A Five Years Tuberculosis Treatment Outcome at Kolla Diba Health Center, Dembia District, Northwest Ethiopia: A Retrospective Cross-sectional Analysis

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Abstract

Background: Multiple studies of tuberculosis treatment have indicated that effective treatment of tuberculosis requires adherence to a minimum of 6 months treatment with multiple drugs. At Kolla Diba Health Center, standardized tuberculosis prevention and control programme, integrating Directly Observed Treatment, Short Course (DOTS) strategy started in 1996. Treatment outcome is an important indicator of tuberculosis control programs as the World Health Organization suggested. We, therefore, carried out this study to investigate the outcome of tuberculosis treatment at Kolla Diba Health Center, Dembia District in Northwest Ethiopia.

Methods: A five years records of 827 tuberculosis patients at Kolla Diba Health Center was analyzed to assess tuberculosis treatment outcomes. Bivariate analyses using logistic regression model was used to analyze the association between treatment outcome and potential predictor variables.

Results: There were 827 (403 males, 424 females) with mean (SD) age of 31.1 (16.9) years study participants. Tuberculosis type was categorized as smear positive, 169 (20.4%), smear negative 278 (33.6%) and extrapulmonary case, 380 (45.9%). Treatment outcome was classified as successfully treated, 708 (85.6%), defaulted, 29 (3.5%), transferred out, 63 (7.6%) and died, 27 (3.3%). Patients aged 15 years or less had significantly high treatment success rate (aOR 4.576, P=0.004) followed by 35-44 years (aOR 3.829, P=0.003) and 25-34 years (aOR 3.669, P=0.002). Ninety (10.9%) patients were co-infected with HIV, which had more likely to die or transferred out compared to uninfected cases.

Conclusion: Treatment success rate was fairly satisfactory. A high proportion of patients died or transferred out in HIV co-infected tuberculosis patients which is a serious public health concern that needs to be addressed right away.

Keywords: Tuberculosis; Treatment outcome; HIV

Introduction

Tuberculosis (TB) is one of the leading causes of death worldwide, and it kills around 1.7 million people each year [1]. Effective treatment of TB requires adherence to a minimum of 6 months treatment with multiple drugs [2,3]. In 1995, World Health Organization (WHO) set up Directly Observed Treatment, Short-course (DOTS) strategy.

It involves provision of standard courses of anti-tuberculosis drugs to patients under trained observers to prevent people from failing to complete their treatment. WHO has set a target level of 85% treatment success. People do often have problems sticking to treatment with unclear reasons. However, factors like access to and a person's social and financial situation might affect adherence to their treatment [1,3].

Ethiopia stands 7th among world's top 22 TB high-burden countries, with an estimated annual incidence of 250 TB cases/10^5 populations [2-8]. As in many other resource-constrained settings, treatment outcomes have not been satisfactory, mainly due to poor treatment compliance [4] and low coverage of short course chemotherapy in North West Ethiopia. Delays in diagnosis and treatment initiation, devastating HIV/AIDS epidemic and potential threat of anti-tuberculosis drug resistance represent serious threats to TB control effort in the region [9]. HIV co-infection among TB patients in the region is also high (52.1%) [9].

Treatment of TB aims at curing patients, interrupting transmission and preventing emerging of drug resistant bacilli [10]; however, these are not achieved in many regions of the world. Possible reasons are death of patients during treatment, default or resistance of bacilli to the drugs prescribed [11]. Treatment outcomes indicate quality of TB treatment provided by a health system. Treatment outcomes evaluation using standardized categories has been issued by WHO in conjunction with European Region of the International Union against Tuberculosis and Lung Diseases (IUATLD) [12].

Ideally, treatment outcomes in all patients should be routinely monitored by the epidemiological surveillance system. According to Ministry of Health of Ethiopia, TB is one of the leading causes of morbidity, the fourth cause of hospital admission, and the second cause of hospital death [13]. Tuberculosis contributes to 4.6% of all Ethiopian disability adjusted life years.

Tuberculosis mortality rate is estimated at $84/10^5$ populations per year [13]. However, treatment outcome of tuberculosis patients has not yet been assessed in Dembia District, Northwest Ethiopia. Therefore, this study aimed to assess treatment outcomes of TB cases attending Kolla Diba Health Center DOTS Clinic.

Materials and Methods

Study setting

Kolla Diba health center is a Governmental health institution serving Dembia District ('Woreda') and the nearby districts of northwest Ethiopian populations. Total population served by the center is over 40,000. It is 780 kilometer away from the capital, Addis Ababa in North western direction. In the health center, DOTS clinic is operating under the National Tuberculosis and Leprosy Control Program (NTLCP) in which diagnosis of pulmonary TB is followed by examination of three sputum smears by Zihel-Nielsen staining method for acid fast bacilli (AFB). Culture and drug susceptibility testing for *Mycobacterium tuberculosis* were not performed in the study setting because there are no such facilities. Chest radiographs and pathological investigations which were done in another hospital using the referral system were also used to support the diagnosis. Patients diagnosed as tuberculosis are referred to the DOTS clinic where they were registered and treated according to the NTLCP guideline [14].

Study design and data collection

A record based retrospective analysis of profile and treatment outcomes of all TB patients registered from July 2007 to June 2012 was conducted. Registration documents reviewed contained basic information: patients' age, sex, address, type of tuberculosis, and treatment outcome.

Operational definition

Clinical case and treatment outcome definitions were used according to the standard definitions of NTLCP [14], and WHO guide lines [15]:

Smear-positive tuberculosis: A patient with at least two sputum were positive for AFB microscopy, or a patient who has only one sputum was positive for AFB microscopy, and chest radiographic abnormalities consistent with active pulmonary TB.

Smear-negative tuberculosis: Symptomatic illness in a patient with at least two sputum smear examinations negative for AFB on different occasions in whom pulmonary tuberculosis is later confirmed by culture, biopsy, or other investigations.

Extrapulmonary TB (EPTB): Tuberculosis of organs other than lungs.

Treatment outcomes: Treatment outcomes were divided into six categories according to NTLCP guidelines: cured (finished treatment with negative bacteriology result at the end of treatment or sputum smear negative on two occasions at the end of treatment), completed treatment (documented treatment completion, but not sputum smear microscopy available at the end of treatment), defaulted treatment (patients who interrupted their treatment for two consecutive months or more after registration), died (patients who died from any cause during the course of treatment), transferred out (a patient referred to another health facility/clinician for treatment in whom information on treatment outcome cannot be obtained) and successfully treated (a patient who was cured and/or completed treatment, or sum of cases that were cured and completed treatment).

Statistical analysis

The following assumptions were taken to calculate the sample size for statistical power determination.

β=80% (0.85), α=95% (1.96), Marginal error (d)=0.05; Treatment success rate (P)=(29.5%~30%) [16].

We have used the sample size (n) formula:

$$n=(z\beta+z\alpha/2)^2pq/2$$

$$=(0.85+1.96)^2(0.3)\times(0.7)/(0.05)^2=663$$

Data were entered, cleared and analyzed using the IBM SPSS Statistics 20 msi. Two individuals were independently cross-checked each entry to ensure quality of data. Association between treatment outcomes and potential predictor variables were analyzed using logistic regression model. P values of less than 0.05 were considered statistically significance.

Results

Demographic characteristics of patients and tuberculosis category

A total of 827 tuberculosis patients were registered at Kolla Diba Health Center between July 2007 and June 2012. However, the calculated sample size to test the power was 663. Of 827+, 403 (48.7%) were males and 424 (51.3) were females, all with mean (SD) age of 31.1 (16.9) years. Thirty three percent (n=275) of the patients were urban resident, and 278 (33.6%) patients were smear negative pulmonary tuberculosis. Table 1 reveals the general characteristics of the patients. Proportion of tuberculosis types across the years are shown in table 2, where the number of smear negative pulmonary tuberculosis cases (28.5%-40.5%) remained highest compared to smear positive pulmonary TB cases (19.3%-21.8%) but lower compared to EPTB cases (37.8%-52.1%) over the years. Ninety (10.9%) of the tuberculosis cases were co-infected with HIV.

Characteristics	Frequency	Percent
Sex		
Male	403	48.7
Female	424	51.3
Total	827	100.0
Age group (years)		
<15	113	13.7
15-24	205	24.8
25-34	201	24.3
35-44	131	15.8
45-54	86	10.4
55-64	44	5.3
>64	47	5.7
Total	827	100.0
Address		
Urban	275	33.3
Rural	552	66.7
Total	827	100.0
TB type		
Smear positive pulmonary TB	169	20.4
Smear negative pulmonary TB	278	33.6
Extra pulmonary TB	380	45.9
Total	827	100.0
HIV status		
HIV positive	90	10.9
HIV negative	737	89.1
Total	**827**	**100.0**

TB=tuberculosis

Table 1: Characteristics of study subjects (n=827), Kolla Diba Health Center, 2007-2012.

Treatment outcome

Table 2 revealed the analysis of treatment outcomes of 827 TB patients registered at Kolla Diba Health Center from July 2007 to June 2012. Of these, 128 (15.5%) were cured, 580 (70.1%) completed treatment, 29 (3.5%) defaulted, 27 (3.3%) died, and 63(7.6%) transferred out. Default rate was steadily decreased across years from 13 (8.7%) in (July 2008-June 2009) to 8 (5.4%) in (July 2009-June 2010), 2 (1.4%) in (July 2010-June 2011) to 1 (0.7%) in (July 2011-June2012). On the other hand, transfer rate of TB patients progressively increases from 2.5% to 5.3%, 7.4% and 13.6% from July 2007-June 2008, July 2008-June 2009, July 2009-June 2010 and July 2010-June 2011 respectively.

Table 3 indicates, as age of patients increased, death rate also increased. We have used Hosmer-Lemeshow goodness-of-fit for the fitness of regression model in this study. Bivariate analysis showed that the adjusted Odds of treatment success rate was lower among HIV co-infected TB patients compared to those HIV uninfected cases (aOR 0.371, 95% CI 0.203-0.679; P=0.001). It is meant that, HIV co-infected TB cases had more likely to die (13.3% vs. 2.0%) or transfer out (11.1% vs. 7.2%) than HIV uninfected ones as an outcome (Table 4).

Referring to table 4, male TB patients had slightly more Odds of treatment success rate (86.6% vs. 84.7%; aOR=1.279; 95% CI=0.843-1.941; P=0.247) than females though not statistically significant.

	Year					
	July 2007-June 2008 N (%)	July 2008-June 2009 N (%)	July 2009-June 2010 N (%)	July 2010-June 2011 N (%)	July 2011-June 2012 N (%)	Total N (%)
Treatment outcomes						
Cured	35 (14.5)	22 (14.7)	25 (16.9)	27 (18.4)	19 (13.6)	128 (15.5)
Completed	191 (78.9)	101 (67.3)	101 (68.2)	89 (60.5)	98 (70.0)	580 (70.1)
Default	5 (2.1)	13 (8.7)	8 (5.4)	2 (1.4)	1 (0.7)	29 (3.5)
Transfer out	6 (2.5)	8 (5.3)	11 (7.4)	20 (13.6)	18 (12.9)	63 (7.6)
Death	5 (2.1)	6 (4.0)	3 (2.0)	9 (6.1)	4 (2.9)	27 (3.3)
Tuberculosis type						
Smear positive pulmonary TB	47 (19.4)	29 (19.3)	32 (21.6)	32 (21.8)	29 (20.7)	169 (20.4)
Smear negative pulmonary TB	69 (28.5)	43 (28.7)	60 (40.5)	58 (39.5)	48 (34.3)	278 (33.6)
Extrapulmonary	126 (52.1)	78 (52.0)	56 (37.8)	57 (38.8)	63 (45.0)	380 (45.9)
TB						
HIV status						
HIV positive	33 (13.6)	18 (12.0)	5 (3.4)	20 (13.6)	14 (10.0)	90 (10.9)
HIV negative	209 (86.4)	132 (88.0)	143 (96.6)	127 (86.4)	126 (90.0)	737 (89.1)

TB=tuberculosis
N=number
%=percent

Table 2: Treatment outcomes of tuberculosis and HIV status by years in Kolla Diba Health Center, 2007-2012.

	Treatment outcome					
Characteristics	**Cured**	**Completed**	**Default**	**Transfer out**	**Death**	**Total**
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Sex						
Male	76 (18.9)	273 (67.7)	15 (3.7)	26 (6.5)	13 (3.2)	403 (48.7)
Female	52 (12.3)	307 (72.4)	14 (3.3)	37 (8.7)	14 (3.3)	424 (51.3)
Age group (years)						
<15	6 (5.3)	100 (88.5)	4 (3.5)	3 (2.7)	0 (0.0)	110 (13.3)
15-24	40 (19.5)	129 (62.9)	9 (4.4)	20 (9.8)	7 (3.4)	205 (24.8)
25-34	39 (19.4)	142 (70.6)	3 (1.5)	15 (7.5)	2 (1.0)	201 (24.3)
35-44	24 (18.3)	93 (71.0)	3 (2.3)	4 (3.1)	7 (5.3)	131 (15.8)
45-54	5 (5.8)	61 (70.9)	4 (4.7)	11 (12.8)	5 (5.8)	86 (10.4)
55-64	8 (18.2)	28 (63.6)	1 (2.3)	3 (6.8)	4 (9.1)	44 (5.3)
>64	6 (12.8)	27 (57.4)	5 (10.6)	7 (14.9)	2 (4.5)	47 (5.7)
Address						
Urban	53 (19.3)	178 (64.7)	8 (2.9)	20 (7.3)	16 (5.8)	275 (33.3)
Rural	75 (13.6)	402 (72.8)	21 (3.8)	43 (7.8)	11 (2.0)	552 (66.7)
Tuberculosis type						
Smear positive pulmonary TB	125 (74.0)	18 (10.7)	6 (3.6)	16 (9.5)	4 (2.4)	169 (20.4)
Smear negative pulmonary TB	1 (0.4)	224 (80.6)	15 (5.4)	22 (7.9)	16 (5.8)	278 (33.6)
Extrapulmonary TB	2 (0.5)	338 (88.9)	8 (2.1)	25 (6.6)	7 (1.8)	380 (45.9)
HIV status						
HIV positive	5 (5.6)	62 (68.9)	1 (1.1)	10 (11.1)	12 (13.3)	90 (10.9)
HIV negative	123 (16.7)	518 (70.3)	28 (3.8)	53 (7.2)	15 (2.0)	737 (89.1)

TB=tuberculosis
N=number
%=percent

Table 3: Treatment outcome by sex, address, age group, tuberculosis type, and HIV status of tuberculosis cases, Kolla Diba Health Center, 2007-2012.

Characteristics	Treatment success		OR	95% CI	p-value	aOR#	95% CI	p-value
	Yes	No						
	N (%)	N (%)						
Sex								
Male	349 (86.6)	54 (13.4)	1.170	0.792-1.728	0.429	1.279	0.843-1.941	0.247
Female	359 (84.7)	65 (15.3)	1 (R)			1 (R)		
Age group (Year)								
<15	106 (93.8)	7 (6.2)	6.424	2.392-17.252	0.000	4.576	1.648-12.704	0.004
15-24	169 (82.4)	36 (17.6)	1.992	0.968-4.097	0.061	1.643	0.769-3.510	0.200
25-34	181 (90.0)	20 (10.0)	3.839	1.765-8.352	0.001	3.669	1.616-8.334	0.002
35-44	117 (89.3)	14 (10.7)	3.545	1.538-8.176	0.003	3.829	1.587-9.239	0.003
45-54	66 (76.7)	20 (23.3)	1.400	0.629-3.118	0.410	1.293	0.559-2.991	0.549
55-64	36 (81.8)	8 (18.2)	1.909	0.710-5.132	0.200	1.894	0.685-5.238	0.219
>64	33 (70.2)	14 (29.8)	1 (R)			1 (R)		
Address								
Urban	231 (84.0)	44 (16.0)	1 (R)			1 (R)		
Rural	477 (86.4)	75 (13.6)	1.211	0.809-1.814	0.352	0.966	0.617-1.512	0.878
TB type								
Smear positive pulmonary TB	143 (84.6)	26 (15.4)	0.647	0.380-1.100	0.108	0.664	0.380-1.159	0.150
Smear negative pulmonary TB	225 (80.9)	53 (19.1)	0.499	0.320-0.778	0.002	0.536	0.335-0.858	0.009
Extrapulmonary TB	340 (89.5)	40 (10.5)	1 (R)			1 (R)		
HIV status								
HIV positive	67 (74.4)	23 (25.6)	0.436	0.259-0.734	0.002	0.371	0.203-0.679	0.001
HIV negative	641 (87.0)	96 (13.0)	1 (R)			1 (R)		
Years								
July 2007-June 2008	226 (93.4)	16 (6.6)	2.777	1.412-5.459	0.003	2.678	1.331-5.386	0.006
July 2008-June 2009	123 (82.0)	27 (18.0)	0.896	0.486-1.650	0.723	0.917	0.483-1.744	0.793
July 2009-June 2010	126 (85.1)	22 (14.9)	1.126	0.596-2.127	0.715	1.095	0.562-2.131	0.790
July 2010-June 2011	116 (78.9)	31 (21.1)	0.736	0.405-1.337	0.314	0.754	0.404-1.406	0.374
July 2011-June 2012	117 (83.6)	23 (16.4)	1 (R)			1 (R)		

TB=tuberculosis
N=number
%=percent
R=Reference
OR=Odds Ratio, aOR=Adjusted Odds Ratio
CI=Confidence interval
#=All the variables in the table are included in the model

Table 4: Crude and adjusted odds ratios for various factors that might affect treatment outcome among tuberculosis patients, Kolla Diba Health Center, 2007-2012.

Patients aged 15 years or less had the higher Odds of treatment success rate (aOR4.756, 95% CI 1.648-12.704; P=0.004) followed by 35-44 years (aOR 3.829, 95% CI 1.587-9.239; P=0.003), 25-34 years and (aOR3.669, 95% CI1.616-8.334; P=0.002) compared to other age categories; while those TB cases from rural areas had slightly lower Odds of treatment success (aOR 0.966, 95% CI=0.617-1.512; P=0.878) rate compared to those from urban area.

Smear negative pulmonary TB (aOR 0.536, 95% CI 0.335-0.858, P=0.009), and smear positive pulmonary TB (aOR 0.664, 95% CI 0.380-1.159; P=0.150) patients had significantly low treatment success rate compared to EPTB patients. Treatment success rates for those EPTB patients were 340 (89.5%) compared to smear positive pulmonary TB patients (84.6%) and smear negative pulmonary TB patients (80.9%) (Table 4). HIV-negative TB patients had higher success rates (87.0% vs. 74.4%) than TB/HIV co-infected patients (aOR 0.371; 95% CI 0.203-0.679; P=0.001).

Highest treatment success rate (aOR=2.678; 95%CI=1.331-5.386; P=0.006) was observed from July 2007-June 2008 compared to treatment success rates across the years during the study period (Table 4).

Table 5 showed the magnitude of HIV in different forms of TB. HIV was less prevalent (15.6%) in smear positive pulmonary TB patients compared to smear negative pulmonary (42.2%) patients and EPTB (42.2%) cases.

Discussion

Tuberculosis has long been recognized as a major public health problem since the 1950s. Since then control efforts have been initiated by the establishment of Sanatoria and later strengthened by implementation of DOTS strategy in the 1990s. However, TB fuelled by HIV/AIDS epidemic, still remains a major health problem in Ethiopia and other developing countries [13]. WHO 2005 report on global tuberculosis control [17] showed that treatment success rates under DOTS programs among 22 high-burden countries varied from 60% in Uganda to 93% in China, with an average of 83%. Besides this, the study in Southern Ethiopia revealed that treatment success rate of all TB cases was 49% [18]. Our study, however, found that treatment outcome of TB patients treated under DOTS program at Kolla Dibab Health Center was satisfactory (Table 2). This is in line with nationwide success rate in Ethiopia (85%) [14], a surveillance and outbreak report conducted in three European countries (85%) [19], and WHO 2005 report on global TB control (83%) [17]. On the contrary, our finding is higher than what had previously been reported in Ethiopia (29.5%) [6] and (46.8%-68.7%) [20], European countries (69%) [21], Switzerland (70%) [22], in Brazil (75.9%) [23] and Spain (82%) [24]; however, it is

HIV status		Tuberculosis type	
	Smear positive Pulmonary TB	Smear negative Pulmonary TB	Extra-pulmonary TB
	No. (%)	No. (%)	No. (%)
HIV positive	14 (15.6)	38 (42.2)	38 (42.2)
HIV negative	155 (21.0)	240 (32.6)	342 (46.4)
Total	169 (20.4)	278 (33.6)	380 (45.9)

HIV=human immune deficiency virus
N=number
%= percent
TB=tuberculosis

Table 5: Type of tuberculosis against HIV status of tuberculosis cases, Kolla Diba Health Center, 2007-2012.

lower than reports in California (97.8%) and WHO target success rate in developing settings (90%) [3].

This fairly satisfactory treatment success rate observed in this study might be due to low transfer, default and death rates (Table 2), as compared to other study where transferred, default and death rates were 42%, 18.3%, and 10.1% [6], respectively. Our findings are a testament to (1) the valuable contribution of extension health workers in combating control of diseases, mounting of public awareness on infectious diseases, and expansion of health institutions and (2) an increase in qualified health professionals in underserved areas of the country.

Default rate (Table 2) in this study was lower than average default rate (6.2%) among the 22 high burden countries [17] and in different studies carried out in Ethiopia (10%) [16], (20%) [1], (18.3%) [6], (18.6%) [18], (12.5%-40.6%) [20], Malawi (11.5%) [25], Spain (5%) [24], Brazil (20.9%) [23] and Nigeria (17%) [25]. On top of this, default rates decreased across years from 13(8.7%) in (July 2008-June 2009) to 1 (0.7%) in (July 2011-June 2012) (Table 2) which is different from a report in Ethiopia [6]. Low default rate in our study might be because of the valuable effect of DOTS, increasing of patients' awareness on infectious diseases and expansions of health institutions in the country which can alleviate the effects of distance on treatment outcomes. It was illustrated in a study in Ethiopia which depicted that apparent clinical improvement after intensive treatment phase was the commonest reason for defaulting followed by far distance of the health institution [16]. It is also explained by the fact that studies done in different parts of the world showed patients who completed their treatment had a better understanding of the duration of TB treatment than patients who interrupted their treatment [26,27]. Satisfaction with the health provider had also positive contribution to the continuation of drug intake [27]. The qualitative study in Ethiopia also demonstrated remarkable changes in patients' understanding of TB that treatment completion rate was significantly better in TB club group (68.7%) than (46.8%) comparison group. The defaulter rate was also significantly lower in TB club group (12.5%) compared to (40.6%) comparison group [20]. Thus, enhanced supervision and monitoring, improved counseling during intensive and continuation phases of treatment, home visits, defaulter tracing and health education are useful to reduce TB treatment interruption.

Total death rate found in our study is higher than reports from Ethiopia (2.6%) [18] (Table 2) and Brazil (1.7%) [23], but is lower than other studies carried out in Ethiopia (10.1% [6], Europe (9%) [21], Switzerland (14%) [22] and Brazil (6.4%) [28]. Our study also demonstrated that death rate of TB patients was considerably increased with age from 1.0% in age group of 25-34 years to 9.1% in 55-64 years (Table 3). This is in conformity with findings of studies

conducted elsewhere in the world [6,29]. However, data related to treatment failure were not available in this study. Various previous report indicated that increasing age to be a risk factor for death due to increasing co-morbidities and physiological deterioration with age and thus, close scrutinizing of treatment in older patients is indispensable [21,30]. In addition, MDR-TB (Multi Drug Resistant-Tuberculosis) might have contribution for the death of patients since data from DST survey conducted in Ethiopia between 2003 and 2006 shows that levels of MDR-TB are: 1.6% and 11.8% in new cases and retreatment cases of TB patients, respectively [13]. Increasing adherence and improving in the elderly should also be a priority [4].

Earlier study in Ethiopia showed that high proportions (52.1%) of TB patients were co-infected with HIV [9]. This report is higher than our finding (Tables 1-3). Of which, majority cases were smear negative pulmonary TB (42.2%) and EPTB (42.2%) (Table 5). High fatality rate was seen in those TB patients co-infected with HIV; however, it is slightly lower (15.5%) than a statement from Nigeria [25] (Table 3).

In our study, the number of EPTB cases remained highest compared to smear positive and smear negative TB cases over the years (Table 2). However, it is inconsistency with a finding in Ethiopia where smear negative TB cases the lead [6]. As literatures explained, EPTB has been becoming more common in the era of HIV [14] which supports our finding. Highest treatment success rate was observed among EPTB patients compared to smear positive and smear negative pulmonary TB patients (Table 4).

In summary, treatment success rate of pulmonary and EPTB patients treated under the DOTS program at Kolla Diba health center in northwest Ethiopia was acceptably good. Relatively high proportion of patients died or transferred out in those TB patients co-infected with HIV which is a serious community health alarm that needs to be addressed without delay. To improve treatment outcomes of TB patients mainly, in HIV/TB co-infected, we recommend enhanced supervision and monitoring, improved counselling during the intensive and continuation phases of treatment, home visits, early screening and starting antiretroviral drugs and health education to diminish treatment break.

Acknowledgements

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