ORIGINAL ARTICLE

DELAYS IN TUBERCULOSIS TREATMENT AND ASSOCIATED FACTORS IN JIMMA ZONE, SOUTHWEST ETHIOPIA

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ABSTRACT

BACKGROUND: *Ethiopia ranks eighth among the world's 22 countries with a high tuberculosis burden. Despite early introduction of Directly Observed Treatment in Ethiopia since 1991, access to this service, case detection rate, delays in initiation of treatment and treatment success rates remained far behind the WHO target. The objective of this study was to assess factors affecting delay in treatment for tuberculosis in Jimma Zone, Southwest Ethiopia.*
METHODS: *A cross-sectional study was conducted in 12 public health facilities in Jimma zone among TB patients visiting respective TB clinics during their intensive phase of treatments. The study was conducted from September 2005 to January 2006. All newly registered TB patients (in the National TB and Leprosy Control Program (TLCP) in eligible health facilities were included in the study. Data were analyzed using STATA 9.1 computer software. Cox proportional hazards models for each subgroup were constructed separately for each type of delay outcome.*
RESULTS: *The median duration of patient, health system and total delay for treatment were 8, 2, and 10 weeks, respectively. Total delay for tuberculosis treatment was significantly affected by being divorced, uneducated and rural resident [OR (95% CI) =0.62(0.43 0.89), 1.58(1.01 2.49) 1.41(1.15 1.75) respectively] while patient delay was influenced the first two factors [OR (95% CI) = 0.67(0.47 0.94), 1.91(1.26 2.88) respectively]. Health system delay was within the range of WHO recommended duration.*
CONCLUSION: *The study showed significant total delay until initiation of treatment. However, there were no difference in delay among all categories of tuberculosis with regards to patients, health system, and total delay for initiation of treatment. Thus, Tuberculosis Control Program should design better strategies to reduce total treatment delays especially for those who have open tuberculosis.*

KEYWORDS: *Tuberculosis, Treatment delay, Southwest Ethiopia*

INTRODUCTION

Ethiopia ranks eighth among the world's 22 countries with a high tuberculosis (TB) burden (1). Despite the fact that Ethiopia's TB and Leprosy Control Program (TLCP) began to implement Directly Observed Therapy (DOTS) in 1991, 40% of Ethiopia's people have true access to DOTS. The case detection rate was only 32.7% in 2005, compared with the WHO target of 70 percent detection rate. The treatment success rate was 79% in 2004, compared with the WHO target of 85% success rate (2). In addition to low detection and treatment success rates, delay in TB treatment increase mortality and transmission within the community (3, 4, 5). Not only increase in risk of transmission, delayed diagnosis and treatment increase severity of illness and mortality especially from the extra-pulmonary TB in patients with HIV/AIDS due to depressed immunity. Strategies aiming to improve delay in treatment of TB patients could shorten the duration of infectiousness in the community and thereby reduce the number of new infections.

Despite the fact that similar studies are undertaken about delays in treatment in Ethiopia (6-11) and elsewhere in the world (4), factors influencing this delay varies from culture to culture and from locality to locality. Moreover, unlike the other previous studies (6-11), this study addressed all TB patients (including extra-pulmonary TB). Extra-pulmonary TB is becoming increasingly common form of TB in Ethiopia especially in HIV co-infected patients (12). Identifying factors contributing to delay in treatment among TB patients have paramount importance to reduce morbidity. Therefore, this study assessed factors affecting treatment delay related to patients and health system in Jimma Zone, Southwest Ethiopia.

SUBJECTS AND METHODS

This cross-sectional study was conducted among TB patients attending treatment in 12 public health facilities in Jimma zone, Southwest Ethiopia during their intensive phase of treatments from September 1, 2005 to January 31, 2006.

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Jimma zone has 14 health centers which provide health services for their catchments population based on primary health care initiatives.

The detailed background information about the study area was described elsewhere (*13*).

All newly registered TB patients (smear positive, smear negative and extra-pulmonary) in the TLCP in the 12 health facilities (11 health Centers and one specialized hospital) during their intensive phase of treatment in the study period. All patients at this intensive phase of treatment were included in the study and hence sample size was not calculated. Four health centers were not included in the study as there was a problem of rapid staff turnover and one of them were new health centers and hence there was no services. Participants under 15 years of age were excluded from interview. Critically sick patients (unable to give interview during their visit) were interviewed on their subsequent visit and when they were discharged from the inpatient wards to TB clinic during their intensive phase of DOTS.

The data were collected using pre-tested, Amharic version, structured and interviewer administered questionnaire. Data collectors were health professionals (nurses) who were working in TB clinics and trained for two days training. Upon completion of the pre-testing, a day long follow-up training was conducted with a focusing on issues identified during piloting.

Ethical clearance was obtained from the Research and Publication Office of Jimma University. Written consent was obtained from Jimma Zonal Health Office and respective public health facilities. Patients gave written consent after getting explanation on the purpose of the study.

Data were double entered using SPSS for Windows version 12.0.1 and analyzed using STATA 9.1. Descriptive, univariate and multivariate analyses were employed. Descriptive statistics were calculated for all socio-demographic and economic variables. Chi-square test was used when appropriate for analyzing categorical data. As the data were skewed for the duration of symptoms, rural to urban differences were compared using the non-parametric Mann-Whitney U test. Log-rank test was used in univariate analysis to determine crude hazard ratio (HR). Survival analysis using the Cox proportional hazards model was used in multivariate analysis to estimate the effect of independent variables. Cox proportional hazards models for each subgroup were constructed separately for each type of delay outcome (patient, health system, and total) using variables found to be important in univariate analysis ($P < 0.05$). Cox regression results are presented as HR. $P < 0.05$ was accepted as indicating statistical significance difference and the strength of association was interpreted using the adjusted HR and 95% CI. .

Operational definitions

(i) *Success rate*: detection of 70% of existing case of sputum smear positive tuberculosis and 85% cure rate of existing case of sputum smear positive tuberculosis

(ii) *Detection*: identifying existing case of sputum smear positive tuberculosis

(iii) *Accessibility to treatment*: The availability of treatment of tuberculosis within 10 kilometer radius or two hour walking distance.

(iv) *Defaulter:* A patient whose treatment has been interrupted for more than 2 consecutive months before the end of the course of treatment

(v) *Transfer in: A* patient who has been transferred from another TB register to continue treatment.

(vi) *Relapse:* A patient previously treated for TB who has been declared cured or treatment completed, and is diagnosed with bacteriologically positive (smear or culture) tuberculosis.

(vii) *Patient's delay* is the time interval from onset of symptoms to the first visit to a hospital or health centre;

(viii) *health services delay* is the time interval from the first visit to a hospital or a health centre to a TB diagnosis;

(ix) *Total treatment delay* is the time interval from onset of symptoms until the start of treatment.

RESULTS

The detailed coverage of the study and socio-demographic and economic characteristics of TB patients were described elsewhere (*13*). A total of 565 patients were included in the analysis. The coverage of this was 95.6%. Among 565 patients, 245(43.4%) were smear positive pulmonary TB, 91 (16.1%) were smear negative pulmonary TB, and the rest were extra-pulmonary TB. Among smear positive pulmonary TB cases, 163(66.5 %) came from rural areas and 126(51.4%) were males. Fifty three (58.2%) smear negative pulmonary and 115(50.2%) of extra-pulmonary cases were from urban areas (Table 1). Five hundred fourteen (91.0%) of TB patients were newly diagnosed, 14(2.5%) were defaulters, 35(6.2%) were relapses and 2(0.4%) of them were transfer-in from other health care facility.

Table 1. Patients socio-demographic, economic and category of TB, Southwest Ethiopia, January, 2006

Variable	Category of TB based on the site of infection			Total
	pulmonary smear positive (n=245) n(%)	pulmonary smear negative (n=91) n(%)	extra-pulmonary (n=229) n(%)	
Address				
Rural	163(66.5)	38(41.8)	114(49.8)	315(55.8)
Urban	82(33.5)	53(58.2)	115(50.2)	250(44.2)
Gender				
Male	126(51.4)	47(51.6)	116(50.7)	289(51.2)
Female	119(48.6)	44(48.4)	113(49.3)	276(48.8)
Age of the patients				
15-24	91(37.1)	31(34.1)	92(40.2)	214(37.9)
25-34	81(33.1)	22(24.2)	67(29.3)	170(30.1)
35-44	47(19.2)	24(26.4)	44(19.2)	115(20.4)
45-54	12(4.9)	7(7.7)	20(8.7)	39(6.9)
55-64	10(4.1)	5(5.5)	5(2.2)	20(3.5)
more than 65	4(1.6)	2(2.2)	1(0.4)	7(1.2)
Marital status				
Single	86(35.1)	35(38.5)	85(37.1)	206(36.5)
Married	132(53.9)	42(46.2)	121(52.8)	295(52.2)
Divorced	19(7.8)	6(6.6)	14(6.1)	39(6.9)
Widowed	8(3.3)	8(8.8)	9(3.9)	25(4.4)
Ethnic group classified				
Oromo	167(68.2)	59(64.8)	147(64.2)	373(66.0)
Amhara	39(15.9)	16(17.6)	43(18.8)	98(17.3)
others[§]	39(15.9)	16(17.6)	39(17.0)	94(16.6)
Religion grouped				
Christian	87(35.5)	36(39.6)	88(38.4)	211(37.3)
Muslim	158(64.5)	55(60.4)	141(61.6)	354(62.7)
Educational status grouped				
No formal education	156(63.7)	44(48.4)	122(53.3)	322(57.0)
elementary completed	47(19.2)	20(22.0)	52(22.7)	119(21.1)
J. Sec. completed	13(5.3)	8(8.8)	17(7.4)	38(6.7)
high school completed	18(7.3)	12(13.2)	27(11.8)	57(10.1)
some college or university	11(4.5)	7(7.7)	11(4.8)	29(5.1)
Occupational status grouped				
Farmer	83(33.9)	26(28.6)	70(30.6)	179(31.7)
housewife	53(21.6)	23(25.3)	60(26.2)	136(24.1)
student	35(14.3)	13(14.3)	33(14.4)	81(14.3)
employed	50(20.4)	22(24.2)	53(23.1)	125(22.1)
Unemployed	24(9.8)	7(7.7)	13(5.7)	44(7.8)

Table 2 summarizes the median duration of symptoms experienced in weeks by TB patients before seeking treatment. There was a statistically significant difference ($p<0.05$) for symptoms experienced by TB patients between urban and rural cases except for loss of appetite and generalized malaise. TB patients from urban area experienced shorter median duration of fever, chronic cough, haemoptsis, shortness of breath and drenching night sweating. Symptoms such as unexplained weight

loss and generalized malaise had longer median duration though not statistically significant.

The median duration of patient delay was 8 weeks with inter-quartile range 4 to 12 weeks. In unviariate analysis patients from urban areas revealed less delay compared to patients from rural areas (unadjusted HR= 1.19, 95%CI= 1.01, 1.41) however, in Cox regression this association was not significant. Divorced patients were more likely to have more delay in seeking care from health facility which showed significant association when adjusted for other independent variables (HR= 0.67, 97% CI = 0.47, 0.94). Patients with college level of education had less delay even when adjusted for other independent socioeconomic variables (HR=1.91, 95% CI= 1.26, 2.88). Patients' prior knowledge about TB before seeking care was associated with less delay (unadjusted HR= 1.22, 95%CI= 1.01, 1.48), however, when adjusted it was not significant (Table 3).

The median duration of total delay (patient and health system delay) was 10 weeks with inter-quartile range 6 to 16 weeks. Among the socio-demographic variables, patients from urban areas have less total delay after adjusting for other predictors (HR= 1.37, 95%CI= 1.13,1.16). Divorced patients were more likely to have

The median duration of health system delay was 2 weeks with inter-quartile range 1 to 3 weeks. Among the socio-demographic variables, patients from urban areas had less health system delay after adjusting for other independent predictors (HR=1.47, 95% CI= 1.23, 1.75). Knowledge about TB before health seeking also had less health system delay after adjusting other knowledge variables (HR= 1.37, 95%CI= 1.13, 1.66). Treatment initiated in health center, private clinic and other health facilities were more likely to have longer health system delay than treatment initiated in government hospital which showed significant association when adjusted for other independent variables. Patients who first visit to private clinic and health center were more likely to have longer health system delay. In univaraite analysis, patients who first visited governmental hospital had less health system delay compared patient who did not first visit hospital (unadjusted HR=1.54 95% CI=1.29, 1.82), however after adjustment it was not significant (Table 4). total delay (adjusted HR= 0.62, 95%CI 0.43, 0.89) whereas patients with college/university level of education had less total delay even after adjusting for other independent variables (HR= 1.58, 95%CI 1.01, 2.49) (Table 5).

Table 2. Univariate analysis for median duration of symptom among TB patients in Jimma Zone, Southwest Ethiopia, January, 2006.

Symptoms	Urban		Rural		P-value
	N (%)	Median duration of delay	N (%)	Median duration of delay	
Fever (n=378)	166(43.92)	4	212(56.08)	6	0.0000
Weight loss (n=402)	185(46.02)	8	217(53.98)	6	0.0186
Chronic Cough(n=396)	175(44.19)	4	221(55.81)	8	0.0000
Coughed up Blood(n=124)	51(41.13)	1	73(58.87)	2	0.0019
Chest Pain (n=360)	161(44.72)	4	199(55.28)	4	0.0005
Shortness of breath (n=326)	137(42.02)	2	189(57.98)	5	0.0000
Night sweating(n=435)	188(43.22)	3	247(56.78)	8	0.0000
Loss of appetite(433)	190(43.88)	4	243(56.12)	4	0.5535
Generalized malaise(n=405)	185(45.68)	8	220(54.32)	6	0.7860

Table 3. Multivariate analysis to identify factors influencing patient delay for treatment of TB in Jimma Zone, Southwest Ethiopia, January, 2006.

Variables	*n*	*Median (IQR)*	*Unadjusted HR(95% CI)*	*Adjusted HR(95%CI)*
Address				
Rural	315	8(4 -12)	1.00	NS
Urban	250	8(4 -12)	1.19(1.01 1.41)*	
Sex				
Male	289	8(4 -12)	1.00	NS
Female	276	8(4 -12)	1.06(0.90 1.25)	
Age, years				
15-30 years	316	8(4 -12)	1.00	NS
>30 years	249	8(4 -13)	0.88(0.75 1.04)	
Marital status				
Single	206	8(4 -12)	1.00	1.00
Married	295	8(4- 12)	0.87(0.73 1.04)	0.93(0.77 1.13)
Divorced	39	12(4-20)	0.63(0.45 0.89)*	0.67(0.47 0.94)*
Widowed	25	6(3-12)	1.00 (0.66 1.52)	1.07(0.70 1.64)
Ethnic group				
Oromo	373	8(4 -12)	1.00	NS
Amhara	98	8(4 -12)	0.96(0.77 1.20)	
Other	94	8(4 -12)	1.02 (0.81 1.28)	
Religion				
Christian	211	8(4 -12)	1.00	NS
Muslim	354	8(4 -12)	0.92(0.78 1.09)	
Education				
No formal education	322	8(4 – 12)	1.00	1.00
Elementary school	119	8(4 – 12)	1.06(0.86 1.32)	1.07(0.86 1.32)
Junior secondary school	38	8(4 – 12)	1.13(0.81 1.59)	1.08(0.76 1.54)
High school	57	8(4 – 12)	1.06(0.80 1.40)	1.03(0.76 1.38)
College/university	29	4(3 – 8)	2.10(1.43 3.09)**	1.91(1.26 2.88)*
Occupation				
Peasants	179	8(4-16)	1.00	NS
Housewife	136	8 (4 -12)	1.07(0.86 1.32)	
Students	81	6 (4 -10)	1.13(0.81 1.59)	
Employed	125	8 (4 -12)	1.06(0.80 1.40)	
Unemployed	44	6 (4 -12)	2.10(1.43 3.09)**	
Heard about TB				
No	147	8(4 –16)	1.0	1.00
Yes	418	8(4--12)	1.22(1.01 1.48)*	1.20 (0.98 1.47)
TB is transmittable				
No	32	8(6 -24)	1.00	NS
Yes	533	8(4 -12)	1.42(0.99 2.03)	

* p-value <0.05
** p<value <0.01

Table 4. Multivariate analysis to identify factors influencing health system delay for treatment of TB in Jimma Zone, Southwest Ethiopia, January 2006.

Variables	n	Median (IQR)	Unadjusted HR (95%CI)	*Adjusted HR (95% CI)*
Address				
Rural	315	2(1-4)	1.00	1.00
Urban	250	2(1-3)	1.51(1.27 1.79)**	1.47(1.23 1.75)**
Sex				
Male	289	2(1-3)	1.00	NS
Female	276	2(1-4)	0.96(0.81 1.14)	
Marital status				
Single	206	2(1-3)	1.00	
Married	295	2(1-4)	0.78(0.65 0.94)*	NS
Divorced	39	2(1-3)	0.91(0.64 1.28)	
Widowed	25	2(1-3)	0.96 (0.62 1.49)	
Age, years				
15-30 years	316	2(1-3)	1.00	NS
>30 years	249	2(1-4)	0.93(0.79 1.10)	
Contact history				
No	405	2(1-3)	1.00	1.00
Yes	160	2(1-4)	0.78(0.65 0.94)*	0.76(0.63 0.92)*
Heard of TBC				
No	147	3(2-4)	1.00	1.00
Yes	418	2(1-3)	1.34(1.10 1.62)*	1.37(1.13 1.66)*
Place of diagnosis				
Governmental Hospital	353	2(1-3)	1.00	NS
Health Center	34	2(2-3)	0.81(0.56 1.16)	
Private hospital	108	3(1.5-4)	0.71(0.57 0.89)*	
Private clinic	36	3(1.5-4)	0.89(0.63 1.26)	
Others	34	2(1-2)	0.94(0.63 1.39)	
Place of treatment started				
Governmental Hospital	179	1(1-2)	1.00	1.00
Health Center	280	2(1-4)	0.51(0.42 0.62)**	0.53(0.42 0.68)**
Private hospital	2	1.5(1-2)	1.20(0.30 4.83)	1.03(0.25 4.24)
Private clinic	6	4(2-6)	0.40(0.18 0.91)*	0.44(0.19 1.04)*
Others	98	2(1-4)	0.53(0.41 0.69)**	0.56(0.40 0.79)
Category of TB based on AFB				
Smear positive	244	2(1-3)	1.00	NS
Smear negative	91	2(1-3)	1.17(0.92 1.50)	
Extra-pulmonary	228	2(1-3)	0.99(0.82 1.20)	
Private clinic first visited				
No	369	2(1-3)	1.00	1.00
Yes	196	3(2-4)	0.74(0.62 0.88)*	0.68(0.56 0.84)**
Public clinics first visited				
No	552	2(1-3)	1.00	NS
Yes	13	3(2-4)	0.69(0.39 1.23)	
Health center				
No	339	2(1-3)	1.00	1.00
Yes	226	3 (2-4)	0.72(0.61 0.86)*	0.71(0.57 0.89)*
Hospital				
No	315	2(1-4)	1.00	
Yes	250	2(1-3)	1.54(1.29 1.82)**	NS

*p-value <0.05
** p-value <0.01

Table 5. Multivariate analysis to identify factors influencing total delay for treatment of TB in Jimma Zone, Southwest Ethiopia, January 2006.

	n	Median (IQR)	Unadjusted HR (95%CI)	*Adjusted HR (95% CI)*
Address				
Rural	315	11(6-17)	1.00	1.00
Urban	250	9.79(6-14)	1.33(1.12 1.56)*	1.41(1.15 1.75)**
Sex				
Male	289	11(6-16)	1.00	NS
Female	276	10(6-16)	1.03(0.87 1.22)	
Marital status				
Single	206	9(6-14)	1.00	1.00
Married	295	11(6- 16)	0.81(0.68 0.97)*	0.87(0.68 1.10)
Divorced	39	14(8-21	0.62(0.44 0.87)*	0.62(0.43 0.89)*
Widowed	25	7(5-)16	0.98(0.65 1.49)	1.07(0.69 1.66)
Age, years				
15-30 years	316	9(6-15)	1.00	NS
>30 years	249	11(7-17)	0.87(0.74 1.03)	
Ethnic group				
Oromo	373	10(6-16)	1.00	
Amhara	98	9.29(6-14.43)	1.04(0.83 1.29)	
Other	94	10(6-16)	1.06(0.85 1.33)	
Religion				
Christian	211	9.57(6-15)	1.00	NS
Muslim	354	10.29(6-16)	0.87(0.74 1.04)	
Education				
No formal education	322	10(6-16)	1.00	1.00
Elementary school	119	11(6-15)	1.07(0.87 1.32)	0.98(0.78 1.23)
Junior secondary school	38	10(6-14)	1.17(0.84 1.64)	0.86(0.59 1.26)
High school	57	10(6-17)	0.95(0.72 1.26)	0.80(0.58 1.20)
College/university	29	6.29(5-10)	2.27(1.54 3.33)**	1.58(1.01 2.49)*
Occupation				
Peasants	179	11(7-20)	1.00	1.00
Housewife	136	9.29(6-16	1.13(0.90 1.41)	1.12(0.88 1.41)
Students	81	9 (5-14)	1.35(1.05 1.78)*	1.09(0.78 1.53)
Employed	125	11(7-15)	1.09(0.86 1.37)	0.96(0.73 1.25)
Unemployed	44	8.5(6-15)	1.22(0.88 1.70)	1.15(0.79 1.66)

*P-value <0.05
**P<0.01

DISCUSSION

This study confirms that there is a considerable delay between the onset of illness and the initiation of treatment among all categories of TB patients in the study area. According to the finding of this study, most of the delay was attributable to late patient health seeking from health care facilities. This was consistent with report from the rural setting of South Africa where patient delay contributed more than provider delay to the total time to diagnosis (14).

Patients delay to seeking care from health care facilities might be attributed to different factors. In Ethiopia, a patient delay is considered when there is a delay of more than 3 weeks before seeking treatment from health care facilities (12). This study showed a significant patient delay to seek treatment at the health care facility as compared to recent studies in Ethiopia and Cameroon (15, 16). This might partly lack of awareness about the symptoms of diseases and availability of modern treatment in the health care facilities. Educational status was found to be associated with patient delay where those with high level of education had less delay as compared to patients with no education which is consistent with results from Thailand and China (17, 18). Patients with less education have poorer knowledge about the symptoms of TB and thus less likely to seek treatment at health care facilities at the earliest time possible leading to significant patient delay. However, the study revealed that prior patient knowledge about tuberculosis itself was not associated with patient delay when other confounding variables are controlled. To date no study has persuasively demonstrated that 'lack of knowledge about TB' plays a significant role in patient delay. Some factors associated with TB were the lack of qualified human resources, the lack of health

infrastructure, poor decentralization of the health system and little coordination with the private sector rather than patient knowledge about TB.

According to WHO and the Federal Ministry of Health of Ethiopia guidelines health system delay is considered when treatment with anti-tuberculosis is not initiated within 7 days (12). The median health system delay in this study was two weeks with IQR of 1 to 3 weeks. The finding showed that nearly 50% of patients were diagnosed to have tuberculosis after two weeks of their presentation at health care facilities. The median patient delay in this study was shorter than the delay reported from other developing countries (14, 19, 20, 21, 22) though some studies showed health system delay were shorter than the current findings (23, 24).

There were different factors that were associated with health system delay in this study. One of the factors attributed to health system delay was area of permanent residence where patients from rural area might have difficulty to come to health care facilities on the date of appointment for re-evaluation, which as a result contributed to the delay. Other factor which was associated with health system delay was place where treatment was initiated. For those patients for which treatment initiated in health centers and private clinics showed a significant delay compared to that of hospital. This finding is partly similar to the finding from other part of Ethiopia (9) and in Botswana and China (18, 19). This might be due to lack of adequate facilities for diagnosis such as sputum examination, chest x-ray or other supporting laboratory facilities and quality of services. Part of health system delay might be resulted from patients being given an antibiotic and thus they may have an apparent improvement from their symptoms. It has been noted in other studies that patients with microbiological TB can lose their respiratory symptoms after a course of antibiotics (25, 26). This may be due to the fact that some antibiotics exhibiting a short action of anti-tuberculosis drugs (27, 28).

There was a substantial total delay (patient and health system delay) of 10 weeks with inter-quartile range of 6 to 16 weeks which was related to patient delay than health system delay consistent with other finding in Ethiopia and other developing countries (6-11, 14, 20, 26). A study from Tanzania reported average delays of up to 26 weeks (21). This implies that despite the efforts made so far, still patient and total treatment delay continued to prevail reflecting failure in reduction of transmission in the community and poor prognosis, high rate of hospitalization and finally increased mortality.

One of the limitations of the study was that patient might not recall the onset of their symptoms accurately. Some of the patients had difficulty to comprehend as the disease has non-specific symptoms which might have attributed to other diseases than tuberculosis. Other patients might only remember severe symptoms such as blood in sputum, severe chest pain, and limitation of daily activities. Further more, governmental health system based study cannot provide information on individuals who were never treated in governmental health care facilities and who may die untreated in the community.

In conclusion, the study suggested that there is significant 'patient delay' to seek treatment in the health care facilities. Despite the fact that the health system delay was low compared to other studies, there was significant total delay until initiation of treatment. There were no difference in delay among all categories of tuberculosis with regards to patients, health system, and total delay for initiation of treatment. Therefore, patient and total treatment delay should be reduced to reverse the risk of communicability of pulmonary tuberculosis and to improve the prognosis of the disease in all categories of tuberculosis through a sustainable and feasible approach.

ACKNOWLEDGMENTS

This is study is funded by Global fund through the Federal ministry of Health of Ethiopia. We are grateful to Jimma University for logistic and other support.

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