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Research Article

Treatment Outcomes of Tuberculosis and Associated Factors in an Ethiopian University Hospital

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Background. Tuberculosis remains a major global health problem. It causes ill-health among millions of people each year and ranks alongside the human immunodeficiency virus (HIV) as a leading cause of death worldwide. *Purpose*. To assess the outcome of tuberculosis treatment and to identify factors associated with tuberculosis treatment outcome. *Methods*. A five-year retrospective cross-sectional study was employed and data were collected through medical record review. Data were analyzed using SPSS version 16 and binary and multiple logistic regression methods were used. A p value of less than 0.05 was considered as statistically significant in the final model. *Results*. Out of the 1584 pulmonary TB patients (882 males and 702 females) including all age group, 60.1% had successful outcome and 39.9% had unsuccessful outcome. In the final multivariate logistic model, the odds of unsuccessful treatment outcome was higher among patients of weight category 30–39.9 kg (AOR = 1.51, 95% CI: 1.102–2.065) and smear negative pulmonary TB (AOR = 3.204, 95% CI: 2.277–4.509) and extrapulmonary TB (AOR = 3.175, 95% CI: 2.201–4.581) and retreatment (AOR = 6.733, 95% CI: 3.235–14.013) and HIV positive TB patients (AOR = 1.988, 95% CI: 1.393–2.838) and unknown HIV status TB patients (AOR = 1.506, 95% CI: 1.166–1.945) as compared to their respective comparison groups. *Conclusion*. In this study, high proportion of unsuccessful treatment outcome was documented. Therefore emphasis has to be given for patients with high risk of unsuccessful TB treatment outcome and targeted interventions should be carried out.

1. Introduction

(1) Background. According to the 2015 global tuberculosis report, tuberculosis (TB) is a major global health problem [1]. It causes ill-health among millions of people each year and ranks alongside the human immunodeficiency virus (HIV) as a leading cause of death worldwide [1]. In 2014, there were an estimated 9.6 million new TB cases and there were also 1.5 million TB deaths [1]. Of the 9.6 million new TB cases in 2014, 58% were in the Southeast Asia and Western Pacific Regions. The African Region had 28% of the world's cases in 2014 [1]. Globally, TB prevalence in 2015 was 42% lower than that in 1990 [1].

The World Health Organization (WHO) declared TB a global public health emergency in 1993. Starting in the mid-1990s, efforts to improve TB care and control intensified at national and international levels. WHO developed the Directly Observed Treatment, Short-Course (DOTS), strategy within a decade, almost all countries had adopted the strategy, and there was considerable progress towards global targets established for 2005 [2]. The growing HIV epidemic represents a great challenge for the National Tuberculosis

Programs, which are seeing an increase in HIV infection among TB cases and the appearance of new TB cases among persons infected with HIV. This is compromising health system performance and National Tuberculosis Program efficiency due to increased TB incidence, case-fatality, treatment abandonment, and challenges for the comprehensive treatment of both diseases [3]. Globally, in 2014, there were an estimated 1.2 million new HIV positive TB cases and almost three-quarters of these cases were in the African Region [1]. Challenge in the management of TB and HIV coinfected individual is pill burden, increase of adverse effect, drug-to-drug interaction, and immune reconstitution inflammatory syndrome. HIV/AIDS has a number of impacts on prevention and control of TB [4]. Tuberculosis is an obstacle to socioeconomic development; 75% of people affected by TB are within the economically productive age group of 15–54 years. The HIV epidemic worsened the TB situation and it is estimated that 50 to 60% of HIV infected people will develop TB disease in their lifetime in contrast with HIV negative persons, whose lifetime risk is only 10% [5].

Among the six WHO regions, the highest treatment success rates were in the Western Pacific Region, the Southeast Asia Region, and the Eastern Mediterranean Region. The treatment success rate was 79% in the African Region and 75% for the Region of the Americas and Europe. Most of the 22 HBCs have reached or exceeded a treatment success rate of 85%. Among the 22 HBCs Ethiopia is the one with rates of treatment success for all new and relapse cases in 2013 that were 89% [1]. In Ethiopia a standardized TB prevention and control program, incorporating DOTS, was started in 1992 [5].

According to the WHO treatment guideline the essential anti-TB drugs are Isoniazid, Rifampicin, Pyrazinamide, Ethambutol, and Streptomycin. All anti-TB drugs should be quality assured, and management of anti-TB drugs should be incorporated into the management of other essential medicines by the ministry of health [6]. First-line treatment of TB in Ethiopia is Rifampicin (R); Ethambutol (E); Isoniazid (H); Pyrazinamide (Z); and Streptomycin (S). The drugs are available in fixed dose combination and available as single drugs [5]. The treatment of TB has two phases: intensive (initial) and continuation phase. Intensive phase consists of three or more drugs for the first 8 weeks for new cases and 12 weeks for retreatment cases. Continuation phase requires at least two drugs, to be taken for 4–6 months. During the continuation phase, the drugs must be collected every month and self-administered by the patient, except for retreatment cases and for regimens containing Rifampicin [5]. A better understanding of the predictors and prognostic factors would allow closer follow-up and more targeted interventions to improve TB treatment outcome, thus reducing TB associated morbidity and mortality. The aim of the present study was to assess the outcome of TB treatment and to identify factors associated with TB treatment outcome in UoGTH Northwest Ethiopia.

(2) Statement of the Problem. There were an estimated 8.8 million incident cases of TB globally in 2010, 1.1 million deaths among HIV negative cases of TB, and an additional 0.35 million deaths among people who were HIV positive. In 2009, there were an estimated 9.7 million children who were orphans as a result of parental deaths caused by TB [7]. TB is the leading killer among HIV infected people with weakened immune systems; a quarter of a million TB deaths are HIV associated, with most of them in Africa and 98% of TB deaths in the developing world affecting mostly young adults in their most productive years [8].

Although the implementation of DOTS increases treatment success and decrease transmission of resistant tuberculosis TB kills 5000 people, every day [8–10]. Global TB incidence is still growing at 1% a year due to the rapid increase in Africa and especially affects the most vulnerable such as the poorest and the malnourished [8]. The World Health Organization declared TB a global public health emergency in 1993 and developed the DOTS strategy, a five-component package. Within a decade, almost all countries had adopted the strategy and there was considerable progress towards global targets established for 2005: the detection of 70% of the estimated number of smear positive pulmonary cases (the most infectious cases) and the successful treatment of 85% of these cases. In 2005, the numbers of cases reported by NTPs grew to over 5 million and treatment success rates reached 85% [2].

There is also a finding that shows the magnitude of TB burden worldwide. A retrospective study was conducted in Turkey in 2008 on the treatment outcomes of pulmonary TB and factors affecting treatment outcomes. The burden of TB in these finding accounts for defaulted treatment 5.1%, dead subjects 2.4%, failure 0.3%, and transfer-out 0.5% of all patients and among smear positive pulmonary TB there were defaulted treatment 5.4%, dead subjects 2.9%, failure 0.4%, and transfer-out 0.7% cases [11]. Similarly in different parts of the world defaulted treatment, death, failure and transfer-out cases are the real challenges for TB treatment [12–16].

According to the 2008 report of WHO, Ethiopia ranks seventh among the world's 22 countries with a high tuberculosis burden [17]. The Ethiopian Federal Ministry of Health (FMOH) hospital statistics data has shown that tuberculosis is the leading cause of morbidity, the third cause of hospital admission, and the second cause of death in Ethiopia, after malaria [5]. Based on the 2006 WHO estimate in Ethiopia, the incidence of TB of all forms and smear positive TB stands at 378 and 168 per 100,000 populations, respectively. The prevalence and mortality of tuberculosis of all forms are estimated to be 641 and 83 per 100,000 populations, respectively [17]. A five-year retrospective study done in University of Gondar Teaching Hospital on the treatment outcomes of TB and the treatment success rate of tuberculosis patients showed unsatisfactorily low rate (29.5%). A high proportion of patients died (10.1%) or defaulted (18.3%), which is a serious public health concern that needs to be addressed urgently [18].

Several reasons and risk factors for poor TB treatment outcomes have been reported. High age, male sex, low income, no or limited access to transport, distance from home to the treatment center, incomplete treatment compliance, limited interest in information about the disease and its treatment, limited social support, multidrug resistance, and

comorbidity have all been found to be related to unsuccessful treatment outcomes [13, 19–24].

It is not clear which factors are major contributors to poor outcome of TB patients in the UoGTH. Therefore, it would be better to look for ways of predicting TB treatment outcome and identifying factors that can help to predict poor treatment outcome which will help to identify those patients that are at a higher risk of poor treatment outcome while being treated with anti-TB drugs. With this information, clinicians could give such patients special attention during their follow-up in order to prevent occurrence of negative consequences following poor treatment outcome. This study will assess the TB treatment outcome and the possible associated factors with treatment outcome among TB patients in UoGTH.

2. Objective

2.1. General Objective. General objective is

(i) to assess the treatment outcomes of tuberculosis and associated factors in an Ethiopian University Hospital.

2.2. Specific Objectives. Specific objectives are

(i) to assess the outcomes of patients registered for anti-tuberculosis treatment,

(ii) to identify factors associated with treatment outcomes of tuberculosis.

3. Methods and Participants

3.1. Study Area and Period. The study was conducted in University of Gondar Teaching Hospital TB clinic found in Gondar town. The data were collected from March 1 to April 8, 2013.

3.2. Source Population. The source population of the study was all patients registered for treatment of TB at University of Gondar Teaching Hospital from September 1, 2008, to August 31, 2012.

3.3. Study Participants. The study population was all tuberculosis patients who had treatment outcome at University of Gondar Teaching Hospital between September 1, 2008, and August 31, 2012:

Inclusion criteria were as follows:

(i) Full patient data.
(ii) New case PTB/EPTB.
(iii) Retreatment case.
(iv) Others.
(v) Transfer-in.

Exclusion criteria were as follows:

(i) TB patients who had two outcomes.

3.4. Sample Size and Sampling Technique/Procedure. All data were retrieved from records of patient registration who took anti-TB treatment during the period of September 1, 2008, and August 31, 2012.

3.5. Variables in the Study

Dependent variables were as follows:

Tuberculosis treatment outcome.

Independent variables were as follows:

Sociodemography:

(i) age,
(ii) gender,
(iii) weight.

Comorbidity:

(i) TB/HIV coinfections.

Tuberculosis type:

(i) smear negative pulmonary TB,
(ii) smear positive pulmonary TB,
(iii) extrapulmonary TB.

Category of patient:

(i) new case,
(ii) retreatment case,
(iii) others,
(iv) transfer-in.

3.6. Data Collection and Data Quality. Data were collected through medical record reviews of patients using a prepared standard checklist in TB clinic. The contents of the checklist include sociodemography, HIV status, types of TB, and treatment outcome. In order to assure the quality of data the following measures will be undertaken.

Data was collected by 4 nurses after giving one-day training for data collectors on the data collection format and techniques of data collection. Supervisor was strictly supervising data collectors daily and the principal investigator was reviewing all filled format.

3.7. Data Processing and Analysis. Data were checked for its completeness every day. To be edited, cleaned, and analyzed, the collected data were entered into a computer using SPSS version 16. A descriptive analysis was conducted to check for outliers and consistencies and to identify missed values for independent variables. Bivariate analysis was employed to see the crude association between each exposure and outcome variables. To control the effect of confounding factors or to get independently associated variables, each of the variables that are statistically significant at p value < 0.2 in bivariate analysis was entered into backward stepwise multiple logistic regression model as the independent variable with TB treatment outcome status being a dependent variable. $p < 0.05$ was considered as statistically significant for all the independent variables in the final model.

3.8. Dissemination Plan. The result of the study will be disseminated to responsible bodies such as Jimma University Department of Pharmacy, Federal Ministry of Health, Ethiopia Food, Medicines and Health Care Administration and Control Authority, Regional Health Bureau, zonal and district health offices, and district administration of the study area. The study finding will also be submitted to professional journal for publication so as to serve as baseline for further studies.

3.9. Definitions of Terms. According to the standard definitions of the National Tuberculosis and Leprosy Control Program (NTLCP) guideline adopted from WHO, the following clinical case and treatment outcome definitions will be used.

3.9.1. Smear Positive Pulmonary TB. It refers to the following: a patient with at least two sputum specimens which were positive for acid-fast bacilli (AFB) by microscopy or a patient with only one sputum specimen which was positive for AFB by microscopy, as well as chest radiographic abnormalities consistent with active pulmonary TB.

3.9.2. Smear Negative Pulmonary TB. It refers to the following: a patient with symptoms suggestive of TB with at least two sputum specimens which were negative for AFB by microscopy and with chest radiographic abnormalities consistent with active pulmonary TB (including interstitial or miliary abnormal images) or a patient with two sets of at least two sputum specimens taken at least two weeks apart and which were negative for AFB by microscopy and radiographic abnormalities consistent with pulmonary TB and lack of clinical response to one week of broad spectrum antibiotic therapy.

3.9.3. Extrapulmonary TB (EPTB). This included tuberculosis of organs other than the lungs, such as lymph nodes, abdomen, genitourinary tract, skin, joints and bones, and meninges. Diagnosis of EPTB was based on fine needle aspiration cytology or biochemical analyses of cerebrospinal/pleural/ascitic fluid or histopathological examination or strong clinical evidence consistent with active extrapulmonary tuberculosis, followed by a decision of a clinician to treat with a full course of antituberculosis chemotherapy. In all the cases of EPTB, sputum examinations and chest radiographs were used to investigate the involvement of lung parenchyma.

A case of TB is a patient in whom tuberculosis has been confirmed bacteriologically or diagnosed by a clinician. The following are case definitions:

(i) *New Case (N).* A patient who never had treatment for TB or has been on previous anti-TB treatment for less than four weeks.

(ii) *Relapse (R).* A patient declared cured or whose treatment was 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.

(iii) *Treatment Failure (F).* A patient who, while on treatment, is smear positive at the end of the fifth month or later, after commencing. Treatment failure also includes a patient who was initially sputum smear negative but who becomes smear positive during treatment.

(iv) *Return after Default (D).* A patient previously recorded as defaulted from treatment and returns to the health facility with smear positive sputum.

(v) *Transfer-Out (T).* A patient who started treatment in one treatment unit and is transferred to another treatment unit to continue treatment.

(vi) *Chronic (C).* A TB patient who remains smear positive after completing a retreatment regimen.

(vii) *Others (O).* A patient who does not fit in any of the above-mentioned categories (e.g., a PTB smear negative patient who returns after treatment interruption).

3.9.4. Treatment Outcome. The treatment outcome was divided into seven categories according to NTLCP guideline. These categories were as follows:

(i) *Cured.* Finishing treatment with negative bacteriology result at the end of treatment.

(ii) *Completed Treatment.* Finishing treatment but without bacteriology result at the end of treatment.

(iii) *Failure.* Remaining smear positive at five months despite correct intake of medication.

(iv) *Defaulted Treatment.* Patients who interrupted their treatment for two consecutive months or more after registration.

(v) *Died.* Patients who died from any cause during the course of treatment.

(vi) *Transfer-Out.* Patients whose treatment results are unknown due to transfer to another health facility.

(vii) *Successfully Treated.* A patient who was cured or completed treatment.

In line with WHO criteria, treatment outcomes were categorized into the following:

(i) *Successful Treatment Outcome.* If TB patients were cured (i.e., negative smear microscopy at the end of treatment and on at least one previous follow-up test) or completed treatment with resolution of symptoms.

(ii) *Unsuccessful Treatment Outcome.* If treatment of TB patients resulted in treatment failure (i.e., remaining smear positive after 5 months of treatment), default (i.e., patients who interrupted their treatment for two consecutive months or more after registration), or death.

However, patients who transferred out to other districts were excluded from the treatment outcome evaluation as information on their treatment outcome was unavailable.

4. Result

4.1. Sociodemographic and Clinical Characteristics. Out of 1584 patients who had known outcome between January 2008 and December 2012 at University of Gondar Teaching Hospital, 882 (55.7%) were males and their mean age was 28.3 (SD ± 1.47) years (Table 1).

Among patients for whom disease categories were documented 303 (19.1%) were smear positive pulmonary TB and 844 (53.3%) were smear negative pulmonary TB. Categories of patients were also documented for all types of TB; of these 1307 (82.5%) were classified as new cases. With regard to HIV status, 212 (13.4%) were positive and, of those HIV positive, 54 (25.5%) and 45 (21.2%) initiated CPT (Cotrimoxazole Preventive Treatment) and ART (Antiretroviral Treatment), respectively. Concerning smear result, 32 (10.6%) were positive at the second month (Table 2).

4.2. Treatment Outcome of all TB Patients in UoGTH, 2008–2012. Among all TB patients enrolled in this study 735 (46.4%) completed treatment, 338 (21.3%) defaulted, 281 (17.7%) died, 217 (13.7%) were cured, 13 (0.8%) had treatment failure (Table 3). From the 1584 patients evaluated for treatment outcome, 952 (60.1%) had successful treatment outcome and 632 (39.9%) had unsuccessful treatment outcome (Table 4). Of the patients with unsuccessful treatment outcome, 281 (17.7%) had died, 13 (0.8%) had treatment failure, and 338 (21.3%) had defaulted (Table 3).

4.3. Treatment Outcome of TB and Factors Independently Associated with Outcome. Logistic regression analysis was done for all characteristics. In the final multivariable logistic model, unsuccessful treatment outcome varied by weight, tuberculosis type, category of patients, and HIV status (Table 4).

The probability of developing unsuccessful treatment outcome was 1.508 (95% CI: 1.102–2.065) times higher among weight category 30–39.9 kg compared to 40–54.9 kg. Those with weight categories 50–70.9 kg of TB patients were less likely to experience (AOR = 0.573, 95% CI: 0.415–0.790) unsuccessful treatment outcome compared to those with weight categories of 40–54.9 kg. Successful treatment outcomes were documented in weight category ≥71 kg compared to weight category 40–54.9 kg (AOR = 0.199, 95% CI: 0.044–0.897). Patients who were being treated for smear negative PTB had 3.204 (95% CI: 2.277–4.509) times the unsuccessful treatment outcome compared to patients being treated for smear positive PTB. A type of TB documented as EPTB had also 3.175 (95% CI: 2.201–4.581) times higher probability of unsuccessful treatment outcome compared to smear positive PTB. The likelihood of unsuccessful treatment outcome was more frequent (AOR = 6.733, 95% CI: 3.235–14.013) in retreatment than in newly treated cases. Transfer-in patients were less likely to experience (AOR = 0.380, 95% CI: 0.214–0.673) unsuccessful treatment outcome when compared to those newly treated. Patients who were being treated for HIV positive TB had unsuccessful treatment outcome compared to patients being treated for HIV negative TB (AOR = 1.988, 95% CI: 1.393–2.838). The probability of developing unsuccessful treatment outcome was 1.506 (95% CI: 1.166–1.945) times higher among TB patients with nontested HIV status compared to HIV negative TB patients (Table 4).

Table 1: Sociodemographic characteristics of all TB patients in UoGTH, 2008–2012.

Characteristics	Frequency	Percent
Age (years)		
<15	211	13.3
≥15	1373	86.7
Total	*1584*	*100%*
Sex		
Male	882	55.7
Female	702	44.3
Total	*1584*	*100%*
Weight (kg)		
0–4.9	14	0.9
5–7.9	31	2.0
8–14.9	60	3.8
15–19.9	35	2.2
20–29.9	65	4.1
30–39.9	216	13.6
40–54.9	831	52.2
55–70.9	238	15.0
≥71	16	1.0
Unknown	78	4.9
Total	*1584*	*100%*

5. Discussion

Assessment of antituberculosis treatment outcome as well as analysis of factors responsible for poor treatment outcome is one of the major indicators for the evaluation of the performance of a national TB program. In this study, the successful treatment outcomes of all TB types were 60.1% which is lower than the NTLCP and WHO target of 85% and in addition lower than the studies conducted in some parts of Ethiopia including 74.8% in Southern Region [20] and 89.0% in Tigray region of Ethiopia [25] but has higher success rate compared to studies done previously in University of Gondar Teaching Hospital (29.5%) [18] and 26% in Felege Hiwot Referral Hospital [26].

In this finding successful outcome increases from the previous 29.5% to 60.1% and this could be due to the exclusion of transfer-out patient, because large number of transfer-out patients could compromise the treatment success rate, as this group is often included in the denominator. Here the feedback system is poor and there are no mechanisms to confirm whether these patients registered to continue treatment in other centers. The other possible reason for the increment of successful treatment outcome in UoGTH compared to the previous study conducted in this university hospital could be the encouragement of DOTS performance.

Table 2: Clinical characteristics of all TB patients in UoGTH, 2008–2012.

Characteristics	Frequency	Percent
Tuberculosis type		
Smear positive	303	19.1
Smear negative	844	53.3
Extrapulmonary	437	27.6
Total	*1584*	*100%*
Category of patients		
New	1307	82.5
Retreatment	41	2.6
Others	89	5.6
Transfer-in	147	9.3
Total	*1584*	*100%*
HIV status		
Positive	212	13.4
Negative	420	26.5
Unknown	952	60.1
Total	*1584*	*100%*
CPT initiation for HIV positive TB patients		
Yes	54	25.5
No	158	74.5
Total	*212*	*100%*
ART initiation for HIV positive TB patients		
Yes	45	21.2
No	167	78.8
Total	*212*	*100%*
Smear result at 2nd month for PTB +ve patients		
Positive	32	10.6
Negative	207	68.3
Not tested	64	21.1
Total	*303*	*100%*
Smear result at 5th month for PTB +ve patients		
Positive	5	1.7
Negative	221	72.9
Not tested	77	25.4
Total	*303*	*100%*
Smear result at 7th month for PTB +ve patients		
Positive	3	1.0
Negative	218	71.9
Not tested	82	27.1
Total	*303*	*100%*

The unsuccessful treatment outcome of our finding 39.9% is lower when compared to 70.6% of the previous study conducted in UoGTH [18] and 76% in Felege Hiwot Referral Hospital [26]. The 21.3% default, 17.7% death rate, and 0.8% treatment failure documented in our finding are also lower than Southern Region of Ethiopia, where 60.9% patients had defaulted, 36.9% had died, and 2.2% failed treatment [20]; this could be study participant variation between the two studies. Compared to this data, studies done in other parts of the world recorded lower proportion of poor outcome [11, 12, 27]. This difference may be due to variation in DOTS service and setup. There was little knowledge about TB and inappropriate health seeking behavior and stigma towards TB in the Gilgel Gibe field research area [21]; this could be another possible reason for the difference.

In multivariable logistic regression the unsuccessful treatment outcomes of our finding were significantly higher in weight category 30–39.9 kg and smear negative PTB and EPTB and retreatment cases and seropositive TB patients and unknown serostatus TB patients but lower in weight categories 55–70.9 kg and ≥71 kg and transfer-in patients.

In this study weight of the patient during initiation of anti-TB treatment (30–39.9 kg) was significantly associated with unsuccessful treatment outcome but weight category of 55–70.9 kg and ≥71 kg during initiation of anti-TB treatment was significantly associated with successful treatment outcome. One study in Addis Ababa revealed that body weight at initiation of anti-TB treatment (<35 kg) was a significant risk factor of death during antituberculosis treatment period [28]. This difference may be related to the classification of body weight at initiation of anti-TB treatment; in this study body weight classification is based on WHO standard treatment guideline but a study conducted in Addis Ababa used another type of body weight classification. Other study also reported that, among persons who were underweight at diagnosis, weight gain of 5% or less after two months of treatment was associated with an increased risk of relapse [29].

In this observation tuberculosis type was associated with unsuccessful treatment outcome. The characteristics of TB patients associated with unsuccessful treatment outcome during anti-TB treatment were being smeared negative pulmonary TB and extrapulmonary TB [20, 26]. This could be due to the treatment outcome monitoring of smear positive pulmonary TB patients and by testing sputum result at 2nd, 5th, and 7th months in addition to clinical progression of the patients but monitoring the treatment outcome of patients with smear negative pulmonary TB and extrapulmonary TB is only clinical condition. The numbers of patients having smear negative pulmonary TB and extrapulmonary TB were higher compared to smear positive pulmonary TB which could be another possible justification for unsuccessful treatment outcome.

The finding of this study showed that treatment category was associated with unsuccessful treatment outcome especially for patients who were treated previously. One study stated that undergoing retreatment was found to be a significant risk factor for unsuccessful treatment outcome [25]. Similar findings also reported that retreatment was significantly correlated with unsuccessful treatment outcome [20, 25, 28, 30]. Thus, the high proportion of unsuccessful treatment outcome in retreatment cases in this study could be related to prior suboptimal therapy and drug resistance.

Table 3: Outcomes of all TB patients by age, sex, and year of registration in UoGTH.

Characteristics	Total (n = 1584)	Cured	Treatment completed	Death	Failure	Default
Age (years)						
<15	211	2	125	14	0	70
≥15	1373	215	610	267	13	268
Sex						
Male	882	119	415	158	6	184
Female	702	98	320	123	7	154
Year of registration						
2008	419	69	173	97	7	73
2009	348	49	161	61	1	76
2010	285	33	138	47	2	65
2011	296	35	124	44	3	90
2012	236	31	139	32	0	34

n = number.

Table 4: Multivariable logistic regression analysis and factors associated with unsuccessful treatment outcome in all types of TB patients in UoGTH, 2008–2012.

Characteristics	Successful treatment outcome n (%)	Unsuccessful treatment outcome n (%)	AOR (95% CI)	p-value
Weight (kg)				
0–4.9	4 (28.6)	10 (71.4)	2.826 (0.868–9.196)	0.084
5–7.9	12 (38.7)	19 (61.3)	1.909 (0.901–4.047)	0.092
8–14.9	36 (60)	24 (40)	0.830 (0.480–1.437)	0.507
15–19.9	23 (65.7)	12 (34.3)	0.605 (0.294–1.245)	0.172
20–29.9	42 (64.6)	23 (35.4)	0.695 (0.403–1.198)	0.191
30–39.9	104 (48.1)	112 (51.9)	**1.508 (1.102–2.065)**	**0.010**
40–54.9	491 (59.1)	340 (40.9)	1	
55–70.9	168 (70.6)	70 (29.4)	**0.573 (0.415–0.790)**	**0.001**
≥71	14 (87.5)	2 (12.5)	**0.199 (0.044–0.897)**	**0.036**
Unknown	58 (74.4)	20 (25.6)	1.204 (0.573–2.532)	0.624
Tuberculosis type				
Smear positive	224 (73.9)	79 (26.1)	1	
Smear negative	469 (55.6)	375 (44.4)	**3.204 (2.277–4.509)**	**0.000**
Extrapulmonary	259 (59.3)	178 (40.7)	**3.175 (2.201–4.581)**	**0.000**
Category of patients				
New	772 (59.1)	535 (40.9)	1	
Retreatment	13 (31.7)	28 (68.3)	**6.733 (3.235–14.013)**	**0.000**
Others	54 (60)	36 (40)	0.841 (0.536–1.319)	0.451
Transfer-in	113 (77.4)	33 (22.6)	**0.380 (0.214–0.673)**	**0.001**
HIV status				
Positive	105 (49.5)	107 (50.5)	**1.988 (1.393–2.838)**	**0.000**
Negative	288 (68.6)	132 (31.4)	1	
Not tested	559 (58.7)	393 (41.3)	**1.506 (1.166–1.945)**	**0.002**

AOR = Adjusted Odds Ratio and 1 indicates reference. n = number, % = percent, and CI = confidence interval.

Globally, 3.7% (2.1–5.2%) of new cases and 20% (13–26%) of previously treated cases are estimated to have MDR-TB [2]. The proportion of MDR-TB in Ethiopia is 0–2.9% among new cases and 6–11.9% among retreatment cases [2]. Unlike retreatment cases, transfer-in patients had successful treatment outcome compared to new cases; successful treatment outcome could be associated with large number of patients that may not have comorbidity like HIV. The other possible reason could be the fact that patients may have good knowledge about TB and its treatment. There was

a lower proportion of treatment success among the transfer-in patients (69%) when compared to non-transfer-in patients (83%) as there were more patients with missing treatment outcomes among the transfer-in patients (27% versus 8%) [31].

Regarding comorbidity our study showed that HIV positive TB patients have an increased risk of unsuccessful treatment outcome compared to HIV negative TB patients. Similarly one study showed that TB/HIV coinfection was significantly associated with unsuccessful treatment outcome [19, 32, 33]. The unsuccessful treatment outcome in TB and HIV coinfection patients in this study could be related to pill burden, increase in adverse effect, drug-to-drug interaction, and immune reconstitution inflammatory syndrome. Like TB and HIV coinfected patients unknown HIV status TB patients have also increased risk of unsuccessful treatment outcome compared to HIV negative TB patients. One study conducted in San Francisco stated that significantly large percentage of the HIV infected patients died compared to the HIV-uninfected/unknown patients [34]. The possible reason for unsuccessful treatment outcome in unknown HIV status TB patients in this study could be even if their HIV status is not tested that these patients might be HIV positive and noninitiation of HAART timely for those HIV positive TB patients is a contributory factor for unsuccessful treatment outcome. Comorbidity other than HIV may be another possible reason. The use of HAART during treatment for tuberculosis significantly protected against mortality when compared with HIV infected patients who did not receive antiretroviral medications or who received regimens other than HAART [34]. Similar study stated that HIV infections without the use of ART were a factor that reduced the probability of cure [15]. HIV infected patients who received HAART during tuberculosis treatment converted their sputum smears and cultures into negative significantly faster than those not treated with HAART [34]. Another study in South India showed that noninitiation of ART significantly associated with unfavorable outcome [30].

6. Conclusions

High proportion of unsuccessful treatment outcome was documented in this study. Moreover, the following risk factors were identified as predictors of unsuccessful treatment outcome: body weight at initiation of anti-TB treatment (30–39.9 kg), smear negative PTB, EPTB, retreatment cases, HIV positive TB patients, and unknown HIV status TB patients. Based on the findings of this study, we recommend that emphasis has to be given for patients with high risk of unsuccessful treatment outcome and targeted interventions should be carried out. Furthermore the fate of transfer-out patients is not known; therefore we recommend further study on these patients.

Ethical Approval

Letter of ethical clearance was obtained from Research Ethics Committee of Jimma University. The patient data were accessed upon the approval of clinical director of UoGTH. Confidentiality was ensured during the data collection; thus name and address of the patient were not recorded in the data collection checklist.

Competing Interests

The authors declare that they have no competing interests.

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