

## Research Article

# Time Interval for Diagnosis of Tuberculosis and Related Expenditure in Selected Health Centers in Addis Ababa, Ethiopia

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**Background.** Tuberculosis (TB) has continued to be a major health problem globally, in spite of the efforts to improve the diagnosis, treatment, and prevention. It affects millions of people each year and stands as the second cause of death due to infectious disease in the world. Early case finding and timely initiation of treatment is essential to ensure effective control of the disease as late diagnosis and treatment can aggravate the disease and result in poor outcomes and increase chances of transmission. Although TB services are supposed to be provided free of charge, TB affected families incur different types of costs in the process of seeking care, which might include health and nonhealth related costs. TB programs need to identify the underlying factors for delay and related expenditure for TB related services, in order to devise an effective strategy to reduce them. Therefore, the study aimed to assess the time interval between developing TB symptom until patients start anti-TB treatment and associated cost incurred by patients and families. **Methods.** This cross-sectional study was conducted among pulmonary TB patients who are bacteriologically confirmed, whose age is above 15 years and diagnosed at health centres in Addis Ababa. **Results.** The median time interval between onset of symptom and commencement of treatment was 4 weeks (IQR: 3, 6). Most patients with TB symptoms visited several health facilities before the final diagnosis was confirmed, the median number of visits being two, and only 48.8% were diagnosed on their first visit. Hence, they spent a lot of their limited resource in search of getting the right diagnosis. The total combined expenditure for all the visits was estimated to be median (IQR) 172.65 birrs (12, 671). Two variables were found to show statistically significant association with higher expenditure. Respondents who have good level of knowledge about TB are less likely to spend more than the median expenditure almost by a fifth compared to those with limited knowledge on TB, (adjusted odds ratio (AOR) = 0.2, with 95% confidence interval (CI): 0.06, 0.84). Patients who visited public hospitals were almost three times and those who visited private health facilities almost four times more likely to pay more than the median total expenditure, compared to those who visited health centre, AOR (95% CI) = 2.8 (1.53, 5.19) and AOR (CI) of 3.86 (1.06, 14.03), respectively. **Conclusion.** Patients with TB symptoms visit several health facilities till they are diagnosed, the median duration from onset of symptom till commencement of TB treatment being 4 weeks. It was noted that they face major expenses in the process of navigation to the right care. Two variables had statistically significant association with high pre-diagnosis expenditure, where patients with good level of knowledge about TB are less likely to spend more than the median, while patients who visited public hospitals or private health facilities had very high expenses. Improved public awareness about TB, minimizing service charges and other related fees, and further improvement in increasing access to services could reduce the length of time and expense for TB patients and their families. It is recommended to build capacity of health service providers to update them on programmatic approaches and latest diagnostic algorithm. It is important to strengthen public private partnership for TB services.

## 1. Introduction

Tuberculosis (TB) is an infectious disease caused by slowly generating bacteria and it is transmitted through droplet. The lungs are the most affected part of the body; however, it can affect other parts, and the symptoms are dependent on where the bacteria multiply. Pulmonary TB typically causes chronic cough, productive sputum, chest pain, and other symptoms like night-sweats, weight loss, haemoptysis, fever, and fatigue [1].

Late diagnosis of tuberculosis can make the disease worse, increases risk of mortality and transmission of infection in the household, community, and the health care facilities [2]. Patient's awareness and perception of the disease, access to health care services, and the technical skill of the health care providers are among factors that can influence the time spent in diagnosis [3]. Previous studies in Ethiopia have shown that patients' delays were strongly associated with practice of self-treatment, first visit to nonformal health providers, and prior attendance to a health post or clinic [4]. Cost is also among the major reasons for delay. Ideally TB services are free in the public sector, which include consultations, laboratory investigations, and treatment. Similarly, those private health facilities that are covered under public private mix model, provide free TB diagnostic and treatment services. However, there is a general fee applicable to all patients who visit health facilities to pay for registration regardless of the type of health problem [5].

It has been reported that TB services increase risk of financial burden to patients and exacerbate impoverishment for families [6]. A systematic review in sub-Saharan Africa on the contribution of patient costs showed variation from a little share of average monthly household income for middle income families, to about ten-fold of average annual income for income earners in the lowest quintile of the society [7]. Based on a cost and epidemiological modelling conducted in Ethiopia, the out-of pocket medical cost for TB was \$49 per patient with impact to lead households to fall under poverty line [8]. The WHO end-TB strategy aims for no TB affected families to face catastrophic costs by 2020 and to be maintained thereafter [9]. Because of the unfortunate synergy between TB and poverty, reducing the impact of high cost associated with the illness is of a serious concern for TB control. Poverty is known to pose a greater risk for TB disease, makes treatment outcomes poorer as well as challenges health seeking behaviour [10]. TB disease also make poverty worse due to high expenditure as well as reducing patients' mental and physical strength to work, eventually leading to reduction of income [11].

Information on the time spent for TB services and related cost is vital for good planning and management of TB programme. However, literature on delay and cost analysis of TB services in Ethiopia is scarce. Therefore, this study tries to shed more light by determining the duration from development of TB symptoms until confirmation of diagnosis and enrolment for treatment, as well as TB patient's expenditure in relation to seeking care including direct and indirect costs.

## 2. Methods and Materials

*2.1. Study Population.* A cross-sectional study was conducted on bacteriologically confirmed pulmonary TB patients with

age greater than 15 years, who were newly registered at twenty health centres in Addis Ababa.

*2.2. Sample Size.* This was part of a bigger research to assess the risk factors for tuberculosis and the same group of respondents were approached with additional questions on the duration for diagnosis and cost. The sample size for the main study was calculated considering HIV as most important risk factor for TB disease and based on the latest data from Ministry of health, 8% of TB patients were HIV positive [12]. Considering power and confidence interval of 90% and 95% respectively, the total sample size was calculated to be 236. Anticipating a 10% nonresponse rate, the sample size was adjusted as 260.

*2.3. Data Collection.* The study applied both quantitative and qualitative methodologies, using a structured questionnaire adopted from the WHO multi-country study which was designed to estimate duration of TB treatment [13] and tool developed to estimate TB patients' cost by KNCV/WHO/JATA [14]. Data were collected from unit TB register using checklist. The questionnaire was translated to the local language. Data collectors and supervisors were given training on the tools, principles of data collection, and the study protocol. Interview was conducted with all eligible newly registered bacteriologically confirmed TB patients on the first day of enrolment for TB treatment. The qualitative data were collected by conducting Focus Group discussion using semi-structured discussion guide with groups of males and females TB patients. A total of eight FGDs were conducted covering areas such as knowledge on TB, health care seeking behaviour, opinion on quality of services, cost for TB related services and associated challenges. Key informant interview was also conducted with TB clinic officers who have rich experience in TB control program by using structured questionnaire to assess their opinion about duration for care seeking, challenges to access health services, quality of care, TB patients' expenditure, and related factors.

*2.4. Data Analysis.* The collected data were checked for completeness, examined for errors, then cleaned and data entered in RedCap version 8.03. Analysis was conducted by using STATA version 11 statistical software. The basic variables were summarized by descriptive statistics including sociodemographic characteristics, life style, living condition, previous and current medical history, knowledge of TB and cost incurred for TB related services. Odds ratio and 95% confidence interval were used to determine the association between the different variables. The effect of each variable to contribute to the time interval between onset of symptom and initiation of TB treatment and testing for statistical significance was done running a bivariate analysis.

The qualitative data were recorded by voice recorders and detailed notes taken during key informant interview and FGD. Transcription of interviews verbatim was done by the qualitative research team. Subsequently, the data were read, re-read, and then reviewed for quality check and clarify any misunderstanding. Contrast and compare method was applied to analyse the texts and the team then developed the first categorization based on thematic analysis and later developed sub-categories.

**2.5. Ethical Considerations.** Ethical review was conducted by institutional review board of the college of health sciences, Addis Ababa University. Additional screening was done by institutional review board of AHRI/ALERT, as well as Addis Ababa public health institute. All respondents were briefed on the purpose, potential risks, or benefits of the study and given full assurance that under no circumstances findings of the interview and other information will be disclosed to any unauthorized authority. Subsequently, a written agreement by the participant was obtained using a consent form.

**2.6. Timeframe.** The study was started in January 2017 and the data collection conducted in the period till 30 December 2017.

### 3. Results

**3.1. Socio-Demographic Characteristics.** A total of 260 participants were recruited in the study. Majority (46.5%) were between 26 and 45 years of age and the median age was 27 (range 22–35) years. More than half (55.8%) were males, while 44.2% were females, as seen in Table 1. About fifty two percent were unmarried, 76.2% were trained at least primary level, and about two-third reported to be merchants or daily wage or have formal employment.

Just over half (53.1%) have less than four family members and the median family size was 3. Little less than half of the respondents (42.3%) live in households with more than 2000 birrs (80 USD), while 29.6% live in household with less than 1000 Birrs (40 USD) per month.

**3.2. Health Seeking Behaviours and Knowledge of TB.** Majority (66.5%) of the respondents visit health facility when they feel sick, and just less than a quarter start with self-treatment. In most cases (74.2%), it is self-decision about where to go for help, followed by 17.3% whose decision is influenced by mainly family members (Table 2).

Significant majority (86.2%) of the respondents have heard about TB and they mentioned major symptoms. Among them, nearly all (97.3%) mentioned the major route of transmission correctly, and its curability. Information about cost of TB service was diverse.

Public health centres were the first health facilities visited, for the current illness, by 65.8% of the TB patients and visit to private health facilities was minimal, as seen in Table 2. Most patients visited several health facilities before the final diagnosis was confirmed, and the median number of visit was two. Only close to half (48.8%) were diagnosed on their first visit. The median duration of cough from onset till initiation of treatment, was found to be 4 weeks, (IQR: 3, 6). Distance to the nearest government TB diagnosis and treatment facility, in hour, was estimated at, mean (SD), 2.5 (1.1), and median (IQR), 2 [2, 3] by walk, while it was a mean of 0.7 (SD: 0.3) and median of 0.5 (IQR: 0.5, 1) by public transport.

More than half (51.6%) of the respondents decided by themselves to visit the health centre where the final diagnosis was made, while others did it by referral and based on advice of relatives/friends. Referral from private health facilities (50.6%) was a little higher than government health facilities (44.2%).

TABLE 1: Socio-demographic characteristics ( $n = 260$ ).

Characteristics	Frequency	Percent
<b>Sex</b>		
Male	145	55.8
Female	115	44.2
<b>Age category (years)*</b>		
≤25	112	43.1
26–45	121	46.5
>45	27	10.4
<b>Marital status</b>		
Unmarried	135	51.9
Married	98	35.7
Divorced	18	6.9
Widowed	9	3.5
<b>Educational status</b>		
Illiterate	41	15.8
Read and write	21	8.1
Up to elementary	86	33.1
Secondary school	83	31.9
College or more	29	11.2
<b>Occupation</b>		
Employed/merchants/wage	184	67.7
Unemployed	76	32.3
<b>Size of the family*</b>		
<4	138	53.1
4–6	70	26.9
>6	52	20.0
<b>Average household monthly income (ETB)</b>		
<1000 birrs	77	29.6
1000–2000 birrs	73	28.1
>2000 birrs	110	42.3

\*Median age 27 years (range 22–35), and the mean age was 30 years (standard deviation  $\pm 11.27$ ).

Among 123 patients who visited health facilities for the second time, 56% visited health centres, 26% visited hospital and small percentage did visit private facilities. While among 59 patients who visited health facilities for the third time, the percentage of those who visited health centre and hospital was reduced while relatively increased for hospitals, and the rate remained similar for those who had the fourth visit (Figure 1). Most of the TB patients had laboratory tests done in every visit: in the first visit 65% had sputum test, 21% chest X-ray. During subsequent visits, an increasing tendency observed for sputum test after some drop in the second visit, while X-ray reduced during the fourth visit (Figure 2). Treatment was given for more than half of the cases during every visit ranging from 59% in the first visit to 64% in the third visit (Figure 3). Over three quarters of the respondents did not show any improvement for the treatment they were given, which was the main reason for the repeated visits, however, it was less than half of the respondents who were given medical advice to return in case of no improvement (Figure 4).

TABLE 2: Health seeking behaviour and knowledge on TB of the study participants ( $n = 260$ ).

Characteristics	Frequency	Percent
<i>What do you usually do when you feel sick?</i>		
Visit health facility	173	66.5%
Self-treatment	57	21.9%
Other/do nothing	30	11.5%
<i>Who influenced the decision about where to go for help?</i>		
Self	193	74.2
Family members	45	17.3
Friend/neighbours	22	8.5
<i>Heard of a disease known as TB?</i>		
Yes	224	86.2
No	36	13.8
<i>What are the symptoms of TB?</i>		
Cough	220	98.2
Weakness	111	49.6
Sputum	96	42.9
Weight loss	94	42.0
Fever	94	42.0
Haemoptysis	67	29.9
<i>How is TB transmitted?</i>		
Through breathing	218	97.3
Other	3	1.3
Do not know	3	1.3
<i>Is TB a curable disease</i>		
Yes	220	98.2
No	4	1.8
<i>Cost of treatment for taking anti-TB drugs?</i>		
Free	127	56.9
Expensive	47	20.8
Cheap	22	10.0
I do not know	28	12.3
<i>Type of facility visited first for current illness</i>		
Public health centre	171	65.8
Public hospital	76	29.2
Private facilities	13	5.0
<i>Number of visits of formal health facilities till TB diagnosis*</i>		
One	127	48.8
Two	69	26.5
Three	37	14.2
Four	18	6.9
Five	9	3.5
<i>How did you decide to come to this health centre eventually?</i>		
Self-decision	134	51.6
Referral from other health care provider	77	29.6
Relatives/friends advice	49	18.8
<i>Who gave you referral to come to this health centre?</i>		
Private provider	39	50.6
Other government facilities (hospital, health posts/clinics)	34	44.2
Other	4	5.2

NB. \*Median number of visits before diagnosis is made=2, mean=1.8, minimum=1, and range 1-5. \*\*Duration of cough from onset to diagnosis, in weeks, median = 4, IQR (3, 6). \*\*\*Distance to the nearest government TB diagnosis and treatment facility, in hours; By walking: mean 2.5, SD = 1.1, median = 2, IQR (2, 3). By transport: mean 0.7, SD = 0.3, median = 0.5, IQR (0.5, 1).

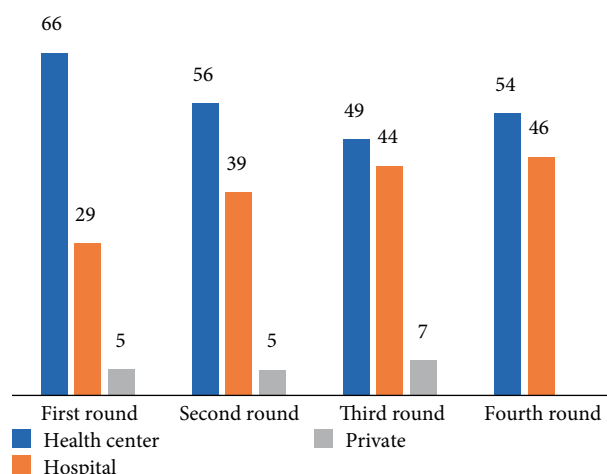


FIGURE 1: Health seeking behaviour for current medical condition of the study participants ( $n = 260$ ). Types of health facilities visited in each round, % ( $n = 260$ ).

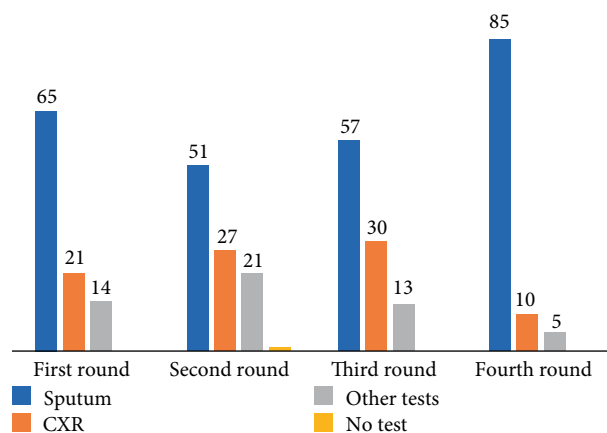


FIGURE 2: Health seeking behaviour for current medical condition of the study participants ( $n = 260$ ). Types of diagnostic services received, % ( $n = 123$ ).

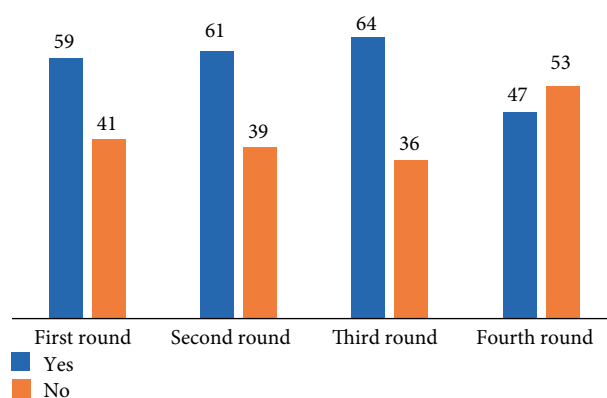


FIGURE 3: Health seeking behaviour for current medical condition of the study participants ( $n = 260$ ). Treatment given, % ( $n = 64$ ).

3.3. *Expenditure for TB Related Services.* The study tried to capture the expense incurred by patients during the first four visits by various cost elements including administrative cost paid mainly for consultation, for diagnostics, for treatment, travel and food as seen in Table 3.

TABLE 3: Distribution of expenses of TB patients by visit, until final diagnosis is made, 2017:  $n = 260$ ? For all providers combined.

Variables	First visit, birrs		Second visit, birrs		Third visit, birrs		Fourth visit, birrs		All visits combined, birrs	
	Median	IQR*	Median	IQR*	Median	IQR*	Median	IQR*	Median	IQR*
Total time spent per visit (in hours, including travel time)	4	(1, 8)	3	(1, 6)	3	(1, 6)	3.3	(2, 6)	6	(3, 12)
Administrative costs (consultation, registration, etc.)	3	(2, 35)	5	(2, 50)	5.5	(2, 50)	2	(1.5, 64)	10	(2, 52)
Laboratory costs (for sputum, blood, etc., except X-ray)	102.5	(14.5, 300)	97.5	(50, 250)	140	(31.3, 398)	60	(35, 467)	212.5	(65, 500)
X-ray costs (includes sending X-rays to radiologist)	147.5	(20, 180)	50	(30, 150)	100	(60, 150)	60	(40, 120)	150	(100, 200)
Drug costs (all kinds total)	65	(25, 120)	60	(30, 160)	90	(45, 210)	20	(14, 62)	160	(50, 400)
Travel costs (including return)	10	(5, 50)	10	(5, 30)	10	(5, 30)	10	(7, 24)	23	(10, 60)
Food costs (total for food and drink)	23	(0, 60)	0	(0, 50)	0	(0, 30)	100	(53, 100)	52	(30, 127)
Total expenditure (sum of all costs)									172.65	(12, 671)

\*IQR= Inter quartile range.

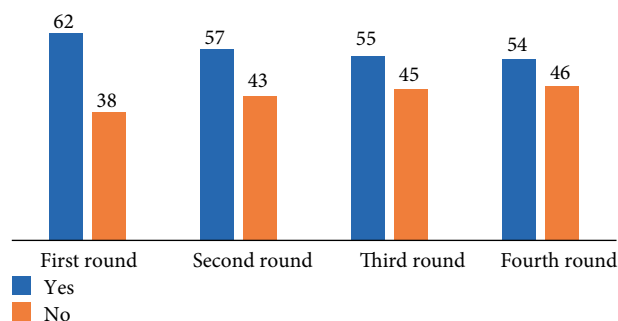


FIGURE 4: Health seeking behaviour for current medical condition of the study participants ( $n = 260$ ). Advice to return, if no improvement, % ( $n = 27$ ).

The median total time spent for the four visits was reported be 6 hours (IQR: Inter quartile range of 3, 12). Administrative costs which include payment for consultation, registration, and related cost was median (IQR) 10 birrs (2, 52). Laboratory cost for sputum, blood, and other investigation excluding X-ray was median (IQR) of 212.5 birrs (65, 500), whereas cost for X-ray was 150 (100, 200). Expense for various therapeutic services which include mainly different types of drugs was median (IQR) of 160 birrs (50, 400), the median (IQR) amount paid for travel of the patients as well as accompanying family members or friends was estimated at 23 birrs (10, 60), while food expenses were median (IQR) of 52 birrs (30, 127). The total expenditure for all the four visits which covers all components mentioned above was estimated to be median (IQR) 172.7 birrs (12, 671).

Table 4 presents further analysis disaggregated by type of health service provider which showed that, TB patients whose

initial visit was at health centre spend a median (IQR) of 114 birrs (6, 372), and the major portion was paid to X-ray and other laboratory tests. TB patients who first visited public hospital spent median (IQR) of 517.5 (41, 1103), and the major share of the expenditure was for laboratory tests, therapeutic services, and X-ray. Some of the patients made their first visit to private clinics and hospitals and according to expenditure analysis, the median (IQR) expense was 619 (284, 791), mainly for laboratory and drugs.

3.4. Comparative Analysis. Bivariate and multivariable logistic regression analysis was conducted to explore factors associated with high expenditure for the TB services of above the median. It was observed that among females, most of them (23.9%) spent more for TB related services above the median while 20.4% spent less than the median. The reverse is true for males; however, the difference was not statistically significant. The difference in expenditure by marital status, educational status and household income was insignificant.

Health care seeking behaviour did not demonstrate any major difference in expenditure. Analysis of expenditure by distance from the nearest TB diagnostic and treatment service providing health facility revealed that respondents who have shorter travel time either on walk or by using public transport tend to spend less than the median expenditure compared to those who live far; however, no statistically significant difference was observed.

According to the multivariable logistic regression analysis, only two variables were found to show statistically significant association after controlling possible confounders. Respondents who have heard at least about TB symptoms, route of transmission and curability, are less likely to spend

TABLE 4: Expenditure for TB services by the study participants TB patients in Addis Ababa, by type of health service provider visited first, 2017:  $n = 260$ .

Variables	All visits combined for health centres, birrs		All visits combined for public hospital, birrs		All visits combined for private health service, birrs	
	Median	IQR*	Median	IQR*	Median	IQR*
Total time spent per visit (in hours, including travel time)	5	(2.5, 12)	7.7	(4, 18)	3	(2, 8)
Administrative costs (consultation, registration, etc.,)	3	(2, 12)	50	(22, 100)	50	(30, 101)
Laboratory costs (for sputum, blood, etc., except X-ray)	152	(30, 335)	370	(105, 600)	280	(147.5, 397)
X-ray costs (includes sending X-rays to radiologist)	150	(70, 152)	170	(150, 305)	120	(115, 126)
Drug costs (all kinds total)	103	(47, 233)	372	(122, 587)	301	(240, 345)
Travel costs (including return)	21.5	(10, 50)	24	(15, 50)	19.5	(8.7, 50)
Food costs (total for food and drink)	37	(25, 100)	100	(54, 150)	0	(0, 0)
Total expenditure (sum of all costs from)	114	(6, 372)	517.5	(41, 1103)	619	(284, 791)

\*IQR = Inter quartile range.

more than the median expenditure almost by a fifth compared to those with limited knowledge on TB, (adjusted odds ratio (AOR) = 0.2, with 95% confidence interval (CI): 0.06, 0.84). The type of health care providers visited first also made a difference with regards to expenditure above the median value, where patients who visited public hospitals were almost three times more likely to pay more than the median total expenditure for TB related services compared to those who visited health centre (adjusted odds ratio (AOR) = 2.8, with 95% confidence interval (CI): 1.53, 5.19). Similarly, patients who visited private health facilities were almost four times more likely to pay more than the median total expenditure for TB related services compared to those who visited health centre (adjusted odds ratio (AOR) = 3.86, with 95% confidence interval (CI): 1.06, 14.03) (Table 5).

### 3.5. Qualitative Information

**3.5.1. Focus Group Discussion.** The following themes emerged from the focus group discussion with TB patients.

**3.5.2. Knowledge on TB symptom and cost.** There was diversity among the respondents regarding knowledge about TB. Some said they are aware of a disease called TB and mentioned the basic symptoms; cough, sweating, sputum, chest pain, weakness, etc., and the fact that it is transmitted mainly through breathing, while other respondents said they had never heard about TB prior to their diagnosis.

In terms of curability of TB, majority responded that it is a curable disease provided that the treatment is taken properly, for instance a young female respondent said, "if patients eat well and take the medication without interruption, TB is curable". There were also respondents who said TB is not curable, as one male respondent said, "TB can improve with medication, but it comes back when you finish treatment". Most common sources of information were mentioned to be radio, television, public transport, posters, health education and friends.

**3.5.3. Cost of Services.** Most of the patients mentioned that they pay a lot money while they visit health facilities for services related to diagnosis of TB. According to them, most of the expenses go to payment to consultation with doctors,

for different types of laboratory tests and for medications. The expense varies according to the type of health facilities they visited, and majority said private sector is most expensive. They also highlighted that apart from health service related expense, they spend a lot for transport, food, expense for family members who accompany the patient, etc. The respondent mentioned different amounts of expense based on their own personal experience, for instance one response said, "I have spent more than 400 birrs for services in private sector, excluding the amount paid for transport and related things".

**3.5.4. Health Seeking Behaviour.** Most people take different actions when they feel sick, primarily self-treatment as initial step using homemade medication such as mix of garlic with honey as well as visiting health centre, hospital, consulting friend/families, and even traditional healers. In terms of the time for visiting health facilities, the majority believe most patients go to health facilities late. Some of the reasons they mentioned were: "lack of awareness about the disease," "a hope that it will improve by itself like common cold," "lack of money to pay for health service and transport," "negligence," "fear of being tested for HIV," "lack of trust on quality of service at public health services," "more trust on Holi water and traditional medicine," etc.

Several reasons were mentioned as challenge for accessing health service including distance to the nearest health facility, lack of transport, lack of knowledge where TB service is provided, inconvenient opening hours especially after working hours, long waiting time, people with disability find it difficult to access service repeatedly especially during treatment follow up, lack of complete package of services, etc.

**3.5.5. Satisfaction with Health Service.** The opinion of the patients on the quality of service provided at public health facilities was described as a "good patient provider rapport," "convenient," and "caring," however, some respondents expressed its limitations mainly the lack of comprehensiveness of services like diagnostics and medications, giving inappropriate treatment, long appointment, not welcoming environment, etc.

When they were asked about opinion on TB treatment services, majority of the respondents expressed satisfaction

TABLE 5: Bivariate and multivariate analysis of expenditure for TB services by socio demographic characteristic participants TB patients, at health centres in Addis Ababa, 2017:  $n = 260$ .

	Total expenditure above the median, birrs				COR (95% CI)	P-value	AOR (95% CI)	P-value
	Yes (n)	%	No (n)					
<i>Sex</i>								
Male	68	26.2	77	29.6			Reference	
Female	62	23.9	53	20.4	1.32 (0.81, 2.16)	0.261	0.6 (0.36, 1.14)	0.139
<i>Marital status</i>								
Single	67	25.8	68	26.2			Reference	
Married/widowed/divorced	63	24.2	62	23.9	1.03 (0.63, 1.67)	0.901	0.9 (0.51, 1.68)	0.804
<i>Education</i>								
Literate	114	43.9	105	40.4	1.69 (0.85, 3.35)	0.128	1.8 (0.78, 4.21)	0.164
Illiterate	16	6.2	25	9.6			Reference	
<i>Average household monthly income</i>								
<1000 birrs	34	13.1	43	16.5			Reference	
1000–2000 birrs	38	14.6	35	13.5	1.37 (0.72, 2.61)	0.334	1.3 (0.6, 2.72)	0.509
>2000 birrs	58	22.3	52	20.0	1.41 (0.78, 2.53)	0.249	1.2 (0.58, 2.31)	0.656
<i>What do you usually do when you feel sick?</i>								
Visit health facility	92	35.4	81	31.2	1.56 (0.85, 2.85)	0.148	1.4 (0.72, 2.67)	0.325
Self-treatment	24	9.2	33	12.7			Reference	
Other/do nothing	14	5.4	16	6.2	1.17 (0.35, 3.95)	0.790	1.6 (.41, 6.31)	0.489
<i>Heard about tuberculosis*</i>								
Yes	102	39.3	116	44.6	<b>0.44 (1.13, 4.55)</b>	<b>0.02*</b>	<b>0.2 (0.06, 0.84)</b>	<b>0.027*</b>
No	28	10.7	14	5.4			Reference	
<i>How is TB transmitted?</i>								
Through breathing	106	40.7	110	42.3			Reference	
Other/do not know	24	9.3	20	7.7	1.24 (0.41, 2.53)	0.509	1.3 (.64, 8.36)	0.200
<i>Type of provider visited first</i>								
Health centre	71	27.3	100	38.5			Reference	
Public hospital	50	19.2	26	10.0	<b>2.7 (1.54, 4.75)</b>	<b>0.001*</b>	<b>2.8 (1.53, 5.19)</b>	<b>0.001*</b>
Private	9	3.5	4	1.5	3.16 (0.93, 10.69)	0.063	<b>3.9 (1.06, 14.03)</b>	<b>0.040**</b>
<i>Distance to the nearest health centre/hospital by walk</i>								
Below mean ( $\leq 2.5$ )	70	26.9	73	28.1			Reference	
Above mean (2.5)	60	23.1	57	21.9	1.09 (0.67, 1.78)	0.708	0.9 (.443, 1.84)	0.786
<i>Distance to the nearest health centre/hospital by transport</i>								
Below mean (<0.7)	85	32.7	88	33.9			Reference	
Above mean (0.7)	45	17.3	42	16.2	1.10 (0.66, 1.85)	0.693	0.9 (.41, 1.76)	0.666

Notes: \*Have heard at least about TB symptoms, route of transmission and curability. \*\*Variables that showed significant association during bivariate analysis at  $p < 0.05$ , COR. Abbreviations: TB:tuberculosis; COR: crude odds ratio; AOR: adjusted odds ratio, CI: confidence interval. All significant values are written in bold.

on the quality of care they were receiving, saying; “they treat us courteously”, “service time is convenient”, “timely service”, “everyone is served according to priority, the nurses are welcoming, they treat with respect and care, however, there is gap in providing health education”. Some respondents expressed their concern on the service with reference to timing of daily treatment, for instance two respondents said “the service time is not convenient, since my work is on transport sector, I have to leave home early at 5:00 AM, however TB service starts at 7:00 AM, so forced to resign”, “I asked the nurse to give me medication for a week but she refused saying it contradicts with the policy, so I am obliged to make special arrangement to attend treatment on daily basis”.

**3.5.6. Key Informant Interview.** Key informant interview was also conducted with eight TB program officers working at the study health centres to get their perception about TB patients’ level of knowledge about the disease, their most sources of information, health seeking behaviour, duration between onset of symptom and confirmation of diagnosis, factors for delay and quality of TB services. The TB officers are nurses by profession with service year ranging from 5 to 10 years in general health service, and 3–6 years in TB clinics.

**3.5.7. Perception on Patients’ Knowledge on TB.** The respondents shared different opinion regarding knowledge of TB patient about TB, and majority said the level of knowledge

ranges from those who almost never heard of the disease to some patients with detailed knowledge. As one respondent puts it, "In my observation, about a quarter of them have good level of knowledge about TB, about half have some basic awareness, however the remaining 25% have no awareness at all". However, in general terms, majority of TB patients do not have clear awareness of the disease. Regarding source of information about TB, majority of the respondent TB officers believe most people get it mainly from the media.

**3.5.8. Health Care Seeking Behaviour.** According to the health workers, most people first visit health facilities when they develop TB symptoms, with preference to health centres. Their perception for such action is related to convenient working time, proximity, and free service.

**3.5.9. Opinion on Time Interval.** Several different responses were observed regarding their opinion on duration between TB patients develop symptom until they are finally started on anti-TB treatment: "it might take an average of two months", "most patient come to health facilities in time", "Patient used to spend long before confirmation of diagnosis, however these days many patients come in time. Now the challenge is that, health workers do not confirm diagnosis timely, and in effect diagnosis get delayed", "About three fourth of the patients spend long period of time before the diagnosis is confirmed, however once it is confirmed, treatment initiation is automatic", etc. With respect to the possible reasons for patients to be late in coming to health facilities, the respondents mentioned different reasons such as self-treatment, homemade remedy, hope for improvement of condition and delayed action till symptoms get worse, lack of awareness, etc. The major challenges in accessing public health services were mentioned to be related to transportation, cost and preference for older health facilities.

**3.5.10. Cost Related to Diagnosis.** The health workers were requested to share their opinion whether TB patients spend money before they are started on treatment. The commonest response was that most TB patients spend lot of money before the final diagnosis is made mainly for diagnostic services such as X-ray, sometimes CT scan, several hematologic and chemistry related laboratory investigations, and repeated visits especially in private sector. The respondents mentioned several examples on what patients shared with them. One respondent said, "my patient had spent more than 2000 birr for CT scan", and another patient "spent more than 150 birrs for X-ray alone".

It was also highlighted during the interview that patients' expenditure is decreasing these days due to service expansion, and better diagnostic technologies such as GeneXpert, as a senior nurse said "in this health centre we have started using GeneXpert as first diagnostic test and that has transformed the diagnostic process making it quicker and high quality, enabling early detection and treatment, and saving cost".

**3.5.11. Perception on Service Provided.** The TB officers were requested to comment on the quality of TB services they are providing, and most of the nurses said, majority of their clients

expressed satisfaction on the quality of service they receive. Typically, clinic opens before the regular working hour, usually 7:30–8:30 AM, and many of the TB patients come that time. Their opinion on gaps in service includes lack of proper waiting area and pill burden.

**3.5.12. What to Improve.** The responders also expressed their opinion on different areas related to TB service. Some highlighted importance of patient counselling, for instance one respondent said, "Sometimes patients refuse to come to health facilities to take drug on daily basis initially, however, after proper counselling, most of them get convinced and finish the entire course happily". There was an opinion on challenge of ensuring regularity, as one respondent said, "Some patients tend to pay less attention on importance of regularity, and interrupt treatment perhaps related to the fact that the service is provided free of charge", however, "Most patient take treatment responsibly and correctly".

Contact tracing and significance of providing affordable service was emphasized by some respondents; "I strongly suggest to strengthen contact tracing through effective collaboration with health extension workers, and we are happy to dedicate time for home visit, if the system allows that", another respondent emphasized the need TB patients to be exempted from service charge, "I suggest for TB patients to get free service for all kinds of diagnostic services such as X-ray which is usually available at hospital level".

## 4. Discussion

Majority (66.5%) of the respondents visit health facility when they feel sick and about a quarter try self-treatment. According to the qualitative information, the self-treatment can be using homemade treatment, use of herbs or western medicine. Whichever way it is done, it is likely to contribute to delay for seeking care. About three-fourth (74.2%), of the respondents decide by themselves which health facility to visit, while about a quarter of them decide based on advice of a family/friend/neighbours, showing the degree of influence in health care seeking behaviour.

The median time interval from onset of symptom till initiation of treatment was 4 weeks (IQR: 3, 6). The finding is similar to some studies conducted in Ethiopia which reported median of 30 days [9, 25]. On the contrary it was lower than other local studies that showed a median of 56 days [15], 40 days in Arsi Zone [16], 60 days in Bahirdar [17], 70.5 days in Afar [18] and also elsewhere, 50 days in Nepal [19]. This may be explained by the difference in access to health service and quality of services; these studies were conducted in the rural parts of Ethiopia where health seeking behaviour and access are likely to be low. Moreover, the median time interval documented in this study was also lower than a study conducted in Addis Ababa a decade ago, which reported a median delay of 60 days [20]. This might be due to the achievements of the TB prevention and control measures to improve public awareness, access to health service, quality of care as well as socioeconomic conditions.

Analysis for the first four rounds of health service visit showed that, among the 123 patients who had second visit,



56% visited health centres and 39% visited hospital, and among 59 patients who had three visits, 49% visited health centre and 44% hospital before diagnosis. This trend continued till the fourth visit, where the percentage of those who visited health centre decreased across the rounds while the percentage of visit to public hospitals increased proportionally. This indicates that when patients were not satisfied in the first visited facility, there is a tendency to visit higher level facilities in subsequent rounds. A pathway analysis study conducted at national level in Ethiopia showed that about a third of patients-initiated care at health centres [21].

Sputum test which is the main stay of TB diagnosis [5] was done for 65% of patients during the first visit and slightly lower for subsequent visits. This demonstrated a missed opportunity for TB diagnosis, as the sputum test could have detected cases much earlier shortening the time interval and minimizing expenditure. Another interesting finding is the fact that more than half of the respondents were not advised to return to the same facility if they do not have any improvement. In absence of such advice, it is difficult to ensure continuum of care, as patients might lose trust in the service and visit a different facility next time. Patient pathway analysis, conducted in five countries including Ethiopia, also revealed that only 24% of patients with tuberculosis started care seeking in a facility which has a capacity to diagnose tuberculosis [22].

This study also revealed that patients incurred substantial cost in the pre-treatment phase, highlighting the financial burden TB patients shoulder as part of navigating the right service to confirm the diagnosis. The overall cost could be disastrous which might worsen the vicious circle of TB and poverty.

Major share of the cost went to diagnostic services which include consultation fee, cost of different laboratory investigation, and X-ray. Payment for consultation and registration was reported to be median (IQR) of 10 birrs (3, 52), while the median laboratory cost was 212.5 birrs (IQR of 65, 500). Other studies reported that over half (53.6%) of the total cost were incurred before diagnosis of TB [23]. According to a study from South Africa the highest expense was incurred between the development of symptoms and initiation of treatment [24]. Other patient cost studies where pre-treatment and treatment costs were included also demonstrated a similar trend [25, 26].

The median expense for various therapeutic services which include mainly the amount paid for different types of medication to treat symptoms of other differential diagnosis was estimated at median (IQR) of 160 (50, 400) which is close to a quarter of the total cumulative expense. This is similar to a study in India which showed one-fourth of the TB related costs were spent on drugs [27], while in Nigeria the reported expense for nonTB drugs accounted for 36% of the total cost [28].

The median amount paid for travel of the patients as well as accompanying family members was estimated at median (IQR) 23 birrs (10, 60), while food expenses had a median of 52 birrs (IQR of 30, 127). It is lower than other study [23], which reported nonmedical cost during pre-diagnosis period of 14.5%. The reason for low expense for food and transport is due to the fact that the study was conducted in urban setting which achieved rapid expansion of health centres where most

of the community can access health service in walking distance [29]. This has significant implication in reducing transportation cost and even the need for extra food and drink as patients do not need to travel far from home.

The total expenditure for all the visits combined which covers all cost categories was estimated to be median (IQR) 172.65 birrs (12, 671). This is relatively low compared to other similar studies [23], and the major difference is due to the setting, rural vs. urban, and the fact that the other studies also included estimate of loss of income due to the illness. In any cases, the total expense demonstrates that patient with TB symptoms visit several health facilities and spend a lot of their limited resource in search of getting the right diagnosis.

The cost was seen to exceed their income given more than half of the respondents reported average monthly household income of less than 2000 birrs, which include 29.6% with income of less than 1000 birrs and 28.1% with income between 1000 and 2000 birrs. This indicates that those with already low income are experiencing disproportionate costs, placing a significant burden on households given that only less than half (42.3%) of respondents are employed or merchants. Per capita spending on health in Ethiopia in 2010/11 was only \$20.77 [30], which is way lower than \$34 suggested by WHO in 2001, which was revised to US\$60 in 2015 [31].

According to the multivariable logistic regression analysis, only two variables were found to show statistically significant association. Respondents who have heard at least about TB symptoms, route of transmission, and curability are less likely to spend more than the median expenditure almost by a fifth compared to those with limited knowledge on TB, (adjusted odds ratio (AOR) = 0.2, with 95% confidence interval (CI): 0.06, 0.84). The type of health care providers visited first made a difference with regard to expenditure above the median value, where patients who first visited public hospitals were almost three times, and patients who visited private health facilities were almost four times more likely to pay more than the median total expenditure for TB related services compared to those who visited health centre (AOR = 2.8, 95% CI: 1.53, 5.19) and (AOR = 3.86, with 95% CI: 1.06, 14.03), respectively. Similar findings were reported in earlier studies where seeking care at private health facilities was found to be independent predictor of high expenditure for TB services (AOR: 5.1) [28]. It was also consistent with other studies which reported patients diagnosed at private facilities incurring significantly higher pre-diagnosis cost compared to those diagnosed at public facilities [23, 28, 31]. This is mainly related to the fact that the private facilities often charge high service charges.

There are potential limitations in this study: recall bias might have been introduced as patients may not accurately remember the exact date of the onset of symptom and the date of the first visit to a health facility. However, a time reference like major events, religious holidays, national holidays and medical records were used as a reminder to minimize bias. Similarly, reporting bias cannot be excluded, since the study relied on self-reported costs. We limited recall bias by conducting the interview the very day the diagnosis was confirmed when patients are highly likely to remember about the costs they incurred during their recent visits. We determined only the cost incurred from onset of illness until anti-TB

treatment initiation only; however, we missed to estimate the indirect cost related to income loss due to lost work days during visiting health services. Besides, it does not include the cost during treatment follow up.

Among the strengths of the cost components of the study is the fact that it captures expenditure data by visit and type of health service providers, which is important to understand the cost variation among providers. Reasons for long time interval for TB care and associated high expenditure may be different among those who live in other cities or in rural areas; hence, the findings are more applicable to patients in similar settings, because of the similarities in patients' characteristics and the health systems. The sample size was relatively small but adequate to address the intended purpose.

## 5. Conclusion

The study highlights the time interval for diagnosis of bacteriologically confirmed pulmonary TB patients in health centres in Addis Ababa, Ethiopia. The median duration from onset of symptom till commencement of TB treatment 4 weeks (IQR: 3, 6). It is consistent with other studies conducted in Ethiopia and elsewhere; however, it was lower than findings of other studies conducted in rural areas, which can be explained by the difference in access to health care service and socioeconomic differences. Patients with TB symptoms visit several health facilities and face major expenditures due to TB care and the major share of the cost went to diagnostic services. The total combined expenditure for all the visits was estimated to be median (IQR) 172.65 birrs (12, 671).

Two variables were found to have statistically significant association with high pre-treatment expenditure, where patients with good level of knowledge about TB are less likely to spend more than the median, while patients who first visited public hospitals were almost three times, and those who visited private health facilities almost four times more likely to pay more than the median total expenditure compared to those who visited health centre.

Improving awareness on TB, minimizing cost of services and other related fees, and further decentralization of services could reduce the length of time and expenditure for patients and their households. It is recommended to build capacity of health service providers to update them on programmatic approaches on latest algorithm, and also strengthen public private partnership. We suggest to conduct a big scale research involving different socio-economic contexts to further determine the time interval and associated expenditure, so that the necessary actions are taken to further minimize the burden to TB patients and families. This will have paramount significance to decrease TB burden in Ethiopia through early detection and treatment, cut chain of transmission and minimize economic loss, and help the country achieve its vision to be free from TB.

## Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the publication of this paper.

## Authors' Contributions

The paper is a result of team work, where ES conceived and designed the study, prepared protocol, coordinated data collection, conducted data analysis and drafted manuscripts. FE, AA provided technical support with the preparation of the proposal and the interpretation of data, advised on and participated in data analysis, and critically reviewed the manuscript. MT, AM, GW supported preparation of protocol, coordinated field work, supported data analysis, and interpretation. TH coordinated data entry and analysis. All authors read and approved the final manuscript. All authors participated in critical appraisal and revision of the manuscript.

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