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ORIGINAL ARTICLE

Assessment of current practices in management of childhood TB among frontline clinicians in Southern Nigeria

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Background: Poor competence of clinicians may be a critical factor responsible for the under-diagnosis of childhood TB in high-burden settings. Our objective was to assess the current practices of management of childhood TB among clinicians in Nigeria.

Methods: A cross-sectional survey was conducted among clinicians recruited through a three-stage sampling technique from 76 health facilities in Southern Nigeria. A semi-structured questionnaire was administered to all participants.

Results: Of 106 clinicians who completed the survey, 73 (68.9%) were <40 years and 67 (63.2%) were males. Also, 14 (13.2%) were paediatricians, 22 (20.8%) were paediatric specialist trainees and 70 (66%) were medical officers in primary and secondary care health facilities. About 94% of the respondents perceived diagnosis of childhood TB a challenge in Nigeria. The overall mean (SD) knowledge score was 3.8±0.9 (maximum 5), and 68 (64.2%) had good knowledge of childhood TB. The mean (SD) appropriate practice score was 4.0±1.7 (maximum 10) and, only 8 (7.5%) of them were considered to have adopted appropriate practices regarding childhood TB care.

Conclusions: There are gaps in practices adopted by frontline clinicians in the management of childhood TB in Nigeria. Focused training of health workers on childhood TB care is urgently recommended.

Keywords: Children, Clinicians, Nigeria, TB, Tuberculosis

Background

Globally, childhood TB constitutes 6–10% of all TB cases.[1] WHO estimates that in high burden countries, about 40% of all TB cases are expected to occur in children.[1] Childhood TB has historically been neglected by clinicians, policymakers and the global health community.[1,2] This is partly because of difficulty in confirming a case of childhood TB due to lack of accurate, reliable diagnostic tools and poor recording and reporting practices. Only smear-positive cases have been routinely reported by national programmes while the majority of children have other types of TB.[1,2] In addition, this neglect partly stems from the misperceptions that childhood TB is usually less infectious than adult TB, and that childhood TB would disappear simply by containing TB in the adult population[1,2] Furthermore, the neglect of childhood TB occurs partly due to the misplaced faith in the protective efficacy of the BCG vaccine, which although has been shown to prevent disseminated TB in children, does not prevent the occurrence of TB in a substantial proportion of children or adults. Consequently, it may not be considered an effective measure of TB control.[1,2] Due to lack of a reliable preventive vaccine, the burden of childhood TB may be a reflection of the level of TB control achieved within a particular community, because TB in children results from recent transmission.[3]

Nigeria ranks third among the 22 high-TB burden countries of the world and children account for about 40% of its population.[1,4] It is estimated that Nigeria accounts for 10% of the total burden of paediatric TB in the 22 countries.[5] However, childhood TB accounted for only 5.8% of notified cases in 2013.[6] In addition, a review of 12-year data from 14 State Control Programmes in Southern Nigeria assisted by the German Leprosy and Tuberculosis Relief Association (GLRA) showed that the proportion of children

among notified cases ranged from 1–5%.[7,8] In order to end the neglect and overcome barriers in the control of childhood TB, there is a need for greater awareness and screening for childhood TB in high-burden settings.[2] The responsibility for early diagnosis and treatment of childhood TB cases starts in the community where the burden of TB exists. This responsibility however, extends to all who are engaged in delivering health care to children and adolescents especially at the levels of primary and secondary care, where most sick children present. Failure of the health system to detect childhood TB cases may contribute to the persisting burden of TB in Nigeria.

Identifying and filling gaps in frontline clinicians' knowledge and appropriate practices regarding childhood TB care is crucial to improving case detection and management. However, guidelines available on paediatric TB vary substantially, reflecting wide variations in the management of paediatric TB in the US, UK and South Africa, and WHO recommendations.[9–12] In 2013, a multi-centre study funded by the Stop TB Partnership's TB REACH was set up by the GLRA with the aim of implementing intensified TB case finding in children. This included training frontline clinicians in the diagnosis and treatment of TB in children. Before implementation of the project, a survey of current practices regarding the management of paediatric TB was carried-out. The aim of this study was to assess the current practices of management of childhood TB among clinicians in Southern Nigeria in the context of national and international guidelines.

Materials and methods

Study design

This was a descriptive cross-sectional survey of medical doctors carried-out during June 2013 in six states in Southern Nigeria. Participants were clinicians involved in caring for sick children in their facilities. All participants gave written informed consent to participate in the study.

Study area and sampling

Nigeria is divided into six geo-political zones (three each in the north and south) with each having between five and seven states. The study was carried out in the three zones in Southern Nigeria. Participants were recruited through a three-stage sampling technique. First, two states were selected from each of the three geo-political zones in southern Nigeria through simple random sampling. The study states include Akwa Ibom and Rivers (south-south zone), Enugu and Ebonyi (south-east zone), and Ogun and Lagos (south-west zone). In each selected state, the top 20 (public and private) health facilities attending to sick children and notifying the highest proportion of childhood TB were identified and selected. In each of the selected health facilities, one to three clinicians who attend to paediatric patients were purposively selected across the selected healthcare facilities for enrolment into the study. However, a total of 106 doctors from 76 health facilities from the study states completed the survey (Figure 1).

The selected clinicians were invited to complete a questionnaire during a training programme prior to the implementation of an intervention to improve TB case finding in children in their state. The study instrument was a semi-structured self-administered questionnaire with a combination of open-ended and closed questions on knowledge, perception and practices of management of childhood TB.

The survey instrument was reviewed by a stakeholder group representing academics, practicing clinicians, TB control officers and other public health officials from the Ministry of Health in Ebonyi and Enugu States. After the initial design of the questionnaire, pre-testing was carried-out among clinicians involved in the supervision of the frontline health workers which resulted in minor modifications in the initially designed questionnaire. The training programme and data collection were carried out in June 2013.

Analysis and statistics

The data entry, cleaning and analysis were performed using Epi Info 3.5.1 (CDC, Atlanta, GA, USA). Participants with a knowledge score of >60% were considered to have good knowledge; those with ≤60% were considered to have poor knowledge. Similarly, those with a practice score of >60% were considered to have appropriate practice; those with ≤60% were considered to have poor practice of childhood TB management. Continuous variables were summarised as mean±SD. Categorical groups were summarised as proportions and differences between groups were compared using χ^2 test (and where appropriate using Fisher's exact or Mid-p exact tests). Statistical significance was set at p-value <0.05.

Results

Socio-demographic characteristics

A total of 106 clinicians completed the survey. Of these, 73 (68.9%) were below age 40 years and 67 (63.2%) were male (Table 1). Also, 14 (13.2%) were paediatricians, 22 (20.8%) were paediatric specialist trainees and the majority of them (70, 66.0%), were medical officers in primary and secondary care. Most of the clinicians surveyed (88, 83.0%) worked in a public sector health facility while others (18, 17.0%) worked in either private-for-profit (4, 3.8%) or private-not-for-profit (14, 13.2%) health facilities. In addition, 67 (63.2%) had attended to sick children for five or more years, and 80 (75.5%) attended to six or more sick children daily.

Knowledge and perception of childhood TB

The respondents were assessed regarding their knowledge and perception on childhood TB (Table 2). The overall mean (SD) knowledge score was 3.8±0.9 (maximum 5) suggesting that they generally had a fairly good knowledge on the burden of childhood TB, the need to screen children presumed to have TB for HIV and -screen children of HIV-positive mothers for TB (Table 3). However, the most knowledge deficit was in identifying the age group of the children most affected by TB, with only 33.0% (35) having the correct knowledge (Table 3). Overall, 68 (64.2%; 95% CI 55.2 to 73.4%) had good knowledge of childhood TB (Table 2).

Furthermore, 102 (96.2%) of the respondents perceived childhood TB to be a major problem in Nigeria, 100 (94.3%) perceived the diagnosis of TB in children to be a major challenge and 95 (89.6%) had suspected TB in a child in the past year.

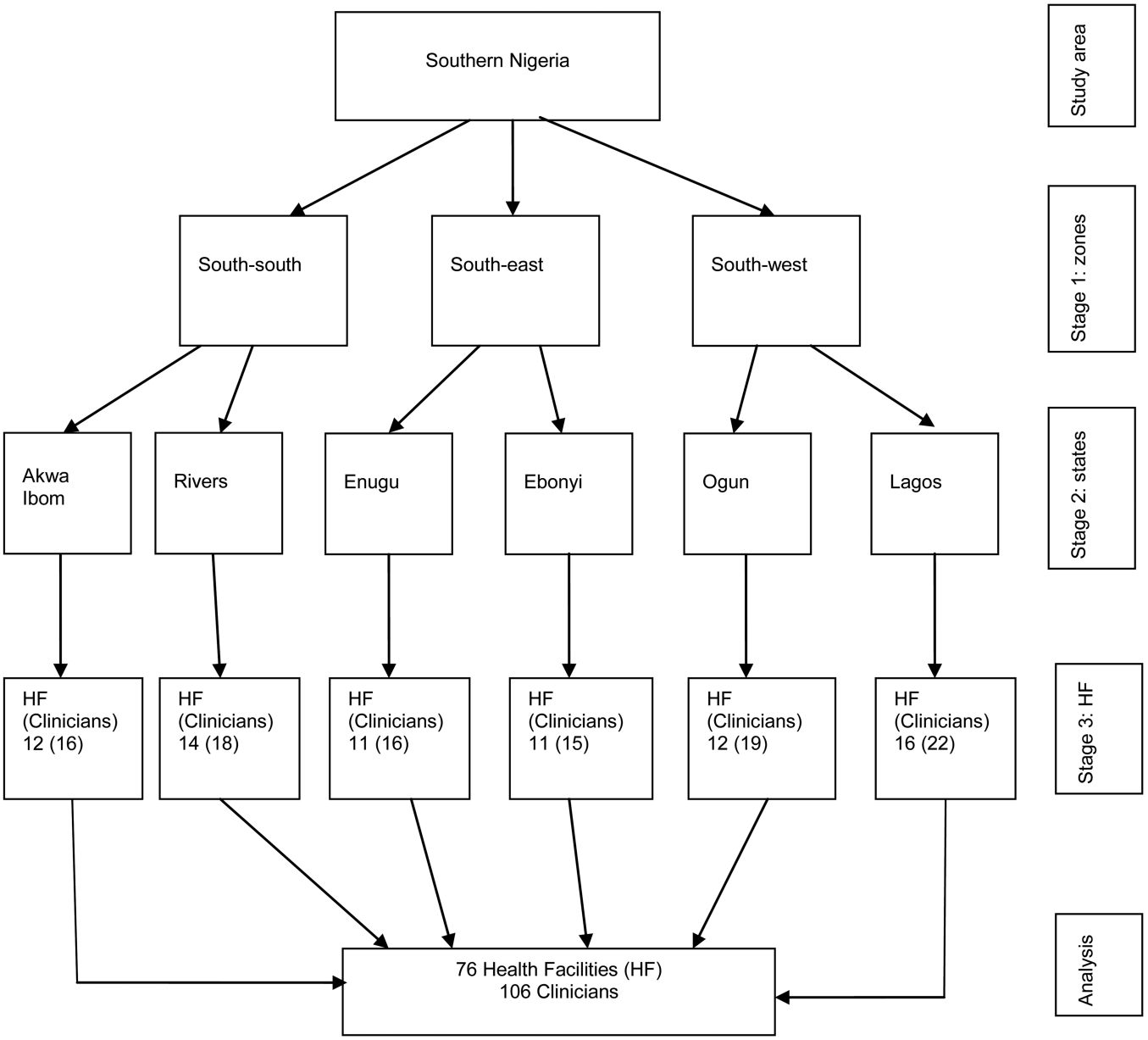

Figure 1. Flowchart of recruitment of study participants.

Assessment of practices

A total of 47 (44.3%) of the respondents have used the national guidelines for the management of TB in children. A similar proportion of them, 41 (38.7%), have used the childhood TB screening score chart from the Nigeria National TB Control Programme (NTP; Table 1). Although, 57 (53.8%) correctly identified the clinical features they would consider suggestive of TB in children in their practice, only 34 (32.1%) correctly identified the appropriate investigations for confirming the diagnosis. Only 31 (29.2%) had used the childhood TB screening score chart and considered it useful (Table 1). Moreover, only 29 (27.4%) of the respondents correctly identified the anti-TB regimen for treating a newly-diagnosed child with drug-susceptible TB. In addition, only 9 (8.5%) respondents have ever received additional training on management of TB in children, but 101 (95.3%) agreed that additional training of health workers on the use of the TB screening score chart will improve diagnosis of childhood TB. The respondents' mean (SD) appropriate practice score was 4.0±1.7 (maximum 10) and overall, only 8 (7.5%; 95% CI 2.5 to 12.5%) were considered to have appropriate practices regarding TB in children.

Factors associated with knowledge and practice of childhood TB

The relationships between the socio-demographic characteristics of the respondents and knowledge TB in children is shown in Table 4. Good knowledge did not differ according to age

Table 1. Socio-demographic characteristics of the respondents according to years of caring for sick children

Variables	Overall n (%)	<5 years n (%)	≥5 years n (%)	p-value
Total	106	39 (37)	67 (63)	
Age (years)				<0.001
<40	73 (68.9)	37 (95)	36 (54)	
≥40	33 (31.1)	2 (5)	31 (46)	
Gender				NS
Male	67 (63.2)	27 (69)	40 (60)	
Female	39 (36.8)	12 (31)	27 (40)	
Designation of respondents				NS
Consultant	14 (13.2)	0	14 (21)	
Resident	22 (20.8)	8 (21)	14 (21)	
Medical officer	70 (66.0)	31 (79)	39 (58)	
Level of health facility				NS
Primary	11 (10.4)	7 (18)	4 (6.0)	
Secondary	61 (57.5)	22 (56)	39 (58)	
Tertiary	34 (32.1)	10 (26)	24 (36)	
Type of facility				NS
Public	88 (83.0)	29 (74)	59 (88)	
Private for profit	4 (3.8)	3 (8)	1 (1)	
Private not for profit	14 (13.2)	7 (18)	7 (11)	
Number of children seen daily				NS
≤5	26 (24.5)	8 (20)	18 (27)	
6 or more	80 (75.5)	31 (80)	49 (73)	

NS: not significant.

(p=0.22) or gender (p=0.21) categories. Also, good knowledge of childhood TB did not differ according to the rank of clinician (p=0.21), type of health facility of practice (p=0.56), duration of working in paediatric setting (p=0.23) or number of children attended to daily (p=0.21). However, clinicians in tertiary care were more likely to have good knowledge of childhood TB compared to those in secondary or primary care (p=0.04).

The relationship between the socio-demographic characteristics of the respondents and appropriate practices regarding TB in children is shown in Table 5. Appropriate practice regarding TB in children did not differ according to the age (p=0.74), gender (p=0.24) or rank of the respondents (p=0.17). Also, there were no differences in appropriate practice on TB in children according to type of facility (p=0.42), duration attending to paediatric cases (p=0.95) or number of children seen daily (p=0.94). Although, clinicians who worked in tertiary care had a higher rate of appropriate practice (4, 12%) compared with those who worked in secondary (3, 5%) or primary care (1, 9%), the difference, however, did not reach statistical significance (p=0.45)

Discussion

In this study, we have shown that frontline clinicians involved in caring for sick children had fairly good knowledge of childhood TB—with a major knowledge deficit being not knowing the age-group of children most affected by TB. We have also shown that most of the study clinicians had the right perceptions about TB in children. However, we found that appropriate practices regarding childhood TB diagnosis and treatment are grossly poor. Moreover, their socio-demographic and clinical characteristics were neither associated with their knowledge of childhood TB nor their appropriate practices regarding childhood TB. Previous studies that have evaluated the management outcomes of childhood TB, reported that treatment practices of TB in children are substantially variable and clinicians generally do not follow the national/WHO guidelines for treating childhood TB.[13–15]

The clinicians surveyed reported some knowledge gaps that should inform the development of comprehensive training programme. Although in general, the clinicians had good overall knowledge scores, they were found to have poor knowledge of the age-group of children likely to be most affected by TB. Furthermore, only about half of them could correctly identify childhood symptoms of TB in their practices prior to the training. As prompt diagnosis of TB is essential for early treatment and reduction in community transmission of TB, the inability of the clinicians to recognise the symptoms of childhood TB and identify subgroups of children who may likely have TB disease may lead to delays in treatment.[16] Such poor symptom recognition could result in several missed opportunities to diagnose childhood TB in the clinic and these delays may contribute to TB spread among family members. In addition, we found that knowledge scores differed by level of health facilities, with clinicians based at tertiary health facilities having better knowledge scores compared to those at the primary and secondary levels of care. The continuous medical education and training available at tertiary facilities may have been contributory, and this underscores the need for continuous capacity building for clinicians in primary and secondary care. However, we found no differences in appropriate practices regarding childhood TB across all levels of care demonstrating that even in tertiary facilities increased knowledge scores have not translated to improvement in appropriate practices in the management of childhood TB. Three recent studies in the UK, India and Tanzania evaluated knowledge or practices on diagnosis and management of childhood TB among health workers.[17–19] Consistent with the findings of this study, health workers and paediatricians in Tanzania and India, respectively, had high knowledge scores of childhood TB, but reported some gaps in knowledge.[18,19] Given that these studies developed and used various questionnaires according to their local TB situation and surveyed different respondents (viz, paediatricians in the public sector in the UK, paediatricians in the private sector in India, and doctors and nurses in urban/rural Tanzania),[17–19] they could not be meaningfully compared. There is a need to develop a standardised instrument for assessing clinicians' knowledge and practice of childhood TB. This should include areas such as diagnosis and treatment, management of close contacts, drug-resistant TB and TB/HIV.

Childhood TB has the challenge of microbiological confirmation due to difficulties in performing sputum induction, bronchoalveolar or gastric lavages, or having TB cases presenting with mild cough that is non-productive of sputum.[18,20] In European settings for example, only 42.3% of TB cases in children reported to the European Centre for Disease Prevention and Control (ECDC) in 2000–2009 had mycobacterial cultures done, of which 39.9%

Table 2. Proportions of respondents' knowledge and practices related to TB in children according to years of caring for sick children

Variable	Total n (%; 95% CI)	<5 years n (%; 95% CI)	≥5 years n (%; 95% CI)	p-value[a]
Overall	106	39	67	
% knowledge score				NS
≤40	8 (7.6; 2.6–12.6)	2 (5; 1.4–16.9)	6 (9; 7.2–23.6)	
41–60	30 (28.3; 19.7–36.9)	15 (38; 25.0–54.1)	15 (22; 14.1–33.7)	
61–80	46 (43.4; 34.0–52.8)	15 (38; 25.0–54.1)	31 (46; 34.9–58.1)	
>80	22 (20.7; 13.0–28.4)	7 (18; 9.0–32.7)	15 (22; 14.1–33.7)	
Good knowledge (>60%)	68 (64.2; 55.2–73.4)	23 (59; 43.4–72.9)	45 (67; 55.3–77.2)	NS
Poor knowledge (≤60%)	38 (35.8; 26.6–44.8)	16 (41; 27.1–56.6)	22 (33; 22.8–44.7)	
% appropriate practices				NS
≤30	45 (42.5; 33.1–51.9)	21 (54; 38.6–68.4)	24 (36; 25.4–47.8)	
31–50	42 (39.6; 30.3–48.9)	13 (33; 20.6–49.0)	29 (43; 32.1–55.2)	
51–70	17 (16.0; 9.0–23.0)	5 (13; 5.6–26.7)	12 (18; 10.6–28.8)	
>70	2 (1.9; -0.7–4.5)	0 (0.0–9.0)	2 (3; 0.8–10.3)	
Appropriate practice (>60%)	8 (7.5; 2.5–12.5)	2 (5; 1.4–16.9)	6 (9; 4.2–18.2	NS
Poor practice (≤60%)	98 (92.5; 87.5–97.5)	37 (95; 83.1–98. 6)	61 (91; 81.8–95.8)	

NS: not significant.
[a] p-value based on Fisher's exact (or mid-p exact) test.

Table 3. Respondents knowledge, perception and practices regarding childhood TB according to years of caring for sick children

Variable	Total n (%) correct	<5 years n (%) correct	≥5 years n (%) correct	p-value[a]
Overall	106	39	67	
Knowledge				
Identified the proportion of children in notified TB	81 (76.4)	31 (80)	50 (75)	NS
Every childhood TB suspect should have HIV test?	94 (88.7)	36 (92)	58 (87)	NS
Which age-group is childhood TB most common	35 (33.0)	14 (36)	21 (31)	NS
Children of HIV positive mothers are at risk of developing TB	98 (92.5)	37 (95)	61 (91)	NS
The cut off for tuberculin test positivity is usually lower in HIV infected children	77 (72.6)	27 (69)	50 (75)	NS
Perception				
Perceive childhood TB to be a public health problem in Nigeria	102 (96.2)	37 (95)	65 (97)	NS
Consider the diagnosis of childhood TB a challenge in Nigeria	100 (94.3)	38 (97)	62 (93)	NS
Have suspected TB case in a child in the past one year	95 (89.6)	35 (90)	60 (90)	NS
Practices				
Use of National TB guidelines for diagnosis of childhood TB	47 (44.3)	22 (56)	25 (37	NS
Use of the National TB Programme Score Chart for childhood TB diagnosis	41 (38.7)	11 (28)	30 (45)	NS
Correctly identified all clinical features suggestive of TB in children	57 (53.8)	18 (46)	39 (58	NS
Correctly identified investigations for diagnosing TB in children	34 (32.1)	13 (33)	21 (31)	NS
Have used a TB score chart and considered it useful	31 (29.2)	7 (18)	24 (36)	NS
Have been able to treat a child following TB diagnosis	66 (62.3)	22 (56)	44 (66)	NS
Correctly identified the regimen for category I TB in a child	29 (27.4)	11 (28)	18 (27)	NS
Agreed that paediatric anti-TB drugs are readily available in his/her health facility	38 (35.8)	12 (31)	26 (39)	NS
Have ever received additional training on management of TB in children	9 (8.5)	2 (5)	7 (11)	NS
Agreed that training of health workers on score chart use will improve childhood TB diagnosis	101 (95.3)	36 (92)	65 (97)	NS

NS: not significant.
[a] p-value based on Fisher's exact (or mid-p exact) test.

Table 4. Relationship between characteristics of the respondents and knowledge of TB in children

Variables	Poor knowledge n (%)	Good knowledge n (%)	χ^2	p-value[a]
Total	38	68		
Age (years)			1.5	NS
<40	29 (40)	44 (60)		
≥40	9 (27)	24 (73)		
Gender			1.6	NS
Male	27 (40)	40 (60)		
Female	11 (28)	28 (72)		
Designation of respondent			1.5	NS
Consultant	4 (29)	10 (71)		
Resident	6 (27)	16 (73)		
Medical officer	28 (40)	42 (60)		
Level of health facility			7.6	0.04*
Primary	7 (64)	4 (36)		
Secondary	24 (39)	37 (61)		
Tertiary	7 (21)	27 (79)		
Type of facility			1.2	NS
Public	30 (34)	58 (66)		
Private for profit	1 (25)	3 (75)		
Private not for profit	7 (50)	7 (50)		
Years caring for sick children			1.5	NS
<5 years	17 (44)	22 (56)		
≥5 years	21 (31)	46 (69)		
Number of children seen daily			1.6	NS
≤5	12 (46)	14 (54)		
6 or more	26 (32)	54 (68)		

NS: not significant.
[a] p-value based on Fisher's exact (or mid-p exact) test.

were culture-positive.[21] In response, the NTP recommended the use of a WHO validated TB score chart for screening of sick children in order to identify those that will require further evaluation for TB.[22] In this study, less than two-thirds of the clinicians have used this score chart. In addition, only one-third of the clinicians who were asked to report on their practices regarding investigations they performed in diagnosing TB in children correctly reported an appropriate investigative test. These highlight the need to undertake training programmes targeted at improving the management of childhood TB for clinicians involved in caring for sick children in Nigeria.

The survey showed that about two-thirds of the clinicians reported that they had diagnosed and treated children with TB. However, only about half of those who reported managing children with TB correctly identified the recommended regimen for treating a newly-diagnosed drug-sensitive TB. Complete TB treatment is essential to reducing TB-related morbidity and mortality as well as limiting the risk of transmission in the community. Our study showed gaps in treatment of childhood TB which potentially could lead to sub-optimal treatment outcomes. Previous studies have shown that clinicians adopted varying treatment practices with some having their own type of regimen for managing TB.[14,18] Unlike the findings of a survey in the UK, the treatment practices for childhood TB reported in this study were consistent with the results of a study in India which showed that only one-third of paediatricians were following recommended first-line regimen for treatment of TB.[17,18]

This survey showed that less than a tenth of clinicians involved in treating children had received additional training on the management of childhood TB and almost all the participants agreed that such training would improve TB case detection and control. Consistent with previous studies, this study has identified substantial gaps in knowledge and practices regarding TB in children in Nigeria. Thus, focused training for clinicians involved in paediatric care in this setting is likely to improve childhood TB control. This training should involve field training, hands-on supervision, regular clinical meetings and other participatory problem-solving techniques in order to ensure that the lessons learnt could easily be applied to practice.[23] The benefits of such targeted training and follow-up for childhood TB have been previously shown. For example, in Bangladesh, providing simple guidance, training and logistical support at microscopy centres led to a three-fold increase in child TB case detection compared to baseline.[24] Also, focused training of clinicians and other health workers in

Table 5. Relationship between characteristics of the respondents and practices on TB in children

Variables	Poor practice n (%)	Appropriate practice n (%)	p-value[a]
Total	98	8	
Age (years)			NS
<40	67 (92)	6 (8)	
≥40	31 (94)	2 (6)	
Gender			NS
Male	64 (96)	3 (4)	
Female	34 (87)	5 (13)	
Designation of respondent			NS
Consultant	13 (93)	1 (7)	
Resident	18 (82)	4 (18)	
Medical officer	67 (96)	3 (4)	
Level of health facility			NS
Primary	10 (91)	1 (9)	
Secondary	58 (95)	3 (5)	
Tertiary	30 (88)	4 (12)	
Type of facility			NS
Public	80 (91)	8 (9)	
Private for profit	4 (100)	0 (0)	
Private not for profit	14 (100)	0 (0)	
Years caring for sick children			NS
<5 years	36 (92)	3 (8)	
≥5 years	62 (93)	5 (7)	
Number of children seen daily			NS
≤5	24 (92)	2 (8)	
6 or more	74 (93)	6 (7)	

NS: not significant.
[a] p-value based on Fisher's exact (or mid-p exact) test.

high-burden settings has been associated with increases in TB screening, contact tracing, and TB case reporting in Nigeria and Bangladesh.[25,26]

This study has a number of strengths and limitations. The result of this study captures practices across public and private facilities with varying levels of care and may be representative of the practice of the high end performing paediatric TB treatment centres in the Southern region of Nigeria. The findings of our desk review for TB notifications for 2000–2011 showed that 85% of all childhood TB notifications came from the centres participating in this survey.[7] Second, previous studies which assessed practices of management of TB in children targeted mainly paediatricians[17,18]; however, at the primary and secondary levels of care, paediatricians are not routinely available to care for sick children, rather general clinicians do. Our survey covered a broader range of practitioners involved in caring for children at the primary and secondary levels of care. However, this survey reflects self-reported practices by the clinicians, we did not attempt to verify this by examining their records of patient management. Also, the data collection tool was targeted at a comprehensive review of practices regarding diagnosis and treatment of drug-susceptible childhood TB. At the time of the survey, the use of Xpert (GeneXpert) MTB/RIF testing kits by the NTP for diagnosis of drug-resistant TB had not been scaled-up. Furthermore, we did not survey the clinicians' practices of treating children with TB/HIV co-infection or children at risk of TB infection that may benefit from isoniazid preventive therapy. These should be considered in future surveys and training programmes for clinicians involved in paediatric care.

Conclusions

This survey showed that there is a mismatch of good knowledge and appropriate practice score results among frontline clinicians regarding childhood TB in Nigeria. Although 68 (64.2%) of the clinicians had good knowledge scores, only 8 (7.5%) were considered to have followed appropriate practices regarding management of TB in children. We have shown that these poor practices occurred irrespective of levels of care, job category of the clinician, years caring for sick children and the majority of the clinicians having the right perceptions regarding paediatric TB. The challenges that prohibit this knowledge to practice translation may be due to lack of adequate training in managing childhood TB. These gaps in practices may lead to suboptimal outcomes of TB care in children. We recommend that the NTP should routinely undertake focused training of health care workers caring for sick children on the current NTP guidelines and international standards of TB care towards translating good knowledge scores to actual practices; and the impact of such training on future practices needs to be reassessed–particularly, how they contribute to improved case finding and management of childhood TB in the region.

Authors' contributions: JNC, KNU, NE, and DCO conceived the study and designed the study protocol; CCN, AOM, NOM, MCA, CO, JA, JI, and KNU carried out data collection, analysis and interpretation. JNC, AOM, NOM, MCA, CO, JA, KNU, NE, and DCO drafted the manuscript. All authors critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. KNU and JNC are guarantors of the paper.

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Competing interests: None declared.

Ethical approval: The study complies with international guidelines for research and was approved by the Ethical and Research Advisory Board of the German Leprosy and TB Relief Association, Nigeria. Approval was obtained from the State TB Control Programme in the six selected States for the project.

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