Prevalence and determinants of delay in diagnosis of pulmonary tuberculosis in Darjeeling district of West Bengal

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ABSTRACT

Background: Delayed diagnosis of tuberculosis (TB) is a significant problem both in individual as well as community level. Different studies around globe revealed that these diagnostic delays are attributed to both patient delay and health system-related delay.

Aims: This study aims to assess the magnitude of delay in diagnosis and the association with sociodemographic profile among new sputum-positive pulmonary TB patients in Darjeeling district. Materials and Methods: A cross-sectional study was conducted among 374 TB patients from October 2011 to March 2012 using a predesigned pretested schedule by face-to-face interview. Statistical Analysis: Logistic regression analysis, odds ratios (OR), adjusted ORs. Results: Patient delay, health system delay and total diagnostic delay were 27 days, 20.1 days, and 20.6 days; mean delays were 23.64, 5.71, and 29.46 days, and median delays were 25, 5, and 32 days, respectively. Risk factors associated with patient delay were female gender, rural residence, illiteracy, smoking, alcohol consumption, taking two, or more alternate treatments; for health system delay were female sex, rural residence, time to reach health facility, time spent per visit; and for total diagnostic delay were female sex, alcoholism, and seeking more than two alternate treatment. Conclusions: The risk factors for delay identified may be the subject of future interventions.

Keywords: Health system delay, patient delay, total diagnostic delay, tuberculosis

Introduction

India has highest burden of both tuberculosis (TB) and multi-drug-resistant (MDR) TB and the second highest burden of HIV-associated TB based on the WHO Global TB Report 2015. Out of estimated global annual incidence of 9.6 million TB cases, 2.2 million occur in India, i.e., one-fourth of global incident TB cases; there are 2.5 million prevalent cases; about 2.2 lakhs people die annually; 3% among new TB cases and 12%–17% among previously treated TB cases have MDR-TB. In 2015, total population of India covered under Revised National Tuberculosis Control Program (RNTCP) were 1284 million; 9,132,306 TB suspects were examined; 902,732 smear-positive TB patients were diagnosed; and 1,423,181 patients were registered for treatment.

West Bengal data revealed that in 2015, total population covered by RNTCP was 952 lakhs; 592,280 TB suspects were examined; 58,408 smear-positive TB patients were diagnosed; 44,609 smear positive cases started RNTCP DOTS within 7 days of diagnosis; and 87,468 TB patients were registered for treatment.

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Already West Bengal was one of the earliest States of India to implement DOTS, Darjeeling was the last district to implement RNTCP in West Bengal (December 2004) but one of the first districts to start DOTSPPLUS (October 2009) due to high failure rate (11%) of CAT II patients. It has the highest case detection rate (326/Lac) in West Bengal but poor case holding, i.e. poor cure rate (82%), failure rate (4%), high default rate (7%), and high death rate (6%) suggesting high rates of transmission and late case recognition. All this and the fact that it has diverse and difficult terrain and long periods of political turmoil make Darjeeling definitely an epidemiologically important district as far as TB is concerned. Population covered under RNTCP in this district in 2013 was 18.8 lakhs; TB suspects examined were 14,771; total patients registered for treatment were 3236, and received DOT through a community volunteer were1755 (54%).

As per WHO, early case detection and treatment are critical for controlling TB. However, National TB programmes are mainly dependent on passive case findings and so unnecessary delay occurs. Different studies around globe revealed that these diagnostic delays are attributed to both patient delay and health system delay.

At the individual level, delayed diagnosis of TB can enhance the transmission of infection, worsen the disease and may be a reason why TB incidence has not substantially declined despite the global scale-up of the DOTS strategy. Moreover, it also leads to a more advanced disease state at presentation, which contributes to late squelma, more morbidity and mortality. The individual suffers more, absent from his work, cannot contribute to the family income and he along with his family is stuck in the viscous cycle of disease, poverty, inadequate food, and malnutrition.

Delay in diagnosis is important not only with regard to disease progression at the individual level but also transmission within the community. It is estimated that a smear-positive pulmonary TB case in the general community may infect 10–15 other persons in a year and remain infectious for 2–3 years if left untreated.

Although many studies have been done in India regarding the assessment of delay in diagnosis of TB; till now probably none has been done in West Bengal. Therefore, this study was conducted with the objectives of to assess the magnitude of delay in diagnosis of pulmonary TB from the onset of symptoms and to elucidate the association of diagnostic delay with their sociodemographic profile.

### Materials and Methods

- **Type of study:** Observational descriptive
- **Study design:** Cross sectional
- **Study area:** Darjeeling district
- **Study population:** New sputum-positive (NSP) pulmonary TB patients, previously treated cases, not seriously ill, gave informed written consent
- **Inclusion criteria:** New sputum-positive (NSP) pulmonary TB patients, not seriously ill, gave informed written consent
- **Exclusion criteria:** Extrapulmonary TB, new sputum smears negative pulmonary TB patients, previously treated cases, seriously ill, not consented to participate in the study
- **Study tools:** A predesigned, pretested structured interview schedule, different registers, relevant medical records, and reports of patients
- **Study technique:** Consecutive face-to-face interview
- **Sample size:** One study conducted in East Sikkim, India, the prevalence of total diagnostic delay was 58.2%. Therefore, sample size taking 95% confidence level and 5% error was 1.96 × 1.96 × 0.58 × 0.42/0.05 × 0.05 = 374
- **Sampling method:** Two TB units were randomly selected from existing six TB units in Darjeeling district. New sputum smear-positive pulmonary TB patients registered in these two units were progressively enrolled during the data collection period for the study until the required sample size of 374 was recruited
- **Study variables:** Sociodemographic factors (age, gender, religion, caste, residence, marital status, education, occupation, smoking history, history of alcohol intake, and per capita monthly income)
- **Delay in diagnosis:** Patient-related factors (patient delay) and service provider related factors (health system delay)
- **Data collection technique:** Eligibility criteria were formulated by the Ethical Committee of All India Institute of Hygiene and Public Health, Kolkata, to obtain the required sample size. The study was informed, obtained consent, and was based on the study population.
- **Data analysis:** The collected data were tabulated, analyzed, and interpreted by proper statistical methods (proportions, univariate, and multivariate analysis). Patient delay was dichotomized using a cutoff value of 30 days; health system delay using a cutoff value of 7 days and total delay using a cutoff value of 37 days. Statistical comparisons between the groups were done using the Chi-square test. *P < 0.05* was considered statistically significant. Mantel–Haenszel Crude odds ratios (OR) and 95% confidence intervals (CI) were calculated for the interpretation of univariate analysis. To identify the independent risk factors for prolonged
Operational definitions

**Dependent (outcome) variables**

- Diagnostic delay: Any time lag between perceptions of symptom possibly related to pulmonary TB to the time of final diagnosis was considered as diagnostic delay. It has two components:
  a. Patient delay: Period from the onset of the first symptom(s) of suspected pulmonary TB to the date when the patient first contacted any health-care service facility. If it was more than 30 days then considered as prolonged patient delay
  b. Health system delay: From the date of patient’s first contact with any health-care service to the date of final diagnosis. If this period was >7 days, it is taken as prolonged health system delay
  c. Total diagnostic delay: Total delay was defined as the sum of patient delay and health system delay. If this period was >37 days, it was taken as prolonged total diagnostic delay.

**Independent variables**

- Education: Literate: A person can be considered literate if he/she can read and write with understanding in any language and he/she should be 7 years and above
- Smoker: Smoking at least 100 cigarettes in their lifetime and who, at the time of survey, smoked either every day, or some days
- Alcohol consumption: Patients who said they habitually drunk alcohol every day during the study period were considered to be alcoholic for the purpose of this study
- Pulmonary TB case: Refers to a patient with TB disease involving the lung parenchyma
- New case: A TB patient who has never had treatment for TB or has taken anti-TB drugs for <1 month
- Formal health medical facility: All facilities providing modern (allopathic) health-care services
- Nonformal health-care facility: Drug shop/vender, traditional injectors/healers, etc.

Results

A total of 374 TB patients were included in this study. Sociodemographic characteristics of TB patients revealed that about 44.7% of the study population were between 16 and 30 years; their mean age was 31.11 years (standard deviation - 12.89) and median age was 27.5 years; 68.2% were males and rest 31.8% were females; 64.4% were from rural background; SC/ST/OBCs constituted 63.9%; about 31.3% were illiterate; 23.5% were housewives; mean and median per capita income were Rs. 685.62/and Rs. 625.00/, respectively; 60.4% had per capita income between Rs. 500/and Rs. 1000/; 71.9% of the patients were married; 28.9% were from minority groups among whom 23.5% were Christians; 60.70% were smokers; and 52.1% consumed alcohol.

About 61.5% reported to any public health facility between 3rd and 5th weeks of onset of symptoms; 97.9% were diagnosed within 10 days of reporting, and 56.1% were diagnosed beyond 4th weeks of onset of symptoms [Table 1].

Table 2 demonstrated that distribution of the study population according to different types of prolonged delay. About 27% had prolonged patient-related delay; 20.1% had health system related delay; and 20.6% were diagnosed of TB beyond 37 days of onset of symptoms. Different types of prolonged delay were described in Table 3. Mean patient-related prolonged delay, health system-related delay, and total diagnostic delay were 23.64, 5.71, and 29.46 days, respectively; and median delays were 25.5 and 32 days, respectively.

| Table 1: Distribution of patients according to the number of days of delay (n=374) |
|-----------------|-----------------|
| n (%)            | Patient-related delay (days) |
|                 | 0-7              | 8 (4.3) |
|                 | 8-14             | 16 (4.3) |
|                 | 15-21            | 73 (19.5) |
|                 | 22-28            | 133 (35.6) |
|                 | 29-35            | 97 (25.9) |
|                 | >35              | 12 (3.2) |
| Health system-related delay (days) | n (%) |
| ≤5              | 189 (50.5) |
| 6-10            | 177 (47.3) |
| >10             | 8 (2.2) |
| Total diagnostic delay | n (%) |
| 0-7             | 8 (2.2) |
| 8-14            | 8 (2.2) |
| 15-21           | 60 (16.0) |
| 22-28           | 88 (23.5) |
| 29-35           | 101 (27.0) |
| >35             | 109 (29.1) |
| Total           | 374 (100) |

| Table 2: Distribution of the study population according to different types of prolonged delay (n=374) |
|-----------------|-----------------|
| n (%)            | Patient-related delay (days) |
|                 | >30              | 101 (27.0) |
|                 | ≤30              | 273 (73.0) |
| Health system-related delay (days) | n (%) |
| >7              | 75 (20.1) |
| ≤7              | 299 (79.9) |
| Total diagnostic delay (days) | n (%) |
| >37             | 77 (20.6) |
| ≤37             | 297 (79.4) |
Factors associated with prolonged patient delay >30 days were age >median, female gender, married, rural residents, minority caste, minority religion, illiterate, per capita income <median, using alcohol, and taking 2 or more alternate treatments [Table 4]. Table 5 revealed factors associated with health system delay >7 days female gender, rural residents, employed, smoking, per capita income <median, and time spent per visit >median. Factors associated with total diagnostic delay >37 days were female gender, minority religion, caste, illiteracy, alcohol consumption, per capita income <median, and 2 or more alternate treatment [Table 6].

**Discussion**

The RNTCP, adopting the WHO recommended strategy of DOTs, recommends that persons having cough of 2 weeks or more, with or without other symptoms, are referred to as pulmonary TB suspect; they should have two sputum samples examined for acid-fast *Bacillus* as soon as possible and not later than 2 days after it is collected.\(^\text{12}\)

### Table 3: Magnitude of different types of prolonged delays (n=374)

| Type of prolonged delay | Mean (days) | SD | Median (days) | Range (minimum-maximum) |
|-------------------------|-------------|----|---------------|-------------------------|
| Prolonged patient delay  | 23.64       | 8.21 | 25            | 39 (3-42)               |
| (n=101)                 |             |     |               |                         |
| Prolonged health system delay (n=75) | 5.71 | 1.97 | 5             | 12 (2-14)              |
| Prolonged diagnostic delay (n=77) | 29.46 | 8.65 | 32            | 39 (7-46)              |

**Table 4: Factors associated with prolonged patient delay (n=374)**

| Characteristics                                    | Prolonged patient delay (days) | χ²; P  | OR (95% CI) | AOR |
|-----------------------------------------------------|--------------------------------|--------|-------------|-----|
|                                                     | >30 (n=101)                    | ≤30 (n=273) | Total (n=374) |
| Age                                                 |                                |        |             |     |
| > Median                                            | 62 (33.16)                     | 125 (66.84) | 187 (50.0) | 7.17; 0.00 | 1.88 (1.18-2.99) | 1.25 (0.57-3.54) |
| ≤ Median                                            | 39 (20.86)                     | 148 (79.14) | 187 (50.0) |              |              |                 |
| Gender                                               |                                |        |             |     |
| Female                                              | 39 (32.77)                     | 80 (67.23)  | 119 (31.8) | 2.94; 0.08 | 1.51 (0.94-2.44) | 7.053 (1.86-26.95) |
| Male                                                | 62 (24.31)                     | 193 (75.69) | 255 (68.2) |              |              |                 |
| Residence                                            |                                |        |             |     |
| Rural                                               | 80 (33.20)                     | 161 (66.80) | 241 (64.4) | 13.17; 0.00 | 2.65 (1.54-4.53) | 2.54 (0.98-6.12) |
| Urban                                               | 21 (15.79)                     | 112 (84.21) | 133 (35.6) |              |              |                 |
| Caste                                               |                                |        |             |     |
| SC/ST/OBC                                           | 75 (31.38)                     | 164 (68.62) | 239 (63.8) | 6.43; 0.01 | 1.91 (1.15-3.18) | 1.06 (0.45-2.51) |
| General                                             | 26 (19.26)                     | 109 (80.74) | 131 (35.6) |              |              |                 |
| Religion                                             |                                |        |             |     |
| Minority                                            | 38 (35.19)                     | 70 (64.81)  | 108 (28.9) | 5.15; 0.02 | 1.74 (1.07-2.84) | 1.56 (0.96-3.84) |
| Hindu                                               | 63 (23.68)                     | 203 (76.32) | 266 (71.1) |              |              |                 |
| Marital status                                       |                                |        |             |     |
| Married                                              | 85 (31.60)                     | 184 (68.40) | 269 (71.9) | 10.25; 0.00 | 2.56 (1.42-4.64) | 1.43 (0.54-3.85) |
| Single                                               | 16 (15.24)                     | 89 (84.76)  | 105 (28.1) |              |              |                 |
| Occupation                                            |                                |        |             |     |
| Employed                                             | 62 (29.11)                     | 151 (70.89) | 213 (56.95) | 1.11; 0.29 | 1.28 (0.80-2.04) | 6.21 (1.99-19.23) |
| Unemployed                                           | 39 (24.22)                     | 122 (75.78) | 161 (43.05) |              |              |                 |
| Education                                             |                                |        |             |     |
| Illiterate                                           | 50 (42.73)                     | 67 (57.27)  | 117 (31.3) | 21.37; 0.00 | 3.01 (1.86-4.85) | 2.38 (0.96-5.92) |
| Literate                                             | 51 (19.84)                     | 206 (80.16) | 257 (68.7) |              |              |                 |
| Smoker                                               |                                |        |             |     |
| Yes                                                  | 66 (29.07)                     | 161 (70.93) | 227 (60.7) | 1.25; 0.26 | 1.31 (0.81-2.11) | 0.46 (0.08-2.57) |
| No                                                   | 35 (23.81)                     | 112 (76.19) | 147 (39.3) |              |              |                 |
| Alcoholic                                             |                                |        |             |     |
| Yes                                                  | 62 (31.79)                     | 133 (68.21) | 195 (52.1) | 4.74; 0.02 | 1.67 (1.05-2.66) | 3.23 (0.92-11.24) |
| No                                                   | 39 (21.79)                     | 140 (78.21) | 179 (47.9) |              |              |                 |
| PCMI                                                  |                                |        |             |     |
| < Median                                             | 74 (37.37)                     | 124 (62.63) | 198 (52.94) | 22.94; 0.00 | 3.29 (1.99-5.43) | 1.88 (0.79-4.45) |
| ≥ Median                                             | 27 (15.34)                     | 149 (84.66) | 176 (47.06) |              |              |                 |
| Health seeking behavior/choice of first health-care provider (alternate treatment) | | | | |
| ≥2                                                   | 38 (37.62)                     | 12 (4.40)  | 50 (13.37) | 70.28; 0.000 | 13.12 (6.18-28.3) | 75.65 (18.99-301.202) |
| <2                                                   | 63 (62.38)                     | 261 (95.60) | 324 (86.63) |              |              |                 |

AOR: Adjusted odds ratio; OR: Odds ratio; CI: Confidence interval; PCMI: Per capita monthly income
Since in RNTCP case reporting is based on passive surveillance, the time interval from the onset of symptoms and reporting is dependent on many factors including sociodemographic factors of the patients. Moreover, the time interval of diagnosis of TB is also dependent on health service-related factors.

As seen in most other studies, the present study also elicited that patient delay was the main contributor to the total diagnostic delay, although few studies found health system delay as the main contributor. In our setting, the ratio of patient delay and health system delay was 5:1; the corresponding figures were 3:1 in Sikkim; 2.8:1 in Nepal; 4.3:1 in Angola; 1.5:1 in Navi Mumbai; 1.1:1 in Mandi; 1.7:1 in Oromia; 3.1:1 in Puducherry; 1.4:1 in Brazil; and 2.5:1 in Argentina. Patient delay represented 83.3% of total delay in our study; 75% in Sikkim; 73% in Nepal; 81% in Angola; 59.5% in Navi Mumbai; 53.6% in Mandi; 64.4% in Oromia; 75% in Puducherry; 59% in Brazil; 71.3% in Argentina; and 32.6% in Mumbai.

### Median patient delay

In the present study, the median patient delay was 25 days which was similar to Navi Mumbai study by Konda et al. (25 days), shorter median patient delay was reported from Sikkim by Tobgay et al. (21 days), Mandi, Himachal Pradesh by Thakur and Murhekar (15 days), Maharashtra by Nimbarte et al. (19 days), Mumbai by Tamhane et al. (15 days), and Indian literature by Sreramarreddy et al. (18 days), Hamza et al. (30 days), Puducherry by Purty et al. (37 days), and Rio De Jenero, Brazil by

### Table 5: Factors associated with prolonged health system delay (n=374)

| Characteristics | Prolonged health system delay (days) | χ² P | OR (95% CI) | AOR |
|-----------------|--------------------------------------|------|-------------|-----|
|                 | >7 (n=75) | ≤7 (n=299) | | | |
| Age | > Median | 42 (22.46) | 145 (77.54) | 187 (50.0) | 1.35; 0.24 | 1.35 (0.81-2.24) | 0.337 (0.91-1.25) |
|     | ≤ Median | 33 (17.64) | 154 (82.36) | 187 (50.0) | 7.90; 0.00 | 2.08 (1.24-3.50) | 9.548 (1.60-56.865) |
| Gender | Female | 34 (28.57) | 85 (71.43) | 119 (31.8) | 0.52; 0.47 | 1.22 (0.71-2.09) | 7.431 (1.88-29.32) |
|     | Male | 41 (16.08) | 214 (83.92) | 253 (68.2) | 1.75; 0.18 | 0.70 (0.42-1.18) | 2.55 (0.69-9.44) |
| Residence | Rural | 51 (21.16) | 190 (78.84) | 241 (64.4) | 0.34; 0.55 | 1.19 (0.66-2.12) | 1.53 (0.38-6.17) |
|     | Urban | 24 (18.05) | 109 (81.95) | 133 (35.6) | 1.35 (0.81-2.24) | 0.337 (0.91-1.25) |
| Caste | SC/ST/OBC | 43 (17.99) | 196 (82.01) | 239 (63.8) | 1.75; 0.18 | 0.70 (0.42-1.18) | 2.55 (0.69-9.44) |
|     | General | 32 (23.70) | 103 (76.30) | 135 (36.2) | 0.52; 0.47 | 1.22 (0.71-2.09) | 7.431 (1.88-29.32) |
| Religion | Minority | 22 (20.37) | 86 (79.63) | 108 (28.9) | 0.01; 0.92 | 1.02 (0.58-1.79) | 1.98 (0.97-2.58) |
|     | Hindu | 53 (19.92) | 213 (80.08) | 266 (71.1) | 0.52; 0.47 | 1.22 (0.71-2.09) | 7.431 (1.88-29.32) |
| Marital status | Married | 56 (20.82) | 213 (79.18) | 269 (71.9) | 0.34; 0.55 | 1.19 (0.66-2.12) | 1.53 (0.38-6.17) |
|     | Single | 19 (18.10) | 86 (81.90) | 105 (28.1) | 0.34; 0.55 | 1.19 (0.66-2.12) | 1.53 (0.38-6.17) |
| Occupation | Employed | 40 (18.78) | 173 (81.22) | 213 (56.95) | 0.50; 0.47 | 0.83 (0.50-1.38) | 21.27 (4.47-100) |
|     | Unemployed | 35 (21.74) | 126 (78.26) | 161 (43.05) | 0.50; 0.47 | 0.83 (0.50-1.38) | 21.27 (4.47-100) |
| Education | Illiterate | 23 (19.66) | 94 (80.34) | 117 (31.3) | 0.01; 0.89 | 0.95 (0.55-1.65) | 0.95 (0.271-3.311) |
|     | Literate | 52 (20.23) | 205 (79.77) | 257 (68.7) | 0.01; 0.89 | 0.95 (0.55-1.65) | 0.95 (0.271-3.311) |
| Smoker | Yes | 44 (19.38) | 183 (80.62) | 227 (60.7) | 0.16; 0.68 | 0.90 (0.53-1.50) | 3.83 (0.64-23.03) |
|     | No | 31 (21.09) | 116 (78.91) | 147 (39.3) | 0.16; 0.68 | 0.90 (0.53-1.50) | 3.83 (0.64-23.03) |
| Alcoholic | Yes | 38 (19.49) | 157 (80.51) | 195 (52.1) | 0.08; 0.77 | 0.92 (0.55-1.54) | 0.91 (0.43-1.98) |
|     | No | 37 (20.67) | 142 (79.33) | 179 (47.9) | 0.08; 0.77 | 0.92 (0.55-1.54) | 0.91 (0.43-1.98) |
| PCMI | < Median | 51 (25.76) | 147 (74.24) | 198 (52.94) | 8.53; 0.00 | 2.19 (1.28-3.75) | 13.16 (3.33-52.01) |
|     | ≥ Median | 24 (13.64) | 152 (86.36) | 176 (47.06) | 8.53; 0.00 | 2.19 (1.28-3.75) | 13.16 (3.33-52.01) |
| Time spent/visit (min) | >60 | 32 | 80 | 112 | 7.23; 0.00 | 2.04 (1.20-3.44) | 0.51 (0.16-1.6) |
|     | ≤60 | 43 | 219 | 262 | 7.23; 0.00 | 2.04 (1.20-3.44) | 0.51 (0.16-1.6) |

AOR: Adjusted odds ratio; OR: Odds ratio; CI: Confidence interval; PCMI: Per capita monthly income
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Machado et al. (30 days)\(^{[30]}\) and four provinces of Argentina by Zerbini et al. (31 days)\(^{[31]}\)

The differences may be due to variation in the operational definition of patient delay and selection of the study population. Some previous studies' operational definition of patient delay was matched with our definition: the time interval between the onset of first symptom of TB and the first contact with “any health-care facility”\(^{[15,17,20,23]}\) whereas some references defined it as “any formal health-care facility” (health centers, hospitals or DOTS centers, etc.)\(^{[13,14,16,18,19,21,22]}\). We and some studies included “new sputum smear-positive pulmonary TB patients” only\(^{[16,17,19‑23]}\) whereas some studies included “suspected TB cases”;\(^{[13]}\) some considered “both new sputum smear-positive pulmonary TB, and sputum smear-negative pulmonary TB”;\(^{[14]}\) and very few studies included “all types of new TB” (NSP, new sputum negative and new extrapulmonary) TB patients;\(^{[14,15]}\) and Oromia study included all types of TB (new and retreatment).\(^{[18]}\)

### Median health service delay

In the current study, the health system delay was very short, suggesting that diagnosis was swift whenever a person with TB symptoms interacted with the health system. Our study revealed median health service delay was 5 days; which was shorter compared to all of other previous studies like Sikkim (7 days);\(^{[13]}\) Nepal (18 days);\(^{[14]}\) Angola (7 days);\(^{[20]}\) Navi Mumbai (17 days);\(^{[21]}\) Mandi (13 days);\(^{[22]}\) Oromia (9 days);\(^{[18]}\) Puducherry (12 days);\(^{[23]}\) Brazil (21 days);\(^{[24]}\) Argentina (12.5 days);\(^{[25]}\) and Mumbai (31 days).\(^{[26]}\) This shorter duration might be due to relatively good infrastructure of health services in this district, and/or easy access to diagnostic centers.

Again, there were differences in the operational definition of health system delay; in this study, it represented the time interval

## Table 6: Factors associated with prolonged total diagnostic delay (n=374)

| Characteristics | Prolonged diagnostic delay (days) | \(\chi^2; P\) | OR (95% CI) | AOR |
|-----------------|-----------------------------------|-------------|------------|-----|
|                 | >37 (n=77) | \(\leq37\) (n=297) | Total (n=374) |
| Age             |          |                  |               |
| > Median        | 42 (22.46) | 145 (77.54)     | 187 (50.0)    | 0.80; 0.37 | 1.25 (0.76-2.08) | 0.74 (0.28-1.96) |
| \(\leq\) Median | 35 (18.72) | 152 (81.28)     | 187 (50.0)    |          |          |                |
| Gender          |          |                  |               |
| Female          | 35 (29.41) | 84 (70.59)      | 119 (31.8)    | 8.31; 0.00 | 2.11 (1.26-3.53) | 78.44 (86-718.78) |
| Male            | 42 (16.47) | 213 (83.53)     | 255 (68.2)    |          |          |                |
| Residence       |          |                  |               |
| Rural           | 56 (23.24) | 185 (76.76)     | 241 (64.4)    | 2.90; 0.08 | 1.61 (0.92-2.80) | 0.559 (0.187-1.669) |
| Urban           | 21 (15.79) | 112 (84.21)     | 133 (35.6)    |          |          |                |
| Caste           |          |                  |               |
| SC/ST/OBC       | 63 (26.36) | 176 (73.64)     | 239 (63.8)    | 13.49; 0.00 | 3.09 (1.65-5.77) | 13.38 (3.38-51.78) |
| General         | 14 (10.37) | 121 (89.63)     | 135 (36.2)    |          |          |                |
| Religion        |          |                  |               |
| Minority        | 32 (29.63) | 76 (70.37)      | 108 (28.9)    | 7.59; 0.00 | 2.06 (1.22-3.48) | 1.51 (0.57-4.05) |
| Hindu           | 45 (16.92) | 221 (83.08)     | 266 (71.1)    |          |          |                |
| Marital status  |          |                  |               |
| Married         | 61 (22.68) | 208 (77.32)     | 269 (71.9)    | 2.55; 0.10 | 1.63 (0.89-2.98) | 3.36 (0.98-11.35) |
| Single          | 16 (15.24) | 89 (84.76)      | 105 (28.1)    |          |          |                |
| Occupation      |          |                  |               |
| Employed        | 46 (21.60) | 167 (78.40)     | 213 (56.95)   | 0.30; 0.57 | 1.15 (0.69-1.92) | 4.22 (1.28-13.89) |
| Unemployed and house wife | 31 (19.25) | 130 (80.75) | 161 (43.05) |          |          |                |
| Education       |          |                  |               |
| Illiterate      | 34 (29.06) | 83 (70.94)      | 117 (31.3)    | 7.47; 0.00 | 2.03 (1.21-3.41) | 1.294 (0.464-3.60) |
| Literate        | 43 (16.73) | 214 (83.27)     | 257 (68.7)    |          |          |                |
| Smoker          |          |                  |               |
| Yes             | 50 (22.03) | 177 (77.97)     | 227 (60.7)    | 0.73; 0.39 | 1.25 (0.74-2.11) | 1.56 (0.18-13.403) |
| No              | 27 (18.37) | 120 (81.63)     | 147 (39.3)    |          |          |                |
| Alcoholic       |          |                  |               |
| Yes             | 46 (23.59) | 149 (76.41)     | 195 (52.1)    | 2.24; 0.13 | 1.47 (0.88-2.45) | 9.33 (1.51-56.53) |
| No              | 31 (17.32) | 148 (82.68)     | 179 (47.9)    |          |          |                |
| PCMI            |          |                  |               |
| < Median        | 58 (29.30) | 140 (70.70)     | 198 (52.94)   | 19.50; 0.00 | 3.42 (1.94-6.02) | 4.41 (1.38-14.06) |
| \(\geq\) Median| 19 (10.80) | 157 (89.20)     | 176 (47.06)   |          |          |                |
| Alternate treatment |      |                  |               |
| \(\geq2\)       | 30 (60.00) | 20 (40.00)      | 50 (13.37)    | 54.83; 0.00 | 8.84 (4.63-16.84) | 24.47 (7.136-83.94) |
| \(<2\)         | 47 (14.51) | 277 (85.49)     | 324 (86.63)   |          |          |                |

AOR: Adjusted odds ratio; OR: Odds ratio; CI: Confidence interval; PCMI: Per capita monthly income
from the “first visit to any health-care facility until the date of final diagnosis” whereas many studies included “the period between the diagnosis of TB and the initiation of anti-TB treatment” and some defined it as “days between the first action taken by the patients and the date of sputum examination for diagnosis of TB.” Health system delay could be due to lack of trained staffs, availability of diagnostic facilities, poor quality of services, ineffective supervision, and patients not keeping their appointment for getting the examination results timely.

Median total diagnostic delay
In the present study, total diagnostic delay was 32 days, shorter than Nepal (60 days), Angola (45 days), Navi Mumbai (50 days); Mandi (33.5 days); Oromia (40 days); Puducherry (65 days); Brazil (68 days); and Argentina (62 days) and Indian literature (55 days).

We have defined total diagnostic delay as “sum of patient delay and health system delay,” i.e., “perception of symptom possibly related to pulmonary TB to time of final diagnosis” but not “perception of symptom of pulmonary TB to initiation of treatment.”

Prolonged patient delay
Prolonged patient delay was reported by 27% of the participants in this study, the corresponding figures in different previous studies in India and abroad were as follows: Sikkim (17%), Angola (61.82%), Navi Mumbai (46%), Oromia (36.74%), Wardha, Maharashtra (35%), Brazil (70.64%), Argentina (50%), and Mumbai (29%).

Prolonged health system delay
In the present study, the prolonged health system delay was 20%, which was lower than reported from 49% in Sikkim, 27.53% in Angola, 41% in Navi Mumbai, 49.72% in Oromia, 51.83% in Brazil, 50% in Argentina, and 81% in Mumbai.

Again, there were different cutoff points of “prolonged health system delay.” We and some authors defined it as “delay more than 15 days” in contrast to certain studies where it was “more than 7 days,” “more than 25 days,” “more than 9 days,” “more than median,” “more than 21 days,” etc.

Prolonged total delay
In our setting, total diagnostic delay was 20.58%; whereas it was 58% in Sikkim, 15% in Angola, and 48.9% in Oromia; cutoff point for prolonged total delay was 37 days in the present study; compared to 30 days in Sikkim, 20 weeks in Angola, 50 days in Navi Mumbai, 40 days in Oromia, and 60 days in Argentina.

Reasons for patient delay
In the present study, the reasons for postponement cited by patients to seek care were long waiting time, followed by lack of awareness, whereas in Sikkim, Mandi, Oromia, Maharashtra, and Argentina, lack of awareness was the main factor.

Median time to reach the health facility was 40 min in our study; whereas in Mumbai, it was 15 min and in Navi Mumbai 10 min. It may be due to much more strenuous traveling in Darjeeling which is a hilly area.

Median time spent per visit was 60 min observed in this study; whereas in Angola, median waiting time was 15 min.

Determinants of delay
In the present study, factors significantly associated with patient delay were female gender, rural residence, illiteracy, smoking, alcohol consumption, and taking 2 or more alternate treatments.

The main risk factors associated with health system delay were female sex, rural residence, more time to reach health facility, and more time spent per visit.

Risk factors associated with prolonged total diagnostic delay were female sex, backward classes, being alcoholics, and seeking more than 2 alternate treatments before consultation at any public health facility.

Among the many factors, restoring to more number of alternate treatment of the TB patients was one of the risk factors for all types of delay found in present study; this finding was in line with Sikkim; Navi Mumbai; Mandi; Oromia study; and Mumbai.

We noted that alcohol users had more patient delay compared with those who did not report alcohol use; which was corroborative with some other previous studies like Sikkim; Navi Mumbai; and Oromia.

In Nepal, smokers had significantly higher risk of both patient and health system delay which was also found in our study.

A longer patient delay was associated with illiteracy, which was in consistent with Angola; Navi Mumbai; Mandi; Oromia; and Maharashtra; in contrast no relation with literacy was seen in Puducherry.

It was observed that living in a suburban area was associated with health system delay; also found in Angola and Oromia which suggested that the suburban health centers were poor at diagnosis of TB.

In Angola, Navi Mumbai, Oromia, Brazil and Mumbai, compared to men, women were more likely experienced all types of delay. However, contrary to this popular belief, it was found that men, rather than women, were more likely to delay in seeking care in Maharashtra, whereas in Puducherry, no association was observed with gender.

Limitations
Our study had several limitations. First of all, only those patients diagnosed in the public health facility were enrolled in the
present study. Patients diagnosed in the private setup could not be included.

Second, only new sputum smear-positive TB patients were included in the study as involving the sputum-negative patients; extrapulmonary patients and previously treated would have required much more time and workforce.

All aspects involved in the health system delay would have required much more thorough and in-depth analysis which was beyond the scope of this study.

Another weakness was the dependence on patients’ recall for all the data about delay.

Conclusions and Recommendations

This study revealed that the prevalence of prolonged patient-related delay, health system-related delay, and total diagnostic delay were 27 days, 20.1 days, and 20.6 days, respectively. Mean patient delay, health system delay, and total delay were 23.64, 5.71, and 29.46 days, respectively and median delays were 25.5, and 32 days, respectively. Risk factors associated with prolonged patient-related delay were female gender, rural residence, illiteracy, smoking, alcohol consumption, and taking two or more alternate treatments. The main risk factors associated with health system delay were female sex, rural residence, more time to reach health facility, and more time spent per visit. Risk factors associated with prolonged total diagnostic delay were female sex, being alcoholics, and seeking more than two alternate treatments before consultation at any public health facility.

The risk factors for delay identified in this study may be the subject of future interventions to reduce delay in diagnosis and delivery of treatment to TB patients and hence transmission of the disease in the community.

The study also opens scope for other studies involving private sectors that can further suggest ways to make health service delivery more accessible.

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Conflicts of interest

There are no conflicts of interest.

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