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Treatment Outcome of Tuberculosis Patients and Associated Risk Factors at Dessie and Woldiya Town Health Institutions, Northeast Ethiopia: A Retrospective Cross Sectional Study

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Abstract

Background: Ethiopia introduced directly observed therapy short-course (DOTS) strategy for TB in 1995; reaching its full coverage in 2005. Treatment success rate (TSR) was 84% in 2009 and dropped to 83% in 2010. Despite the progress made in tuberculosis control throughout Ethiopia, risk factors leading to poor treatment outcome have not been assessed in Dessie and Woldiya town health institutions. Therefore, this study aimed to determine treatment outcome of TB patients and risk factors for poor treatment outcome in Dessie and Woldiya town health institutions, Northeast Ethiopia.

Methods: A three years (September 2010 to August 2012) retrospective study was conducted from medical records of 1511 TB patients at Dessie and Woldiya town health institutions. Data were collected using a questionnaire that consists of patients' age, sex, weight, TB history, TB type, HIV status, availability of supporter, availability of mobile number, drug type and TB treatment outcomes in treatment cards and TB logbook from February, 2013 to April, 2013. Pearson chi-square test and logistic regression were employed for data analysis.

Results: From 1511 TB patients, 1,331(88.1%) were successfully treated, 123 (8.1%) died, 45 (3.0%) defaulted and 12 (0.8%) failed from treatment. In terms of TB type, 57.4% were pulmonary TB, 40.5% were extra pulmonary TB and 2.1% were both smear negative pulmonary and extra pulmonary TB. In addition, TB-HIV co-infection rate was 42.9% in 2010, with significant reduction in 2012 (33.7%) ($P<0.01$). Multivariate logistic regression showed the odds of successful treatment outcome was higher among females (AOR=2.09, 95% CI: 1.27-3.45), new TB patients (AOR=10.52, 95% CI: 3.96-27.93), patients with unknown HIV status (AOR=7.16, 95% CI; 1.56-32.75) and HIV negative (AOR=1.80, 95% CI: 1.09-2.99) when compared with the respective comparison groups. The odds of defaulting was higher among TB patients started treatment in Dessie Health Center (AOR=4.09, 95% CI: 1.33-12.60) and combined smear negative pulmonary and extra pulmonary TB disease (AOR=8.87, 95% CI: 2.53-31.02) compared with the respective comparison groups.

Conclusions: Treatment success rate of TB patients in this study was very encouraging for TB control through DOTS strategy. Nevertheless, TB patients with HIV/AIDS, combined smear negative pulmonary and extra pulmonary TB and with previous history of TB were found to be at risk of poor treatment outcome. Correspondingly, male TB patients and those who attend health centers should be encouraged for successful treatment outcome. Generally, to reduce poor treatment outcome, patients should be strictly followed by health extension workers or trained community health workers in Dessie and Woldiya town health institutions.

Keywords: Tuberculosis patients; Treatment outcomes; Dessie and Woldiya towns; Northeast Ethiopia

Abbreviations

AOR: Adjusted Odds Ratio; ART: Antiretroviral Therapy; CDR: Case Detection Rate; CI: Confidence Interval; COR: Crude Odds Ratio; CPT: Co-Trimoxazole Preventive Therapy; DOTS: Directly Observed Therapy Short-course; FMOH: Ethiopian Federal Ministry of Health; HEWs: Health Extension Workers; HIV: Human Immunodeficiency Virus; IPT: Isoniazid Preventive Therapy; MDGs: Millennium Development Goals; MDR: Multidrug-Resistant TB; NTLCP: National TB and Leprosy Control Program; NTPs: National TB control Programmes; SPSS: Statistical Package for Social Sciences; TB HBCs: TB High Burden Countries; TB/HIV: Tuberculosis/Human Immunodeficiency Virus; TB: Tuberculosis; TSR: Treatment Success Rate; WHO: World Health Organization; XDR TB: Extensively drug-resistant TB

Background

Tuberculosis (TB) causes ill-health among millions of people each year and ranks as the second leading cause of death from infectious diseases worldwide, after the human immunodeficiency virus (HIV). In 2011, there were an estimated of 125 cases of TB and 20 deaths per 100,000 populations globally. Specifically, 82% of incident cases of TB were reported from the 22 high burden countries (HBCs) [1].

Ethiopia ranked 9th among the world's 22 TB HBCs with 220, 000 incident cases (258 incident cases per 100,000 populations) [1]. Besides, the 2010/11 national population based TB prevalence survey reported prevalence of 108 and 63 per 100,000 populations for smear positive TB among adults and all age groups, respectively and a prevalence of 240/100,000 populations for all forms of TB [2]. The Ethiopian Federal Ministry of Health (FMOH) hospital statistics data showed 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 next to malaria [3].

Directly observed therapy short-course (DOTS) has been used as internationally recommended TB control strategy since 1994 by World Health Organization (WHO) under stop TB strategy components to achieve the TB related millennium development goals (MDGs) by 2015 [4]. The specific targets of DOTS detailed in the updated Global Plan (2011-2015) were to achieve a case detection rate (CDR) of 84% (for all cases and smear-positive cases specifically) and a Treatment Success Rate (TSR) of 87% by 2015 [5]. Globally, in 2010, TSR for new cases of sputum smear-positive pulmonary TB was reached the target of 87% set for 2015 and 88% for 22 TB HBCs. In Ethiopia, the National TB and Leprosy Control Program (NTLCP) introduced the DOTS strategy in 1995 and despite reaching full coverage in 2005, treatment success rate was 84% in 2009 and dropped to 83% in 2010 [1].

Continued scale-up of early diagnosis and proper treatment in line with the "stop TB strategy" by involving the community and engaging all care providers has paramount importance in the control and elimination of TB [6].

Treatment success in particular and quality of TB control in general is highly relied on the risk factors. There are several influential risk factors for treatment outcome of TB patients which have been identified so far. The following are among the recognized factors that lead to poor treatment outcome of the patients: male sex [7-13], old age [7,8,14-17], unemployment [14,18], distance or travel cost to a healthcare facility [10,18-20], being on retreatment [7,14,16,21-24], TB/HIV co infection [9,10,22,25-27], side effects of anti-TB drugs [10,28-31], family size greater than 5 persons [14], having smear-negative pulmonary TB [7,8]. In addition, illiteracy [20,30,32], low educational level [27,31], substance abuse [10,27,29,30,32,33], previous history of treatment default [19,23,27,29], inadequate/poor knowledge about TB [12,23,30], herbal medication use [23], other co-morbidities (excluding HIV) [27], subsequent hospitalization [29], are risk factors that lead the patient to be poor in treatment outcome (non-adhered, defaulted and died).

Despite the high DOTS coverage and the progress made in TB control throughout Ethiopia, treatment outcome of TB patients and associated risk factors leading to poor treatment outcome has not been assessed so far in Desssie and Woldiya town health institutions. Hence, this study aimed to determine treatment outcome of TB patients and associated risk factors for poor treatment outcome in Dessie and Woldiya town governmental health institutions, Northeast Ethiopia.

Materials and Methods

Study design and data collection

A record based retrospective study undertook by incorporating data from TB logbook and TB treatment cards at governmental health institutions in Dessie and Woldiya towns from September, 2010 to August, 2012. The study carried out in purposely selected health institutions based on the high number of TB patients flow in the health settings: Dessie referral hospital, Dessie health center and Bambuwuha health center at Dessie town and Woldiya general hospital and Woldiya health center at Woldiya town. Information registered in TB logbook and treatment cards contained the following variables: age, sex, weight, TB history (new or previous history of TB), TB type, HIV status, supporter, mobile number, drug regimen prescribed and treatment outcome of the patient.

All TB patients who were registered followed and completed their treatment at the DOTS logbook from September, 2010 to August, 2012 in the selected health institutions. However, TB patients who transferred out to other health institutions and had incomplete data were not enrolled to this study.

Data were collected using a questionnaire that consists of variables recorded in treatment cards and TB logbook from February 2013 to April, 2013. The data were collected by three and two nurses (Bachelor of Science) who work in TB clinic in Woldiya general hospital and Woldiya health center, respectively and three, four and two nurses (Bachelor of Science) who work in TB clinic in Dessie referral hospital, Dessie health center and Bambuwuha health center, respectively.

Data quality was assured by employing pre-test for the questionnaire and administering ample training for data collectors how they collect the data. In addition, there was a close supervision of data collectors by researchers. Moreover, data were checked for completeness and consistency before and after data entry.

Statistical analysis

The collected data were coded, double entered and cleaned through Epidata version 3.1[a] for Windows. Statistical package for social sciences (SPSS) version 16.0 for Windows and Stata version 11.0 were used for analysis. Data was cleaned and edited by simple frequencies and cross tabulation before analysis.

Descriptive statistics with frequencies and cross tabulations were used to describe patients' characteristics. Pearson chi-square test was used to compare categorical variables and two-sided p-values were calculated. Associations between the response variable, TB treatment outcomes and the potential explanatory variables were assessed using bivariate and multivariate logistic regression model. P-values of less than 0.05 were considered statistically significant. Crude odds ratio (COR) and adjusted odds ratio (AOR) with 95% confidence intervals (CI) were calculated.

Operational definitions

Patient case category/clinical case and treatment outcome definitions were based on the standard definitions of NTLCP [3] and WHO guide lines [34]. However, in case of patient case category/TB type we included a third category comprising of TB patients having both smear negative pulmonary TB and extra pulmonary TB and from treatment outcome categories, transferred out/not evaluated TB

patients were excluded. For employing logistic regression, treatment outcomes were categorized as successful (TB patients who were cured and treatment completed) and poor (TB patients who were died, failed and defaulted) treatment outcomes.

Characteristics		Treatment outcomes					Total	Pearson Chi-Square (P-value)
		Cured N (%)	Treatment completed N (%)	Defaulted N (%)	Failed N (%)	Died N (%)		
Sex	Male	151 (17.8)	598 (70.3)	26 (3.1)	8 (0.9)	67 (7.9)	850	1.4 (0.846)
	Female	107 (16.2)	475 (71.9)	19 (2.8)	4 (0.6)	56 (8.5)	661	
Age (years)	≤ 14	5 (5.5)	84 (92.3)	1 (1.1)	0	1 (1.1)	91	70.0 (P<0.01)
	15-24	93 (13.3)	273 (68.4)	8 (2)	3 (0.8)	22 (5.5)	399	
	25-34	89 (19.5)	313 (68.6)	14 (3.1)	4 (0.9)	36 (7.9)	456	
	35-44	49 (17.3)	196 (69.3)	6 (2.1)	2 (0.7)	30 (10.6)	283	
	45-54	10 (7.7)	95 (73.1)	9 (6.9)	2 (1.5)	14 (10.8)	130	
	55-64	5 (5.7)	66 (75)	4 (4.5)	1 (1.1)	12 (13.6)	88	
	≥ 65	7 (10.9)	46 (71.9)	3 (4.7)	0	8 (12.5)	64	
Tuberculosis history	Previous TB history[a]	27 (38)	27 (38)	5 (7.0)	4 (5.6)	8 (11.3)	71	57.6 (P<0.01)
	New TB cases	231 (16)	1046 (72.6)	40 (2.8)	8 (0.6)	115 (8.0)	1440	
Weight (Kgs)	<20	1 (2.3)	42 (95.5)	0	0	1 (2.3)	44	35.9 (P<0.01)
	20-39	30 (16.9)	124 (69.7)	5 (2.8)	0	19 (10.7)	178	
	40-55	183 (18.7)	671 (68.5)	24 (2.5)	10 (1.0)	91 (9.3)	979	
	>55	44 (14.2)	236 (76.1)	16 (5.2)	2 (0.6)	12 (3.9)	310	
TB type	Pulmonary TB	258 (29.8	496 (57.2)	29 (3.3)	12 (1.4)	72 (8.3)	867	2.7 (P<0.01)
	Extra pulmonary TB	0	549 (89.7)	12 (2.0)	0	51 (8.3)	612	
	Both[b]	0	28 (87.5)	4 (12.5)	0	0	32	
Pulmonary TB typec	Smear positive pulmonary TB	256 (77.6)	26 (7.9)	15 (4.5)	11 (3.3)	22 (6.7)	330	6.8 (P<0.01)
	Smear negative pulmonary TB	2 (0.4)	498 (87.5)	18 (3.2)	1 (0.2)	50 (8.8)	569	
HIV status	Positive	91 (15.6)	385 (65.9)	24 (4.1)	7 (1.2)	77 (13.2)	584	42.9 (P<0.01)
	Negative	154 (18.6)	613 (73.9)	18 (2.2%	5 (0.6)	40 (4.8)	830	
	Unknown	13 (13.4)	75 (77.3)	3 (3.1)	0	6 (6.2)	97	
Defaulting history	Yes	1 (33.3)	1 (33.3)	0	0	1 (33.3)	3	3.5 (0.475)
	No	257 (17.1)	1072 (71.1)	45 (3.0)	12 (0.8)	122 (8.1)	1508	

[a]Previous TB history represents retreatment cases (relapse, failure, defaulter), [b]both represents only combination of extra pulmonary TB and smear negative pulmonary TB; smear positive pulmonary TB and extra pulmonary TB combination is grouped under pulmonary TB, [c]the frequency distribution (n) is calculated out of 899.

Table 1: Treatment outcome of TB patients with respect to selected variables in Dessie and Woldiya town governmental health institutions, 2010-2012.

Ethical issues

Ethical clearance (Ethical reference number=04WU/13) was obtained from the review committee of College of Medicine and Health Sciences and Wollo University.

Results

General characteristics of TB patients

Treatment outcome of TB patients

From a total of 1511 TB patients analyzed, 1,331 (88.1%) were successfully treated (cured and treatment completed) despite 180 (11.9%) were not successful (failed, defaulted and died). More specifically, from the total TB patients analyzed, 1073 (71%), 258 (17.1%), 123 (8.1%), 45 (3.0%) and 12 (0.8%) were treatment completed, cured, died, defaulted and failed from treatment, respectively. Among the defaulters, 29 (64.4%) and 16 (35.6%) defaulted during the continuation and the intensive phase, respectively and from dead TB patients, the larger proportion 78 (63.4%) died during the intensive phase. Table 1 shows that the proportion of dead female TB patients 56 (8.5%) was higher compared with male dead TB patients 67 (7.9%). Furthermore, as the age of TB patients increased, the proportion of dead patients was raised from 1(1.1%) to 22 (5.5%), 36 (7.9%), 30 (10.6%), 14 (10.8%), 12 (13.6%) and 8(12.5%) in the age categories of ≤ 14, 15-24 , 25-34, 35-44, 45-54, 55-64 and ≥ 65 years, respectively.

The death rate of TB patients was decreased over the years from a rate 53 (8.9%) (September 2010-August 2010) to 40 (8.3%) (September 2011-August 2011) and to 30 (7%) (September 2012-August 2012). Similarly, the defaulter rate was decreased from (September 2010-August 2010) to (September 2011-August 2011) from a rate 25 (4.2%) to 10 (2.1%) and slightly increased to the year (September 2012-August 2012) by a rate of 10 (2.3%). The proportion of extra pulmonary TB was clearly increased from (September 2010- August 2010) to (September 2011-August 2011) from 207 (34.7%) to 217 (44.9%) and steadily decreased to the year (September 2012-August 2012) of a rate 188 (43.6%). However, in these three successive years, the proportion of all cases of TB was decreased. In addition, the prevalence rate of HIV infection among TB patients was clearly decreased in these three successive years (Table 2).

Variables		Year the patient's history was taken			Total	Pearson Chi-Square (P-value)
		September 2010 - August 2010 N (%)	September 2011 - August 2011 N (%)	September 2012 - August 2012 N (%)		
Treatment outcome	Cured	116 (19.4)	75(15.5)	67(15.6)	258 (17.1)	15.2 (0.056)
	Treatment completed	396 (66.3)	354(73.3)	323(74.9)	1,073 (71)	
	Defaulted	25 (4.2)	10 (2.1)	10 (2.3)	45 (3.0)	
	Failed	7 (1.2)	4 (0.8)	1 (0.2)	12 (0.8)	
	Died	53 (8.9)	40 (8.3)	30 (7.0)	123 (8.1)	
TB type	Pulmonary TB	384 (44.3)	248 (28.6)	235 (27.1)	867	26.6 (P < 0.01)
	Extra PTB	207 (33.8)	217 (35.5)	188 (30.7)	612	
	Both[b]	6 (18.8)	18 (56.2)	8 (25.0)	32	
	All TB cases	597 (39.5)	483 (32.0)	431 (28.5)	1511	
HIV status	Positive	256 (42.9)	183 (37.9)	145 (33.7)	584 (38.6)	11.9(0.018)
	Negative	302 (50.6)	265 (54.9)	263 (61.0)	830 (54.9)	
	Unknown	39 (6.5)	35 (7.2)	23 (5.3)	97 (6.3)	

Table 2: Trends of treatment outcome, TB type and HIV status across years among TB patients in Dessie and Woldiya town governmental health institutions, 2010-2012.

Variables		Treatment outcome		COR (95% CI)	AOR (95% CI)
		Successful N (%)	Poor N (%)		
Sex	Male	749 (88.1)	101 (11.9)	1.00	1.00
	Female	582 (88.0)	79 (12.0)	0.99(0.73-1.36)	2.09(1.27-3.45)*

Age(years)	0-14	89 (97.8)	2 (2.2)	1.00	1.00
	15-24	366 (91.7)	33 (8.3)	0.25(0.06-1.06)	0.24(0.03-2.01)
	25-34	402 (88.2)	54 (11.8)	0.17(0.04-0.67)*	0.17(0.02-1.44)
	35-44	245 (86.6)	38 (13.4)	0.15(0.03-0.61)*	0.17(0.02-1.40)
	45-54	105 (80.8)	25 (19.2)	0.09(0.02-0.41)*	0.09(0.01-0.84)*
	55-64	71 (80.7)	17 (19.3)	0.09(0.02-0.42)*	0.08(0.01-0.77)*
	65 and above	53 (82.8)	11 (17.2)	0.11(0.02-0.51)*	0.16(0.01-1.72)
Tuberculosis history	Previous TB history	54 (76.1)	17 (23.9)	1.00	1.00
	New TB cases	1277 (88.7)	163 (11.3)	2.47(1.40-4.36)*	10.52(3.96-27.93)*
HIV status	Positive	476 (81.5)	108 (18.5)	1.00	1.00
	Negative	767 (92.4)	63 (7.6)	2.76(1.98-3.85)*	1.80(1.09-2.99)*
	unknown	88 (90.7)	9 (9.3)	2.22(1.08-4.54)*	7.16(1.57-32.75)
Health institutions	Woldiya General Hospital	298 (84.7)	54 (15.3)	1.00	1.00
	Dessie Referral Hospital	175 (80.3)	43 (19.7)	0.74(0.47-1.15)	4.88(1.94-12.31)*
	Dessie Health Center	426 (90.6)	44 (9.4)	1.75(1.15-2.68)*	1.17(0.60-2.27)
	Bambuwuha Health Center	258 (89.9)	29 (10.1)	1.61(0.99-2.61)	3.02(1.46-6.27)*
	Woldiya Health Center	174 (94.6)	10 (5.4)	3.15(1.57-6.35)*	3.23(1.29-8.12)*

AOR: Adjusted Odds Ratio; COR: Crude Odds Ratio; CI: Confidence Interval. *Statistically significant values; variables: weight, type of TB and pulmonary TB type were not statistically significant during bivaraite as well as multivariate regression model.

Table 3: Crude and adjusted odds ratios for various factors that affect treatment outcome among TB patients, Dessie and Woldiya town governmental health institutions, 2010-2012.

Factors associated with treatment outcomes

As shown in Table 3, female TB patients were more likely to have successful treatment outcome than males (AOR=2.09, 95% CI: 1.27-3.45, P=0.004). In addition, TB patients in the range of 45-54 (AOR=0.09, 95% CI: 0.01-0.84, P=0.034) and 55-64 (AOR=0.08, 95% CI: 0.01-0.77, P=0.029) years had lower odds of successful treatment outcome than the reference category. Furthermore, patients that had new TB cases (AOR=10.52, 95% CI: 3.96-27.93, P<0.01) had higher odds of successful treatment outcome than that had previous TB history. On the other hand, HIV co infected TB patients had lower odds of successful treatment outcome when compared with HIV negative (AOR=1.80, 95% CI: 1.09-2.99, P=0.022) and unknown HIV status TB patients (AOR=7.16, 95% CI; 1.57-32.75, P=0.011). Institutionally, TB patients that were started treatment in Dessie Referral Hospital (AOR=4.88, 95% CI: 1.94-12.31, P=0.001), Bambuwuha Health Center (AOR=3.02, 95% CI: 1.46-6.27, P=0.003) and Woldiya Health Center (AOR=3.23, 95% CI: 1.29-8.12, P=0.013) had higher odds of successful treatment outcome than the comparison group, Woldiya General Hospital.

Having compared defaulters with non-defaulters, patients started treatment in Dessie health center (AOR=4.09, 95% CI: 1.33-12.60, P=0.014) were more prone to be defaulted than the comparison group, Woldiya general hospital whereas patients started treatment in Dessie referral hospital (AOR=0.24, 95% CI: 0.06-0.88, P=0.032) had lower odds of defaulting compared with the comparison group. In addition, TB patients that had previous TB history were more likely to be defaulters than new cases (AOR=0.21, 95% CI: 0.05-0.85, P=0.029). Furthermore, TB patients that had combined smear negative pulmonary TB and extra pulmonary TB (AOR=8.87, 95% CI: 2.53-31.02, P=0.001) had higher odds of defaulting than patients that were affected only by pulmonary TB (Table 4).

Variables		**Treatment outcome**		**COR(95% CI)**	**AOR(95% CI)**
		Non defaulters N (%)	**Defaulters N (%)**		
Health institutions	Woldiya general hospital	337(95.7)	15(4.3)	1.00	1.00
	Dessie referral hospital	215(98.6)	3(1.4)	0.31(0.09-1.10)	0.24(0.06-0.88)*

	Dessie health center	452(96.2)	18(3.8)	0.90(0.44-1.80)	4.09(1.33-12.60)*
	Bambuwuha health center	279(97.2)	8(2.8)	0.64(0.27-1.54)	0.63(0.25-1.61)
	Woldiya health center	183(99.5)	1(0.5)	0.12(0.02-0.94)*	0.22(0.03-1.74)
Tuberculosis history	Previous TB history	66(93.0)	5(7.0)	1.00	1.00
	New TB cases	1400(97.2)	40(2.8)	0.38(0.14-0.99)*	0.21(0.05-0.85)*
TB type	Pulmonary TB	838(96.7)	29(3.3)	1.00	1.00
	Extra PTB	600(98.0)	12(2.0)	0.58(0.29-1.14)	0.79(0.37-1.68)
	Both[b]	28(87.5)	4(12.5)	4.13(1.36-12.54)*	8.87(2.53-31.02)*
AOR: Adjusted Odds Ratio; COR: Crude Odds Ratio, CI: Confidence Interval. *Statistically significant values					

Table 4: Crude and adjusted odds ratios for various factors that affect defaulting rate of TB patients, Dessie and Woldiya town governmental health institutions, 2010-2012.

Discussion

Routine recording and reporting of the numbers of TB cases diagnosed and treated by national TB control programmes (NTPs) and monitoring of the outcomes of treatment was one of the five elements of TB control emphasized in the DOTS strategy, and remains one of the core elements of the stop TB strategy [34]. Hence, evaluating treatment outcome of TB patients and recognizing influential factors underpin TB control strategy. Moreover, tracing defaulters and intensified active TB case finding are the national TB control programmes (NTPs) with emphasized in the DOTS strategy to be done by health extension workers, trained community health workers or health professionals at the health care setting.

The present study revealed that the treatment success rate was 88% for all TB cases. In parallel, treatment success rates varied from 80% to 94% across the health institutions. The higher treatment success rate in this study might due to active involvement of health extension workers in the national health policy of Ethiopia. However, studies conducted for all TB cases in Southern Ethiopia 74.8% [7] and Northwest Ethiopia 29.5% [8], 80.5% [9] and 85.6% [25] showed lower treatment success rates than the present study. These differences could be due to geographical location and study period duration.

On the other hand, a recent study in northern Ethiopia 89% [10] and a community-randomized trial intervention in Southern Ethiopia 89.3% [35] showed slightly higher treatment success rate than the present study. This might be due to study design difference, proper DOTS implementation and health care setting difference.

Moreover, studies conducted in Yaoundé, Cameroon and Norway also showed TSR of 68.4% [36] and 83% [14] respectively which is lower than the present study. The difference might be geographical location, health institution setting and implementation of DOTS strategy.

In this study, a death rate of 8% is higher than default rate (3%) and failure rate (0.8%). This is due to the high prevalence of HIV in TB patients (36.8%). Previous studies in Ethiopia showed a death rate of 10.1% and default rate of 18.3% [8] and death (36.9%) and default (60.9%) [7]. The difference might be due to nature of the study population, study period duration, HIV co-infection. However, another study reported 3.9% death rate and 3.2% default rate [10] which might be due to inclusion of smear positive pulmonary TB cases.

A TB/HIV co infections rate of 36.8% was observed in this study. Previous research works reported co infections rate of 8.6% [14], 12% [19], 10.9% [25]. The difference might be due to study population difference. On the other hand, other studies reported higher co infections, 38.1% [9] and 52.1% [37] in northwest Ethiopia. The difference could be due to geographical and socioeconomic difference. In addition, studies out of Ethiopia reported co infections of 23.4% [38] and 19% [26]. TB patients in this study might have lower awareness about the synergetic effect of the two diseases.

The death rate of TB patients was decreased for three successive years from 8.9% in 2010 and 7% in 2012. Similarly, one study showed reduction of death rate for five successive years [8]. This is due to the enhanced effort for the implementation of collaborative TB/HIV activities (HIV testing of TB patients, provision of ART and CPT to TB patients living with HIV, HIV prevention services for TB patients, intensified TB case-finding among people living with HIV, IPT for people living with HIV who do not have active TB, and infection control in health care and congregate settings) [34].

Correspondingly, defaulting rate was also decreased across the years from 4.2% in 2010 to 2.3% in 2012 which showed a similar trend with a study conducted in northwest Ethiopia [25]. This could be due to increased commitment and involvement of healthcare workers and health extension workers on retrieval of defaulters, efficient implementation of DOTS strategy and access and availability of healthcare facilities near to patients' home in recent years. However, a previous study in Northwest Ethiopia showed increment of defaulting rate across the years [8]. The difference might be due to the date the study was conducted.

Moreover, defaulting of TB patients started treatment in Dessie Health Center was four times higher than in Woldiya General Hospital. However, TB patients started treatment in Dessie Referral Hospital had five times lower defaulting than in Woldiya General Hospital. This could be due to the higher proportion of HIV co infected TB patients in Dessie Health Center but not in Dessie Referral Hospital compared with Woldiya General Hospital. HIV co infection has been identified as risk factor for defaulting of TB patients

[9,10,22,25-27]. In addition, it might be due to workload of HCWs and number of patients that took from the health institutions.

In this study, trend of TB was decreased from 39.5% in 2010 to 28.5% in 2012. However, a study conducted in Northwest Ethiopia showed increment of TB cases across the years [9]. The difference could be due to low HIV prevalence in present study.

This study also showed that the prevalence rate of HIV among TB patients was decreased from 42.9% in 2010 to 33.7% in 2012. This might be due to the reduction of proportion of TB cases across the years and increased awareness and availability of HIV prevention methods.

As the age of TB patients increased, the death rate of TB patients was raised from 1.1% in the age group of 0-14 years to 13.6% in the age group of 55-64 years. This is in line with studies conducted in northwest Ethiopia [8,25] and Eastern Taiwan [39]. Previous studies showed old age as a risk factor for death [22,40,41].

Likewise, as the age of TB patients increased, defaulting rate of the patients was increased from 1.1% in the age group of 0-14 years to 4.7% in the age group of 65 and above years. This is in agreement with a study conducted in northwest Ethiopia [8]. Higher age has been identified as a risk factor for default [32]. However, another study in Brazil showed old age as a protective factor for default [27]. This could be geographical location and genetic difference of the study participants.

Female TB patients were twice more likely to have successful treatment outcome. Previous studies reported females had successful treatment outcomes [7-13]. This is more likely due to females are not exposed to various crowded social and environmental settings.

In this study poor treatment outcome of TB patients were observed in the age range of 45-54 and 55-64 years compared with 0-14 years which is similar in northwest Ethiopia [25]. This is in agreement with previous studies which reported old age increases the risk of poor treatment outcome [7,14-17,42]. It was identified that older individuals had the poorest treatment outcomes [7,14]. Older age groups have often co infections and physiological upset with age, less able to reach health institutions and are also poorer than the younger population [7,40,41].

Patients that had new TB cases were ten times higher to have successful treatment outcome compared with previous TB history which is similar with previous studies [7,14,16,21-24]. The reason for high proportion of poor treatment outcome in retreatment cases is that the increasing prevalence of MDR TB due to interruption and misuse of anti-TB drugs by patients.

This study revealed that HIV co infected TB patients had poor treatment outcome. Other studies also reported as a significant factor for poor treatment outcome [9,10,22,25-27]. This is due to the administration of anti-tuberculosis and antiretroviral drugs concomitantly which can lead to default resulting from pill burden and patient compliance, drug interactions, overlapping toxic effects, and immune reconstitution syndrome. Moreover, MDR and XDR TB can spread rapidly among an immune compromised population, resulting in high death rates [43].

TB patients that had previous history of TB were frequently exposed for defaulting compared with new TB cases which are similar a study conducted in Eastern Taiwan [39]. Moreover, studies also reported retreatment as a risk factor for poor treatment outcome [7,14,16]. However, one study didn't support our finding in which previous treatment had no association with defaulting [11]. This could be due to genetic variability and sample size difference.

TB patients that had both pulmonary (smear negative) and extra pulmonary TB was eight times at risk of defaulting than TB patients that had only pulmonary TB. Another study showed co-existence of pulmonary TB with extra-pulmonary TB as a risk factor for poor treatment outcome [17].

Although we assessed certain variables, there was no data on ART status, patient category of treatment, smear result at 2nd, 5th, and 7th, CD4 value, type of EPTB, concomitant diseases excluding HIV, Hg level, substance abuse and hospitalization history. In addition, factors related with healthcare system and other patient related factors were not assessed. Besides, since the study is retrospective involving secondary data, it has its own limitation. Therefore, further study with a different study design should be conducted to point out the influences of the variables not assessed under this study.

Conclusions

In summary, treatment success rate of TB patients in this study was very encouraging for TB control through DOTS strategy. Nevertheless, TB patients with HIV/AIDS, combined smear negative pulmonary and extra pulmonary TB and with previous history of TB were found to be at risk of poor treatment outcome. Correspondingly, male TB patients and those who attend health centers should be encouraged for successful treatment outcome. Generally, to reduce poor treatment outcome, patients should be strictly followed by health extension workers or trained community health workers in Dessie and Woldiya town health institutions.

Competing interests

The authors declare that they have no any competing interests.

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