

1 Prevalence of Tuberculosis among Children with Severe Acute Malnutrition at Ola During
2 Children's Hospital in Freetown Sierra Leone

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6 **Abstract**

7 **Prevalence of Tuberculosis among Children with Severe Acute Malnutrition at Ola**
8 **during Children's Hospital in Freetown Sierra Leone. Worldwide, pediatric tuberculosis**
9 **account for about 1million cases, annually, accounting for 10-15% of all tuberculosis;**
10 **with more than 100,000 estimated mortality annually, it is also one of the 10 most**
11 **common causes of childhood mortality. Aim of this study was to determine the**
12 **prevalence of tuberculosis among children with severe acute malnutrition at Ola During**
13 **Children's Hospital in Freetown Sierra Leone. It was a descriptive cross-sectional**
14 **study, carried out at the therapeutic feeding center (TFC) of Ola During Children's**
15 **Hospital in 2018. Patients who met the World Health Organisation (WHO) criteria for**
16 **diagnosis of severe acute malnutrition and were admitted into the TFC were randomly**
17 **selected and interviewed using a structured questionnaire after obtaining written**
18 **informed consent, from their mothers or caregivers. Diagnosis of tuberculosis was**
19 **both clinically and by laboratory investigations 74 children who met the inclusion**
20 **criteria and their mothers/caregivers consented for the study were recruited. Data was**
21 **entered into an excel spread sheet and analyzed using Epi info version 7. There were 74**
22 **children with a median age of 11months ± 9.9SD. Forty (54.1%) Males and 34(45.9%)**
23 **Females, with a M:F ratio of 1.18:1. Prevalence of tuberculosis was 20%. Diagnosis of**
24 **Tuberculosis was based on clinical findings of extreme weight loss or failure to gain**
25 **weight, Chest x-ray findings of perihilar infiltrates. Gene Xpert MTB RIF results were all**
26 **negative 0(0%). Most of the mothers 59 (79.7%) were aged between 20-29years,**
27 **45(60.9%) of them were petty traders, while 15(20.3%) had no formal education. There**
28 **was no statistically significant difference between gender and TB, P= 0.3415, there is a**
29 **statistically significant difference between no formal education and occurrence of**
30 **tuberculosis in their children P= 0.0467.**

31 **CONCLUSIONS/RECOMMENDATIONS:** Prevalence of Tuberculosis is still high among
32 children with severe acute malnutrition. Gene Xpert MTB RIF was unable to make a
33 bacteriological confirmation.

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36 **KEY WORDS:** Prevalence, Tuberculosis, Severe acute malnutrition. Paediatrics.

37 **1. INTRODUCTION**

38 Ten to twenty percent of deaths in children under the age of 15years in tuberculosis
39 (TB) endemic countries are alleged to be associated with tuberculosis. [1,2] The World
40 health Organisation reported a total of 140,000 mortalities in Paediatric age in their

41 2015 global TB report from vital registration data. [3] In 2012, TB accounted for 2% of
42 total deaths in children. [4] In Southeast Asia and Sub-Saharan Africa tuberculosis in
43 children accounted for less than 4% among the notified new tuberculosis cases[4]
44 Tuberculosis continues to be a major cause of morbidity and mortality in children
45 globally especially in those from resource limited settings.[5] Globally there are about
46 9million new TB cases each year and 11% of these occur in Paediatric patients.[5]
47 Children living in areas where TB is endemic are also plagued with malnutrition and it
48 accounts for 2.2million deaths in children less than 5years all over the world.[6]
49 Malnutrition and poor infection control have blossomed in an environment of poverty,
50 overcrowding, food insecurity, human immunodeficiency Virus [7] Malnutrition is deadly
51 when coexisting with tuberculosis, social and economic factors that cause malnutrition
52 to thrive such as poverty, illiteracy, ignorance, overcrowding and poor sanitation also
53 contribute to the prevalence of tuberculosis.[8] Hence we tried to look at the
54 prevalence of tuberculosis among children with severe acute malnutrition at Ola During
55 Children's hospital in Freetown and some of its socioeconomic factors, since there has
56 been no known study in this subject matter in Freetown.

57 2. Materials and Methods

58 a. Study Area

59 Therapeutic feeding center (TFC) of the Ola During children's hospital in
60 Freetown, Sierra Leone. A place where children with severe acute
61 malnutrition are admitted and managed

62 b. Study Population

63 Under-five children admitted in to TFC during the period of the study whose
64 parents or care giver consented for the study were recruited. The children
65 were admitted in to TFC, if they met the WHO criteria for severe acute
66 malnutrition. Severe acute malnutrition criteria was met as defined by WHO, if
67 there was very low weight for height (Below -3zscores of the median
68 NCHS/WHO growth standards), or visible severe wasting, or presence of
69 nutritional oedema. [9] All children were to have a chest X-ray and a gene X-
70 pert MTB RIF test done for the diagnosis of tuberculosis. But often times the
71 diagnosis of TB was made clinically as most times the chest X-ray machine
72 was not working or the gene X-pert machine was not functioning.

73 c. Selection and Inclusion criteria

74 i. Inclusion criteria

75 All children on admission at TFC ward during the period of the study
76 whose parent or caregiver consented for the study.

77 2.3.2 Exclusion criteria

78 All patients on admission in TFC during the period of the study whose
79 parents or caregivers refused to consent for the study.

81 d. Sampling Method

82 This was a descriptive cross-sectional study. A non-probability
83 sampling method (opportunistic sampling) was used, in which every
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85 next child admitted into TFC, whose parents and caregivers consented
86 for the study was recruited into the study until we got 74 subjects. All
87 parents or caregivers whose children were on admission at TFC during
88 the period of the study, who were approached by the researcher
89 consented for the study. The study was collected over a six months
90 period in 2018. A structured questionnaire was used to collect data on
91 parents or caregiver's biodata, child's biodata, clinical and laboratory
92 results. Data was entered into Microsoft excel spread sheet and
93 analyzed using Epi-info version 7

94 **3. Results and Discussions**

95 There were 74 subjects, 40(54.05%) Males and 34(45.95%) females giving a M:F
96 ratio of 1.17:1. Their median age was 11 months SD \pm 9.9. 48(64.9%) were aged
97 between 12-59 months. The prevalence of tuberculosis was high 20(27%).
98 Tuberculosis was highest in the age group 12-59 months 14(70.0%) Diagnosis
99 was mostly clinical and with chest X-ray 15(20.27%) as all the gene X-pert test
100 done 13(17.57%) came out negative. The chest X-rays showed pulmonary
101 infiltrates and perihilar opacities All 20(27%) of the children with TB had received
102 BCG at birth. 59(79.7%) of the parents/caregivers were aged between 20-
103 29 years., they were mostly traders 45(60.9%) while 8(10.45) were unemployed,
104 15(20.3%) had no formal education. There was a statistically significant
105 difference between no formal education in parents/caregivers and occurrence of
106 TB in their children P-value 0.046. There was no significant difference in sex P-
107 value 0.341

108 **Discussions**

109 This study found a 20% prevalence of TB among patients with SAM. This in
110 contrast to the finding of Munthali et al [10] working in Lusaka, Zambia who had a
111 prevalence of 1.58% in Zambia among malnourished children. The number of
112 patients (74) in this study was much smaller than the Zambian study that was
113 reported among 9540, this may have accounted for the difference in the
114 prevalence. However, it is comparable to the work of Veeraraja et al [8] in India
115 who found a prevalence of tuberculosis of 22% among children with severe acute
116 malnutrition. There was a 0 % bacteriological confirmation in this study which is
117 also in contrast to the Zambian study that had a 25% bacteriological confirmation
118 among the 151 patients with tuberculosis in their study. Although the method of
119 bacteriological confirmation employed in their study was a smear microscopy
120 performed on gastric aspirates. This study used a more sensitive Xpert MTB RIF
121 which gave a 0% yield. Using more sensitive Xpert MTB RIF was also of no
122 additional value among severely malnourished children in Malawi [11] This
123 however shows that there is a low yield of Mycobacterium tuberculosis. The
124 bacteriological isolation of mycobacterium tuberculosis in children is said to be

125 very difficult due to the pauci bacillary nature of childhood tuberculosis [8] This
126 study found a median of age of 11±9.9months this is in keeping with the finding of
127 other workings with a peak incidence of pulmonary tuberculosis among
128 malnourished children of 1-3years [8,12,13] However Veeraraja et al [8] found
129 incidence of pulmonary tuberculosis at a younger age of 6-12months in severely
130 malnourished children. While Munthali et al had a higher median age of
131 16months. However, they are all among preschool children. Just like other
132 workers [8,12,13] this study did not find any sex predilection. No child in this
133 study had the severe forms of tuberculosis such as disseminated TB and neuro
134 tuberculosis. as they were all vaccinated with BCG. This is not surprising as
135 BCG is known to protect from the very severe forms of tuberculosis such as
136 disseminated TB and neuro tuberculosis [13] 20.27% of the parents in this study
137 had no formal education, 10% were unemployed and 79.7% of them were young
138 adults. These features conform to the description of poverty, illiteracy,
139 ignorance that constitute risk factors for the formation of tuberculosis [6]

141 **Conclusion**

142 The prevalence of tuberculosis is high among children with severe acute
143 malnutrition. One interesting thing that was found in this study is the fact that
144 although Xpert MTB RIF is said to be highly sensitive in diagnosis of
145 mycobacterium tuberculosis there was a zero percent yield with it in this study.

147 **Limitations**

148 This was a hospital-based study and so needs to be replicated in a rural
149 community. Also, the Xpert MTB RIF test should be done in a community-based
150 study as it was epileptic in its function during the period of this study and the
151 results obtained in this study need to be validated in a larger sample in the
152 community.

162 **4. Tables and Figures**

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Table. 1 Socio-demographic information of children

Age-Groups (months)	Frequency (n = 74)	Percent (%)
1 – 11	26	35.1
12 – 59	48	64.9
Median ±SD	11.0 ±9.9	
Gender		
Male	40	54.1
Female	34	45.9

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Table 2. Cross-Tabulation of TB with age groups

Age-Groups (months)	TB positive	TB Negative	Chi-square (p-value)
1 – 11	6 (30.0)	20 (37.04)	0.31
12 – 59	14 (70.0)	34 (62.96)	(0.5733)**
Total	20 (100.0)	54 (100.0)	

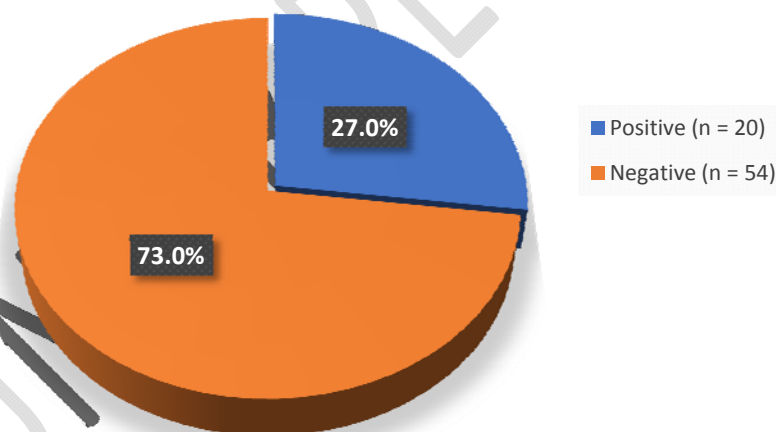
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Figure 1.



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Prevalence of TB in Childen

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Table 3. Distribution of Nutritional Status of Patients

Nutritional Status Of Patients	Frequency (%)
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Marasmus	65 (87.80)
Kwashiokor	9(12.20)
Total	74(100)

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Table 4. Chest X-ray and GeneXpert MTB RIF

	CXR (%)	GeneXpert MTB RIF (%)
Test Done	15 (20.27)	13 (17.57)
Not Done	59(79.73)	61 (82.43)
Total	74 (100.0)	74 (100.0)

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Table 5. Socio-demographic information of parents

Variables	Frequency (n = 74)	Percent (%)
Age Groups (years)		
20 - 29	59	79.7
30 - 39	11	14.9
≥ 40	4	5.4
Mother's Occupation		
Unemployed	8	10.80
Trader	45	60.80
Student	13	17.60
Teacher	1	1.35
Tailor	1	1.35
Electrician	1	1.35
Hair dressing	3	4.05
Driver	1	1.35
Caterer	1	1.35
Education		
No Formal Education	15	20.27
Primary	5	6.76
Secondary	50	67.57

Tertiary 4 5.4

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Table 6. Cross tabulation of Mother's education and TB Prevalence

Education	TB Positive	TB Negative	Chi-square (p-value)
No Formal Education	1 (5.0)	14 (25.9)	3.95 (0.0467)*
Primary	2 (10.0)	3 (5.6)	0.45 (0.4987)**
Secondary	15 (75.0)	35 (64.8)	0.85 (0.3559)**
Tertiary	2 (10.0)	2 (3.7)	1.13 (0.2874)**
Total	20 (100.0)	54 (100.0)	

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Table 7. Cross tabulation of Gender and TB among children

Gender	TB Positive	TB Negative	Chi-square (p-value)
Male	9 (45.0)	31 (57.4)	0.90 (0.3415)**
Female	11 (55.0)	23 (42.6)	
Total	20 (100.0)	54 (100.0)	

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**Difference between both groups is not statistically significant (p > 0.05)

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Table 8. BCG Vaccination Status of Patients

Vaccine	TB POSITIVE (%)	TB NEGATIVE (%)	TOTAL (%)
BCG	20(27.0)	54(73.0)	74(100)

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Competing Interest There was no competing interest in this study

Consent. Written informed consent was obtained from participants

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211 **Ethical Approval.** There no ethical Issues in this study

212 **References**

213 [1] Marais BJ, Schaaf HS. Childhood tuberculosis an emerging and previously
214 neglected problem. *Infect Dis Clin North. Am* 2010 ;24:727-49.

215 [2] Winston CA Menzies HJ, Pediatric and Adolescent tuberculosis in United States,
216 2008-2010. *Pediatrics* 2012; 130: e1425-32

217 [3] Global tuberculosis Report Geneva Switzerland: World Health Organization. 2015.
218 In 2012,

219 [4] Graham SM, Sismanidis C, Menzies HI, Marais BJ, Derjen AK, Black RE. Importance
220 of tuberculosis control to address child survival. *Lancet.* 2014;383: 1607-08

221 [5] World health Organisation (WHO) Guidance for national tuberculosis programmes on
222 the management of tuberculosis in children. Geneva: World Health Organisation. 2006

223 [6] Black RE, Allen IH, Bhutta ZA et al Maternal and Child Undernutrition: global and
224 regional exposures and health consequences. *Lancet.* 2008; 371: 243-60

225 [7] Walker VP, Mindin RL. The Vitamin D concentration to Pediatric infections and
226 immune function. *Pediatr Res* 2009;65: 106R-113R

227 [8] Veeraraja B, Sathenahalli, Naikey M, Vinod G, Rakesh K, Karan J et al Association of
228 tuberculosis with severe acute Malnutrition. 2015;4(68):11865-70

229 [9] WHO Child Growth Standards and the identification of severe Acute Malnutrition in
230 infants and Children. A Joint Statement by the World Health Organisation and the
231 United Nations Children's Fund, 2009

232 [10] Munthali T, Chabala C, Chama E, Mugode R, Kapata N, Musonda P et al.
233 Tuberculosis caseload in Children with severe acute malnutrition related with high
234 hospital-based mortality in Lusaka, Zambia. *BMC Res Notes* 2017; 10:206

235 [11] LaCourse SM, Chester FM, Preidis G, McCrary LM, Arscott-Mills T, Maliwichi M,
236 Use of Xpert for the diagnosis of pulmonary tuberculosis in severely malnourished
237 hospitalized Malawian children. *Pediatr Infect Dis J* 2014;33(11):1200-02

238 [12] Singh M, Mynak ML, Kumar L, Mathew L, Jindal SK. Prevalence and Risk factors for
239 transmission of infection among children in household contact with adults having
240 pulmonary TB Arch Dis Child 2005;90:624-28

241 [13] Dahiwale N, Rao S, Singh I, Rawat AK. Significance of Family Survey of Index case
242 for Detection of Tuberculosis. Indian Pediatr 2011; 48:387-89

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