EARLY IMPACT OF THE CHALLENGE TB PROJECT ON TUBERCULOSIS CONTROL IN OSUN STATE, NIGERIA.

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A mini-thesis submitted in partial fulfilment of the requirements for the degree of Master in Public Health at the School of Public Health, University of the Western Cape, South Africa.

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ABBREVIATIONS:

AFB – Acid Fast Bacilli

ART – Antiretroviral Therapy

CBO – Community Based organization

CTB – Challenge TB Project

DOTS – Directly Observed Treatment-Shortcourse

DRTB – Drug Resistance TB

ETB – Ethambutol

FMOH – Federal Ministry of Health

INH – Isoniazid

KNCV – Royal Dutch Tuberculosis Foundation

LGA – Local Government Area

MTB - Mycobacterium Tuberculosis

NPHCDA – National Primary Health Care Development Agency

NTBLCO – National TB Buruli Ulcer Leprosy Control Program

NTP – National TB Control Program

PLHIV – People Living with HIV

PMDT – Programmatic Management of DR-TB

TA – Technical Assistance

TBLS – Tuberculosis and Buruli Ulcer Local Government area Supervisor

USAID – United States Agency for International Development

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ABSTRACT:

Mycobacterium Tuberculosis (MTB) is an endemic disease in Nigeria. The World Health Organization (WHO) estimates the incidence rate for all forms of Tuberculosis at 322 per 100,000 population in Nigeria in 2014 (WHO, 2015). This figure places Nigeria fourth among the 22-high burden countries in the world after India, Indonesia and China. These 22 countries have been prioritized for intensified Tuberculosis (TB) control at the global level, and together they accounted for over 82% of all estimated forms of Tuberculosis the world over in 2014 (WHO, 2014).

The United States Agency for International Development (USAID) estimates the Osun state Tuberculosis Case Notification Rate for all forms of TB to be 54 per 100,000 (USAID, 2014). Osun state also has a total of 30 Local Government Areas (LGAs) with 30 TB and Leprosy Supervisors (TBLS) overseeing TB control at local government level. Osun state TB, Leprosy and Buruli Ulcer programme was established in 1993 and currently comprises of 218 health centres implementing the DOTS (Directly Observed Therapy Short-course) strategy and 55 Acid Fast Bacilli (AFB) diagnostic microscopy centres.

The Challenge TB Project (CTB) is a 5-year USAID-funded project operational in 22 countries of the world, with a vision of a world free of tuberculosis and with a goal of ending the global tuberculosis epidemic through a 75% reduction in tuberculosis deaths and prevalence decline to less than 50 TB cases per 100,000 population (Challenge Tb, 2017). The CTB interventions included but were not limited to: contact investigations of bacteriologically confirmed TB cases; increased community awareness of TB and TB services through community stakeholders' engagement; and scale-up of treatment and rapid diagnostic services including the GeneXpert MTB/RIF technique.

CTB is further committed to quality-focused deliverables and technical assistance; locally owned and generated innovations, research and solutions; innovative approaches and technologies; and a patient-centred focus throughout their work. These are embodied and summarized in the CTB

project's three objectives which include improving access to quality tuberculosis care, strengthened DR-TB and TB/HIV services; the prevention of tuberculosis transmission and progression; and ensuring provision of tuberculosis delivery platforms.

This study was a retrospective before-and-after descriptive study utilizing routinely collected data aimed at evaluating the impact of CTB project strategies on Osun state's tuberculosis control, and how the strategies have impacted on tuberculosis case-finding. Data was collected using standard tuberculosis reporting indicators from the fourth quarter of 2014 to the end of the third quarter of 2016, entered into an excel database and thereafter analysed using Epi-Info. Particular indicators were measured before and after implementation of the CTB project activities in the state to determine the impact of the programme, please see appendix A.

The indicators include: the number of presumptive TB cases identified, the number of bacteriologically confirmed TB cases and all forms of TB identified and the number of TB-HIV co-infected individuals identified in the period under review. These indicators were selected because they speak directly to TB case notification which comes from the pool of presumptive TB cases detected. For this study, confirmed TB cases are detected through bacteriological (GeneXpert MTB/RIF and microscopy), radiological (via chest X-ray) and clinical means. Other indicators measured include number of extra-pulmonary TB (EPTB) cases in the period under review, a measure of TB treatment outcomes and the percentage of TB-HIV co-infected individuals detected in the period under review.

Analyzing patient outcomes using ANOVA, the Challenge TB (CTB) Program resulted in a higher TB case notification rate of 6.9425±0.2263, p value <= 0.05 (mean +standard deviation) compared to 6.3369±0.5749 that was obtained before the intervention of the program. Additionally, Lost to Follow-Up (LTFU) rates were shown to be higher prior to the commencement of the CTB project (0.0405±0.0194) compared to during and after the intervention (0.0214±0.0066, p value <= 0.05). Furthermore, treatment cure rates were found to be higher after intervention (0.8825±0.0162, p value <= 0.05), compared to before the intervention of the CTB program (0.7780±0.0929. p value <= 0.05); with treatment cure rate of

89.6% obtained in the second quarter of 2016. Per definition, treatment after loss to follow-up patients: are previously treated for TB and were declared Lost to follow-up at the end of their most recent treatment episode. (These were previously known as Return after default patients

The findings of this study are germane for stakeholders to improve the implementation of successful and highly effective TB control strategies in the state. The analysis will also provide stakeholders with an important decision making guide for improved TB control in Osun state especially in areas of TB services demand creation, expansion of quality TB diagnostic and treatment services as well as improvement of available TB services in the state. This is based on the study conclusions that increasing access to quality TB care; improving and expanding TB diagnostics techniques as well increasing the demand for TB services all led to demonstrable progress of the TB program in Osun state.

CHAPTER ONE

1.0 INTRODUCTION

Tuberculosis has re-emerged as one of the most significant infectious diseases with recent increasing impact on human mortality and morbidity despite historical records of declining disease burden and mortality over the past few decades (Murray, 2004). To date, it has been well documented that TB cases are missed or diagnosed late due to poor health seeking behaviours of individuals, low sensitivity of smear microscopy in TB bacilli detection in sputum samples (Khan et al., 2016) or TB misdiagnosis on the part of healthcare workers (HCWs). This often results in TB case under-notification. These issues are worsened by the scourge of multi-drug resistant tuberculosis (MDR-TB) caused by Mycobacterium TB strains resistant to at least isoniazid and rifampicin, which largely results from deficiencies in TB case management and program management as a whole (Zignol et al., 2006). Due to these pressing challenges and issues, the CTB project was developed with a vision of a world free of TB; setting a goal of ending the global tuberculosis epidemic through a 75% reduction in tuberculosis deaths and prevalence decline to less than 50 TB cases per 100,000 population (Challenge Tb, 2017).

CTB is an efficient mechanism to deliver much needed TB services, with particular emphasis on reaching vulnerable communities. It assists countries to move towards universal access through a patient-centred approach that identifies and addresses the needs of all patients including women and children (challengetb.org). The CTB project is currently working in 22 countries in Europe, Central Asia, Eastern Asia and Africa and is implemented globally by a consortium of nine international organizations led by KNCV Tuberculosis Foundation (Koninklijke Centrale Vereniging tot bestrijding der Tuberculose) with its headquarters in the Hague, Netherlands.

TB is an endemic disease in Nigeria. WHO estimates the incidence rate for all forms of Tuberculosis at 322 per 100,000 population in Nigeria in 2015 (WHO, 2015). The country also has an estimated 3,700 multi-drug resistant TB cases per year (WHO, 2015). These figures place Nigeria third among the 22-high burden countries in the world after India, Indonesia and China.

The national program on TB has been supported by external donors for some time now, with varying levels of progress in different states and zones of the country. For example, Damien Foundation Belgium (DFB), a Belgian organization with its primary funding from the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), has been providing support to Osun state since 1993 (Damien Foundation Nigeria, 2017); various KNCV TB projects have been implemented in Osun state since 2003. Therefore, it is important to assess the early impact of KNCV implemented CTB project.

Furthermore, over the past few years, there has been a fluctuating trend in TB case notification in the South-Western region of Nigeria as noted by Adejumo et al., (2017) and may have been due to socio-cultural barriers mitigating on access to TB diagnostic and treatment services as well as several industrial strike actions. This also buttresses the need to evaluate CTB project thus far to inform future strategies geared at addressing the possible barriers to accessing TB services. Projects such as CTB are required in Nigeria to deal with issues hindering the progress and success of TB programs. Such issues include lack of awareness and poor knowledge of TB among the population. In a cross-sectional study by Hassan et al., (2017) in Nigeria, majority of the population knew nothing about the cause, symptoms and signs of Tb as only 26.5% knew the main cause of TB. This implies a lack of general knowledge on TB among the population.

In Nigeria, the CTB project, which commenced activities in late August 2015, is currently supporting activities in 15 states to help implement strategies that include but are not limited to the expansion of services and increase in the quality of TB care, especially diagnostic and treatment services in high-population density and under-served areas. In collaboration with the government and in partnership with other donor agencies and the National Primary Health Care Agency (NPHCA) to ensure the effective integration of TB and HIV services, the project is re-activating a number of previously non-functional primary healthcare centres offering TB services. This study therefore aimed to assess the early impact of CTB in Osun state a year after commencement of activities.

1.1 Problem Statement

In Osun state, Nigeria, the extent of the impact of the CTB programme on TB control has not been adequately assessed, with little research publications recorded and despite regular internal and external funding from donors. Through the programme, there has been implementation of a number of interventions such as contact tracing of bacteriologically confirmed TB cases; increased community awareness of TB and associated services through engagement of CBOs and media houses; and increased utilization of rapid diagnostic services such as GeneXpert MTB/RIF technique. Assessing the impact of these strategies is vital for decision making by key stakeholders. This is buttressed by the fact that available research evidence indicates that interventions targeting increased awareness of TB and its symptoms, as well as demand creation for TB diagnostic and treatment services, all increase TB case detection and notification at all levels.

1.2 Purpose of the study

The findings of this study are germane for stakeholders to improve the implementation of successful and highly effective TB control strategies in the state. The analysis will also provide stakeholders with an important decision making guide for improved TB control in Osun state especially in areas of TB services demand creation, expansion of quality TB diagnostic and treatment services as well as improvement of available TB services in the state.

Successes and challenges of the project will also offer an opportunity for other programs to learn from. It can also enable the CTB project to make some changes and improvements in areas it has not had a large impact.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter focuses on review of national and international literature related to national and global and Nigerian TB epidemic, TB infection control, the DOTS strategy, an overview of TB case management in Nigeria and evaluation of TB interventions and projects.

2.1 The global and Nigerian TB epidemic

In 2016, TB remains a global disease and is a major cause of suffering and death in many countries. Each year, over two billion individuals are infected with *Mycobacterium tuberculosis*- the causative organism of TB- with more than 9.6 million incident cases and over 1.5 million deaths (Tb Alliance, 2017).

Of those newly and re-infected TB patients registered globally in 2013, 86% were successfully treated (WHO, 2013). The incidence rates for TB have experienced an upsurge in numerous sub-Saharan African countries since the turn of the century (WHO, 2005), making the African continent, which contains approximately 11% of the total world population, account for 27% of the global burden of TB and one third of TB-related deaths (Lawn et al., 2005).

Considering these statistics, TB remains grossly underfunded and with often sub-standard clinical and research programs. Reports on funding into HIV and TB research during the period 2005–2007 indicated that for every $1 spent on HIV research, $0.05 was spent on TB research (Harrington, 2010). Furthermore, in 2015, the Global Fund dedicated about 15.8% of its disbursements to the fight against TB which was in stark contrast to 53.4% allocated to HIV (Global Fund, 2016). These TB investments contrast the significant strides and investments made in HIV resulting in the on-going neglect of a disease that has affected men, women, and children for decades.

TB is an endemic disease in Nigeria. WHO estimates the incidence rate for all forms of Tuberculosis at 322 per 100,000 population in Nigeria in 2015 (WHO, 2015). The country also has an estimated 3,700 MDR- TB cases per year (WHO, 2015). These figures place Nigeria third among the 22-high burden countries in the world after India, Indonesia and China. These 22 countries have been prioritized for intensified Tuberculosis control at global level, and together they accounted for over 82% of all estimated forms of Tuberculosis the world over in 2014 (WHO, 2014).

Despite the progress of the national program in achieving its national targets for case detection (>70%) and treatment success rate (85%), vitals aspects of a successful program such as early diagnosis, prompt treatment and the scourge of HIV co-infection (currently at 41%), still remain a challenge in the country (Oshi et al., 2016). Factors associated with delay in diagnosis and treatment includes low educational level in the community, resulting in low levels of awareness and knowledge about TB (Dewi et al., 2016).

2.2 HIV/AIDS and CTB

The epidemiology of TB is connected and closely associated with sub-optimal socio-economic conditions such as overcrowding and poverty (Lacerda et al., 2014). However, human immunodeficiency virus (HIV) is the strongest risk factor for development of active TB, and TB ranks as the first cause of death among people living with HIV (PLHIV), causing over 40% of HIV related deaths, even after the advent of anti-retroviral therapy (Sulis et al., 2015). The association between HIV and TB has been well documented as evidence has shown an increase in TB case detection in populations affected by HIV, as well as an increased risk of TB in HIV induced immunosuppression (Wood et al., 2000). Enhancing stronger TB/HIV collaboration between TB and HIV services delivery remains one of the key areas of intervention under CTB largely because of the relationship between both diseases.

As a consequence of sufficient stakeholder engagement, the adoption of prevention measures and ART, the incidence of HIV has been documented to have steadily declined from 3.5 million in

1996 to 2.1 million as at the end of 2015. This represents a 40% decrease (UNAIDS, 2016). By harmonizing efforts, strategizing the rapid integration of TB and HIV services and scaling up of quality TB and HIV diagnostic and treatment services, the once inconceivable end of the deadly duet of TB and HIV may not be far from realization (Padayatchi et al., 2017).

A successful ART program however is critically entwined with successful prevention and control of new TB infections, improved TB treatment outcomes and enhanced TB prevention services. These will ultimately help attain the year 2030 Sustainable Development Goals (SDG) for TB which include: a 90% reduction in the number of TB deaths compared with 2015 achievement rates; an 80% reduction in TB incidence rates compared to 2015 figures; and with no TB-affected families facing catastrophic costs due to TB (WHO, 2015).

Despite advances in HIV drug treatment and new WHO recommendations of early ART initiation preferably between two and eight weeks of commencement of anti-TB treatment, enrolment on ART in co-infected individuals is often delayed in real-life practice due to reasons such as drug interactions, and poor referral linkages from HIV to TB service units and vice versa (Kerschberger et al, 2012). Multidrug resistant tuberculosis (MDR-TB), which is defined as resistance to, at least, rifampin and isoniazid, poses an additional threat to TB control globally (WHO, 2015). Approximately 480,000 new cases of MDR-TB occur annually, resulting from poorly managed TB cases due to inappropriate regimens and dosing, reduced patient drug adherence, and limited availability of pharmaceutical products and commodities (WHO, 2015). The development and spread of MDR-TB poses and urgent threat to TB control, and the epidemic is beset with challenges including regular unavailability of drugs and other relevant commodities, the expensive and often toxic drug treatment regimens and issues pertaining to stigma and patient treatment adherence (Blondal, 2007).

2.3 TB Infection Control, TB transmission and CTB.

The transmission of TB poses a high risk to individuals, especially healthcare workers (HCWs) at health facilities. HCWs are not adequately protected from TB infection, particularly health facilities where TB infection control practices are not properly adhered to (Chen et al., 2016).

This has been buttressed by findings from recent studies carried out in resource-constrained settings that showed TB infection control measures have been inadequately implemented at facility level (Brower et al., 2016). In a study conducted in South Africa by Naidoo et al.,(2012), only 22% of 51 clinics had infection control policies. The importance of TB infection control measures cannot be over-emphasized especially in sub-Saharan Africa. Consequent on this, CTB emphasized the development and implementation of TB Infection Control (TBIC) Policies in supported facilities and LGAs. In the light of this, further mandates of CTB project is to increase attention and action related to TBIC issues at the community level and thus to reduce the risk of TB transmission from clients to HCWs and to reduce household and community transmission of TB.

TB IC measures at the community level are critically important - particularly in areas of high HIV prevalence. Most TB IC efforts to date, however, have focused on larger healthcare settings and facilities, neglecting community settings. As a result of this neglect, there are limited resources available to help HCWs avoid becoming infected themselves while working with the communities they serve. HCWs also lack adequate educational materials to use in their day-to-day educational activities with patients and the community.

TB, HIV, and TB/HIV patients face numerous obstacles when seeking services at traditional clinic and hospital settings that are often too few and too far from where patients live. Recognizing these barriers, CTB created community-based care and treatment programs. These programs allow HCWs to provide TB treatment and treatment support, DOT, and educate people on TB and other public health topics; with minimal risk of further transmission of TB.

The implementation of TB infection control in some facilities in Nigeria has been documented to be poor due to a myriad of barriers. Such barriers to TB infection control include weak managerial support; poor availability of funding; lack of space and insufficient staff. Practical and affordable measures to reduce the risk of TB among HCWs in the country include diagnosis and treatment of infectious TB patients, investigation of TB suspects on out-patient basis, environmental controls, use of face masks; patient cough hygiene and regular TB screening of health staff (Kuyinu et al., 2016).

2.4 TB DOTS Strategy and CTB

As a background to TB case management globally and in Nigeria, the Global End TB Strategy was launched by the WHO in May 2014, and aims to reduce TB deaths and incidence in all countries to levels currently seen in high income countries. This can be achieved through improving early diagnosis, providing more effective treatment, monitoring possible mycobacterial resistance, and expanding contact tracing and infection control (WHO, 2015). Ensuring that TB patients on treatment adhere to and complete an appropriate treatment regimen is a vital responsibility of TB control programs, and to that effect, directly observed treatment (DOT) is used to ensure that TB patients are taking their required medications until they are declared cured (CDC, 1995).

In 1993, WHO's Global Tuberculosis Programme (GTB) declared TB a global emergency. In 1995, GTB promoted Styblo's strategy (using a basic management unit for the diagnosis, treatment, recording and reporting of TB management progress in a population area of 100,000 to 150,000) to a technical and management package termed DOTS (WHO, 1999). The WHO recommended DOTS strategy was adopted by the NTP in 1993. By the end of 2002, only 21 of the 36 states in Nigeria were implementing the strategy. However, with the support of donor agencies, DOTS was expanded to all states by the end of 2004. As at the end of 2013, there were over 5,300 TB services points and 1,602 microscopy centres distributed across the 774 local government areas in Nigeria (FMOH, Nigeria, 2015).

Thus far, the DOTS strategy has been successful in many parts of the world, leading to some degree of TB control, interruption of TB transmission in several countries, reduced morbidity, mortality and disability, as well as preventing the spread of drug resistant strains (WHO, 2004). It has also caused the reduction of the TB burden among People Living with HIV (Guda et al., 2011). Furthermore, the DOTS strategy has been a corner stone in TB case management in CTB supported LGAs in the state, with TB patients managed and monitored using the DOTS strategy.

Strategic expansion of DOTS services was an area of emphasis of the CTB project. In all, 18 new DOTS centres were established in Osun in less than twenty four months of CTB project implementation. This DOTS expansion was also undertaken with training of DOTS staff and infrastructural upgrade of the DOTS centres.

The DOTS strategy in Nigeria is based on five fundamental components viz: sustained political and financial commitment; diagnosis through quality ensured sputum-smear microscopy; standardized short-course anti-TB treatment given under direct and supportive observation (DOT); a management system for uninterrupted supply of anti-TB drugs; and an information system that allows monitoring and evaluation of actions and their impacts (Sbarbaro, 2001).

2.5 Factors influencing TB treatment success in Nigeria.

There is a paucity of research on factors influencing TB treatment success following DOTS strategy implementation in Nigeria, but studies carried out in Kenya by Ndwiga et al., (2016), highlighted that patient related factors such as socio-economic status and; level of education positively have a significant impact on TB treatment success. Additionally, treatment success is often higher in patients from urban areas when compared to patients from the rural areas. This is related to the lower level of TB awareness at both community and individual levels at the rural areas as highlighted by Gebrezgabiher et al., (2016) in a 5-year retrospective study carried out in Ethiopia. However, a study by Creswell et al. (2014) which evaluated 28 TB projects emphasizing on case detection in 28 countries, showed a general increase in case detection, notification, management and TB awareness despite varying approached and interventions in 25 countries.

Even when these are in place, other challenges still hamper adequate TB service delivery. They include poor treatment success rates of MDR-TB, the increasing number of missed TB cases annually, the incidence of TB among HIV infected individuals and the annual funding gap for quality service delivery (Dirlikov et al., 2015). Through the support of USAID, CTB is piloting the use of a shorter MDR-TB drug treatment regimen using the bedaquiline and delamanid backbone (kncvtbc.org). This drug regimen is taken for 9 months, which differs from the previous 20 month-MDR-TB duration.

CTB project embarked on engaging civil society organizations (CSO) and community-based organizations (CBO) to conduct a series of community awareness campaigns to address the knowledge and demand gap. One of the main advantages of implementing both strategies (CSO and CBO engagement) in Nigeria was the provision of TB diagnostic and treatment services to patients at no cost due to a combination of donor and national funding, yet a gap remains between what is received and what is actually required for universal coverage (Erah & Ojieabu, 2009).

Intensified case finding remains one of the most important strategies for the identification and treatment of missed tuberculosis cases, which accounted for a 33% increase in case notification in 2012 (Jerene et al., 2015). One strategy employed here is TB contact investigation. The investigation of contacts of TB cases is prioritized due to their increased risk of developing active disease, with an emphasis on presumptive contacts, immune-compromised cases (such as individuals co-infected with HIV/AIDS), contacts of DR-TB patients as well as contacts less than 6 years of age (Albanese et al., 2015). However, prior to commencement of CTB activities, contact tracing was not routinely carried out in the state largely due to factors including insufficient human resources and neglect on the part of overburdened available healthcare workers to carry out the process of tracing by inviting contacts to the health facility for symptomatic screening, or conducting home visits to index cases for contact tracing.

In light of these developments, CTB commenced and prioritized contact investigation of bacteriologically confirmed TB cases in the supported LGAs. This was done by the training of contact investigators, provision of the necessary recording and reporting tools as well as provision of transport stipends to the investigators for the smooth running of the activity.

The aim of TB contact investigations is the reduction of TB morbidity, interruption of further TB transmission, and institution of isoniazid preventive treatment for HIV infected persons to prevent the development and progression of TB disease (Erkens et al., 2010). Preventive therapy with isoniazid is fully indicated in patients who, due to the intensity of contact, are at high risk for developing TB disease, especially persons under 6 years of age. From a programmatic point of view, the most important TB infection sources are patients with identifiable tubercle bacilli in their sputum in a volume that is detectable via microscopic examination. These individuals comprise an important target group that represents a significant infectious source of TB known as “open tuberculosis” (Erkens et al., 2010).

A similar concept of radius contact screening has been tried successfully in patients with smallpox (Kretzschmar et al., 2004). Similarly, in another study in Sindh, Pakistan, active case detection through household TB contact investigation found a 22% increase in the detection of TB patients (Shah et al. 2013).

Despite being a key strategy for increasing case detection in TB control, contact identification can be an arduous challenge for TB elimination in Nigeria because TB patients are often reluctant to share contact information due to disease associated stigma and discrimination. Thus, ensuring prompt diagnosis, treatment completion of confirmed TB cases and contact investigations of confirmed TB cases also presents a significant challenge for TB control practitioners (Mitnick et al., 2003). Treatment is lengthy and must be provided even when patients do not feel sick. Patients with TB disease or infection often have competing challenges in their lives, including substance abuse and/or homelessness, which make adhering to a treatment regimen difficult. Persons who are close or household contacts of bacteriologically confirmed TB patients undergo TB screening (Bartu, 2016) based on the WHO recommendations (2012). They are examined and their sputum samples are examined with the GeneXpert technique for rapid detection of TB, with those contacts less than 6 years of age referred for chest radiography according to the Nigerian national guidelines. Therefore, contact investigation of TB patients remains a priority for the NTP.

To further strengthen TB surveillance in Nigeria, the NTP has recommended the GeneXpert MTB/RIF as the first-line diagnostic technique for presumptive TB cases (Nigeria Stop TB Partnership, 2015). This followed from the World Health Organization approval in 2010 for the use of GeneXpert MTB/RIF test for TB case diagnosis and rifampicin resistance in countries with MDR-TB and a high prevalence of HIV infection.

The GeneXpert MTB/RIF test is a nucleic acid amplification-based test which rapidly utilizes real time polymerase chain reaction for the detection of *Mycobacterium tuberculosis* and rifampicin resistance (Cox et al., 2014). The CTB project in collaboration with the NTP, in less than twelve months, successfully installed 4 GeneXpert MTB/RIF machines in four health facilities in the state, further ensuring a comprehensive, high quality diagnostic network. GeneXpert MTB/RIF offers a new possibility for TB diagnosis. In addition to detecting MDR-TB, it also offers further testing for presumptive TB patients who initially tested negative on sputum examination (Fatima et al., 2016). This is particularly advantageous as sputum smear negative patients of whom there remains a high index of suspicion of having TB are quite prevalent in Nigeria.

On the other hand, sputum smear microscopy still remains one the main methods of TB diagnosis and TB treatment monitoring in Nigeria as it is in many sub-Saharan African countries, despite the advent of GeneXpert MTB/RIF. The purpose of sputum smear microscopy is three fold: (A) to diagnose patients with infectious TB, (B) to monitor the treatment progress of individual patients on a monthly basis until conversion is performed to ensure that patients are responding to treatment, and (C) to document treatment outcome at the end of treatment. For the diagnosis of a TB case in Nigeria, two repeated sputum specimens are collected from each TB suspect: one on-the-spot, followed the next day by one early morning (Hamusse et al., 2017). Pulmonary tuberculosis (PTB) treatment is usually initiated when two of the specimens are smear-positive or one is smear-positive but X-ray and/or clinical findings are suggestive of PTB. For follow-up cases, only one specimen, preferably early morning, is collected at the second (repeated at month 3, if smear is still positive at month 2), fifth and sixth month.

The CTB project in collaboration with the Osun state TB control program and through the support of USAID, has also successfully established over 15 sputum microscopy centres in Osun state as AFB remains the mainstay of monitoring TB treatment progress during the duration of TB case treatment. The advantages of smear microscopy are that it is rapid (not as rapid as the

GeneXpert), cost-effective and requires little in the way of equipment. In addition, it detects most infectious cases. The disadvantages, however, are that it is dependent on the quality of the sputum, the slide staining technique and reading ability of the microscopist (Hamusse et al., 2017). To maintain a reliable laboratory service that will facilitate accurate diagnosis and offset the disadvantages of using smear microscopy, a well-functioning quality assurance (QA) system is essential to ensure that information generated by the laboratory is accurate, reliable and reproducible.

While there is little room for doubt that the advent of GeneXpert MTB/RIF has provided a ray of hope to TB care and control in terms of revolutionized TB diagnostics, expanded access to new and repurposed drugs (such as bedaquiline) and reduced treatment duration for drug-resistant TB for patients in the treatment failure category, it is evident that scientific advances on their own are inadequate to achieve the WHO's goal to end TB by 2035. TB is a social disease fortified by poverty, overcrowding, stigma, and discrimination and therefore requires more than the old-fashioned and narrow-minded biomedical approach. Understanding the socio-economic, cultural, and health system barriers that drive the TB epidemic, including late presentation to care, poor adherence, drug resistance, and loss to follow-up, is important in achieving favourable outcomes, particularly in HIV co-infected patients.

2.8 Aims and Objectives

2.8.1 Aim

To describe the Challenge TB Project's early impact on the Osun state's tuberculosis control programme, with an emphasis on tuberculosis case-finding.

2.8.2 Objectives

The objectives are to:

1. Use routine TB health information to describe changes in TB indicators prior to, and after one year of implementation of the CTB Project in Osun State, Nigeria.

2. Determine whether increases in tuberculosis case finding and notification in Osun State could be plausibly linked to CTB project activities.

CHAPTER THREE

3.0 METHODOLOGY

This chapter focuses on the methods used in undertaking this study and these include study design, study setting, sampling procedures, data collection methods, data analysis, ethical consideration, study validity and reliability. Osun state has 30 LGAs out of which 15 are supported by the CTB project and two healthcare facilities each from the 15 LGAs were selected for the study.

3.1 Study Design

This thesis is based on a retrospective descriptive before-and-after study using routinely collected health information. This study evaluates the early impact of CTB project by comparing certain indicators for a one year period before (prior to September 2015) and one year period after (from September 2015) implementation of the CTB project activities in Osun state, Nigeria.

3.2 Study Setting

Osun State was carved out of the old Oyo state in 1991. It is situated in the south- west geo-political zone of Nigeria with a 2016 population of over 4.5 million and a total land mass of 9,231 square kilometres (Osun.gov.ng). The major occupation is trading and farming. It has a total of 30 Local Government Areas (LGAs) which are the smallest basic geographical units of a state in Nigeria.

3.3 Study population and sampling

Each of the LGAs in Osun state has an array of healthcare facilities, including publicly-owned healthcare facilities, faith-based non-profit-oriented healthcare facilities, and for-profit private healthcare facilities. These facilities fall into primary, secondary, and tertiary levels. The study included all categories of healthcare facilities. Two healthcare facilities each from 15 CTB supported LGAs were purposely selected to include facilities that attend to the highest number of

TB cases in each state. 9 of the 15 LGAs are rural settlements, while the other 7 are urban LGAs. Thus, a total of 30 healthcare facilities from 15 LGAs were selected.

The study population consisted of all registered TB cases captured in the routine health information system at 30 clinics for a one year period prior to commencement of CTB activities (September 2014 to September 2015) and all registered TB cases captured in the routine health information system at the same 30 clinics for a one year period after commencement of CTB activities (October 2015 – September 2016).

3.4 Sample size

All registered TB cases from the 30 facility's TB registers in the two 1 year periods before and after CTB activities were included, amounting to 1,198 and 1,261 TB patients in the pre and post CTB period, respectively.

3.4 Intervention: CTB Programme

The CTB interventions which began on 25th August, 2015, included but were not limited to: contact investigations of bacteriologically confirmed TB cases; increased community awareness of TB and TB services and increased utilization of treatment and rapid diagnostic services including the GeneXpert MTB/RIF technique.

By way of definition, contact tracing/investigation is a systematic process intended to identify previously undiagnosed cases of TB among the contacts of an index case (Erkens et al., 2010). It is a common method of active case finding (Albanese et al., 2015). In the TB DOTS clinics, healthcare workers and TB supervisors provided health education to registered cases. Those who gave consent were visited at home, where screening forms were used to assess their contacts for symptoms and signs of TB.

The second strategy entails the engagement of CBOs, community leaders, community volunteers and healthcare workers for TB and TB services awareness campaigns at the community and grassroots level. Handbills, posters and flyers, targeted at intensified case finding, are distributed in the community as well.

The final key strategy is utilization of GeneXpert MTB/RIF by the state. Prior to the commencement of CTB project activities in Osun state, there were just 3 GeneXpert machines installed in the state. However, with support from USAID through the KNCV implemented CTB project, 4 additional machines have been successfully installed in Osun state. More so, in March 2016 the Nigerian Federal Ministry of Health (FMOH) ratified a policy that GeneXpert MTB/RIF become the first line of diagnosis of TB and Ziehl–Neelsen smear/alcohol-fast bacilli microscopy be used for follow up investigations during the course of anti-TB treatment.

Challenge TB project is further committed to quality-focused deliverables and technical assistance; locally owned and generated innovations, research and solutions; innovative approaches and technologies; and a patient-centred focus throughout their work. These are embodied and summarized in the CTB project’s three objectives which include improving access to quality tuberculosis care, strengthened DR-TB and TB/HIV services; the prevention of tuberculosis transmission and progression; and ensuring provision of tuberculosis delivery platforms.

3.5 Data Collection

Records utilized were drawn from standard NTP data collected in the course of routine programmatic implementation with no personal identifiers linked. Standard baseline data and quarterly data reports of TB program indicators and GeneXpert MTB/RIF machine data were captured after obtaining required permission from the LGA and state regulatory bodies. Data sources include presumptive TB register, TB treatment registers and ART registers which are domicile at the facilities. The presumptive TB register captures patients with symptoms and signs of TB who have not been confirmed as TB cases using conventional diagnostic techniques. The TB treatment register captures patients from the moment they are commenced on anti-TB treatment. The registers reviewed contain basic information such as patient's age, sex, address, category, TB type, drug regimen, date treatment started, treatment follow-up, follow-up sputum result and treatment outcomes. We also checked when DOTS was initiated in each health institution and looked for the availability of TB drugs and reagents during the time of visit. To ensure the quality of data entered into the computer database, two people independently cross-checked each entry. A data extraction form was developed to collect required data from TB records. Indicator descriptions and definitions are included in Appendix A and B. The extraction forms were entered into an excel database for analysis using Epi-Info.

3.6 Data analysis

Data was analysed using Epi-Info and indicators include percentage of presumptive TB and confirmed TB cases identified in the pre and post intervention periods; proportion initiated on anti –TB treatment; proportion co-infected with HIV/AIDS; and case detection rate. Data was summarized using frequencies, percentages and standard deviations including mean values. Significant changes in TB cases, case detection rates (CDR) and treatment success rates (TSR) were determined using chi-square and t-test for trends comparing the two time periods.

Descriptive analyses such as frequency, mean, and standard deviation were computed as appropriate. Adjusted odds ratio was used to determine the strength of association between the study variables at 95% CI and P value <0.05.

3.7 Reliability and validity

Currently, Osun state TB control program records and reports all TB data using WHO reporting format for TB case detection and treatment. Data for the study period was crosschecked for the same information which was reported through WHO reporting format so as to maintain accuracy of the reporting data for the same study period. The data extraction form was piloted on a sample of records to determine its ease of use and completeness of the required information.

3.8 Generalizability

The results of this study could be applied beyond the study population and beyond Osun state as it could more broadly apply to other states of Nigeria where CTB project is implemented in approximately the same scale and magnitude.

3.9 Ethical Considerations

An ethics approval was obtained from the UWC Ethics Committee and the Osun State Ministry of Health through the Tuberculosis, Leprosy and Buruli Ulcer Control Program (Appendix B). The retrospective data extracted from routine records included aggregated anonymous data with no personal identifiers, and instead only clinic patient numbers. Therefore, there was no risk posed to the confidentiality of the patients and the researcher did not make contact with any of the patients during the course of the research.

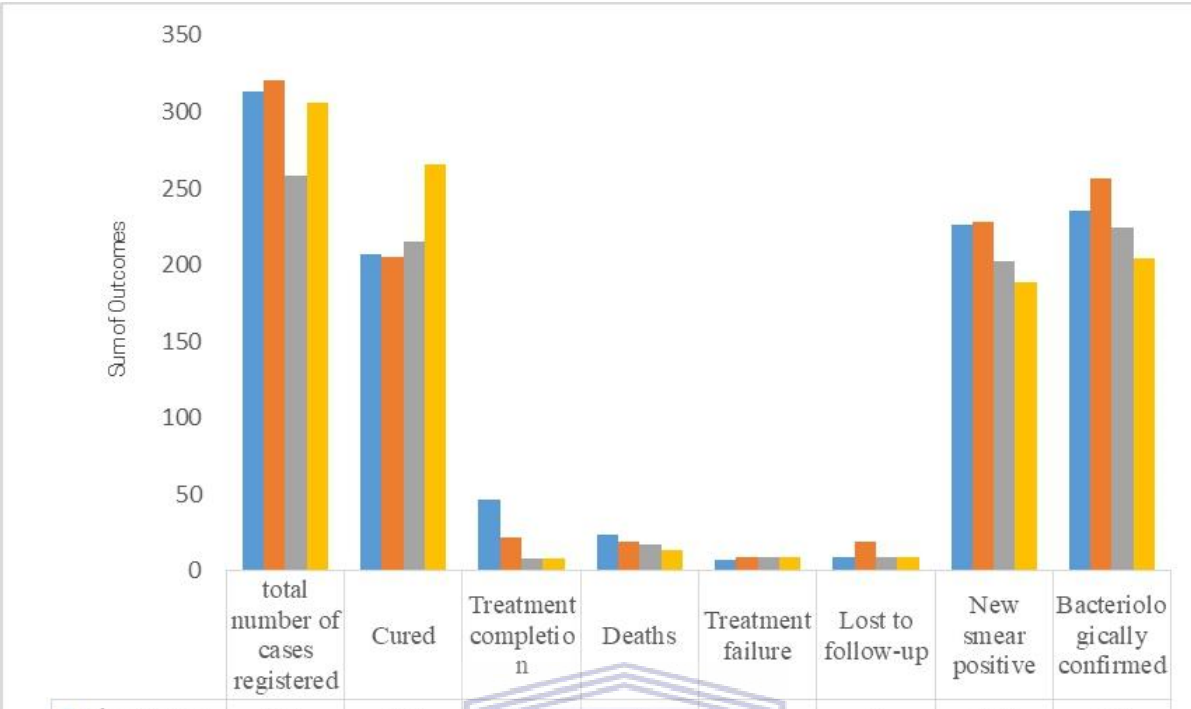
CHAPTER FOUR

4.0 RESULTS

This chapter focuses on the findings of the study from the selected 30 facilities across 15 LGAs. The data extraction took place in a period of 5 weeks commencing from late November, 2016.

Figures 1 to 4 reveal the treatment outcomes for the 30 selected facilities from 15 LGAs from 4th quarter of 2014 to 3rd quarter of 2016 with comparison of outcomes before and after commencement of CTB activates in the state. Indicators include all forms of TB new smear positive cases, cured, treatment completion, loss to follow up and bacteriologically diagnosed for all the quarters.

Figure 1 shows that the 4th quarter of 2014, has the highest number of treatment completion cases (47) but without known anti-tuberculosis treatment outcomes as 15 patients were not evaluated at the end of the treatment course to determine treatment outcome. The same quarter had the highest number of deaths (24; 8% of the total number of registered cases). The 1st quarter of 2015 had the highest number of lost to follow up (19; 5% of the total number of registered cases)

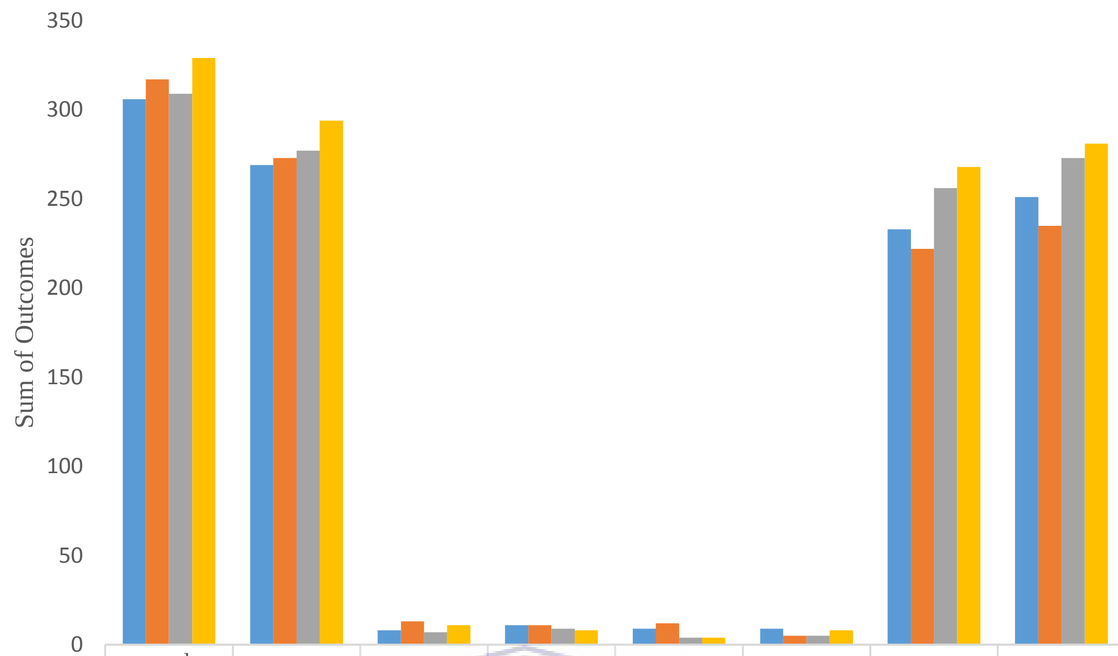


	total number of cases registered	Cured	Treatment completion	Deaths	Treatment failure	Lost to follow-up	New smear positive	Bacteriologically confirmed
4th Qtr 2014	313	207	47	24	7	9	226	235
1st Qtr 2015	321	205	22	19	9	19	228	256
2nd Qtr 2015	258	215	8	17	9	9	202	224
3rd Qtr 2015	306	266	8	14	9	9	189	204

Figure 1: Treatment outcomes before challenge TB project initiation in Osun State

19 and 47 patients unevaluated in 4thQ of 2014 and 1stQ of 2015, respectively.

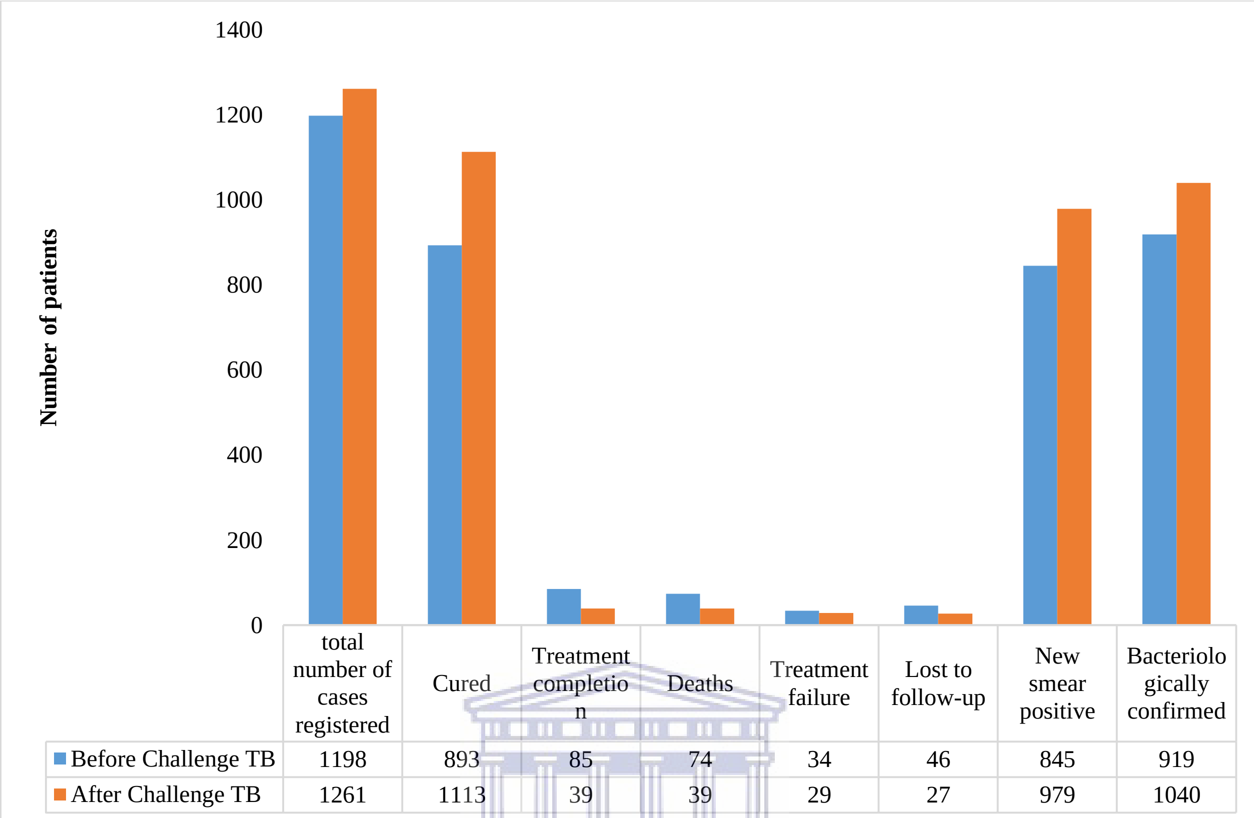
In Figure 2, 3rd quarter of 2016 had the highest number of registered cases of all forms of TB (329) and the highest number of cured (294) individuals; representing 89% having been cured. The 2nd quarter of 2016 had 277 cured individual which is equal to 89% of the total number of registered cases for the quarter (309) and lowest percentage of individual patients having completed treatment but without known anti-tuberculosis treatment outcomes (2%). 1st quarter of 2016 had the lowest number of cases lost to follow up.



	total number of cases registered	Cured	Treatment completion	Deaths	Treatment failure	Lost to follow-up	New smear positive	Bacteriologically confirmed
4th Qtr 2015	306	269	8	11	9	9	233	251
1st Qtr 2016	317	273	13	11	12	5	222	235
2nd Qtr 2016	309	277	7	9	4	5	256	273
3rd Qtr 2016	329	294	11	8	4	8	268	281

Figure 2: Treatment outcomes after challenge TB project initiation in Osun State (15 Local Government Areas). The values are the number of patients.

Figure 3 shows outcomes before and after the intervention of Challenge TB. The results show an increase of 63 cases of TB registered after the start of CTB activities. There was an increased number of cured patients after intervention (1113) compared to before intervention (893). Treatment completion without outcome was higher before the intervention (85) than after intervention (39). A similar trend was revealed for number of death (74 and 39), loss to follow up (46 and 27) and treatment failure (34 and 29) before and after Challenge TB intervention respectively.



	total number of cases registered	Cured	Treatment completion	Deaths	Treatment failure	Lost to follow-up	New smear positive	Bacteriologically confirmed
Before Challenge TB	1198	893	85	74	34	46	845	919
After Challenge TB	1261	1113	39	39	29	27	979	1040

Figure 3: Treatment outcomes before and after challenge TB in Osun State (15 Local Government Areas). The values are the total number of patients.

Figure 4i shows the mean treatment outcomes registered before and after CTB intervention. The statistical analysis showed no significant difference between the average number of cases registered in the two periods. Results also found that between the average numbers of patients cured between the periods, the period of intervention had higher value for cured cases registered compared to before the intervention. The average values of death and loss to follow-up cases were significantly higher before intervention. The average values of treatment failure cases and treatment completion without a particular outcome was higher before the intervention without a significant difference.

Figure 4ii shows the Percentage treatment outcomes before and after Challenge TB interventions. Overall, the percentage treatment outcomes were higher in the period before the

CTB interventions compared to the period after. However, percentage treatment completion, death and LTFU were higher before CTB intervention.

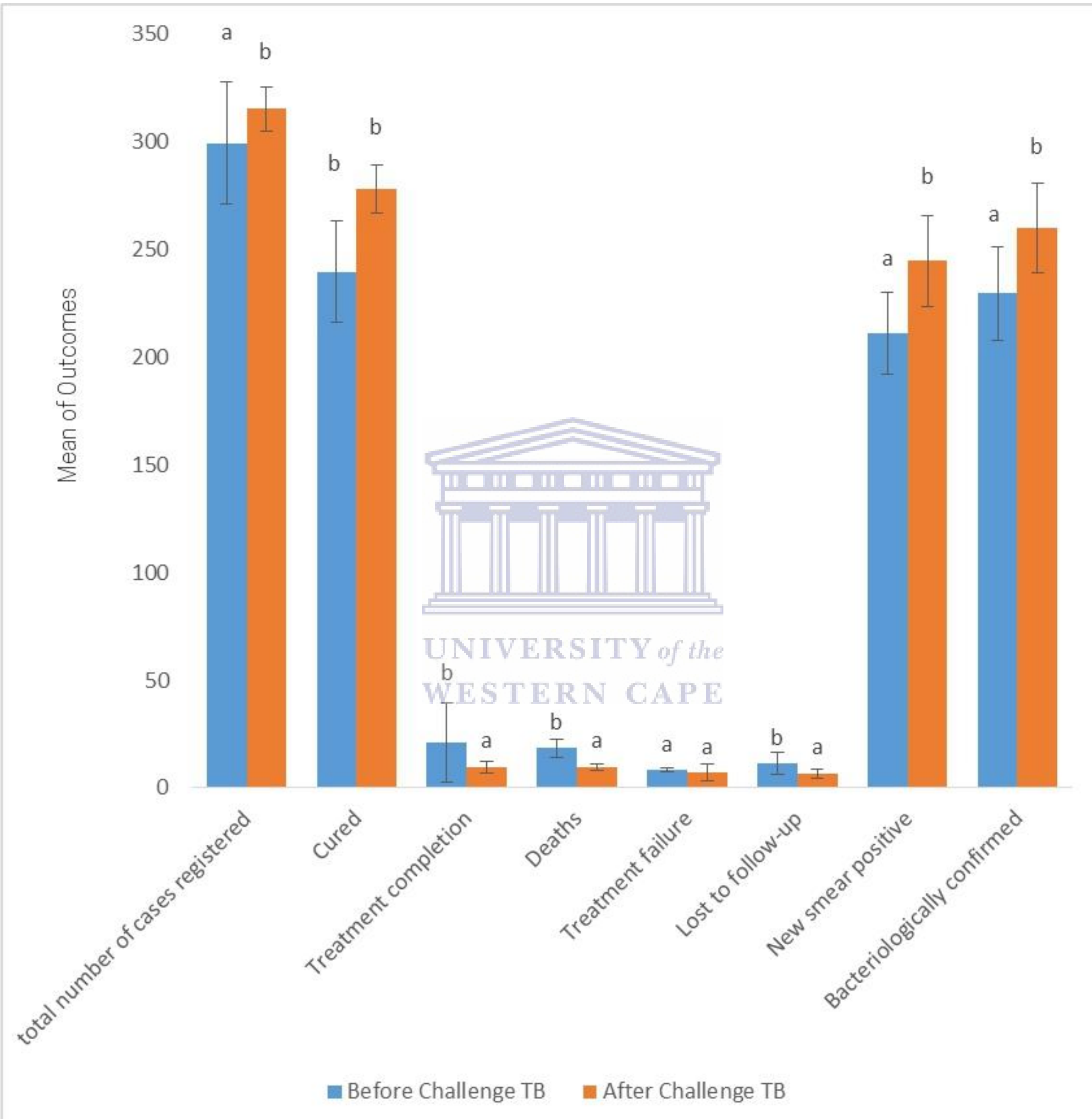


Figure 4i: Mean Treatment outcomes before and after Challenge TB. Results show the mean and 95% confidence interval (as error bar). significant difference (P<0.05).

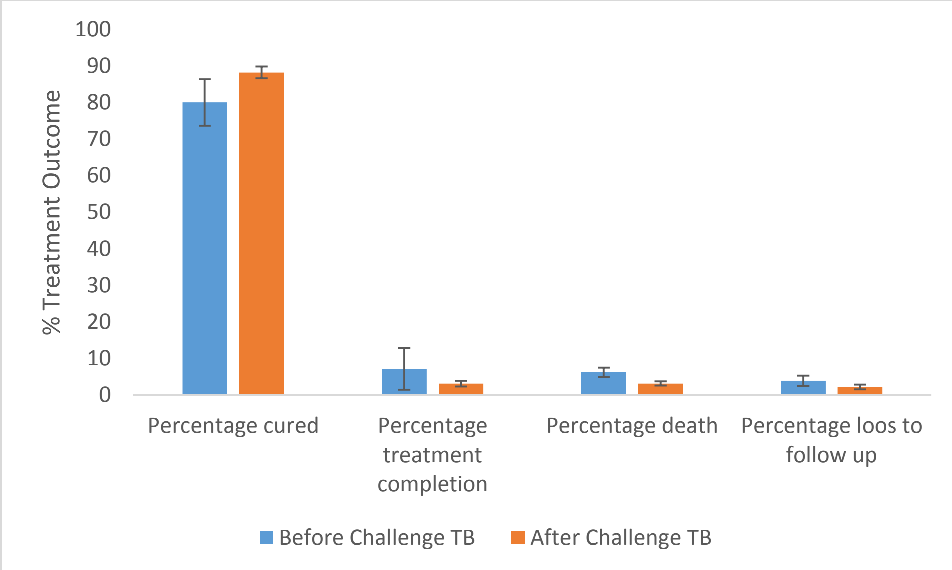


Figure 4ii: Percentage treatment outcomes before and after Challenge TB. Results show the mean and 95% confidence interval (as error bar). Significant difference (P<0.05).

Table 1 shows treatment outcomes from the 4th quarter of 2014 to 3rd quarter of 2016 in Osun State. The 3rd quarter of 2016 had the lowest treatment failure rate (0.012). The highest treatment failure rate took place in the 1st quarter of 2016 (which was the second quarter of the intervention period) (0.038). Rate of treatment completion without known anti-tuberculosis treatment outcomes data was highest in 4th quarter of 2014 (0.15) but lowest in the 2nd quarter of 2016 (0.023). The death rate was highest in 4th quarter of 2014 (0.077) but lowest in the 3rd quarter of 2016 (0.024). Treatment cure rate was highest in the 2nd quarter of 2016 (0.896) followed by the 3rd quarter of 2016 (0.894), in comparison to the lowest rate of treatment completion in the 4th quarter of 2014 (66%).

Table 1: Treatment outcome rate from 4th quarter of 2014 to 3rd quarter of 2016 in Osun State

	Total no. of cases registered	Case Notification Rate	Cured	Treatment completed	Death	Treatment failure	Lost to follow up	Lost to follow up rate	Treatment Cured Rate	Treatment completion rate	Death rate	Treatment failure rate
4th Qtr 2014	313	6.8930	207	47	24	7	9	0.0287	0.6613	0.1501	0.0766	0.0223
1st Qtr 2015	274	6.0341	205	22	19	9	19	0.0693	0.7481	0.0802	0.0693	0.0328
2nd Qtr 2015	258	5.6817	215	8	17	9	9	0.0348	0.8333	0.0310	0.0658	0.0348
3rd Qtr 2015	306	6.7388	266	8	14	9	9	0.0294	0.8692	0.0261	0.0457	0.0294
4th Qtr 2015	306	6.7388	269	8	11	9	9	0.0294	0.8790	0.0261	0.0359	0.0294
1st Qtr 2016	317	6.9810	273	13	11	12	5	0.0157	0.8611	0.0410	0.0347	0.0378
2nd Qtr 2016	309	6.8049	277	7	9	4	5	0.0161	0.8964	0.0226	0.0291	0.0129
3rd Qtr 2016	329	7.2453	294	11	8	4	8	0.0243	0.8936	0.0334	0.0243	0.0121

*Yellow highlight revealed the quarters before the intervention of challenge TB program. Values are sum of all 15 local government areas for each quarter.

Table 2 shows the differences in TB outcome rates between the before and after the implementation of the Challenge TB intervention and the significant relationship between them using One Way Analysis of Variance (ANOVA). The intervention of the CTB project presented high case notification rate (6.9425±0.2263) though not significantly different from before the intervention of CTB (6.3369±0.5749). The before and after results do not violate the ANOVA test assumptions such as the fact that the observations are independent of each other. The LTFU rate was significantly higher before the intervention of Challenge TB (0.0405±0.0194) compared to after the start of the intervention (0.0214±0.0066). Treatment cure rate was higher after the start of the intervention (0.8825±0.0162), compared to before the intervention (0.7780±0.0929). The intervention of Challenge TB reduced the rate of death from 0.0644 to 0.031, as well as treatment completion without treatment outcomes (0.072 to 0.031) and treatment failure (0.03 to 0.023) rates.

Table 2: Treatment outcome rate before and after intervention of challenge TB in Osun State, showing the mean rates of the outcomes.

	Case Notification Rate	Lost to follow up rate	Treatment Cured Rate	Treatment completion rate	Death rate per 100000 cases	Treatment failure rate
Before Challenge TB mean	6.3369±0.5749	0.0405±0.0194#	0.7780±0.0929	0.0719±0.0576	0.0644±0.0132#	0.0298±0.0055
After Challenge TB mean	6.9425±0.2263	0.0214±0.0066	0.8825±0.0162	0.0308±0.0081	0.0310±0.0054	0.0230±0.0127

Values are expressed as mean ± standard deviation. # indicate significant difference (P<0.05).

CHAPTER 5

5.0- DISCUSSION

This study found that the Challenge TB project has resulted in several improvements in the TB program compared to the period prior to the launch of the program. Such improvements include a rise in TB case notification and improved treatment outcomes. The improvement in TB outcomes following the implementation of the CTB project could plausibly have been due to the project addressing health system failures and knowledge gaps noted among healthcare providers with regard to WHO treatment guidelines. These were vital areas of consideration in formulation of CTB project strategies. This is as evidenced by a 4.9% increase in treatment completion rate seen in the period after commencement of CTB activities. The high TB case notification realized in the third quarter of 2016 (as seen in fig. 2) may have been due to increased case finding activities supported by CTB such as community outreaches, contact tracing and also by the fact that HCW industrial actions were called off at the end of the second quarter of 2016. Nonetheless, TB case notification and number of presumptive TB cases were not statistically significant before and after CTB interventions.

However, death due to TB was highest in the fourth quarter of 2014 (as seen in figure 1), as was LTFU with 5% of registered cases having defaulted. This may have possibly been due to strike actions of HCWs during that period which must have negatively affected healthcare and TB service delivery. These were vital areas of consideration in formulation of CTB project strategies.

In the 2000s, a high degree of attention was aimed at improving TB case detection as this was a period in which TB case finding targets were set (Stop TB, 2003). Early detection and treatment of TB are critical to mitigating the spread of the disease. Active case finding (ACF) is a novel approach to TB screening and a promising tool for increasing early case detection among marginalized populations. As opposed to passive case-finding, active case finding involves the systematic searching for TB in individuals who would not spontaneously present for care. Prompt linkage of diagnosed TB patients to treatment is crucial to ACF's success, as failure to do so may result in disease progression and continued transmission within the community (Lorent et al., 2015). Tuberculosis resulted in great societal intolerance; the discrimination of people with the tuberculosis disease had prompted several people to either prefer treatment away from their local government areas of residence or health facility close to them. However, the objective of the Challenge TB (CTB) project was to make TB treatment and awareness patient centred, as well as taking TB diagnosis, treatment and demand creation to the door-steps of index cases so as to ensure that the infection rate is reduced and the disease is eradicated.

The DOTS strategy was introduced in 1993 as a strategy to curb the spread of TB in Nigeria, and has since then been the cornerstone of TB control in Nigeria (Ukwaja et al., 2011), and was followed by systematic expansion. This stepwise scaling up of TB services has resulted in considerable progress in TB control in Nigeria, yielding approximately 74% DOTS service coverage by the end of 2014. That is similar to some reports from Ethiopia where 73% of zonal DOTS service coverage was attained in seven years after the commencement of the DOTS strategy (Shargie &Lindtjorn, 2005). This scale-up of DOTS centres was extended to Osun state where, with the support of CTB project; no less than 18 DOTS centres have been established. This may have accounted for the increase in TB case notification from 1,141 to 1,261 in the one year before and after the commencement of CTB project activities in the state. This study finding is similar to results from previous studies in Southern Ethiopia where a ten-year trend of all forms of TB notification rose from 45 to 143 cases in eight years following strategic expansion of DOTS services (Shargie & Lindtjorn, 2005). This however, further reiterates the need to strengthen and allocate more resources to active case finding strategies targeted at high-risk groups (Ho et al., 2016) within communities through the engagement of CBOs and lower cadre health workers to conduct community outreach campaigns, implement DOTS and contact tracing of bacteriologically confirmed TB cases (Datiko &Lindtjorn, 2009).

Another explanation for the increase in TB case detection could be due to the expansion of diagnostic and treatment services such as the use of GeneXpert technique as the first line diagnostic measure in Nigeria and Osun state. The other reason could be improvements in recording and reporting of TB case detection following intensified CTB project supportive supervision and monitoring even if there are no real increments in case detection resulting from DOTS expansion as concluded from a study by Obermeyer et al. (2007).

Despite Osun state being ranked among the top four states in Nigeria with the highest levels of education (osun.gov.ng. 2017), the dissemination of the anti-tuberculosis messages was challenging particularly due to the remote nature of the state which made it especially difficult to access the hard-to-reach-areas. However, the program had made provisions for medical volunteers to partner with TB local supervisors and state supervisors to take the message to the marginalized settlements in the state. This is of particular importance because of the 15 LGAS, 9 are made up of mostly rural communities; and since there was a general upsurge in TB case notification in the LGAs, demand and awareness creation conducted by CTB through the volunteers and general HCWs at facilities could have been responsible for the increase in TB case finding..

The door-to-door TB screening program through contact tracing of index cases in Osun State could plausibly have contributed substantially to case notifications, with increased number of TB cases registered from the 4th quarter of 2015 to 3rd quarter of 2016 (period of Challenge TB intervention) with significant increase compared to the period before the intervention. Also, from the study results, volunteers of the CTB program and staff from the LGA level were engaged in follow-up activities of TB cases, resulting in a 50% (4% to 2%) decline in the proportion of patients lost to follow up following CTB project. Treatment failure also declined, ensuring that individuals were permanently cured. The average percentage of treatment failure before the intervention was 7% with a reduction by about 4% in the intervention period. CTB ensured a percentage reduction in death from 6% to 3%, and increased percentage of patients cured from 74% to about 90%. The understanding of real and perceived barriers faced by TB patients and key stakeholders was likely responsible for improved and effective case finding in the LGA supported by CTB project. Nevertheless, reasons for low turnout in the period before the intervention have not yet been fully explored, but the success achieved from the intervention of CTB project could be as a result of significant financial investments, introduction of new diagnostic techniques, community led interventions and successful implementation of its thought-out plans and strategies.

While TB treatment was provided free of charge through the NTP with external donor funding, some TB patients reported indirect costs hindering prompt uptake of and adherence to treatment. In a cross-sectional cost-of-illness analysis by Getahun et al. (2016), TB patients mean productivity and income reduced by 37% and 10 %, respectively, compared with pre-treatment level, while mean household expenditure increased by 33 % and working hours reduced by 78 % due to TB illness. Such extra costs are often due to factors such as due to long distances to health facilities and transportation challenges, as well as other indirect hospital costs. For some TB patients who are gainfully employed by the state government and are also required to access TB treatment through the daily facility-based DOTS, there could be a risk of loss of livelihood (Lorent et al., 2015).

As a consequence, the CTB program set up a mini-scheme to minimize these constraints by providing transport support for the movement of sputum samples to GeneXpert laboratories to reduce result turnaround time; and also by hiring ex-TB patients to work in the capacities of health educators and 'community influencers'. This therefore was reflected in the rates of treatment outcomes in the 15 local government areas in the state, with a significant ($P<0.05$) decrease in the death rate of TB patients before CTB program implementation compared to a year after CTB program implementation. Significant reductions were also noted for the rate of treatment failure and rate of lost to follow up ($P>0.05$).

An increase in public awareness of TB symptoms, signs and available services can be expected to increase passive case detection through patient self-reporting at the health facilities. This finding is supported by the fact that in this study, there was a steady rise in TB case detection up to the two quarters in 2016. This increase may be attributed to greater awareness generated by massive community outreach campaigns and airing of radio jingles and dramas. A study in Delhi, India (Sharma et al.,2005), also demonstrated that provision of information through engagement of mass media and IEC materials encouraged smear examination and ultimately resulted in increased case-finding of TB.

5.1- STUDY LIMITATIONS

The impact of the CTB project on TB control in Osun state has not been maximally harnessed because one year assessment is not a very long and adequate time for change assessment, hence the need for a more in-depth study of the impact of the Challenge TB Project in the state. This gap in the literature calls for innovative approaches towards case finding that, when coupled with effective treatment measures, will significantly reduce TB incidence and enhance TB elimination. This need is especially great in areas with high TB and HIV co-infection rates, where the WHO Expanded DOTS Framework for Effective Tuberculosis Control also advocated more than DOTS in high HIV settings (WHO, 2002).

Furthermore, nationally coordinated, high-quality TB control strategies, as embodied by the DOTS strategy, are key in improving outcomes for patients with TB. However, full cost effectiveness analysis, age and gender disaggregation of data was not done and these therefore, afford the opportunity for further research to be carried out in these areas. Also, while this study may throw some light on the successes of the CTB project in Osun state of Nigeria, it lacks a comparison or control group and therefore the control of confounders, which makes it more difficult to establish with some degree of certainty, the cause and effect relationship between CTB project and the recorded impact.

CHAPTER 6

6.1 CONCLUSION

After this study, we conclude that increasing favourable TB treatment outcomes due to CTB interventions as well increasing the demand for TB services all led to demonstrable progress of the TB program in Osun state. Furthermore, capacity building and supportive supervision to ensure adherence to guidelines may have also contributed to the increased favourable TB treatment outcomes. More so, demand creation through the community and mass media engagement was also vital in the improvement of TB indicators. However, certain areas need to be improved upon to ensure a more successful and sustainable program. One such key area is treatment completion, which declined after CTB project. Other areas include government will and support through funding and supportive supervision. This will ensure sustainability and strengthen program ownership.

6.2- RECOMMENDATIONS

As the impacts of the CTB project on tuberculosis control has not been sufficiently measured using a one-year period, there is a need for an in-depth study into the impact of the project in Osun State preferably with comparison or control areas, as areas for further research. In the future, it will be worthwhile to consider engaging in house-to-house TB case active finding which could detect more TB cases as this study showed no significant increase in TB case notification after interventions on active case finding from community outreaches implemented by the CTB project.

Additionally, the negative impact of HCW industrial action on TB case notification and TB treatment outcomes warrants further research and development of interventions that will serve as stop-gap measures that ensure constant availability of TB services when strike actions occur.

Also, for effective TB control, it is imperative to understand the factors that impact on TB case detection in Nigeria, one of which is gender. In this study, gender disaggregation was of finding was not captured, thus it will be of programmatic gain for future studies to do so, and also to understand factors affecting TB case finding. TB case detection is higher in males than in females in most countries globally (Borgdorff et al., 2000; Adetifa et al., 2012; Horton *et al*., 2016). Whether the difference is related to gender difference in TB epidemiology and /or gender difference in access to TB health care requires further investigation and study. However, these gender differences in TB detection may arise from varied societal roles of men and women which impact on health seeking behaviours and access to health services ultimately (Hudelson, 1996). This study also found that 25-34 years age group had the highest number of TB cases detected and started on treatment. This is in keeping with studies carried out in Gambia and South Africa. In a South African study by Blaser et al., (2015) which aimed to determine the drivers underlying the age-patterns in TB notification rates in Cape Town, the peak TB notification occurred at 25-29 years (463/100,000 yrs).

It is also evident that creating more awareness and demand for TB services at the community levels will go a long way in identifying missing TB cases; therefore, more resources should be channeled to activities focused on them. Engagement of media houses, stakeholders, community leaders, CBOs, health care providers at primary and secondary levels in the dissemination of TB messages and information will sensitize, inform and re-orientate the community to make better health decisions pertaining to TB. These strategies may help to de-stigmatize TB and increase voluntary testing and accessing services at a minimal cost. Results from a study by Okuonaghae et al., (2010) showed that stigmatization could prevent families from revealing TB cases to health officials and instead resort to alternative, ineffective measures for treating the disease (measures that may not even deal with the problem), thereby increasing the infectious period of the person and putting other family members at risk of infection.

Furthermore, studies have shown that contact tracing of bacteriologically confirmed TB cases could help mop up the missing TB cases in the community (Razia et al, 2016), especially with the advent of DR-TB in Nigeria and through the availability of faster and more efficient diagnostic techniques such as the GeneXpert MTB/RIF test. DR-TB management involves an arduous treatment journey (Loveday et al. 2013), huge financial implications and delicate screening and close monitoring of households and close contacts of the confirmed DR-TB patients.

Socio-economic inequalities in health are persistent, widespread, and widening. The lower the individual's position on the socio-economic hierarchy, the worse their health status, whether measured by life expectancy, disability, or self-reported wellbeing (Kawachi, 1998). The socio-economic status of the residents of Osun State is very low, this could emanate from the fact that the residents are either subsistence farmers or civil servants, and with this low standard of living, the prognosis of the anti-TB treatment might not be as good as expected. Challenge TB developed an account system that provides monthly allowances to DR-TB patients as well as daily transportation support to-and-from the DOTS facilities to ensure compliance and adherence to drug treatment to try to address this barrier.

To reach the SDG 3 target 3.3 to end the epidemic of TB by 2030 and the WHO End TB vision of less than 10 cases per 100 000 by 2035, however, we will need new interventions (Fletcher and Schrager, 2016). Such new interventions will include new drugs, shorter drug treatment durations, new vaccines and new diagnostic techniques including point-of-care testing for rapid on-the-spot testing. More so, there has to be engagement of stakeholders at all levels to ensure increased, government ownership as well as increased awareness of the population and resulting demand for TB services.

Globally in 2014, only 50% of the DR-TB patients achieved a successful treatment outcome (cure or treatment completion), while many of the 190,000 with confirmed DR-TB cases lost their lives even before treatment could be commenced (WHO, 2015). In Osun state, as of October 2016, of the 39 confirmed DR-TB patients, 28 were put on treatment while 9 DR-TB patients lost their lives in the course of treatment or even before treatment was started. However, 10 patients have not been started on treatment for various reasons. Such reasons include denial on the part of the patient and patient absconding post-diagnosis. This underpins the necessity for more work to be done in the area of PMDT (Programmatic Management of Drug resistant TB). There is cause for optimism however, as there is hope of scale-up of GeneXpert MTB/RIF technique, drug susceptibility testing (DST) and the hope of newer, more tolerable and shorter drug treatment regimens (Moore, 2016).

Therefore, in the interim, contact tracing of all household and close contacts of DR-TB patients should take the utmost priority. Also, for close contacts of index cases known to have drug-susceptible TB (susceptible to rifampicin and isoniazid) who are deemed to be at high risk of progression to active disease – such as young children, HIV-infected, immunosuppressed, DR-TB patients – IPT is recommended, as there is strong evidence that this affords good protection against subsequent TB disease in well-defined populations (Smieja et al., 2000; Abossie & Yohanes, 2017; Chehab et al, 2017; Shivaramakrishna et al, 2017)). However, challenges such as erratic supply of INH tablets and irregular prescription of INH medication by healthcare workers negatively impact on the success of IPT implementation. Thus for now, early diagnosis and treatment as well as screening and close monitoring of contacts remain the key to minimizing DS-TB and DR-TB transmission and overall morbidity and mortality. Chronic infectious diseases like TB and HIV should be incorporated into emergency responses offered by organizations and agencies for internally displaced persons.

There is also a need for the further strengthening of integration of TB services into other services such as in the HIV and ante-natal setting. For instance, according to the 2013 WHO global report, women of the reproductive age group (15-49 years) accounted for 38% and 47% of the burden of smear positive TB cases and PLHIV, respectively. TB infection in pregnant women increases both maternal and infant morbidity and mortality rates. In low HIV prevalence settings, TB is estimated to cause 6–10% of all maternal mortality from both direct and indirect obstetric causes, with this figure increasing to 15% in high HIV prevalence settings (Ahmed et al., 1999). Hence, TB services integration with reproductive health through TB screening and rapid molecular diagnostic testing among women attending ANC is critical for the elimination of TB.

Public participation and community engagement needs to be built into TB control.
Innovative ways of public education, awareness creation and empowerment are all essential. Citizens should know TB is infectious and treatment is for at least 6months duration; and completion of treatment is in the interests of all concerned – both affected and unaffected individuals including children. We must educate the public to adopt hygiene and infection control behaviours – for example, not spitting in public spaces and observing cough/sneeze etiquette.

TB can affect any organ system of the body; therefore, all medical and surgical subspecialties that treat TB must be brought under the Public Health surveillance system. Such gathering of information is not realistic for just one pathogen; all pathogens under Public Health purview must be made notifiable.

TB control is both a means to, and a measure of, economic and social development of a nation. These many additional interventions, coupled with the DOTS strategy require a re-organization of the health management approach in Nigeria. TB control must be in ownership of the federal and state governments – for which flexibility in interventions, implementation and freedom to innovate must be given, while regularly auditing the performances at all levels of implementation. More so, maintenance of quality TB diagnostic and treatment services through sustainable commitment from all stakeholders through supportive monitoring and supervision; strengthening of DOTS strategy; and strengthening of the referral linkage systems to increase uptake of GeneXpert MTB/RIF for TB case diagnosis are all critical to ensuring quality of service delivery in Osun state.

On a final note, to improve the impact of CTB on TB control in Osun state in the future, priority areas of focus should include awareness and demand creation, as well as extensive community engagement.

APPENDIX A: Description of indicators used in the analysis

Data variable	Description	Formula
Number of Presumptive TB cases identified at the facility	Describes the number of presumptive cases notified over the period under review.	Sum total of all presumptive TB cases notified over the period under review.
Proportion of Presumptive TB cases referred from the community	Proportion of Presumptive TB cases referred from the community (e.g, by the community volunteers, patent medicine)	Numerator: total number of presumptive TB cases referred from the community. Denominator: total number of presumptive TB cases notified over the period under review
Proportion of HIV infected Presumptive TB cases	Proportion of HIV infected Presumptive TB cases over the period under review	Numerator: total number of HIV positive presumptive TB cases. Denominator: total number of presumptive TB cases notified over the period under review
TB Cases (all forms) notification rate	The number of TB cases notified for every 100,000 population.	Numerator: Total TB patients reported in a year (× 100,000) Denominator: National population in the same year
Proportion (%) of notified TB cases with HIV positive test result recorded in the TB register	Total number of notified TB cases with HIV test result recorded in the TB register among the total number of TB cases notified	Numerator: Total number of notified TB cases with HIV test result recorded in the TB register Denominator: Total number of notified TB cases over the same period
Proportion (%) of new smear-positive	Total number of new smear positive PTB cases that	Numerator: Total number of new smear-positive PTB cases that were

PTB cases who were successfully treated (Treatment success rate)	were cured and those that completed treatment but did not meet the criteria for cure or failure among total number of new smear-positive pulmonary TB cases notified.	cured and those that completed treatment but did not meet the criteria for cure or failure Denominator: Total number of new smear- positive pulmonary TB cases notified over the same period.
Proportion (%) of new smear-positive PTB cases who were lost to follow-up (Loss to follow-up rate).	Total number of new smear positive PTB cases that interrupted treatment for 2 consecutive months or more among total number of new smear-positive pulmonary TB cases notified.	Numerator: Total number of new smear-positive cases that interrupted treatment for 2 consecutive months or more. Denominator: Total number of new smear- positive pulmonary TB cases registered.
Proportion (%) of new smear-positive PTB cases that died (Death rate). Total number	Total number of new smear positive PTB cases who died from any cause while on TB treatment among total number of new smear-positive pulmonary TB cases notified. Numerator: Total number of	Numerator: Total number of new smear-positive PTB cases who died from any cause while on TB treatment Denominator: Total number of new smear-positive pulmonary TB cases notified over the same period.
Proportion (%) of new smear-positive PTB cases that	Total number of new smear positive PTB cases who remain	Numerator: Total number of new smear-positive PTB cases who remain or became smear-positive at end of 5th

failed treatment (Treatment failure rate) Total	or became smear-positive at end of 5th month of their TB treatment or after among total number of new smear-positive PTB cases notified.	month or after. Denominator: Total number of new smear- positive PTB cases notified over the same period.
Proportion (%) of new smear-positive PTB cases that was transferred-out (Transferred-out rate)	Total Number of new smear positive PTB cases notified that were transferred to another LGA/State or country and for whom the treatment outcome is unknown among total number of new smear-positive PTB cases notified.	Numerator Total Number of new smear-positive PTB cases notified that were transferred to another LGA/State or country and for whom the treatment outcome is unknown. Denominator: Total number of new smear- positive PTB cases notified over the same period
Proportion (%) of new smear-positive PTB cases that was not evaluated.	Total number of new smear positive PTB cases that have no outcome at the end of their treatment among total number of new smear- positive PTB cases notified.	Numerator: Total number of new smear-positive PTB cases that have no outcome at the end of their treatment Denominator: Total number of new smear- positive PTB cases notified over the same period.

Appendix B: Definitions of TB client categories

Previously treated (Re-treatment) patients: Are patients who have received 4 weeks or more of anti-TB drugs in the past. They may have Xpert, smear, culture positive/negative PTB or EPTB and are further classified by the outcome of their most recent course of treatment as follows:

Relapse patients: Are patients previously treated for TB and were declared cured or treatment completed at the end of their most recent treatment episode and are now diagnosed with a recurrent episode of TB. These patients could be true relapses or a new episode of TB caused by reinfection.

Treatment after failure patients: are previously treated for TB and whose treatment failed at the end of their most recent treatment episode.

Treatment after loss to follow-up patients: are previously treated for TB and were declared Lost to follow-up at the end of their most recent treatment episode. (These were previously known as Return after default patients).

Other previously treated patients: are previously treated for TB but with an unknown or undocumented outcome for their most recent treatment episode, or do not fit into any of the categories listed above.

Patients with unknown previous TB treatment history: are those who do not fit into any of the categories listed above.

Transfer in patients: A patient who has been diagnosed and registered for treatment in a facility in one LGA and is transferred to a facility in another LGA to continue treatment. The smear conversion and treatment outcome for this patient must be reported back to the facility that transferred the patient.

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