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Trend of Childhood TB Notifications in Nigeria

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Abstract
Background: Childhood tuberculosis (CTB) accounted for 10% of the total global tuberculosis (TB) burden in 2017. During the same year, CTB accounted for only 6% of the total TB cases notified by the National TB control programme (NTP) in Nigeria giving credence to the widely held belief that, over the past few years, clinicians and public health officials in the country may have given more attention to the diagnosis and treatment of TB in adults compared to children, resulting in under reporting of the true burden of the disease. Thus this study assessed the trend of childhood TB notifications in Nigeria, from 2012 to 2016.**Methods**: Retrospective record review of childhood TB cases notified by the NTP between January 1, 2012 and December 31, 2016. **Results**: A total of 27,793 CTB cases, representing 5.8% of all forms of TB cases, were notified and treated during the study period. This proportion is more or less similar for every year within the period under review.**Conclusion**: The case notification rate of TB among children has plateaued within the period under review. Efforts should be made to improve CTB detection, reporting and notification into the NTP Monitoring & Evaluation (M&E) system.
Keywords: Tuberculosis, World Health Organization, Bauchi, Childhood TB, National TB Control Programme, Caregivers, Quality of Life, Monitoring and Evaluation, Northeastern Nigeria.

1. Introduction

The World Health Organization, in its 2017 global TB report, estimated that about 1.04 million CTB cases (representing 10% of the global estimated burden of 10.4 million TB cases) occurred in 2016, out of which an estimated 210,000 cases died. However, only 358, 521 CTB cases were notified in 2014 by countries in the six WHO regions[1], as shown in Table 1. This figure represents only 39% of the global estimated burden of 1.04 million CTB cases, leaving 641,479 CTB cases or 61% as missed or not notified. At the country level, there is need to compare expected with notified CTB cases over the years so as to determine the magnitude of missed or not notified CTB cases by the NTP, if any. This will allow for discussions on programmatic issues that may explain possible reasons for the under reporting of the CTB cases and attempt to proffer solutions on how to improve CTB notification in the country. Thus, the purpose of this study is to assess the trend of CTB notifications in Nigeria over a 5-year period, from January 1, 2012 to December 31, 2016.

Table 1
Estimated Number of Incident CTB Cases in 2014, Globally by WHO Region

WHO Region	*Number of CTB case Notifications*	*Best Estimate*	*Estimated TB Incidence Uncertainty Level*
AFR	90,523	330,000	290,000-370,000
AMR	10,489	27,000	25,000-29,000
EMR	42,028	80,000	64,000-97,000
EUR	9,898	31,000	28,000-34,000
SEAR	168,310	340,000	310,000-370,000
WPR	37,273	150,000	130,000-170,000
Global	358,521	1,000,000	900,000-1,100,000

Note. TB = tuberculosis; AFR = African; AMR = American; EMR = Eastern Mediterranean; EUR = European; SEAR = South East Asian Region; WPR = Western Pacific Region. Adapted from "Global TB Report," by the World Health Organization, 2015, p. 33. Reproduced with permission.

2. Methodology

2.1 Study setting

Nigeria is a lower-middle-income country, having a Gross Domestic Product (GDP) of $481.1 billion and an estimated population of 186 million people as at 2016, comprising of 51% females and 49% males, making it the most populous country in Africa[2, 3]. Moreover, children aged 0-14 years constitute 45.7% (85 million) of the entire population, while those aged 65 years and above constitute a mere 4%, signifying that Nigeria comprises

of a young population with a broad-based population pyramid, as is typically found in developing countries with high fertility rates[2].

The West African country is divided into 36 states plus Abuja, the nation's capital city, 774 local government areas (LGAs), all grouped into six geopolitical zones: North Central, North East, North West, South East, South-South, and South West. Furthermore, it occupies an estimated 923, 768 square kilometers of land mass, extending from the Gulf of Guinea in the south to the borders of the Sahara Desert in the North corresponding to latitudes 4º16' and 13º53' north and longitudes 2º40' and 14º41' east. The country is geographically diverse, consisting of both low and highlands as well as wet and dry seasons[2].

In order to reduce the burden of TB in the country, the National TB, Leprosy and Buruli Ulcer Control Program (NTBLCP), herein referred to as the National TB Program (NTP), was established in 1988. The NTP, which is a unit in the department of Public Health, Federal Ministry of Health, Abuja, has been saddled with the responsibility of controlling TB, Leprosy and Buruli ulcer in Nigeria with the overall goal of reducing significantly the burden of these three diseases in line with the global targets.

With active support from development partners and other stakeholders, the NTP has, over the years, established a total of 7,458 TB service points, 3729 microscopy centers and 390 Xpert machines distributed across the 774 LGAs in the country, all of them integrated into the existing health system infrastructure and general health care services[4]. These services are implemented in collaboration with the HIV/AIDS control program at various levels of the health care system, the private health care providers, the community and development partners. Part of these services the NTP renders includes the diagnosis, classification and management of TB in children.

2.2 Study design

The study is a retrospective review of childhood TB notification data of NTP between January 1, 2012 and December 31, 2016.

2.3 TB diagnosis and treatment

Diagnosis of TB in children, as in adults, begins with the identification of a presumptive case by active or passive means. The health care worker then obtains specimen from the case and send for Xpert MTB/RIF assay as well as perform HIV testing. Three possible scenarios will ensue:

- Mycobacterium Tuberculosis (MTB) detected, Rifampicin Resistance (RR) not detected: this patient is treated as drug-susceptible TB (DS-TB) case.
- MTB detected, RR detected: this patient is referred to the drug-resistant (DR) TB section of the NTP for further management
- MTB not detected (GeneXpert negative/not done): in this patient, consider the presence of
    - Positive contact history
    - Physical signs suggestive of PTB
    - Chest x-ray suggestive of PTB

If none or only one of these features is present and the child is ill, he/she is referred to a Medical Officer or a Pediatrician for further management. However, if the child is well, it is unlikely to be TB, but is reviewed after 2 to 4 weeks. For those with 2 of the 3 features above, they are considered as DS-TB cases and treated as such. In situations where Xpert MTB/RIF assay is not feasible, AFB smear microscopy is performed instead for both diagnosis and treatment monitoring.

However, collecting sputum specimen may be difficult in under 5 children, in which case advanced techniques of specimen collection such as sputum induction (nebulization), gastric washings/aspirate and bronchoscopy are employed. Other investigations performed to establish CTB diagnosis, especially those involving body organs other than the lungs (extrapulmonary TB or EPTB), include radiological, tuberculin skin test (TST), body fluid analysis and histological tests. It is important to state that Xpert MTB/RIF assay, AFB smear microscopy, chest x-ray and the treatment are at no cost to the childhood TB patients as these are borne by the NTP and Partners.

The CTB drug dosages can be seen in Table 2. Furthermore, the treatment regimen of childhood DS-TB cases (both PTB and EPTB) consists of 2 months' intensive phase of Rifampicin, Isoniazid and Pyrazinamide as a fixed dose combination (FDC) and Ethambutol, and 4 months' continuation phase of Rifampicin and Isoniazid given as FDC (see Table 3).

Table 2
Childhood TB Drug Dosages

Drug	Dosage (mg/kg)	Range (mg/kg)	Maximum dose (mg/day)
Isoniazid (H)	10	7-15	300
Rifampicin (R)	15	10-20	600
Pyrazinamide (Z)	35	30-40	2000
Ethambutol (E)	20	15-25	1200

From *National Tuberculosis and Leprosy Control Program* (p. 7) by the Department of Public Health Nigeria. Copyright 2014 by the Department of Public Health Nigeria. Reproduced with permission.

Table 3
Regimen and Dosages for Children with Susceptible PTB/EPTB Cases

Daily Regimen	Weight			
	<5 kg	5-9 kg	>9-13 kg	>13-18 kg
Intensive phase (2 months)				
Combined tablets of RHZ (60 mg +30 mg+150 mg)	1	2	3	4
Ethambutol tablet (100 mg)	1	2	3	4
Continuation phase (4 months)				
Combined tablets of RH (60 mg +60 mg)	1	2	3	4

Note. PTB = Pulmonary TB; EPTB = Extra-pulmonary TB; RHZ = Rifampicin, Isoniazid, Pyrazinamide; RH = Rifampicin, Isoniazid. From *National Tuberculosis and Leprosy Control Program* (p. 7) by the Department of Public Health Nigeria. Copyright 2014 by the Department of Public Health Nigeria. Reproduced with permission.

However, the treatment duration is prolonged to 12 months for tuberculous meningitis (TBM) and osteo-articular TB (see Table 4). The treatment is directly observed (DOT) by health care workers in DOTS clinics or by treatment supporters (TS) in communities. The DOTS centers are manned by various cadres of trained health care workers (Nurses, community health workers, environmental health technicians etc.) and are located in tertiary, secondary and primary health care centres, both public and private, including faith-based.

Table 4
Regimen and Dosages for Children with TB Meningitis and Osteo-articular TB

Daily Regimen	Weight			
	<5 kg	5-9 kg	>9-13 kg	>13-18 kg
Intensive phase (2 months)				
Combined tablets of RHZ (60 mg +30 mg+150 mg)	1	2	3	4
Ethambutol tablet (100mg)	1	2	3	4
Continuation phase (10 months)				
Combined tablets of RH (60 mg +60 mg)	1	2	3	4

Note. RHZ = Rifampicin, Isoniazid, Pyrazinamide; RH = Rifampicin, Isoniazid. From *National Tuberculosis and Leprosy Control Program* (p. 7) by the Department of Public Health Nigeria. Copyright 2014 by the Department of Public Health Nigeria. Reproduced with permission.

2.4 Ethical issues

Data for this study were retrieved from secondary data routinely collected by the NTP and WHO Annual Global TB reports which are all in public domain, and as such no ethical clearance was obtained.

3. Results

A total of 27,793 CTB cases, representing 5.8% of all forms of TB cases, were notified and treated during the

study period. This proportion is more or less similar for every year within the period under review. Thus it can be stated that within the period under review, the CTB notifications in Nigeria has more or less stagnated between 5.8% to 6.0% among all forms of notified TB cases. Furthermore, there is a gap between expected and notified CTB cases in each of the years under review, culminating in a total of 20,268 missed or not notified CTB cases (see Table 5).

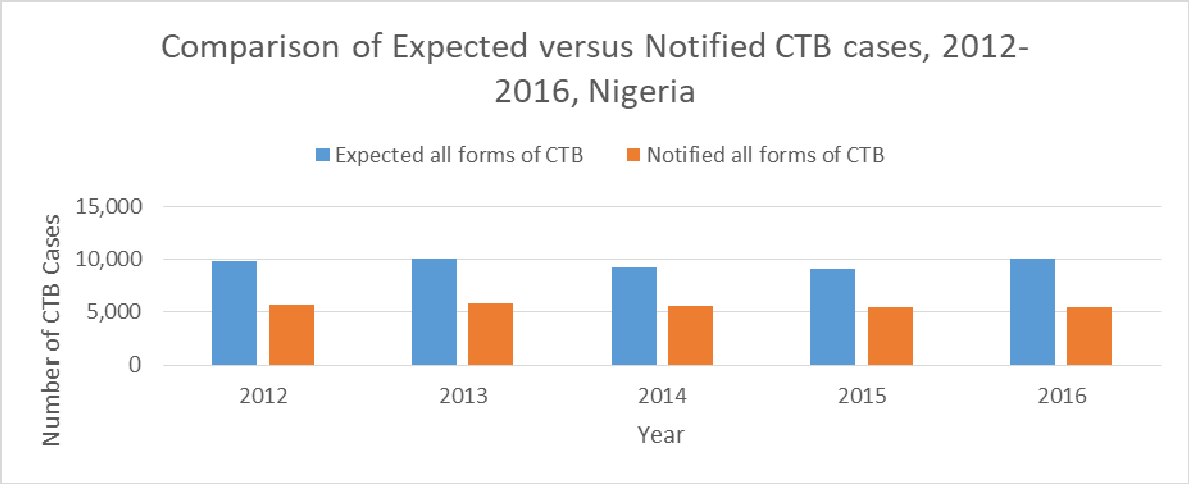
This finding has thus confirmed that in Nigeria, yearly CTB notification represent only about 6% of the total notification of all forms of TB. This has fallen short of the WHO recommendation that CTB notifications should constitute about 10-15% of the total notifications of all forms of TB[1]. The finding of this study that CTB notifications in Nigeria constitute only 6% of the notification of all forms of TB is comparatively lower than what obtains in other developing countries such as 15% in South Africa[5], 25% in Afghanistan[6], 3.4% in India[7], and 7.9% in Peru[8].

Table 5

Comparison of Expected versus Notified CTB cases, 2012-2016, Nigeria

Year	All Forms of TB	Expected all forms of CTB	Notified all forms of CTB	Missed/not notified CTB cases	Percentage of CTB among all forms
2012	97,853	9,785	5,687	4,098	5.8
2013	100,401	10,040	5,776	4,264	6.0
2014	91,354	9,135	5,481	3,654	6.0
2015	90,584	9,058	5,435	3,623	6.0
2016	100,433	10,043	5,414	4,629	6.0
Total	480,625	48,061	27,793	20,268	5.8

Figure 1.



3. Discussion

This study reviewed retrospectively the NTP childhood TB data with the sole purpose of assessing the trend of childhood TB cases notified in Nigeria within a 5-year period, from January 2012 to December 2016. The finding showed that over the years, CTB cases have constituted only a mere 6% of the total TB notifications in the country, a situation which is far below what obtains in other developing countries as well as below what was recommended by WHO. This gross under reporting of CTB cases in Nigeria may have given credence to the widely held belief that, over the past few years, clinicians and public health officials have given more attention to the diagnosis and treatment of TB in adults compared to children, resulting in under reporting of the true burden of the disease.

Other probable reasons for this finding include those related to difficulty faced by clinicians in diagnosing CTB cases since: they are seldom bacteriologically confirmed; clinicians who diagnose cases do not always report them to NTPs; high burdened TB countries are less likely to report them compared with adults; ignorance and stigma in the society; inadequate contact investigation; low access to laboratory tests; and insufficient trained health manpower[8]. Furthermore, children living with HIV/AIDS present another challenge when it comes to TB diagnosis because the HIV infection tend to complicate the interpretation of Mantoux tests and chest x-rays, both of which are important tests in the diagnosis of CTB[9].

Additionally, CTB cases are mainly noncontagious[10], and confirming their diagnosis in the laboratory can be very challenging due to difficulty in collecting sputum and other relevant specimens from infants and young

children, and the tendency to have false negative results due to low sensitivity of the tests while trying to detect smaller number of bacteria in children[11]. Thus, the diagnosis of CTB in many settings is confirmed on the basis of several criteria, namely: typical clinical signs and symptoms of the disease, positive purified protein derivative test (PPD), and positive interferon gamma release assay (IGRA), typical TB chest x-ray patterns, and history of contact with an infectious TB case[11]. Ultimately, the number of confirmed CTB cases determines the burden of the disease in a particular community, state, region, or country. This burden is likely to increase in regions of the world where adult TB is increasing, such as in sub-Saharan Africa[6].

The challenge of under reporting of CTB cases in Nigeria, as revealed by this study, could be addressed by strengthening the TB surveillance system, studying the roles of NTPs in curbing the spread of CTB, and better identification of potential risk factors for the occurrence of CTB. Risk factors for the occurrence of CTB vary by regions of the world[6]. For instance, whereas parents' or caregivers' nationalities, immigration status, and race and ethnicity remain key in the occurrence of CTB in North America and Europe[12,6,13], socioeconomic risk factors such as poverty, crowding, malnutrition, as well as caregivers' quality of life and educational status were found to be associated with a greater risk of children developing TB in low and middle income countries[14,6, 15,16] .

5. Conclusion

The study has established a 5-year trend of CTB notifications in Nigeria, which has plateaued between 5.8% to 6.0% of all forms of notified TB cases, thereby falling short of the WHO recommended 10-15% CTB notification among of all forms of TB. Secondly, the study has revealed a wide gap between expected and notified CTB cases in each of the years reviewed. Thus, it can be concluded that there is gross under reporting of CTB cases in Nigeria, a situation that calls for urgent strengthening of the TB surveillance system, prompt identification and cure of infectious TB in adults and better identification of potential risk factors for the occurrence of CTB.

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The authors wish to acknowledge the immense roles played by the NTP and WHO in accessing the secondary data and annual global TB reports respectively.

Conflicts of Interest

The authors wish to declare that there is no any conflict of interest or royalty attached to this study.

Key-points

- The study has established a 5-year trend of CTB notifications in Nigeria
- The study has revealed a wide gap between expected and notified CTB cases in each of the years reviewed.
- The study has established gross under reporting of CTB cases in Nigeria
  The policy implication is for the NTP and Partners to strengthen the existing TB surveillance system such that all infectious cases in adults are promptly identified, treated and cured, there by breaking the chain of transmission of the infection to healthy children.

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