

# ANALYSIS OF RISK FACTORS OF TUBERCULOSIS INCIDENCE IN PIDIE JAYA DISTRICT, ACEH PROVINCE, INDONESIA

**Farrah Fahdhienie<sup>1\*</sup>, Aryandi Darwis<sup>2</sup> and Frans Yosep Sitepu<sup>3</sup>**

<sup>1,2</sup> Faculty of Public Health, University of Muhammadiyah Aceh,  
Banda Aceh, Aceh, Indonesia.

<sup>3</sup> Provincial Health Office, North Sumatera, Indonesia.

\*Corresponding Author Email: [farrah.fahdhienie@unmuha.ac.id](mailto:farrah.fahdhienie@unmuha.ac.id)

DOI: [10.5281/zenodo.12516155](https://doi.org/10.5281/zenodo.12516155)

## Abstract

Tuberculosis (TB) is the third highest cause of death worldwide, which is influenced by risk factors. Identifying risk factors helps identify individuals at high risk of developing TB. Controlling risk factors is an important component in preventing and controlling TB. This study aimed to determine the risk factors for pulmonary TB incidence in Pidie Jaya District, Aceh. This was a case control study with total number of sample was 92 respondents consisting of 46 cases and 46 controls (1:1). The results showed that there was a relationship between age ( $p= 0.018$ ; OR = 5.06), knowledge ( $p= 0.038$ ; OR = 2.44), food security ( $p= 0.038$ ; OR = 2.44), and contact history ( $p= 0.046$ ; OR = 2.53) with the incidence of Pulmonary TB in Pidie Jaya District.

**Keywords:** Tuberculosis, Age, Knowledge, Food Security, Contact History.

## INTRODUCTION

Tuberculosis (TB) is an infectious disease and still the main cause of death in developing countries. TB is caused by the bacteria *Mycobacterium tuberculosis*, which infects the lungs. The more global mobility increases, the more TB spreads between regions. The development of TB drug-resistant cases is a serious problem and makes it difficult to control the spread of TB. In the other hand, TB is also related to comorbid conditions with other diseases as well as the influence of social and cultural aspects in society.<sup>1,2</sup>

It is predicted that one-third of 1.9 billion of the world's population suffer from pulmonary TB. About 8 million people are estimated to be affected annually, and 3 million of those people die of complications of the disease. An active TB case can infect up to 10-15 other people through close contact over a year.<sup>3</sup> Indonesia is in second place with the highest number of TB cases in the world after India, with 969,000 cases and 144,000 deaths.<sup>1,2</sup>

In 2021, based on a report from the Provincial Health Office of Aceh, this province was one of Indonesia's highest contributors to TB cases, with a Case Notification Rate (CNR) of 115 per 100,000 population.<sup>4</sup> The success rate of TB treatment in Pidie Jaya District was still below 85% (national target: 90%) with a CNR of 85 per 100,000 population.<sup>4,5</sup>

In Pidie Jaya District, the increase in TB cases was not commensurate by the treatment success rate. TB problems are caused by multifactorial, such as smoking behaviour, comorbidities, and alcohol consumption.<sup>4-6</sup> Other factors are knowledge, socio-economic status, contact history, food security and nutritional status.<sup>7-11</sup> This study aimed to determine the determinants of TB incidents in Pidie Jaya District, Aceh Province, Indonesia.

## METHODS

### Study Design and Setting

This study used a case-control design, conducted in twelve community health centres (Puskesmas) working area, Pidie Jaya District. The total number of respondents was 92 people aged  $\geq 15$  years. The total number of cases was 46 BTA (+) pulmonary TB cases, diagnosed in 2022. At the same time, the total number of controls was 46, neighbours of the cases who were not BTA (+) pulmonary TB. The ratio between the case group and the control group was 1:1.

### Study Procedure

Data was collected by directly interviewing the cases and control group. The questionnaire consists of the characteristics of the respondents (gender, education level, marital status, and occupation) and the study variables (age, smoking habits, knowledge, contact history, and food security). The age group divided into high risk ( $\geq 26$  years) and low risk age ( $\leq 25$  years). Smoking habits divided into three category: non-smoker (respondent who has never smoked), former smoker (respondent who has smoked before, but has stopped smoking  $\geq 3$  months before the study), and smoker (respondent who smokes at one cigarette or another type of cigarette  $\geq 6$  months before the study). Knowledge about TB was measured by 32 item questions assessing the cause of TB, signs/symptoms of TB, epidemiology of TB and knowledge of effective prevention methods. Every correct answer will get 1 score, while incorrect answer will get 0 score. Good knowledge with a mean value of  $\geq 24$ . To measure contact history by asking the respondents with close contact history with TB cases in the household, schools, or working places. Good food security is obtained from three indicators, they were food availability  $\geq 30$  days, good food access, and food utilization, while when one of the indicators was not met it meant that food security was poor.

### Data Analysis

The independent variables of the study were age, smoking habits, knowledge, contact history, and food security. All data were analyzed by using SPSS version 25, to calculate odds ratio (OR) and 95% confidence interval (CI). Logistic regression was also performed for all variables and those with p-value lower than 0.25 were included in the multivariate model. OR was used to determine the potential risk factors

### Ethical Consideration

The study was approved by the Research Ethics Committee of Universitas Sari Mulia Banjarmasin (No: 027/KEP-UNISM/V/2023). We conducted the interview with agreement of the respondents. All personal information of the respondents involved in the study have been kept confidential.

## RESULTS

### The Characteristics of Respondents

The analysis of the characteristics of respondents resulted that female (54.35%), level of education was middle (46.7%), married (68.5%) and not employee (69.6%) (Table 1). TB cases were spread throughout all the community health centers (Puskesmas) in Pidie Jaya District. The largest proportion of cases were in Puskesmas Bandar Baru (17.4%), Puskesmas Nyoeng (15.2%), Puskesmas Bandar Dua (13%), and Puskesmas Ulim (10.9%). Community Health Center.

### The Bivariate Analysis

The bivariate analysis resulted that high risk age group ( $p= 0.018$ ;  $OR= 5.06$ ), poor level of knowledge ( $p= 0.038$ ;  $OR= 2.44$ ), poor of food security ( $p= 0.038$ ;  $OR= 2.44$ ), and having contact history with TB patients ( $p= 0.046$ ;  $OR= 2.53$ ) were related to the incidence of TB. While smoking status was not related to the incidence of TB (Table 3).

### The Multivariate Analysis

The findings in the multivariate analysis showed that age was the most risk factor of TB incidence ( $p= 0.033$ ;  $OR = 4.52$ ) (Table 4). Respondents who were in high risk age group ( $\geq 26$  years) were 4.52 times more likely to get infected of TB than those who were in low risk age group ( $\leq 25$  years).

**Table 1: The Characteristics of Respondent (n=92)**

Variables	f	%
Gender		
Male	42	45.65
Female	50	54.35
Level of education		
Primary	23	25.0
Secondary	43	46.7
Tertiary	26	28.3
Marital status		
Single	14	15.2
Married	63	68.5
Divorced	15	16.3
Occupation		
Not employee	64	69.6
Employee	28	30.4

Table 2 showed that the highest age group was high risk (83.70%), smoking (39.13%), poor level of knowledge (45.65%), contact history (31.52%), and poor of food security (45.65%). The knowledge of respondents' variable obtained by calculating the mean value of the respondents' answers.

**Table 2: Frequency Distribution of Independent Variables (n=92)**

Variables	f	%
Age		
High risk ( $\geq 26$ years)	77	83.70
Low risk ( $\leq 25$ years)	15	16.30
Smoking habit		
Non-smoker	50	54.35
Former smoker	36	39.13
Smoker	6	6.52
Knowledge of TB		
Good	50	54.35
Poor	42	45.65
Contact history		
No	63	68.48
Yes	29	31.52
Food security		
Good	50	54.35
Poor	42	45.65

**Table 3: Association between Age, Smoking Status, Knowledge of TB, Contact History, and Food Security with TB Incidence**

Variables	Cases (n=46)		Control (n=46)		P-Value	OR (95% CI)
	n	%	n	%		
Age						
Low risk	3	26.09	12	6.52		
High risk	43	73.91	34	93.48	0.018	5.06 (1.32-19.37)
Smoking habit						
Non-smoker	21	42.0	29	58.0		
Former smoker	4	66.7	2	33.3	0.137	0.52 (0.22-1.23)
Smoker	21	58.3	15	41.7	0.701	1.43 (0.23-8.84)
Knowledge of TB						
Good	20	43.48	30	65.22		
Poor	26	56.52	16	34.78	0.038	2.44 (1.05-5.65)
Contact history						
No	27	58.70	36	78.28		
Yes	19	41.30	10	21.74	0.046	2.53 (1.02-6.32)
Food security						
Good	20	43.48	30	65.22		
Poor	26	56.52	16	34.78	0.038	2.44 (1.05-5.65)

**Table 4: Multivariate Analysis of Risk Factors of TB Incidence**

Variables	P-Value	OR (95% CI)
Age	0.033	4.52 (1.13-17.99)
Contact history	0.077	2.39 (0.91-6.31)
Knowledge of TB	0.127	1.99 (0.82-4.84)

## DISCUSSIONS

Our findings showed that high risk age (adult) was the strongest risk factor that associated with TB incidence. Adults are more likely than children to get TB. The incidence rise with age among those who are 15 years of age and older.<sup>12,13</sup> The risk of tuberculosis susceptibility is markedly elevated in high-risk age individual. It is indicating that the older population is one of the main reservoirs for M. tuberculosis infection. This could be happened because of older adult immune system usually decline and more likely to get sick, especially TB.<sup>14-16</sup>

TB is a unique problem among the elderly due to a combination of factors, such as aging-related immunodeficiency, the possibility of developing new immune-depressive disorders associated with other comorbidities, and possible drug interactions between anti TB drugs and other prescriptions.<sup>15,17,18</sup> Furthermore, there is information specifically available regarding tuberculosis in elderly individuals. In addition, adults who carrying out busy activities and poor working condition are more susceptible to disease due to a weak immune system. This findings is in line with previous studies that demonstrated an association between age and the incidence of TB.<sup>12,14-16,19</sup>

TB contact was another risk factors of TB incidence in the study area. TB contacts are defined as individuals who have exchanged airspace or close contact with someone who was active TB for any length of time. These people could be friends, coworkers, classmates, or other members of the household. The danger of contracting the disease is very high for those who are in close proximity to someone who has active TB. Extended and close contact increases the chance of tuberculosis infection.<sup>11,20,21</sup> In addition, it is crucial to find, identify, and evaluate contacts for TB infection and

disease as soon as possible. It is estimated that 1% of all TB contacts require medical attention because they have TB disease at the time of the contact inquiry. Furthermore, between 20% and 30% of TB contacts have Mycobacterium tuberculosis infections and, in the event that latent TB infection (LTBI) is not identified and treated, may develop TB illness. In order to stop TB infection in the community, TB contacts should be investigated systematically and actively.<sup>22,23</sup> This findings is consistent with other previous studies that have determined association between having contact history with TB cases and the incidence of TB.<sup>11,20,21,24,25</sup>

In the multivariate analysis we found that knowledge was not related to TB incidence. However, in the bivariate analysis knowledge was related to the incidence of TB. As much as 26 out of 46 (56.52%) TB cases were poor level of knowledge. Poor level of knowledge about TB causes, symptoms, transmission, prevention and free treatment can increase a person's risk of being infected with TB.<sup>7,26</sup> We found that 88.9% of respondents know that someone could be infected with TB through inhaling TB bacilli, however, the majority believed that smoking, sharing food and eating from the same plate were the causes of TB. It can be concluded that there was a gap of knowledge of TB which increased the risk of TB incidence. A crucial factor is the respondents' familiarity with tuberculosis. Delays in seeking a diagnosis and poor treatment adherence are both results of inadequate respondents' knowledge of tuberculosis. Healthcare seeking is delayed due to a lack of awareness and inadequate knowledge about TB symptoms. Owing to the respondents' comparatively low level of familiarity with TB, public education campaigns regarding the illness are clearly needed.<sup>27-29</sup>

Our study resulted that smoking habits was not associated with the incidence of TB. However, our study revealed that smoker were 1.<sup>43</sup> times more likely to get infected of TB than those who non-smoker. Smoking habits impacts the immune system, smokers more susceptible to TB infection. Smoking habits will damage the lung defense mechanism called mucociliary clearance. The cilia, which are microscopic hairs in the lungs, become inflamed and cease to function when exposed to smoke. Phlegm and other particles are expelled from lungs with the aid of the cilia.<sup>1,12,30,31</sup> In addition, the variable of food security was not associated with the incidence of TB. Food security is defined as the condition of a person who has access to sufficient, safe and nutritious food to fulfill the needs of a healthy life. Our study resulted that 64% of households with TB were food insecure. TB cases and food security are fundamental problems that can be interrelated. Household food insecurity can affect the ability of family members to ward off infectious diseases such as TB. Nutritional status in TB patients is closely related to food security.<sup>32-34</sup> Our study just assesses the individual risk factors, it would be better if the physical environment of the house such as lighting, occupation density, ventilation, humidity and temperature were also assessed to determine whole risk factors of the TB incidence in the study area.

## CONCLUSION

Our study resulted that there was a relationship between age, knowledge, having contact history with TB patient, and food security with the incidence of TB in Pidie Jaya District, Aceh, Indonesia. Among all the variables, age was the most risk factor of TB incidence. Therefore, it is necessary to educate people in high-risk age groups to increase awareness of being infected with TB. Apart from that, the development of risk factor-based TB surveillance instruments also needs to be carried out routinely and continuously.

## Acknowledgments

The authors would like to acknowledge to all of Puskesmas' head and staff of TB program in Pidie Jaya District, Aceh, Indonesia.

## Conflict of Interest

None.

## Funding Sources

This study funded by Institute for Research and Community Service (LP4M) University of Muhammadiyah Aceh.

## References

- 1) World Health Organization (WHO). *Global Tuberculosis Report 2022.*; 2022.
- 2) Kemenkes. *Evaluasi Capaian Program Tuberculosis.*; 2022.
- 3) Nkiruka Bridget Odu, Rajesh Prasad, Clement Onime BKS. How to implement a decision support for digital health: Insights from design science perspective for action research in tuberculosis detection. *Int J Inf Manag Data Insights.* 2022;2(2). doi:<https://doi.org/10.1016/j.jjime.2022.100136>
- 4) Dinkes Aceh. *Laporan Tuberculosis Provinsi Aceh Tahun 2021.*; 2022.
- 5) Dinkes A. *Profil Kesehatan Aceh Tahun 2021.*; 2021.
- 6) Aceh Province Bureau of Statistics. *Aceh Province in Figures.*; 2021.
- 7) Craciun OM, Torres MDR, Llanes AB, Romay-Barja M. Tuberculosis Knowledge, Attitudes, and Practice in Middle- and Low-Income Countries: A Systematic Review. *J Trop Med.* 2023;2023. doi:10.1155/2023/1014666
- 8) Wen CP, Chan TC, Chan HT, Tsai MK, Cheng TY, Tsai SP. The reduction of tuberculosis risks by smoking cessation. *BMC Infect Dis.* 2010;10. doi:10.1186/1471-2334-10-156
- 9) Echazarreta A, Zerbini E, De Sandro J, et al. Tuberculosis and comorbidities in urban areas in Argentina. A gender and age perspective. *Biomedica.* 2018;38(2):180-188. doi:10.7705/BIOMEDICA.V38I0.3904
- 10) Cegielski JP, McMurray DN. The relationship between malnutrition and tuberculosis: Evidence from studies in humans and experimental animals. *Int J Tuberc Lung Dis.* 2004;8(3):286-298.
- 11) Aditama W, Sitepu FY, Depari E. Having contact history with tb active cases and malnutrition as risk factors of TB incidence: A cross-sectional study in North Sumatera, Indonesia. *Malaysian J Public Heal Med.* 2020;20(1):192-198. doi:10.37268/mjphm/vol.20/no.1/art.482
- 12) Kawatsu L, Yoshiyama T, Kato S. Tuberculosis in the Elderly. *Essent Tuberc.* Published online 2021:253-258. doi:10.1007/978-3-030-66703-0\_28
- 13) Narasimhan P, Wood J, Macintyre CR, Mathai D. Risk factors for tuberculosis. *Pulm Med.* 2013;2013. doi:10.1155/2013/828939
- 14) Hase I, Toren KG, Hirano H, et al. Pulmonary Tuberculosis in Older Adults: Increased Mortality Related to Tuberculosis Within Two Months of Treatment Initiation. *Drugs and Aging.* 2021;38(9):807-815. doi:10.1007/s40266-021-00880-4
- 15) Teo AKJ, Morishita F, Islam T, et al. Tuberculosis in older adults: challenges and best practices in the Western Pacific Region. *Lancet Reg Heal - West Pacific.* 2023;36(April):100770. doi:10.1016/j.lanwpc.2023.100770
- 16) Teo AKJ, Rahevar K, Morishita F, et al. Correction: Tuberculosis in older adults: case studies from four countries with rapidly ageing populations in the western pacific region (BMC Public Health, (2023), 23, 1, (370), 10.1186/s12889-023-15197-7). *BMC Public Health.* 2023;23(1):1-11. doi:10.1186/s12889-023-15576-0
- 17) Restrepo BI. Diabetes and Tuberculosis. Schlossberg D, ed. *Microbiol Spectr.* 2016;4(6). doi:10.1128/MICROBIOLSPEC.TNMI7-0023-2016

- 18) Silva DR, Muñoz-Torrico M, Duarte R, et al. Risk factors for tuberculosis: diabetes, smoking, alcohol use, and the use of other drugs. *J Bras Pneumol.* 2018;44(2):145. doi:10.1590/S1806-37562017000000443
- 19) Snow KJ, Sismanidis C, Denholm J, Sawyer SM, Graham SM. The incidence of tuberculosis among adolescents and young adults: A global estimate. *Eur Respir J.* 2018;51(2). doi:10.1183/13993003.02352-2017
- 20) Jelip J, Mathew GG, Yusin T, et al. Risk factors of tuberculosis among health care workers in Sabah, Malaysia. *Tuberculosis.* 2004;84(1-2):19-23. doi:10.1016/J.TUBE.2003.08.015
- 21) Hassen J, Gizaw A, Mohamed S. Determinants of pulmonary tuberculosis in public health facilities of Dire Dawa City, Eastern Ethiopia: Unmatched Case-control study. *Int J mycobacteriology.* 2019;8(2):118-123. doi:10.4103/IJMY.IJMY\_50\_19
- 22) Verdier JE, de Vlas SJ, Kidgell-Koppelaar ID, Richardus JH. Risk factors for tuberculosis in contact investigations in Rotterdam, the Netherlands. *Infect Dis Rep.* 2012;4(2):101-105. doi:10.4081/idr.2012.e26
- 23) Chan G, Triasih R, Nababan B, du Cros P, Wilks N, Al. E. Adapting active case-finding for TB during the COVID-19 pandemic in Yogyakarta, Indonesia. *Public Heal Action.* 2021;11(2):41-49. doi:10.5588/pha.20.0071
- 24) Tesema C, Tadesse T, Gebrehiwot M, Tsegaw A, Weldegebreal F. Environmental and Host-Related Determinants of Tuberculosis in Metema district, north-west Ethiopia. *Drug Healthc Patient Saf.* 2015;7:87-95. doi:10.2147/DHPS.S82070
- 25) Dodd PJ, Yuen CM, Becerra MC, Revill P, Jenkins HE, Seddon JA. Potential effect of household contact management on childhood tuberculosis: a mathematical modelling study. *Lancet Glob Heal.* 2018;6(12):e1329-e1338. doi:10.1016/S2214-109X(18)30401-7
- 26) Luba TR, Tang S, Liu Q, Gebremedhin SA, Kisasi MD, Feng Z. Knowledge, attitude and associated factors towards tuberculosis in Lesotho: A population based study. *BMC Infect Dis.* 2019;19(1):1-10. doi:10.1186/s12879-019-3688-x
- 27) Lee JY, Kwon N, Goo G yeon, Cho S il. Inadequate housing and pulmonary tuberculosis: a systematic review. *BMC Public Health.* 2022;22(1):1-12. doi:10.1186/s12889-022-12879-6
- 28) Thomas S, Sagan A, Larkin J, Cylus J, Figueras J, Karanikolos M. *Strengthening Health Systems Resilience, Key Concepts and Strategies.*; 2020. <https://apps.who.int/iris/handle/10665/332441>%0Ahttps://apps.who.int/iris/bitstream/handle/10665/332441/Policy-brief-36-1997-8073-eng.pdf
- 29) Noykhovich E, Mookherji S, Roess A. The Risk of Tuberculosis among Populations Living in Slum Settings: a Systematic Review and Meta-analysis. *J Urban Heal.* 2019;96(2):262-275. doi:10.1007/s11524-018-0319-6
- 30) Khan, A.H., Sulaiman, S.A.S., Hassali MA. Effect of smoking on treatment outcome among tuberculosis patients in Malaysia; a multicenter study. *BMC Public Health.* 2020;20(854). doi:https://doi.org/10.1186/s12889-020-08856-6
- 31) Genet A Amere, Pratibha Nayak, Argita D Salindri, K M V Narayan MJM. Contribution of Smoking to Tuberculosis Incidence and Mortality in High-Tuberculosis-Burden Countries. *Am J Epidemiol.* 2018;187(9). doi:https://doi.org/10.1093/aje/kwy081
- 32) Amrith N, Laksiri J, Nayanathara N, Derore IK. Food Security and Nutrition among the Tuberculosis infected patients A case study among the patients screened at Chest Clinic of Medical Research Institute of Colombo, Sri Lanka.
- 33) Susilaningrum D, Ulama BSS, Wulandari SP, Salamah M. The analysis of factors that affecting household food security of tuberculosis patients in Surabaya. *J Phys Conf Ser.* 2019;1341(9). doi:10.1088/1742-6596/1341/9/092014
- 34) Food and Agriculture Organization (FAO), AFAD, UNICEF, WFP, WHO. *The State of Food Security and Nutrition in the World 2021.* FAO, IFAD, UNICEF, WFP and WHO; 2021. doi:10.4060/cb4474en