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Strategy to Reduce the Incidence of Pulmonary Tuberculosis (TB) Through Spatial Analysis and Literacy Studies in Batang Regency, Indonesia

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A B S T R A C T

Every year, around 2 million people in the world die from TB, and 9 million become infected with TB. Indonesia is located in position third after India and China. Batang Regency is one of the locations with a high prevalence of TB in Central Java. In 2021, there were 840 TB cases recorded in Batang Regency, increasing sharply in 2022 to 1192 cases. Seeing this trend, it is necessary to carry out research on strategies to reduce the incidence of pulmonary TB using literacy studies and spatial analysis in Batang Regency, Indonesia, in 2023. This study is a descriptive study using spatial analysis. This research is accompanied by an in-depth look at answers to TB program holders at the Batang Regency Health Service. The subjects in this study were patients with pulmonary TB in Batang Regency. The data analysis used the ArcView GIS program to obtain a map of the distribution of pulmonary TB cases in Batang Regency. Research results show that there were 831 pulmonary TB cases in 2020, 840 cases in 2021, and a sharp increase in 2022 with 1192 cases. The highest number of cases was in Batang District, with 279 cases, followed by Warungasem District, with 123 cases, and Bandar District, with 111 cases. These three districts are lowland and densely populated areas. Therefore, the Batang Regency Health Service needs to prioritize TB control programs in areas with the most cases.

1. Introduction

Tuberculosis is a disease caused by infection with *Mycobacterium tuberculosis,* which is a rod-shaped, aerobic bacterium that does not have spores. It is easily transmitted through the air, which then enters through the respiratory tract, which is generally obtained by inhaling small particles (1-5 mm in diameter) that reach the alveoli. In Indonesia, tuberculosis is the number one killer among infectious diseases and is the third cause of death after heart disease and acute respiratory diseases in all age groups. In Indonesia, some TB cases are cases with positive BTA, and treatment is carried out for 6 months or even up to 9 months. However, up to now, TB disease is still a disease that is the cause of death of the population in Indonesia because many patients have not completed TB treatment for 6 months or even have MDR (multidrug resistant TB) status. This is what makes TB treatment unsuccessful and even develops to become more severe. In fact, the government has launched a TB control program such as TOSS TB, providing IEC-related TB prevention and treatment up to TB elimination, which is targeted by 2030. The TB elimination program requires an acceleration strategy through 6 steps, namely strengthening the role and leadership of district/city-based programs, increasing access to quality services, controlling risk factors for TB transmission, increasing partnerships, increasing community independence, strengthening program management, and strengthening TB systems and management through various efforts including research and development.[1-3]

With an incidence of 842,000 cases per year and notification of TB cases of 569,899 cases, there are still

around 32% that have not been notified, either unreached, undetected, or unreported. From these incidence figures, the TB burden in each province and district/city was calculated. Batang Regency is one of the locations with a high prevalence of TB in Central Java. In 2021, there were 840 TB cases recorded in Batang Regency, increasing sharply in 2022 to 1192 cases. Seeing that the trend of increasing TB cases in Batang Regency is increasing every year, cross-sector collaboration to overcome this problem is very necessary. Knowing the locus of areas that are TB endemic areas so that existing programs can be implemented appropriately is one way of knowing the spread of TB disease in Indonesia and making it easier for policyholders to formulate appropriate strategies to overcome problems regarding TB and for health institutions it would be better if there were records or reporting with city/district layouts in each work area. This layout can be obtained or processed in addition to being able to overcome problems by knowing which areas have high TB prevalence so that the focus of elimination activities will be more effective and efficient.[4-7] This study aimed to explore strategies for reducing the incidence of pulmonary TB through literacy studies and spatial analysis in Batang Regency, Indonesia, in 2023.

2. Methods

This study is a descriptive study using spatial analysis of secondary data collected from the Batang Regency Health Service. This research is also equipped with an in-depth look at answers to TB program holders at the Batang Regency Health Service regarding programs to countermeasure disease TB in Batang Regency. The subjects in this study were BTA (+) pulmonary tuberculosis sufferers who lived in the Batang Regency and were recorded in the pulmonary tuberculosis register of the Batang Regency Health Service from January to December 2022. The data analysis used the ArcView GIS program to obtain a map of the distribution of pulmonary TB cases in Batang Regency.

3. Results and Discussion

Based on data on the distribution of pulmonary TB cases obtained from the Batang Regency Health Office, the distribution of pulmonary TB cases in the last three years has increased quite significantly. This can be seen from secondary data obtained from the pulmonary TB program holders at the Batang Regency Health Office that in 2020, there were 831 cases of pulmonary TB. In 2021, there were 840 cases, and there was a sharp increase in 2022, with 1192 cases over the past year. This trend of increasing pulmonary TB cases apparently has two sides; one side of the trend of increasing cases is a positive indicator, and on the other side, it is a negative indicator. The positive indicator here that the program holder hopes is that with the increasing number of cases discovered, the target of eliminating pulmonary TB by 2030 will be easier to achieve. The hope is that if more cases are found and families or close contacts can be screened, it will be easier to prevent them and make further diagnoses. The next side is the negative side. Seeing that the trend of increasing pulmonary TB cases in Batang Regency is increasing every year, this is quite unfortunate, so the prevalence is increasing, and usually, with a high prevalence, the area or location is determined to be endemic for pulmonary TB. Cooperation between sectors to overcome this problem is very necessary. Knowing the locus of areas that are endemic areas for pulmonary TB so that existing programs can be implemented appropriately is one of them is knowing the spread of pulmonary TB disease in Batang Regency and making it easier for policyholders to formulate appropriate strategies to overcome problems regarding TB and for health institutions, it would be better if there were recording or reporting with a layout in the work area of each Health Centers. This layout can be obtained or processed in addition to being able to overcome problems by knowing which areas have high TB prevalence so that the focus of elimination activities will be more effective and efficient.[8,9]

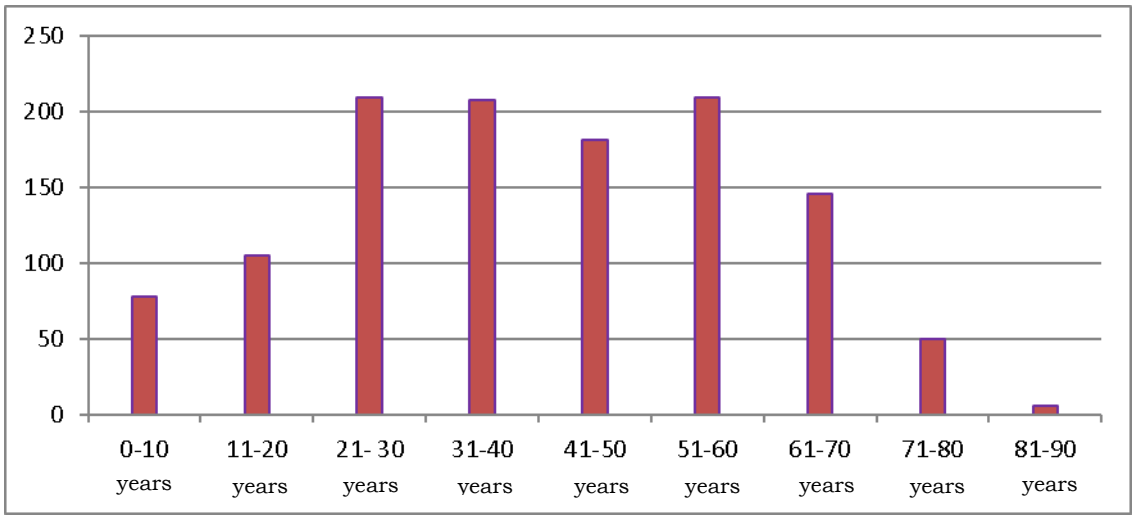

Figure 1. Incidence of pulmonary TB by age.

Based on data on pulmonary TB cases that have been obtained from the Batang Regency Health Service (Dinkes), pulmonary TB cases are often found in the productive age range, namely in the age range of 21 years to 60 years. This can be seen from secondary data obtained from pulmonary TB program holders at the Batang Regency Health Office that there were 209 cases of pulmonary TB aged 21-30 years, 208 cases aged 31-40 years, 181 cases aged 41-50 years, and aged 51-60 years there were 209 cases. Many cases of pulmonary TB are experienced by people of productive age. This could be because, at a productive age a person is still active in activities and work and has active social interactions with other people. The results of this study are in line with research by Agustian et al. (2022). In this study, it was found that out of 206 pulmonary TB sufferers, there were 187 sufferers of productive age (90.8%) and 19 sufferers of non-productive age (9.2%).

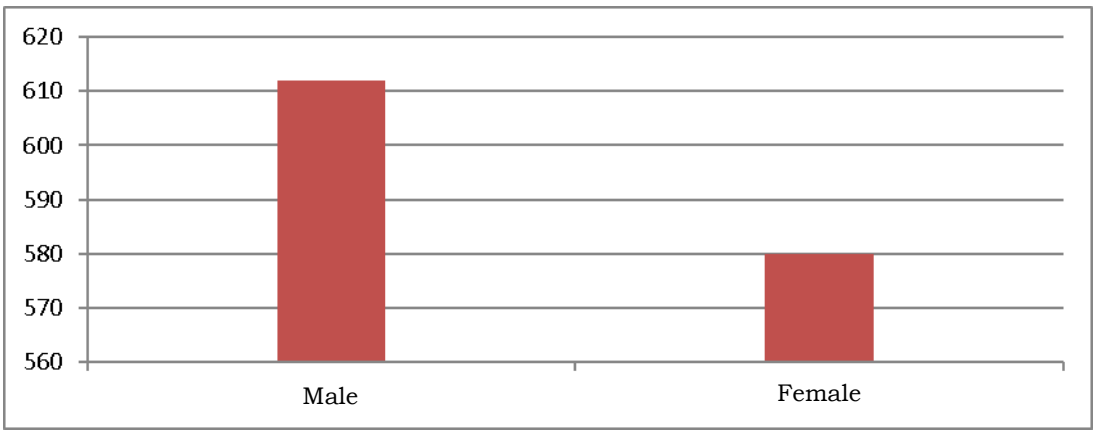

Figure 2. Incidence of pulmonary TB by gender.

Based on data on pulmonary TB cases obtained from the Batang Regency Health Office, pulmonary TB cases in Batang Regency are more male than female. This can be seen from secondary data obtained from pulmonary TB program holders at the Batang Health Office that there were 612 cases of pulmonary TB in men (51.3%) and 580 cases in women (48.5%). There are more cases of pulmonary TB in Batang Regency in men than women, although looking at the number of cases, the difference is only small. The risk factors for

pulmonary TB between men and women are currently not much different, and the mobility of both is said to be almost the same. However, men's smoking habits can trigger a decrease in the body's immunity, making them easily exposed to bacteria that cause pulmonary TB.[10,11]

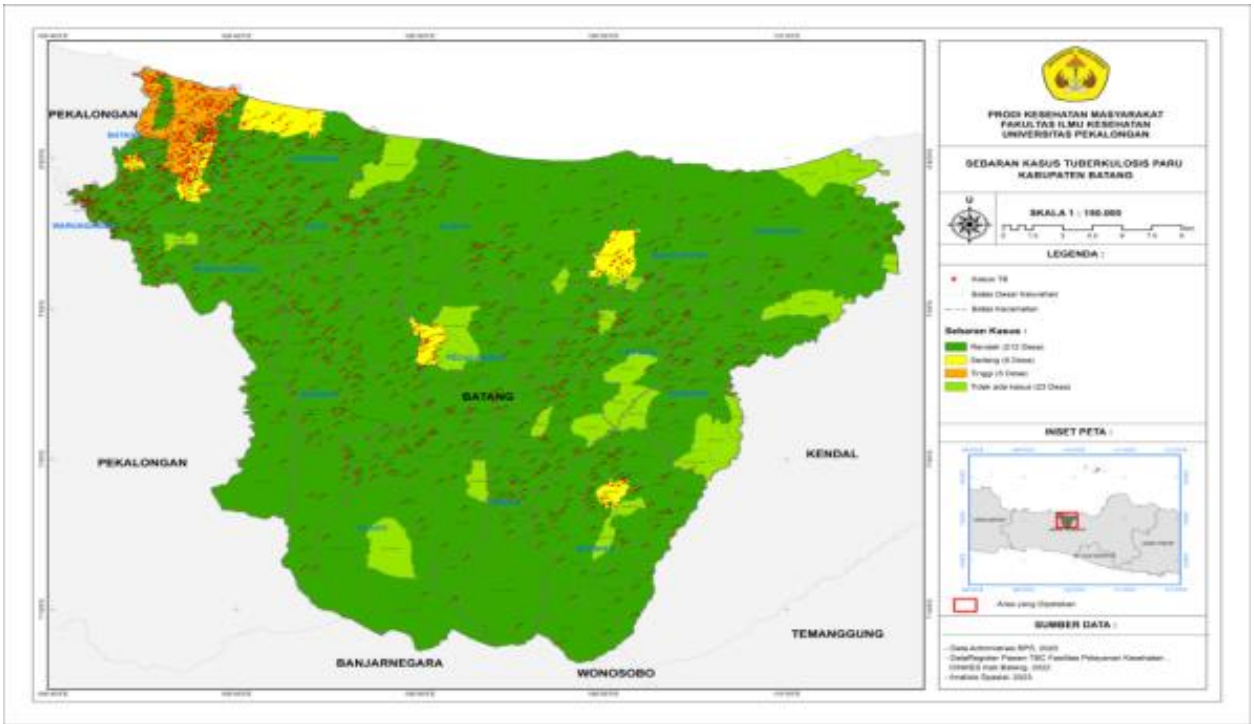

Figure 3. Spatial analysis of the distribution of pulmonary TB cases in Batang Regency.

Results of mapping the distribution of pulmonary TB cases in Batang Regency show that most pulmonary TB cases are in Batang District. This can be seen from the orange map. The number of cases in Batang District was 279 cases, followed by Warungasem District with 123 cases and Bandar District with 111 cases. Of the 279 pulmonary TB cases in Batang District, the most cases were in Kasepuhan Village with 33 cases, followed by North Karangasem Village with 32 cases and Kauman with 30 cases. The distribution of pulmonary TB cases in Batang Regency tends to follow the distribution of population density. This can be seen from the fact that most cases are in Batang District, which is a densely populated area. The dense population is a risk factor for the transmission of pulmonary TB. This is because the opportunity for contact with pulmonary TB sufferers is greater. House conditions, for example, lack of ventilation, overcrowding in the house, and lack of sunlight entering the house can directly affect the transmission of pulmonary TB.[12]

Mapping results spread pulmonary TB cases in Batang Regency show that most pulmonary TB cases are in lowland areas. This can be seen from the map, which is colored red. The highest number of cases was in Batang District, with 279 cases, followed by Warungasem District, with 123 cases, and Bandar District, with 111 cases. These three Districts are lowland areas. The altitude of the area contributes to the high number of pulmonary TB cases in Batang Regency. This is because lowland areas have a 3 times greater risk of having a high number of pulmonary TB cases compared to highland areas. In relation to pulmonary TB cases, altitudes in an area have different temperatures, humidity, oxygen density, and exposure to sunlight. This can affect the viability of tuberculosis bacteria. Therefore, theoretically, tuberculosis bacteria cannot survive for long in an environment that is at a certain height above sea level.[13]

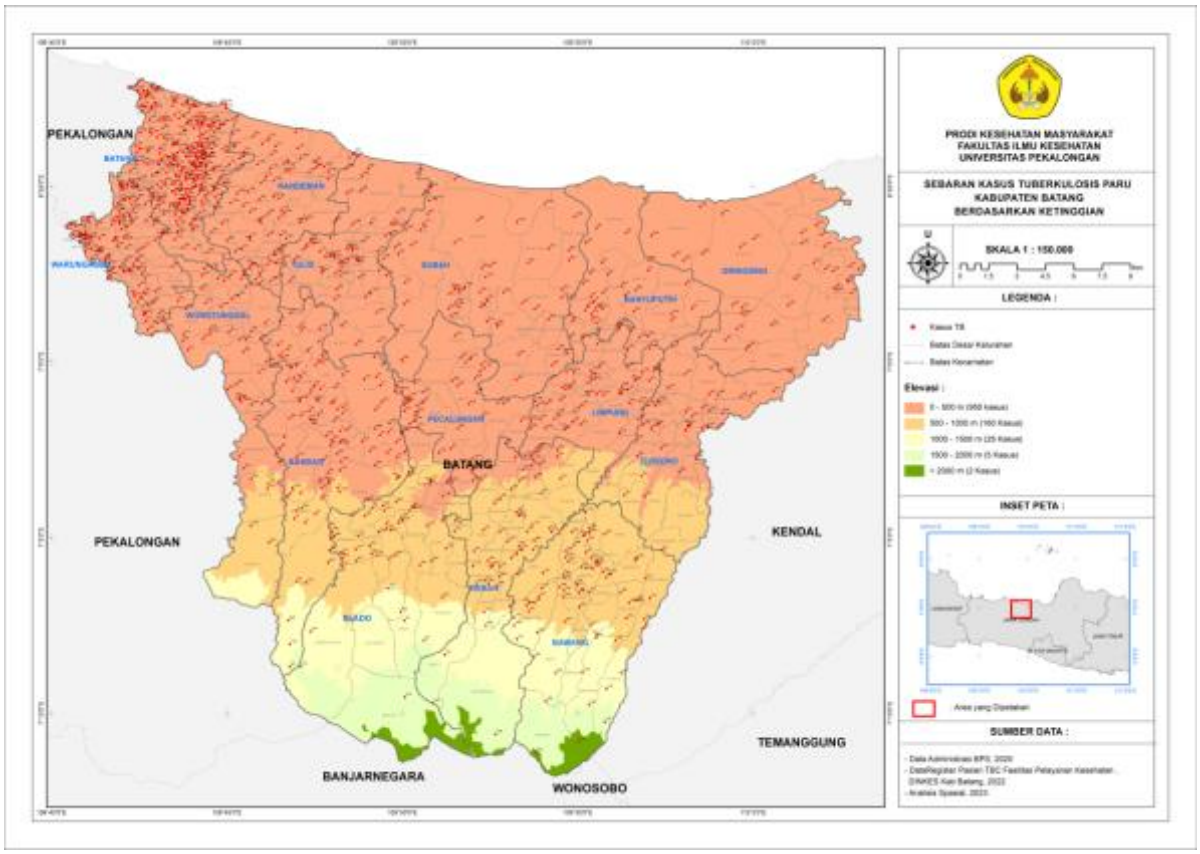

Figure 4. Spatial analysis of pulmonary TB cases based on regional altitude.

The community needs continuous, massive education related to preventing transmission of pulmonary TB, both for themselves and those in close contact with the patient, because the family is the person closest to the patient who is most likely to be very at risk of being infected and infecting other people in the surrounding environment. There is some factor The risks of transmitting pulmonary TB include smoking habits, home environmental conditions, and residential density. Pulmonary TB screening needs to be carried out more actively in order to truly find out which suspects are already showing symptoms of pulmonary TB. This screening is one of the success milestones in achieving the elimination of pulmonary TB by 2030. Evaluations related to the pulmonary TB control and prevention program are considered not yet optimal because funds are deemed insufficient in several locations so that health workers, when they want to carry out screening or tracking, are constrained by funding and human resources who have fewer ratios. Planning, organizing, discovery, diagnosis, treatment, monitoring progress, treatment results, monitoring, and evaluation are in accordance with guidelines, but active screening and home visits are lacking.[14,15]

4. Conclusion

Pulmonary TB cases in 2020 were 831 cases. In 2021, there were 840 cases, and there was a sharp increase in 2022, with 1192 cases over the past year. Pulmonary TB cases were mostly found in the productive age range, namely in the age range 21 years to 60 years, namely 807 cases. There were 612 cases of pulmonary TB in men (51.3%) and 580 cases in women (48.5%). The highest number of cases was in Batang District, with 279 cases, followed by Warungasem District, with 123 cases, and Bandar District, with 111 cases. These three Districts are lowland and densely populated areas.

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