ARAŞTIRMA/ORIGINAL ARTICLE

Gülhane Tıp Derg 2015;57: 397-407

doi: 10.5455/gulhane. 161306

Treatment outcomes and associated factors among tuberculosis patients in Southwest Ethiopia

Tigist Abebe (*), Mulugeta Tarekegn Angamo (**)

SUMMARY

The aim of this study is to assess treatment outcome and associated factors among tuberculosis patients in Southwest Ethiopia. A five year general retrospective cohort was employed. Data were collected from patients' follow up record and analyzed using SPSS version 16.0(Chicago: SPSS Inc., 2007). P-value 0.05 was considered statistically significant. In the multivariate logistic regression model, age range of (35-44.9 years (AOR=6.5, 95% CI: 3.2-13.4),45-54.9 years (AOR=12.4,95% CI: 5.9-26.2),55-64.9 years (AOR=26.9, 95% CI:11.3-64.2) and ≥65 years (AOR=25.93, 95% CI: 6.9-98.3); male gender (AOR=2.9, 95% CI: 1.9-4.5); rural residence (AOR=3.07, 95% CI: 2.08-4.53);being at prison(AOR=2.67,95% CI: 1.11-6.37);retreatment with anti-tuberculosis medications (AOR=1.9, 95% CI: 1.25-2.89);smear negative tuberculosis (AOR=6.7,95% CI: 4.2-10.7); extra-pulmonary tuberculosis (AOR=5.2, 95% CI: 3.1- 8.7); TB-HIV co-infected patients without co-trimoxazole preventive therapy (AOR=58.6, 95% CI: 6.7-507.8); TB-HIV co-infected patients without antiretroviral treatment(AOR=10.5, 95% CI: 1.4-77.5) were identified as independent risk factors for poor treatment outcomes in the current study. Treatment outcome among tuberculosis patients was satisfactory in the study area. Male gender, age greater than 35 years, smear negative and extra-pulmonary tuberculosis, retreatment with anti-tuberculosis medications, rural residence, being at prison, TB-HIV co-infection without co-trimoxazole preventive therapy and antiretroviral therapy were known to be independent predictors of poor treatment outcomes.

Key words: *Tuberculosis, Treatment outcomes, Associated factors, Southwest Ethiopia*

* St. Peter's Tuberculosis Specialized Hospital.
** Jimma university, Department of pharmacy

Ayrı Basım İsteği: Mulugeta Tarekegn Angamo
Jimma university, Department of pharmacy
e-mail: mulugeta.tarekegn@ju.edu.et

Makalenin Geliş Tarihi: Jun 04, 2014 • Kabul Tarihi: Jul 02, 2014 • Çevrim İçi Basım Tarihi:30 Aralık 2015

Introduction

Tuberculosis, which is one of the oldest diseases known to affect humans and a major cause of illness and death worldwide, especially in Asia and Africa (1). The African region has 24% of the world's cases and the highest rates of cases and deaths per capital(2).In Sub Saharan Africa,it was estimated that a single TB patient with active disease if not treated can infect on average 10-15 people every year (3).

TB is estimated to cause at least three million deaths per year worldwide (1).WHO has published a global report on TB every year since 1997 and the main aim of the report is to provide a comprehensive and up-to-date assessment of the TB epidemic and progress made in prevention, care and control of the disease at global, regional and country level(2).

The 2012 global tuberculosis report indicated that tuberculosis remains a major global health problem. It causes ill-health among millions of people each year and ranks as the second leading cause of death from an infectious disease worldwide, in particular after the human immunodeficiency virus (HIV). The latest estimates included in this report are that there were almost 9 million new cases in 2011 and 1.4 million TB deaths (990,000 among HIV negative people and 430,000 HIV-co-infected patients). This is despite the availability of treatment that will cure most cases of TB. Short-course regimens of first-line drugs that can cure around 90% of cases have been available since the 1980s(2).

TB burden in Africa showed that 12 out of the 15 countries with the highest estimated TB incidence rates per capital are in Africa. In 2007, TB notifications from the African region accounted for 30% of all notified cases in the world. In the same year, 9 million new cases of TB were diagnosed worldwide, and 1.8 million people died due to TB (3,4).

Many factors have been linked to anti-tuberculosis treatment discontinuation in sub-Saharan Africa, including infrequent bacilloscopic monitoring, transfer of patients across health service units, lack of family support, side effects of medications, patient misinformation and healthcare system factors such as distant place, inadequate laboratory equipment and reagents, and insufficient health education programs(5).Demographic factors, social factors, lifestyle factors, and clinical factors were reported to be the predictors of death due to TB among people co-infected with HIV and those infected with TB only. Depletion of CD4+ cells in HIV-infected persons increases the risk of both primary and reactivation tuberculosis. HIV-positive people infected with TB are fifty times more likely to develop active TB in their lifetime than people who are HIV-negative(6).

Despite the recent progress of global efforts, tuberculosis is still one of the leading causes of morbidity and mortality worldwide, and remains as a major public health burden in many developing countries (7). Patient default from treatment is one of the most important problems in TB control, tuberculosis treatment defaulters, especially those who are smear positive, propagate ongoing community transmission and promote the development and acquisition of drug-resistant TB strains resulting in a higher number of TB cases(8).

In many industrialized countries with good treatment facilities and a secured supply of drugs free of charge for patients, treatment results have not reached the targets set by WHO (9).The global burden of TB is highest in the Sub-Saharan Africa region and this can be attributed to the high prevalence of human immunodeficiency virus infection (HIV) which is known to increase the risk of developing TB (10).

HIV status played an important role in TB treatment outcomes. A retrospective cohort study conducted in Brazil from 2003-2008 on the outcomes of TB treatment with HIV Status showed that treatment outcomes were best for those with HIV negative cases and worst for those known HIV positive patients (cure rate of 85.7% and 55.7% respectively). Risk of having an unfavorable outcome (all outcomes except cure) was 3.09 times higher for those HIV positive compared with those HIV negative. The risk of death and default also increased with HIV positivity (11).Similar study showed that HIV status played an important role in TB treatment outcomes (12-13).

In the study conducted in Southern region of Ethiopia by Muñoz-Sellart et.al (2010) on the factors associated with poor Tuberculosis treatment outcome, 16.7% of the patients had poor treatment outcomes, 6.9% of them were transferred to other districts and significant minority (1.5%) were discontinued treatment during the first initiation phase. Of the patients with poor treatment outcome, 60.9% were defaulters, 36.9% died and 2.2% had treatment failure (14).on the contrary, the study in Tigray region by Berheet.al.in 2012 evaluated 401 smear-positive pulmonary tuberculosis patients, whom10.8% of the patients experienced unsuccessful treatment outcomes. Of the patients with unsuccessful treatment outcome, 3.7% had treatment failure, 3.2% had defaulted and 3.9% had died (15).

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 (after deliveries and malaria), and the second cause of death in Ethiopia, after malaria(16).According to the WHO Global TB report 2011, Ethiopia ranks 8th in the list of 22 high burden countries, and 3rd in Africa, with an estimated prevalence of all forms of TB in 394 per 100,000 populations (17).Treatment success measured by a standardized process of treatment outcome monitoring is one of the pillars of TB control. The most important intervention for the control of TB is effective treatment of infectious cases. Failure to complete treatment poses a significant public health risk through disease reactivation, increased transmission, and development of drug-resistance (18).

Therefore, there has been limited research into this phenomenon in the current study area, and investigation is required to determine the underlying factors for poor tuberculosis treatment outcome so that implementation measures might be required for addressing it. Thus, the primary aim of this study is to assess patients' treatment outcomes of tuberculosis and identifying risk factors related to poor treatment outcomes of tuberculosis patients.

Method and Participants

The study was conducted at Jimma University Specialized Hospital and Omonada training health center, Southwest Ethiopia. The hospital and health center possess basic facilities for tuberculosis treatment and serves surrounding populations close to 15 million. The data were collected from March 03 to April 7/2013.

Health facility based general retrospective cohort study among TB patients treated from September 2008 to august 2012 was conducted.

All Tuberculosis patients treated at Jimma University Specialized Hospital and Omonada training health center between 1st September 2008 to August 31st 2012 and who were under regular follow up in the TB clinic and had treatment outcome of tuberculosis and who fulfill the inclusion criteria were included.

All tuberculosis patients who were registered on TB patient's standard registration book, who had treatment outcomes result (cured completed, defaulted, transferred out, died) in the follow up periods were used as an inclusion criteria, whereas Patients' data that had not full information on treatment outcomes and illegible records were excluded from the study.

The dependent Variable in this case is treatment outcomes of tuberculosis. In the current study, those patients who were cured and completed the treatment were categorized as successfully treated while those who default the treatment, died, and having treatment failure record were classified as unsuccessfully treated. However, as per the WHO recommendation, we did not include transfer out cases in the analysis of the logistic regression as their outcome is not yet known. The independent Variables include Socio-demographic and anthropometric factors (Age ,Sex, Body Weight, Residence); Type of TB (Smear positive Pulmonary TB, Smear negative Pulmonary TB, Extra-pulmonary TB); Category of patient (Newly treated, Re-treated patients); Co-morbidities (e.g. HIV), concomitant medications (CPT and ART).

Data was collected through medical record reviews of TB patients' using checklist from TB clinic. The content of the checklist include socio-demographic characteristics, HIV status and respective medication, patient category and tuberculosis type. In order to assure the quality of data, the following measures were undertaken:-Pre-test was done before 3 days of the research conduction and accordingly modifications were made. The data collectors were trained for 2 days on the data collection format and techniques of data retrieval. The principal investigators and supervisor strictly monitored data collectors daily to assure the completeness of filled formats. During entry into the computer, data cleaning were performed.

Data were coded and then checked for its completeness and consistency. Then entered and analyzed using SPSS for windows version 16.0 statistical software program (Chicago: SPSS Inc., 2007). A descriptive analysis was conducted to check for outliers, consistencies and to identify missed values

for independent variables. Bivariate analysis was employed to see the association between independent variables and treatment outcomes. To control the effect of confounding factors or to determine independently associated variables, each variables that are statistically significant at p–value < 0.25 in bivariate analysis was entered in to backward stepwise multiple logistic regression model as the independent variable. P < 0.05 was considered as statistically significant for all the independent variables in the final model.

Ethical clearance to carry out this study was obtained from institution review board, Jimma University (Ref. No. RPGC /148/2013). The patient data from medical charts were accessed upon the approval of the research proposal by clinical director of Jimma University specialized hospital. Confidentiality was secured during the data collection, thus name and address of the patient was not recorded in the data collection format.

The following Definitions of terms were used in this study: Cured: a patient who was initially sputum smear-positive and who was sputum smear-negative in the last month of treatment and on at least one previous occasion. Completed treatment: a patient who completed treatment but did not meet the criteria for cure or failure. This definition applies to sputum smear-positive and sputum smear-negative patients with pulmonary TB and to patients with extrapulmonary disease. Chronic (C): A TB patient who remains smear-positive after completing a retreatment regimen. Died: a patient who died from any cause during treatment. Defaulted: a patient whose treatment was interrupted for 2 consecutive months or more. Extra-pulmonary TB (EPTB): This included tuberculosis of organs other than the lungs, such as lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges, etc. Failed: a patient who was initially sputum smear-positive and who remained sputum smear positive at month 5 or later during treatment. New case (N): A patient who never had treatment for TB, or has been on previous anti-TB treatment for less than four weeks. Not evaluated: a patient whose treatment outcome is not known. Other (O): A patient who does not fit in any of the above mentioned categories. Return after default (D): A patient previously recorded as defaulted from treatment and returns to the health facility with smear-positive sputum. Smear-positive Pulmonary TB: 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, and chest radiographic abnormalities consistent with active pulmonary TB. Smear-negative pulmonary TB: 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. 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. Transfer out (T): A patient who started treatment in one treatment unit and is transferred to another treatment unit to continue treatment. Successfully treated: a patient who was cured or who completed treatment.

According to WHO criteria (2), treatment outcomes were categorized into: Successful 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. Unsuccessful outcome or Poor 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 as per this study.

Results

1. Socio-demographic and clinical characteristics of TB patients

A total of 2107 patients were treated for tuberculosis in Jimma University Specialized Hospital and Ommo-Nada Training Health Center, from September 2008 to August 31st 2012. More than half 1248 (59.2%) of the participants were males. The mean age of the participants was 29.5 + 1.31 years, ranging from 1-74 years. About one third of the participants were in the age range of 15- 24.9 year and urban dwellers were (72.3%) (Table1).

Among participants for whom disease category were documented, 1023 (48.6%), 619 (29.4%) and 465 (22.1%) of them had smear-positive, smear-negative pulmonary TB (PTB) and extrapulmonary TB (EPTB) respectively. The highest number of participants 1569 (74.5%) were from Jimma University Specialized Hospital and 1770(84%) of participants were newly treated cases. With regard to HIV status, 1175(84.2%) and 178(8.4%) of patients were HIV negative and positive respectively. Of those HIV-positive participants, 122(68.5%) and 104(58.4%) were initiated co-trimoxazole preventive therapy (CPT) and antiretroviral therapy (ART) respectively (Table 2).

2. Treatment outcome among Tuberculosis patients

Among 1751 participants evaluated for treatment outcomes, 1135 (53.9%) and 369 (17.5%) of them completed the treatment and cured respectively. Similarly, among 1751 participants, 1504 (85.9%) of them had successful treatment outcomes as per the WHO treatment outcome evaluation criteria. Among a total of 42 deaths identified, 32 of them were males. Among 1248(59.2%) male participants, 617(49.4%) and 230 (18.4%) of them completed the treatment and transferred out respectively, while 518 (60.3%) and 157 (18.3%) of females completed the treatment and cured respectively. At both study area, higher number of participants completed the treatment; on the other hand, higher number of cured patients were from urban residence, while defaulters were from rural residence and transferred out were from prisoners. Participants who completed their treatment were relatively evenly distributed in each age group, however, transferred out were mainly from the age group of 35-44.9 years and defaulters from the age group of 45-64.9 (Table 3).

3. Unadjusted logistic regression analysis showing association of factors affecting treatment outcomes among Tuberculosis patients

Unadjusted logistic regression analysis was carried out for all patients who had outcome except transferred out cases. All of the variables (age, gender, weight, residence, patients category, TB type HIV Status, CPT initiation for HIV positive,

Table1: Socio-demographic and anthropometric characteristics of participants in Jimma University Specialized Hospital and Ommo-Nada Training Health Center from September 1st 2008 to August 31st 2012 (n=2107).

Characteristics		JUSH and ONTHC		JUSH		ONTHC	
		Frequency	Percent	Frequency	Percent	Frequency	Percent
Sex	Male	1248	59.2	916	58.4	332	61.7
	Female	859	40.8	653	41.6	206	38.3
Age (years)	0-14.9	186	8.8	140	8.9	46	8.6
	15-24.9	681	32.3	541	34.5	140	26.0
	25-34.9	578	27.4	417	26.6	161	29.9
	35-44.9	349	16.6	255	16.3	94	17.5
	45-54.9	199	9.4	142	9.1	83	15.4
	55-64.9	88	4.2	59	3.8	3	.6
	>/= 65	26	1.2	15	1.0	11	2.0
Residence	Urban	1523	72.3	1134	72.3	389	72.3
	Rural	508	24.1	359	22.9	149	27.7
	Prison	76	3.6	76	4.8	0	0
Weight (Kg)	7-14.9	47	2.2	36	2.3	46	8.6
	15-19.9	44	2.1	33	2.1	140	26.0
	20-20.9	76	3.6	55	3.5	161	29.9
	30-39.9	135	6.4	110	7.0	94	17.5
	40-54.9	1303	61.8	975	62.1	57	10.6
	55-75	502	23.8	360	23.0	29	5.4

Table 2: Clinical characteristics of participants in Jimma University Specialized Hospital and Ommo-Nada Training Health Center from September 1st 2008 to August 31st 2012.

Characteristics		JUSH		ONTHC	
Frequency		percent	Frequency	percent	
Tuberculosis type	Smear positive	755	48.1	268	49.8
	Smear negative	460	29.3	159	29.6
	Extrapulmonary	354	22.6	111	20.6
Total		1569	100.0	538	100.0
HIV status	Positive	116	7.4	62	11.5
	Negative	1385	88.3	390	72.5
	Unknown	68	4.3	86	16.0
Total		1569	100.0	538	100.0
CPT initiated for Sero-positive TB patients	Yes	82	44.6	40	27.0
	No	34	18.5	22	14.9
	Unknown	68	37.0	86	58.1
Total		184	100.0	148	100.0
ART initiated for Sero-positive TB patients	Yes	69	37.5	35	23.6
	No	47	25.5	27	18.2
	Unknown	68	37.0	86	58.1
Total		184	100.0	148	100.0
Smear result at 2nd month for PTB positive patients	Positive	77	4.9	26	4.8
	Negative	254	16.2	85	15.8
	Not tested	1238	78.9	427	79.4
Total		1569	100.0	538	100.0
Smear result at 5th month for PTB positive patients	Positive	6	4	0	0
	Negative	268	17.1	105	19.5
	Not tested	1295	82.5	433	80.5
Total		1569	100.0	538	100.0
Smear result at 7th month for PTB positive patients	Positive	0	0	0	0
	Negative	269	17.1	105	19.5
	Not tested	1300	82.9	433	80.5
Total		1569	100.0	538	100.0

Table 3: Treatment Outcome of all TB patients by socio-demographic and clinical characteristics of participants in Jimma University Specialized Hospital and Ommo-Nada Training Health Center from September 1st 2008 to August 31st 2012

Characteristics				Cured N (%)	Completed treatment N (%)	Transferred out N (%)	Default N (%)	Failure N (%)	Death N (%)
Sex	Male			212(17.0)	617(49.4)	230(18.4)	128(10.3)	29(2.3)	32(2.6)
female		157(18.3)	518(60.3)	126(14.7)	41(4.8)	7(0.8)	10(1.1)		
Total				369(17.5)	1135(53.9)	356(17.0)	169(8.0)	36(1.7)	42(2.0)
Residence									
	Urban			289(19)	913(62)	212(13.9)	78(5.1)	19(1.2)	12(0.8)
Rural									
73(14.4)			127(25.0)	81(15.9)	17(3.3)	28(5.5)			
182(35.8)									
Prison									
7(9.2)			17(22.4)	10(13.2)	0(0.0)	2(2.6)			
40(52.6)									
Total				369(17.5)	1135(53.9)	356(17.0)	169(8.0)	36(1.7)	42(2.0)
Age group (years)									
	0-14.9			28(15.0)	95(51.1)	23(12.4)	26(14.0)	6(3.2)	8(2.3)
	15-24.9		165(24.2)	354(52.0)	148(21.7)	11(1.6)	2(0.2)	1(0.1)	
	25-34.9		135(23.4)	318(55.0)	91(15.7)	28(4.8)	4(0.7)	2(0.4)	
	35-44.9		34(9.7)	196(56.2)	50(14.3)	49(14.1)	8(2.3)	12(3.4)	
	45-54.9		6(3.0)	110(55.0)	30(15.0)	35(18.0)	7(3.5)	11(5.5)	
	55-64.9		1(1.1)	48(54.5)	11(12.5)	18(20.5)	5(5.7)	5(5.7)	
	>65		0(0.0)	14(54.0)	3(12.0)	2(8.0)	4(15.0)	3(11.0)	
Total				369(17.5)	1135(53.9)	356(17.0)	169(8.0)	36(1.7)	42(2.0)
	Smear positive pulmonary TB			369(36.0)	484(47.0)	128(13.0)	31(3.0)	7(0.7)	4(0.3)
TB Type	Smear negative pulmonary TB			0(0.0)	371(60.0)	128(20.6)	81(13.1)	19(3.1)	20(3.2)
	EPTB			0(0.0)	280(60.2)	100(21.5)	57(12.3)	10(2.4)	18(3.8)
Total				369(17.5)	1135(53.9)	356(17.0)	169(8.0)	36(1.7)	42(2.0)

Table 4: Bivariate logistic regression analysis and association with treatment outcome among study participants in Jimma University Specialized Hospital and Ommo-Nada Training Health from September 1st 2008 to August 31st 2012

Characteristics		Treatment outcomes		P-Value	COR	95% CI	
		Successful N (%)	Unsuccessful N (%)		Lower	Upper	
Age group (yrs)	0-14.9	123 (75.5)	40 (24.5)	<0.001	12.06	6.36	22.85
	15-24.9	519 (97.4)	14 (2.6)		1		
	25-34.9	453 (93.0)	34 (7.0)	0.002	2.78	1.47	5.25
	35-44.9	230 (77.0)	69 (23.0)	0.000	11.12	6.13	20.16
	45-54.9	116 (68.6)	53 (31.4)	0.000	16.93	9.09	31.56
	55-64.9	49 (63.6)	28 (36.4)	0.000	21.18	10.46	42.88
	=/>65	14 (60.9)	9 (39.1)	0.000	23.83	8.84	64.23
Sex	Male	829(81.4)	189(18.6)	0.000	2.65	1.94	3.62
	Female	675(92.0)	58(8.0)		1		
Weight (Kg)	7-14.9	31(70.5)	13 (29.5)	0.013	2.33	1.19	4.54
	15-19.9	32 (76.2)	10 (23.8)	0.139	1.73	0.84	3.59
	20-29.9	48 (75.0)	16 (25.0)	0.041	1.85	1.03	3.33
	30-39.9	99 (90.0)	11 (10.0)	0.141	0.62	0.32	1.17
	40-54.9	915 (84.7)	165 (15.3)		1		
	55-75	379 (92.2)	32 (7.8)	0.000	0.47	0.32	0.69
Residence	Urban	1202(91.7)	109(8.3)		1		
	Rural	255(67.0)	126(33.0)	0.000	5.45	4.08	7.28
	Prison	47(79.7)	12(20.3)	0.002	2.82	1.45	5.47
Patients Category	New	1294(89.3)	155(10.7)		1		
	Retreatment	210(69.5)	92(30.5)	0.000	3.66	2.72	4.92
TB Type	Smear positive pulmonary TB	853(95.3)	42(4.7)		1		
	Smear negative pulmonary TB	371(75.6)	120(24.4)	0.000	6.57	4.53	9.53
	EPTB	280(76.7)	85(23.3)	0.000	6.17	4.16	9.14
HIV Status	Positive	90(55.9)	71(44.1)		1		
	Negative	1317(91.0)	130(9.0)	0.000	0.13	0.09	0.18
	Unknown	97(67.8)	46(32.2)	0.033	0.60	0.38	0.96

Table 4: Bivariate logistic regression analysis and association with treatment outcome..... (Continued)

Characteristics		Treatment outcomes		P- Value	COR	95% CI	
		Unsuccessful N (%)				Upper	
Successful N (%)					Lower		
CPT initiation for HIV positive	Yes	87(77.7)	25(22.3)		1		
	No	3(6.1)	46(93.9)	0.000	53.36	15.29	186.19
ART initiation for HIV positive	Yes	76(79.2)	20(20.8)		1		
	No	14(21.5)	51(78.5)	0.000	13.84	6.41	29.89
Smear result at 2nd month for Smear positive PTB	Positive	68(74.7)	23(25.3)		1		
	Negative	323(99.7)	1(0.3)	0.000	0.01	0.001	0.07
	Not tested	462(96.2)	18(3.8)	0.000	0.12	0.06	0.22
Year of treatment	2008	356(84.0)	68(16.0)	0.000	3.16	1.84	5.44
	2009	282(80.0)	70(20.0)	0.000	4.11	2.39	7.07
	2010	237(79.8)	60(20.2)	0.000	4.19	2.41	7.29
	2011	331(91.4)	31(8.6)	0.153	1.55	0.85	2.83
	2012	298(94.3)	18(5.7)	0.000	1		
Treatment Centre	JUSH	1095(88.3)	145(11.7)	0.000	0.53	0.40	0.70
	ONTHC	409(80.3)	102(19.7)		1		

ART initiation for HIV positive, Smear result at 2nd month for Smear positive PTB, year of treatment and treatment Centre) in the bivariate logistic regression analysis were candidate for multiple logistic regressions analysis, as all of them had P-value less than 0.25. Thus, from the above variables, age, gender, weight, residence, patients category, TB type, HIV Status, CPT initiation for HIV positive, ART initiation for HIV positive, Smear result at 2nd month for Smear positive PTB, and year of treatment have significant association with treatment outcome as it is indicated by P-value of <0.05 (Table 4).

4.Adjusted logistic regression analysis showing factors independently associated with treatment outcome

Multi-variate logistic regression analysis showed that patients aged between 35-44.9, 45-54.9, 55-64.9 and ≥65 years were 6.54, 12.41, 26.97 and 25.93 times more risky to develop poor treatment outcomes compared to patients aged 15-24.9 years respectively. Being male is 2.99 times more likely to have poor treatment outcomes than females. Patients from rural residence and prisons were 3.1 and 2.7 times more likely to develop poor treatment outcomes compared to those from urban residents respectively. TB patients enrolled on retreatment were 1.9 times more likely to develop poor treatment outcomes compared to newly diagnosed and treated patients. Smear negative and EPTB patients were 6.6 and 5.2 times more likely to develop poor treatment outcomes compared to patients with smear positive TB respectively. TB patients without HIV were 0.06 times less likely to develop poor treatment outcomes compared to TB/HIV co-infected patients. Among HIV positive patients, who didn't start co-trimoxazole preventive therapy (CPT) and antiretroviral therapy (ART) were 58.6 and 10.5 times more likely have poor treatment outcome compared to patients who start CPT and ART respectively. Patients who were enrolled to TB treatment in the year 2008 and 2009 were 2.26 and 2.67 times more likely to have poor treatment outcome compared to those patients who were enrolled in 2012 (Table 5).

Discussion

Assessment of TB treatment outcomes and identifying factors responsible for poor treatment outcome is one of the major indicators for the evaluation of the performance of a national TB program.

In the current study area, treatment success rate was 85.9%, in which the WHO international target of 85 % was achieved (2). Therefore, in the current study area; the treatment was satisfactory which was explained by high rate of patients completed the treatment and also cured.

The treatment success (85.9%) of this study is higher than previous studies conducted in some parts of Ethiopia like

Table 5: Adjusted logistic regression analysis of factors that independently affect treatment outcome among tuberculosis patients in Jimma University Specialized Hospital and Ommo-Nada Training Health Center from September 1st 2008 to August 31st 2012

Characteristics		Treatment success		P-Value	AOR	95% CI	
		Unsuccessful			Lower	Upper	
Successful	N (%)	N (%)					
Age group (yrs)	0-14.9	123 (75.5)	40 (24. 5)	0.376	2.19	0.385	12.49
	15-24.9	519 (97.4)	14 (2.6)		1		
	25-34.9	453 (93.0)	34 (7.0)	0.170	1.69	0.79	3.62
	35-44.9	230 (77.0)	69 (23.0)	0.000	6.54	3.20	13.35
	45-54.9	116 (68.6)	53 (31.4)	0.000	12.41	5.88	26.19
	55-64.9	49 (63.6)	28 (36.4)	0.000	26.97	11.34	64.17
	=/>65	14 (60.9)	9 (39.1)	0.000	25.93	6.85	98.25
Sex	Male	829(81.4)	189(18.6)	0.000	2.99	1.99	4.48
	Female	675(92.0)	58(8.0)		1		
Weight (Kg)	7-14.9	31(70.5)	13 (29.5)	0.257	3.09	0.44	21.79
	15-19.9	32 (76.2)	10 (23.8)	0.059	6.55	0.93	46.02
	20-29.9	48 (75.0)	16 (25.0)	0.055	5.97	0.96	37.04
	30-39.9	99 (90.0)	11 (10.0)	0.143	1.98	0.79	4.92
	40-54.9	915 (84.7)	165 (15.3)		1		
	55-75	379 (92.2)	32 (7.8)	0.001	0.44	0.27	0.72
Residence	Urban	1202(91.7)	109(8.3)		1		
	Rural	255(67.0)	126(33.0)	0.000	3.07	2.08	4.53
	Prison	47(79.7)	12(20.3)	0.028	2.66	1.11	6.37
Patients Category	New	1294(89.3)	155(10.7)		1		
	Retreatment	210(69.5)	92(30.5)	0.003	1.90	1.25	2.89
TB Type	Smear positive PTB	853(95.3)	42(4.7)		1		
	Smear negative PTB	371(75.6)	120(24.4)	0.000	6.67	4.15	10.73
	EPTB	280(76.7)	85(23.3)	0.000	5.20	3.12	8.68
HIV Stats	Positive	90(55.9)	71(44.1)				
	Negative	1317(91.0)	130(9.0)	0.000	0.06	0.03	0.09
	Unknown	97(67.8)	46(32.2)	0.000	0.29	0.14	0.58

Table 5: Adjusted logistic regression analysis Continued....

CPT initiation for HIV-positive	Yes	87(77.7)	25(22.3)		1		
	No	3(6.1)	46(93.9)	0.000	58.58	6.76	507.84
ART initiation for HIV-positive	Yes	76(79.2)	20(20.8)		1		
	No	14(21.5)	51(78.5)	0.021	10.48	1.42	77.46
Smear result at 2nd month for Smear positive PTB	Positive	68(74.7)	23(25.3)		1		
	Negative	323(99.7)	1(0.3)	0.000	0.008	0.001	0.08
	Not tested	462(96.2)	18(3.8)	0.000	0.12	0.04	0.34
Year of treatment	2008	356(84.0)	68(16.0)	0.166	1.64	0.82	3.29
	2009	282(80.0)	70(20.0)	0.028	2.26	1.09	4.66
	2010	237(79.8)	60(20.2)	0.007	2.67	1.31	5.47
	2011	331(91.4)	31(8.6)	0.553	0.79	0.37	1.72
	2012	298(94.3)	18(5.7)		1		

Note: CPT: Cotrimoxazole prevention therapy, EPTB: Extra-pulmonary Tuberculosis, PTB: Pulmonary Tuberculosis, ART: Antiretroviral therapy

Gondar University Teaching Hospital, 29.5% (19); Felege Hiwot Referral Hospital, 26% (20); and Southern region (14), which was 74.8%. This difference might be due to improvement in patient monitoring during treatment period or change in patient awareness because of exhaustive work in prevention and control of tuberculosis program or might be statistical calculation difference as treatment success was calculated in the current study after removing those transfer out cases, however, in the Gondar University Teaching Hospital study not. However, the current treatment success is lower than the study conducted in Tigray region (89.0%) (15).The difference could be due to variation in DOT performance in the various study areas, difference in duration of study period, sample size, patient awareness about TB, health seeking behavior.

In the current study, patients with poor treatment outcome can be explained by 8% of defaulters, 2% of death and (1.7%) of treatment failure. Such results were comparatively lower than the result reported from Gondar University Teaching Hospital (19) with 18.3% of defaulters and 10.1% of deaths, and also 3.7% of treatment failure rate from Tigray region (15). Probably this indicates that patient follow up procedures and patient awareness about TB treatment was improved time to time because of involvement of all stake holders in the patient care process. Besides, there might be difference in patient and professional interaction institution to institution that might affect adherence and ultimately their outcomes.

In multivariable logistic regression model, poor treatment outcome was significantly associated with patients' age group of ≥35 years compared with the age group of 15-24.9years. This showed that as age increases the occurrence of poor TB treatment outcome out ways. These could be due to the presence of co-morbidities, fear of medication side effects as well as general physiological deteriorations, which might be accompanied by poor medication adherence. Similarly, a retrospective survey conducted in Northeastern Thailand (21) showed that the risk of treatment failure/death were significantly associated with the patients' age greater than 60 years. Other studies also showed similar reports (3, 15). Being male was also independent risk factor for poor treatment outcome in the current study. Similar findings were reported from other studies (21, 22, 23).

Weight (at initiation of TB treatment) greater than 55 Kg was significantly associated with successful treatment outcomes as compared to those less than 54.9 Kg. As body weight increases, the patients' general conditions and pharmacokinetic profile also changes secondary to treatment, which was one of the success indicators. Even though there is difference in weight classification, similar results were reported from the study conducted in Addis Ababa (24).

Patients on retreatment had poor outcomes compared to those newly diagnosed and treated cases. As the patients were exposed to anti-TB medication frequently, sub-optimal therapy and drug resistance might occur. Besides, patients' adherence might also be affected negatively. Similar findings also reported that re-treatment was significantly associated with poor outcome treatment (22, 24, 25).

Being at rural residence and prison was significantly associated with poor treatment outcome as higher number of defaulters were from rural residence and higher number of transferred out cases were from prisoned patients when compared to patients who lived in urban areas. This variation might be due to low DOT performance, inadequate health seeking behavior, stigma towards TB and the long distance between their homes and the treatment center. The above probable reason could be explained in line with one study report from rural community of Southwest Ethiopia (26) which showed that there was little knowledge about TB transmission and prevention. On the other hand, the study conducted among prisoners in Eastern Ethiopia (27) reveals that prisoners have misconceptions about the causes, control, prevention and treatment of TB. Close monitoring and health education for rural residence and prisoned patients is mandatory in order to improve such misconception and improve health seeking behavior and medication adherence, which were core activities for treatment success.

In the current study, the type of tuberculosis was associated with poor treatment outcomes. Smear negative and extra-pulmonary TB were significantly associated with poor treatment outcomes compared to smear positive PTB patients. For example, smear negative and EPTB patients were 6.6 and 5.2 times more likely to develop poor treatment outcomes compared to patients with smear positive TB, respectively. This

is probably due to low rate of definite diagnosis and as a result delays to start treatment. Besides, monitoring of treatment outcome among smear-negative and extra pulmonary TB is using only clinical condition of the patient but smear-positive pulmonary TB patients are by testing sputum result at 2nd , 5th and 7th in addition to clinical progression of the patients, thus, easy to define the patient condition in the current study set up (19, 20, 22).

The current study showed that HIV-negative TB patients have good treatment outcomes compared to HIV-positive TB patients. Being TB patients alone might be with low pill burden, minimum medication related adverse effects, mild clinically significant drug-drug interactions and good immunity compared to TB/HIV co-infected patients. This is similar with other published reports, in which TB/HIV co-infection was significantly associated with poor treatment outcomes (13, 25). The problem of TB is worse by the concurrent infection with HIV. It is estimated that 50% of TB patients are co-infected with HIV (6). Patients with HIV and TB are likely to face more challenges because they have to get HIV care in addition to the TB care. This may lead to poor adherence among these patients (7).

In this study, sero-positive TB patients who were initiated antiretroviral therapy timely have good treatment outcomes. In the contrary, TB- HIV co-infection without the use of ART resulted in poor treatment outcomes (13, 28). HIV-infected patients who received ART during tuberculosis treatment converted their sputum smears and cultures to negative significantly faster than those not treated with ART (11).

The treatment success rate of TB from 2008 to 2012 become improved subsequently, which is explained as patients who were enrolled to TB treatment in 2008 and 2009 enrolment years were more likely to have poor treatment outcomes compared to patients who were enrolled to treatment in 2012 enrolment years. This difference might be due to improvement in patient awareness about TB transmission and treatment as a result of health education and promotion, health extension workers' involvement in the community mobilizations and improvements in DOT performance in the subsequent year of treatment. Similar results were reported from Southern Ethiopia (14) which showed that introduction and expansion of DOT significantly increased treatment success rate and decreased in defaulters and failure rates.

Conclusions

Treatment outcome among tuberculosis patients was satisfactory in the study area. Male gender, age greater than 35 years, smear negative and extra-pulmonary tuberculosis, retreatment with anti-tuberculosis medications, rural residence, being at prison, TB-HIV co-infection without co-trimoxazole preventive therapy and antiretroviral therapy, and treatment enrollment years were known to be independent predictors of poor treatment outcomes among tuberculosis patients in the study area.

References

1. World Health Organization. WHO report. Global tuberculosis control: epidemiology, strategy, financing. WHO/HTM/ TB/2008.393. Geneva, Switzerland: WHO, 2008.
2. World Health Organization. WHO report. Global tuberculosis control: epidemiology, strategy, financing. WHO/HTM/ TB//2012.6.). Geneva, Switzerland: WHO, 2012.
3. Castelnuovo B. A review of compliance to anti tuberculosis treatment and risk factors for defaulting treatment in Sub Saharan Africa. African health sciences. 2010;10(4):320-4.
4. Collins BN. Assessing the outcome of tuberculosis treatment in the Cameroon Baptist convention health board tuberculosis treatment centers. Sweden: Umea; 2011; 27-29.
5. Pefura Yone EW, Kengne AP, Kuaban C. Incidence, time and determinants of tuberculosis treatment default in Yaounde, Cameroon: a retrospective hospital register-based cohort study. BMJ Open. 2011;1(2):e000289.
6. Amuha, M. G. Kutyabami, P. Kitutu, F. E. Odoi-Adome, R. Kalyango, N. J. Non-adherence to anti-TB drugs among TB/HIV co-infected patients in Mbarara Hospital Uganda: prevalence and associated factors. African health sciences. 2009;9 (1):8-15.
7. Weiguo Xu, Wei Lu, Yang Zhou, Limei Zhu, Hongbing Shen, Wang. J. Adherence to anti-tuberculosis treatment among pulmonary tuberculosis patients: a qualitative and quantitative study. BMC Health. 2009;9(169).
8. Bronner LE, Podewils LJ, Peters A, Somnath P, Nshuti L, Van der Walt M, et al. Impact of community tracer teams on treatment outcomes among tuberculosis patients in South Africa. BMC Public Health. 2012;12(621).
9. Vasankari T, Holmstrom P, Ollgren J, Liippo K, Kokki M, Ruutu P. Risk factors for poor tuberculosis treatment outcome in Finland: a cohort study. BMC Public Health. 2007;7:291.
10. Takarinda KC, Harries AD, Srinath S, Mutasa-Apollo T, Sandy C, Mugurungi O. Treatment outcomes of adult patients with recurrent tuberculosis in relation to HIV status in Zimbabwe: a retrospective record review. BMC Public Health. 2012;12(124).
11. Sanchez M, Bartholomay P, Arakaki-Sanchez D, Enarson D, Bissell K, Barreira D, et al. Outcomes of TB treatment by HIV status in national recording systems in Brazil, 2003-2008. Plos One. 2012;7(3):e33129.
12. Gloria Akosua Ansa JDW, Kamran S,Xiaolin W. Assessing the impact of TB/HIV services integration on TB treatment outcomes and their relevance in TB/HIV monitoring in Ghana. BioMed Central. 2012;122-31.
13. Tansuphasawadikul S, Saito W, Kim J, Phonrat B, Dhitavat J, Chamnachanan S, et al. Outcomes in HIV-infected patients on antiretroviral therapy with tuberculosis. Southeast Asian J Trop Med Public Health. 2007;38(6):1053-60.
14. Munoz-Sellart M, Cuevas LE, Tumato M, Merid Y, Yassin MA. Factors associated with poor tuberculosis treatment outcome in the Southern Region of Ethiopia. Int J Tuberc Lung Dis. 2010;14(8):973-9.
15. Berhe G, Enquselassie F, Aseffa A. Treatment outcome of smear-positive pulmonary tuberculosis patients in

Tigray Region, Northern Ethiopia. BMC Public Health. 2012;12:537.

16. Ministry of Health of Ethiopia (MOH): Tuberculosis, Leprosy and TB/HIV Prevention and Control Programme Manual. Addis Ababa: MOH 4th edition. 2008,29-33.
17. World Health Organization. WHO report. Global tuberculosis control: epidemiology, strategy, financing. WHO/HTM/ TB/2011.16. Geneva, Switzerland: WHO, 2011.
18. Day M , Middlemiss A, Thorpe J , Okereke E. What really happens to tuberculosis patients classified as lost to follow-up in West Yorkshire. 2012:1-6.
19. Tessema B, Muche A, Bekele A, Reissig D, Emmrich F, Sack U. Treatment outcome of tuberculosis patients at Gondar University Teaching Hospital, Northwest Ethiopia. A five year retrospective study. BMC Public Health. 2009;9:371.
20. Fantahun B, Berhanu A, Tewodros D, Belay A, Woghata T, Belay T, et al. A retrospective study on the outcomes of tuberculosis treatment in Felege Hiwot Referral Hospital, Northwest Ethiopia. International Journal of Medicine and Medical Sciences.2013; 5(2) 85-91.
21. Anunnatsiri S, Chetchotisakd P, Wanke C. Factors associated with treatment outcomes in pulmonary tuberculosis in northeastern Thailand. Southeast Asian J Trop Med Public Health. 2005;36(2):324-30.
22. Fatiregun AA, Ojo AS, Bamgboye AE. Treatment outcomes among pulmonary tuberculosis patients at treatment centers in Ibadan, Nigeria. Ann Afr Med. 2009;8(2):100-4.
23. Shargie EB, Lindtjorn B. DOT improves treatment outcomes and service coverage for tuberculosis in South Ethiopia: a retrospective trend analysis. BMC Public Health. 2005; 5(62).
24. Belete G, Gobena A, Sibhatu B, Girmay M. Mortality and associated risk factors in a cohort of tuberculosis patients treated under DOTS programme in Addis Ababa, Ethiopia. BMC Infectious Vijay S, Kumar P, Chauhan LS, Rao SV, Vaidyanathan P. Treatment outcome and mortality at one and half year follow-up of HIV infected TB patients under TB control programme in a district of South India. Plosone. 2011;6(7):e21008.
25. Abebe G, Deribew A, Apers L, Woldemichael K, Shiffa J, Tesfaye M, et al. Knowledge, health seeking behavior and perceived stigma towards tuberculosis among tuberculosis suspects in a rural community in southwest Ethiopia. Plos one. 2010;5(10):e13339.
26. Abebe DS, Biffa D, Bjune G, Ameni G, Abebe F. Assessment of knowledge and practice about tuberculosis among eastern Ethiopian prisoners. Int J Tuberc lung Dis. 2011; 15(2):228-33.
27. Manosuthi W, Chottanapand S, Thongyen S, Chaovavanich A, Sungkanuparph S. Survival rate and risk factors of mortality among HIV/TB-coinfected patients with and without antiretroviral therapy. J Acquir Immune Defic Syndr. 2006;43(1):42-6.

. List of Acronyms and Abbreviation

AFB:	Acid-Fast Bacilli
ART:	Antiretroviral Therapy
CPT:	Co-trimoxazole Preventive Therapy
DOT:	Directly observed treatment
DR-TB:	Drug-resistant Tuberculosis
DST:	Drug Sensitivity Test
EPTB:	Extra-pulmonary Tuberculosis
FMOH:	Federal Ministry of Health
HIV:	Human Immunodeficiency Virus
JUSH:	Jimma University Specialized Hospital
MDR-TB:	Multidrug-resistant tuberculosis
NTP:	National Tuberculosis Control Programme
ONTHC:	Ommo-Nada Training Health Center
PTB:	Pulmonary Tuberculosis
TB:	Tuberculosis
TB/HIV:	TB and HIV Co-infection
WHO:	World Health Organization