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A Case Control Studies of Factors that Associated with Tuberculosis of Child

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Abstract

Childhood tuberculosis (TB) remains a major health issue in Magetan District, East Java. Key risk factors include contact history, exposure duration, nutritional status, and parental income. To analyze the association between these factors and TB incidence in children aged 0–5 years. This case-control study was conducted from January to March 2025 at Panekan Health Center, involving 38 respondents (19 cases and 19 controls). Data were collected through structured interviews and medical records. Bivariate analysis used the Chi-square test, and variables with $p < 0.25$ were entered into logistic regression. TB incidence was significantly associated with contact history (OR = 11.56; 95% CI: 2.41–55.39; p = 0.003), exposure duration (OR = 11.56; 95% CI: 2.41–55.39; p = 0.003), and nutritional status (OR = 10.50; 95% CI: 2.34–47.20; p = 0.003). Parental income was not significant (p = 0.097). Multivariate analysis identified contact history (aOR = 8.67; p = 0.013) and poor nutrition (aOR = 7.87; p = 0.018) as dominant predictors. Contact history and poor nutrition strongly predict childhood TB. Strengthening contact tracing and nutritional programs are essential. This study is limited by small sample size, purposive sampling, and potential reporting bias, which may affect generalizability.

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Introduction

Tuberculosis (TB) remains one of the leading infectious diseases globally, with high morbidity and mortality. According to the World Health Organization (WHO, 2023), Indonesia ranks second after India, with an estimated 1.1 million cases annually (World Health Organization, 2023). Approximately 12% of cases occur in children aged 0–14 years, and those aged 0–5 years are particularly vulnerable due to immature immune systems (Wahidah et al., 2023).

Several risk factors contribute to childhood TB, including household contact with adult TB patients, prolonged exposure, poor nutritional status, and low family income (Iis Lestari, 2020)(Wijaya et al., 2021). Previous studies have shown that children with a history of household contact are up to nine times more likely to develop TB (Wijayanti et al., 2020). Likewise, prolonged exposure in enclosed spaces and malnutrition significantly increase susceptibility (Fitria & Rita, 2021). Poverty and limited access to healthcare further exacerbate this risk in many low- and middle-income countries (Singh et al., 2013). Despite growing evidence, there is limited research focusing on rural settings in Indonesia, particularly in East Java. Most existing studies address urban populations, while data on children living in rural districts remain scarce.

This study aims to fill that gap by analyzing the association between household contact, exposure duration, nutritional status, and family income with TB incidence among children aged 0–5 years in Magetan District, East Java.By emphasizing both biomedical and socio-economic determinants, this research highlights the importance of integrating household-based TB control with nutritional and poverty-reduction strategies.

Methods

This research employed an analytical observational design with a case–control approach. The case group consisted of children aged 0–5 years who had been diagnosed with tuberculosis, while the control group consisted of children in the same age range who had not been diagnosed with tuberculosis. The study was conducted at Panekan Community Health Center from January to March 2025. The study population included all children aged 0–5 years living in households with or without adult TB patients. A total of 38 respondents were recruited using consecutive sampling, consisting of 19 cases and 19 controls. Parents or guardians were interviewed to obtain information related to exposure history and household characteristics. The dependent variable was the incidence of tuberculosis in children, which was confirmed through medical records from the Community Health Center. The independent variables were contact history, duration of exposure, nutritional status, and family income. Contact history was defined as whether the child had lived in the same household with an adult TB patient for at least two weeks, categorized as "yes" or "no." Duration of exposure referred to the average number of hours per day the child spent in the same room with the adult TB patient and was classified as less than eight hours or eight hours and above. Nutritional status was assessed using anthropometric indicators based on weight-for-age Z-scores and was categorized into good nutrition (Z-score ≥ -2 SD) and undernutrition (Z-score < -2 SD) according to WHO growth standards. Family income was classified by comparing the household's monthly income to the regional minimum wage, categorized as below the minimum wage or equal to/above the minimum wage. Information on these variables was collected through structured questionnaires completed by parents or guardians and verified using health records.

Data were collected through face-to-face interviews with parents or guardians using standardized questionnaires and supplemented with secondary data from medical records. All collected data were coded and entered into SPSS software for analysis. Bivariate analysis was conducted using chi-square tests to examine the associations between independent variables and TB incidence. Variables with p-values less than 0.25 were included in the multivariate analysis, which was carried out using logistic regression. The strength of the associations was presented as odds ratios (OR) with 95% confidence intervals (CI), and statistical significance was set at $p<0.05$.

Results

A total of 38 respondents were included in this study, consisting of 19 cases (children with TB) and 19 controls (children without TB). The mean age of respondents was 3.2 years (SD= 1.4), and the gender distribution was relatively balanced (52.6% male vc 47.4% female).

Table 1. Characteristics of respondens

Variable	Cases (n=19)	Controls (n=19)	Total (n=38)
Age (mean ± SD)	3.4 ±1,5	3.0 ± 1,2	3.2 ± 1,4
Male	10 (52.6%)	10 (52.6%)	20 (52.6%)
Female	9 (47.4%)	9 (47.4%)	18 (47.4%)

Bivariate analysis showed significant associations between childhood TB incidence and history of contact, duration of exposure, and poor nutritional status. Family income was not significantly associated.

Table 2. Distribution of main variables

Variable	Cases (n=19)	Controls (n=19)	OR (95% CI)	p-value
History of contact (Yes)	16 (84.2%)	5 (26.3%)	11.56 (2.41–55.39)	0.001
Duration ≥8 hrs/day	15 (78.9%)	5 (26.3%)	11.56 (2.41–55.39)	0.001
Poor nutrition	14 (73.7%)	4 (21.1%)	10.50 (2.34–47.20)	0.002
Low income	12 (63.2%)	7 (36.8%)	3.11 (0.79–12.14)	0.091

Multivariate logistic regression identified history of contact and poor nutritional status as dominant predictors of TB incidence in children.

Table 3. Multivariate logistic regression of risk factors

Variable	aOR	95% CI	p-value
History of contact	8.67	1.92–39.20	0.005
Poor nutrition	7.87	1.64–37.65	0.009

Confidence intervals were relatively wide, reflecting the small sample size and potential limitations in precision.

Discussion

This study confirmed that close contact with adult TB patients and poor nutritional status were the most dominant predictors of childhood TB in Magetan District. These findings are consistent with previous studies in Indonesia and other high-burden countries, which reported that household contact increases the risk of TB in children up to ninefold. Prolonged exposure in poorly ventilated environments further facilitates transmission of Mycobacterium tuberculosis (Singh et al., 2013)(Fox et al., 2018).

The significant role of nutritional status highlights the vulnerability of undernourished children. Malnutrition impairs immune function, reducing the body's ability to contain latent infection and increasing progression to active TB. Similar results have been reported in India and Vietnam, where undernutrition was identified as one of the strongest modifiable determinants of TB (Bhargava et al., 2013)(Martinez et al., 2020). In the context of Magetan, a rural district with socioeconomic challenges, poor dietary diversity and household poverty may compound this risk.

Unlike some studies, family income was not significantly associated with TB incidence in this study. This may be explained by relative homogeneity of socioeconomic status in the study area, limiting observable differences between cases and controls. Nevertheless, poverty remains a recognized determinant of TB globally, and its indirect effects should not be overlooked (Cegielski & McMurray, 2004).

Novelty of this study lies in its focus on a rural Indonesian population, where evidence remains limited. By combining biomedical and socioeconomic risk factors, the study contributes to a more comprehensive understanding of TB determinants in early childhood. In the Indonesian context, these findings align with the national "TOSS TB" program, which emphasizes early detection and treatment of all TB cases and their contacts (Kemenkes RI, 2019). Strengthening contact tracing for children in rural areas such as Magetan could accelerate the achievement of TB elimination targets set for 2030 under the Sustainable Development Goals (SDGs) (Chamber, 2025). Integrating nutritional support into TB programs is also crucial, as malnutrition remains highly prevalent in rural East Java and contributes significantly to disease progression. Future research should also examine environmental determinants such as household ventilation and crowding, which may interact with nutritional and socioeconomic risk factors in shaping TB transmission among young children.

Limitations : This study used a small sample size with purposive sampling, which may reduce statistical power and introduce selection bias. Wide confidence intervals suggest limited precision of estimates, and residual confounding cannot be ruled out. Findings should therefore be interpreted cautiously and may not be fully generalizable.

Conclusion

Contain This study demonstrates that history of contact with adult TB patients and poor nutritional status are the strongest predictors of childhood TB in Magetan District, East Java. Children with prolonged exposure to infectious adults and those who are undernourished face substantially higher risk of TB. These findings underscore the importance of strengthening household contact tracing and integrating nutritional support into TB control programs at the community level. Public health interventions in rural districts should not only focus on early case detection but also address malnutrition and poverty-related vulnerabilities that exacerbate TB transmission among children.Future research with larger sample sizes and longitudinal designs is recommended to better establish causal relationships and to explore the role of environmental and socioeconomic factors more comprehensively.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Health Research Ethics Committee of STIKES Bhakti Husada Mulia Madiun (protocol number: 004/E KEPK/STIKES/BHM/V/2025, approved in May 2025).

References

Bhargava, A., Chatterjee, M., Jain, Y., Chatterjee, B., Kataria, A., Bhargava, M., Kataria, R., D'Souza, R., Jain, R., Benedetti, A., Pai, M., & Menzies, D. (2013). Nutritional Status of Adult Patients with Pulmonary Tuberculosis in Rural Central India and Its Association with Mortality. PLoS ONE, 8(10), 1–11. https://doi.org/10.1371/journal.pone.0077979

Cegielski, J. P., & McMurray, D. N. (2004). The relationship between malnutrition and tuberculosis: Evidence from studies in humans and experimental animals. International Journal of Tuberculosis and Lung Disease, 8(3), 286–298.

Chamber, T. C. (2025). SDG Action Segment for Goal 5 equality and empower all.

Fitria, P. A., & Rita, E. (2021). Karakteristik Skrining yang Berhubungan Dengan Kejadian Tuberkulosis (TB) Paru pada Anak. Indonesian Journal of Nursing Sciences and Practices, 2.

Fox, G. J., Nhung, N. V., Sy, D. N., Hoa, N. L. P., Anh, L. T. N., Anh, N. T., Hoa, N. B., Dung, N. H., Buu, T. N., Loi, N. T., Nhung, L. T., Hung, N. V., Lieu, P. T., Cuong, N. K., Cuong, P. D., Bestrashniy, J., Britton, W. J., &

Marks, G. B. (2018). Household-Contact Investigation for Detection of Tuberculosis in Vietnam. New England Journal of Medicine, 378(3), 221–229. https://doi.org/10.1056/nejmoa1700209

Iis Lestari. (2020). Hubungan Antara Investigasi Kontak Dengan Penemuan KasusTuberkulosis Pada Anak Di Wilayah Kerja Puskesmas Johar Baru,Jakarta Pusat. 012.

Kemenkes RI. (2019). Lembar Balik TOSS TB. Tuberkulosis (TB), 70. https://tbindonesia.or.id/page/view/9/apa-itu-tbc

Martinez, L., Cords, O., Horsburgh, C. R., Andrews, J. R., Acuna-Villaorduna, C., Desai Ahuja, S., Altet, N., Augusto, O., Baliashvili, D., Basu, S., Becerra, M., Bonnet, M., Henry Boom, W., Borgdorff, M., Boulahbal, F., Carvalho, A. C. C., Cayla, J. A., Chakhaia, T., Chan, P. C., … Zhu, L. (2020). The risk of tuberculosis in children after close exposure: a systematic review and individual-participant meta-analysis. The Lancet, 395(10228), 973–984. https://doi.org/10.1016/S0140-6736(20)30166-5

Singh, J., Sankar, M. M., Kumar, S., Gopinath, K., Singh, N., Mani, K., & Singh, S. (2013). Incidence and Prevalence of Tuberculosis among Household Contacts of Pulmonary Tuberculosis Patients in a Peri-Urban Population of South Delhi, India. PLoS ONE, 8(7), 1–11. https://doi.org/10.1371/journal.pone.0069730

Wahidah, L., Wardani, R. S., & Meikawati, W. (2023). Faktor Kejadian Tuberkulosis Paru Pada Anak Usia 5-14 Tahun. Prosiding Seminar Kesehatan Masyarakat, 1, 23–28.

Wijaya, M. S. D., Mantik, M. F. J., & Rampengan, N. H. (2021). Faktor Risiko Tuberkulosis pada Anak. E-CliniC, 9(1), 124–133. https://doi.org/10.35790/ecl.v9i1.32117

Wijayanti, H. N., Tamtomo, D., & Suryani, N. (2020). Hubungan antara pemberian imunisasi BCG , status gizi dan lingkungan rumah dengan kejadian penyakit TB paru pada anak balita. Holistik Jurnal Kesehatan, 14(3), 420–428.

World Health Organization. (2023). Global Tubercolusis Report 2023. In January: Vol. t/malaria/ (Issue March).