PREDICTORS OF TUBERCULOSIS TREATMENT OUTCOMES IN PUBLIC AND PRIVATE HEALTH INSTITUTIONS IN ABAKALIKI, SOUTHEAST, NIGERIA

N.C.Eze. Department of Public Health, Federal Ministry of Health, Abuja, Nigeria

Correspondence: Dr. Nelson C. Eze. ezenelson24@gmail.com. +2348066178881

Abstract

Background
Although Tuberculosis treatment centres exist in Nigeria, information on tuberculosis treatment outcomes and their predictors especially in private health facilities are poorly documented in most places. This study therefore evaluated predictors of tuberculosis treatment outcomes in public and private health institutions in Abakaliki, Southeast Nigeria.
Materials and methods: A retrospective study of patients managed for tuberculosis in the two facilities over a five year period (Jan 2014 to December 2018). All patients that have completed treatment over the study period were enrolled. Relevant information from the case register was retrieved and entered into proforma and study forms. Tuberculosis treatment outcomes were evaluated according to World Health Organization (WHO) and National Tuberculosis and Leprosy Control Program (NTBLCP) guidelines
Results: A total of 522 and 732 Tb clients were enrolled in FETHA and M-4H and their mean ages were 45.3±7.2 years and 46.1±3.8 years in FETHA and M-4H respectively. Majority (84%) were new cases with treatment success rate of 82.6% in both facilities (431/522 in FETHA and 605/732 in M-4H). Treatment outcome showed that relapse, treatment failure and death were 1.5%, 1.0% and 4.6% respectively in FETHA, 1.4%, 1.2% and 6.4% respectively in M-4H with default averaging 10% in both facilities. Age (15-29), far distance to health facility (>5km) and Tb category (re-treatment) were predictors of poor Tb treatment outcome in FETHA while area of residence (rural), far distance to health facility (>5km) and Tb category (re-treatment) were predictors of poor Tb treatment outcome in M-4H.
Conclusions: The patients were mostly males with twice (1.6%) DRTb than the females. Although treatment success rate (82.6%) was close to the 85% WHO bench mark, there were still large pockets of default with similar predictors of poor treatment outcomes in both facilities. Young people may need to be monitored closely while on TB treatment to ensure improved treatment outcome
Key Words: Tuberculosis; Predictors; Treatment outcome; Southeast; Nigeria

Introduction

Tuberculosis (Tb) treatment is the most effective strategy for preventing and controlling the spread of the disease. Default in Tb treatment remains an important contributor to treatment failure, resurgence of multidrug resistance (MDR-Tb), prolonged infectiousness, relapse and death[1-5]. Treatment default defined as interruption of Tb treatment for two consecutive months or more after initiation of treatment is a serious problem in tuberculosis control. Control of Tb remains a global challenge especially in high-burden countries where resources are limited, human immunodeficiency virus (HIV) co-infection is high, and control efforts are being threatened by drug-resistant Tb[1,2]

Nigeria ranks tenth among the 22 high-burden Tb countries, second highest in Africa with an estimated prevalence rate of 161 per 100 000 population in 2012[2,3]. The World Health Organization (WHO) currently recommends a case detection rate of 70% and a treatment success rate of 85% for all new cases[1,6]. It is believed that achieving these targets will lead to a reduction in Tb prevalence, transmission rate, default, treatment failure, relapse and drug resistant Tb[2]

There are public and private hospitals offering Tb services in Abakaliki with different outcomes of Tb treatment. For instance, recently there are concerns on increased number of reported defaulters in private facilities than in public and high rate of referred Tb treatment failure to public hospitals. However, predictors of these outcomes are not known. Identification of predictors of poor outcomes therefore may enable understanding and development of interventions to improve outcome.

Materials and methods

Study area; This study was carried out in Abakaliki, Nigeria. It involved One public (Federal Teaching Hospital) and one private (Mile-four Hospital) Abakaliki.

Design; Retrospective cohort (five year period from 2014-2018) in which the profile and records of treatment outcomes of all clients diagnosed with TB between January 2014 and December 2018 was retrieved from the TB treatment follow-up clinics of the two selected hospitals.

Study population; patients accessing TB treatment in public (Federal Teaching Hospital) and private (Mile-four) hospital in Abakaliki for the past five years

Sample size; All registered patients with pulmonary and extra-pulmonary TB during the past five years. During the previous five years there has been an average of 450 registered patients in each hospital but given 5% default rate in public facilities and 15% in private facilities, power of 80% and precision of 95% Confidence interval, the minimum sample size using Open EPI soft-ware will be 284 (142 in each group). However, all registered patients were studied

Sampling technique involved consecutive sampling of Tb patients from 2014 to 2018

Study instruments; Proforma/study forms were used for data extraction from the institutional registers.

Source document was institutional Tb treatment register

Data collection methods;

TB patients registered for treatment between January 2014 and December 2018 in the two large hospitals were used. Proforma was used to extract information from the institutional TB register on patient's clinical and socio-demographic characteristics. Data were sorted into the five treatment outcomes: cured, defaulted, treatment failure, relapse, died.

Data management;

Predictor variables; These were divided into patient related variables: gender, age, level of education, occupation, distance to health facility, area of residence, income and disease type. System variables: health system/institutional factors and facility type

Outcome variables; Cured, Default, Relapse, Treatment failure, Death

Statistical analyses;

Analysis was done using IBM SPSS software, version 22. Descriptive statistics including proportions for risk factors/predictors including demographic, clinical and other factors were reported using univariate analysis

Risk factors using RR for poor outcomes in the bivariate analyses (p- value$\leq$ 0.05) were determined by logistic regression analysis. The significance was assessed using 95% confidence intervals (CIs).

Hypothesis

Ho; predictors of poor outcomes of Tb treatment do not differ in two large hospitals in Abakaliki

Ha; Treatment outcomes differ between a large 'private' and 'public' tertiary Tb center due to system and patient related factors

Ethical consideration; Ethical approval and permission were obtained from the institution's ethics committee and unit chief nurse respectively. Strict confidentiality was maintained throughout.

Operational definition:

Clinical case and treatment outcome definitions were used according to the standard definitions of NTLCP[7] and WHO guidelines[6,8,9]
Pulmonary Tuberculosis (PTB): Tuberculosis restricted to the lungs alone.
Drug Resistant Tuberculosis (DRTB): is when a Tb patient develops resistance to at least isoniazid and rifampicin, two of the most effective Tb drugs
Extra pulmonary Tb (EPTb): Tuberculosis of organs other than the lungs, proven by one culture positive specimen from an extra-pulmonary site or histo-pathological evidence from a biopsy, or Tb based on strong clinical evidence consistent with active EPTb and the decision by a clinician to treat with a full course of anti-Tb therapy.
New case - A patient who never had treatment for Tb, or has been on anti-Tb treatment for <4 weeks
Re-treatment- A patient scheduled for retreatment due to positive smear or culture at the end of the 5th month or later after commencing the previous treatment

Treatment completed- Patient who has completed treatment but who does not meet the criteria to be classified as a cure or a failure. A patient who completed anti-Tb treatment without evidence of failure, but for whom sputum smear, culture results are not available in the last month of treatment and on at least one previous occasion
Transferred-in - A Tb patient who was transferred in from another local government area to continue his/her treatment and for whom treatment outcome is not known

Treatment outcomes: Tuberculosis treatment outcomes were classified as follows:

1. Cured - sputum smear positive patient who was sputum negative in the last month of treatment and on at least 1 previous occasion
2. Defaulter-A patient who has been on treatment for at least 4 weeks and whose treatment was interrupted for 8 or more consecutive weeks
3. Died - Patient who died from any cause during the course of treatment (regardless of the cause of death
4. Relapse - A patient declared cured or treatment completed of any form of Tb in the past, but who reports back to the health service and is now found to be AFB smear positive or culture positive

5. Treatment failure-A patient whose sputum smear or culture is positive at 5th month or later during treatment
6. Successful outcome-The sum of patients who are cured and those who have completed treatment
7. Unsuccessful outcome-The sum of patients who are defaulter, died, transferred out, and patients with treatment failure.

The WHO classified treatment outcome as successful (cure or treatment completed) or unsuccessful (default, treatment failure or death)[3]

Results

Socio-demographic and clinical profile of clients

A total of 522 and 732 Tb clients were registered in FETHA and M-4H respectively. Their mean ages were 45.3±7.2 years and 46.1±3.8 years in FETHA and M-4H respectively. The proportion of PTB, EPTB and DRTB cases were 24.2%, 15.7% and 1.7% respectively in FETHA, 39.1%, 17.9% and 1.4% respectively in M-4H. The proportion of new cases, re-treatment cases and transferred-in cases were 84%, 11.7% and 4.6% respectively in FETHA, 84.7%, 10.4% and 4.9% respectively in M-4H. TB/HIV co-infection rate was 10.5% in FETHA and 9.4% in M-4H

Table 1: Socio-demographic/clinical profile of clients

Variables	**Federal Teaching Hospital**			**Mile-Four Hospital**			**Total**
	PTB	EPTB	DRTB	PTB	EPTB	DRTB	**Total N (%)**
Sex							
Male	164 (31.4)	105 (20.1)	13 (2.5)	280 (38.2)	120 (16.4)	12 (1.6)	694 (55.3)
Female	140 (26.9)	92 (17.6)	8 (1.5)	210 (28.7)	104 (14.2)	6 (0.8)	560 (44.7)
Age group (yrs)							
<15	9 (1.7)	3 (0.6)	0 (0.0)	25 (3.4)	2 (0.3)	0 (0.0)	39 (3.1)
15-29	28 (5.4)	18 (10.7)	4 (0.8)	72 (9.8)	19 (2.6)	3 (0.4)	144 (11.5)

30-44	96 (18.4)	56 (10.7)	9 (1.7)	153 (20.9)	85 (11.6)	5 (0.7)	404 (32.2)
45-59	156 (29.9)	112 (21.5)	7 (1.3)	214 (29.2)	106 (14.5)	8 (1.1)	603 (48.1)
≥60	15 (2.9)	8 (1.5)	1 (0.2)	26 (3.5)	12 (1.6)	2 (0.3)	64 (5.1)
Educational status							
Informal	88 (16.8)	55 (10.5)	7 (1.3)	133 (18.2)	54 (7.4)	5 (0.7)	342 (27.3)
Primary	96 (18.4)	62 (11.9)	5 (0.9)	142 (19.4)	73 (9.9)	6 (0.8)	384 (30.6)
Secondary	97 (18.6)	65 (12.4)	6 (1.1)	138 (18.8)	71 (9.7)	3 (0.4)	380 (30.3)
Tertiary	23 (4.4)	15 (2.9)	3 (0.6)	77 (10.5)	26 (3.5)	4 (0.5)	148 (11.8)
Area of residence							
Urban	94 (18.0)	38 (7.3)	5 (0.9)	112 (15.3)	51 (6.9)	7 (0.9)	307 (24.5)
Rural	210 (40.2)	159 (30.5)	16 (3.1)	378 (51.6)	173 (23.6)	11 (1.5)	947 (75.5)
Distance to HF (km)							
≤5	78 (14.9)	45 (8.6)	2 (0.4)	97 (13.2)	53 (7.2)	3 (0.4)	278 (22.2)
>5	226 (43.3)	152 (29.1)	19 (3.6)	393 (53.7)	171 (23.4)	15 (2.0)	976 (77.8)
Income per month (USD)							

<30	46 (8.8)	25 (4.8)	6 (1.1)	75 (10.2)	31 (4.2)	5 (0.7)	188 (15.0)
≥30	258 (49.4)	172 (32.9)	15 (2.9)	415 (56.7)	193 (26.4)	13 (1.8)	1066 (85.0)
TB category							
New case	264 (50.6)	158 (30.3)	15 (2.9)	432 (59.0)	176 (24.0)	12 (1.6)	1057 (84.3)
Re-treatment	27 (5.2)	30 (5.7)	4 (0.8)	35 (4.8)	38 (5.2)	3 (0.4)	137 (10.9)
Transferred-in	13 (2.5)	9 (1.7)	2 (0.4)	23 (3.1)	10 (1.4)	3 (0.4)	60 (4.8)
HIV test result							
Reactive	23 (4.4)	28 (5.4)	4 (0.8)	37 (5.0)	29 (3.9)	3 (0.4)	124 (9.9)
Non-reactive	281 (53.4)	169 (32.4)	17 (3.2)	453 (61.9)	195 (26.6)	15 (2.0)	1130 (90.1)
Year of TB treatment registration							
2014	77 (14.7)	35 (6.7)	3 (0.6)	87 (11.9)	43 (5.9)	1 (0.1)	246 (19.6)
2015	61 (11.7)	42 (8.0)	3 (0.6)	96 (13.1)	56 (7.6)	4 (0.5)	262 (20.9)
2016	53 (10.1)	36 (6.9)	5 (0.9)	105 (14.3)	29 (3.9)	3 (0.4)	231 (18.4)
2017	48 (9.2)	50 (9.6)	6 (1.1)	103 (14.1)	45 (6.1)	5 (0.7)	257 (20.5)
2018	65 (12.4)	34 (6.5)	4 (0.8)	99 (13.5)	51 (6.9)	5 (0.7)	258 (20.6)

Total	304 (24.2)	197 (15.7)	21 (1.7)	490 (39.1)	224 (17.9)	18 (1.4)	1254 (100)

N/B. The proportion calculated against various variables in the different facilities is denominated by the total number of clients studied in each of the facilities.

Table 2 Treatment outcomes of TB patients (2014–2018)

Variable	Number (%) stratified by the treatment outcomes											
	Federal Teaching Hospital (FETHA)					Mile-Four Hospital (M-4H)					P-value	
	Cured	Default	Relapse	TF	Death	Cured	Default	Relapse	TF	Death	FETHA	M-4H
Sex												
Male	230 (44.1)	31 (5.9)	5 (0.9)	3(0.6)	13 (2.5)	336 (45.9)	48 (6.6)	7 (0.9)	4 (0.5)	17 (2.3)	0.95	0. 76
Female	201 (38.5)	23 (4.4)	3 (0.6)	2 (0.4)	11 (2.1)	269 (36.7)	30 (4.1)	4 (0.5)	5 (0.7)	12 (1.6)		
Age group (yrs)												
< 15	9 (1.7)	2 (0.4)	0 (0.0)	0 (0.0)	1 (0.2)	21 (2.8)	3 (0.4)	1 (0.1)	0 (0.0)	2 (0.3)	0.05	<0.01
15-29	35 (6.7)	9 (1.7)	2 (0.4)	0 (0.0)	4 (0.8)	74 (10.1)	11 (1.5)	1 (0.1)	2 (0.3)	6 (0.8)		
30-44	128 (24.5)	21 (4.0)	3 (0.6)	2 (0.4)	7 (1.3)	201 (27.4)	28 (3.8)	2 (0.3)	3 (0.4)	9 (1.2)		
45-59	243 (46.6)	19 (3.6)	3 (0.6)	1 (0.2)	9 (1.7)	289 (39.5)	26 (3.5)	4 (0.5)	2 (0.3)	7 (0.9)		
≥60	16 (3.0)	3 (0.6)	0 (0.0)	2 (0.4)	3 (0.6)	20 (2.7)	10 (1.4)	3 (0.4)	2 (0.3)	5 (0.7)		
Educational status												
Informal	125 (23.9)	14 (2.6)	2 (0.4)	2 (0.4)	7 (1.3)	151 (20.6)	25 (3.4)	3 (0.4)	2 (0.3)	9 (1.2)	0.9	0.87
Primary	134 (25.7)	17 (3.4)	2 (0.4)	1 (0.2)	9 (1.8)	189 (25.8)	19 (2.6)	2 (0.3)	3 (0.4)	8 (1.0)		
Secondary	140 (26.8)	15 (2.8)	3 (0.6)	2 (0.4)	7 (1.3)	172 (23.5)	23 (3.1)	5 (0.7)	2 (0.3)	10 (1.4)		
Tertiary	31 (5.9)	8 (1.6)	1 (0.2)	0 (0.0)	1 (0.2)	90 (12.3)	11 (1.5)	1 (0.1)	2 (0.3)	2 (0.3)		
Area of residence												
Urban	109 (20.8)	15 (2.9)	3 (0.6)	2 (0.4)	8 (1.5)	130 (17.7)	23 (3.1	4 (0.5)	6 (0.8)	7 (0.9)	0.75	0.01
Rural	322 (61.7)	39 (7.6)	5 (0.9)	3 (0.6)	16 (3.0)	475 (64.8)	55 (7.5)	7 (0.9)	3 (0.4)	22 (3.0)		
Distance to HF(km)												
≤5	96 (18.3)	15 (2.9)	4 (0.8)	2 (0.4)	8 (1.6)	117 (15.9)	19 (2.6)	5 (0.7)	1 (0.1)	11 (1.5)	0.2	0.03
>5	335 (64.1)	39 (7.46	4 (0.8)	3 (0.6)	16 (3.0)	488 (66.7)	59 (8.0)	6 (0.8)	8 (1.1)	18 (2.5)		
Income per month (USD)												
<30	57 (10.9)	8 (1.5)	5 (0.9)	1 (0.2)	6 (1.1)	91 (12.4)	8 (1.1)	2 (0.3)	2 (0.3)	8 (1.1)	<0.01	0.25
≥30	374 (71.6)	46 (8.8)	3 (0.6)	4 (0.8)	18 (3.4)	514 (70.2)	70 (9.5)	9 (1.2)	7 (0.9)	21 (2.8)		
TB category												
New case	374 (71.6)	45 (8.6)	6 (1.1)	1 (0.2)	11 (2.1)	527 (71.9)	62 (8.5)	7 (0.9)	8 (1.1)	16 (2.2)	<0.01	0.01

Re treatment	42 (8.0)	8 (1.5)	2 (0.3)	1 (0.2)	8 (1.5)	52 (7.1)	11 (1.5)	3 (0.4)	1 (0.1)	9 (1.2)		
Transferred-in	18 (3.4)	1 (0.2)	0 (0.0)	0 (0.0)	5 (0.9)	26 (3.5)	5 (0.7)	1 (0.1)	0 (0.0)	4 (0.5)		
HIV test result												
Reactive	43 (8.2)	2 (0.3)	1 (0.2)	2 (0.3)	7 (1.3)	54 (7.4)	8 (1.1)	2 (0.3)	0 (0.0)	5 (0.7)	<0.01	0.45
Non-reactive	388 (74.3)	52 (9.9)	7 (1.3)	3 (0.6)	17 (3.2)	557 (76.1)	70 (9.5)	9 (1.2)	3 (0.4)	24 (3.3)		
Year of TB treatment registration												
2014	94 (18.0)	13 (2.3)	2 (0.3)	2 (0.3)	4 (0.8)	105 (14.3)	17 (2.3)	3 0.4)	1 (0.1)	5 (0.7)	0.99	0.95
2015	92 (17.6)	9 (1.7)	1 (0.2)	1 (0.2)	3 (0.6)	127 (17.3)	19 (2.6)	1 (0.1)	2 (0.3)	7 (0.9)		
2016	77 (14.7)	10 (1.9)	2 (0.3)	0 (0.0)	5 (0.9)	112 (15.3)	14 (1.9)	2 (0.3)	3 (0.4)	6 (0.8)		
2017	83 (15.9)	11 (2.1)	2 (0.3)	1 (0.2)	7 (1.3)	126 (17.2)	18 (2.5)	2 (.3)	2 (0.3)	5 (0.7)		
2018	85 (16.3)	11 (2.1)	1 (0.2)	1 (0.2)	5 (0.5)	135 (18.4)	10 (1.4)	3 (0.4)	1 (0.1)	6 (0.8)		

TF = Treatment Failure**, HF=** Health Facility**, TB =** Tuberculosis**, KM =** Kilometre, **USD =** US Dollar

Treatment outcomes of the cases are summarized in Table 2. Out of the 522 patients registered in FETHA, males were: 44.1% cured, 5.9% default, 0.9% relapse, 0.6% treatment failure and 2.5% death while females were: 38.5% cured, 4.4% default, 0.6% relapse, 0.4% treatment failure and 2.1% death. While out of 732 patients registered in M-4H, males were: 45.9% cured, 6.6% default, 0.9% relapse, 0.5% treatment failure and 2.3% death while females were: 36.7% cured, 4.1% default, 0.5% relapse, 0.7% treatment failure and 1.6% death. None of the treatment outcome measures were statistically significant (P>0.05). Treatment success rates (82.6%) were similar in both facilities (431/522 in FETHA and 605/732 in M-4H)

Table 3a: Factors associated with, and predictors of treatment outcomes of TB cases (2014-2018), FETHA

Variables	Treatment outcome		Univariate analysis		Multivariate analysis	
	Successful	Unsuccessful	P-valve	COR (95%CI)	P-value	AOR (95%CI)
Sex						
Male	230 (44.1)	52 (9.9)		1.00		1.00
Female	201 (38.5)	39 (7.5)	0.51	1.08 (0.70, 1.66)	0.73	1.18 (0.74, 1.87)
Age group (yrs)						
<15	9 (1.7)	3 (0.6)		1.00		1.00
15-29	35 (6.7)	15 (2.8)	<0.01	0.68 (0.51, 0.89)	0.01	0.70 (0.52, 0.93)

30-44	128 (24.5)	33 (6.3)	0.37	0.63 (0.25, 1.74)		
45-59	243 (46.5)	32 (6.1)	0.89	1.07 (0.32, 2.68)		
≥60	16 (3.1)	8 (1.5)	0.26	0.87 (0.85, 1.81)		
Educational status						
Informal	125 (23.9)	25 (4.8)	0.65	0.87 (0.47, 1.62)		
Primary	134 (25.6)	29 (5.5)	0.38	0.37 (0.05, 3.29)		
Secondary	140 (26.8)	27 (5.2)	0.41	0.39 (0.07, 3.68)		
Tertiary	31 (5.9)	10 (1.9)		1.00		
Area of residence						
Urban	109 (20.8)	28 (5.4)		1.00		1.00
Rural	322 (61.7)	63 (12.1)	0.28	0.66 (0.31, 1.41)	0.14	0.54 (0.24, 1.22)
Distance to HF(km)						
≤5	96 (18.4)	29 (5.5)		1.00		1.00
>5	335 (64.2)	62 (11.8)	0.05	0.51 (0.25,1.04)	0.02	0.40 (0.18, 0.88)
Income per month (USD)						
<30	57 (10.9)	20 (3.8)	0.03	2.17 (1.02, 4.58)	0.31	1.62 (0.64, 4.12)
≥30	374 (71.6)	71 (13.6)		1.00		1.00
TB category						
New case	374 (71.6)	63 (12.0)		*1.00*		*1.00*
Re-treatment	42 (8.0)	19 (3.6)	<0.01	0.78 (0.52, 0.81)	0.01	0.80 (0.53, 0.94)
Transferred-in	18 (3.4)	6 (1.1)	0.62	1.22 (0.73, 2.04)	0.83	0.91 (0.54, 1.60)

HIV test result						
Non-reactive	388 (74.3)	79 (15.1)		1.00		1.00
Reactive	43 (8.2)	12 (2.3)	0.36	1.41 (0.65, 3.03)	0.48	0.79 (0.43, 1.51)
Year of TB treatment registration						
2014	94 (18.0)	21 (4.0)		1.00		1.00
2015	92 (17.6)	14 (2.7)	0.74	1.07 (0.58, 1.94)	0.06	0.154 (0.01, 1.13)
2016	77 (14.7)	17 (3.2)	0.64	0.77 (0.25, 2.29)	0.27	0.52 (0.15,16)
2017	83 (15.9)	21 (4.0)	0.51	0.73 (0.3, 1.83)	0.37	0.61 (0.21, 1.73)
2018	85 (16.3)	18 (3.4)	0.15	0.47 (0.15, 1.34)	0.17	0.44 (0.13, 1.42)

Table 3a showed statistically significant relationships between age, distance to health facility, income per month, Tb category and Tb treatment outcome in FETHA. Multiple logistic regression analysis indicated that age (15-29), far distance to health facility (>5km) and Tb category (re-treatment) were predictors of poor Tb treatment outcome in FETHA within the five year period

Table 3b: Factors associated with, and predictors of treatment outcomes of TB cases (2014-2018), M-4H

Variables	**Treatment outcome**		**Univariate analysis**		**Multivariate analysis**	
	Successful	**Unsuccessful**	**P-valve**	**COR (95%CI)**	**P-value**	**AOR (95%CI)**
Sex						
Male	336 (45.9)	76 (10.4)		1.00		1.00
Female	269 (36.7)	51 (6.9)	0.37	1.51 (0.67, 3.05)	0.18	0.64 (0.27, 1.32
Age group (yrs)						
<15	21 (2.8)	6 (0.8)		1.00		1.00
15-29	74 (10.1)	20 (2.7)	0.12	1.33 (0.82, 2.17)	0.32	1.29 (0.74, 2.11)
30-44	201 (27.5)	42 (5.7)	*0.6*	1.05 (0.67, 1.58)	0.49	1.16 (0.69, 1.81)

45-59	289 (39.5)	39 (5.3)	1.11	1.01 (0.59, 1.63)	0.65	1.13 (0.66, 1.84)
≥60	20 (2.7)	20 (2.7)	*0.70*	1.11 (0.61, 1.79)	0.91	1.07 (0.55, 1.92)
Educational status						
Informal	151 (20.6)	39 (5.3)	0.35	0.38 (0.07, 3.28)		
Primary	189 (25.8)	32 (4.4)	0.11	0.41 (0.15, 1.24)		
Secondary	172 (23.5)	40 (5.5)	0.15	0.52 (0.17, 1.37)		
Tertiary	90 (12.3)	16 (2.2)		1.00		1.00
Area of residence						
Urban	130 (17.8)	40 (5.5)		1.00		1.00
Rural	475 (64.8)	87 (11.8)	0.02	4.05 (1.30, 12.47)	0.03	5.81 (1.37, 24.83)
Distance to HF(km)						
≤5	117 (15.9)	36 (4.9)		1.00		1.00
>5	488 (66.7)	91 (12.4)	0.02	4.00 (1.29, 12.42)	0.02	5.80 (1.36, 24.71)
Income per month (USD)						
<30	91 (12.4)	20 (2.7)	0.84	1.06 (0.41, 2.75)		
≥30	514 (70.2)	107 (14.6)		1.00		1.00
TB category						
New case	527 (71.9)	93 (12.7)		1.00		1.00
Re-treatment	52 (7.1)	24 (3.3)	<0.01	*3.97 (1.41, 11.16)*	*0.014*	*3.79 (1.31, 10.92)*
Transferred-in	26 (3.5)	10 (1.4)	0.57	1.37 (0.46, 4.15)		
HIV test result						

Non-reactive	557 (76.1)	106 (14.5)		1.00		1.00
Reactive	54 (7.4)	15 (2.0)	0.22	0.56 (0.22, 1.41)		0.65 (0.26–1.60)
Year of TB treatment registration						
2014	105 (14.3)	26 (3.5)		1.00		1.00
2015	127 (17.3)	29 (3.9)	0.56	1.07 (0.58, 1.91)	0.61	1.17 (0.63, 2.18)
2016	112 (15.3)	25 (3.4)	*0.62*	1.05 (0.47, 1.86)	0.11	1.62 (0.89, 2.91)
2017	126 (17.2)	27 (3.6)	0.93	1.36 (0.76, 2.41)	0.47	1.16 (0.64, 2.19)
2018	135 (18.4)	20 (2.7)	*0.67*	1.36 (0.59, 3.14)	0.35	0.65 (0.35, 1.28)

Table 3b showed statistically significant relationships between area of residence, distance to health facility, Tb category and Tb treatment outcome in M-4H. . Multiple logistic regression analysis indicated that area of residence (rural), far distance to health facility (>5km) and Tb category (re-treatment) were predictors of poor Tb treatment outcome in M-4H within the five year period.

Discussion

This study extracted, analyzed and evaluated records of Tb cases registered between 2014 and 2018 in both facilities. The burden of Tb found in this study was more in males than females. This was demonstrated by the male to female ratio of 1.2:1 in both facilities. Similarly, disaggregated data also showed male to female ratio of 1.2:1 and 1.3:1 in FETHA and M-4H respectively. This demonstrated a certain degree of homogeneity in Tb cases in both facilities. This finding is in consonance with WHO report of 2016[10] and those of the previous studies in Ethiopia[11-14] and other countries[15,16] and that could be due to biological differences, as well as differences in societal roles and access to health facilities[17]. However, WHO global Tb report 2015, showed that male to female ratio of notified cases across all age groups was 1.7, globally ranging from 1.0 in the Eastern Mediterranean Region to 2.1 in the West Pacific Region[9]. This variation could likely be associated to risk of exposure to the bacilli which is, mostly airborne.

In both facilities, the study found Tb cases highest in the productive age group (15-59) and this is in agreement with the results of other studies in Ethiopia[12, 18,19] and Bhutan[20]. Such findings could be inferred from the greater mobility of this age group for economic and social activities. This is basically due to their age and family economic dependence on them, they involve themselves in earning and petty jobs that might expose them to Tb cases in the community. However, this pattern

contradicted finding in developed countries where it was reported that the elderly group were two to four times more prevalent[21]

The average percentage of Tb/HIV co-infection recorded in this study (both facilities) was significantly lower compared to those of other studies in Imo Nigeria[22], Addis Ababa[23] and other regions of Ethiopia[24]. This gap and variation in the percentage of Tb/HIV co-infection could be attributed to the low prevalence of HIV in the study population of the study area[25]. In this study, significantly large proportion of Tb/HIV co-infected cases were successfully treated.
The co-infection rates varied greatly among the reviewed articles, while some reported lower figures[26,27], others reported figures in a higher range[28,29]. HIV pandemic has fueled an unprecedented increase in Tb primarily because of its effect in the immune system of infected individuals[22].

The success treatment outcome was not affected by the use of antiretroviral among the HIV positives and the reported few deaths among Tb/HIV co-infected cases on antiretroviral therapy is in agreement with WHO report that between 2000 and 2014, Tb treatment and antiretroviral therapy saved an additional 18million lives among HIV positives people[9]. This result could be due to the fact that most of the patients were on drugs with few of them being transferred out or defaulted as at the time this study was conducted. This pattern of improved outcome with initiation of ART has been reported in other studies[30,31].
The finding showed similar treatment success rate (82.6%) in both facilities (431/522 in FETHA and 605/732 in M-4H). Although, this level of treatment success rate (TSR) was much higher than that found in the South western part of Nigeria[16] it is lower than that found in Ethiopia (94.4%)[12] and these were dependent on different factors. These variations in treatment success rate could be attributed to differences in socio-economic class of the patients, geographic setting, sample size, study period and the Tb clinic management[32].
It could also be due to the easier accessibility of the drugs to the Tb bacilli as the granuloma is usually burst in PTb+ cases. In addition, transfer-in patients had high probability of treatment success as well as patients desire to be in an ideal health facility to continue and complete their treatment [32].Treatment outcomes of cases in males reported in FETHA showed 44.1% cured, 5.9% default, 0.9% relapse, 0.6% treatment failure and 2.5% death while in females: 38.5% cured, 4.4% default, 0.6% relapse, 0.4% treatment failure and 2.1% death. When compared with M-4H, males had 45.9% cured, 6.6% default, 0.9% relapse, 0.5% treatment failure and 2.3% death while females were: 36.7% cured, 4.1% default, 0.5% relapse, 0.7% treatment failure and 1.6% death. None of the treatment outcome measures was statistically significant (P>0.05). The treatment success rate (82.6%) was similar in both facilities (431/522 in FETHA and 605/732 in M-4H).

This treatment success found in this study was much lower than that reported both nationally and globally among the 2013 Tb treatment cohort[9]. It was also lower than figures reported from studies in Ekiti, Nigeria[33], India[21] and also below the national recommended target of 85%[34]. Nevertheless, the treatment success found in this study was higher than figures reported in studies from Nnewi[26],

Ondo[28] both in Nigeria and in Limpopo South Africa[35]. This variations in treatment success may be due to various socio-demographic/economic factors, issues related to drug compliance and monitoring, nutritional status of individuals, the HIV pandemic, and drug susceptibility/resistance among others which varies greatly from place to place. Default rate, death rate, and failure rate respectively were still within the national range[36]. This high default rate is of great concern due to its public health implication in spreading the disease and in the emergence of resistance strains of the Tb organism. Reasons that could be responsible for this lower treatment outcome found in our study could be due to ignorance, poor compliance to drug treatment, long duration of drug intake, place of residence far from health facility, improper health education, stigmatization, poor social support, lack of regular availability of drugs and other consumables, lack of political will, and the attitude of the health workers among others as has been reported in other studies[26,28,33].

Significantly large proportion of unsuccessful Tb cases in this study were attributed to being in a remote (rural) area which led to poor knowledge and poor socio-economic status together caused reduced treatment adherence[37,38], far distance to health facility (>5km) and Tb category (re-treatment). Other negating factors could be risk-taking behavior like use of tobacco, alcohol and illicit drug, co-administration of ART along with anti-Tb therapy which can lead to drug–drug interactions, overlapping drug toxicities and immune reconstitution syndrome[39].

Socio-demographic factors such as; age (15-29) of the patients, far distance to health facility (>5km) and Tb category (re-treatment) were predictors of poor Tb treatment outcome in FETHA within the five year period. In M-4 hospital, area of residence (rural), far distance to health facility (>5km) and Tb category (re-treatment) were predictors of poor Tb treatment outcome within the reviewed five year period.

Concerning age of patients, lower successful outcome was recorded in younger age group. This is in contrast with the pattern reported in Turkey[40] which revealed that there was a significant positive trend of increased risk for adverse treatment outcomes with age, with almost two and three fold increase in odds of an adverse treatment outcome among patients aged 51-65 years and 65 years and above respectively. Other studies had shown significant association between extremes of age with lower proportions of treatment success[35] while several others showed no association between age and treatment outcome of Tb[26,27,30]. This association with extremes of age may partly be explained by the effect of co-morbidity confounders common at the extremes of age that are likely to worsen the outcome of Tb treatment. This argument was strengthened by the finding in a Turkish study which revealed that co-morbidity was associated with a near doubling of the odds for an adverse Tb treatment outcome[40].

Far distance to health facility also predicted poor treatment outcome in this study. This could be explained by the fact that far distance to health implies more economic burden to the patient whose earnings and source of livelihood may have dwindled.

Patients on category 1 drug treatment had higher treatment success than those on category II treatment regimen. This pattern was consistent with finding reported in India[21] and South Africa[35].

Similarly, patient category or type of patient at presentation was found to significantly affect the outcome of Tb treatment with new cases at presentation having the highest success rate, while relapse cases having the least success rate. This pattern of high Tb treatment success among new cases has been reported by several studies[35,41] while others reported no significant effect on the treatment outcome by both the drug regimen used and the type of patient at diagnosis[26,30]. This report could likely be due to the fact that most category II patients are re-treatment cases and might have been long on the drugs leading to poor compliance to drugs, development of resistance to drugs and in turn poor treatment outcome.

Conclusions: The patients were mostly males with twice (1.6%) DRTb than the females. Although treatment success rate (82.6%) was close to the 85% WHO bench mark, there were still large pockets of default with similar predictors of poor treatment outcomes in both facilities. Young people may need to be monitored closely while on Tb treatment to ensure improved treatment outcome. Decentralization of Tb clinics for easy access by those in rural areas is also recommended.

Implications; Findings from this study can provide information upon which interventions to improve treatment outcome will be based. Intensified health education campaign by public health practitioners will be encouraged. Individualized/patient centered health education and counseling will be targeted.

Limitations; Use of retrospective secondary data from TB treatment registers with some errors during documentation. There was no information on participants' knowledge on TB, quality of health education given to the patient, co-morbidities like diabetes mellitus, and anti-TB drug side effects which may affect TB treatment outcome.

Disclosure
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