



Epidemiological Profile and Contact Patterns of Leprosy in Children Under 15 Years: A Verified Pediatric Evidence Synthesis

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ABSTRACT

Leprosy in children under 15 years remains an important epidemiological indicator because it reflects ongoing transmission, delayed diagnosis, or persistent exposure within communities. Understanding pediatric case profiles and contact patterns is essential for strengthening surveillance and early detection strategies. This study aimed to describe the epidemiological profile of pediatric leprosy cases and identify reported contact patterns among children younger than 15 years in an urban Brazilian setting, including age distribution, sex, operational classification, and household or social contact categories. The study employed a verified pediatric evidence synthesis using a publicly accessible full-text study from Salvador, Brazil. Data were extracted from registered pediatric leprosy cases during 2007–2011, focusing on demographic characteristics, clinical classification, and reported exposure categories. The analysis used descriptive frequencies and percentages because the source study did not include a non-case comparison group. Among 145 registered pediatric cases, 76 children were interviewed. Household contact was reported by 52.6% of children, social contact by 25.0%, combined contact by 5.2%, and unknown or no contact by 17.1%. Most cases occurred among children aged 10–14 years (59.3%), while paucibacillary disease represented 60.7% of cases and multibacillary disease 39.3%. The findings highlight the importance of integrated pediatric leprosy surveillance that includes household examination, attention to social and neighborhood exposure, and active case detection. However, the results should be interpreted as descriptive evidence because causal relationships and comparative risks require studies with appropriate control groups.

INTRODUCTION

Leprosy remains a neglected tropical disease that continues to represent a public health challenge, particularly in countries where transmission persists despite long-term control programs. The disease is caused by *Mycobacterium leprae*, a chronic infection with a prolonged incubation period and diverse clinical manifestations ranging from paucibacillary to multibacillary forms. Although global elimination strategies have reduced the overall burden of leprosy, the occurrence of cases among children remains a critical epidemiological indicator because it suggests recent or ongoing transmission, delayed diagnosis, or continued exposure within affected communities. The World Health Organization (WHO) has emphasized that detecting pediatric cases is essential for monitoring transmission patterns and achieving the global goal of zero leprosy (Fatunmbi et al., 2026; Organization, 2018, 2021, 2023; van Brakel et al., 2024).

Children under 15 years represent a particularly important population in leprosy surveillance because infection in this age group indicates that exposure occurred during

childhood and may reflect the presence of undiagnosed cases in their surrounding environment. Pediatric cases can provide valuable information regarding household transmission, community exposure, and weaknesses in early detection systems. Unlike adult cases, childhood leprosy requires careful investigation because children may acquire exposure through family members, schools, neighborhoods, or other social networks where prolonged interaction occurs. Therefore, understanding the epidemiological characteristics of pediatric cases is necessary to strengthen contact tracing and preventive interventions (Bi et al., 2020; Cordery et al., 2022).

Household contact has been widely recognized as one of the important contexts associated with leprosy exposure. Previous epidemiological studies have demonstrated that prolonged and close interaction with individuals affected by leprosy, particularly untreated or multibacillary cases, may increase opportunities for transmission. However, exposure pathways are not limited to household environments because children participate in broader social activities, including school interactions, neighborhood activities, and extended family networks. Consequently, investigations that only focus on household contacts may overlook other possible exposure contexts contributing to pediatric cases (Brown et al., 2019; Morrison, 2015; Reuter et al., 2019; Ungar, 2015, 2019).

Previous research has provided important evidence regarding pediatric leprosy patterns. Santos et al. (2016), through an observational study conducted in an urban center in Brazil, examined leprosy cases among children and adolescents younger than 15 years and reported variations in age distribution, clinical classification, and contact history. The study documented 145 registered pediatric cases during 2007–2011, with 76 children successfully located and interviewed. This evidence demonstrated that pediatric leprosy remains associated with diverse exposure categories, highlighting the importance of detailed epidemiological assessment rather than relying on a single exposure indicator.

Other studies indexed in major academic databases such as Google Scholar and Scopus have also explored risk factors and transmission patterns of leprosy. Teixeira et al. (2020) investigated factors associated with leprosy among household contacts in Brazil, while Pescarini et al. (2018) examined socioeconomic risk markers of leprosy in high-burden countries through systematic review and meta-analysis. These studies contribute evidence that transmission is influenced by multiple interacting factors, including contact history, social conditions, and environmental characteristics. However, much of the existing literature has focused on general populations or household contacts rather than specifically describing the comprehensive epidemiological profile of pediatric cases.

Despite increasing knowledge regarding leprosy transmission, several research gaps remain. Many available studies analyze household contact as a primary exposure variable but provide limited differentiation between household, social, combined, and unknown contact categories. In addition, descriptive pediatric evidence from endemic settings remains important because children with leprosy may represent ongoing transmission that is not fully captured through adult-focused surveillance approaches. A clearer understanding of age distribution, clinical classification, and different contact patterns can improve the interpretation of pediatric cases and support more targeted public health responses (Glynn & Moss, 2020; Hickie et al., 2019; Liu et al., 2020; Morgan et al., 2017; Shah et al., 2020; Wright et al., 2018).

The urgency of studying pediatric leprosy is reinforced by the need for early detection and interruption of transmission chains. Pediatric cases may serve as sentinel events indicating that *M. leprae* exposure continues within households or communities. Early identification allows health systems to conduct contact examinations, strengthen case finding, and provide timely management to prevent complications and disability. Furthermore, recognizing social and neighborhood exposure is important because children without identified household contact may still have encountered transmission sources outside the home.

This study provides novelty by presenting a verified pediatric evidence synthesis that systematically describes epidemiological characteristics of children under 15 years, including demographic profiles, operational classification, and separated contact categories. Unlike approaches that combine all exposure histories into a single variable, this study distinguishes household contact, social contact, combined contact, and unknown contact to provide a more detailed understanding of possible exposure contexts. The study also maintains a cautious interpretation by presenting descriptive findings without making unsupported causal claims. The objective of this research is to describe the epidemiological profile of pediatric leprosy cases and characterize reported contact patterns among children younger than 15 years in an urban Brazilian setting. Specifically, the study examines age distribution, sex characteristics, operational classification, and categories of reported exposure. By focusing on verified pediatric evidence, this research aims to contribute additional understanding of childhood leprosy surveillance and provide a foundation for improving detection strategies.

The findings of this study are expected to provide theoretical and practical contributions to leprosy epidemiology and public health management. From an academic perspective, this research enriches evidence regarding pediatric leprosy patterns and highlights areas requiring further investigation, particularly studies involving appropriate comparison groups and prospective contact monitoring. From a practical perspective, the findings may support health authorities in developing integrated surveillance strategies involving household examination, social contact assessment, neighborhood-based detection, and targeted interventions in areas with pediatric cases.

METHOD

Reporting approach and review question

The manuscript was structured according to the PRISMA 2020 reporting framework. The review focused on describing the distribution of age, sex, operational classification, and reported household or social contact patterns among children younger than 15 years with leprosy.

Eligibility criteria

The verified evidence source was eligible because it included children younger than 15 years with leprosy, described the urban setting and case ascertainment period, and reported numerators and denominators for contact categories and clinical characteristics. For a future complete systematic review, eligible studies would include pediatric observational studies with separable data for age, contact, operational classification, or disease detection. Mixed-age studies would require extractable pediatric data.

Information source and verification

The principal source was an open-access full-text study from Salvador, Bahia, Brazil, available through PubMed Central. The article described cases registered in the Brazilian surveillance system during 2007–2011 and the subset of children who were located and interviewed. The source was read in full to verify the sample denominators and outcome categories.

Data items

The extracted variables were study setting, recruitment period, number of registered cases, number interviewed, sex, age group, operational classification, clinical form, household contact, social contact, combined contact, and unknown or absent contact. Percentages were retained as reported. We did not infer missing contact data or convert descriptive frequencies into risk estimates.

Interpretation of contact categories

Household contact referred to contact with another case in the home. Social contact included contact in the neighborhood, school, or through a close friend. Combined contact represented both household and social contact. Unknown contact represented children who did not know or did not report a source. These categories describe reported exposure and are not equivalent to laboratory-confirmed transmission pathways.

Statistical approach

Because the verified source was a descriptive case series without an uninfected comparison group, the analysis was limited to frequencies and percentages. No odds ratio, risk ratio, hazard ratio, or pooled meta-analysis was calculated. A comparative meta-analysis would require studies that report both pediatric cases and an appropriate non-case or contact comparison group.

RESULTS AND DISCUSSION

Study setting and ascertainment

The study identified 145 registered cases of leprosy in children younger than 15 years in Salvador during 2007–2011. Of these, 76 children (52.4%) were successfully located and interviewed. The remaining cases could not be included in the interview-based contact analysis because the children could not be found or their parents did not consent to the interview.

Age and sex distribution

Among the interviewed children, 42 (55.3%) were female and 34 (44.7%) were male. The age distribution was concentrated in early adolescence: 10–14 years accounted for 59.3% of cases, 5–9 years for 30.3%, and 0–4 years for 10.3%. The presence of cases in the youngest age group is epidemiologically important, although it cannot by itself establish recent infection because the incubation period of leprosy may be long.

Operational classification and clinical profile

Among registered pediatric cases, paucibacillary disease accounted for 60.7% and multibacillary disease for 39.3%. The tuberculoid clinical form was the most common reported form, representing 44.1% of cases. Multibacillary disease was more frequent in older children and was associated in the study with borderline clinical forms. These findings are descriptive and should not be extrapolated to all endemic settings because local referral, case finding, and disease spectrum may differ.

Reported contact patterns

Among 76 interviewed children, 40 (52.6%) reported household contact with another person with leprosy. Social contact was reported by 19 children (25.0%), including contact in the neighborhood, school, or through a close friend. Four children (5.2%) reported both household and social contact. Thirteen children (17.1%) reported unknown or no contact.

The contact pattern indicates that household exposure was the largest single reported category, but 36 children (47.4%) did not report household contact alone. This group included social contact, combined contact, and unknown or absent contact. The finding should not be interpreted as evidence that non-household contact caused the cases; it indicates that household history alone may not identify every relevant exposure context.

Spatial context

The original study described a focal distribution of pediatric cases across neighborhoods in Salvador, with cases concentrated in a subset of neighborhoods and higher detection rates in areas characterized as hyperendemic. Spatial concentration may help guide active case finding and contact examination, but neighborhood-level associations should not be interpreted as individual-level causal effects.

Quantitative synthesis decision

A pooled estimate was not calculated. The verified study did not provide a comparison group of children without leprosy, and the contact categories were based on reported history. The available numbers therefore support a descriptive evidence summary but not a comparative estimate of the risk associated with household or social contact.

This verified pediatric evidence synthesis provides three main observations. First, most cases occurred among children aged 10–14 years, but a meaningful proportion occurred among children younger than five years. Second, paucibacillary disease was more common than multibacillary disease, although nearly two fifths of registered cases were multibacillary. Third, household contact was the most common reported category, but social and unknown exposure categories were also substantial.

The age distribution has practical implications. The larger proportion of cases among 10–14-year-olds may reflect longer cumulative opportunity for exposure, improved ability to report symptoms, or detection through school and community interactions. Conversely, cases in children aged 0–4 years may indicate intense exposure, earlier clinical recognition, or a combination of factors. Age at diagnosis should therefore be used as a surveillance variable rather than treated as a direct measure of time since infection.

The household contact finding is consistent with the role of close exposure in leprosy transmission and case detection. Household examination remains a central public-health intervention because it is feasible, actionable, and linked to an identifiable index case. However, limiting investigations to household members may miss children exposed through schools, neighborhoods, extended families, or other social networks.

The social-contact category is important because it demonstrates the practical limits of a purely household-centered approach. One quarter of interviewed children reported social contact. This category was broad and may include different levels of proximity and duration. It should not be interpreted as a homogeneous biological exposure, but it does justify careful attention to community contact tracing in settings where pediatric cases cluster geographically.

Unknown or absent contact was reported by 17.1% of interviewed children. Several explanations are possible: the source case may have been undiagnosed, the child or caregiver may not know the relevant history, the incubation period may make recall difficult, or stigma may reduce disclosure. The category therefore represents an epidemiological uncertainty that should trigger broader surveillance rather than be interpreted as absence of exposure.

The operational classification results also have clinical significance. Paucibacillary disease represented 60.7% of registered cases, but multibacillary disease represented 39.3%. A substantial multibacillary proportion among children may indicate delayed diagnosis, severe disease spectrum, or referral selection. It reinforces the need to combine dermatological examination with neurological assessment and contact evaluation.

Spatial clustering can improve the efficiency of public-health action. When pediatric cases are concentrated in particular neighborhoods, local services may prioritize active case finding, examination of household and social contacts, training of primary-care workers, and community education. Spatial information should be used to direct services, not to stigmatize communities or assume that every resident has the same risk.

A major strength of the verified study is its separation of household, social, combined, and unknown contact categories. A major limitation is the absence of a comparison group. Without children who do not have leprosy, it is not possible to quantify how much more common household contact is among cases than in the background population. Interview non-response and inability to locate cases may also affect representativeness.

Future pediatric studies should report the population under surveillance, the number of registered and interviewed cases, definitions of contact, contact examination results, BCG status where available, operational classification, disability grade, and the period between index-case diagnosis and pediatric-case diagnosis. Prospective contact cohorts would be especially valuable because they can estimate incidence among exposed and unexposed children and can distinguish screening intensity from underlying risk.

Strengths and limitations

This manuscript reports only figures verified from a publicly accessible full text and preserves the original denominators. It avoids unsupported causal inference and does not present a pooled estimate that the available data cannot justify. The main limitations are that only one descriptive urban study was used for the quantitative results, the interview subset was smaller than the registered case series, exposure categories were self-reported, and the setting may not represent other endemic regions. A complete global systematic review would require additional full-text studies and independent duplicate screening.

Conclusions/Significance

In the verified Salvador study, household contact was reported by 52.6% of interviewed children, social contact by 25.0%, combined contact by 5.2%, and unknown or no contact by 17.1%. Children aged 10–14 years comprised 59.3% of cases, while 10.3% were aged 0–4 years. Paucibacillary disease accounted for 60.7% and multibacillary disease for 39.3%. The findings support integrated pediatric surveillance that includes household examination, attention to social and neighborhood exposure, early neurological assessment, and targeted action in high-detection areas. These descriptive results should not be interpreted as comparative risk estimates until pediatric studies with appropriate control groups are available.

CONCLUSION

This verified pediatric evidence synthesis demonstrates that childhood leprosy remains an important epidemiological indicator of ongoing exposure and potential transmission within affected communities. The analysis of pediatric cases in an urban Brazilian setting showed that most cases occurred among children aged 10–14 years, although cases among children younger than five years were also identified. Household contact was the most frequently reported exposure category (52.6%), followed by social contact (25.0%), combined household and social contact (5.2%), and unknown or no reported contact (17.1%). In addition, paucibacillary disease was more frequently identified than multibacillary disease. These findings emphasize that pediatric leprosy surveillance should not focus solely on household exposure but should also consider social and neighborhood contexts to improve early detection, contact investigation, and targeted public health interventions. However, the findings remain descriptive because the evidence source did not include a non-leprosy comparison group; therefore, causal relationships and comparative risks cannot be established.

Future research should expand pediatric leprosy evidence through multicenter studies and prospective cohort designs involving affected children and appropriate comparison groups. Further investigations should collect standardized information regarding contact definitions, household and social exposure history, contact examination results, Bacillus Calmette–Guérin (BCG) vaccination status, operational classification, disability grade, and the interval between diagnosis of index cases and pediatric cases. Such studies would enable more accurate estimation of transmission risks and help distinguish exposure patterns from underlying epidemiological factors. In addition, broader systematic reviews incorporating high-quality studies from different endemic regions are needed to improve the generalizability of findings and support more comprehensive strategies for pediatric leprosy prevention and control.

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