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Spatial Disparity in Availability of Tuberculosis Diagnostic Services Based on Sector and Level of Care in Nigeria

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Abstract

Background: Delay in Tuberculosis (TB) diagnosis can contribute to late presentation, severe disease, and continued transmission. KNCV TB Foundation Nigeria through the United States Agency for International Development (USAID) funded the TB Local Organization Network (LON) 1 and 2 projects that explored the availability of Tuberculosis services based on sector and levels of care. **Methods:** TB Patient Pathway Analysis was carried out in 14 states comprising 92 facilities. It involved primary, secondary, and tertiary levels of health care in both the public and private sectors. This was a cross-sectional study under program implementation. Proforma was used to collect data on the available TB diagnostic services. **Results:** In public health facilities, GeneXpert was available at 100% in tertiary facilities in 8 (57%) states; up to 82% in 4 (33%) states, 50% available at secondary facilities in 2 states, and < 2% in 5 states. There is none at the primary facilities. Smear microscopy was available at 100% in tertiary facilities in 9 (64%) states and 3 (25%) states have 50% to 82%; secondary −10 (71%) states have > 70% at facilities; primary 1 (7%) state has it in 61% of facilities. Loop-mediated isothermal amplification (TB-LAMP) in tertiary 2 (17%) states have 20% and 100% respectively; secondary 4 (<30%) states have in 1 or 2 facilities; none for primary facilities. In private health facilities, 79% of states have Smear microscopy at both primary and secondary facilities, and only 2 states (14%) at tertiary facilities. Only 1 (7%) state has GeneXpert in all tertiary facilities, 2 (14%) states have secondary facilities,

and 4 states in about 1% of facilities. TB LAMP was not available in any tertiary facility, one (7%) state at secondary with coverage of 1%, and 2 (14%) states at primary both with 4% overall facility coverage. **Conclusions:** There is an inequitable distribution of TB diagnostic services in both sectors and levels of care in Nigeria. TB care and control will improve with enhanced equitable distribution of TB diagnostic services across the health system.

Keywords

Tuberculosis, Diagnostic Services, Disparity, Sector, Level, Nigeria

1. Introduction

Nigeria is a high-burden country for Tuberculosis (TB), Multidrug-Resistant TB (MDR-TB), and TB-HIV [1]. There were 440,000 cases of TB in 2019 [1]. In the same year, the country has case detection rates of 117,320 (27 percent) incident cases which is one of the lowest among high TB burden countries [1]. This largely inhibits infection control measures as it leads to delays in treatment initiation. The burdens of TB could be greatly minimized if effective preventive strategies, early diagnosis, and appropriate treatment are instituted on time [2]. However, this could be possible if health facilities are easily accessible and offer TB services, especially diagnostic services as it is key to the commencement of treatment and monitoring of follow-up to treatment [3] [4] [5] [6] [7]. A national assessment of TB services for confirmed TB patients reported that health facilities do not have regular access to necessary equipment for diagnosis and drug supplies. In addition, health workers do not receive refresher training and frequent supervision as required [8]. This implies that the existing health system in Nigeria faces multiple challenges in the management of presumptive and confirmed TB.

There have been concerted global efforts to end the Tuberculosis (TB) epidemic through improved TB case detection and treatment to achieve Sustainable Development Goal (SDG) 3.3 by 2030. However, these efforts have not been effective in significantly reducing the global burden of the TB epidemic. The main global indicator used to monitor progress in ending TB by 2030 is the TB incidence rate (number of new TB cases per 100,000 population per year). This cannot be effectively assessed without adequate efficient diagnostic services. This led the global TB community to prioritize the development of interventions and monitoring tools to improve TB case detection to reach SDG goal 3.3 to end the global TB epidemic by 2030 [9] [10].

In Nigeria, health service is organized into primary, secondary, and tertiary levels as well as public and private sectors. Previously, Nigeria's national program to screen and treat TB was limited to the public sector [11]. Since the majority of Nigerians report that they seek health care from the private sector [12] [13] [14] and the Word Heath Organization's (WHO) STOP TB strategy recom-

mends linking private facilities to the national TB program, Nigeria's National TB and Leprosy Control Programm (NTBLCP) and its donor partners have recently sought to expand private sector participation in Nigeria's TB response [15] [16]. Both the private and public sectors are playing an increasingly important role in TB control.

Private sector engagement is extremely important in Nigeria, as an estimated 60% of all health care is delivered by the private sector, however, their role in TB control is highly limited [7]. The NTBLCP has stepped up its engagement through a Public-Public/Public-Private Mix (PPM) approach, implemented in all 36 States, and Federal Capital Territory (FCT) providing a range of TB services (referral, diagnosis and/or treatment) [17]. However, low TB service coverage among all health facilities exists at < 11%, with an even lower value in private facilities at 5%; combined with poor utilization of existing TB services and weak referral systems [18]. These challenges and gaps are due to among many others, a combination of limited knowledge about TB symptoms and under diagnosis (people with TB not accessing health care or not diagnosed when they access health care). The National TB Prevalence Survey (NPS) conducted in 2012, showed 75% of the smear-positive cases detected had symptoms that met national screening criteria but had not been previously diagnosed, demonstrating a need to strengthen access to TB diagnostic services [11].

Strong health systems are prerequisites to improve health outcomes and accelerate progress towards achieving the national target of elimination of TB. Moreover, knowing the gap that exists between the available TB diagnostic services in countries with a high tuberculosis burden like Nigeria is critical to TB control and treatment outcomes. Findings from this will help national tuberculosis programs more accurately identify some of the health system gaps that can be addressed through targeted program interventions [19]. Also, when armed with data from this study, national tuberculosis programs can plan prevention and care services that address patient care-seeking preferences and options.

2. Methods

2.1. Study Setting

The study was in 14 states of Nigeria (8 in the northern regions and 6 in the southern regions), in a total of 92 facilities (53 in the north and 39 in the southern regions). The public health service is organized into primary, secondary, and tertiary levels with responsibilities for primary health care ascribed to local governments, secondary care to states, and tertiary care to the federal level. It involved all levels of health care (primary, secondary, and tertiary) in both the public and private sectors. As of 2019, there are 5389 DOTS centers providing TB treatment services with most having smear microscopy in Nigeria. Similarly, there were 398 GeneXpert MTB-Rif machines in use, supported by numerous partners and placed in all 36 states plus FCT [14].

2.2. Study Design

This was a program implementation, facility-based cross-sectional study from June 2020 to December 2021.

2.3. Data Collection and Tools

This analysis is based on the proportion of facilities that have TB diagnostics available per state in the different sectors and health system levels, with a deep dive into the specific diagnostic types.

Data collection was conducted by trained and proficient personnel to ensure good quality data. The health workers were trained by Principal Investigator or consultant, a State Program Manager (SPM), and Senior Program Officers (SPOs). This training was further cascaded to research assistants who conducted the data collection from the facilities and respondents. The research assistants were made up of health workers at facilities, ad hoc staff, and volunteer workers of KNCV Nigeria.

Data was collected using proforma from registers at facilities including facility name, sector (public or private), level of care (primary, secondary, or tertiary), applicable diagnostic tool(s) separate for Drug Sensitive Tuberculosis (DS-TB), and Drug-Resistant Tuberculosis (DR-TB), Acid Fast Bacilli (AFB) microscopy, GeneXpert, Chest X-ray, TB LAMP, Culture as well as available TB treatment services (for both DS and DR-TB). Data was collected on paper forms.

2.4. Data Analysis

It was collated, entered, and cleaned using Microsoft Excel (version 2019-2021). The analysis was done in Tableau 15 (version 2021.4 Germany) for easy visualization and interpretation. The data visualizations show the distribution of diagnostics, TB, and DR-TB treatment disaggregated by the level of care of the health system as well as the available TB diagnostics in the public and private sectors.

2.5. Ethical Consideration

Ethical clearance was obtained from the National Research and Ethics Committee (NHREC/01/01/2007-08/01/2021). Written informed consent, confidentiality, voluntary participation, and permission from appropriate authorities were observed where and when necessary.

3. Results

3.1. Availability of TB Diagnostic Services in the Public Sector

Overall, in public facilities, GeneXpert and smear microscopy are mostly available at tertiary facilities, see **Figure 1**. Of the fourteen states, nine (64%) of these have smear microscopy available in tertiary facilities and eight states (57%) have GeneXpert in tertiary facilities. In over 70% of secondary facilities, smear microscopy is available in 10 states (71%), while GeneXpert is available in over 50% of its facilities as shown in **Figure 1**. In the primary facilities, the presence of TB

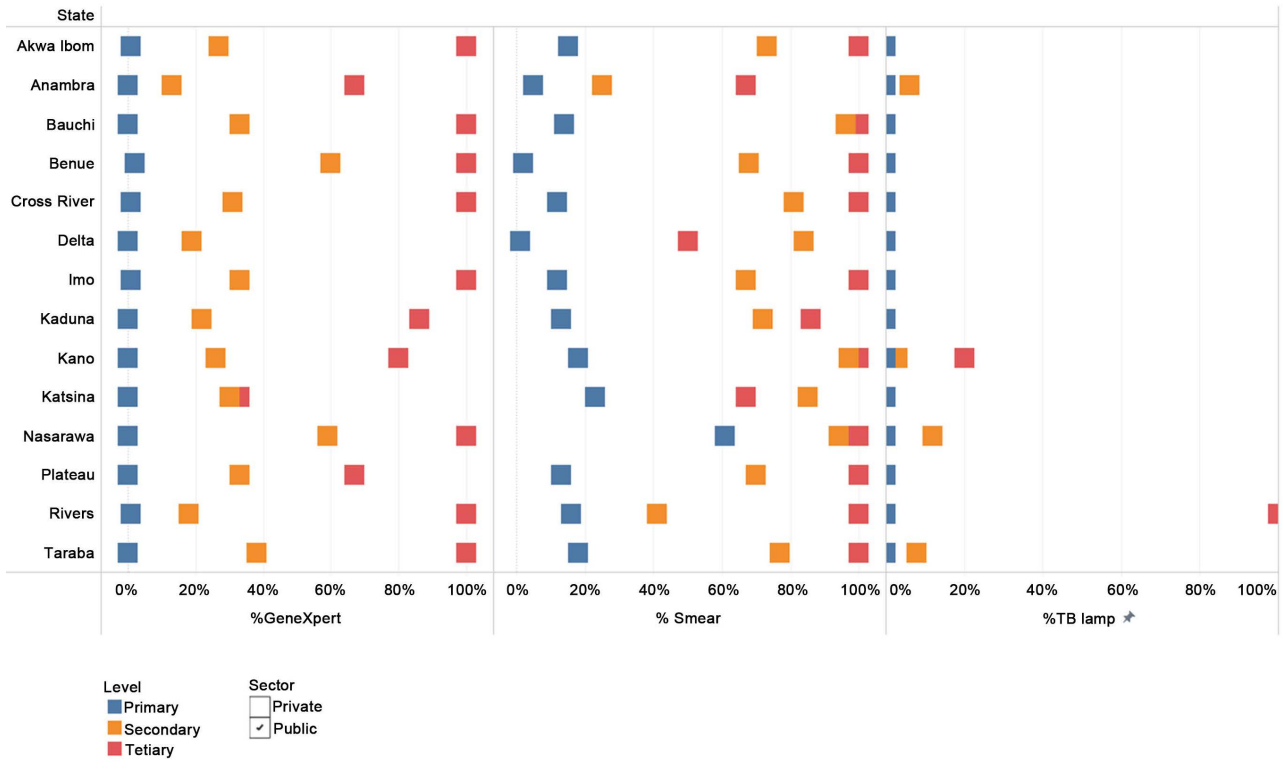

Figure 1. Distribution of diagnostic availability in the public sectors.

diagnostic availability is low where one state (7%) has 61% of its facilities with smear microscopy, and five states with less than 2% of their facilities with GeneXpert, see as shown in **Figure 2**. Availability of TB LAMP is low as 6 states (36%) have TB LAMP at the tertiary and secondary levels – howbeit with very low coverage of 20% or less, and none in the primary facilities as shown in **Figure 2**.

3.2. Availability of TB Diagnostic Services in the Private Sector

Overall, in private facilities, TB diagnostics at different levels are much lower when compared to facilities in the public sector. Also, like the public sector, smear microscopy has the highest proportion in facilities compared to other types of diagnostics as 79% of states have smear microscopy at both primary and secondary facilities, and two states (14%) have this available in private tertiary facilities, see **Figure 3**. GeneXpert is similarly poorly distributed at all levels, with the lowest numbers in the tertiary facilities-one state (7%) in all tertiary facilities, two states (14%) having the machines in secondary facilities, and the lowest at primary facilities; four states (7%) with 1% of facilities with availability as shown in **Figure 4**. There is no TB LAMP available in any tertiary facility and scanty in the other two levels as shown in **Figure 3**. One state (7%) has TB LAMP in secondary facilities (with a facility coverage of 1%), and two states (14%) have in primary facilities, both with less than 4% overall facility coverage as shown in **Figure 4**.

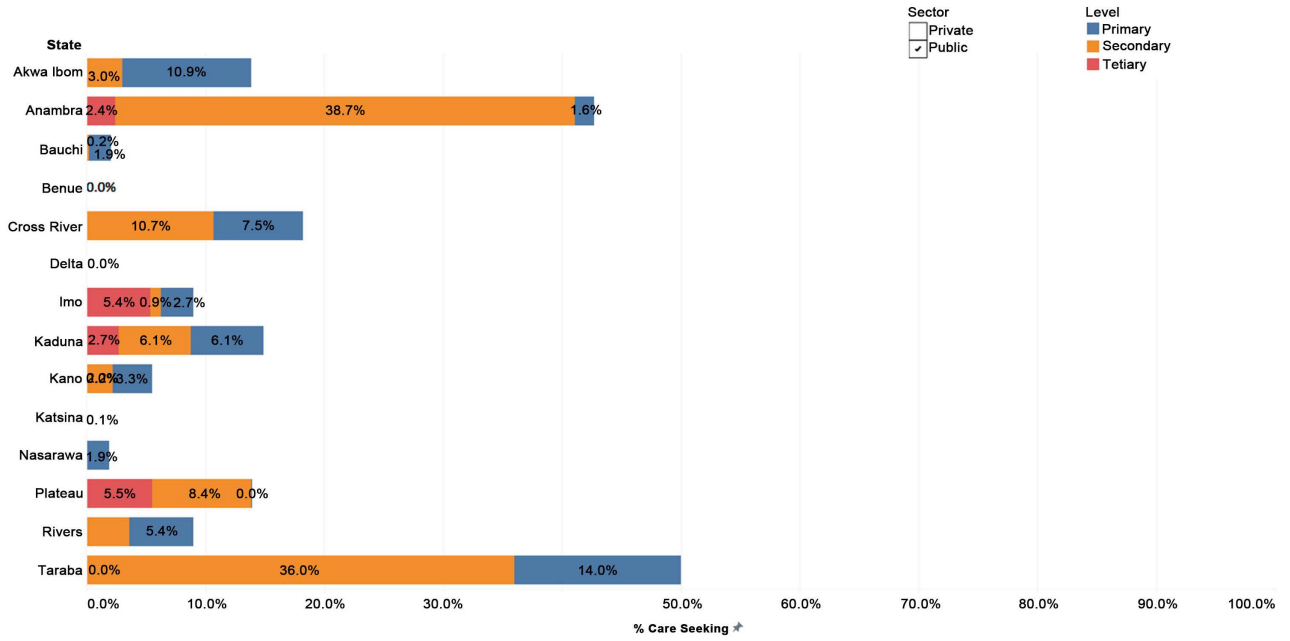

Figure 2. Proportion of diagnostics available in the public sector per health system level.

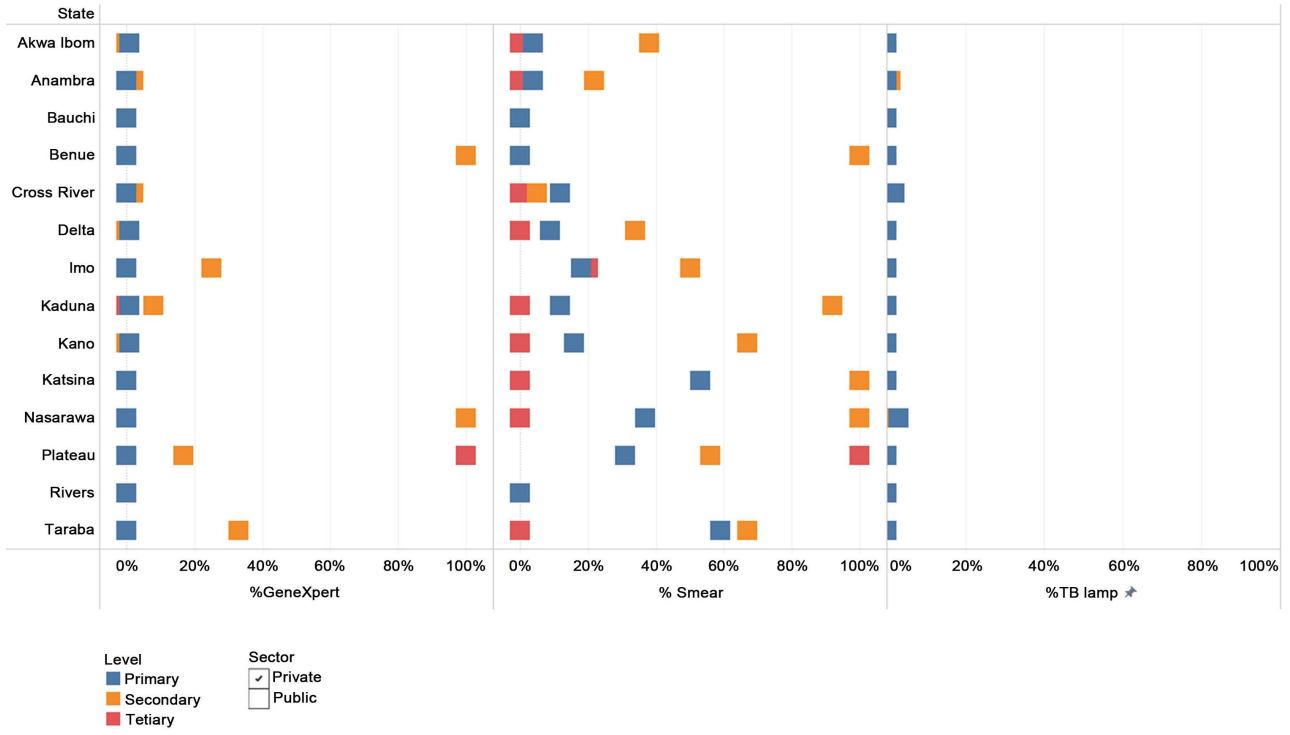

Figure 3. Distribution of diagnostic availability in the private sectors.

4. Discussion

Ensuring access and quality of healthcare services is one of the main functions of a health system, but most of the developing countries failed to achieve this due to poverty [7] [20], poor facility readiness [3] [4], and not using advanced diagnostic technologies in the health systems [6] [21].

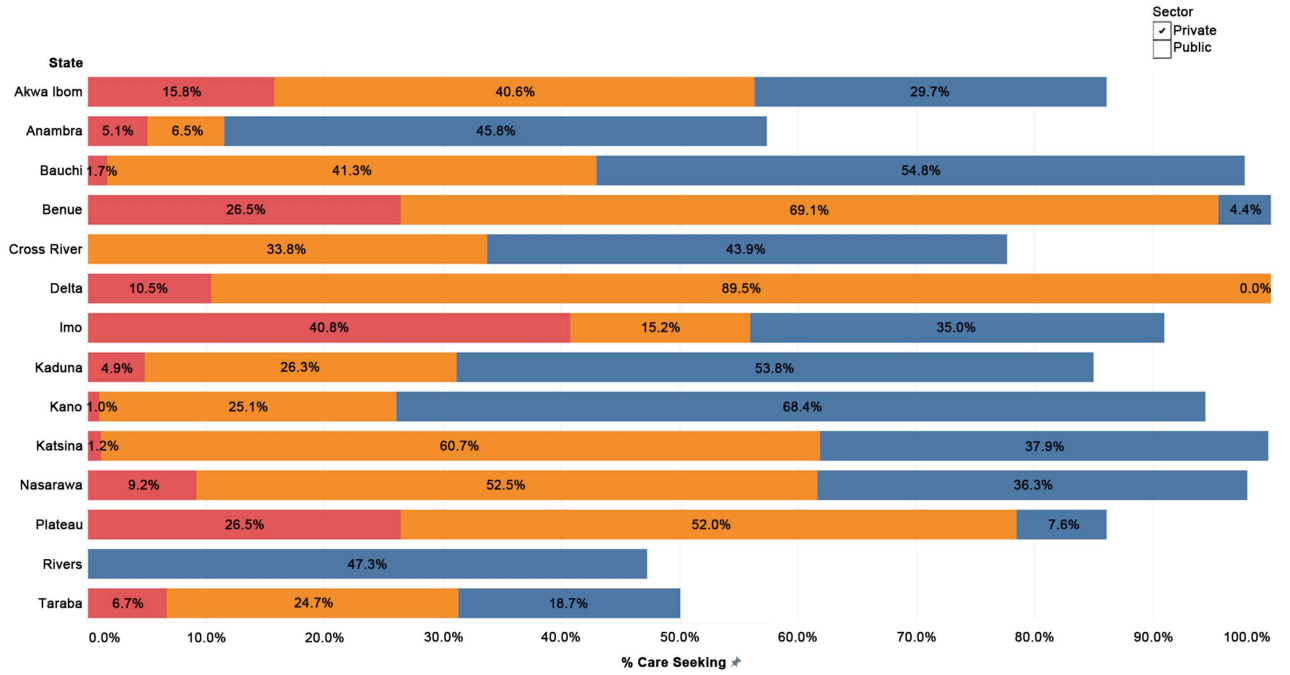

Figure 4. Distribution of diagnostics available in the private sector per health system level.

Findings from this study show that available diagnostic services are very low in all levels of care and in both sectors for all types. The diagnostics at the different levels is much lower at private facilities when compared to facilities in the public sector. There is an equally inequitable distribution of diagnostic services. This is not encouraging for the TB elimination program and various targets set by different partners in TB control. Smear microscopy is the most common diagnostic service while TB LAMP is the least. This is expected as TB LAMP is a new technology that was introduced in the country about 2 years ago. It is expensive compared to other diagnostics like smear microscopy and requires training on its operations which may limit its use at lower levels of care

Evidence has shown that the major problem with TB control in Nigeria is the low diagnosis of people with TB [22]. The same study also reported that out of estimated 407,000 TB patients expected in the year 2017, only 104,904 patients were detected leaving a gap of 302,096 patients who were either undetected or detected but not notified [23]. Similarly, in the year 2020, only 30% of the estimated numbers of individuals infected with TB were detected [24]. Centers for Disease Control and Prevention (CDC) acknowledged that finding missing cases and breaking the cycle of transmission need a strong health care system, a health workforce that can reach those who need care, the laboratory capacity to diagnose the disease, innovative approaches to meet people where they receive care, and expansion of access quickly and effectively to TB diagnostic and treatment services [25].

In Nigeria, this can only be possible by adequately engaging private health providers, though heterogeneous and poorly regulated, private providers are an important entity in the Nigerian health system. They constitute a large part of

the Nigerian health system, accounting for over 60 percent of care provision in Nigeria. Commonly when sick, individuals often visit a Patent and Proprietary Medicine Vendor (PPMV) or community pharmacy for over-the-counter medications. Some of these individuals will go to public laboratories for diagnostic tests, and others will seek care at a private clinical facility in their neighborhood [22] [26]. Unfortunately, diagnostics available at the different levels in private facilities is much lower than in the public sector. This can be due to the limited involvement of this sector in TB services. Also, most private facilities though not profit-oriented operate at a cost for logistics and manpower, this may make it difficult for most to participate in TB services including diagnostics. Also, TB is a disease of poverty, and most patients cannot afford a diagnostic test if they are to pay out of their pocket for little cost to maintain the services.

The report has shown that less than a third (31%) of health facilities in Nigeria are providing TB services as of 2019 [24]. The study stated that low coverage of TB services is a key factor in the under diagnosis of TB in Nigeria [14]. Consequently, of this, there is a need to improve diagnostics and Direct Observed Treatment Short (DOTS) course coverage in health facilities in the country [24] [27]. National TB Prevalence survey similarly documented that despite the implementation of DOTS for many years in Nigeria, DOTS services have not been able to penetrate the community hence recommended that NTBLCP should consider decentralizing TB care and control services into the community [11]. For DOTs services to be efficient there must be commensurate and equitable diagnostics to monitor TB patients during the follow-up. Moreover, the precept of universal health coverage in the post-2015 development agendas reemphasizes the need for distributional equity and efficiency in healthcare service delivery, through the provision of technical and financial support to healthcare facilities at all levels of administering services [1] [8]. This is equally helpful in the realization of TB health-related targets in the Sustainable Development Goals (SDGs) [11] [12].

The disparity among levels of care is expected as there is widely varied attention or commitment to the levels by government and donor agencies. The healthcare system in Nigeria is provided by the public healthcare system and poorly regulated private sector [28] [29]. The public health service is organized into primary, secondary, and tertiary levels with responsibilities for primary health care ascribed to local governments, secondary care to states, and tertiary care to the federal level. The primary health facilities were established to serve as the first point of contact with healthcare for individuals and communities, but have been abandoned, by the local governments, individuals, and the communities they were supposed to serve [30] [31]. This is reflected in the cadre of workers, infrastructure, and equipment including diagnostics at this level. Secondary and tertiary facilities of health care have better equipment, manpower, and services rendered when compared to primary health centers. The third level of health facility employs specialist services that should be devoted to the care of particular groups with special needs [30]. A study in Southeast Nigeria reported that tertiary health

facilities manage many cases that can be managed at the primary health centers and stressed that to improve the utilization of primary health centers there is a need for enhanced manpower and diagnostic equipment at these centers [31].

A study reported that the time to reach the facility of a TB patient's first consultation was significantly associated with delays in diagnosis. It went further to state that improvements in the availability and accessibility of healthcare services are imperious to reduce delays and expedite TB diagnosis and treatment [10]. This becomes imperative bearing in mind that undetected TB cases pose a great threat to society at large as they serve as a reservoir for the continued transmission of TB in the country. In a single year, people who are living with TB disease can infect up to 10 to 15 close contacts [25].

5. Conclusion

There is an inequitable distribution of TB diagnostic services in both sectors and levels of care in Nigeria. TB care and control will improve with enhanced equitable distribution of TB diagnostic services across the health system.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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