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Transmission pattern and the role of DOTS clinic in the control strategies of Tuberculosis in Kano, Nigeria

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Abstract
Tuberculosis (TB) is a major public health concern not only in developing nations but globally and the World Health Organization (WHO) estimated 10.4 million incident cases of TB and 1.67 million TB deaths in 2017. The study was conducted in Infectious Disease Hospital (IDH), Kano, a reference health facility for infectious disease of public health importance. The aim of the study was to determine the transmission pattern of Mycobacterium tuberculosis complex (MTBC) strains and the role played by Directly Observed Therapy Short course (DOTS) clinic in the control of TB. Of the 945 case-patients enrolled, 625 (66.1%) were males and 320 (33.9%) were females. The mean age of patients in years was 32.8 ± 13.8 SD and the median age was 30 years (range 3-95 years). Incidence of TB among presumptive cases was 15.0%. There was a fairly consistent increase in TB prevalence from 2015 (11.0%), 2016 (11.5%), 2017 (10.0%) and 2018 (36%). Pulmonary TB was diagnosed in 884 (93.5%) while Extra-Pulmonary TB accounted for 6.5%. New cases of TB within the study period were 819 (86.7%) and while 126 (13.3%) were relapse TB cases. Treatment outcome that included patients described as cured or have completed treatment successfully (smear negative) were recorded in 811 (85.8%) cases. DOTS clinic has improved TB detection rate through the years and consequently played a big supervisory role in TB treatment and control strategy in the state.

Keywords: Control, Patients, Pulmonary, Relapse, Treatment, Tuberculosis

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INTRODUCTION

Tuberculosis (TB) is a major public health concern not only in developing nations but globally and the World Health Organization (WHO) estimated 10.4 million incident cases of TB and 1.67 million TB deaths in 2017 (WHO, 2018).Tuberculosis is a chronic disease principally caused by the bacillus *Mycobacterium tuberculosis* (MTB) and other members of the *Mycobacterium tuberculosis* complex (MTBC). It is an infectious disease characterized by high morbidity and mortality in developing countries and in urban areas of developed countries (WHO, 2015). It is spread through coughing, sneezing, or by respiratory fluids (aerosols) through the air by infected patients. Most infections do not have symptoms, a condition known as latent tuberculosis (LTB). About one in ten latent infections eventually progresses to active disease which, if left untreated, kills more than 50% of those so infected. However, the probability of developing TB is higher among people with immune suppression such as human immunodeficiency virus (HIV) infection (Maiyaki *et al.,* 2017; Cajetan *et al.,* 2017). Tuberculosis causes ill-health among millions of people each year but the burden is not uniformly distributed, as 80% of all cases live in sub-Saharan Africa and Asia (WHO, 2019). In recent years, the estimated number of new TB cases on this continent has exceeded 2 million with over 600,000 deaths (WHO, 2015).Nigeria being among the ten high TB burden countries accounted for 8% of the global 76% gap between TB incidence and reported cases (WHO, 2017). The National Tuberculosis & Leprosy Control Program (NTLCP) was established in 1989 and officially launched in February 1991. Its mandate was to coordinate TB, Leprosy and Buruli ulcer control activities in all states in Nigeria in order to significantly reduce the public burden of the three diseases (NTBLCP, 2015). The study aimed to determine the transmission dynamics of TB and the role played by DOTS in the control of TB in Kano, Nigeria.

Materials and Methods

Study site

Kano is the capital of Kano state in Northwestern Nigeria. According to the 2006 census, Kano state has a population of 9.38 million, which is comprised predominantly of Hausa and Fulani ethnic groups (Nas *et al*., 2017). It is recognized as one of the fastest growing cities in Nigeria with a population density of about 1,000 inhabitants per km^2. It lies within the Sahel savannah region with daily mean temperature of about 30–33°C during the dry months of March to May and 10°C during the autumn months of September to February. Rainy season varies from year to year, but typically commences in May and ends in October, with an average annual rainfall of 600mm while the dry season starts from November to April (Mohammed *et al*., 2015).

Study Population and Procedures

The study population comprised all case-patients with tuberculosis that were reported to DOTS clinic of IDH, Kano for treatment. The study started by reviewing all available DOTS registers and extracted patient information from June, 2015 to July, 2018 assisted by the TB DOTS clinic staff.A notebook was used to collect data on sex, age, whether the TB was new or a relapse case, type of presentation (pulmonary/extra- pulmonary), HIV status, and smear result after at least the 2nd month of initiation of the treatment or treatment outcome (cured/completed or lost to follow-up due to death/disappearance/change of location etc) and year of patient visit.

TB case definition

In IDH, Kano, almost all cases of TB are diagnosed or confirmed by Ziehl Neelsen stain procedure (NTBLCP, 2014) performed on sputum smear and recently by GenXpert introduced

in the year -2012. Any request for culture is referred to the North-West zonal TB reference laboratory at AKTH, Kano. A positive AFB result is sufficient for notification of a case of TB.

Data analysis/Statistical Analysis

Data entry was done using Microsoft Office Excel 2007 worksheet (Microsoft, Redmond, WA, USA) and was subjected to descriptive statistical analysis using percentages in determining the prevalence rates of TB in the different groups. Means (including SDs) and medians and ranges for continuous variables were calculated. Comparisons between groups (year of visit, type of TB, HIV status, etc) were made by using Chi squared test, and 95% CIs were calculated when appropriate. All analyses were done using statistical package for social sciences (SPSS) version 20.0.

RESULTS

Of the 945 case-patients enrolled, 625 (66.1%) were males and 320 (33.9%) were females. The mean age of patients in years was 32.8 ± 13.8 SD and the median age was 30 years (range 3-95 years). The incidenceof TB among presumptive cases is 15.0%. The result has indicated a fairly consistent rise of prevalence in 2015 (11.0%), 2016 (11.5%), 2017 (10.0%) and 2018 (36%). Rate of PTB was 884 (93.5%) while EPTB was 61(6.5%) while their separate HIV-TB rates were 120(12.7%) and 5(0.5%) respectively. New cases of TB was calculated as 819 (86.7%) and Relapse TB cases was determined as 126(13.3%).811 (86%)patients who were on first-line anti-TB treatment were captured as cured or having completed treatment in the period June, 2015 – July, 2018, in IDH, Kano, Nigeria.

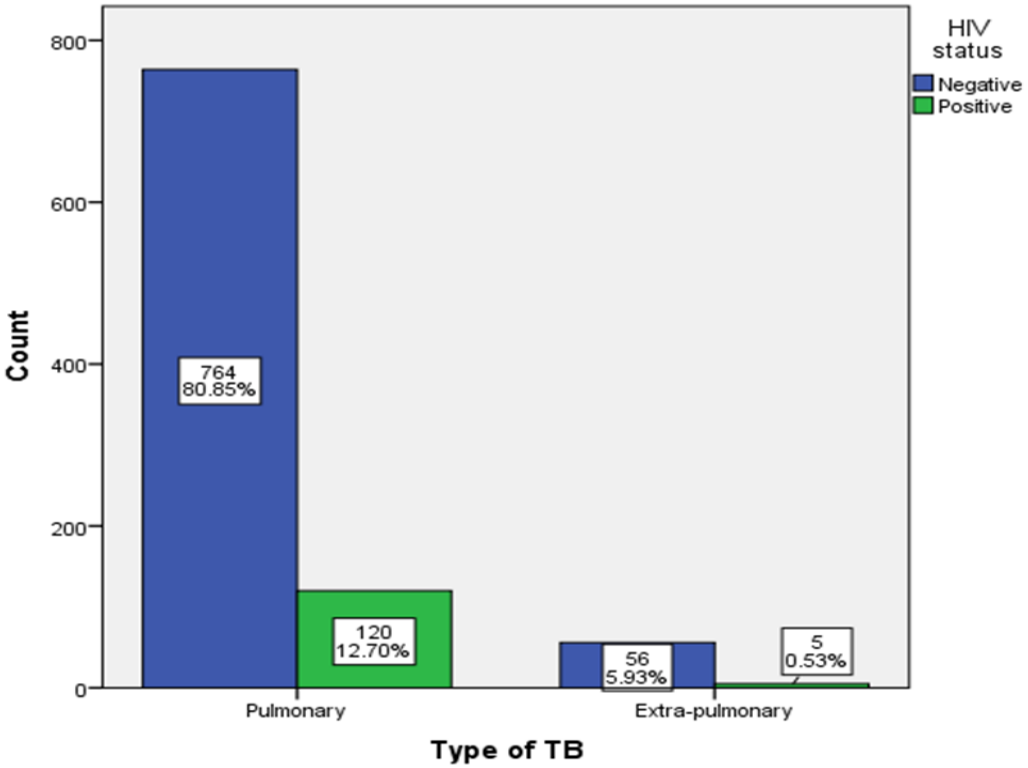

Figure 1: Types of TB infection among study subjects attending IDH, Kano
$\chi^2 = 1.438$, P= 0.230. Not significant at P < 0.05

Table 1: Outcome of TB treatment according to age groups of TB subjects attending DOTS clinic, IDH, Kano

Age range (years)	Outcome of Treatment			Total (%)
	Cured (%)	Lost (%)	Failed (%)	
1-10	10(1.2)	2 (1.6)	0	12 (1.3)
11-20	146 (18)	12 (9.8)	0	158 (16.7)
21-30	304 (37.5)	41 (33.3)	7 (67.0)	352 (37.2)
31-40	193 (23.8)	32 (26.0)	1 (9.0)	226 (24.0)
41-50	83 (10.2)	16 (13.0)	3 (27.3)	102 (10.8)
51-60	37 (4.6)	13 (10.6)	0	50 (5.3)
61 and above	38 (4.7)	7 (5.7)	0	45 (4.8)
Total	**811**	**123**	**11**	**945**

$\chi^2 = 22.483$, P =0.032. Significant at P < 0.05

Table 2: Type of TB among patients attending IDH, Kano according to year of visit

Year of Visit	Type of TB		Total
	Pulmonary (%)	Extra-pulmonary (%)	
2015	85 (9.6)	5 (8.2)	90 (9.5)
2016	173 (19.6)	12 (19.7)	185 (19.6)
2017	260 (29.4)	25 (41.0)	285 (30.1)
2018	366 (41.4)	19 (31.1)	285 (40.7)
Total	**884**	**61**	**945**

$\chi^2 = 4.128$, df=3, P = 0.0248. Significant at P < 0.05

DISCUSSION

This study showed that TB infection was associated with age group 21- 40 years. This is contrary to what was reported in similar studies from Lagos where TB infection was associated with higher age groups (Olusola *et al*., 2017) which confirms that TB and HIV are known to affect people in the reproductive age groups (NAftCoA, 2014). Treatment cure rate was determined to be 86% while the age group most affected by the dual infection contributed 61%. This is in line with the global treatment outcome of 85% reported (WHO, 2019). Since there is consistent rise of prevalence from 2015 to 2018, it means that DOTS clinic is improving the detection rate of TB and consequently playing a supervisory role in TB treatment and control.

The latest treatment outcome data showed a global treatment success rate of 83%, similar to recent years. There were 476, 774 reported cases of HIV-positive TB (46% of the estimated incidence), of whom 85% were on antiretroviral therapy (ART). A total of 129, 689 people were started on treatment for drug-resistant TB, a small increase from 125, 629 in 2015 but only 22% of the estimated incidence; treatment success remains low, at 54% globally.The increasing emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) tuberculosis (TB) in the era of human immunodeficiency virus (HIV) infection presents a major setback in efforts to effectively control TB (Aminu *et al*., 2017). This study describes the epidemiologic characteristics of tuberculosis cases during 2015–2018 in the area and also provides scientific information for TB prevention and control in the future.

CONCLUSION

Directly Observed Treatment (DOT) clinic has improved the detection rate of TB and consequently played a supervisory role in TB treatment and control. The findings in this study however have revealed that there was need to address the issue of clinical drug-resistant TB that could largely occur as a result of man-made selection during treatment. These include erratic drug supply, suboptimal physician prescription and poor patient adherence since a substantial number of resistant cases come from follow-up/relapse patients. These findings therefore highlight the need for ways to fully address these short comings.

The study team has recommended strengthening the resource capacity of TB laboratories and DOTS clinics for a better understanding of the transmission pattern to meet the challenges of TB for effective control strategy. Rapid MDR assays and genotyping techniques should be introduced to revolutionize TB diagnostics/diagnosis to understand the dynamics of DR-TB.

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