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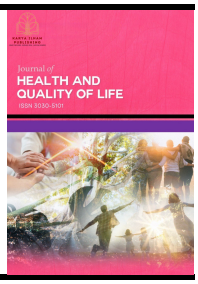


# Health-related quality of life and its association with lung function in post-treatment paediatric tuberculosis patients in North-Central Nigeria

Eno Eloho Ekop[1,*], Emmanuel S. Aliyu [2], Ramsey M. Yalma[3,4], Adaeze C. Ayuk[5]

[1] Department of Paediatrics, Faculty of Clinical Sciences, College of Health Science, University of Abuja, Nigeria
[2] Department of Physiotherapy, University of Abuja Teaching Hospital, Abuja FCT, Nigeria
[3] 3Department of Community Medicine, College of Health Sciences, University of Abuja, Nigeria
[4] Department of Community Medicine, University of Abuja Teaching Hospital, Abuja FCT, Nigeria
[5] Department of Paediatrics, College of Medicine, University of Nigeria, Enugu Campus, Enugu State and Department of Paediatrics, University of Nigeria Teaching Hospital, Ituku Ozalla, Enugu, Nigeria

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**ABSTRACT**

This cross-sectional study evaluated health-related quality of life (HRQoL) and lung function among Nigerian children and adolescents who completed pulmonary tuberculosis (TB) treatment 6 months to 5 years earlier. HRQoL was assessed using the SF-36 survey, while spirometry measured lung function. Participants had a median age of 13 years, and most completed treatment 12–23 months before the study. Overall HRQoL scores were high, with physical functioning scoring highest and general health perception lowest. About 68.4% of participants reported good overall HRQoL. Significant associations were found between lung function and several HRQoL domains, including role-physical, general health, vitality, social functioning, and overall wellbeing. The findings highlight the importance of incorporating HRQoL assessments into post-TB care and follow-up programs for children and adolescents, emphasizing the need to address physical, social, and mental health outcomes after TB treatment.

## 1. Introduction

Health-related quality of life (HRQoL) reveals how a person perceives their physical, mental and social wellbeing [1]. Such self-assessments of HRQoL have been shown to be better predictors of morbidity and mortality compared with many other measures [2]. Studies have shown that quality of life among patients with tuberculosis (TB) can be affected by gender, age, comorbidities, socio-economic challenges and educational level[3,4,5]. The disease also results in respiratory sequelae termed post-tuberculosis lung disease (PTLD) which can be diagnosed using symptoms, chest radiologic imaging and lung function tests [6,7]. A cross-sectional study among 59 adults previously treated for TB in Lagos, Nigeria, reported a high proportion with poor health-related quality of life which was associated with poor lung function[7].

* *Corresponding author.*
*E-mail address: eno.ekop@uniabuja.edu.ng*

Given the high burden of TB in Nigeria, the impact the disease has on growth and development, the paucity of studies on post-TB sequelae on children and adolescents, this study determined the health-related quality of life and its association with lung function among children and adolescents who had completed treatment for pulmonary TB.

## 2. Materials and methods

The study was carried out in the Paediatric Pulmonary Clinic of the University of Abuja Teaching Hospital (UATH), Gwagwalada, Abuja Federal Capital Territory (FCT), Nigeria. Gwagwalada is one of the six area councils in the FCT. The council hosts several government agencies such as the tertiary hospital, the University of Abuja, the Federal Radio Corporation of Nigeria, Federal Government Secondary schools among others. There are also several private establishments.

This was a cross-sectional, descriptive, hospital-based study among children and adolescents aged six years to nineteen years who had been treated for pulmonary TB (pTB) within the previous five years and were at least six months since treatment completion. It was a pilot study. Names and contact details of caregivers of eligible participants were obtained from the Directly Observed Therapy Strategy (DOTS) clinic records of UATH and phone calls made to contact and recruit their wards as participants for the study. Those willing to have their wards participate were scheduled for enrolment visits during work hours at the hospital between 8am and 4pm. Participants with signed caregiver informed consent, who assented, had completed treatment for PTB within the previous five years and certified cured, and who were at least six years old at their last birthday were included in the study. Children and adolescents who felt too ill to participate or had been treated for extrapulmonary TB or had contraindications for spirometry, were excluded from the study. Caregivers signed for children and adolescents who were less than 18 years old while verbal assent was obtained from them. Those aged 18 years and 19 years personally signed the forms. The signatures were obtained after reading the participant information sheet provided by the researchers.

A proforma developed by the researchers was used to obtain the biodata and history of TB, which were then confirmed using the clinic case notes. The Short Form – 36 (SF-36) health survey questionnaire [8] was used to obtain information on the health-related quality of life (HRQoL). The SF-36 consists of 36 questions related to eight scales which are: general health perception (includes five items), physical functioning (includes 10 items), role-physical functioning (includes 4 items), bodily pain (includes two items), vitality (includes 4 items), social functioning (includes two items), emotional functioning (includes three items), mental health (includes five items) and one on change in health status[9]. The scores were coded from 0-100. The higher the score, the better the quality of life. Mean scores of 50 are accepted as the norm or average. For this study, Total HRQoL scores of ≤47, 48-61 and ≥62 were taken as weak, medium and good HRQOL, respectively[10]. The total mean HRQoL score consisted of the mean scores of the eight scales.

For the Mental Component Summary (MCS) scores, corresponding cut-offs were ≤44, 45-63, ≥64, for low, moderate and high, respectively, while for the Physical Component Summary (PCS), cut-offs were ≤43, 44-59, ≥ 60, respectively.[10] The MCS score consisted of the mean of four combined scales: role-emotional, vitality, social functioning and mental health.[10] While the PCS score consisted of the mean of the other four combined scales: general health, physical functioning, bodily pain and physical functioning scales[10].

The SF-36 questionnaire was interviewer-administered in English as all the participants understood the language therefore there was no need to use the Hausa version which had previously been translated. Spirometry was conducted using a portable digital spirometer (spirolab new MIR©).

Calibration was performed daily using a 3-liter syringe, in accordance with American Thoracic Society/European Respiratory Society guidelines[11]. Trained technicians certified in pediatric spirometry administered the tests. Reference values were based on the Global Lung Initiative (GLI) standards for African children and adolescents[11]. The forced expiratory volume in one second (FEV1), forced vital capacity (FVC) and FEV1/FVC result obtained were used to determine normal and abnormal lung function of the participants. Values demonstrating obstruction or restriction such as those less than – 1.64 z scores for FEV1, FVC and FEV1/FVC were considered as abnormal spirometry results. The study lasted for a period of 20 months, from November 2023 to July, 2025.

The data was analysed using SPSS version 27. The means were calculated and frequency tables have been used to show proportions. Chi square and Fishers exact (where cell count was less than five) were used to determine associations between the eight HRQoL scales and lung function. A P value < 0.05 was regarded as significant.

Ethical approval was obtained from the Health Research and Ethics Committee of the University of Abuja Teaching Hospital (UATH/HREC/PR/262). The principles of research ethics were maintained according to the Helsinki Declaration of 1975 as revised in 2013. All participants and their caregivers were informed that they could withdraw from the study at any time without fear of repercussions.

## 3. Results

Thirty-eight children and adolescents out of the 55 reached via phone calls, participated in the study, giving a response rate of 69.1%. Those excluded include one (1.8%) with active TB, three (5.5%) who had relocated, seven (12.7%) who had died and six (10.9%) who declined consent. The median age of participants was 13 with Interquartile range 12-13 years. Of the 38 participants, 9 (23.7%) were in primary schools, 28 (73.7%) in secondary schools and 1 (2.6%) in a tertiary school. There was only one (2.6%) female while no participant had previously been treated for recurrent TB. TB diagnosis was bacteriologically confirmed in 20 (52.6%), while other methods such as chest radiograph, acid fast bacilli, clinical symptoms and signs, Mantoux and TB scoring systems were used in the TB diagnosis of the others. None of the participants had Human Immunodeficiency Virus (HIV) or had been previously treated for TB. Most, 15 (39.5%) participants had completed their TB treatment within 12 months to 23 months prior to participating in the study (Figure 1).

### *3.1 Mean health-related quality of life scores of the participants*

The mean HRQoL scores for each of the eight scales were high as they were each above 50. The mean score for physical functioning was the highest, 91.14 SD ±11.42 while the lowest was reported for General health perception, 80.84 SD ±21.77. The minimum, maximum and mean HRQoL scores for each of the eight scales, the total HRQOL, the PCS and MCS scores, and their standard deviations are shown in Table 1.

### *3.2 Proportions of low, medium and high HRQoL scores across the scales*

Majority of the children and adolescents 26 (68.4%) had high total overall wellbeing HRQoL scores, while 12 (31.6%) had moderate scores. None of the participants fell into the category with low total HRQoL scores. All, 38 (100%) reported high HRQoL scores for physical functioning. The second leading reported scale for good HRQOL scores was in the bodily pain scale, 33 (86.8%). For moderate HRQoL, the highest number of participants of 15 (39.5%) each were obtained in the role-physical, vitality and social functioning scales as shown in Table 2.

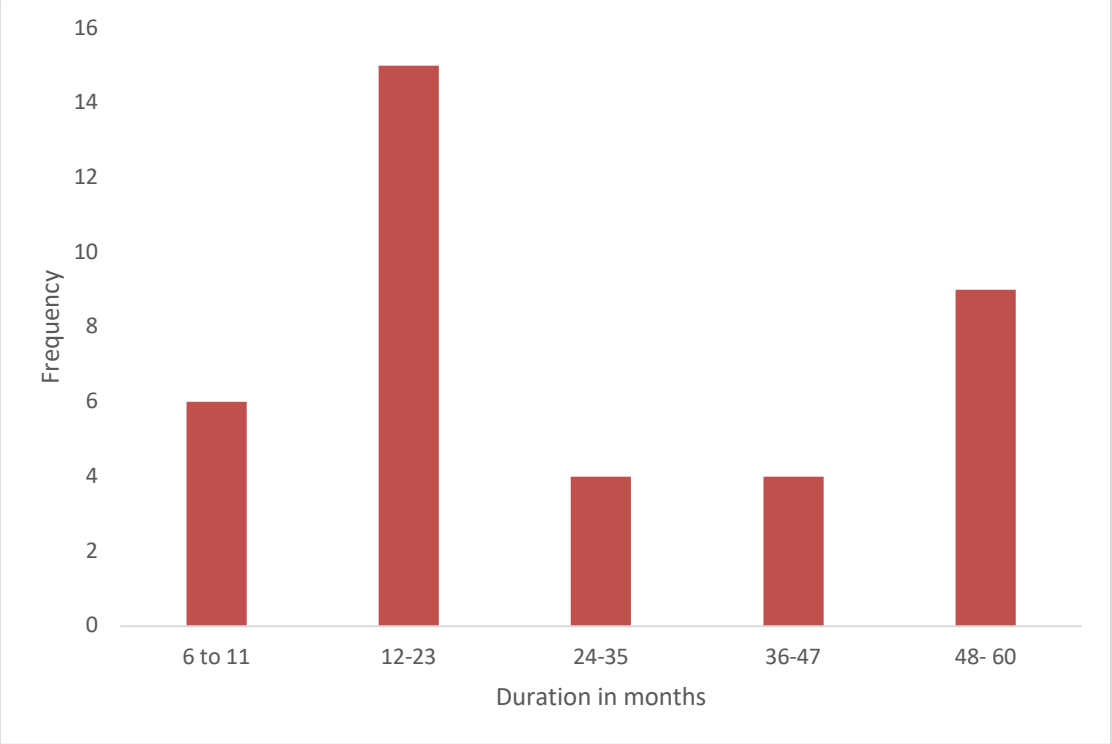


**Fig. 1.** Time interval in months between TB treatment completion and study

**Table 1**
Mean health-related quality of life scores of the participants

| Scales | N | Minimum score | Maximum score | Mean | Standard Deviation |
|---|---|---|---|---|---|
| Physical functioning | 38 | 73.33 | 100.00 | 91.14 | 11.42 |
| Role-physical | 38 | 50.00 | 100.00 | 80.26 | 24.77 |
| Bodily pain | 38 | 50.00 | 100.00 | 81.36 | 15.67 |
| General health perception | 38 | 48.00 | 100.00 | 80.84 | 21.89 |
| Vitality | 38 | 50.00 | 100.00 | 76.21 | 19.73 |
| Social functioning | 38 | 60.00 | 100.00 | 83.16 | 19.19 |
| Role-Emotion | 38 | 50.00 | 100.00 | 83.77 | 21.04 |
| Mental health | 38 | 50.00 | 100.00 | 82.89 | 18.87 |
| Total mean HRQOL[†] | 38 | 56.00 | 100.00 | 82.45 | 18.11 |
| Perceived health transition | 38 | 60.00 | 100.00 | 86.32 | 16.18 |

| | | | | | |
|---|---|---|---|---|---|
| Physical component summary | 38 | 58.00 | 100.00 | 83.40 | 17.71 |
| Mental component summary | 38 | 52.50 | 100.00 | 81.51 | 18.84 |

HRQOL†: Health-related quality of life

**Table 2**
Proportions of medium and high HRQoL scores across the domains

| SF-36 Scales | Frequency (%) | |
|---|---|---|
| | Moderate n (%) | High n (%) |
| Physical Function | 0 (0) | 38 (100.0) |
| Role-Physical | 15 (39.5) | 23 (60.5) |
| Bodily Pain | 5 (13.2) | 33 (86.8) |
| General Health | 12 (31.6) | 26 (68.4) |
| Vitality | 15 (39.5) | 23 (60.5) |
| Social Functioning | 15 (39.5) | 23 (60.5) |
| Role-Emotion | 7 (18.4) | 31 (81.6) |
| Mental Health | 7 (18.4) | 31 (81.6) |
| Total HRQoL | 12 (31.6) | 26 (68.4) |

*3.3 Association between health-related quality of life and post-TB treatment duration*

Majority, 25 (65.8%) had abnormal lung function results, with most 15 (39.5%) being within 12 to 23 months post treatment. The association between HRQoL and post TB-treatment duration was significant with p = <0.001. (Figure 2)

*3.4 Association between health-related quality of life and lung function test*

Majority, 25 (65.8%) had abnormal spirometry results. Statistically significant associations were found between the lung function tests results and the following HRQoL scale variables: role-physical (p = <0.001), general health (p = 0.003), vitality (p = <0.001), social function (p = < 0.001), overall wellbeing (p = 0.003) using chi square and Fishers Exact tests were cells had values of less than five. as shown in Table 3.

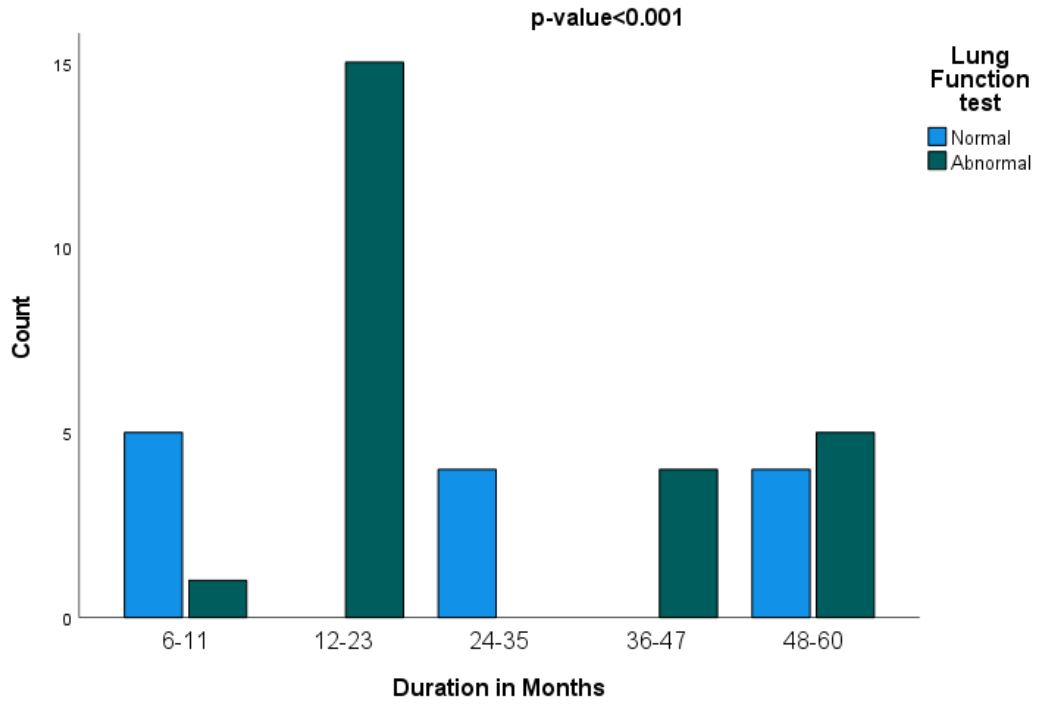


**Fig. 2.** Association between health-related quality of life and post-TB treatment duration

**Table 3**
Association between health-related quality of life and lung function test

| | Lung function test | | | |
|---|---|---|---|---|
| **Variable** | **Normal** | **Abnormal** | **Total** | **p-value** |
| | **n (%)** | **n (%)** | **n (%)** | |
| **Physical Function** | | | | |
| Good | 13 (34.2) | 25 (65.8) | 38 (100.0) | — |
| **Role-Physical** | | | | |
| Medium | 0 (0.0) | 15 (100.0) | 15 (100.0) | <0.001 |
| Good | 13 (56.5) | 10 (43.5) | 23 (100.0) | |
| **Bodily Pain** | | | | |
| Medium | 0 (0.0) | 5 (100.0) | 5 (100.0) | 0.144 |
| Good | 13 (39.4) | 20 (60.6) | 33 (100.0) | |
| **General Health** | | | | |
| Medium | 0 (0.0) | 12 (100.0) | 12 (100.0) | 0.003 |

| | | | | |
|---|---|---|---|---|
| Good | 13 (50.0) | 13 (50.0) | 26 (100.0) | |
| **Vitality** | | | | |
| Medium | 0 (0.0) | 15 (100.0) | 15 (100.0) | <0.001 |
| Good | 13 (56.5) | 10 (43.5) | 23 (100.0) | |
| **Social Functioning** | | | | |
| Medium | 0 (0.0) | 15 (100.0) | 15 (100.0) | <0.001 |
| Good | 13 (56.5) | 10 (43.5) | 23 (100.0) | |
| **Role-Emotion** | | | | |
| Medium | 0 (0.0) | 7 (100.0) | 7 (100.0) | 0.072 |
| Good | 13 (41.9) | 18 (58.1) | 31 (100.0) | |
| **Mental Health** | | | | |
| Medium | 0 (0.0) | 7 (100.0) | 7 (100.0) | 0.072 |
| Good | 13 (41.9) | 18 (58.1) | 31 (100.0) | |
| **Total HRQoL** | | | | |
| Medium | 0 (0.0) | 12 (100.0) | 12 (100.0) | 0.003 |
| Good | 13 (50.0) | 13 (50.0) | 26 (100.0) | |

## 4. Discussion

Tuberculosis (TB) has been shown to significantly affect patients' quality of life during and after treatment, particularly among adults. However, limited studies have explored this impact in children and adolescents. Existing research varies widely in methodology and assessment tools, making cross-study comparisons challenging. This study employed the SF-36 health survey [9] to evaluate both physical and mental dimensions of health-related quality of life (HRQoL) in post-TB pediatric patients. In our cohort, the lowest scores were observed in the role-physical, vitality, and social functioning domains, two of which contribute to the Physical Component Summary (PCS). These findings align with a study from The Gambia,[12] which reported low physical health scores in a similarly aged population, although different tools were used, limiting direct comparison. Similarly, a study from Uzbekistan found reduced social functioning scores among children and adolescents, disaggregated by gender and age[13]. While our study also identified social functioning as a low-scoring domain, we did not stratify by demographic variables. According to the World Health Organization, quality of life is shaped by cultural values and societal expectations[14]. Reduced social functioning may indicate challenges in fulfilling roles such as student, friend, or family member,[15] and may reflect diminished satisfaction in leisure and social engagement[16].

Therefore, lower social functioning scores as seen in this study may suggest that after treatment for Tb children and adolescents may not meet up with their schooling and other social expectations. A systematic review on post-TB respiratory impairment and disability reported that more children less than 10 years old had reduced quality of life[17].

Although overall HRQoL scores were generally high, the domain of general health perception scored lowest, suggesting lingering concerns about wellbeing. This may be due to residual symptoms, psychological distress, or uncertainty about long-term recovery. Notably, while most participants reported good HRQoL in both physical and mental domains, scores remained below the maximum threshold, indicating that TB treatment may not fully restore pre-illness quality of life although this assumes that scores were maximal prior to TB disease as we did not assess. Our study findings mirror adult studies that highlight persistent psychological and physical challenges post-treatment[7,18]. Stigma and social isolation, as reported in previous research, may further compromise psychological wellbeing, underscoring the need for intentional mental health assessments in post-TB care[19].

The generally good HRQoL scores observed may reflect recovery over time, as most participants were in the one- to two- year post-treatment phase. Furthermore, there was a significant association between HRQoL and duration of time post-treatment. This aligns with findings from an Indian study which reported comparable HRQoL scores between post-TB patients and the general population after one year using the SF-36 questionnaire[20]. However, due to the cross-sectional nature of our study and absence of a control group, definitive conclusions about recovery trajectories cannot be drawn.

Significant associations between HRQoL and lung function impairment were observed, consistent with prior studies[7,12]. This reinforces the importance of recognizing post-TB lung disease (PTLD) as a contributor to long-term morbidity[6, 12, 21, 22, 23]. Children, due to their longer life expectancy and developmental vulnerability, may be at greater risk of accumulating complications over time. Moreover, their limited ability to articulate symptoms necessitates proactive and holistic follow-up care,[24] including both HRQoL assessments and spirometry.

Comparable studies from Nigeria,[7] The Gambia,[12] South Africa,[22] and India[20] have reported similar HRQoL outcomes post-TB treatment, though mental health domains vary. These differences may be shaped by cultural perceptions, healthcare access, and stigma. Our findings support the integration of HRQoL assessments into national TB programs, with routine post-treatment follow-up incorporating psychosocial screening and pulmonary rehabilitation—especially for children with impaired lung function. This therefore, underscores the need for building capacity and providing equipment for spirometry and pulmonary rehabilitation as this is currently inadequate in the country.

This study contributes to the limited global data on the wellbeing of patients post-TB treatment and offers valuable insights for shaping follow-up care, preventive strategies, and national TB programmes and policies. Identifying these health challenges can help address unmet supportive needs for TB survivors.

This study has some limitations. Its cross-sectional design precludes causal inference, and reliance on self-reported HRQoL introduces potential recall bias. There was also the risk of selection bias. The absence of a control group limits comparative analysis with the general population. Additionally, the small sample size may affect generalizability. While the SF-36 is validated, it may not fully capture paediatric-specific concerns as it is meant for a population 15 years and above and so may not fully explore the HRQoL in the younger children used in the study. Nonetheless, as a pilot study, it provides important preliminary data and highlights the need for longitudinal research with larger, nationally representative samples.

## 5. Conclusion

Health-related quality of life assessment is essential for post-TB care in children and adolescents and should encompass physical, social, and mental domains. Where feasible, spirometry should be routinely included in follow-up evaluations to identify patients who need pulmonary rehabilitation. These measures can inform comprehensive care strategies and guide national policy development for TB survivors, noting the need for continued follow-up medical visits post-treatment.

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