Introduction: The global burden of Tuberculosis (TB) remains enormous. Delay in TB diagnosis may lead to a higher infectious pool in the community and a more advanced disease state at presentation increasing the risk of mortality. This study is conducted to determine the total delay before treatment among smear positive Pulmonary Tuberculosis (PTB) patients.

Methods: A health institution based cross sectional study was conducted in five primary health centers in southern Ethiopia from June to December 2012. A total of 328 smear positive PTB patients were enrolled in the study. A structured and pre-tested questionnaire was used. Median patient, diagnostic, and treatment delays were calculated to determine the total delay. Multiple logistic regression analysis was used to identify factors associated with total delay.

Results: The median patient, diagnostic, treatment and total delays measured in days were 30 (IQR 20.2, 60), 7 (IQR: 3, 14), 3 (IQR: 1, 4) and 45 (IQR: 34.5, 69.5) days respectively. Patients for whom treatment was not initiated within 45 days of onset of symptom(s) (total delay) constituted 49% of the study participants (59.5% among males and 39.2% among females; P<0.001). Total delay was found to be associated with: being female [AOR = 0.34, 95% CI: 0.18–0.62], having attended tertiary level education [AOR = 0.11, 95% CI: 0.02–0.55], perceived severity of stigma during the current TB disease course [AOR = 2.18, 95% CI: 1.07, 4.42] and living in houses with higher family size [AOR = 0.26, 95% CI: 0.11, 0.61].

Conclusion: Total delay in treatment of TB is still high in the study area. Patient’s sex, perceived stigma, educational status and family size are significantly contributing for total delay. Therefore, a concerted effort should be taken in order to improve health seeking behavior of the community on TB and to reduce delays from seeking care after experiencing TB symptoms.
Study population and sampling

The study subjects of this study were smear positive PTB patients who were following their DOTS treatment in the study facilities. The sample size for the study was determined using the formula to calculate sample sizes for a single population proportion under the following assumptions: confidence interval of 95%, a proportion of 59% for total delay more than 30 days among smear positive patients [8], margin of error of 5%, and an expected non response rate of 10%. Hence the calculated sample size was 371. But, since the size of the target population (number of smear positive PTB patients in the study area) in 2011/2012 was small (1182), we have considered a finite population correction of 95%, a proportion of 59% for total delay more than 30 days (that is the median total delay). The scales were added up for all patients and those with a score of 11/12 were coded as mild stigma and those with score ≤7 were recorded as severe stigma and the remaining values as moderate stigma score.

Operational definition of terms

Smear positive PTB patients: patients with two or more sputum smears which are positive for acid fast bacilli.

Total treatment delay: the time interval between dates of onset of the main TB symptom as reported by patients as their chief complaints, and initiation of anti TB treatment, in this case more than 45 days (that is the median total delay).

Stigma scores: patients were asked to rate (using scale of 3) their responses to the following four questions: feeling ashamed, feeling of hiding the disease, feeling that TB affects relation with others and preference of feeling isolated. The responses were coded as 1 = strongly agree, 2 = neutral and 3 = strongly disagree. The scales were added up for all patients and those with a score of 11/12 were coded as no/mild stigma, and those with score ≤7 were recorded as severe stigma and the remaining values as moderate stigma score.

Ethical approval

This study was conducted after an ethical clearance was secured from the Institutional Review Board of the College of Medicine and Health Sciences, Hawassa University. Permission letters to conduct the study was also obtained from the health facilities included in the study. Moreover, verbal consent was obtained from all study participants who participated in the study. Written consent was not obtained from study participants as verbal consent meets the criteria for ethical approval from the institutional review board and the study used only interview as data collection method.
Verbal consents were sought after explaining benefits of the study and assurance of confidentiality to study participants; participants’ consent was documented using check boxes which are put on every questionnaire’s information sheet.

Results

Basic profiles of study participants
A total of 328 smear positive PTB patients were included in the study. The median age was 28 years (IQR: 20–30 years). Most study participants (56.7%) were in the age range between 21 and 30 years and little more than half (51.8%) were females. More than half of the study participants (65.9%) had income less than or equal to 550 Birr per month and around 4 out of 5 study participants had not attended formal education at all or were only able to read and write (Table 1).

Among the study participants, 178 (54.6%) reported to have taken less than 30 minutes to arrive at their respective health facility during the date of interview. The number of persons per room in the respondents’ residential home was more than 3.5 persons in nearly one-fourth (24.4%) of the study participants (Table 1).

Major complaints of outpatient department (OPD) visits by patients
Cough was the most important symptom that derived patients to seek medical care from the health centers. More than 63% of patients had complaints of cough as a major symptom triggering to seek medical care. This was followed by chest pain accounting for around 19% of the reason for OPD visits (Figure 2).

First visit for care and duration of symptoms before visiting the current health institution
Relatively large proportion of patients (46.3%) first visited the current health institution for medical care for their major complaint. The remaining patients had visited private clinic (35.4%), had applied self treatment at home hoping that symptoms would go away soon (14.6%), visited traditional healers (1.2%) or sought religious healing (2.4%).

Weight loss is the symptom with higher mean duration before seeking treatment where as haemoptysis had the shortest mean duration, 44.1 (SE of mean = 12.0) vs. 6.9 (SE of mean = 1.2) days respectively. Patients with cough presented to the current health facility after a mean duration of 42.5 (95% CI: 36.4, 48.6) days (Figure 3).

Knowledge and stigma score
Two hundred seventy two patients (82.6%) have ever heard of TB before their current TB disease. No any gender difference was observed for ever hearing about TB (p > 0.05). Mass media (45.7%) and TB disease among friends (45.7%) were the relatively commonest sources of information for TB; followed by health workers, other friends/close relatives and school education acting as a source of information for 39.0%, 32.9% and 17.7% of respondents respectively.

Patients were asked three main questions to assess the correctness of the information they had. In general the knowledge level can be judged as ‘limited’ with 59.1%, 53.7% and 75.6% knowing that TB is not hereditary, TB is contagious and TB is curable respectively.

Further gender segregation of the data indicated that, in terms of the contagiousness and hereditary perceptions of TB, no significant difference was observed among males and females (p > 0.05 for both variables). However, the fact that TB is a curable disease is more reported from males than females (OR = 3.67; 95% CI: 1.38, 9.77).

Overall the stigma related responses are not significantly different for males and females (p > 0.05 for all the questions). A total of 112 (34.1%) patients felt ashamed of their current TB disease (32.9% among males and 35.3% among females). Moreover, 68 (20.7%) patients had the feeling that they had to hide their TB disease from others (16.5% among males and 24.7% among females) (Table 2).

Patient, diagnostic and Treatment delays
The delays in days are displayed in Table 3. It was found that the median patient, diagnostic, treatment and total delays measured in days were 30 (IQR: 20.2, 60), 7 (IQR: 3, 14), 3 (IQR: 1, 4) and 45 (IQR: 34.5, 69.5) days respectively. The median health systems delay was 11 (IQR: 7, 18) days. The median patient and diagnostic delays were not significantly different across sex of study participants. However, there was a higher total delay among males (p = 0.004), and marginally lower treatment delay among females (p = 0.015).

Among the TB patients for whom the total treatment delay was calculated (n = 306), 150 (49%) have experienced total treatment delays.
delay. When stratified by sex, 59.2% males and 39.5% females had a total TB treatment delay (P<0.001). In this study, total delay was associated with being female, which revealed that females are less likely to experience total delay than males [AOR = 0.34, 95% CI: 0.18–0.62]. Similarly, patients with tertiary level of education were less likely to experience total delay in treatment than those with primary or secondary level of education [AOR = 0.11, 95% CI: 0.02–0.55]. Furthermore, patients who live in dense family were less likely to have a total delay in initiating treatment than their counterparts [AOR = 0.26, 95% CI: 0.11–0.61] (Table 4).

Discussion

This study depicts that total delay in treatment among smear positive PTB patients was high (49%). From the total delay, majority of the delay is attributable to patients’ delay followed by diagnostic delay. This necessitates the implementation of a cost effective strategy to mitigate those delays in order to hasten the treatment success and reduce transmission of the disease.

In the current study, 81.7% of patients visited health workers for their main symptom which is less than another study conducted in Afar region, Ethiopia (88.4%) and higher than a study conducted in Amhara region, Ethiopia [9,10]. This may be due to difference in study subjects of the Afar’s study which included patients with all forms of TB. But, a study which included PTB patients from ten districts of Tigray region, Ethiopia, revealed that 54% of patients first received care from formal health providers which is far less than the finding of this study [11]. This difference might be as a result of the fact that there is a diverse cultural and religious belief in Ethiopia across regions, and this difference is believed to contribute to variation in health seeking behavior [6,9,10,14,17].

Table 1. Socio-demographic and other baseline characteristics of study participants, southern Ethiopia, June-December 2012.

| Variable                                | Frequency (%) |
|-----------------------------------------|---------------|
| Age in completed years                  |               |
| 15–20                                   | 84 (25.6)     |
| 21–30                                   | 186 (56.7)    |
| ≥ 31                                    | 58 (17.7)     |
| **Total**                               | **328 (100.0)**|
| Median (IQR)                            | 28 (20, 30)   |
| Sex                                     |               |
| Male                                    | 158 (48.2)    |
| Female                                  | 170 (51.8)    |
| **Total**                               | **328 (100.0)**|
| Residence (patients’ response)          |               |
| Urban                                   | 160 (48.8)    |
| Rural                                   | 168 (51.2)    |
| **Total**                               | **328 (100.0)**|
| Time taken to reach health center (self report) (n = 326) |       |
| ≤ 30 minutes                            | 178 (54.6)    |
| 31–60 minutes                           | 102 (31.3)    |
| > 60 minutes                            | 46 (14.0)     |
| **Total**                               | **326 (100.0)**|
| Estimated Income, Birr (n = 282)*       |               |
| ≤ 550/month                             | 216 (65.9)    |
| > 550/month                             | 66 (20.1)     |
| **Total**                               | **282 (100.0)**|
| Educational status                      |               |
| No formal education/read and write only | 276 (84.2)    |
| Elementary/high school                  | 26 (7.9)      |
| Tertiary                                | 26 (7.9)      |
| **Total**                               | **328 (100.0)**|
| Crowdedness measures                    |               |
| 1–2 persons/room                        | 148 (45.1)    |
| 2.1–3.5 persons/room                    | 100 (30.5)    |
| ≥ 3.6 persons/room                      | 80 (24.4)     |
| **Total**                               | **328 (100.0)**|

*On average 1 USD was around 17.5 birr during the data collection period.

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conducted in Uganda (9.1%) [18]. Visiting traditional healers for the first time after onset of symptom(s) was also reported in other Ethiopian studies in Tigray (13%), East Wollega (4.1%), and Amhara (27%) [7,11,12]. Health cadres should try to involve traditional healers in the provision of care for TB patients, which was found to be productive in Hlabisa district, South Africa [19]. A similar recommendation was also forwarded from a research conducted in Malawi which suggested involvement of traditional healers to detect and refer TB patients to health facilities [20].

A mean duration of 42.5 days was experienced by patients with cough before appearing at their respective health center. This figure is much higher than the recommended date of visit (14 days) which is forwarded by the World Health Organization [21]. In this study it was observed that patients visit health facilities very quickly when they experience worrying symptoms (e.g. haemoptysis). This may indicate that patients are reluctant for less worrying/gradually progressing symptoms like weight loss or cough.

There is general understanding that considerable proportions of TB patients in developing countries don’t have adequate knowledge on TB. For example, 4.7% of PTB patients don’t know that TB is contagious in a study carried out in Vietnam [22] which is far less than the finding from this study (53.7%). But, in similar study conducted in Zambia, 57% of respondents reported as TB is a contagious disease [23]. Among the total respondents,
### Table 2. Stigma indicating questions stratified by sex of study participants, southern Ethiopia, June-December 2012.

| S. No | Stigma related questions                                                                 | Scale                  | Male     | Female    | P-value |
|-------|-----------------------------------------------------------------------------------------|------------------------|----------|-----------|---------|
|       | Do you feel ashamed of your TB disease (n = 328)                                         | Strongly agree         | 52 (32.9)| 60 (35.3) | >0.05   |
|       |                                           | Average                | 28 (17.7)| 26 (15.3) |         |
|       |                                           | Do not agree at all    | 78 (49.4)| 84 (49.4) |         |
| 2     | Do you have to hide others that you have TB disease (n = 328)                           | Strongly agree         | 26 (16.5)| 42 (24.7) | >0.05   |
|       |                                           | Average                | 38 (24.1)| 34 (20.0) |         |
|       |                                           | Do not agree at all    | 94 (59.5)| 94 (55.3) |         |
| 3     | Does TB affect your relation with others (n = 328)                                       | Strongly agree         | 34 (21.5)| 42 (24.7) | >0.05   |
|       |                                           | Average                | 40 (25.3)| 30 (17.7) |         |
|       |                                           | Do not agree at all    | 84 (53.2)| 98 (57.7) |         |
| 4     | Do you prefer to live isolated due to your current illness (n = 322)                    | Strongly agree         | 66 (42.9)| 62 (36.9) | >0.05   |
|       |                                           | Average                | 16 (10.4)| 38 (22.6) |         |
|       |                                           | Do not agree at all    | 72 (46.8)| 68 (40.5) |         |
| 5     | Are girls unable to decide to seek TB care on their own (n = 324)                       | Strongly agree         | 10 (6.4) | 10 (5.9)  | >0.05   |
|       |                                           | Average                | 30 (19.2)| 40 (23.8) |         |
|       |                                           | Do not agree at all    | 116 (74.4)| 118 (70.2)|         |

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### Table 3. Different categories of total delay segregated by sex of study participants, southern Ethiopia, June-December 2012.

| Delays                                      | Total (for both males and females) | Male    | Female   | P-value (Mann-Whitney test) |
|----------------------------------------------|------------------------------------|---------|----------|-----------------------------|
| **Patient delay (days)**                     |                                    |         |          |                             |
| Mean (± 1 SD)                                | 42.6 (39.5)                        | 42.5 (28.6) | 42.6 (47.9) |                             |
| Median                                       | 30                                 | 30       | 30       | 0.347                       |
| IQR                                          | (20.3, 60)                         | (20, 60) | (25.0, 31.3)|                             |
| **Diagnostic delay (days)**                  |                                    |         |          |                             |
| Mean (± 1 SD)                                | 13.5 (17.3)                        | 16.4 (21.9) | 10.9 (11.1)|                             |
| Median                                       | 7                                  | 7        | 7        | 0.068                       |
| IQR                                          | (3, 14)                            | (3, 14)  | (3, 14)  |                             |
| **Treatment delay (days)**                   |                                    |         |          |                             |
| Mean (± 1 SD)                                | 3.7 (5.1)                          | 3.1 (4.2) | 4.2 (5.9) | 0.015*                      |
| Median                                       | 3                                  | 2        | 3        |                             |
| IQR                                          | (1, 4)                             | (1, 4)   | (2, 4)   |                             |
| **Health systems delay (days)**              |                                    |         |          |                             |
| Mean (± 1 SD)                                | 17.3 (18.1)                        | 19.9 (22.2) | 15.0 (12.9)|                             |
| Median                                       | 11                                 | 11       | 9        | 0.113                       |
| IQR                                          | (7, 18)                            | (8, 17.0)| (6.18.0) |                             |
| **Total Delays (days)**                      |                                    |         |          |                             |
| Mean (± 1 SD)                                | 59.8 (44.2)                        | 61.8 (33.4) | 57.9 (52.4)|                             |
| Median                                       | 45                                 | 53       | 41       | 0.004*                      |
| IQR                                          | (34.8, 69.3)                       | (36, 78) | (34.0, 65.0)|                             |

*Significantly associated.

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75.6% knew that TB is curable. But there was high proportion of knowledgeable patients in a hospital based study conducted in Thailand (96%) [24] which may be due to the set up difference. Apart from this, 42.9% of men and 36.9% of women strongly agreed with the idea that they want to live isolated (self discrimination) which may be due to fear of transmitting TB, and avoiding gossip and potential discrimination [25]. A study from Dharan, India also depicted as stigma was found to be associated with treatment outcome and delay in seeking care [26] which is in line with the finding of this study.

Female participants of this study were found to be less likely to experience total delay than their counterparts [AOR = 0.34, 95%CI: 0.18–0.62]. This association was also reported by a study conducted in Uganda among smear positive TB patients which showed that males were more likely to experience delay in treatment [AOR = 1.83, 95%CI: 1.02–3.29] [18]. However other studies conducted in Ethiopia (Amhara [7], Afar [9], and Tigray [11] regions), Nigeria [27], Spain [28], and Brazil [29] did not show any difference with regards to gender of participants. This gender difference showed as women seek care faster than men and this is justified by other studies [30,31].

Educational status of patients was associated with total delay in this study. Several studies conducted also found out that patients with improved educational status were less likely to experience total delay in TB treatment [32,33]. This could be due to the increased awareness of the TB disease and reinforced by good

Table 4. Multivariate analysis of risk factors of total delay among smear positive PTB patients, southern Ethiopia, June-December 2012.

| Variables                        | Total Delay | Crude OR (95% CI)* | Adjusted OR (95% CI)** |
|----------------------------------|-------------|--------------------|------------------------|
|                                  | Yes         | No                 |                        |
| **Sex**                          |             |                    |                        |
| Male                             | 88          | 60                 | 1.00                   |
| Female                           | 62          | 96                 | 0.44 (0.28, 0.70)**    | 0.34 (0.18, 0.62)** |
| Residence                        |             |                    |                        |
| Urban                            | 70          | 76                 | 1.00                   |
| Rural                            | 80          | 80                 | 1.09 (0.69, 1.70)      | 1.06 (0.48, 2.31)   |
| Age in completed years           |             |                    |                        |
| ≤20                              | 40          | 40                 | 1.00                   |
| 21–30                            | 86          | 88                 | 0.98 (0.58, 1.66)      | 1.48 (0.70, 3.13)   |
| ≥31                              | 24          | 28                 | 0.86 (0.43, 1.73)      | 0.79 (0.31, 2.00)   |
| Educational status               |             |                    |                        |
| Primary/secondary                | 18          | 8                  | 1.00                   |
| Tertiary                         | 4           | 22                 | 0.8 (0.02, 0.31)**     | 0.11 (0.02, 0.55)** |
| No formal education/able to read and write | 126     | 126                | 0.45 (0.19, 1.08)      | 0.78 (0.27, 2.26)   |
| Estimated monthly income (In birr)|             |                    |                        |
| ≤500                             | 104         | 92                 | 1.00                   |
| >500                             | 26          | 40                 | 0.58 (0.33, 1.01)      | 0.60 (0.27, 1.36)   |
| Family density                   |             |                    |                        |
| <2 persons per room              | 76          | 60                 | 1.00                   |
| 2.1–3.5 persons per room         | 44          | 48                 | 0.72 (0.43, 1.23)      | 0.40 (0.20, 0.82)*  |
| ≥3.6 persons per room            | 30          | 48                 | 0.49 (0.28, 0.87)**    | 0.26 (0.11, 0.61)** |
| Time travelled to arrive at health center |         |                    |                        |
| ≤30 minutes                      | 82          | 84                 | 1.00                   |
| 31–60 minutes                    | 38          | 58                 | 0.67 (0.40, 1.12)      | 0.75 (0.35, 1.57)   |
| >60 minutes                      | 30          | 12                 | 2.56 (1.23, 5.34)**    | 1.58 (0.59, 4.29)   |
| First visited facility           |             |                    |                        |
| Nom-medical†                     | 26          | 30                 | 1.00                   |
| Private clinic                   | 52          | 60                 | 1.00 (0.53, 1.90)      | 1.41 (0.65, 3.06)   |
| Current health center            | 68          | 66                 | 1.19 (0.64, 2.22)      | 1.32 (0.59, 2.93)   |
| Stigma scores                    |             |                    |                        |
| Mild/no stigma                   | 38          | 46                 | 1.00                   |
| Moderate stigma                  | 72          | 56                 | 1.56 (0.90, 2.71)      | 2.18 (1.07, 4.42)** |
| Severe stigma                    | 36          | 52                 | 0.84 (0.46, 1.53)      | 0.78 (0.36, 3.06)   |

*All variables were controlled for each other, †Self treatment/traditional healer/religious healer.

p-value <0.05, **statistically significant.
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Total Delay in TB Treatment

Conclusions

Total delay in treatment of TB is still high in the study area. Patient's gender, literacy level, family size, and perceived personalized stigma contributed their own share for total delay. In addition to this, knowledge of patients on TB is still inadequate and needs further attention. In order to mitigate the consequences of TB, concerned stakeholders need to design successful mechanisms to improve awareness of the community on TB and to reduce delay from seeking care after experiencing TB symptoms.

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Author Contributions

Conceived and designed the experiments: AA WT. Analyzed the data: AA WT. Contributed to the writing of the manuscript: AA WT.

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