CHILDREN PULMONARY TUBERCULOSIS RISK FACTORS AT TADJUDDIN CHALID CCENTER HOSPITAL AND LABUANG BAJI DISTRICT HOSPITAL, MAKASSAR, INDONESIA

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Abstract

Background: Every year around 1.5 million children and teenagers contract tuberculosis. The younger the child, the greater the chance of being infected with tuberculosis. Every year around 1.5 million children and teenagers contract tuberculosis. Tuberculosis is the primary cause of illness and death among children worldwide, resulting in 233,000 child fatalities in 2017. The greatest death rate is observed in children under 5, particularly in children who are malnourished. **Objective:** This study aims to identify variables that pose a risk for Pulmonary Tuberculosis in children at RSTC and Labuang Baji City Hospital Makassar. **Methods:** This study used a case-control study design. The sample consisted of 165 participants, with 55 classifieds as cases and 110 as controls. Bivariate data analysis uses the OR test, whereas multivariate analysis utilizes Multiple Logistic Regression. **Findings:** The results showed that certain risk variables significantly influence the occurrence of Pulmonary Tuberculosis. These include the age of children (OR= 3.40, CI 95%: 1.3448-8.673), maternal education level (OR: 2.04, CI 95%: 0.939-4.419), maternal occupation (OR: 2.47, 95% CI: 1.128-5.373), family income (OR: 1.09, CI 95%: 0.505-2.437). and (OR: 2.26, CI 95%: 1.109-4.613). **Conclusion:** It was determined that three out of the six variables examined were correlated with the occurrence of tuberculosis in children. These variables are the child's age, mother's education, and residential density.

Keywords: Child Tuberculosis, Pulmonary Tuberculosis, Age, Maternal Education, Maternal Occupation, Family Income.

INTRODUCTION

Childhood tuberculosis generally occurs in countries with a high incidence of tuberculosis. Every year around 1.5 million children and teenagers contract tuberculosis. The younger the child, the greater the chance of being infected with tuberculosis. Infants and children with tuberculosis have a risk of more severe disease and a faster onset.(1) In 2018, a quarter of the world's population (1.8 billion people) was infected with *Mycobacterium tuberculosis*, 70 million of whom were children aged 0-14 years.(2) Every year around 7.5 million children are infected with latent TB, 1-1.2 million children develop active tuberculosis disease, and more than half of them are children under 5 years old. (3)

Tuberculosis is the leading cause of child morbidity and mortality globally, responsible for 233,000 child deaths in 2017.[4] The highest mortality occurs in children aged <5 years, especially in malnourished children. Approximately 30 countries with a high TB burden account for 87% of all estimated incident cases worldwide. Eight countries among them donate more than two-thirds of the total global cases: India (28%), Indonesia (9.2%), China (7.4%), Philippines (7.0%), Pakistan (5.8%), Nigeria (4.4%), Bangladesh (3.6%) And Republic Democratic Congo (2.9%). (4)

In Indonesia, tuberculosis is a problem health which is complex in health, social, economic, and cultural aspects. (5) The proportion of tuberculosis cases in children aged 0-14 years in 2020 and 2021 is 9.3% and 9.7% respectively, which means that TB cases in children have increased. Tuberculosis Pulmonary child which was recorded in the Department Health Office Makassar in 2022 will have 332 cases, this is a significant increase from the previous two years, namely 138 cases in the year 2020 and as many as 158 cases in the year 2021. The highest incidence rate was at RSTC (Tadjuddin Chalid Hospital) with 25 cases and at Labuang Baji Hospital with 30 people. This figure has increased significantly from 2020 to 2021. RSTC had no recorded paediatric pulmonary TB patients, while Labuang Baji Hospital had 18 cases and 14 cases respectively. (6)

MATERIALS & METHODS

Study Design and Population

This type of research is observational and analytical with a case-control design. The existence of the control group is to strengthen the existence or non-existence of a causal relationship between the dependent variable (child's pulmonary tuberculosis) and the independent variables (child's age, mother's education, mother's occupation, family income, and density of housing). The unit of analysis for this study is data from medical records at Tadjuddin Chalid Hospital and Labuang Baji Regional Hospital and interviews with respondents. (7) This research was conducted from October to December 2023.

Sampling and Selection of Cases and Controls

The case population in this study was all children with pulmonary tuberculosis aged 0–14 years who were diagnosed and registered in the medical records in RSTC and Labuang Baji Hospital that is 55 children, came for treatment from January to June 2023. Meanwhile, the control population is all non-tuberculosis patients with respiratory disorder (influenza, bronchitis, pneumonia, ISPA).

Variables, Tools, and Techniques Data Collection

The case sampling technique used in this study was an exhaustive sampling method, meaning that all eligible patients were included in the case group. In the interim, the control group was carried out using a purposive sampling technique adjusted for the age of the main group. The data collection method used in this study involves both primary and secondary data. The primary data collected by direct interview with parents using quiestionnaire. The secondary data obtained from medical records at RSTC and RSUD Labuang Baji Kota Makassar.

Ethical Considerations

The ethical clearance was obtained through a certificate from Department of Epidemiology, Faculty of Public Health, Hasanuddin University with number: 5264/UN4.14.1/TP.01.02/2023.

Data Analysis

All analyses were performed using Stata 14.2 (StataCorp (2015). Statistical Software: Release 14. College Station, TX: StataCorp LP). Univariate analysis is used to obtain an overview of the distribution and frequency of Tuberculosis disease in children based on individual characteristics such as age and gender. Bivariate analysis is

conducted to examine the relationship between independent variables (child's age, maternal education, maternal occupation, family income, and residential density) with Pulmonary Tuberculosis in children.

This study is used to examine the relationship between independent variables as risk factors for the occurrence of the dependent variable (Childhood Pulmonary Tuberculosis). Multivariate analysis is performed to identify a number of variables that overlap with the dependent variables. The variables that have been proven to be significantly related through bivariate analysis are further analysed using multivariate analysis. The test used in this multivariate analysis was Logistic Regression.

FINDINGS

Respondent Ccharacteristics and Case Distribution

Table 1 indicates that most respondents in the case group were female, specifically 54 individuals (98.18%), the control group was predominantly composed of 110 individuals (100%). Therefore, it is common for most patients who see RSTC and Labuang Baji Hospital is to be accompanied by their parents, particularly the mother of the patient.

The breakdown of participants by age group reveals that the 20-29 age group has the highest number of individuals in both the case and control groups. Specifically, there are 28 individuals (50.91%) in the case group and 50 respondents (45.45%) in the control group. Most respondents had a high school education, with 77 respondents (46.67%).

Among them, the case group consisted of 20 respondents (36.36%) while the control group consisted of 57 respondents (51.82%). At the junior high school level, there were a total of 44 respondents. Among them, 20 respondents (36.36%) were in the case group and 24 respondents (21.82%) were in the control group. Additionally, all 44 respondents had completed D3/S1. The percentage of instances was 26.67%, with 15 respondents representing (27.27%) and a control group of 30 respondents representing (26.36%).

The demographic information of the respondents was obtained from the parents or guardians of paediatric children during their visit to RSUP. Tadjuddin Chalid and RSUD Labuang Baji. The occupational distribution of respondents reveals that domestic workers constitute the largest proportion in both the case and control groups, specifically 88 individuals (80%) in the case group and 34 individuals (61.82%) in the control group.

The data on the distribution of children according to family income reveals that the group with the highest number of individuals, both in the case group and the control group, consists of families with an average monthly income ranging from 1,600,000 to 3,200,000. Specifically, the case group comprises 60 individuals (54.55%), while the control group includes 26 individuals (61.82%). The age distribution of children reveals that the biggest number of children falls between the 1–4-year age range in both categories.

Table 1: Distribution of Respondents Characteristics at RSUP. Tadjuddin Chalid and RSUD. Labuang Baji, Makassar

Characteristics Respondent	Cases (54)		Control (111)		Total	
	n	(%)	n	(%)	n	(%)
Gender						
Man	1	1,82	0	0	1	0,6
Woman	54	98,18	110	100	164	99,4
Age						
≤19	0	0	12	10,91	12	7,27
20-29	28	50,91	50	45,45	78	47,27
≥30	27	49,09	48	43,64	75	45,45
Education						
Completed SMP/MTs	20	36,36	24	21,82	44	26,67
Completed SMA/SMK/MA	20	36,36	57	51,82	77	46,67
Completed D3/S1/S2/S3	15	27,27	30	26,36	44	26,67
Occupation						
Housewife	34	61,82	88	80	122	73,94
Civil servant/TNI/POLRI	5	9,09	13	11,82	18	10,91
Private sector	4	7,27	0	0	4	2,42
Self-employed	10	18,18	8	7,27	18	10,91
Farmer/fisherman	2	3,64	1	0,91	3	1,82
Family Income						
≤1.500.000	14	25,45	18	16,36	32	19,39
1600.000-3.200.000	26	47,27	60	54,55	86	52,12
3.300.000-5000.000	12	21,82	17	15,45	29	17,58
>5.000.000	3	5,45	15	13,64	18	10,91
Children age						
01-Apr	46	83,64	66	60	112	67,88
05-Sep	9	16,36	26	23,64	35	21,21
Oct-14	0	0	18	16,36	18	10,91
Children sex						
Male	33	60	66	60	99	60
Female	22	40	44	40	66	40

Source: Primary Data, 2023.

Table 2: Bivariate Analysis Children Pulmonary Tuberculosis at RSUP. Tadjuddin Chalid and RSUD. Labuang Baji Makassar

Variables	Case		Control		Total	
	n	(%)	n	(%)	OR	CI
Child Age						
High Risk	46	83.64	66	60	3.4	1,448-8,673
Risk Low	9	16.36	44	40		
Maternal Education						
High Risk	20	36.36	24	21.82	2.04	0.939-4.419
Risk Low	35	63.64	86	78.18		
Maternal Occupation						
High Risk	21	38.18	22	20	2.47	1,128-5,373
Risk Low	34	61.82	88	80		
Family Income						
High Risk	40	72.73	78	70.91	1.09	0.505-2.437
Risk Low	15	27,27	32	29.09		
Residential Density						
High Risk	31	56.36	40	36.36	2.26	1,109-4,613
Risk Low	24	43.64	70	63.64		

Source: Primary Data, 2023.

According to Table 2, the child age variable has an Odds Ratio (OR) value of 3.40 (95% CI: 1.448-8.673). These findings indicate that a child's age has a significant role in determining the probability of developing pulmonary tuberculosis. Specifically, children in the age range of 0-4 years have a 3.40 times higher risk of contracting pulmonary tuberculosis compared to children aged 5-14 years.

The maternal education variable has an Odds Ratio (OR) value of 2.04 (95% CI: 0.939-4.419). This indicates that maternal education is not a significant risk factor for the occurrence of pulmonary tuberculosis in children. Children with mothers who have not completed high school have a 2.04 times higher chance of developing pulmonary tuberculosis compared to children with mothers who have completed high school or an equivalent level of education.

The variable representing maternal occupation has an Odds Ratio (OR) value of 2.47 (95% CI: 1.128-5.373). Maternal occupation is a notable risk factor for the occurrence of pulmonary tuberculosis in children. It can be inferred that children whose mothers work outside the home for at least 8 hours a day are 2.47 times greater chance of developing pulmonary tuberculosis compared to children whose mothers have flexible working hours or stay at home as housewives.

The variable representing family income has an Odds Ratio (OR) value of 1.09 (95% CI: 0.505-2.437). Family income is considered a risk factor. However, it does not have a statistically significant impact on the occurrence of pulmonary tuberculosis in children.

The residential density variable has an Odds Ratio (OR) value of 2.26 (95% CI: 1.109-4.613). Residential density is a notable risk factor for the occurrence of Pulmonary Tuberculosis in children. It can be inferred that children residing in overcrowded housing face a 2.26 times higher risk of developing Pulmonary Tuberculosis compared to those living in less crowded housing.

According to Table 3, the research concludes that three variables - child age, mother's education, and mother's occupation - are statistically significant. The incidence of Tuberculosis in children is most strongly influenced by maternal education, with an odds ratio (OR) of 4.10 (CI 95%: 1.742-9.669). Children with mothers who have a poor level of education are 4.10 times more prone to developing tuberculosis compared to children with mothers who have a high level of education.

Table 3: Multivariate Analysis Children Pulmonary Tuberculosis Risk Factors at RSUP. Tadjuddin Chalid and RSUD. Labuang Baji Makassar

Research variables	*OR*	(CI 95%)
Age child	3,89	(1,588-9,567)
Maternal education	4,10	(1,742-9,669)
Maternal occupation	2,83	(1,253-6,398)

Source: Primary Data, 2023

The outcomes of multivariate analysis can be affected by the interactions among the variables under investigation. In the first model, certain variables may exhibit large odds ratios (ORs), whereas in the second model, the OR falls. The child's age is the most precarious variable in the first model, whereas the mother's education is the most precarious variable in the second model.

Hence, the regression equation can be expressed as:

$$y = conts + coef_{(age\ child)} + coef_{(maternal\ education)} + coef_{(maternal\ occupation)}$$
$$y = -2,395 + 1,360 + 1,412$$
$$\qquad + 1,041 \tag{1}$$
$$y = 1,418$$

Then the probability calculation is carried out using the following formula

$$P = \frac{1}{(1 + exp^{(-y)})}$$
$$P = \frac{1}{(1 + exp^{(-1,418)})} \tag{2}$$
$$P = 80,5\%$$

According to the calculation results, the probability is that children in the 0–5-year age group, mothers with low education, and mothers who work outside the home for more than 8 hours a day have an 80.5% chance of experiencing pulmonary tuberculosis.

DISCUSSION

The age of children in both groups. The case group (83.64%) and the control group (60%)—who are at high risk. There were 33 cases of male and 22 cases of female children. According to this study, children under the age of 14 have a 3.4 times higher risk of developing tuberculosis than children between the ages of 5 and 14 since they are more susceptible to the illness than adults. When it comes to children under five, the infection is typically acquired within the last year and the source of infections is typically the same home. Children are more susceptible to contracting diseases from external sources when they come into contact with populations beyond their household. Contradicts with other study which found that TB was more common in the age group of 5–14 years (55.8%) than in the 0–4-year age group (44.2%).(8) On the other hand, according to another study, among infants infected with tuberculosis, 43% will develop the disease, followed by 24% in children aged 1 to 5 years, 15% in teenagers, and 5–10% in adults. Young children under five years old are more susceptible to disseminated tuberculosis, which carries a high morbidity and mortality rate. This includes miliary tuberculosis and tuberculous meningitis. (9) The first year following infection, particularly the first six months, is when there is the greatest chance of developing tuberculosis disease from infection.

Most kids spend more time with their closest family members at home. However, a youngster is seemingly to have tuberculosis if an adult patient has the illness. (10) Without realizing it, children who spend more time at home with their mothers will have an impact on the child's development and growth. Since a child's immune system is still developing, it is weaker in children. Therefore, it is imperative to focus on initiatives to preserve children's health to lower child mortality rates and produce a future generation that is intelligent, healthy, and of the highest calibre. (11)

The majority of maternal education in the case group (63.64%) and control group (78.18%) was associated with low risk. Because children tend to rely on their mothers, the mother's education has an impact on the child's health. According to this research, children whose mothers did not attend school or did not complete elementary, middle,

or high school had a 2.04 times higher risk of developing tuberculosis than children whose mothers had completed high school or its equivalent.

Because the research site was in a metropolis, mothers can more easily and rapidly access health information, particularly on the spread of tuberculosis in children. The more comprehensive an individual's expertise, the more this will impact their decision-making on the kind and quantity of food that family, especially the kids. (13) It is undeniable that a person's ability to absorb information and, eventually, their level of knowledge increase with their level of education. (14) The attitude that a person develops toward acceptance, information, and newly offered principles will be hampered by a lack of education.

This study is in line with research which found that educational factors affect the prevalence of pulmonary tuberculosis. (15) This implies that when parents have higher education level, there is a corresponding rise in the number of cases of pulmonary tuberculosis because children tend to learn more about health. Mothers with lower education levels are frequently the mothers of children with pulmonary TB. (16) Moreover, it is indicated a connection between mother education and the prevalence of pulmonary TB in children. (17) There is a stigma and lack of awareness in society around tuberculosis in youngsters. Prolonged waiting periods are a prevalent obstacle to accessing tuberculosis services in numerous contexts. (18) Nevertheless, expedited tuberculosis services can effectively tackle this problem. Enlisting dedicated healthcare professionals can enhance adherence to diagnostic protocols and provide timely consultations and staff responsibility.(19)

By offering health education, one can enhance the awareness of participants regarding the prevention of tuberculosis transmission. Respondents will receive information through health education about preventing the spread of tuberculosis, and they will interpret this information in a way that expands their knowledge base and improves their overall understanding of the topic. It is intended that behaviour changes in preserving and improving health based on knowledge and awareness will result from health education.

The majority of mothers in this study (61.82%) in the case group and (80%) in the control group did not work outside the home. According to this study, children whose mothers worked outside for more than eight hours a day were 2.47 times greater risk to develop pulmonary tuberculosis than children whose mothers were domestic workers or had flexible work schedules. Some mothers choose to spend most of their time at home to oversee and manage their children's growth and development. Since mothers work an average of ≥8 hours a day, there may be variations in the amount of care they provide their kids. Because their place of business is at home, mothers who work as entrepreneurs (10.91%) have more time to spend with their children. The grocery shop and laundry were identified as the business premises based on the research findings.

Parents occupation can impact the level of illness exposure within the family, thus indicating that the nature of their work can affect an individual's susceptibility to contracting a disease. A detrimental work environment heightens the probability of acquiring Tuberculosis. (20) Mothers who are employed outside of their homes come into contact with individuals whose health status is uncertain. Consequently, if they spend a significant amount of time in these external environments, they may inadvertently introduce diseases into their households. (21) Larger families tend to put

conflicting demands on mothers, restricting the time and resources available to care for each child, nevertheless, mothers affect their children's growth. (22)Moreover, farming was the most vulnerable occupation in terms of TB. Rural regions generally exhibit unfavourable economic conditions and limited access to public health services, especially when lacking essential community infrastructure for instance roads, water, and power. (23) Nevertheless, there are adverse consequences associated with the potential infection risk faced by the mother from her colleagues at work. Work is typically evaluated based on the potential for specific exposure, considering the level or degree of exposure and the scale of risk.

The case group and control group both had a significant percentage of family income at risk (72.73%) and (70.91%) respectively. This study discovered that family income was identified as a risk factor, however, it did not demonstrate statistical significance. Fluctuations in revenue will have an impact on expenses. Therefore, individuals with incomes below the minimum wage are considered economically incapable of fulfilling essential food and non-food requirements, as assessed from the perspective of expenditure. Residents with low incomes are defined as those whose average monthly per capita expenditure falls below the minimum wage. Individuals with a monthly income below the minimum wage experience diminished dietary requirements and insufficient food nutrition. This leads to immunodeficiency in the infant, rendering them vulnerable to several diseases, particularly pulmonary tuberculosis.

According to other studies, families with low earnings struggle to afford healthful food because of budgetary constraints. (24) In addition to its economic consequences, pulmonary TB also gives rise to social shame and even social exclusion. There is a significant correlation between income and tuberculosis. (25) Consequently, individuals with lesser income are more prone to experience the circumstances that lead to poverty, resulting in a higher probability of contracting tuberculosis for those in less privileged social classes. (26) Socioeconomic status has the potential to impact every stage of tuberculosis pathogenesis. (27)

This study discovered that there is a significantly higher risk of residential tuberculosis in the case group (43.64%) compared to the control group (63.64%). Specifically, children living in houses with a residential density of more than 2 people/9m^2 have a 2.26 times greater risk of developing pulmonary tuberculosis compared to children living in houses with a residential density of less than 2 people per 9m2. Most families with tuberculosis-infected children reside in densely populated dwellings with more than 5-7 individuals per household. These children lack individual bedrooms, resulting in many of them sharing a room with their parents, while others share a room with their siblings. According to the findings, it is assumed that there are still numerous undetected cases of pulmonary tuberculosis among patients. Many families of pulmonary tuberculosis patients receiving treatment fail to screen their family members, leading to a failure in detecting the route of tuberculosis transmission.

Household exposure to active adult TB patients is a significant risk factor for children contracting Tuberculosis. (28) The primary cause of pulmonary tuberculosis in children is the transmission of the virus from contagious adults. (29) The risk will escalate if there is close contact, specifically residing in the same household as an individual afflicted with tuberculosis. Areas with high population density have the highest prevalence of pulmonary tuberculosis cases. (30)

CONCLUSION

According to the findings of a study carried out at RSUP. Tadjuddin Chalid and RSUD. Labuang Baji. The children age, maternal occupation, and residential density were found to be correlated with children tuberculosis. Nevertheless, the conclusive outcomes of the multivariate analysis revealed that maternal education, child's age, and maternal occupation were the most robust correlation with the occurrence of children tuberculosis. The limitations of this study include the variable of population density. The researcher only conducted interviews with respondents and did not visit the patients' homes directly, thereby obtaining information solely from the respondents' questionnaire responses. Another limitation is the discrepancy between the number of patients in the Pulmonary Clinic and the number of patients in the Pediatric Clinic, necessitating cross-checking of the data by the researcher.

Conflıcts of Interest

There are no conflicts of interest.

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