overlay* method, which is by combining two or more maps with a digital stacking system to create a new map.

RESULT AND DISCUSSION

The number of pulmonary TB cases and population density in each district/city of North Sumatra in this study was obtained based on a recording report by the Central Statistics Agency of North Sumatra Province in 2022. The frequency distribution is seen in the following table.

Table 1. Distribution of Pulmonary TB and Population Density by Regency/City in North Sumatra Province in 2022

NO	Regency/City	TB Cases	Population Density
1.	Nias	33	0,81
2.	Mandailing Christmas	801	0,79
3.	South Tapanuli	357	0,51
4.	Central Tapanuli	524	1,71
5.	North Tapanuli	398	0,84
6.	Toba	253	0,91
7.	Labuhan Batu	667	2,36
8.	Asahan	477	2,13
9.	Simalungun	1178	2,34
10.	Dairi	472	1,64
11.	Karo	426	1,95
12.	Deli Serdang	2967	8,72
13.	Langkat	937	1,66
14.	South Nias	117	2,05
15.	Humbang Hasutututan	319	0,87
16.	Pakpak Bharat	100	0,45
517.	Samosir	179	0,67
18.	Serdang bedagai	674	3,52
19.	Coal	451	4,51
20.	North old field	414	0,68
21.	Old field	366	0,69
22.	South Labuhanbatu	309	0,89
23.	North Labuhanbatu	420	1,09
24.	North Nias	108	1,25
25.	West Nias	58	1,93
26.	Sibolga	338	21,88
27.	Tanjungbalai	320	16,67
28.	Pematangsiantar	636	49,24
29.	High cliffs	274	57,35
30.	Terrain	2697	94,13
31.	Binjai	1457	50,69
32.	Padangsidimpuan	344	20,15
33.	Gunungsitoli	76	0,49

Based on the table above, it shows that the highest number of new cases of pulmonary TB is found in Deli Serdang district, namely 2967 cases, the lowest of which is found in Nias district.

Population density data is obtained from the number of population per district/city divided by the area per district/city. Data on the population and area of districts/cities can be obtained from the website of the Central Statistics Agency (BPS) of North Sumatra Province in 2022.

Based on the table above, it can be seen that the most densely populated population density is in Medan City, which is 94.13 people/km2 of population, while the lowest population density is in Pakpak Bharat, which is 0.45 people/km2 of population.

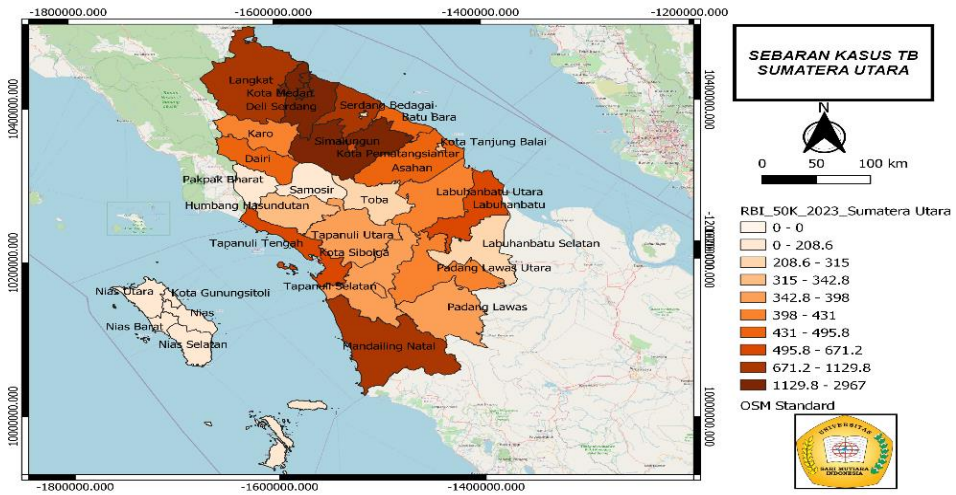

Image 1. Pulmonary TB Prevalence Map

The figure shows that the district/city area marked in dark orange is a district/city that has a high prevalence of pulmonary TB (≥1129.8-2967 population) of the total number of discovery targets. The sub-districts marked with white and light orange are districts/cities that have a low prevalence of pulmonary TB (<1129.8-2967 population). The figure shows that there are 4 districts/cities with a high prevalence of pulmonary TB, namely in Deli Serdang district, Medan City, Binjai City, and Simalungun Regency. The figure also shows that there are 26 districts/cities in North Sumatra province with moderate prevalence of pulmonary TB and there are 3 districts/cities with low prevalence of pulmonary TB.

Table 2 Frequency Distribution of Population Density Prevalence by District/City of North Sumatra Province

NO	Regency/City	Area	Population	seating density
1.	Nias	121830	54609	0.45
2.	Mandailing Christmas	280778	137583	0.49
3.	South Tapanuli	603047	307312	0.51
4.	Central Tapanuli	206905	139337	0.67
5.	North Tapanuli	391805	267275	0.68
6.	Toba	389274	267275	0.69
7.	Labuhan Batu	613400	484874	0.79
8.	Asahan	184251	149249	0.81
9.	Simalungun	379164	318424	0.84
10.	Dairi	233533	202299	0.87
11.	Karo	232889	212133	0.91
12.	Deli Serdang	359600	320324	0.89
13.	Langkat	357098	390954	1.09
14.	South Nias	120278	150780	1.25
15.	Humbang Hasutututan	192780	315460	1.64
16.	Pakpak Bharat	626200	1039926	1.66
517.	Samosir	218800	374734	1.71
18.	Serdang bedagai	212700	414429	1.95
19.	Coal	47373	91346	1.93
20.	North old field	182520	373674	2.05
21.	Old field	370221	787681	2.13
22.	South Labuhanbatu	436900	1021615	2.34
23.	North Labuhanbatu	215602	508024	2.36
24.	North Nias	190022	667998	3.52
25.	West Nias	92220	416367	4.51
26.	Sibolga	224168	1953986	8.72
27.	Tanjungbalai	10783	179748	16.67
28.	Pematangsiantar	11466	231062	20.15
29.	High cliffs	4131	90366	21.88
30.	Terrain	5566	274056	49.24
31.	Binjai	5919	300009	50.69
32.	Padangsidimpuan	3100	177785	57.35
33.	Gunungsitoli	26500	2494512	94.13

The table shows that the population of North Sumatra Province in 2022 is 15,115,206 people. Based on the table, the average prevalence of high population density is obtained when ≥43,768 and low when <43,768.

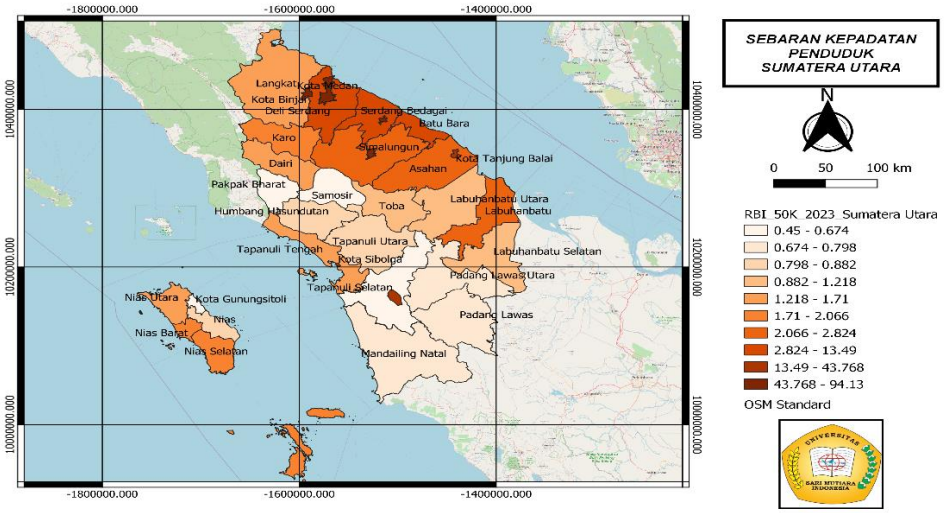

Image 2. Population Density Map

The figure shows that the dark orange sub-district is an area with a high population and the white is an area with a low population. In 2022, there are 3 regencies/cities with high population density. The picture also shows 4 districts/cities with medium populations and there are 26 districts/cities with low populations.

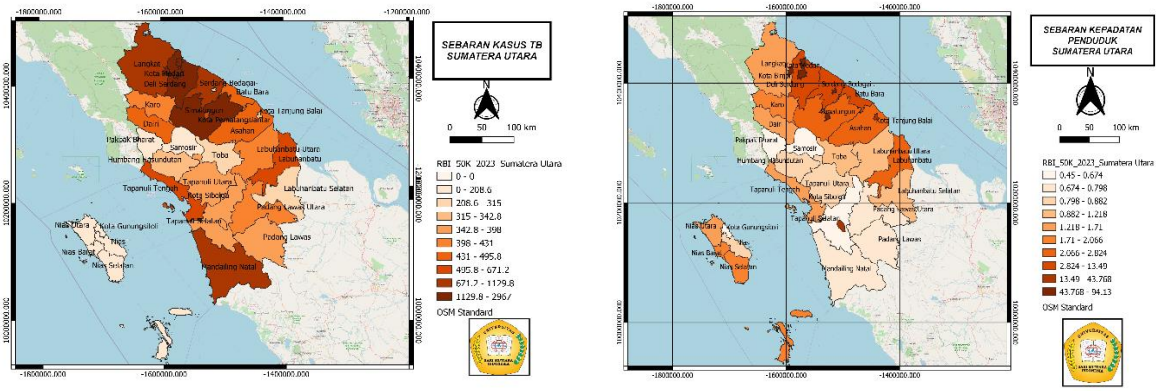

Image 3. Comparison of the distribution of pulmonary TB cases with population density by district/city in North Sumatra Province in 2022

From the image of the map of the distribution of TB cases by district/city and the map of population density distribution in 2022 above, it is found that the district/city with the largest number of TB cases in North Sumatra province is dominated by districts/cities that have a high population density, namely the city of Medan with a total of 2697 cases, Simalungun district with a total of 1178 cases, the city of Binjai with a total of 1457 cases, Deli Serdang Regency with a total of 2967 cases. The results of the spatial analysis showed that there was a relationship between population density and the new number of pulmonary TB. The highest number of new cases of Lung was found in areas with high population density.

Population density factors affect the process of transmission or transfer of diseases from one person to another.

However, based on data on new cases of pulmonary TB throughout 2022, it can also be known that there are several districts/cities with high populations but rarely have TB cases such as in Tebing Tinggi district, which has a population density of 57.35 people/km^2 of which the number of cases is 274, so it can prove that high TB cases are not always in densely populated areas. The results of this study show that high cases of pulmonary TB occur and develop not only in areas with high population density, but also low population density as seen in Mandailing Natal district with a population density of 0.79 people/^{km2} where the number of cases reaches 801 cases. This condition can be interpreted that spatially, the distribution of the population has no effect on the distribution of pulmonary TB cases in North Sumatra.

In addition, according to the assumption of researchers, the population density factor does not play an important role in the increase in TB cases in North Sumatra Province in 2022, but there are several other factors that may be triggering the high number of TB cases. Some of the factors that trigger the high number of TB cases are imbalances in health programs**,** crowded environments and intensive contact between people infected with TB and other people can accelerate the transmission of the disease. Inappropriate or incomplete abuse or use of TB drugs can cause TB bacteria to become resistant to the drugs used, making treatment difficult and increasing the risk of transmission, Poor Social and Economic Conditions, People with TB have a weak immune system, making them more susceptible to TB infection. In some regions, low BCG vaccination coverage may increase the risk of developing TB in children. Lack of knowledge or stigma against TB can hinder the search for appropriate treatment and effective prevention.

Based on the results of this study, it shows that population density based on the administrative area in each district/city in North Sumatra province cannot be used as an indicator of the high incidence of TB in the area

CONCLUSION

Based on the analysis of the distribution of pulmonary tuberculosis (TB) cases in North Sumatra Province, it can be concluded that there are 2 regions with high pulmonary TB cases in areas with high population density (Medan city and Binjai city). In this study, it is also known that there are high cases of pulmonary TB in areas with low area density.

Based on the data of this study, it shows that population density based on the administrative area in each district/city in North Sumatra province cannot be used as an indicator of the high incidence of TB in the area.

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