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Risk factor model for pulmonary tuberculosis occurrence in Makassar using spatial approach☆

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Abstract
Objective: To investigate the distribution of pulmonary TB cases and develop a risk factor model for pulmonary TB occurrence in Makassar using Spatial Autoregressive (SAR) approach.
Method: This research was observational analytic using case control method to develop a risk factor model for pulmonary tuberculosis occurrence with SAR. The sample was 368 people consisting of 182 cases and 186 control.
Results: The results indicate that there is relation between pulmonary tuberculosis occurrence in one location and another (spatial effect). Variables that are related to the disease occurrence are: occupancy density as well as humidity and lighting of house environment. Meanwhile, variables that are not related to the disease occurrence are: temperature and history of contact with tuberculosis.
Conclusion: The risk factor model for pulmonary tuberculosis occurrence was (SAR): $Y = -1.212 - 0.185\sum_{j=1,i\neq j}^{n} w_{ij}y_i + 0.28$ occupancy density $+ 0.31$ humidity $+ 0.44$ lighting $+ 0.09$ temperature $- 0.24$ history of contact.

Introduction

Tuberculosis (TB) is an infectious disease caused by bacilli tuberculosis Mycobacterium infection that becomes a global concern.[1,2] Based on the WHO report in the 2016 Global Tuberculosis Report, tuberculosis was estimated to infect 10.4 million people and cause 1.4 million deaths in 2015.

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India, Indonesia, and China are countries with the largest number of tuberculosis patients. In 2015, there were 5.2 million pulmonary TB cases and 57% of them were acid-fast bacilli (AFB) smear-positive.[3]

TB in Makassar indicates fluctuating numbers. There were 2166 cases in 2014. The number increased to 2372 in 2015 with new cases of AFB TB. The number increased to 3917 in 2016, however, new AFB smear-positive cases decreased to 1850.[4] Makassar, which is a coastal region, is vulnerable to infectious diseases influenced by environmental factors, including tuberculosis (TB). In addition to environmental changes, several issues such the high population density, poverty, low hygiene awareness and poor environmental condition.[5–7]

In examining infectious diseases, especially pulmonary TB in the coastal areas of Makassar, the SAR model was used due to the high community mobility from one location to another. Therefore, based on this concept, the high prevalence rate in a location was affected by the high prevalence rate in other nearby locations. This can be understood because the chance of mobilization from one location to a nearby location was greater than to a far away location.[8] Prevalence modeling with its affecting factors can be performed using regression analysis.[9] Modeling can also be performed using Geographical Weighted Regression.[10]

Material and method

Research design

This research was analytic using case control design to study the distribution of pulmonary TB cases and develop a risk factor model for pulmonary TB occurrence in Makassar using Spatial Autoregressive (SAR) approach.

Population and sample

The population in this study was people with AFB smear-positive pulmonary TB recorded in TB 03 forms quarter I, II, III and IV in the 2018–2019 period in community health centers in Makassar.

The case inclusion criteria were:

1. Willing to be a research subject by signing the provided informed consent.
2. Recorded in TB 03 forms quarter I, II, III and IV in the 2018–2019 period in Makassar and domiciled in the area (Tallo and Ujung Tanah Sub-districts).
3. The control population was community health center outpatients in the 2018–2019 period in Makassar (Tallo and Ujung Tanah Sub-districts) with the following criteria: Recorded in the outpatient register of the community health center.

Results

Bivariate analysis

Bivariate analysis was performed to discover the relationship between independent variables (occupancy density, humidity, lighting, temperature, and history of contact with TB) and dependent variables (and pulmonary TB occurrence) (Table 1).

Statistical test using Chi-square obtained $p = 0.060$, which was larger than $\alpha = 0.05$. Thus, Ho was accepted. Finally, history contact with patient's family was higher in case compared to control. It was 32 people (17.6%) in case and 20 people (10.8%) in control. Statistical test using Chi-square

Table 1 Risk of independent variables on pulmonary TB in Makassar in 2019.

Independent variables	TB occurrence						*p*
	Case		Control		Total		
	n	%	*n*	%	*n*	%	
Occupancy density							0.734
Not eligible	104	57.1	102	54.8	206	56.0	
Eligible	78	42.9	84	45.2	162	44.0	
Humidity							0.012
High	38	20.9	20	10.8	58	15.8	
Normal	144	79.1	166	89.2	310	84.2	
Lighting							0.000
Not eligible	135	74.2	64	34.4	199	54.1	
Eligible	47	25.8	122	65.6	169	45.9	
Temperature							0.060
Not eligible	83	45.6	69	37.1	152	41.3	
Eligible	99	54.4	117	62.9	216	58.7	
History of contact							0.083
Have a history	32	17.6	20	10.8	52	14.1	
No history	150	82.4	166	89.2	316	85.9	

Table 2 Spatial dependency diagnostic results.

No.	Spatial dependency test	Value	*p*-value	Conclusion
1	Lagrange multiplier (lag)	3.939	0.043	Ho rejected
2	Lagrange multiplier (*error*)	1.751	0.185	Ho accepted
3	Lagrange multiplier (SARMA)	2.474	0.290	Ho accepted

Table 3 Results of factor analysis on pulmonary TB occurrence in Makassar in 2019 using spatial approach.

Variables	Coefficient	SE	*Z* value	*p*	R^2 value
W_TB	−0.185	0.143	−1.292	0.196	0.89
Constant	−1.212	8.085	−0.149	0.880	
Occupancy density	0.286	0.138	2.067	0.038	
Humidity	0.317	0.084	3.773	0.000	
Lighting	0.448	0.091	4.890	0.000	
Temperature	0.090	0.062	1.436	0.150	
History of contact	−0.246	0.211	−1.169	0.242	

obtained $p = 0.083$, which was larger than $\alpha = 0.05$. Thus, Ho was accepted.

Spatial analysis

In most spatial data, observation in a location depends on other nearby locations (neighboring). Pulmonary TB cases are interrelated between one location and another. If someone gets pulmonary TB in a location, it may affect other locations due to mobilization and contact with other people with pulmonary TB.

Spatial dependency test

Prior to spatial analysis, a spatial dependency test was performed to determine that pulmonary TB occurrence in a particular location was related to other locations. Spatial dependencies can be identified using two methods: Moran's I and Lagrange Multiplier (LM). The results of spatial dependency analysis using GeoDa software can be seen in Table 2.

Based on Table 2, Lagrange Multiplier-Lag Test obtained $p = 0.043$, which was smaller than $\alpha = 0.05$. It indicated that there was a spatial effect, pulmonary TB occurrence in a particular location was related to other locations. If a spatial effect exists, the best test to find out factors related to pulmonary TB occurrence in Makassar is a test that takes into account spatial effect.

Risk factor analysis on pulmonary TB occurrence using spatial approach

The results of analysis using GeoDa software with queen contiguity matrix can be seen in Table 3.

The *p* value of temperature was 0.150 and contact history was 0.242. Further, occupancy density, humidity, and lighting variables have something to do with pulmonary TB occurrence since the *p* value of those variables were smaller than $\alpha = 0.05$. The *p* value of occupancy density, humidity, and lighting variables were 0.038, 0.000, and 0.000 respectively. So, the risk factor model for pulmonary TB occurrence using spatial approach is as follows:

$$Y = -1.212 - 0.185\sum_{j=1, i\neq j}^{n} w_{ij}y_i + 0.28 \quad \text{occupancy density} + 0.31 \quad \text{humidity} + 0.44 \quad \text{lighting} + 0.09 \quad \text{temperature} - 0.24 \quad \text{history of contact}$$

where:

Y = number of TB occurrence

W_{ij} = spatial weights matrix

Pulmonary TB cases distribution mapping

The total number of patients with pulmonary TB was 182 cases. There were 41 (22.5%) patients within a radius of 250 meters and 124 (68.1%) patients within a radius of 500 meters from Community Health Center areas. The number indicated that more than half the number of pulmonary TB cases are located near the community health center areas (Fig. 1).

Discussion

Rooms with poor air circulation and little to no sunlight increase the risk of pulmonary TB transmission.[11] One of environmental variables affecting pulmonary TB occurrence is occupancy density.[12–14] Occupancy density is a comparison between the house floor area and family members in one house. The occupancy density requirement for ordinary housing is stated in m^2 per person. The minimum area per person varies, depending on building quality and facilities available.[14] The bivariate analysis results indicate that housing density variable is not related to pulmonary TB occurrence. However, in multivariate analysis that takes into account spatial effect, housing density is related to pulmonary TB occurrence. According to the researchers, the difference occurs because all independent variables are

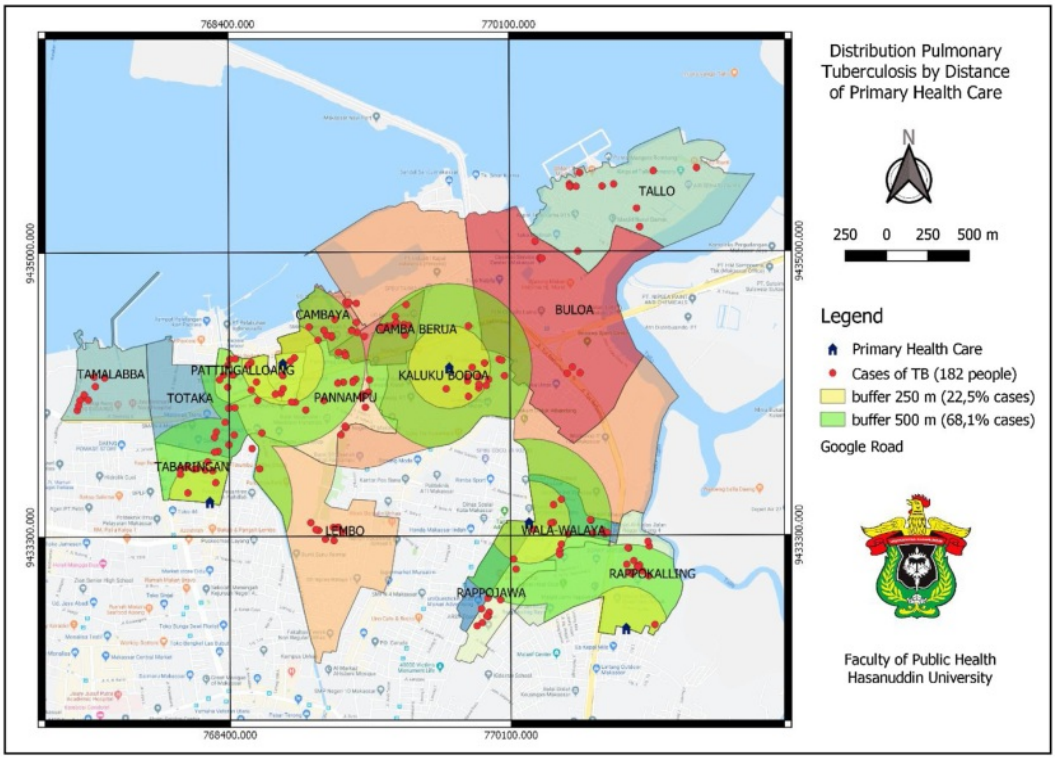

Figure 1 Map of pulmonary TB case distribution according to the distance to health center in the coastal areas of Tallo & Ujung Tanah sub-districts, Makassar.

analyzed simultaneously in multivariate analysis so that they are correlated.[15]

High indoor humidity is a suitable medium for bacteria growing process causing pulmonary TB since the disease is easily transmitted in unhealthy environmental conditions. The results of multivariate analysis that takes into account spatial effect indicate that there is a relationship between indoor humidity level and pulmonary tuberculosis occurrence in Makassar. The results of multivariate analysis that takes into account spatial effect indicate that there is a significant relationship between natural lighting and pulmonary TB occurrence. A room with an indoor lighting <60 lx has a higher chance of developing pulmonary TB than a room with an indoor lighting >60 lx.

Based on multivariate test results, there is no relationship between temperature and pulmonary TB occurrence because all family members of patients with pulmonary TB and control share the same indoor temperature. Moreover, the observation results indicate that most rooms for patients with pulmonary tuberculosis and control do not have good air circulation so that the room temperature level becomes not eligible. The research states that there is a relationship between temperature and pulmonary TB occurrence, yet it is not linear with this research.

The results of bivariate and multivariate analyses indicate that history of contact with family members is not related to patients with pulmonary TB. It may happen because most patients do not have any family member that is affected by pulmonary TB. In fact, interviews with patients reveal that contacts with neighbor or coworker may cause a spatial effect that plays a role in spreading the occurrence to other places.

Conclusions

There is a relationship between occupancy density and pulmonary TB occurrence in Makassar. There is a relationship between humidity and pulmonary TB occurrence in Makassar. There is a relationship between lighting and pulmonary TB occurrence in Makassar. There is no relationship between house temperature and pulmonary TB occurrence in Makassar. There is no relationship between history of contact with family members of patient and pulmonary TB occurrence in Makassar. Risk factor model for pulmonary TB occurrence in Makassar is:

$$Y = -1.212 - 0.185\sum_{j=1,i\neq j}^{n} w_{ij}y_i + 0.28 \quad \text{occupancy density} + 0.31 \quad \text{humidity} + 0.44 \quad \text{lighting} + 0.09 \quad \text{temperature} - 0.24 \quad \text{history of contact}$$

where:

Y = number of pulmonary tuberculosis occurrence
W_{ij} = spatial weights matrix

Conflict of interest

The authors declare no conflict of interest.

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References

1. Rahman SA, Salmah AU, Dwinata I, Mallongi A. Risk prediction model of lung tuberculosis using spatial approach in the coastal area of Makassar City. Indian J Public Heal Res Dev. 2019;10:1220–4.
2. Najmah. Epidemiologi penyakit menular. Jakarta: Trans Info Media (TIM); 2015.
3. World Health Organization. Global tuberculosis report 2016. WHO; 2016.
4. Makassar D. Profil kesehatan kota makassar tahun 2015. Makassar; 2016.
5. Sumampouw OJ, Soemarno, Andarini S, Sriwahyuni E, Nelwan JE. Eksplorasi masalah kesehatan masyarakat di daerah pesisir Kota Manado. Universitas Sam Ratulangi; 2015.
6. Mallongi A, Daud A, Ishak H, La Ane R, Birawida AB, Ibrahim E, et al. Clean water treatment technology with an up-flow slow sand filtration system from a well water source in the Tallo district of Makassar. J Environ Sci Technol. 2017;10:44–8.
7. Palutturi S. The key challenges and recommendations for healthy cities implementation of North Kolaka, Indonesia, Indian. J Public Heal Res Dev. 2017;8:252–7.
8. Chen D, Moulin B, Wu J. Introduction to analyzing and modeling spatial and temporal dynamics of infectious diseases. In: Chen D, Moulin B, Wu J, editors. Analyzing and modeling spatial and temporal dynamics of infectious diseases. New Jersey: Wiley; 2015.
9. Rahmawati R, Kartono K, Sulistyo RH, Noranita B, Sarwoko EA, Wardaya AY. Analisis pengaruh karakteristik wilayah (kelurahan) terhadap banyaknya kasus demam berdarah dengue (Dbd) di Kota Semarang. Media Stat. 2012;5:87–93.
10. Jaya IGNM, Abdullah AS, Hermawan E, Ruchjana BN. Bayesian spatial modeling and mapping of dengue fever: a case study of dengue feverin the City of Bandung, Indonesia. Int J Appl Math Stat. 2016;54.
11. Kementerian Kesehatan RI. Pedoman Penanggulangan Tuberkulosis Jakarta: Kementerian Kesehatan Republik Indonesia. Jakarta: Kementerian Kesehatan Republik Indonesia; 2017.
12. Wardani DWSR, Lazuardi L, Mahendradhata Y, Kusnanto H. Pentingnya analisis cluster berbasis spasial dalam penanggulangan tuberkulosis di Indonesia. Natl Public Heal J. 2013;8.
13. Mawardi M, Indah MF. Hubungan Kondisi Fisik Rumah dan Kepadatan Hunian dengan Kejadian TB Paru di Wilayah Kerja UPT Puskesmas Dadahup Kecamatan Dadahup Kabupaten Kapues. J Kesehat Masy. 2014;1:14–20.
14. Mallongi A, Handayani, Selomo M, Daud A, Rahman SA, Mattangang A, et al. The spatial pattern and risk factors of leprosy occurrence in Barru, Indonesia. Indian J Public Heal Res Dev. 2018;9:1489–94.
15. Rahman SA, Rahim A, Mallongi A. Forecasting of dengue disease incident risks using non-stationary spatial of geostatistics model in Bone Regency Indonesia. J Entomol. 2017;14:49–57.

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