Original Article

Determinants of Treatment Failure among Tuberculosis Patients in Kandahar City, Afghanistan: A 5-Year Retrospective Cohort Study

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Abstract

Background: Tuberculosis (TB) is a preventable and treatable chronic disease. Afghanistan is among the high-TB-burden countries. The aim of this study is to find the determinants of treatment failure among TB patients in Kandahar City, Afghanistan. Methods: This was a retrospective cohort study conducted in Kandahar City during a period of 5 years (August 2014–July 2019). For data analysis, descriptive statistics, Chi-square test, and logistic regression were used. Results: Among 1416 TB patients, 894/1416 (63.1%) had pulmonary TB (PTB), whereas 522/1416 (36.9%) had extrapulmonary TB (EPTB). Mean age in these patients was 34.7 years while most of them were females in PTB (530/894 [59.3%]) and EPTB (340/522 [65.1%]) patients. Sputum smear was positive in 618/860 (71.9%) and 16/404 (4%) of PTB and EPTB patients, respectively. TB treatment failure was more in PTB (56/894 [6.3%]) than EPTB (4/522 [0.8%]). Chi-square test of TB cases showed that statistically significant determinants that may cause the treatment failure were re-treatment cases (crude odds ratio [COR] 7.7, \(P < 0.001\)), absence of fever (COR 5.2, \(P < 0.001\)), absence of cough (COR 1.7, \(P = 0.004\)), living in rural areas (COR 1.4, \(P = 0.035\)), and no weight loss (COR 1.3, \(P = 0.033\)). Binary logistic regression of the statistically significant variables revealed only absence of fever (adjusted odds ratio 6.0, \(P < 0.001\)) as the risk factor for treatment failure in TB patients. Conclusion: TB is still a major threat for Kandahar City. Low treatment success rate and increased number of defaulted cases are the major threats.

Keywords: Determinants, extrapulmonary, factors, pulmonary, tuberculosis

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Introduction

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis, spreads through air, and is preventable as well as treatable.\(^1\) M. tuberculosis and humans have coexisted for thousands of years.\(^2\) Although approximately 1.7 billion people are estimated to be infected with M. tuberculosis globally, only few of them will develop active TB.\(^3\) TB has been considered as a global public health emergency for the past 25 years.\(^4\) Globally, this fatal disease has an enormous bad impact on the economy of many countries.\(^5\) TB is considered a disease of poverty occurring mostly in low- and middle-income countries.\(^6\) In 2017, the World Health Organization (WHO) estimated that nearly 10 million (range 9–11.1 million) people became newly sick with TB, with 8.7 million (87%) of these people living in 30 high-burden countries. Among these patients, 1.6 million people died globally, making TB the leading cause of death (above HIV/AIDS) from a single infectious agent.\(^7\)

In many countries, drug-resistant TB is a major threat for TB control.\(^8\) Each year, more than half a million people get TB which is rifampicin resistance. While in 2017, only 160,684 TB patients were diagnosed or notified, and only 139,114 were given the treatment.\(^7\) Multi-drug-resistant-TB (MDR-TB)
has become a major threat in many regions of the world and in some countries extensively resistant TB (XDR-TB) has emerged and have raised a very serious threat of untreatable TB.[8] A study on patients with treatment failure or relapse in Pakistan revealed that MDR-TB was present in 66/113 (58.4%) patients, while XDR-TB in 2/113 (1.8%) of the patients.[9] One of the main consequences of drug-resistant TB is treatment failure. Treatment failure has been reported from many countries of the world, ranging from 0.9% in Thailand to 2.5% and 4.8% in Nigeria.[10-12]

Afghanistan has been in war for the past 40 years, and hence, there are very few published studies about TB from the whole Afghanistan. According to 2014 WHO TB report, Afghanistan is among the world’s top 22 TB high-burden countries.[13] Afghanistan has a population of approximately 36 million. In 2017, the WHO estimated that TB incidence rates (per 100,000 population) among all TB, only HIV-positive, and MDR/RR-TB patients in Afghanistan were 189 (122–270), 0.6 (0.39–0.86), and 9 (4.3–15), respectively.[7]

In 2017, nearly 67,000 (43,000–96,000) new cases and 10,000 (6,100–15,000) deaths due to TB were reported in Afghanistan.[7] In Afghanistan, TB patients are usually treated with 6 months’ standard short course regimen of 2HRZE/4HR (isoniazid, rifampicin, pyrazinamide, and ethambutol for 2 months/isoniazid and rifampicin for 4 months) or with the 8 months’ retreatment regimen of 2HRZES/1HRZE/5HRE (isoniazid, rifampicin, pyrazinamide, ethambutol, and streptomycin for 2 months/isoniazid, rifampicin, pyrazinamide, and ethambutol for 1 month/isoniazid, rifampicin, and ethambutol for 5 months).

Treatment outcome is one of the best measures to explain how the current TB regimens work. To the best of our knowledge, no study has been published from Afghanistan regarding the determinants of treatment failure in TB patients. In this study, we will find out the sociodemographic data, clinical and laboratory investigations, and determinants of treatment failure among TB patients attending health facilities in Kandahar City.

# Subjects and Methods

This was a retrospective cohort study. Data of 5 years (August 2014-July 2019) were retrieved from the medical record forms of all pulmonary and extrapulmonary TB (EPTB) patients who attended public health facilities in Kandahar City. Data collection forms were used to collect all the required available demographic, clinical features, laboratory investigations, treatment, and follow-up data of the TB patients.

## Research question

What are the determinants of treatment failure among TB patients in Kandahar City?

## Main objectives

To find out the sociodemographic data, clinical and laboratory investigations, and determinants of treatment failure among TB patients in Kandahar City.

## Inclusion criteria

- Pulmonary TB (PTB) or EPTB patients
- Patients of all age groups.

## Exclusion criteria

- Pregnant women
- Patients whose treatment regimens were changed by physician due to adverse events or drug resistance.

## Sample size calculations

Sample size was calculated using the following formula:

\[
N = \frac{P(1-P)}{(E/1.96)^2}
\]

where \(n\) is the total sample size, \(P\) is the prevalence of outcome expressed as a proportion, \(E\) is the margin of error which is 0.05 in this case, 1.96 is the standard normal Z-value corresponding to the 95% confidence interval (CI). The sample size and power calculations have been performed in Stata 15 (College Station, Texas, USA). Our sample size was 1416 TB patients.

## Ethical considerations

This study was approved by Kandahar University Ethics Committee. Proposal was sent to Ethics Committee on January 4, 2014. Proposal was approved on February 18, 2014.

## Data analysis

After data collection, data were entered into Microsoft Excel sheet. Then, data were entered, cleaned, and analyzed using the Statistical Package for the Social Sciences software (IBM

| Age group (years) | All TB cases, \(n\) (%) | Pulmonary TB cases, \(n\) (%) | Extra-pulmonary TB cases, \(n\) (%) |
|------------------|------------------------|-----------------------------|---------------------------------|
| <15              | 100 (7.1)              | 44 (4.9)                    | 56 (10.7)                      |
| 15-24            | 412 (29.1)             | 270 (30.2)                  | 142 (27.2)                     |
| 25-34            | 300 (21.2)             | 176 (19.7)                  | 124 (23.8)                     |
| 35-44            | 186 (13.1)             | 104 (11.6)                  | 82 (15.8)                      |
| 45-54            | 150 (10.6)             | 88 (9.8)                    | 62 (11.9)                      |
| 55-64            | 118 (8.3)              | 102 (11.4)                  | 34 (6.5)                       |
| ≥65              | 150 (10.6)             | 110 (12.3)                  | 22 (4.2)                       |
| Total            | 1416 (100)             | 894 (100)                   | 522 (100)                      |

TB: Tuberculosis
SPSS Statistics Version 22, IBM, USA, 2013) for Windows. Appropriate descriptive statistics such as mean (with standard deviation) and frequencies (with percentages) were used to describe the study population in relation to relevant variables. Chi-square test was used to find significant differences in different variables and treatment outcomes observed in pulmonary and EPTB patients. Value of $P < 0.05$ was considered as statistically significant.

**Operational definitions**

**Sputum smear**

- Smear-positive PTB – Patient with at least two sputum specimens positive for acid-fast bacilli (AFB), one sputum specimen positive for AFB with the presence of chest radiographic abnormalities suggestive of PTB or at least one sputum smear-positive with a culture positive conformity[44]
- Smear-negative PTB – A patient with at least two negative sputum specimens but culture positive for AFB, chest X-ray showing lesions of active PTB, and decision of a clinician to be treated with anti-TB drugs.

**Treatment outcome**

- Cure – A smear-positive PTB patient who has completed full course of TB therapy and has two consecutive negative smear results including one after the completion of therapy
- Treatment completed – A patient who completed treatment but who does not have a negative sputum smear or culture result in the last month of treatment and on at least one previous occasion
- Treatment failure – A patient with positive sputum smear microscopy at month five or later during treatment
- Died – A patient who dies from any cause during the treatment
- Default – A patient whose treatment was interrupted for two or more consecutive months
- Transfer out – A patient who has been transferred to another recording and reporting unit and whose treatment outcome is unknown.

**Results**

During the 5-year-period (August 2014–July 2019), a total of 1416 TB patients were retrospectively studied who were treated in public health facilities in Kandahar City. Among these patients, 894/1416 (63.1%) patients had PTB, whereas 522/1416 (36.9%) had EPTB. Mean ($\pm$SD, range) of age in all TB, PTB, and EPTB patients were 34.7 ($\pm$18.7, 1–90) years, 36.5 ($\pm$19.3, 1–90) years, and 31.5 ($\pm$17.1, 2–85) years; respectively. Majority of the patients in PTB (270/894 [30.2%]) and EPTB (142/522 [27.2%]) patients were in the age group of 15–24 years [Table 1].

Most of the cases were females in both PTB (530/894 [59.3%]), and EPTB (340/522 [65.1%]) patients. History of contact was present in 172/536 (32%) and 62/360 (17.2%) of PTB and EPTB patients, respectively. Nearly all of the PTB (868/888 [97.7%]) and EPTB (464/492 [94.3%]) had fever. Retreatment cases in PTB were 22/894 (2.5%) while there were no retreatment cases among EPTB patients [Table 2].

Sputum AFB smear at first visit was positive in 618/860 (71.9%) and 16/404 (4%) of PTB and EPTB patients, respectively. On first visit, most of the PTB (476/618 [78.3%]) and EPTB (14/16 [87.5%]) patients had high bacillary density (AFB +) [Table 3].

TB treatment success rate was nearly the same in PTB (656/894 [73.4%]) and EPTB (384/522 [73.6%]) patients [Table 4].

Chi-square test of TB cases showed that statistically significant variables that may cause the failure of TB treatment were retreatment cases (crude odds ratio [COR] 7.7, 95% CI 3.0%–19.7%, $P < 0.001$), absence of fever (COR 5.2, 95% CI 2.8%–9.4%, $P < 0.001$), absence of cough (COR 1.7, 95% CI 1.2%–2.4%, $P = 0.004$), living in rural areas (COR 1.4, 95% confidence interval).

**Table 2: Data of tuberculosis patients**

| Variable            | All TB, n (%) | Pulmonary TB, n (%) | Extra-pulmonary TB, n (%) |
|---------------------|---------------|---------------------|---------------------------|
| Gender              |               |                     |                           |
| Male                | 546 (38.6)    | 364 (40.7)          | 182 (34.9)                |
| Female              | 870 (61.4)    | 530 (59.3)          | 340 (65.1)                |
| Total               | 1416 (100)    | 894 (100)           | 522 (100)                 |
| Place of living     |               |                     |                           |
| Urban               | 948 (66.9)    | 594 (66.4)          | 354 (67.8)                |
| Rural               | 468 (33.1)    | 300 (33.6)          | 168 (32.2)                |
| Total               | 1416 (100)    | 894 (100)           | 522 (100)                 |
| Site of TB          |               |                     |                           |
| Pulmonary           | 894 (63.1)    | 894 (100)           | 0 (0)                     |
| Extrapulmonary      | 522 (36.9)    | 0 (0)               | 522 (100)                 |
| Total               | 1416 (100)    | 894 (100)           | 522 (100)                 |
| TB status           |               |                     |                           |
| New cases           | 1394 (98.4)   | 872 (97.5)          | 522 (100)                 |
| Retreatment cases   | 22 (1.6)      | 22 (2.5)            | 0 (0)                     |
| Total               | 1416 (100)    | 894 (100)           | 522 (100)                 |
| History of contact  |               |                     |                           |
| Yes                 | 234 (26.1)    | 172 (32.0)          | 62 (17.2)                 |
| No                  | 332 (73.9)    | 366 (68.0)          | 298 (82.8)                |
| Total               | 898 (100)     | 538 (100)           | 360 (100)                 |
| Fever               |               |                     |                           |
| Present             | 1332 (96.5)   | 868 (97.7)          | 464 (94.3)                |
| Absent              | 48 (3.5)      | 20 (2.3)            | 28 (5.7)                  |
| Total               | 1380 (100)    | 888 (100)           | 492 (100)                 |
| Cough               |               |                     |                           |
| Present             | 1228 (88.9)   | 866 (97.5)          | 362 (73.3)                |
| Absent              | 154 (11.1)    | 22 (2.5)            | 132 (26.7)                |
| Total               | 1382 (100)    | 888 (100)           | 492 (100)                 |
| Weight loss         |               |                     |                           |
| Present             | 782 (55.2)    | 510 (57.0)          | 272 (52.1)                |
| Absent              | 634 (44.8)    | 384 (43.0)          | 250 (47.9)                |
| Total               | 1416 (100)    | 894 (100)           | 522 (100)                 |

TB: Tuberculosis
Table 3: Sputum acid-fast bacilli examinations of the tuberculosis patients

| Variable | All TB cases, n (%) | Pulmonary TB cases, n (%) | Extra-pulmonary TB cases, n (%) |
|----------|---------------------|--------------------------|---------------------------------|
| Sputum smear at first visit | | | |
| Positive | 634 (50.2) | 618 (71.9) | 16 (4.0) |
| Negative | 630 (49.8) | 242 (28.1) | 388 (96.0) |
| Total | 1264 (100) | 860 (100) | 404 (100) |
| AFB status at first visit | | | |
| Low bacillary density (AFB 1+ and 2+) | 144 (22.7) | 142 (23.0) | 2 (12.5) |
| High bacillary density (AFB 3+) | 490 (77.3) | 476 (78.3) | 14 (87.5) |
| Total | 634 (100) | 618 (100) | 16 (100) |
| Sputum smear after 2 months (end of intensive phase) of anti-TB treatment | | | |
| Positive | 24 (2.1) | 22 (2.9) | 2 (0.5) |
| Negative | 1142 (97.9) | 742 (97.1) | 400 (99.6) |
| Total | 1166 (100) | 764 (100) | 402 (100) |
| AFB status after 2 months (end of intensive phase) of anti-TB treatment | | | |
| Low bacillary density (AFB 1+ and 2+) | 24 (100) | 22 (100) | 2 (100) |
| High bacillary density (AFB 3+) | 0 (0) | 0 (0) | 0 (0) |
| Total | 24 (100) | 22 (100) | 2 (100) |
| Sputum smear after 6 months (at the end of anti-TB treatment) | | | |
| Positive | 22 (2.0) | 20 (2.9) | 2 (0.5) |
| Negative | 1080 (98.0) | 680 (97.1) | 400 (99.6) |
| Total | 1102 (100) | 700 (100) | 402 (100) |
| AFB status after 6 months (at the end of anti-TB treatment) | | | |
| Low bacillary density (AFB 1+ and 2+) | 22 (100) | 20 (100) | 2 (100) |
| High bacillary density (AFB 3+) | 0 (0) | 0 (0) | 0 (0) |
| Total | 22 (100) | 20 (100) | 2 (100) |

AFB: Acid-fast bacilli, TB: Tuberculosis

Table 4: Treatment outcome of the tuberculosis patients

| Treatment outcome | All TB cases, n (%) | Pulmonary TB cases, n (%) | Extra-pulmonary TB cases, n (%) |
|-------------------|---------------------|--------------------------|---------------------------------|
| Success | 1040 (73.4) | 656 (73.4) | 384 (73.6) |
| Cured | 364 (25.7) | 338 (37.8) | 26 (5.0) |
| Treatment completed | 676 (47.7) | 318 (35.6) | 358 (68.6) |
| Failure | 376 (26.6) | 238 (26.6) | 138 (26.4) |
| Defaulted | 156 (11.0) | 90 (10.1) | 66 (12.6) |
| Failed | 60 (4.2) | 56 (6.3) | 4 (0.8) |
| Transferred | 150 (10.6) | 84 (9.4) | 66 (12.6) |
| Death | 10 (0.7) | 8 (0.9) | 2 (0.4) |
| Total | 1416 (100) | 894 (100) | 522 (100) |

TB: Tuberculosis

CI 1.1%–1.7%, \( P = 0.035 \), and no weight loss (COR 1.3, 95% CI 1.0%–1.6%, \( P = 0.033 \)) [Table 5].

Binary logistic regression of the above-mentioned statistically significant variables revealed only absence of fever (adjusted odds ratio 6.0, 95% CI 2.7%–13.4%, \( P < 0.001 \)) as the risk factor for the treatment failure in TB patients [Table 6].

**Discussion**

This was a retrospective cohort study conducted on 1416 TB patients in high-TB-burden city of Kandahar. Most of the PTB and EPTB patients in our study were females. Nearly similar results with more females have been reported from Pakistan (50.5% and 56.2%).[15,16] Contrary, most of the literatures have reported TB prevalence more common in males from Nigeria (55%,[17] 57.7%,[18] 59%,[19] 59.6%,[20] and 60.0%,[21] Ethiopia (54.5%,[15] 55.8%,[22] 59.8%,[23] 60%,[24] 61.3%,[25] and 62.6%),[26] Egypt (60.4%),[27] Pakistan (52.5% and 58.8%),[28,29] India (61.5% and 70%),[30,31] and Malaysia (65%).[32] Mean age of patients in our study was 34.7%. Mean/median age in other studies were 29, 31.5, 32.4, 33.0, and 38.2 years.[20,23,30,33,34] Nearly two-third of our patients were living in urban areas. It is because our study was only in...
AOR: Adjusted odds ratio, CI: Confidence interval, TB: Tuberculosis

Table 5: Chi-square test for treatment outcome of success versus failure among all tuberculosis patients

| Variable                        | Treatment success, n (%) | Treatment failure, n (%) | COR  | 95% CI      | P    |
|---------------------------------|--------------------------|--------------------------|------|-------------|------|
| Gender                          |                          |                          |      |             |      |
| Male (n=546)                    | 384 (70.3)               | 162 (29.7)               | 0.8  | 0.6-1.0     | 0.035|
| Female (n=870)                  | 656 (75.4)               | 214 (24.6)               | 1    |              |      |
| Place of living (n=1416)        |                          |                          |      |             |      |
| Urban (n=948)                   | 716 (75.5)               | 232 (24.5)               | 1    | 1.1-1.7     | 0.012|
| Rural (n=468)                   | 324 (69.2)               | 144 (30.8)               | 1.4  |              |      |
| Site of TB (n=1416)             |                          |                          |      |             |      |
| Pulmonary (n=894)               | 656 (73.4)               | 238 (26.6)               | 1.0  | 0.8-1.3     | 0.939|
| Extra-pulmonary (n=522)         | 384 (73.6)               | 138 (26.4)               | 1    |              |      |
| TB status (n=1416)              |                          |                          |      |             |      |
| New case (n=1394)               | 1034 (74.2)              | 360 (25.8)               | 1    | 3.0-19.7    | <0.001|
| Re-treatment case (n=22)        | 6 (27.3)                 | 16 (72.7)                | 7.7  |              |      |
| History of contact (n=898)      |                          |                          |      |             |      |
| Yes (n=234)                     | 158 (67.5)               | 62 (32.5)                | 0.9  | 0.7-1.2     | 0.558|
| No (n=664)                      | 462 (69.6)               | 202 (30.4)               | 1    |              |      |
| Fever (n=1380)                  |                          |                          |      |             |      |
| Yes (n=1332)                    | 1008 (75.7)              | 324 (24.3)               | 1    | 2.8-9.4     | <0.001|
| No (n=48)                       | 18 (37.5)                | 30 (62.5)                | 5.2  |              |      |
| Cough (n=1382)                  |                          |                          |      |             |      |
| Yes (n=1228)                    | 928 (75.6)               | 300 (24.4)               | 1    | 1.2-2.4     | 0.004|
| No (n=154)                      | 100 (64.9)               | 54 (35.1)                | 1.7  |              |      |
| Weight loss (n=1416)            |                          |                          |      |             |      |
| Yes (n=782)                     | 592 (75.7)               | 190 (24.3)               | 1    | 1.0-1.6     | 0.033|
| No (n=634)                      | 448 (70.7)               | 186 (29.3)               | 1.3  |              |      |
| Sputum smear at first visit (n=1264) |                  |                          |      |             |      |
| Positive (n=634)                | 468 (73.8)               | 166 (26.2)               | 1.0  | 0.8-1.2     | 0.8  |
| Negative (n=630)                | 468 (74.3)               | 162 (25.7)               | 1    |              |      |

CI: Confidence interval, COR: Crude odds ratio, TB: Tuberculosis

Table 6: Binary logistic regression for estimating the risk factors of tuberculosis

| Variable                        | AOR  | 95% CI      | P    |
|---------------------------------|------|-------------|------|
| Place of living                 | 1.1  | 0.8-1.6     | 0.481|
| TB status                       | 1.6  | 0.2-11.0    | 0.643|
| Fever                           | 6.0  | 2.7-13.4    | <0.001|
| Cough                           | 1.3  | 0.7-2.4     | 0.318|
| Weight loss                     | 1.0  | 0.7-1.5     | 0.805|

AOR: Adjusted odds ratio, CI: Confidence interval, TB: Tuberculosis

health facilities inside the city, while the one-third patients of rural areas were coming to the city for the treatment.

In our study, the youngest patient was 1-year-old, whereas the oldest patient was 90 years of age. Majority of the patients were young adults of the age group 15–24 years. Other studies have also reported that majority of the patients were young adults.

More than one-third (36.9%) of our patients had EPTB. Our findings are comparable with other studies showing the EPTB patients’ percentages of 20.3%,33 33.3%,34 36%,35 38.8%,36 39.7%,37 and 40.1%.38 This high proportion of EPTB may be due to overdiagnosis or misclassification bias.

Sputum smear-positive PTB patients were 71.9% in our study. Percentages of smear-positive PTB patients reported from other countries are Pakistan (40.1%,39 42.2%,40 and 44.4%),41 China (64.5%),42 Turkey (76.1%),43 South Korea (30.9%),44 and Ethiopia (28% and 35.4%).45,46 In our study, 2.5% of the PTB were retreatment cases while no retreatment cases among EPTB patients. Percentages of retreatment group reported in other studies were 2.4%,42 3%,43 5%,44 5.7%,44 8.9%,45 9.9%,44 10.9%,46 11.1%,47 and 17.5%.48

Treatment success rate in our study was 77.4%. Surprisingly, it is much lower than the national 93% success rate of Afghanistan reported by the WHO in 2018.47 There is an intense need for more TB studies in different parts of Afghanistan to support the reliability of the published data. Treatment success rate varies widely among countries and even different parts of the same country. For example, treatment success rates reported from India (77.4%,48 89.7%,49 and 90.2%),47 Turkey (91.7%),48 South Korea (83.9%),33 Nigeria (74.4%),48 and Ethiopia (89.2%).49

One of the biggest problems in TB control program is treatment failure. Our study showed 4.2% of treatment failure. TB treatment failure reported from other countries are Turkey (0.3%),41 China (0.5%),40 Egypt (6.2%),27 Ethiopia (1.2% and 3.5%),33,34 and Nigeria (4.8%).12 In our study, TB associated death rate was 0.7%. In a previous study,
TB associated death rate in Kandahar Province (both urban and rural areas) was 0.5%.[30] Studies in other parts of the world have reported TB associated death rate of 0.7,[40] 1.83,[28] 2.9%,[51] 3.1%,[22] 3.4%,[25,42] 3.7%,[38] 3.9%,[23] and 4.5%.[26] While other studies have reported higher proportion of TB associated death rate, ranging from 5.6%–17.7%.[12,32,37,53-55] The decreased death rate in our study was may be due to increased number of defaulted cases (11%) and under reporting.

Our study showed the absence of fever as the risk factor associated with TB treatment failure. Studies have been done in different countries to identify the TB treatment outcome and the associated factors that can influence the treatment outcomes in different parts of the world. A study from Pakistan revealed that age 0–14 years is associated with treatment failure.[23] A recent study in Ethiopia showed that being male, having HIV/TB coinfection, and retreatment case of TB were the factors associated with TB treatment failure.[23] A study in Nigeria showed that the presence of HIV/TB coinfection was the main factor associated with death ($P < 0.001$).[54] Main associated factors of TB reported in the literature were old age,[56-61] male sex,[60,62] comorbid illnesses such as diabetes and HIV,[60,62] advanced chest radiographic findings,[60,62] history of previous TB treatment,[53,57] unememployment,[53,57] multidrug resistance status,[58] alcoholism,[14,53] and drug abuse.[53]

**CONCLUSION**

TB is prevalent in Kandahar City and still a very big challenge for Afghanistan Ministry of Public Health (MoPH). Low treatment success rate, no response of some patients to first-line anti-TB drugs, and increased number of defaulted cases are major threats and need more attention and supervision of Afghan MoPH and WHO. More studies, especially prospective, are needed to find the real disease burden, causes of low treatment success rate and confirmation of MDR and XDR-TB cases in Afghanistan.

Main limitations of our study were as follows: (a) being representative of mostly urban area and therefore cannot be generalized for the entire population and (b) the retrospective nature of our study, and hence, we cannot get all the variables of our need from the registers of the patients.

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**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Tao NN, Li YF, Liu XY, Liu JY, Song WM, Liu Y, et al. Epidemiological characteristics of pulmonary tuberculosis among children in Shandong, China, 2005-2017. BMC Infect Dis 2019;19:408.
2. Comas I, Coscolla M, Luo T, Borrell S, Holt KE, Kato-Maeda M, et al. Out-of-Africa migration and neolithic coexpansion of *Mycobacterium tuberculosis* with modern humans. Nat Genet 2013;45:1176-82.
3. Houben RM, Dodd PJ. The global burden of latent tuberculosis infection: A Re-estimation using mathematical modelling. PLoS Med 2016;13:e1002152.
4. Nathavitharana RR, Friedland JS. A tale of two global emergencies: Tuberculosis control efforts can learn from the Ebola outbreak. Eur Respir J 2015;46:293-6.
5. World Health Organization. Global Tuberculosis Report 2013. WHO Rep 2013. WHO/HTM/TB; 2013.
6. Furin J, Cox H, Pai M. Tuberculosis. Lancet 2019;393:1642-56.
7. World Health Organization. Global Tuberculosis Report 2018. World Health Organization; 2018. Available from: https://www.who.int/tb/publications/global_report/en/. [Last accessed on 2019 Jul 16].
8. Thwaites G. Tuberculosis. In: Farrar J, Peter H, Thomas J, Guganendip K, David L, Nicholas W, editors. Manson’s Tropical Diseases. 23rd ed. Philadelphia: Saunders Ltd.; 2013. p. 468-505.
9. Ghafoor A, Mehrj, Afzli ND, Rafiq Y, Wendl-Richter HU, Hasen R. Multidrug resistant *Mycobacterium tuberculosis* amongst category I and II failures and category II relapse patients from Pakistan. Int J Mycobacteriol 2012;1:118-23.
10. Sookaromdee P, Wiwanitkit V. Smear-negative pulmonary tuberculosis: Relative incidence and outcome of treatment in a drug-resistant endemic setting in Indochina. Biomed Biotechnol Res J 2013;3:109-10.
11. Alobu I, Oshi DC, Oshi SN, Ukwaja KN. Profile and determinants of treatment failure among smear-positive pulmonary tuberculosis patients in Ebonyi, Southeastern Nigeria. Int J Mycobacteriol 2014;3:127-31.
12. Ebuenyi I, Ikuape P, Junmo J. Treatment outcome of tuberculosis at one year: A single centre’s experience in Niger Delta, Nigeria. Int J Trop Dis Health 2016;12:1-6.
13. World Health Organization. Global Tuberculosis Report 2014. World Health Organization; 2014. Available from: http://apps.who.int/medicinedocs/en/m/abstract/Js21634/en/. [Last accessed on 2019 Jul 21].
14. World Health Organization. Guidelines for Treatment of Drug-Susceptible Tuberculosis and Patient Care (2017 update). World Health Organization; 2018.
15. Damte D, Mengistu L, Jango B. Trend of tuberculosis and treatment outcomes in Gambella region with special emphasize on Gambella regional hospital, Western Ethiopia. Mycobact Dis 2013;3:130.
16. Ahmad T, Zohaib, Daud M, Zaman Q, Saifullah, Jadoon M, et al. Prevalence of tuberculosis infection in general population of district Dir (Lower) Pakistan. Middle East J Sci Res 2015;23:14-7.
17. Fatiregun AA, Ojo AS, Bangbeyo AE. Treatment outcomes among pulmonary tuberculosis patients at treatment centers in Ibadan, Nigeria. Ann Afr Med 2009;8:100-8.
18. Oshi SN, Alobu I, Ukwaja KN, Oshi DC. Investigating gender disparities in the profile and treatment outcomes of tuberculosis in Ebonyi state, Nigeria. Epidemiol Infect 2015;143:932-42.
19. Babatunde O, Elegbodu A, Ayodele M, Fadare J, Isinjaye A. Factors affecting treatment outcomes of tuberculosis in a tertiary health center in Southwestern Nigeria. International Review of Social Sciences and Humanities 2013;4:209-18.
20. Adejumo OA, Daniel OJ, Otusanya AF, Adejumo EN. Determinants of health system delay at public and private directly observed treatment, short course facilities in Lagos state, Nigeria: A cross-sectional study. Int J Mycobacteriol 2016;5:257-64.
21. Sunday O, Oladimeji O, Ayedele M, Fadare J, Isinjaye A. Factors affecting treatment outcomes of tuberculosis in a tertiary health center in Southwestern Nigeria. International Review of Social Sciences and Humanities 2013;4:209-18.
22. Shargie EB, Lindtjorn B. DOTS improves treatment outcomes and service coverage for tuberculosis in South Ethiopia: A retrospective trend analysis. BMC Public Health 2005;5:62.
23. Tola A, Minshore KM, Ayele Y, Mekuria AN. Tuberculosis treatment outcomes and associated factors among TB patients attending public hospitals in Harar town, Eastern Ethiopia: A five-year retrospective study. Tubere Res Treat 2014;2014:201705.
24. Asebe G, Dissahe H, Teklu T, Gebregziabehde G, Tafesse K, Ameni G. Treatment outcome of tuberculosis patients registered at DOTS centre in Ogbomoso, Southwestern Nigeria: A 4-year retrospective study. Tubere Res Treat 2014;2014:201705.
25. Gebrezaghiber G, Romha G, Ejeta E, Asebe G, Zemene E, Ameni G. Treatment outcome of tuberculosis patients under directly observed treatment.
treatment short course and factors affecting outcome in Southern Ethiopia: A five-year retrospective study. PLoS One 2016;11:e0150560.

26. Zenebe T, Tefera E. Tuberculosis treatment outcome and associated factors among smear-positive pulmonary tuberculosis patients in Afar, Eastern Ethiopia: A retrospective study. Braz J Infect Dis 2016;20:635-6.

27. El-Shabrawy M, El-Shafei DA. Evaluation of treatment failure outcome and its predictors among pulmonary tuberculosis patients in Sharkia Governorate, 2013–2014. Egypt J Chest Dis Tuberc 2016;66:145-52.

28. Ahmad T, Haroon, Khan M, Khan MM, Ejeta E, Karami M, et al. Treatment outcome of tuberculosis patients under directly observed treatment short course and its determinants in Shangla, Khyber-Pakhtunkhwa, Pakistan: A retrospective study. Int J Mycobacteriol 2017;6:360-4.

29. Ahmad T, Ullah N, Ahmad KA. A descriptive study of tuberculosis in Chakdara Town, Pakistan. Asian J Nat Appl Sci 2013;2:98-103.

30. Kashyap R, Singh K. Treatment outcome in tuberculosis patients under DOTS treatment, tuberculosis unit, Naharan, Himachal Pradesh, 2013-2015: A record based descriptive study. Int J Community Med Public Health 2018;5:2894.

31. Uplekar MW, Rangan S, Weiss MG, Ogden J, Borgdorff MW, Hudelson P. Attention to gender issues in tuberculosis control. Int J Tuberc Lung Dis 2001;5:220-4.

32. Liew SM, Kho EM, Ho BK, Lee YK, Mimi O, Farzina MY, et al. Tuberculosis in Malaysia: Predictors of treatment outcomes in a national registry. Int J Tuberc Lung Dis 2015;19:764-71.

33. Ahmad AM, Akhtar S, Hasan R, Khan JA, Hussain SF, Rizvi N. Risk factors for multidrug-resistant tuberculosis in urban Pakistan: A multicenter case-control study. Int J Mycobacteriol 2012;1:137-42.

34. Garedew D, Nemera G. Treatment outcome of tuberculosis and associated factors at Gimbi Town health facilities Western Oromia, Ethiopia. Nurse Care Open Acces J 2017;2:1.

35. Mok J, An D, Kim S, Lee M, Kim C, Son H. Treatment outcome and factors affecting treatment outcomes of new patients with tuberculosis in Busan, South Korea: A retrospective study of a citywide registry, 2014-2015. BMC Infect Dis 2018;18:655.

36. Melese A, Zelke B, Ewene B. Treatment outcome and associated factors among tuberculosis patients in Debere, Northwestern Ethiopia: A retrospective study. Tubere Res Treat 2016;2016:1354356.

37. Ejeta E, Chala M, Arega G, Ayalsew K, Tesfaye L, Birhanu T, et al. Outcome of tuberculosis patients under directly observed short course treatment in Western Ethiopia. J Infect Dev Ctries 2015;9:752-9.

38. Getahun B, Ameni G, Medhin G, Biadgilign S. Treatment outcome of tuberculosis patients under directly observed treatment in Addis Ababa, Ethiopia. Braz J Infect Dis 2013;17:521-8.

39. Ahmad T, Jadoon MA, Haroon, Khattak MN. Prevalence of sputum smear positive pulmonary tuberculosis at Dargai, District Malakand, Pakistan: A four year retrospective study. Egypt J Chest Dis Tuberc 2016;65:461-4.

40. Wen Y, Zhang Z, Li X, Xia D, Ma J, Dong Y, et al. Treatment outcomes and factors affecting unsuccessful outcome among new pulmonary smear positive and negative tuberculosis patients in Anqing, China: A retrospective study. BMC Infect Dis 2018;18:104.

41. Talay F, Kumbetli S, Altin S. Factors associated with treatment success for tuberculosis patients: A single center’s experience in Turkey. Jpn J Infect Dis 2008;61:25-30.

42. Endris M, Moges F, Belyhun Y, Woldehana E, Esmael A, Unakal C. Treatment outcome of tuberculosis patients at Enfraz health center, Northwest Ethiopia: A five-year retrospective study. Tubere Res Treat 2014;2014:726193.

43. Dangisso MH, Datiko DG, Lindtjorn B. Trends of tuberculosis case notification and treatment outcomes in the Sidauna Zone, Southern Ethiopia: Ten-year retrospective trend analysis in urban-rural settings. PLoS One 2014;9:e114225.

44. Jemal M, Tarekegne D, Atanaw T, Ebubu A, Endris M, Tessema B, et al. Treatment outcomes of tuberculosis patients in Metema hospital, Northwest Ethiopia: A four years retrospective study. Mycobact Dis 2015;5:4.

45. Biruk M, Yimam B, Abraha H, Biruk S, Amdie FZ. Treatment outcomes of tuberculosis and associated factors in an Ethiopian university hospital. Adv Public Health 2016;2016:1-9.

46. Joseph N, Nagaraj K, Bhat J, Babu R, Kotian S, Ranganatha Y, et al. Treatment outcomes among new smear positive and retreatment cases of tuberculosis in Mangalore, South India – A descriptive study. Australas Med J 2011;4:162-7.

47. Saha T, Chattopadhyay A, Sain S, Boral K, Yassin S, Basu R. A follow-up study on the performance, outcome and present status of patients treated under ’RNTCP’ in a slum area of Kolkata. J Dent Med Sci 2013;6:63-7.

48. Ige O, Oladokun R. Treatment outcome of newly diagnosed sputum positive adult tuberculosis cases in the context of HIV infection. J Infect Dis Immun 2011;3:210-7.

49. Berhe G, Enquelslassie F, Aseffa A. Treatment outcome of smear-positive pulmonary tuberculosis patients in Tigray region, Northern Ethiopia. BMC Public Health 2012;12:537.

50. Rahimi BA, Rahimi N, Ahmadi Q, Hayat MS, Wasiq AW. Treatment outcome of tuberculosis treatment regiments in Kandahar, Afghanistan. Indian J Tuberc 2018. https://doi.org/10.1016/j.ijtb.2018.10.008. [Epub ahead of print].

51. Mohammed T, Daniel K, Helamo D, Leta T. Treatment outcomes of tuberculosis patients in Nigist Eleni Mohammed general hospital, Hosanna, Southern Nations, nationalities and peoples region, Ethiopia: A five year (June 2009 to August 2014) retrospective study. Arch Public Health 2017;75:16.

52. Tadesse S, Tadesse T. Treatment success rate of tuberculosis patients in Dabat, Northwest Ethiopia. Health (Irvine Calif) 2014;6:306-10.

53. Muñoz-Sellart M, Cuevas LE, Tumato M, Merid Y, Yassin MA. Factors associated with poor tuberculosis treatment outcome in the Southern Region of Ethiopia. Int J Tuberc Lung Dis 2010;14:973-9.

54. Babatunde O, Eleghede O, Ayodele M, Fadare J, Isinjaye A, Jbirongbe D, et al. Factors affecting treatment outcomes of tuberculosis in a tertiary health center in Southwestern Nigeria. Int Rev Soc Sci Humanit 2013;4:209-18.

55. Khazaei S, Hassanzadeh J, Rezaeian S, Ghaderi E, Khazaei S, Mohammadian HA, et al. Treatment outcome of new smear positive pulmonary tuberculosis patients in Hamadan, Iran: A registry-based cross-sectional study. Egypt J Chest Dis Tuberc 2016;65:925-30.

56. Faustini A, Hall AJ, Perucci CA. Tuberculosis treatment outcomes in Europe: A systematic review. Eur Respir J 2005;26:503-10.

57. Lefebvre N, Falzon D. Risk factors for death among tuberculosis cases: Analysis of European surveillance data. Eur Respir J 2008;31:1256-60.

58. Nik Nor R, Mohd N, Wan M, Sharina D, Nik R. Factors associated with unsuccessful treatment outcome of pulmonary tuberculosis in Kota Bharu, Kelantan, Malaysian J Public Health Med 2011;11:6-15.

59. Tessenma B, Muche A, Bekele A, Reissig D, Emmrich F, Sack U. Treatment outcome of tuberculosis patients at Gondar university teaching hospital, Northwest Ethiopia. A five – year retrospective study. BMC Public Health 2009;9:371.

60. Lee JJ, Wu RL, Lee YS, Wu YC, Chiay CY. Treatment outcome of pulmonary tuberculosis in Eastern Taiwan – Experience at a medical center. J Formos Med Assoc 2007;106:25-30.

61. Orofino Rde L, Brasil PE, Trajman A, Schmaltz CA, Dalcolmo M, Rolai VC. Predictors of tuberculosis treatment outcomes. J Bras Pneumol 2012;38:88-97.

62. Diel R, Niemann S. Outcome of tuberculosis treatment in Hamburg: A survey, 1997-2001. Int J Tuberc Lung Dis 2003;7:124-31.

63. Vasankari T, Holmström P, Ollgren J, Liippo K, Kokki M, Ruutu P. Risk factors for poor tuberculosis treatment outcome in Finland: A cohort study. BMC Public Health 2007;7:291.