Preprints.org

Article

Not peer-reviewed version

The Risk Factor Associated with Leprosy Cases in Children under Fifteen Years Old, in Dili, Liquica, Manatuto, Baucau, Raeoa Timor Leste 2014-2023

Pascuela Apriani da Silva *, Aniceto Cardoso Barreto *, Valente da Silva , Nelson Martins

Posted Date: 22 October 2024

doi: 10.20944/preprints202410.1619.v1

Keywords: risk factors; household contacts; household crowding; inadequate ventilation; nutritional deficiency

Preprints.org is a free multidiscipline platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 22 October 2024 doi:10.20944/preprints202410.1619.v1

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Article

The Risk Factor Associated with Leprosy Cases in Children under Fifteen Years Old, in Dili, Liquica, Manatuto, Baucau, Raeoa Timor Leste 2014-2023

Pascuela Apriani da Silva [1,2,*], Aniceto Cardoso Barreto [1,3], Valente da Silva [1] and Nelson Martins [1,4]

[1] Universidade da Paz, Manleuana, Dili, Timor Leste; aniceto_barreto@yahoo.com; valentesilva1958@gmail.com; nmdasilaku@gmail.com

[2] Misaun Lepra Timor Leste, Tibar, Liquiça, Timor Leste

[3] Hospital Nasional Guido Validares, Bidau, Dili, Timor Leste, [4]Menzies, Lecidere, Dili, Timor Leste

* Correspondence: ellaaprianisilva@gmail.com

ABSTRACT: Objective : Children < 15 years old are thought to be the most vulnerable group to contracting the infection than adults due to their immature or developing immunity.We investigated whether index patient child leprosy are associated with parental education, parental unemployment, parental income, household crowding, inadequate ventilation household contacts, neighbor contact and nutritional deficiency in Dili, Liquica, Manatuto, Baucau, RAEOA. **Methods:** We designed matched case-control study. Cases were fathers of children with leprosy under 15 years old while controls were non random sample of children without leprosy who live in the same household and neighbourhood with child leprosy < 15 years who have the same age and gender with child leprosy. The case-to-control ratio was 1:2. We identified the factors that significantly differed between the cases and controls in a multivariable binary logistic regression analysis and reported the odds ratio (OR) and 95% confidence interval (CI). **Results:** We found similar demographic among the 40 cases and 80 controls. The research results indicated that out of the 8 variables examined, 4 variables household contacts, household crowding, inadequate ventilation, and nutritional deficiency were significant risk factors (P value < 0.005). In a multivariate analysis, household contact was identified as a significant factor in the occurrence of leprosy in children under 15 years old (P value = 0.003, AOR = 3.788, 95% CI: 1.593–9.003). Conclusion: Considering that household contacts consist of a recognizable group of individuals under 15 years old with a high risk of disease, as they live in close proximity to a source of infection, it is essential to focus on education, routine screening, and the application of chemoprophylactic protocols towards leprosy prevention among household contacts, especially blood relatives.

Keywords: risk factors; household contacts; household crowding; inadequate ventilation; nutritional deficiency

Introduction

Leprosy, also known as Hansen's disease, is caused by infection with *Mycobacterium leprae.* It is a chronic infectious disease that primarily affects the skin and peripheral nerves. It varies from a localized to a systemic infection. Damage to the peripheral nerves can lead to severe impairment and disability. (1)

A diagnosis of leprosy is based on the presence of specific clinical signs and the loss of skin sensation, which may or may not be associated with thickened nerves. While there are no laboratory tests that can confirm the presence of all cases of leprosy, the identification of acid-fast bacilli (AFB) in skin smears is an irrefutable indicator of a leprosy diagnosis. (2) The WHO classification defines only two types of Leprosy: Paucibacillary (PB) and multibacillary (MB). Paucibacillary has 1 to 5 Lesion definite loss of sensation and only one nerve trunk with the negative identification of acid-fast bacilli (AFB) in skin smears while Multibacillary more then 5 lesions with loss of sensation may or

© 2024 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 22 October 2024 doi:10.20944/preprints202410.1619.v1

may not be present and more then one nerve trunk with the positive identification of acid-fast bacilli (AFB). (2)

A total of 1 0 302 new child cases (5.9% of total new cases) was reported globally in 2022, corresponding to a rate of 5.1 per mil population. Most of the child cases were reported from SEAR (70.1%) with a child case detection rate of 14 per million child population. The rate of detection of child cases increased by 14.6% over 2021 (8991 cases), the increase being most marked in SEAR (27.4%). (3)

The proportion of child cases among new cases ranged from 0.6% in the Bolivarian and Republic of Venezuela to 35.1% in Kiribati. (4)

The incidence of leprosy in children under the age of 15 represents a significant epidemiological indicator. A correlation has been identified between this indicator and recent disease, as well as active foci of transmission within the community. (4)

The risk of developing the disease was found to be elevated in both household and neighbourhood contacts, with an increased risk of up to ninefold and fourfold, respectively. (5,6)

Conversely, the evidence indicated that individuals residing in urban settings were more susceptible to leprosy diagnosis than those in rural areas. (7)

The study revealed that the likelihood of the disease manifesting is significantly elevated among children who have resided in the area for a minimum of five years. Immature immunity may be related to the nutritional status of children. And it is considered to be one of the modulators of the immune response and an important determinant of the risk and prognosis of infectious diseases. This, in turn, is directly influenced by diet. A balanced diet is directly related to immunity, as nutrient deficiencies affect immunological responses and compromise the body's defense against infectious agents. (8)

This may be related to the fact that they inhabit a spatial clustering of endemic disease and share situations of poverty, in which transmissibility is facilitated, since unfavorable socioeconomic conditions and precarious housing conditions influence the risk of acquiring the disease. (6)

Based on Leano *et al* study the factors that were found to be associated with the occurrence of leprosy include: unemployment, non-permanent residence, housing structure (wooden or wattle and daub), number of rooms, number of individuals residing in the household, solid waste management practices, and access to electricity. In instances of recurrence, evidence suggests that individual conditions, adult or elderly life stage, male gender, and multifactorial operational classification are contributing factors. (9)

Moreover, direct indicators of deprivation, including the absence of family income, a lower level of education, and factors reflecting unfavorable living conditions, were found to be associated with an incidence of leprosy that was up to two times higher. A gradient effect was observed, indicating that the risk of leprosy increased with a reduction in income and educational attainment. (7)

The case of lepra from 2012 to 2021 in children under 15 years of age in Timor-Leste recorded 65 cases, which in 2021 recorded 9 cases with 1 G2D. (10)

To date, there has been no study commissioned to investigate and examine the risk factors contributing to the occurrence of child leprosy in Timor-Leste. Such research is important for developing targeted strategies to address and manage the disease more effectively in this population in Timor-Leste.

Research Methods

Setting and Data Source

We abstracted medical records child leprosy patient between January 2014 to December 2023 at Dili. Liquisa, Manatuto Baucau and RAEOA.

Data were abstracted from an electronic data base of local NGO Misaun Lepra Timor Leste and a register book of leprosy patients at a health center. We excluded child diagnosed with leprosy were not at health facility in Dili, Liquisa, Manatuto, Baucau and RAEOA and children without leprosy disease that live far more than 100 meters with child of leprosy. Ethical approval was from the Unit of Ethical Research and Development (UEPD) in Institute National of Public Health Timor Leste.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 22 October 2024 doi:10.20944/preprints202410.1619.v1

Informed consent was waived by the Ethics Committee given the analysis involved secondary anonymous data. Demographic data included age, sex, residence. Risk factor include parental educational level measured using iletrate - Presecondary and Secondary- universitary, Parental income is simplifier to perform more than $115 per month or less than $115 per month. Respectively: nutritional status, parental unemployement, household contact, neighboard contact, household crowding and inadequate ventilation are highly correlated to the occurrence of leprosy in children. (7)

Study Design and Measurements

We designed matched case-control study. Cases were fathers of children with leprosy under 15 years old while controls were non random sample of children without leprosy who live in the same household and neighborhood with child leprosy < 15 years who have the same age and gender with child leprosy. For one case, we selected two controls.

Baseline demographic and risk factors were considered as the exposures of interest, with the outcome as children with leprosy < 15 years, measured on a binary scale (yes vs no)

Statistical Methods

We hypothesized that leprosy disease will more likely occur among children < 15 years old that parents had minimum level of education, unemployed, monthly income of less than $115, household crowded, inadequate ventilation, household contact, neighbor contact with leprosy, nutritional deficiency are more likely to develop leprosy than children whose parents have maximum level of education, employed, monthly income of more than $115, homes are not crowed, adequate ventilation, no have contact with leprosy patients in the house, no have contact with leprosy patients in the neighbor, children whose have a good nutrition.

Sample size was determined using the formula according Sastroasmoro and Ismael were 40 cases. Numerical data were summarized as mean and standard deviation. Categorical data were summarized as frequencies and percentages. Bivariate analysis for categorical data was performed using the chi-square test for cell counts ≥5.

For numerical data, the t test was used as the data were normally distributed. Variables with P <0.05 were considered statistically significant in the bivariate analysis. Factors associated with being a case were modeled using a binary logistic regression, adjusted for relevant factors with P <0.25 in the bivariate analysis. We reported the odds ratio (OR), Adjust Odds ratio (A0D) and 95% confidence interval (CI).

Results

A total of 65 cases were retrieved from the records, of which 26 were excluded for various reasons, including residence outside the municipalities of Dili, Liquica, Manatuto, Baucau, and RAEOA. Of the 49 children with leprosy, only 40 were selected as the sample size. Additionally, 80 fathers without leprosy in their children were non randomly selected as the control group.

Of the 120 study participants, 48% corresponded to case group, and 96% corresponded to the control group. Notified cases of children and adolescents with leprosy showed a mean age of 12,74 years, with a minimum age of 6 year and a maximum of 14 years. The results presented in Table 1 show that among cases, the female gender group comprised 37.5%, compared to 33% for the male group. In contrast, for the control group, females made up 62.5%, while males comprised 68.2%. The geographic location from Urban the case group was 29,2 compared with the control group was 70,8%. Meanwhile the rural area of the case group was 33,8 when compared to the control group was 66,3%. There was a significant normal distribution of data according to the age categories, gender and geographic location which is P Value > 0.05.

Table 2 shows that risk factors of household contacts, household crowding, inadequate ventilation, and nutritional deficiency were significant risk factors (P value < 0.005). In a multivariate analysis, household contact was identified as a significant factor in the

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 22 October 2024 doi:10.20944/preprints202410.1619.v1

occurrence of leprosy in children under 15 years old (P value = 0.003, AOR = 3.788, 95% CI: 1.593–9.003)

Table 1. Participants characteristics.

Characteristic of respondent	Level	Cases (n = 40)	Control (n = 80)	P.Value
Age	6-12			
	13-14	13 (32,5)	27 (67,5)	0,891 > 0,05
		27 (33,8)	53 (66,3)	
Gender	Female			
	Male	12 (37,5)	20 (62,5)	0,5559 > 0,05
		28 (31,8)	60 (68,2)	
Geographic location	Urban			
	Rural			
		21 (29,2)	51 (70,8)	0,236 > 0,05
		19 (39,6)	29 (60,4)	

Source: SPSS Processing Results.

Table 2. Unadjusted and adjusted analysis findings.

Variable	Level	Binary logistic regression analysis	
		Bivariate analysis (OR,95%)	Multivariate Analysis (AOD, 95% CI)
Parental Unemployement	Yes No	**3,002 (1,006-9,421)**	
Household contact with people affected by leprosy	Yes No	**4,167 (1,822-9,528)**	**3,788 (1,593-9,003)**
Nutritional deficiency	Yes No	**2,360 (1,164- 7,788)**	
Household crowding	Yes No	**2,379 (1,174-7,827)**	
Inadequate Ventilation	Yes No	**3,436 (2,200-9,948)**	
Neighbor Contact	Yes No	0,527 (0,226-1,227)	

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 22 October 2024 doi:10.20944/preprints202410.1619.v1

Parental education level	Ilitrate-Presecondary	0,566 (0,259-1,240)
	Secondary-Universitary	
Parental Income	Less than $115	1,204 (0,520-2,789)
	More than $115	

Source: SPSS Processing Results. Note: Bolded figures indicate statistically significant results at a 5% level of statistical significance. aOR, adjusted odds ratio; OR, crude odds ratio.

Discussion

Our study showed that leprosy disease in children is higher among parental unemployment, household contacts, household crowding, inadequate ventilation, and nutritional deficiency.

Pooled estimates between work and leprosy showed high statistical heterogeneity across studies, which may indicate that performing manual or agricultural work may correspond to different levels of poverty and living conditions in the different study settings (e.g. India, Brazil, Bangladesh or Sri Lanka), resulting in different levels of exposure to M. leprae or chances of developing symptomatic disease. Unemployment as risk factor was also studied (11)

As expected, household contact/index case co-habitation with high bacillary load was shown to be a key risk factor in developing leprosy compared with the general population and non-household contacts.

Considering the same type of study Romero-Montoya et al of household contact, the higher incidence among blood relatives within a nuclear family, as compared to the other blood relatives, demonstrates the component of genetic predisposition, which has been widely reported. Also reported that the children appear to be more prone to illness than other family members. This finding highlights the importance of close interpersonal contact in the transmission of leprosy. It suggests that leprosy is likely to spread within families or close communities. (12)

In this study it is also the same as the study associated with the study's socioeconomic factors from Brazil and Bangladesh revealed that food shortage at any time of life was associated with leprosy. Poverty is a major factor for nutritional deficiency of proteins, fruits and vegetables. Diet and nutrition an important risk factor in leprosy. (13)

Improving dietary diversity or nutrition of people living in high-prevalence communities can be tried as one of the measures to control the transmission of leprosy. (13)

The study has shown that in one house there are only 1-3 bedrooms while the people who live together in one house exceed 6 people. Overcrowding often leads to poor sanitation and increased person-to-person contact, both of which can facilitate the spread of infectious diseases like leprosy. Human respiratory activities also affect the airflow distribution structure. Breathing, coughing, and sneezing may all affect the room airflow. (7)

This study showed that houses with no ventilation or houses with windows size was < 60 cm also contributed of contracting leprosy in children < 15 years old.

According to Hong ye kek (2022) ventilation efficiency indicates the ventilation system's ability to remove the contaminants in the space at a given air exchange rate. Natural or mechanical ventilation can provide adequate air exchanges to reduce the risk of airborne microbial spread when the design and placement location is appropriate. Improving ventilation in living areas could be an important preventive measure, potentially reducing the incidence of leprosy. (14)

Conclusions and Recommendation

Children under 15 years who have contact with a leprosy patient in their household, with parental unemployed, nutritional deficiency, household crowding, inadequate ventilation, are more likely to develop leprosy compared to children who have no such contact, employed, good nutritional, no overcrowded, adequate ventilation. Therefore, considering that household contacts

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 22 October 2024 doi:10.20944/preprints202410.1619.v1

consist of a recognizable group of individuals under 15 years old with a high risk of disease, as they live in close proximity to a source of infection, it is essential to focus on education, routine screening, and the application of chemoprophylactic protocols towards leprosy prevention among household contacts, especially blood relatives.

Acknowledgments: We thank NGO Misaun Lepra Timor Leste and Clinical Health Center around Dili, Liquisa, Manatuto, Baucau, and RAEOA for their support in data acquisition. This manuscript arose from a dataset from the Master of Public Health (MPH) dissertation of MS. Pascuela Apriani da Silva.

References

1. Ploemacher, T., Faber, W. R., Menke, H., Rutten, V., & Pieters, T. (2020). Reservoirs and transmission routes of leprosy; A systematic review. *PLoS Neglected Tropical Diseases*, *14*(4), 1–27. https://doi.org/10.1371/journal.pntd.0008276
2. WHO. (2017). Diagnosis of leprosy. Hämtat från http://www.who.int/lep/diagnosis/en/
3. WHO. (2023). Hämtat från https://www.who.int/data/gho/data/indicators/indicator-details/GHO/leprosy---number-of-new-child-(less-than-15-years-of-age)-cases 2018
4. Barreto, J. G., Frade, M. A. C., Bernardes Filho, F., da Silva, M. B., Spencer, J. S., & Salgado, C. G. (2017). Leprosy in Children. In *Current Infectious Disease Reports* (Vol. 19, Issue 6). Current Medicine Group LLC. https://doi.org/10.1007/s11908-017-0577-6
5. Ruiz-Fuentes, J. L., Rumbaut Castillo, R., Hurtado Gascón, L. D. L. C., & Pastrana, F. (2019). Leprosy in children: A Cuban experience on leprosy control. In *BMJ Paediatrics Open* (Vol. 3, Issue 1). BMJ Publishing Group. https://doi.org/10.1136/bmjpo-2019-000500
6. Rodrigues, T. S. V., Gomes, L. C., Cortela, D. C. B., Silva, E. A., Silva, C. A. L., & Ferreira, S. M. B. (2020). Factors associated with leprosy in children contacts of notified adults in an endemic region of Midwest Brazil. *Jornal de Pediatria*, *96*(5), 593–599. https://doi.org/10.1016/j.jped.2019.04.004
7. Nery, J. S., Ramond, A., Pescarini, J. M., Alves, A., Strina, A., Ichihara, M. Y., Fernandes Penna, M. L., Smeeth, L., Rodrigues, L. C., Barreto, M. L., Brickley, E. B., & Penna, G. O. (2019). Socioeconomic determinants of leprosy new case detection in the 100 Million Brazilian Cohort: a population-based linkage study. *The Lancet Global Health*, *7*(9), e1226–e1236. https://doi.org/10.1016/S2214-109X(19)30260-8
8. Farias, M. N., Calças, N. C., Da Costa, L. P., Oliveira, T. de S. da S., Hairrman, R. S., Trindade, M. M. da S., Moraes, M. C. de O., & De Oliveira, A. K. M. (2022). Nutritional status of a leprosy patient in a referral hospital: case report / Estado nutricional de um paciente com hanseníase em um hospital de referência: relato de caso. *Brazilian Journal of Health Review*, *5*(1), 2192–2202. https://doi.org/10.34119/bjhrv5n1-193
9. Leano, H. A. de M., Araújo, K. M. da F. A., Bueno, I. de C., Niitsuma, E. N. A., & Lana, F. C. F. (2019). Socioeconomic factors related to leprosy: an integrative literature review. In *Revista Brasileira de Enfermagem* (Vol. 72, Issue 5, pp. 1405–1415). Associacao Brasilerira de Enfermagem. https://doi.org/10.1590/0034-7167-2017-0651
10. WHO. (den 2023 SEPTEMBER 2023). Weekly epidemiological record. 37, ss. 409-430. Hämtat från http://www.who.int/wer den 08 FEBRUARY 2023
11. Pescarini, J. M., Strina, A., Nery, J. S., Skalinski, L. M., Andrade, K. V. F. de, Penna, M. L. F., Brickley, E. B., Rodrigues, L. C., Barreto, M. L., & Penna, G. O. (2018). Socioeconomic risk markers of leprosy in high-burden countries: A systematic review and meta-analysis. *PLoS Neglected Tropical Diseases*, *12*(7). https://doi.org/10.1371/journal.pntd.0006622
12. Dwivedi, V. P., Banerjee, A., Das, I., Saha, A., Dutta, M., Bhardwaj, B., Biswas, S., & Chattopadhyay, D. (2019). Diet and nutrition: An important risk factor in leprosy. In *Microbial Pathogenesis* (Vol. 137). Academic Press. https://doi.org/10.1016/j.micpath.2019.103714
13. Narang, T., & Kumar, B. (2019). Leprosy in children. *Indian Journal of Paediatric Dermatology*, *20*(1), 12. https://doi.org/10.4103/ijpd.IJPD_108_18
14. Hong Yee Kek, S. B. (2023). Ventilation strategies for mitigating airborne infection in health care facilities: A review ang Bibliometric Analysis. *Energy and Buldings, 295*. doi:http://doi.or/10.1016/j.enbuild.2023.113323

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.