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DIFFERENCES IN PULMONARY TB INCIDENCE IN HIGHLAND AND COASTAL AREAS IN BARRU DISTRICT

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ABSTRACT

Abstract:
Pulmonary tuberculosis, caused by Mycobacterium tuberculosis, remains a global health issue. In Barru District, the number of pulmonary TB cases increased from 327 in 2023 to 464 in 2024. This study aims to investigate differences in the incidence of pulmonary TB between two locations: highland and coastal areas. The method used is quantitative analytical with a cross-sectional approach, involving 86 pulmonary TB patients from Lisu and Padongko Health Centers selected through simple random sampling. In the highlands, most patients were over 60 years old (43.5%), while in the coastal areas, the majority were aged 51–60 years (83.3%). Male patients were more numerous in both locations, with generally low educational levels. The most common occupations in the highlands were housewives and self-employed individuals, while in coastal areas, the majority were unemployed. No significant differences were found in age (ρ=0.494), gender (ρ=0.255), education (ρ=1.000), occupation (ρ=0.665), socioeconomic status (ρ=0.978), housing density (ρ=0.083), ventilation (ρ=0.083), or access to healthcare services. There were no significant differences in TB incidence. It is recommended that the elderly undergo regular health check-ups and maintain a healthy lifestyle to enhance their resistance to pulmonary TB infection.

Abstrak:
Tuberkulosis paru yang disebabkan oleh Mycobacterium tuberculosis masih menjadi masalah kesehatan global. Di Kabupaten Barru, kasus TB paru meningkat dari 327 pada 2023 menjadi 464 pada 2024. Penelitian ini bertujuan meneliti perbedaan kejadian TB paru di dua Lokasi yaitu dataran tinggi dan pesisir. Metode yang digunakan adalah kuantitatif analitik dengan pendekatan cross-sectional, melibatkan 86 penderita TB paru dari Puskesmas Lisu dan Padongko yang dipilih secara simple random sampling. Di dataran tinggi, sebagian besar penderita berusia di atas 60 tahun (43,5%), sementara di pesisir mayoritas usia 51-60 tahun (83,3%). Penderita laki-laki lebih banyak di kedua lokasi, dengan tingkat pendidikan yang umumnya rendah. Pekerjaan terbanyak di dataran tinggi adalah ibu rumah tangga dan wiraswasta, sedangkan di pesisir mayoritas tidak bekerja. Tidak ditemukan perbedaan signifikan pada umur (ρ=0,494), jenis kelamin (ρ=0,255), pendidikan (ρ=1,000), pekerjaan (ρ=0,665), status sosial ekonomi (ρ=0,978), kepadatan hunian (ρ=0,083), ventilasi (ρ=0,083), maupun akses layanan kesehatan. Hal ini tidak terdapat perbedaan signifikan terhadap kejadian TB. Disarankan pada kelompok lansia, dianjurkan melakukan pemeriksaan kesehatan secara berkala serta menjaga pola hidup yang sehat guna meningkatkan daya tahan tubuh terhadap infeksi TB paru.

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INTRODUCTION

Pulmonary tuberculosis remains a serious global health problem, especially in developing countries, including Indonesia, which is listed by the WHO as one of the countries with the highest TB burden in the world [1]. This infectious disease is caused by the bacterium Mycobacterium tuberculosis, which attacks the lungs and can be transmitted through the air when the patient coughs or sneezes [2]. In Indonesia, the annual number of tuberculosis cases is 969,000, and in 2022, 724,309 (75%) tuberculosis cases were reported, with 25% still lacking access to care. A total of 12,531 cases of drug-resistant tuberculosis (TB-RO) were detected, with a coverage rate of 51%. The provinces with the largest populations—West Java, East Java, and Central Java—reported the highest number of cases. These three provinces account for nearly half of all tuberculosis cases in Indonesia, totaling 46%. Environmental and socioeconomic factors play a significant role in the transmission and incidence of pulmonary tuberculosis [3].

According to data from the South Sulawesi Provincial Health Office in 2023, the number of TB patients increased to 6,015 with a recovery rate of 85%. In 2021, there were 15,152 deaths due to TB, and in 2022, there were 21,167. Poor ventilation in homes, overcrowding, and inadequate sanitation significantly increase the risk of TB transmission [4].

In addition, socioeconomic factors such as education level, income, and access to health services also influence TB detection and treatment success [5]. Research shows that the risk of pulmonary TB increases in populations living in poorly ventilated environments, thereby increasing the likelihood of infectious droplets spreading indoors [6]. High population density leads to close contact between individuals, facilitating the transmission of TB from active cases to healthy people around them [7].

In addition to environmental factors, low socioeconomic status limits access to health facilities and nutrition, resulting in an increase in TB cases and complications [8]. Geographical variations such as differences between highland and coastal areas also influence these risk factors through differences in climate, culture, and availability of health resources, which have implications for differences in the incidence of pulmonary TB [9].

In Barru Regency, particularly in the working areas of the Lisu and Padongko Community Health Centers, which have highland and coastal geographical characteristics. The influence of these environmental and socioeconomic factors needs to be studied in greater depth. This study aims to evaluate the relationship between home ventilation, housing density, socioeconomic status, and the incidence of pulmonary tuberculosis in both areas to support more effective and targeted TB control efforts.

RESEARCH METHOD

This study used a cross-sectional design with purposive sampling techniques. The sample in this study consisted of 86 active pulmonary TB patients registered in the working areas of the Lisu and Padongko Community Health Centers in Barru District. The inclusion criteria were patients who had been diagnosed with pulmonary tuberculosis and were recorded in the community health center data during the 2023-2024 period.

Data collection was conducted using a structured questionnaire. The questionnaire instrument was designed to measure research variables, including characteristics of pulmonary TB patients (age, gender, highest level of education, and occupation), socioeconomic status, housing density, home ventilation conditions, and access to health services. Direct interviews were conducted by the researcher at the location to ensure the accuracy and completeness of the data.

The collected data were subsequently analyzed using statistical software, specifically SPSS version 26.

Descriptive statistical methods were used to examine respondent characteristics, the Mann-Whitney test to compare non-normally distributed variables between regional groups, the Chi-square test to assess relationships between categorical variables, and multivariate logistic regression to identify significant risk factors influencing pulmonary TB incidence in the two regions.

RESULTS AND ANALYSIS

Table 1 Distribution of Characteristics of Pulmonary TB Patients in the Highlands and Coastal Areas of Barru Regency

Characteristics	Highlands		Coast	
	n	%	n	%
Age (years)				
11-20	4	80,0	1	20,0
21-30	6	46,2	7	53,8
31-40	4	28,6	10	71,4
41-50	4	30,8	9	69,2
51-60	3	16,7	15	83,3
>60	10	43,5	13	56,5
Gender				
Men	17	31,5	37	68,5
Woman	14	43,8	18	56,3
Education				
Elementary school	14	35,9	25	64,1
Junior high school	4	36,4	7	63,6
Senior high school	8	36,4	14	63,6
Bachelor's degree	5	35,7	9	64,3
Work				
Not working	5	26,3	14	73,3
Student	5	55,6	4	44,4
Housewife	7	35,0	13	65,0
Entrepreneur	7	36,8	12	63,2
Civil servant	4	36,4	7	63,6
Fisherman	2	28,6	5	71,4
Trader	1	100,0	0	0,0
Total	**31**	**36,0**	**55**	**64,0**

In highland areas, TB patients are more prevalent among those over 60 years of age, with 10 cases (43.5%). Meanwhile, in coastal areas, the highest number of pulmonary TB patients is among those aged 51–60 years, totaling 15 people (83.3%). In both highland and coastal areas, pulmonary TB patients are more common among males, with 17 people (31.5%) in highland areas and 37 people (68.5%) in coastal areas. Pulmonary TB patients are more common among those with a primary school education, with 14 cases (35.9%) in highland areas and 25 cases (64.1%) in coastal areas. TB patients living in highland areas are more likely to work as housewives (7 people, 35.0%) and self-employed (7 people, 36.8%). In coastal areas, TB patients are more likely to be unemployed, with 14 people (73.7%) not working.

Table 2 Distribution of Respondents' History of Pulmonary TB in the Highlands and Coastal Areas of Barru District

History of TB	Highlands		Coast	
	n	%	n	%
Treatment				
Yes	31	100.0	55	100,0
Length of Treatment				
6 months	30	39,5	46	60,5
>6 months	1	10,0	9	90,0
TB family				
Yes	15	41,7	21	58,3
No	16	32,0	34	68,0
Total	**31**	**36,0**	**55**	**64,0**

All pulmonary TB patients (100.0%) in both highland and coastal areas have undergone treatment. In highland areas, the majority underwent 6 months of treatment, totaling 30 people (39.5%), while in coastal areas, 49 people (60.5%) underwent treatment. Pulmonary TB patients in both highland and coastal areas were more likely to have no family members with a history of pulmonary TB than those with family members who had a history of pulmonary TB. In highland areas, 16 people (32.0%) had no family members with a history of pulmonary TB, while in coastal areas, 34 people (68.0%) had no family members with a history of pulmonary TB.

The average age of pulmonary TB patients in the highland region was 44.9 years, while in the coastal region it was 48.4 years. From the analysis conducted, the value of $\rho = 0.494 > \alpha = 0.05$, indicating no significant difference in the age of pulmonary TB patients between highland and coastal areas. This is because the age groups of the population in both regions show that the dominant age groups have a higher potential for exposure and infection

with pulmonary TB. Furthermore, although there is a difference in the average age of patients between highland (44.9 years) and coastal (48.4 years) areas, the difference is small and still within the productive age range. This age group has a high risk of exposure to pulmonary TB infection because most of them are actively working outside the home, resulting in more frequent contact with the surrounding environment and many people [10]. Working outside the home increases the chances of exposure to Mycobacterium tuberculosis bacteria due to the potential for wider contact compared to individuals who spend more time indoors [11].

Table 3 Differences in Characteristics of Pulmonary TB Patients in the Highlands and Coastal Areas of Barru Regency

Characteristics	Highlands		Coast		*ρ*
	n	%	n	%	
Age (years)	44,9		48,4		0,494
Gender					
Man	17	31,5	37	68,5	0,255
Woman	14	43,8	18	56,3	
Education					
Low	5	35,7	9	64,3	
Medium	8	36,4	14	63,6	1,000
High	18	36,0	32	64,0	
Work					
Working	26	38,8	41	61,2	
Not working	5	26,3	14	73,7	0,965
Total	**31**	**36,0**	**55**	**64,0**	

This study is in line with Sunarmi's (2022) research in Palembang, which found that age is one of the important risk factors in the increase in pulmonary TB cases because in certain age groups, especially the elderly, immunity and general health conditions begin to decline, making it easier for TB infection to develop [12]. This is reinforced by Fauziah Nasution's (2025) research, which shows that physical development and health in adults and the elderly indicate a significant decline in bodily functions and the immune system at a certain age [13].

TB patients in both highland and coastal areas are predominantly male. The number of male TB patients in highland areas is 17 (31.5%), while in coastal areas it is 37 (68.5%). Based on the analysis conducted, the value of $\rho = 0.255 > \alpha = 0.05$, indicating no significant difference in pulmonary TB incidence based on gender between highland and coastal areas. The proportion of males and females diagnosed with pulmonary TB is relatively balanced in both locations, suggesting that gender is not a primary risk factor in the context of this study.

Although men have a higher incidence of TB due to environmental exposure factors associated with active work and a higher likelihood of developing pulmonary TB compared to those who do not work, the results of this study confirm that the distribution of cases based on gender and occupation—such as housewives, entrepreneurs, students, and formal workers—without any one type of occupation dominating as the main risk factor is also uniform across the districts of Barru. This is because transmission within the household environment is the primary cause of the relatively balanced distribution of pulmonary TB between men and women [14]. In this situation, the risk of transmission is more influenced by the length and intensity of contact with the patient within the home, rather than by gender. Contact within the household is one of the most significant routes of TB transmission, where all family members have an almost equal chance of becoming infected regardless of gender [15].

This study is in line with Jennifer M's (2021) research in the United States, which found that the distribution of pulmonary TB between men and women in the studied area was relatively balanced. Transmission within households was identified as the main mechanism influencing TB incidence, so the risk of infection depended more on the duration and intensity of contact with active cases in the home environment than on gender [15]. In a study by Ayu Boru Ritonga (2022), the duration and intensity of contact with active pulmonary TB patients in the home environment were found to be the main risk

factors for transmission, regardless of gender. The longer and more intensive the contact, the higher the likelihood of contracting pulmonary TB [16].

Based on the highest level of education, TB patients were more prevalent among those with lower education levels, with 18 cases (36%) in highland areas and 32 cases (64%) in coastal areas. The analysis yielded a value of $\rho = 1.000 > \alpha = 0.05$, indicating no significant difference in the highest level of education among TB patients in highland and coastal areas. The distribution of educational levels among respondents in both regions shows a high degree of uniformity. The majority of pulmonary TB patients have an educational background at the lower secondary level or below, so there are no significant differences that could influence variations in infection risk between the regions.

This study is in line with Lilis Kholisah's (2023) research in Merangin Regency, where most patients came from low educational backgrounds. Despite differences in education, knowledge about TB prevention and treatment remained inadequate, meaning that respondents' understanding was still low [17]. The Health Belief Model (HBM) theory also explains that the formal education level of respondents does not always reflect optimal health awareness or behavior related to pulmonary TB. It explains that even though the educational backgrounds of respondents vary, understanding of TB prevention and treatment remains poor if not supported by intensive health education and targeted counseling [18].

The number of pulmonary TB patients in highland and coastal areas who are employed is higher than those who are unemployed. Among pulmonary TB patients in highland areas, 26 individuals (38.8%) are employed, while in coastal areas, 41 individuals (61.2%) are employed. Based on the analysis conducted, the value of $\rho = 0.965 > \alpha = 0.05$, indicating no significant difference in employment status among pulmonary TB patients in highland and coastal areas.

Working outside the home increases the chances of exposure to Mycobacterium tuberculosis bacteria due to the potential for wider contact compared to individuals who spend more time indoors. More people with pulmonary TB do not have a family history of TB. This situation indicates that TB transmission occurs more frequently through social interactions and direct environmental exposure outside the family [11].

TB patients in highland areas are more likely to have a higher socioeconomic status, with 26 people (36.1%) in highland areas and 46 people (63.9%) in coastal areas. From the analysis conducted, the value of $\rho = 0.978 > \alpha = 0.05$ was obtained, indicating no significant socioeconomic difference in TB incidence between highland and coastal areas. People with low socioeconomic status typically face limitations in access to proper nutrition and healthcare services, making them more susceptible to TB infection.

In the coastal areas of Barru Regency, the majority of the community's income comes from fishing, which tends to have fluctuating earnings depending on the fishing season and sea conditions. Meanwhile, in the highland areas, the community's income is largely derived from traditional mortar-and-pestle production. Thus, although no statistically significant differences were found in socioeconomic status variables between study areas regarding tuberculosis (TB) incidence, understanding the characteristics of local occupations provides important contextual insights into the factors determining the well-being of the local community that may influence long-term health risks [19].

This study is in line with Susilowati's (2023) research in Bulungan Regency, which found that socioeconomic conditions play a significant role in the risk of pulmonary TB transmission. TB patients who are classified as belonging to a high socioeconomic group do not contradict the findings that state that groups with low

socioeconomic status have a greater risk of TB [20]. Nadia Utari's research (2024) emphasizes that socioeconomic status, income stability, and access to health services play an important role in influencing health conditions, particularly the risk of developing pulmonary TB [21].

Table 4 Differences in socioeconomic status, housing density, ventilation conditions, and access to health services among pulmonary TB patients in the highlands and coastal areas of Barru District

Variable	Highlands		Coast		ρ
	n	%	n	%	
Socioeconomic status					
High	26	36,1	46	63,9	0,978
Low	5	35,7	9	64,3	
Housing Density					
Meets Requirements	31	38,8	49	61,3	0,083
Does Not Meet Requirements	0	0,0	6	100,0	
Ventilation Conditions					
Compliant	0	0,0	6	100,0	0,083
Non-compliant	31	38,8	49	61,3	
Health Services					
Easy	31	36,0	55	64,0	-
Total	**31**	**36,0**	**55**	**64,0**	

Based on the population density of pulmonary TB patients, more people in highland areas live in houses with acceptable population density, namely 31 people (38.8%), while in coastal areas there are 49 people (61.3%). From the analysis conducted, the value of $\rho = 0.083 > \alpha = 0.05$ was obtained, indicating no significant difference in housing density among TB patients in highland and coastal areas. This condition is closely related to the socioeconomic background of coastal communities, where the majority of residents work as fishermen. This unstable income forces many fishing families to share living spaces with other family members to save on expenses. Kadek Giselda Gityarani (2024) in Denpasar stated that high housing density plays a significant role in increasing the risk of pulmonary TB transmission because it leads to more intense interaction among household members [22].

The results of Puspitasari's (2024) research in Makassar show that housing density does not play a significant role as a risk factor for pulmonary TB. It is explained that the majority of respondents live in houses with a density level that meets standards, so that air circulation inside is still adequate and does not create conditions that increase the risk of pulmonary TB transmission [23].

TB patients in highland areas were more likely to have inadequate ventilation, with 31 people (38.8%) and 49 people (61.3%) in coastal areas. From the analysis, a value of $\rho = 0.083 > \alpha = 0.05$ was obtained, meaning that there was no difference in the ventilation conditions of TB patients in highland and coastal areas. This finding suggests that the quality of home ventilation is not directly influenced by geographical differences between highland and coastal areas. This is because the architecture of homes in both regions follows similar patterns, resulting in comparable ventilation systems. In both study areas, the shape and layout of houses generally follow local building styles or common construction rules. However, these construction approaches do not fully consider environmental health aspects, such as the implementation of effective ventilation or the ideal floor area ratio, which should be at least 10% of the room's floor area [24].

Patients with pulmonary TB in both highland and coastal areas have easy access to health services. In highland areas, 31 people (36.0%) and in coastal areas, 55 people (64.0%) have access to health services. Thus, access to health services is not a distinguishing factor in the incidence of pulmonary TB in both regions. This is because patient satisfaction with the services is also relatively high, reflecting the quality

of responsive and patient-friendly services, ensuring that patients feel supported throughout the treatment process [25].

This study is in line with Thobeka's (2024) research in Africa, which found that pulmonary TB patients in both regions had relatively easy access to health services. Patients could easily reach health facilities that were well-equipped in terms of infrastructure and skilled medical personnel. The relatively short travel distance makes the journey to these facilities manageable. Adequate transportation availability further facilitates patients' routine visits. Administrative processes at healthcare facilities run smoothly without significant obstacles. Meanwhile, patients' satisfaction levels with the services received are good, reflecting responsive and friendly care. This situation underscores that access to healthcare services for pulmonary TB patients in both regions is very good and easily accessible [26].

CONCLUSION

The characteristics of pulmonary TB patients vary in terms of age, gender, education level, and occupation. The results of the study show that there are no significant differences in the characteristics of pulmonary TB cases and environmental factors such as housing density and ventilation conditions between highland and coastal areas. These findings are consistent with the background information that emphasizes the importance of easy and integrated access to health services in the control of pulmonary tuberculosis.

The implication of this study is the need to strengthen the sustainability of health services and educate the public about the risk factors for pulmonary TB, especially in improving the quality of the living environment and ventilation. Community health centers, as the frontline, need to continue to optimize community-based approaches in controlling pulmonary TB.

For further research, it is recommended to increase the sample size to optimize the analysis, as the sample size is still limited due to the relatively small scale of the research location. In addition, environmental factors and individual behavior should be examined more comprehensively.

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