International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Socioeconomic Determinants Influencing Tuberculosis Prevalence Among Severe Acute Malnutrition Children in Pediatric Ward, Gims, Kalaburagi

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Received: 06-10-2025
Accepted: 05-11-2025
Available online: 16-11-2025

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ABSTRACT

Background: Tuberculosis (TB) continues to be a leading public health burden in India, especially among children with Severe Acute Malnutrition (SAM), whose compromised immunity increases susceptibility. Socioeconomic determinants play a pivotal role in TB prevalence and outcomes in such vulnerable pediatric populations.
Objectives: This study aimed to assess the prevalence of TB among SAM children admitted to the pediatric ward at GIMS, Kalaburagi, and analyze the role of socioeconomic factors influencing this burden.
Methods: A prospective cohort study was conducted from September 2024 to February 2025 at GIMS, Kalaburagi. Sixty-two SAM children aged 6–60 months were enrolled and assessed through clinical evaluations, Mantoux tests, chest X-rays, and CBNAAT testing. Socioeconomic data were collected using structured proformas, and results were statistically analyzed using SPSS.
Results: The majority (69.4%) of children were between 13–60 months, with a higher proportion of females (61.3%). Notably, 90.3% belonged to the lower middle class. Mantoux positivity was low (1.6%), while CBNAAT confirmed TB in 3.2% of cases. Findings point to diagnostic challenges and underline the role of poverty, maternal education, and environmental exposures in influencing TB risk.
Conclusion: Socioeconomic vulnerability significantly contributes to the TB burden among SAM children. Molecular diagnostics like CBNAAT are essential in identifying cases in resource-limited settings.

Keywords: *Severe Acute Malnutrition, Tuberculosis, Socioeconomic Determinants, Pediatric TB, CBNAAT.*

INTRODUCTION

Tuberculosis (TB) remains a critical public health threat in India, with complex associations between infectious disease, malnutrition, and socioeconomic deprivation. Children with Severe Acute Malnutrition (SAM) are particularly susceptible to TB due to compromised immunity, poor living conditions, and delayed access to healthcare. In regions such as Kalaburagi, Karnataka, this risk is further intensified by widespread poverty and health inequities.

India contributes significantly to the global burden of TB, with an estimated 2.2 million cases annually, making it the country with the highest TB burden worldwide. Simultaneously, India also houses a significant proportion of the world's malnourished children, where malnutrition and TB exist in a bidirectional relationship—malnutrition weakens immunity and increases the risk of infection, while TB exacerbates nutrient loss and cachexia.

Studies have shown that 22% of children with SAM in India are diagnosed with TB, and the prevalence is higher in infants under 1 year of age. Moreover, the detection of TB among SAM children is often complicated due to reduced tuberculin skin test (TST) reactivity and variable BCG scar presentation, making diagnosis in resource-limited pediatric settings difficult [1].

The socioeconomic context plays a defining role in the prevalence and transmission of TB. For instance, in a study from Sierra Leone—a setting comparable to rural India in terms of healthcare constraints—children whose mothers had no formal education were significantly more likely to develop TB, highlighting the impact of maternal literacy and awareness on pediatric health outcomes. In that study, 20% of SAM children were found to have TB, and diagnostic limitations such as lack of bacteriological confirmation tools worsened underreporting [2].

In West Bengal, a recent study examining adult TB patients found that over 50% were underweight, with 20% being severely underweight. These figures were closely associated with poor food security and chronic comorbidities—factors that also influence children in household settings [3]. The study further emphasized the importance of dietary counseling and food supplementation in managing TB among nutritionally vulnerable populations [3].

Close household contact with TB-positive individuals remains a significant source of infection for children. A study in South India reported that exposure before diagnosis is a major transmission risk, particularly in children under 7 years old. Effective chemotherapy at home was shown to be as safe as sanatorium treatment, provided proper household infection control measures are practiced [4].

Undernutrition is often compounded by a "double or triple burden of malnutrition" in India, where underweight, micronutrient deficiencies, and obesity coexist in the same households. The Comprehensive National Nutrition Survey found that disadvantaged caste status, low maternal education, and poor dietary diversity were strongly associated with double (50.8%) and triple (14.4%) burdens of malnutrition, indirectly raising the risk of diseases like TB in children [5].

Socioeconomic determinants also influence TB treatment outcomes. A case-control study in Wardha, Maharashtra, revealed that indoor air pollution, patient discrimination, and poor satisfaction with services significantly predicted poor TB treatment outcomes. Visits by senior health supervisors improved adherence, indicating how social support networks within the health system can mediate outcomes [6].

The National Family Health Survey (NFHS-4) showed that TB prevalence was highest among poorer households and individuals with low education levels. While over half of the reported TB cases sought care from public services, a significant proportion of the poor preferred private facilities, reflecting gaps in trust, access, or quality in public healthcare delivery [7].

However, knowledge gaps and misconceptions about TB transmission persist in India. In a national survey, only 29.7% of people had correct knowledge about how TB spreads. Misconceptions such as transmission through food or utensils were widespread, and these beliefs were associated with lower wealth and education levels [8]. Such misconceptions directly affect care-seeking behavior and the early identification of TB in children.

Community-based studies in Assam's tea garden populations—one of India's most marginalized groups—have shown that monthly income, type of housing, and ventilation levels significantly influenced TB treatment outcomes. For example, 98.5% of households used firewood for cooking, contributing to indoor air pollution, a recognized risk factor for TB [9]. These findings parallel conditions in rural Karnataka, including Kalaburagi, where similar environmental exposures and economic deprivation exist.

Finally, research calls for a multidimensional approach to TB control that integrates social, nutritional, and economic interventions alongside biomedical strategies. According to Bhargava et al., eliminating TB in India requires pro-poor models of care that combine nutrition, psychosocial support, and financial aid, especially for children from marginalized communities [10].

METHODOLOGY

1. Study Design

This was a prospective cohort study conducted to assess the prevalence and clinical-demographic profile of tuberculosis among children with Severe Acute Malnutrition (SAM). Eligible children were enrolled at admission and followed during their hospital stay until completion of TB evaluation.

2. Study Setting

The study took place in the pediatric ward and Nutrition Rehabilitation Centre (NRC) of Gulbarga Institute of Medical Sciences (GIMS), Kalaburagi. GIMS is a tertiary care hospital catering to malnourished children from surrounding districts.

3. Study Duration
The study was carried out over six months, from September 2024 to February 2025. This duration allowed adequate patient enrollment and completion of clinical assessments.

4. Participants – Inclusion and Exclusion Criteria
Children aged 6–60 months with SAM admitted to the NRC and whose parents gave consent were included. Children discharged before TB work-up or whose parents declined consent were excluded from the study.

5. Study Sampling
Convenient sampling was used. All eligible SAM children admitted during the study period were consecutively enrolled until the required sample size was reached.

6. Study Sample Size
The sample size was fixed at 60 based on the estimated number of SAM admissions over six months and feasibility of TB work-up during hospitalization.

7. Study Groups
There were no intervention groups. Based on TB work-up results, children were later classified as TB-positive or TB-negative for clinical comparison.

8. Study Parameters
The primary outcome was TB prevalence in SAM children. Secondary parameters included clinical features, demographic data, and diagnostic results such as Mantoux test, chest X-ray, and CBNAAT.

9. Study Procedure
All enrolled children underwent clinical assessment, anthropometry, and TB investigations including Mantoux test, chest X-ray, and CBNAAT of gastric aspirate as per protocol.

10. Study Data Collection
Data were recorded using a structured proforma, including history, examination, and investigation results. Information was collected during hospitalization and entered into Excel.

11. Data Analysis
Data were analyzed using SPSS version 16. Descriptive statistics were used for prevalence, and comparative tests were applied to evaluate clinical differences between TB-positive and TB-negative children.

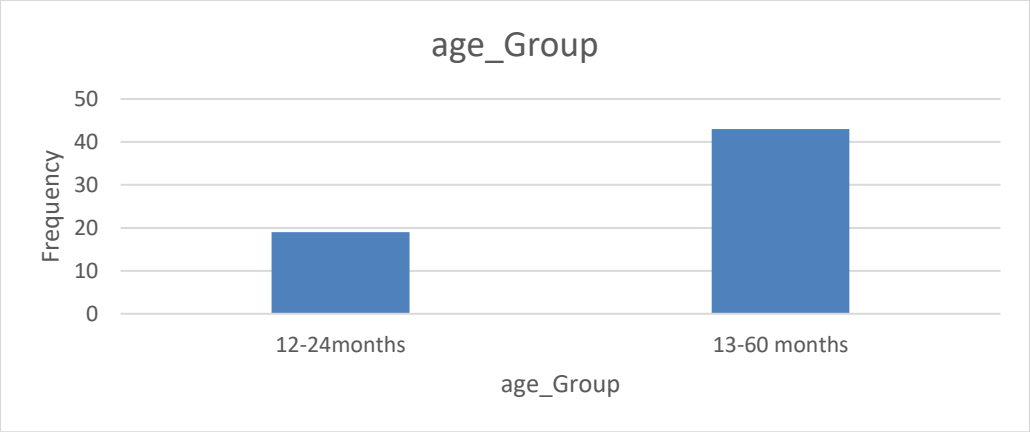
12. Ethical Considerations
Ethical approval was obtained from the institutional ethics committee. Written informed consent was taken from parents, and confidentiality was maintained throughout the study.

RESULTS

1. Age-wise Distribution of SAM Children
The majority (69.4%) of children with SAM were in the 13–60 months age group, suggesting increased vulnerability beyond infancy. This highlights the importance of interventions targeting toddlers and preschool-aged children (Table 1).

Table 1: Distribution of SAM Children by Age Group

Age_Group			
		Frequency	Percent
Valid	12-24months	19	30.6
	13-60 months	43	69.4
	Total	62	100.0



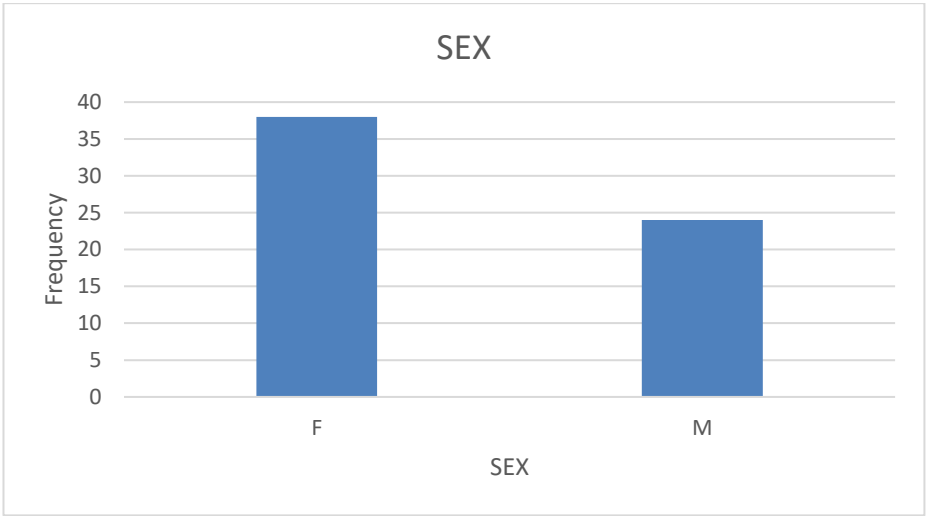
Graph 1: Age-wise Distribution of Children with Severe Acute Malnutrition

2. Sex-wise Distribution of SAM Children

A higher proportion of female children (61.3%) were affected by SAM compared to males, indicating potential gender-related disparities in nutrition or care (Table 2).

Table 2: Sex-wise Distribution of SAM Children

SEX			
		Frequency	Percent
Valid	F	38	61.3
	M	24	38.7
	Total	62	100.0



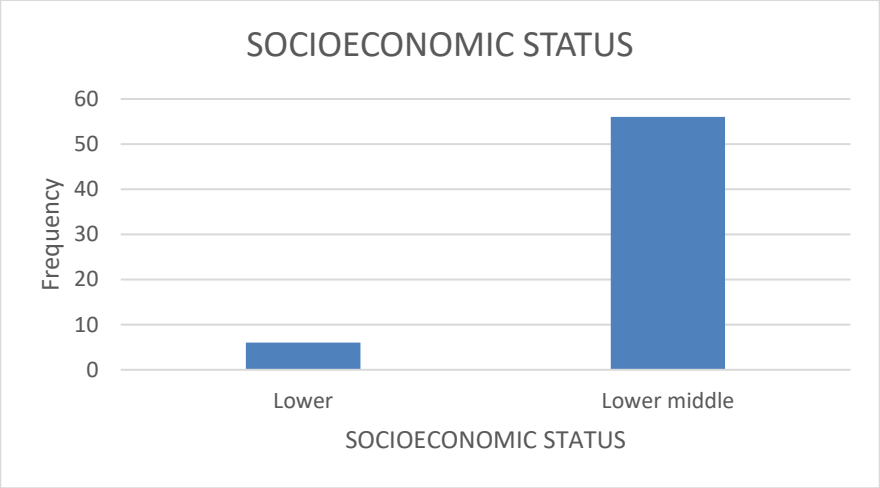
Graph 2: Gender-wise Distribution of Children with Severe Acute Malnutrition

3. Socioeconomic Status of SAM Children

Most SAM children (90.3%) belonged to the lower middle class, showing that malnutrition affects not just the poorest but also economically vulnerable families (Table 3).

Table 3: Socioeconomic Status Distribution of SAM Children

SOCIOECONOMIC STATUS			
		Frequency	Percent
Valid	Lower	6	9.7
	Lower middle	56	90.3
	Total	62	100.0



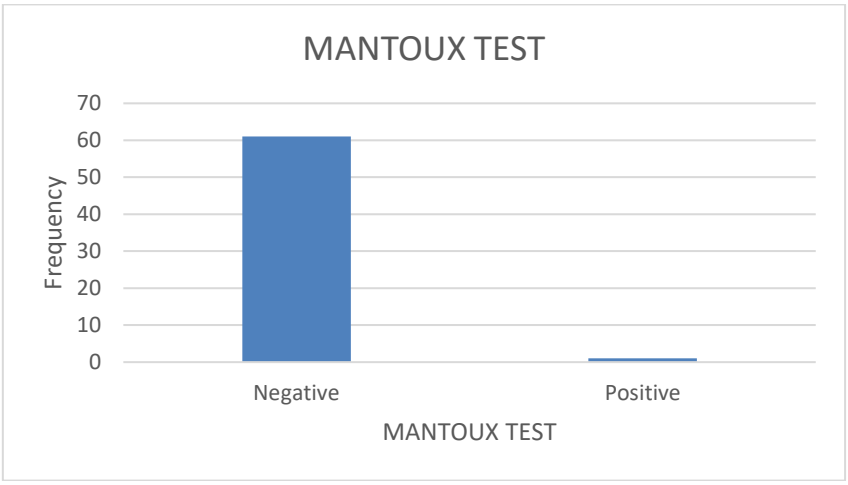
Graph 3: Socioeconomic Classification of Children with Severe Acute Malnutrition

4. Mantoux Test Results in SAM Children

Only 1.6% of children tested positive on the Mantoux test, likely due to anergy from malnutrition, limiting its diagnostic utility in SAM cases (Table 4).

Table 4: Mantoux Test Results Among SAM Children

MANTOUX TEST			
		Frequency	Percent
Valid	Negative	61	98.4
	Positive	1	1.6
	Total	62	100.0



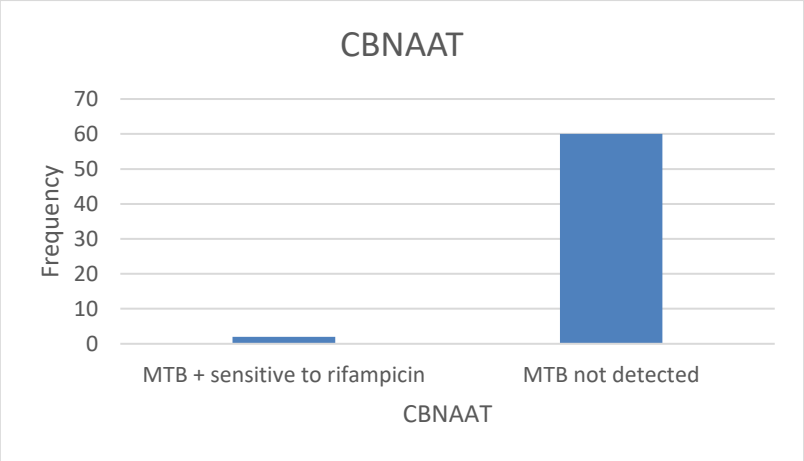
Graph 4: Distribution of Tuberculin Sensitivity (Mantoux Test) in SAM Children

5. CBNAAT Results in SAM Children

MTB was detected in 3.2% of cases, confirming tuberculosis in a small subset and emphasizing the role of molecular testing in suspected pediatric TB with SAM (Table 5).

Table 5: CBNAAT Results for Detection of MTB in SAM Children

CBNAAT			
		Frequency	Percent
Valid	MTB + sensitive to rifampicin	2	3.2
	MTB not detected	60	96.8
	Total	62	100.0



Graph 5: CBNAAT-Based Detection of Tuberculosis in Children with Severe Acute Malnutrition

DISCUSSION

This study investigates the socioeconomic and clinical profile of children with Severe Acute Malnutrition (SAM) in the pediatric ward of GIMS, Kalaburagi, with a focus on their tuberculosis (TB) status. Our findings show that the majority (69.4%) of SAM children were between 13–60 months old, consistent with earlier studies which found increased vulnerability to malnutrition in the toddler and preschool years due to weaning issues, recurrent infections, and inadequate complementary feeding practices (Sarkar & Haldar, 2014) [11].

The sex-wise distribution in our study revealed a higher prevalence among females (61.3%), suggesting possible gender-based nutritional neglect. This pattern aligns with findings from Muniyandi & Ramachandran (2008), who reported significant socioeconomic and gender disparities in TB and malnutrition prevalence in India (Muniyandi & Ramachandran, 2008) [12].

A striking 90.3% of children belonged to the lower middle class, reinforcing evidence that TB and malnutrition are not limited to the poorest but extend into economically vulnerable populations. Bhargava et al. (2020) emphasized that social determinants like poverty, undernutrition, and poor access to healthcare strongly affect TB outcomes, supporting our observations [10].

The Mantoux test showed a low positivity rate (1.6%), likely due to anergy induced by malnutrition—a finding echoed by Sathenahalli et al. (2015), who found similar diagnostic limitations in SAM children [1].

Our CBNAAT results revealed TB in 3.2% of SAM children, a rate slightly lower than the 22% prevalence reported in similar tertiary care settings. However, given the non-specific symptoms and diagnostic challenges in malnourished children, the use of molecular tools like CBNAAT remains critical. This supports findings from other studies advocating for enhanced diagnostic strategies in resource-limited settings (Ide, 2019) [2].

CONCLUSION

This study highlights the critical interplay between malnutrition, tuberculosis, and socioeconomic deprivation in pediatric settings. Although TB prevalence was low based on CBNAAT, diagnostic challenges remain, particularly in children with SAM. The findings emphasize the need for targeted social interventions, improved nutrition, and widespread use of molecular diagnostics. Proactive surveillance and maternal education programs are essential to curb pediatric TB in resource-limited, vulnerable regions such as Kalaburagi. Addressing social determinants remains key to effective TB control among malnourished children.

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