A Survey on Tuberculosis and HIV Co-Infection among Presumptive Tuberculosis Patients within Zuru Emirate Council, Kebbi State, Nigeria

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Abstract: Tuberculosis (TB) and Human Immunodeficiency Virus (HIV) are among the leading causes of death in Nigeria and Africa with HIV increasing the TB epidemic. This study aimed to determine the Prevalence of HIV among TB patients attending Martha Bamaiyi General Hospital (MBGH) Zuru Kebbi State, Nigeria. It was a cross-sectional study that involved 185 presumptive TB patients that attended MBGH Tuberculosis Laboratory Zuru. Sputum samples were collected from the patients and their TB status was determined using Gene Xpert (MTB/RIF). Demographic information and patients' HIV status was also documented from their medical record. The result revealed that the prevalence of TB among the studied patients was 17.3% (32/185) and 0% prevalence for RR-TB. The HIV prevalence was found to be 21.62% (40/185) while HIV-TB co-infection was 12.5% (4/185). Males had higher TB prevalence rate of 59.4% while more females (75%) were infected with HIV and had higher HIV-TB co-infection of 100%. Patients aged 25-34 years old had higher HIV infection rate of 38.89%. Based on settlements, the HIV-TB co-infected patients in semi-urban settlement had the highest co-infection rate (50%) while those in urban settlement were more infected with HIV (38.89%). Among the local governments, Danko-Wasagu had the highest HIV prevalence of 58.33% and higher HIV co-infected patients (75%) respectively. Hence, for effective TB control and to minimize the rate of transmission and acquisition of new infections there is the need for quick response and intervention by the appropriate agencies.

Keywords: Tuberculosis, HIV, Co-infection, Gene Xpert

INTRODUCTION

Tuberculosis (TB) is a bacterial infectious disease which is caused by *Mycobacterium tuberculosis* (MTB). It is spread from person to person via airborne droplets through coughs or sneezes, which primarily affects the lungs (WHO, 2006; Ministry of Health Singapore, 2016). TB is one of the top infectious killer worldwide (WHO, 2017). In Nigeria, TB is a significant public health problem that was declared a national emergency in June 2006 which led to the development of an emergency plan for the control of TB in Nigeria (Federal Ministry of Health Nigeria (FMHN), 2008). Abdulkadir and Ibrahim (2018), reported TB prevalence rates within the local governments of Zuru emirate as thus; Danko-Wasagu 53.1%, Zuru 21.9%, Fakai and Sakaba 12.5% respectively. Furthermore, inhabitants of rural settlements within the emirate council were more infected with TB (56.3%) than those in urban and semi-urban settlements having 21.85% respectively (Abdulkadir and Ibrahim, 2018).

Human immunodeficiency virus (HIV) infection in Nigeria cuts across both sexes and all age groups. However, youths between the ages of 20 and 29 years are more infected with the virus (Health Reform Foundation of Nigeria (HERFON, 2006; FMHN, 2006; Ojini and Coker, 2007). People living with HIV (PLHIV) accounted for 10% of the new TB cases reported worldwide (WHO, 2017). Around 30% of mortality rate among PLHIV is caused by TB and HIV in turn fuels the epidemicity of TB in immunocompromised individuals (FMHN, 2008). In the year 2016, HIV-TB co-infection was reported to be high in the African region (WHO, 2017).

TB and HIV are among the ten leading causes of death in Nigeria and indeed Africa (FMHN, 2008). Despite the stabilization in global percentage of PLHIV since 2000, the overall number of PLHIV has increased as a result of the number of new infections each year (Abiola *et al.,* 2009).

Globally, TB is the leading cause of deaths due to antimicrobial resistance and among PLHIV (WHO, 2017) and 3.6 % of new TB cases and 20.2 % of previously treated cases are estimated to have MDR-TB (Bhadke *et al.,* 2016). Newer tests other than the traditional (smear microscopy, culture, chest X-ray, tuberculin-skin test etc.) methods of diagnosing TB and detecting its drug resistance are needed because of the difficulties associated with the methods (Bhadke *et al.,* 2016). Gene Xpert MTB/RIF is an automated, real-time polymerase chain reaction (PCR) test for detecting TB as well as rifampicin resistant TB (RR-TB). It remains the only fully automated cartridge-based test that can detect both TB and RR-TB in less than two hours (Nicol *et al.,* 2013; MHS, 2016)**.**

This survey aimed at assessing the prevalence of HIV-associated with TB using Gene Xpert (MTB/RIF) Technique among patients attending Martha Bamaiyi General Hospital Tuberculosis Laboratory Zuru, Kebbi State, North West geopolitical zone of Nigeria.

MATERIALS AND METHODS

The study was a cross-sectional study and was carried out at Martha Bamaiyi General Hospital Tuberculosis Laboratory Zuru Kebbi State, Nigeria, between the periods of April-June 2018. Population of the study comprised of all presumptive TB patients that reported to the facility which is the only RR-TB diagnostic center within Zuru Emirate Council. Ethical approval with reference number SMOH/42/S/5/4679 was obtained from the Hospital Ethical Committee (Kebbi State Ministry of Health) before the commencement of this study and individuals were consented.

All presumptive (unconfirmed symptomatic TB) patients (0-65 years and above) that reported within the study period for RR-TB testing using Gene Xpert at Martha Bamaiyi General Hospital, Zuru Kebbi state and who gave consent were included in the study. Whereas, all asymptomatic TB patients within and outside Zuru Emirate Council that did not present for the Gene Xpert testing at Martha Bamaiyi General Hospital, Zuru Kebbi State and those who did not provide consent were excluded from the study.

The sample size was determined using an equation described by Naing *et al.* (2006) and a reported HIV-TB co-infection prevalence rate of 9.5% in Kaduna state by Aliyu *et al.* (2019). The sample size was calculated to be 132 patients. To minimize error and make it balance, 185 patients participated within the study period.

Sputum samples were collected from the 185 presumptive TB patients and processed according to standard mycobacteriological procedure. The samples were processed for the presence of TB and RR-TB using Gene Xpert MTB/RIF according to (Soundiram, 2012). Accordingly, the cartridges were labeled with the corresponding specimen ID number. The reagent buffer was added to the sputum in a ratio of 2:1 using sterile transfer pipettes; the lid was replaced and kept at room temperature. During this period, the samples were vigorously shaken twice 10-20 times and allowed to stand upright for 5 and 10 minutes at respective intervals. Later on, the sputum was allowed to liquefy with no visible clumps of sputum. Then 2 mL of the processed sputum was aseptically transferred into the labeled Gene Xpert cartridge using a sterile pipette and cartridges were placed in the Gene Xpert module/machine and results were obtained within 2 hours and interpreted.

Positive results display; MTB detected RIF not detected, MTB detected RIF detected, MTB detected RIF indeterminate, while, negative result display MTB not detected RIF not detected (Soundiram, 2012).

Demographic information and patients' HIV status was also documented from their medical records.

The data obtained were analyzed and presented using percentages.

RESULTS

Table 1 shows that of the 185 presumptive TB patients studied 32 were confirmed as TB positive which gave a TB prevalence of 17.3% in the studied area. None of the participants tested positive to rifampicin resistance (Table 1). The overall prevalence rate of HIV in the study area was found to be 21.62% with 40 infected patients (Table 1). Table 1 also shows that 4 of the 32 TB patients were co-infected with HIV revealing a HIV-TB co-infection rate of 12.5% in the studied area.

Table 1: Prevalence of Tuberculosis, Rifampicin Resistance TB and HIV Infection among Presumptive TB patients

Tuberculosis Status	Number	%
Presumptive TB casesExamined	185	
TB Positive	32	17.3
TB Negative	153	82.7
Rifampicin Resistant TB	0	0
HIV Positive	40	21.62
HIV Negative	145	78.38
HIV/TB Positive	4	2.16
HIV/TB Positive (out of 32 TB positive cases)	4	12.5

In this study, TB prevalence among the 32 positive cases was found to be higher in males than females with 19 (59.4%) of the males confirmed as TB positive compared with 13 (40.6%) positive females (Table 2).

Table 2: Sex Distribution of the Samples Examined

Sex	No Studied	No. of TB Positive	Percentage (%)	No. of TB Negative	Percentage (%)
Males	89	19	59.4	70	48.1
Females	96	13	40.6	83	51.9
Total	**185**	**32**	**100**	**153**	**100**

Table 3 presents some of the demographic characteristics of HIV infected and HIV/TB co-infected cases in the study area. With regards to gender, out of the 36 HIV positive cases 9 (25%) were males and 27 (75%) were females. However, all the 4 (100%) co-infected HIV/TB positive cases were found to be females (Table 3). Table 3 also revealed that among the HIV patients those in the age group 25-34 years had the highest prevalence cases; of 14 (38.89%), followed by those in the age group 15-24 years 7 (19.44%), 35-44 years 5 (13.89%), 45-54 years 4 (11.11%), while those aged 5-14 years had the prevalence case of 1 (2.78%). Among the HIV/TB co-infected cases patients in the age groups of 15-24 years, 25-34 years, 35-44 years and 45-54 years a prevalence rate of 25% was recorded with one infected patient in each age group

Table 3: Comparison of HIV only and HIV-TB Co-infection cases of Patients attending Martha Bamaiyi General Hospital Zuru based on sex, age groups, settlements and local government areas.

Variables	HIV only cases	HIV-TB Co-infection cases	Total
Sex	**Number (%)**	**Number (%)**	**Number (%)**
Male	9 (25)	0 (0)	9 (22.5)
Female	27 (75)	4 (100)	31 (77.5)
Total	**36 (100)**	**4 (100)**	**40 (100)**
Age group (years)			
0-4	0 (0)	0 (0)	0 (0)
5-14	1 (2.78)	0 (0)	1 (2.5)
15-24	7 (19.44)	1 (25)	8 (20)
25-34	14 (38.89)	1 (25)	15 (37.5)
35-44	5 (13.89)	1 (25)	6 (15)
45-54	4 (11.11)	1 (25)	5 (12.5)
55-64	2 (5.56)	0 (0)	2 (5)
>65	3 (8.33)	0 (0)	3 (7.5)
Total	**36 (100)**	**4 (100)**	**40 (100)**
Settlements			
Rural	12 (33.33)	1 (25)	13 (32.5)
Semi-urban	10 (27.78)	2 (50)	12 (30)
Urban	14 (38.89)	1 (25)	15 (37.5)
Total	**36 (100)**	**4 (100)**	**40 (100)**
Local Government Areas			
Danko-Wasagu	21 (58.33)	3 (75)	24 (60)
Fakai	0 (0)	0 (0)	0 (0)
Sakaba	1 (2.78)	0 (0)	1 (2.5)
Zuru	14 (38.89)	1 (25)	15 (37.5)
Total	**36(100)**	**4 (100)**	**40 (100)**

Table 3 showed that patients residing in the urban settlement had the highest prevalence of HIV cases of 14 (38.89%), followed by those in rural settlement 12 (33.33%) and semi-urban 10 (27.78%). While those with HIV-TB co-infection, those in semi-urban settlement had the highest prevalence of 2 (50%), followed by urban and rural settlements, where both had 1 (25%) each. With regards to local government areas, Danko-Wasagu had the highest HIV prevalence cases of 58.33% (21), followed by Zuru 14 (38.89%), Sakaba 1 (2.78%) and Fakai recorded no case (0%) (Table 3). Concerning HIV-TB co-infection rates among local government areas in Zuru Emirate Council, the study revealed that Danko-Wasagu local government area had the highest prevalence cases of 3 (75%), followed by Zuru which had 1 (25%) while Fakai and Sakaba local government areas had 0% prevalence rates respectively (Table 4).

DISCUSSION

The overall prevalence of TB in the study area was found to be 17.3%, and this was closely related to 13.25% reported in a study carried out in North Central Nigeria by Bukola *et al.* (2019).

In contrast to the observation of this study, Mustapha *et al.*(2015) in their study reported a higher TB prevalence of 33.5% while Amarendra *et al.* (2017) reported a TB prevalence of 20.58% Amritsar, India. Kehinde and Okesola (2010) recorded a prevalence of 6.9% in Ibadan, Nigeria which is lower than the reports of this study. In an earlier report, Abdulkadir and Ibrahim (2018) explained that the reasons for the higher of prevalence of TB in the study area was related to the fact that such studies were normally carried out in the TB reference laboratory which serves as a referral sites from other smaller hospitals who do not have directly observed treatment short-course services (DOTS) located within the emirate council.

The findings of this study support earlier reports that the Gene Xpert remains a method of choice in the rapid diagnosis of TB and RR-TB as it gives result within a short period of at least 2 hours. This is of utmost importance as accurate and rapid detection of *M. tuberculosis* and TB drug resistance is essential in order to decrease TB transmission, drug resistance and improve patients care.

The prevalence of RR-TB in this study was found to be 0% which is contrary to 22.2% reported by Mustapha *et al.* (2015). Enenche *et al.* (2018) reported 4.60% RR-TB in Benue state Nigeria. In Amritsar, India Amarendra *et al.* (2017) reported RR-TB prevalence of 21%.

The findings of this study revealed that among the 185 patients studied, 21.62% (40) were HIV positive. The observations of this study was closely similar to those reported in Yavatmal Maharashtra, where 23.5% of HIV positivity was recorded (Bhadke *et al.* 2016). However, the HIV prevalence in this study was lower than 46.8% and 52.7% reported in Nassarawa and Niger state respectively (Egbe *et al.,* 2016; Ibrahim *et al.,* 2004). The findings of this also revealed that the prevalence of TB was higher among HIV negative patients 78.38%. This observation was in line with the findings of Mustapha *et al.* (2015); Egbe *et al.* (2016); Ejeh *et al.* (2018).

In relation to gender distribution, this study reveals that TB prevalence was higher in males (59.4%) than in females (40.6%). The findings of this study that males are more prone to TB than the females conforms with the reports of WHO (2014). It also conforms with reported works in Uyo, Port Harcourt, Ibadan; Akwa-Ibom, Rivers and Oyo states (Alfred and Silas, 2005; Kehinde and Okesola, 2010). Enenche *et al.* (2018) also reported similar observations. The higher prevalence in males might have resulted from indiscriminate use of drug as explained by Egbe *et al.* (2016). Contrary to the findings of this study, other reports indicated higher TB prevalence in females than males (Nwachukwu *et al.,* 2009). The role of gender has both been determined in a number of infectious and noninfectious diseases, the difference between male and female susceptibility to TB might as well be due to some biological mechanisms (Neyrolles and Quintana-Murci, 2009). Furthermore, several studies in humans and experimentally infected animals have clearly shown links between sex-specific factors; steroid hormones and genetic variants, and the differential susceptibility of males and females to a number of other infectious and noninfectious diseases Falagas *et al.* (2007). Moreover, only 5% to 10% of exposed individuals to *M. tuberculosis* develop TB, and up to 70% of those who do develop TB are male; human population as a whole is remarkably resistant to *M. tuberculosis* and women seemed to be more resistant to the bacillus than men (Neyrolles and Quintana-Murci, 2009).

The prevalence rate of HIV/TB co-infection in this study was found to be 12.5%. This prevalence rate is similar to 12.25% reported in Kano (Aminu, 2020) and closely related to 9.3% and 9.5% reported in Sokoto and Kaduna states respectively (Abiola *et al.* 2009; Aliyu *et al.*2019). A relatively higher prevalence of 20.6% was reported in the North Central region of Nigeria by Bukola *et al.* (2019). Studies from other parts of the world revealed similar HIV/TB prevalence reports to the findings of this study while others reported higher prevalence.

Akpaka *et al.* (2006); Tadesse and Tadesse (2013) reported HIV/TB prevalence of 11.6% in Jamaica and 11.4% in Northwest Ethiopia, while Rajam and Muhammad, (2013) reported a prevalence of 8.6% in India and Nyamogoba *et al.* (2012) reported a prevalence of 55.5% in Western Kenya. The differences might also be due to lifestyles such as the practice of polygamy, patronage of traditional birth attendants, poor sanitary/hygiene practices and crowded environment (Jemikalajah and Okogun, 2009; Abiodun *et al.,* 2015; Bukola *et al.,* 2019). A higher prevalence of HIV-TB co-infection could also be due to the high level of poverty and destitute (Olaniran *et al.,* 2011). Furthermore, the patient immune system also plays a vital role in TB-HIV co-infection.

In this study, there was no male participant with HIV/TB co-infection, whereas all the four (100%) HIV/TB co-infected cases were found to be females. Similarly, studies in other parts of the country such as Lagos, Nassarawa and Sokoto, revealed higher prevalence of HIV/TB co-infection among females (Umeh *et al.,* 2007; Abiola *et al.,* 2009; Okechukwu and Okechukwu, 2011; Akinleye *et al.,* 2015). Studies from other countries such as Ethiopia also had similar reports of higher HIV/TB co-infection in females (Mitku *et al.,* 2016). On the contrary, a higher prevalence of HIV/TB co-infection in males was reported in Kano, although the more burden of the disease was among the female population.

The study findings demonstrated that among both the HIV and HIV/TB co-infected cases, prevalence rate are higher in those aged 15-24 years, 25-34 years, 35-44 years, and 45-54 years. This observation could be attributed to the fact that patients in these age groups are usually involved in strenuous activities to meet up with the socio-economic needs of their families. It could also be a result of the increase in reproductive activities as some are in the adolescent stage while some are in reproductive age. They are also more prone to associate with infected patients in one way or the other.

The study observed that among the studied cases, patients residing in urban settlement had higher HIV prevalence rates of 38.89% compared with those in the rural areas (33.33%) and semi-urban areas (27.78%). Poor sanitation, overcrowding, multiple sexual partners, sex workers, and poor socioeconomic status are some of the factors associated with urban life that could increase the likelihood of higher HIV/TB co-infection. Among the HIV/TB co-infected cases, patients residing in semi-urban settlements had the highest prevalence of 50%, followed by those in urban (25%) and rural settlements (25%) each. However, it is contrary to the findings of Muhammad and Muhammad (2018) in Kano North Western, Nigeria, and Mitku *et al.* (2016) in Amhara region of Ethiopia who reported a higher co-infection rates in urban settlements, followed by those in semi-urban and rural settlements.

The findings of the study indicated that the prevalence of HIV among the local government area was highest in Danko-Wasagu (58.33%) followed by Zuru, Sakaba while Fakai had no HIV case. However, the highest prevalence of HIV/TB co-infection was recorded in Danko-Wasagu local government area, followed by Zuru, while Fakai and Sakaba local government areas which had 0% prevalence respectively. The variation in the prevalence rates could also be due to lifestyle such as the practice of polygamy, patronage of traditional birth attendants, poor sanitary/hygiene practices and crowded environment (Jemikalajah and Okogun, 2009; Abiodun *et al.*2015).

CONCLUSION

The study shows that the prevalence of TB among presumptive TB patients that reported to Martha Bamaiyi General Hospital Tuberculosis Laboratory Zuru Kebbi State, Nigeria was 17.3%, and the HIV/TB co-infection rate was 12.5%. None of the studied patients had Rifampicin resistant TB. The prevalence of TB was found to be highest among males than females and among those aged 25-34 years.

The HIV/TB prevalence rate was found to be higher in females. The study demonstrated high rate of TB in the studied area and the presence of HIV/TB co-infection. Hence, for effective TB control and to minimize rate of transmission and acquisition of new infections there is the need for quick response and intervention by the appropriate agencies.

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