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Predictors of Treatment Outcomes among Tuberculosis Patients Treated in Specialist hospital, Sokoto State, Nigeria

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Abstract

Background: *Tuberculosis (TB) is one of the top 10 causes of death worldwide, and the leading cause from a single infectious agent (above HIV/AIDS). Globally, 10.0 million people developed TB disease in 2017 with an estimated 1.6 million deaths. We conducted this study to determine predictors of treatment outcomes among tuberculosis patients treated at specialist hospital, Sokoto State, Nigeria.*

Methods*: A retrospective cohort study was conducted using medical record of 1501 patients treated of tuberculosis between January, 2014 and January, 2017. Treatment outcomes and TB cases were classified according to National TB control program guidelines. Bivariate and multivariate analysis was conducted to identify predictors of unsuccessful treatment outcomes. Odds ratio (OR) and 95% confidence interval (CI) was calculated. P- value of 0.05 was considered as statistically significant.*

Result: *Of the 1,501 patients treated; 72.2% were males with mean age of 36.5 ±14.9 years. Pulmonary TB accounts for 1,143 (76.2%) cases. A total of 174 (11.6%) were co-infected with HIV. successful outcomes accounts for 1,229 (81.9%) cases. Previously treated cases 89 (5.9%). Of the cases, 44 (2.9%) died. Being previously treated ($P < 0.001$) and co-infection with HIV($p<0.001$) are independent predictors of poor treatment outcomes.*

Conclusion: *The treatment success rate was low as compared to the national target. Therefore, targeted interventions of high-risk patients are recommended.*

Keywords: *Tuberculosis, Treatment outcomes, DOT, Sokoto.*

Introduction

Tuberculosis (TB) remains a major global health problem and the leading cause of death from a single infectious agent in 2017 (WHO G*lobal report*, 2018).). In 2017, TB caused an estimated 1.3 million deaths (range, 1.2–1.4 million) among HIV-negative people and there were an additional 300 000 deaths from TB (range, 266 000–335 000) among HIV-positive people. Globally, 10.0 million people (range, 9.0–11.1 million) developed TB disease in 2017. Eight countries accounted for 66% of the new cases; India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa. The severity of national epidemics varies widely among countries. In 2017, there were fewer than 10 new cases per 100 000 populations in most high-income countries, 150–400 in most of the 30 high TB burden countries, and above 500 in a few countries including Mozambique, the Philippines and South Africa (Tuberculosis, 2018).

Nigeria is among the 30 TB high burden countries with incidence of 418/100,000 population as at 2017. (WHO, 2016).

Effective tuberculosis (TB) treatment has been shown to have a significant effect on the control of TB. Directly Observed Treatment Short-course (DOTS) strategy has been used as internationally recommended strategy since 1994 by World Health Organization (WHO) under the stop TB strategy component as it prevents patients from interrupting their treatment and ensures they adhere to the treatment for the expected duration (Tafess et al., 2018). The goal of the Directly Observed Treatment Short Course (DOTS) programme is to cure at least 85% of new smear-positive patients and to detect at least 70% of new smear-positive cases. Some studies conducted in Nigeria by (A. Fatiregun, Ojo, & Bamgboye, 2009) and (Ofoegbu & Odume, 2015) all reported high unfavourable treatment outcomes (Treatment failure, default, Death, and transferred out).

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Detecting and successfully treating a large proportion of TB cases would have an immediate impact on TB prevalence and mortality. Poor treatment outcome has serious public health consequences especially continuous infectivity and development of MDR-TB. Risk factors for unfavourable treatment outcomes have been reported to include socio-economic factors (age, sex, employment and education) (Malede, Shibabaw, Hailemeskel, Belay, & Asrade, 2015), patient factors (diabetes mellitus, smoking, and having co-infection with HIV) (Johnson et al., 2016), disease factors (history of multiple disease treatment, and health care system factors, attending health centres, hospital referrals) (Yen, Yen, Shih, & Deng, 2012) and (Choi et al., 2014).

Determination of factors that are associated with unfavorable treatment outcomes are good opportunity to identify potential obstacles to achieving TB control and to the best of our knowledge treatment outcomes of TB patients and its associated risk factors leading to unsuccessful outcome has not been assessed at Specialist hospital, Sokoto. In this study, we assess treatment outcomes and identify predictors of unsuccessful treatment outcomes among tuberculosis patients treated at specialist hospital, Sokoto State, Nigeria.

Methods

Study design, population

A retrospective hospital-based cohort study was conducted. The study included all TB patients who were registered and commenced TB treatment for the past four years (January 1st, 2014 – December 31st, 2017) at Specialist hospital Sokoto. The Specialist hospital is a tertiary hospital in Sokoto State.

Sources of data and method of data collection

The TB treatment register and hospital patient folders were the primary sources of data in this study. Data was collected retrospectively by trained health professionals using structured checklist. Data collected included; patients` socio-demographic characteristics, TB history (new or previous history of TB), TB type, HIV status, drug resistance and treatment outcome of the patient.

We trained the data collectors and pretested the questionnaires to ensure quality in the data collection. Also, the data collectors were closely supervised to further ensure quality in the data.

Operational definitions

Treatment outcomes definitions were based on standard definitions of National Tuberculosis and Leprosy control program (“FEDERAL MINISTRY OF HEALTH DEPARTMENT OF PUBLIC HEALTH,” n.d.) and WHO guidelines (“Treatment of tuberculosis,” n.d.) as follows: cured (a pulmonary TB patient, who was bacteriologically confirmed by acid-fast bacilli (AFB) microscopy at the beginning of treatment, becomes AFB smear negative or culture-negative in the last month of treatment completion and on at least one previous occasion), Treatment completed (any patient who was smear-positive at diagnosis and who completed treatment but in whom smear examination results are not available at the end of treatment. And all smear-negative and extra-pulmonary patients who completed treatment), Treatment failure (any patient who remains or becomes smear positive again at the end of fifth month or later during chemotherapy), died (any patient who dies for any reason during the course of his/her chemotherapy), Defaulter (any patient who has interrupted for 8 consecutive weeks or more after the date of the last attendance during the course of treatment), transferred-out (a patient who transferred to another reporting unit and for whom treatment outcome is unknown). A patient whose final outcome was either cured or completed treatment had a ‘‘successful outcome’’ while any other outcome was classified as ‘‘unsuccessful’’.

Ethical considerations

Ethical clearance was obtained from ethics and research committee of Specialist Hospital, Sokoto, Nigeria.

Statistical analysis

Data was analyzed using IBM SPSS version 25 for windows. Categorical (such as sex, tribe) and numeric (such as age) variables were summarized using frequencies, percentages, means and standard deviations accordingly. Univariate and multivariate logistic regression analyses with a confidence level of 95% was performed. Additionally, adjusted odds ratios with their 95% confidence intervals and independent variables with p-value of 0.05 were considered to be predictors of poor treatment outcomes in this study.

Results

A total of 1,501 TB patients were treated, of those treated; 72.2% were males with mean (standard deviation) age of 36.5 (±14.9) years. Majority of cases 410 (27.2%) belong to the age group 20 – 29 years. Ninety-three (11.05%) of the study population had no formal education, while 413 (49.1%) and 223 (26.5%) had secondary and tertiary education respectively. Of the total TB cases treated; 89 (5.9%) were previously treated. Pulmonary TB accounts for 1,143 (76.2%) of cases. TB/HIV co-infection was found in 174 (11.6%) of cases (Table 1).

Table 1. Sociodemographic and clinical characteristics of tb patients treated at specialist hospital, sokoto, nigeria

Characteristics	**Frequency**	**Percent (%)**
Age group (years)		
<10	11	0.73
10-19	124	8.26
20-29	410	27.32
30-39	389	25.92
40-49	246	16.39
50-59	169	11.26
60+yrs	152	10.13
Sex		
Male	1069	71.22
Female	432	28.78
Marital status		
Single	680	45.30
Married	793	52.83
Divorced/separated	28	1.87
Educational level		
No formal education	93	11.05
Primary	113	13.42
Secondary	413	49.05
Tertiary	223	26.48
Tuberculosis Type		
Extra pulmonary	358	23.85
Smear-negative	185	12.33
Smear-positive	958	63.82

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Table 2. Sociodemographic and clinical characteristics of TB patients treated at specialist hospital, sokoto, nigeria

Characteristics	Frequency	Percent (%)
Culture		
Negative	1022	68.09
Positive	479	31.91
Treatment category		
New	1412	94.07
Previously-treated	89	5.93
HIV Status		
Negative	1326	88.40
Positive	174	11.60
Cavity on radiography		
No	750	96.15
Yes	30	3.85
Drug resistance		
No	757	99.74
Yes	2	0.26

Of all the cases; 1,229 (81.9%) had successful outcomes. One hundred and seventy-nine (11.9%) had treatment default, 8 (0.5%) had treatment failure, 41 (2.7%) were transferred-out while 44 (2.9%) died (Table 3).

Table 3. Treatment outcomes of TB patients by age group, sex and HIV status, at Specialist Hospital, Sokoto, Nigeria

Characteristic	Cured (%) (n=412)	Treatment completed (%) (n=817)	Treatment failure (%) (n=8)	Death (%) (n=44)	Default (%) (n=179)	Transferred-out (%) (n=41)
Age group (yrs)						
< 19	34 (8.3)	84 (10.3)	0	1 (2.3)	15 (8.4)	1 (2.4)
20 -29	132 (32.0)	213 (26.1)	1 (12.5)	9 (20.5)	46 (25.7)	9 (22.0)
30 -39	101 (24.5)	208 (25.5)	2 (25.0)	9 (20.5)	57 (31.8)	12 (29.3)
40 -49	68 (16.5)	122 (14.9)	3 (37.5)	15 (34.1)	27 (15.1)	11 (26.9)
50 - 59	50 (12.1)	90 (11.0)	1 (12.5)	6 (13.6)	19 (10.6)	3 (7.3)
60+yrs	27 (6.6)	100 ((12.2)	1 (12.5)	4 (9.1)	15 (8.4)	5 (12.2)
Sex						
Female	108 (26.2)	253 (31.0)	3 (37.5)	14 (31.8)	46 (25.7)	7 (17.1)
Male	304 73.8)	561 (68.7)	5 (62.5)	30 (68.2)	133 (74.3)	34 (82.9)
HIV Status						
Negative	393 (95.4)	786 (96.2)	1 (12.5)	14 (31.8)	117 (65.4)	16 (39.0)

Positive	20 (4.9)	30 (3.7)	7 (87.5)	30 (68.2)	62 (34.6)	25 (61.0)

Patients treated with pulmonary TB were found to have statistically significant association with unsuccessful outcome (P<0.05), similarly, being previously treated, TB location (pulmonary TB), and co-infection with HIV(P<0.05) were significant risk factors for unsuccessful treatment outcomes, While Negative HIV status was protective for unsuccessful outcomes. However, age group, sex, educational level and presence of cavity on radiography were not associated with unsuccessful treatment outcomes (Table 4).

Table 4. Bivariate analysis of some factors that are associated with poor successful treatment outcome at Specialist Hospital, Sokoto, Nigeria

Variable	Unsuccessful outcome	Successful outcome	OR (95% C.I)	P value
Age group (yrs):				
< 40	162 (59.56)	772 (62.82)	0.87 (0.67 – 1.14)	0.32
≥ 40	110 (40.44)	457 (37.18)		
Sex:				
Female	64 (24.9)	367 (29.6)	0.79 (0.58 – 1.07)	0.22
Male	193 (75.1)	874 (70.4)		
Educational level				
No formal education	23 (11.1)	70 (11.0)	1.01 (0.61 – 1.66)	0.97
Formal education	184 (88.9)	565 (89.0)		
TB Location				
Pulmonary	220 (80.88)	923 (75.10)	1.40 (1.01 – 1.94)	0.04
Extra-pulmonary	52 (19.12)	306 (24.90)		
Treatment category				
New	215 (79.04)	1197 (97.40)	0.10 (0.06 – 0.16)	<0.001
Previously-treated	57 (20.96)	32 (2.60)		
HIV Status				
Negative	148 (54.41)	1178 (95.93)	0.05 (0.04 – 0.07)	<0.001
Positive	124 (45.59)	50 (4.07)		
Cavity on radiography				
No	259 (97.74)	491 (95.34)	2.11 (0.85 – 5.23)	0.09
Yes	6 (2.26)	24 (4.66)		
Culture				
Positive	44 (16.18)	435 (35.39)	0.35 (0.25 – 0.50)	<0.001
Negative	228 (83.82)	794 (81.88)		

However, multivariate logistics regression output showed that, being previously treated (aOR 0.10, 95% C.I 0.46 – 0.23, P<0.001) and co-infection with HIV (aOR 9.6, 95% C.I 5.90 – 15.41, P<0.001) were the only independent predictors of unsuccessful treatment outcomes (Table 4).

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Table 5. Logistic regression of factors associated with unsuccessful treatment outcome at Specialist Hospital, Sokoto, Nigeria

Variable	**Adjusted OR**	**95% C. I**	**P-Value**
Age group < 40 yrs	1.21	0.81 – 1.83	0.35
Female Sex	0.86	0.55 – 1.35	0.52
No formal education	0.63	0.33 – 1.22	0.17
Pulmonary TB	1.25	0.74 – 2.11	0.40
Positive culture	0.86	0.51 – 1.45	0.58
Positive HIV status	9.6	5.90 – 15.41	**<0.001**
Previously-treated	0.10	0.46 – 0.23	**<0.001**
Cavity on radiography	0.46	0.14 – 1.40	0.16

Discussion

We found that treatment success rate for TB patients was 81.9%. Being previously treated and TB/HIV co-infection were identified as independent predictors of unsuccessful treatment outcome. The overall default rate was 11.9% while mortality rate was 2.9%. The prevalence of HIV co-infection among TB patients in this study was 11.6%.

The overall treatment success rate reported in this study was higher that than reported in a similar studies conducted in Zimbabwe (43.3%) by (Gabida et al., 2015), Northwest Ethiopia (26%) by (Biadglegne et al., 2013), in Tertiary health center of Southwestern Nigeria (46.1%) by (Babatunde et al., 2013) and in National Hospital Abuja (78.5%) by (Ofoegbu & Odume, 2015). Moreover, studies conducted in Yaoundé, Cameroun and Enugu, Nigeria also revealed treatment success rate of 68.4% and 73,7% (Malede et al., 2015) and (Aniwada, Onodugo, Onwasigwe, & Ajayi, 2018) respectively, which is lower than the present study. However, the reported treatment success rate was lower as compared to that reported in Turkey (92.6%) by (Sengul et al., 2015) and in Kola Dibba Health center of North west Ethiopia (85.5%) by (Yakob, Alemseged, Paulos, & Badacho, 2018). On the other hand, our finding is close to 81.5%, 81%, and 83.0% reported in Ethiopia, South India, and Uzbekistan by (Yakob et al., 2018), (Santha et al., 2002) and (Gadoev et al., 2015) respectively. The observed differences in treatment success rate could be due to differences in study settings, sample size, and study period, additionally, our study found high default rate compared to other studies.

Treatment default is one of the major contributor for unsuccessful treatment outcomes (Ifebunandu & Ukwaja, 2012). The default rate constitutes the major population of unsuccessful outcomes in this study. The default rate reported in this study was higher compared to some studies conducted in Northeast Ethiopia, Uzbekistan, and Nigeria (3.0 – 10.6%) by (Malede et al., 2015)(Daniel Tarekegne et al., 2014)(Gadoev et al., 2015)(Oshi, Oshi, Alobu, & Ukwaja, 2014). However, our reported default rate was lower than that reported by (Babatunde et al., 2013) and (Liew et al., 2015) 66.7% and 25.0% in Southwest Nigeria and Malaysia respectively. In order to reduce default rate among tuberculosis patients, there is need to intensify counselling and health education, home visits and motivation of TB patients.

The mortality rate reported in this study was 2.9% and this was lower than 25.0% and 5.8% reported in South west and south east Nigeria respectively by (Babatunde et al., 2013) and (Oshi et al., 2014). Similarly, the mortality rate recorded in the current study was lower compared to other values recorded in some studies in African countries by (Gadoev et al., 2015; Gebrezgabiher et al., 2016; Teshome Kefale & Anagaw, 2017). However, the mortality rate recorded in this study was higher than that reported in some studies conducted in Nigeria by (A. A. Fatiregun, Ojo, & Bamgboye, 2009; Ofoegbu & Odume, 2015). The identification of risk factors associated with mortality will help in prioritizing cases for surveillance and management of TB patients. Pulmonary TB and patients with positive culture were found to be associated with unsuccessful treatment outcome, even though after controlling for confounders, TB/HIV co-infection and previous treatment for TB were the only independent predictors for unsuccessful treatment outcome in this study. This is consistent with study findings by (El-Shabrawy & El-Shafei, 2017), (Santha et al., 2002), (Atif et al., 2018) and (Oshi et al., 2014). This emphasizes the need for further research for the presence of drug resistant TB among all previously treated cases that is associated with treatment failure and to treat them based on drug susceptibility testing.

HIV is a well-known risk factor for progression to active TB among those infected with Mycobacterium tuberculosis (Lawn, 2009). In this study, the proportion of HIV co-infection among TB patients is 11.6% and this is less compared to co-infection rate reported at National Hospital Abuja, Nigeria (42.7%) and in Northeast Ethiopia (40.4%) by (Ofoegbu & Odume, 2015) and (Belay, Bjune, & Abebe, 2015) respectively. Similarly, our reported TB?HIV co-infection rate was less than what was reported in Addis Ababa, Ethiopia (24.5%) by (Denegetu & Dolamo, 2014) as well as 22.1% and 32.1% by (Deribew et al., 2010) and (Yadeta, Alemseged, & Biadgilign, 2013) respectively. However, our reported TB/HIV co-infection rate is higher than 9.6% reported in North Central Nigeria by (Agbaji, Ebonyi, Meloni, Anejo-Okopi, & Akanbi, 2013). HIV-positive individuals are at greater risk of acquiring opportunistic infections such as TB, and treatment for co-infected patients is complicated by interactions between prescribed drugs. TB/HIV co-infection and previous treatment for TB were the only independent predictors for unsuccessful treatment outcome in this study.

This study, is not without limitations, first, since it is hospital-based study, the findings cannot be generalized to the wider population. Second, the retrospective nature of this study is another limitation, it is impossible to prospectively access some patients` clinical variables and information that were missing in patients' folders. Efforts was made to get some missing data variable through phone calls.

Conclusion

This study revealed that previous treatment for TB and co-infection with HIV are independent predictors of unsuccessful outcomes. These factors may be used in resource-limited settings and for institution/implementation of early intervention.

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