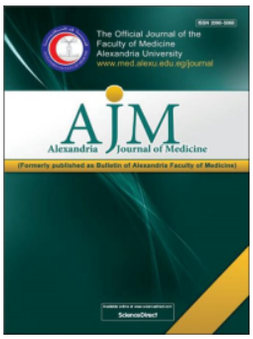

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Successful tuberculosis treatment outcome in East Gojjam zone, Ethiopia: cross-sectional study design

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ABSTRACT

Introduction: Ill health is one of the natural phenomena that can happen to human beings at any time due to either communicable or non-communicable diseases. Tuberculosis (TB) is one of those communicable diseases caused by the bacillus *Mycobacterium tuberculosis* which can be transmitted through droplet nuclei while coughing, sneezing, shouting, or singing. Infection with tuberculosis negatively affects the productive segment of the economy, resulting in a reduction in national productivity. The World Health Organization (WHO) recommended early case detection, accurate diagnosis, and standardized treatment as a means to prevent new infections. In Ethiopia, detecting TB cases early, diagnosing, and treating these cases as per the guideline has been practiced for years through the Directly Observed Treatment Short-course (DOTS) program which was started in 1997. Various researches on TB treatment outcomes and their predictors have been done in Ethiopia. However, almost all of the findings vary from each other even though the country has a standardized definition of the outcomes and data aggregation tools. Moreover, none of the findings and reports showed the magnitude of successful TB treatment outcomes in the study area.

Objective: This research was intended to assess the prevalence of successful TB treatment outcomes among patients enrolled in a DOTS program in the east Gojjam zone, northwest Ethiopia.

Result: Eighty six percent (86%) of all cases enrolled in the DOTS program were successfully treated in the East Gojjam zone, and sex, place of residence, educational status, smear result during entry to the DOTS program, and HIV test result were factors significantly affecting successful TB treatment outcomes in the study area.

Conclusion and Recommendation: The magnitude of successful TB treatment outcome of this study is low compared to the national strategic plan. It is advisable to work on the identified factors to positively affect successful TB treatment outcomes in the study area.

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KEYWORDS
Ethiopia; prevalence; successful TB treatment outcome

What is known about this topic?

- Some global reports and national research endeavors determine the magnitude of both successful and unsuccessful TB treatment outcomes at the national level and in some other geographical areas of the country.
- Determinants of both successful and unsuccessful TB treatment outcomes among patients enrolled in care were identified by researchers in the country.
- Most studies used data from communities to determine treatment outcomes among patients enrolled in the DOTS program.

What does this paper add?

- The magnitude of TB treatment outcome among patients enrolled in care was determined in the study area.
- Factors affecting TB treatment outcome among male and female patients enrolled in care were determined in the study area.
- TB treatment outcome among patients enrolled to care was conducted based on data from records of institutions.

1. Introduction

Ill health is one of the natural phenomena that can happen to human beings at any time resulting from many causes. Some of which could be communicable while others might be non-communicable. Tuberculosis (TB) is one of those communicable diseases caused by the bacillus *Mycobacterium tuberculosis* which can be transmitted through droplet nuclei while coughing, sneezing, shouting, or singing [1]. Infection with tuberculosis negatively affects the productive segment of the economy, resulting in a reduction in national productivity. Reduced productivity but the high consumption of resources during the illness of individuals or communities could create national chaos [2].

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According to the 2020 Global TB report, globally, TB is "one of the top 10 causes of death worldwide and the leading cause of death from a single infectious agent (ranking above HIV/AIDS)" [1]. This report also estimated that by the year 2019 about 10.0 million people were sick because of TB [1]. From this incident case, the lion's share was contributed by WHO Regions of South-East Asia, Africa, and Western Pacific, which were 44%, 25%, and 18%, respectively, while a lower proportion of incident cases was contributed by WHO Regions of Eastern Mediterranean (8.2%), the Americas (2.9%), and Europe (2.5%) [1]. Moreover, in the same year (2019), the estimated epidemiologic burden of TB in Ethiopia was about 140 per 100,000 population which is higher than the global TB burden but lower than the estimates of 30 high TB burden countries [1].

The World Health Organization recommended early case detection, accurate diagnosis, and standardized treatment as a means to prevent new infections. Hence, globally, a total of 7.1 million people were newly diagnosed TB incident cases, out of which 57% and 66% of them were bacteriologically confirmed cases worldwide and in Africa, respectively. From these confirmed cases 85% and 82% of them were successfully treated globally and in Africa, respectively, [1].

In Ethiopia, detecting TB cases early, diagnosing, and treating these cases as per the guideline has been practiced for years through the Directly Observed Treatment Short-course program which was started in 1997. Though annual TB incidence is decreased by 42% from 369 cases per 100,000 populations in 1990–177 per 100,000 populations in 2019, Ethiopia remains to be among the countries with the highest TB, TB/HIV, and DR-TB incidence for the year 2015 to 2020 [2].

According to the Ethiopian national TB and leprosy control strategic plan, it has planned to successfully treat 90% of confirmed TB cases and enroll in the DOTS program [3]. According to the 2020 Global TB report, the successful TB treatment outcome in Ethiopia was 88% by the year 2019 [1]. Various researches on TB treatment outcome and its predictors had been done in Ethiopia [4–10]. However, almost all of the findings vary despite the fact that the country has a standardized definition of the outcomes and data aggregation tools. Moreover, none of the findings and reports showed the magnitude of successful TB treatment outcomes in the study area. Therefore, this research was intended to assess the prevalence of successful TB treatment outcomes among patients enrolled in a DOTS program in the east Gojjam zone, northwest Ethiopia.

2. Materials and methods

2.1. Study setting and period

This research was conducted in East Gojjam zonal administration public health facilities which were located in Amhara national regional state, Ethiopia. Within the administration, there were 18 districts and two town administrations with a total of 2,674,781 inhabitants, 9 hospitals, and 102 health centers. This research reviewed records of 1182 patients enrolled in the DOTS program within five consecutive years (2014–2018). Data were abstracted from the unit TB register and patient cards from December 1 2018 to December 26 2018.

2.2. Study design and population

An institutional-based cross-sectional study design was used. This research reviewed records of all tuberculosis patients of both male and female gender who were enrolled in the DOTS program from Jan 2014 to Dec 2018 within selected public health facilities of the administrative zone.

2.3. Eligibility criteria

Records of all forms of tuberculosis patients, who were within the DOTS program and knew their outcome within Jan 2014 to Dec 2018, were included in the study, while those with incomplete records from Jan 2014 to Dec 2018 and those with pulmonary negative result during the enrollment to the care were excluded from the study.

2.4. Sampling procedure and sample size determination

East Gojjam zonal administration had 9 hospitals and 102 health centers. At the time of data collection for this research, all hospitals and health centers were providing a Directly Observed Treatment Short course in the study area. Accordingly, facilities were used as sampling units while all tuberculosis patients under this care in the selected facilities were used as study units. Primarily, facilities were stratified into two strata (Hospital vs. Health center) and each stratum was given a number. In fact, only two of the hospitals in the study area had been in operation for more than 5 years. As a result, only two hospitals have a record of a Directly Observed Treatment Short course from January 2014 to December 2018 (Debre Markos General Referral Hospital and Motta Hospital). Because of funding and time constraints, it was not possible to include all health facilities in the study, thus one hospital (32 patient records) and 39 health centers (1052 patient records) were chosen. A simple random sampling technique using the lottery method was used to select a hospital, while computer-generated random numbers were used to select health centers. Finally, all patient records of all forms of tuberculosis patients within selected public health facilities of East Gojjam zonal administration were included in the study

2.5. Variables of the study

This study included successful TB treatment outcome (the sum of cured and treatment completed) as a dependent variable while socio-demographic variables (sex, age, residence, and educational status) and clinical variables (Referral status, HIV status, Linkage, Type of TB, and Patient category) as the independent variables.

2.6. Diagnosis of tuberculosis in the study area

In health centers, microscopic diagnosis of acid-fast bacilli (AFB) and culture was a common method of TB diagnosis, while Xpert was also employed to diagnose TB in hospitals in the research area. As a result, this study used patient records from bacteriologically confirmed cases as study subjects, and the outcome of their treatment was also determined using a similar TB diagnostic technique. All pulmonary positive individuals in the study area had their treatment resistant TB tested using Xpert.

3. Definition of terms

According to Ethiopian nation guidelines of TB treatment, Directly Observed Treatment means that an observer watches the patient swallowing their tablets, in a way that is sensitive and supportive to the patient's needs. This ensures that a TB patient takes the right anti-tuberculosis drugs, in the right doses, at the right intervals. National TB program recommends supervision of treatment to be made by a trained health worker, health extension worker, or a trained TB treatment supporter [2].

In Ethiopia, currently, the supervision of treatment is taking place at home by trained TB Treatment Supporter who is identified by the patient and trained to directly observe the optimal administration of TB treatment outside the health facility. The process of identification of a TB Treatment supporter considers acceptance of the person by the patient; living/working in close proximity; willingness to supervise treatment on a daily basis; readiness to assist in identifying and handling adherence problem; and consent to maintain confidentiality.

3.1. Treatment outcomes

Definition of each treatment outcome was used as per definitions of the World Health Organization, global tuberculosis report 2018 and Ethiopian FMoH [1,2].

PTB: positive pulmonary tuberculosis.

3.2. TB close contact

Based on the Ethiopian definition of close contact, TB close contact is defined as living in the same household or being in frequent contact with a person (e.g. caregiver) who is smear-positive for TB. Patients who are sputum smear-negative but culture-positive are also infectious, but to a lesser degree [2].

Outcome	Definition
Cured	A pulmonary TB patient with bacteriological confirmed TB at the beginning of treatment who was smear- or culture-negative in the last month of treatment and on at least one previous occasion
Treatment completed	A TB patient who completed treatment without evidence of failure BUT with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable
Treatment failed	A TB patient whose sputum smear or culture is positive at month 5 or later during treatment
Died	A TB patient who dies for any reason before starting or during the course of treatment
Lost to follow-up	A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more
Not evaluated	A TB patient for whom no treatment outcome is assigned. This includes cases "transferred out" to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit
Treatment success	The sum of cured and treatment completed

4. Data collection and quality assurance

Data for this research was abstracted from the unit TB register and patient cards using a structured observational checklist prepared in English. TB officers working in 10 unselected public health facilities of the administrative zone were involved in data collection, while three supervisors along with lead investigators were supervising the process. In fact, one-day training regarding data collection was given by lead investigators to both data collectors and supervisors prior to data collection. In addition to this, the data collection tool was prepared in advance to handle variables available on TB register and patient cards, and records of 59 (5% of all records included in the review) patients were abstracted to ensure consistency and accuracy of the tool prior to real data collection. During training, data collectors and supervisors were oriented on how to check the completeness of the checklist right after completion regularly on a daily basis.

4.1. Data management and analysis

Epi data version 3.1 was used as a data entry tool, while SPSS version 21 was used for analysis. After the data was cleaned at EPI data, it was exported and analyzed using SPSS version 21. The findings are descriptively presented in terms of frequency tables and percentages. Records of those patients with TB treatment outcomes lost to follow-up and transfer out were excluded for calculating the prevalence of successful TB treatment outcomes and for identifying factors affecting TB treatment

outcomes. The prevalence of successful TB treatment outcomes between genders was comparatively reported. A binary logistic regression model was used to predict the effect of gender on TB treatment outcome. Firstly, the effect of each variable against TB treatment outcome was assessed in both sexes using a cutoff point $p < 0.2$. All variables with a p-value less than 0.2 were exported to multivariate analysis. In a multivariate analysis, the existence of the association between different dependent variables and TB treatment outcome was declared at $p < 0.05$ with a 95% confidence interval.

5. Ethical consideration

Ethically, this research was approved by the institutional research ethics review committee (with an ethical approval reference number; HSC/R/C/Ser/Co/180/8/11). The zonal health department, district health office, facility officials, and administrators agreed to perform the research. Moreover, the purpose of the study and its procedures were explained with the assurance of confidentiality

6. Results

6.1. Socio-demographic determinants of TB treatment outcome

This research reviewed the records of 1,182 TB patients. However, 98 records were excluded from the analysis due to missing data, and a final analysis was conducted on 1,084 TB patients with complete data. This research reviewed 625 (57.7%) and 459 (42.3%) male and female patients, respectively, with a male-to-female ratio of around 1.4:1.

Overall, the mean age was 31.82 ± 12.7 years, while 32.32 ± 12.2 and 31.45 ± 13.06 years were for female and male patients, respectively. Among the total patients, 350 (32.3%) of the patients' age group was between 35 and 44 years, 807 (74.4%) were urban dwellers, 625 (57.7%) were male patients, and 562 (51.8%) were patients who were unable to read and write [Table 1].

6.2. Clinical characteristics of TB patients enrolled in DOTS program

Of the total patients enrolled in the DOTS program, 610 (56.3%) of them had a referral paper written by health extension workers at enrollment in the program. HIV tests were offered and performed for all of the patients at the entry to the program. Hence, 248 (22.9%) of the patients were positive for HIV out of which 231 (93%) of them were linked to HIV care (Table 2).

Table 1. Socio-demographic characteristics of TB patients enrolled in DOTS program in east Gojjam zone, Amhara region, northwest Ethiopia, 2019 (n = 1084).

	Male		Female		Overall	
Variables	Count	%	Count	%	Count	%
Age in years						
0–14	35	66	18	34	53	4.9
15–24	174	60	116	40	290	26.8
25–34	144	55.4	116	44.6	260	24
35–44	198	56.6	152	43.4	350	32.3
45–54	43	53.8	37	46.2	80	7.4
55–64	22	62.9	13	37.1	35	3.1
≥65	9	56.2	7	43.8	16	1.5
Place of residence						
Urban	466	57.7	341	42.3	807	74.4
Rural	159	57.4	118	42.6	277	25.6
Educational status						
Unable to read and write	340	60.5	222	39.5	562	51.8
Able to read and write	285	54.6	237	45.4	522	48.2

Table 2. Clinical characteristics of TB patients enrolled in DOTS program in east Gojjam zone, Amhara region, northwest Ethiopia, 2019 (n = 1084).

	Male		Female		Overall	
Variables	Count	%	Count	%	Count	%
Source of initial referral						
Health Extension workers	361	59.2	249	40.8	610	56.3
Self-referral	251	55.5	201	44.5	452	41.7
Other health facilities	13	59.1	9	40.9	22	2.0
HIV test Result						
Reactive	145	58.5	103	41.5	248	23
Non-reactive	480	57.4	356	42.6	836	77
Linkage to HIV care (n = 248)						
No	5	29.4	12	70.6	17	6.9
Yes	132	57.1	99	42.9	231	93.1
Type of TB						
PTB+	221	58.3	158	41.7	379	35
PTB-	253	55.5	203	44.5	456	42
EPTB	151	60.6	98	39.4	249	23
Patient category at entry						
New	513	57.5	379	42.5	892	82.3
Transferred in	69	56.6	53	43.4	122	11.3
Relapse	30	61.2	19	38.8	49	4.5
Failure	13	61.9	8	38.1	21	1.9

Eight hundred ninety-two (82.3%) of the patients were newly enrolled in the DOTS program (57.5% males and 42.5% females), while 122 (11.3%, 56.6% were males), 49 (4.5%, 61.2% males), and 21 (1.9%, 61.9% males) were enrolled in the program after transferred in, relapse, and treatment failure, respectively (Table 2). More importantly, contacts of all patients enrolled in the DOTS program (N = 7023) were screened for TB, but only 83 (1.18%) were positive for TB.

6.3. Prevalence of successful TB treatment outcome

Based on the findings, the highest numbers (290, 27.1%) of TB patients were enrolled in DOTS program during 2014 followed by 2016 (230, 21.2%) (Figure 1). Out of the total patients enrolled in the DOTS program during the study period and included in the analysis, 79.6% (863/1084) of the patients' TB treatment outcomes were

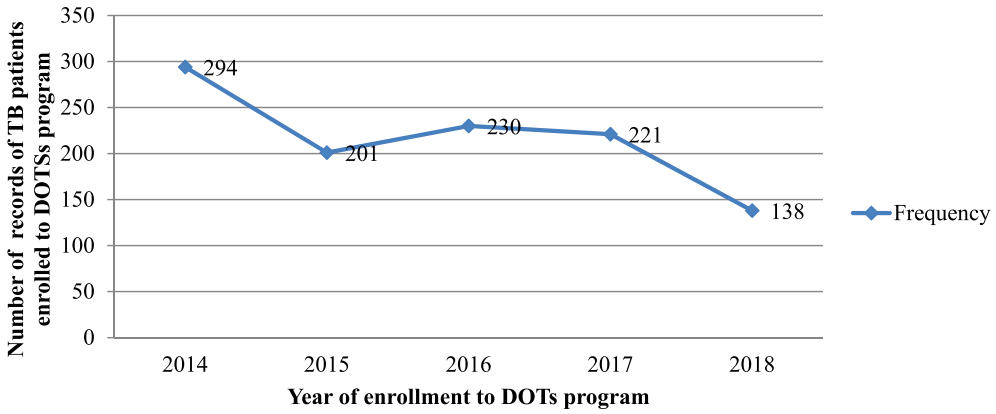

Figure 1. Number of tuberculosis patients enrolled to directly observed treatment short course in east Gojjam zone, Amhara region, northwest Ethiopia, 2019 (n = 1084).

Table 3. Comparison of tuberculosis patients with successful TB treatment outcomes in east Gojjam zone, Amhara region, northwest Ethiopia, 2019 (n = 1084).

	Male		Female		Overall	
Treatment Outcome	N	%	N	%	N	%
Cured	121	19.4	96	20.9	217	20
Treatment completed	310	49.6	215	46.8	525	48.4
Death	27	4.3	25	5.5	52	4.8
Lost to follow-up	12	1.9	24	5.2	36	3.3
Treatment Failure	33	5.3	36	7.9	69	6.4
Transfer Out	122	19.5	63	13.7	185	17.1
Total	625	100	459	100	1084	100

evaluated and recorded. However, the other was not evaluated due to leaving the facility as a transfer out. Among the categories of TB treatment outcomes, treatment completed (525, 48.4%) outnumbers others followed by cured (217, 20%) (Table 3). The prevalence of successful TB treatment outcomes among male patients after excluding transfer out and lost to follow-up was 87.8% (431/491) while for females, it was 83.6% (311/372). The overall prevalence of successful TB treatment outcomes among patients enrolled in the DOTS program in public health facilities of East Gojjam zonal administration was 86% (742/863).

The treatment outcomes of each year were reviewed to see the trend of successful TB treatment outcomes. The percentage of successful treatment outcome ranges from 83.2% in 2017 to 90.6% in 2018. In fact, a slightly consistent trend was observed from 2015 to 2017 but changes in 2018 (Figure 2).

6.4. Factors affecting successful TB treatment outcomes of male and female sex groups independently

Bivariate and multivariate analyses were performed for male and female TB patients enrolled in the DOTS program. Male patients enrolled in the DOTS program from the urban residences were 1.95 times more likely to have successful TB treatment outcomes compared to those male patients from rural residences [AOR = 1.95, 95% CI (1.05, 3.63)]. Male patients enrolled in the DOTS program with non-reactive HIV test results were 3.92 times more likely to have successful TB treatment outcomes compared to male patients with reactive HIV test results [AOR = 3.92, 95% CI (2.16, 7.11)]. Similarly, male TB patients enrolled in the DOTS program with positive

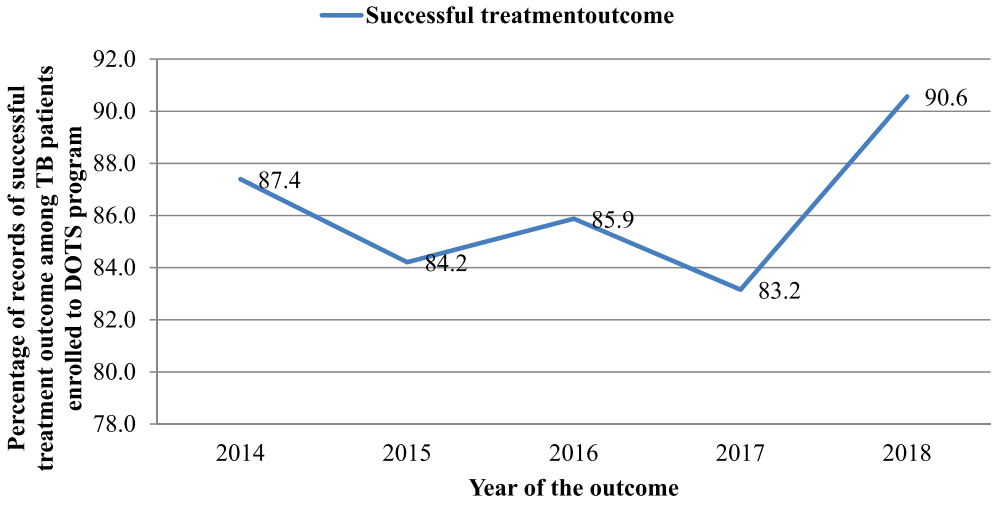

Figure 2. Trend of successful TB treatment outcomes of tuberculosis patients enrolled in DOTS program in east Gojjam zone, Amhara region, northwest Ethiopia, 2019 (n = 863).

Table 4. Bivariate and multivariate analysis of determinants of successful TB treatment outcome among male and female TB patients independently enrolled in DOTS program in east Gojjam zone, Amhara region, northwest Ethiopia, 2019 (n = 863).

	Successful TB treatment outcome				
Variable	No	Yes	Crude COR (95% CI)	Adjusted AOR (95% CI)	P-Value (AOR)
Determinants of TB treatment outcome among records of male TB patients					
Place of residence					
Urban	38[10.3%]	332[89.7%]	1.94[1.1, 3.44]	1.95[1.05, 3.63]*	*P < 0.001*
Rural	22[18.2%]	99[81.8%]	1	1	
Educational Status					
Unable to read and write	40[15.1%]	225[84.9%]	1	1	*P = 0.083*
Able to read and write	20[8.8%]	206[91.2%]	1.83[1.037, 3.24]	1.72[0.932, 3.16]	
HIV test result					
Reactive	28[23.1%]	93[76.9%]	1	1	*P < 0.001*
Non-reactive	32[8.6%]	338[91.4%]	3.18[1.82, 5.55]	3.92[2.16, 7.11]*	
Smear result during entry to DOTS program					
Pulmonary TB positive	8[4.5%]	169[95.5%]	4.39[1.88, 10.29]	6.09[2.5, 14.78]*	*P < 0.001*
Pulmonary TB negative	31[16.1%]	161[83.9%]	1.08[0.59, 1.98]	1.29[0.68, 2.45]	*P = 0.434*
Extra-pulmonary TB	21[17.2%]	101[82.8%]	1	1	
Determinants of TB treatment outcome among records of female TB patients					
Educational status					
Unable to read and write	37[20.6%]	143[79.4%]	1	1	*P = 0.038*
Able to read and write	24[12.5%]	168[87.5%]	1.81[1.035, 3.17]	1.81[1.035, 3.17]	

*Significant below 0.05 level

pulmonary TB results were 6.09 times more likely to have successful TB treatment outcomes compared to male TB patients enrolled in the DOTS program with extra-pulmonary TB [AOR = 6.09, 95% CI (2.5, 14.78)] (Table 4).

However, only female TB patients with the ability to read and write in their educational background during enrollment in DOTS program were 1.81 times more likely to have successful TB treatment outcomes compared to those female patients without the ability to read and write in their educational background during enrollment in DOTS program [AOR = 1.81, 95% CI (1.035, 3.17)] (Table 4).

6.5. Factors affecting successful TB treatment outcomes of both sexes together

The likelihood of having a successful TB treatment outcome among male patients was 1.81 times higher compared to female patients enrolled in DOTS program [AOR = 1.81, 95% CI (1.21, 2.7)]. TB patients enrolled in the DOTS program of all sexes residing in urban areas were 1.63 times more likely to have successful TB treatment outcomes compared to those residing in rural areas [AOR = 1.63, 95% CI (1.06, 2.50)]. TB patients of both sexes enrolled in the DOTS program with positive Pulmonary TB results were 2.77 times more likely to have successful TB treatment outcomes compared to those male and female TB patients enrolled in the DOTS program with extra-pulmonary TB [AOR = 2.77, 95% CI (1.54, 4.97)].

Regarding HIV test result and educational status, successful TB treatment outcome was 2, and 1.72 times higher among male and female TB patients with non-reactive HIV test results [AOR = 2, 95% CI (1.33, 3.14)] and who were able to read and write [AOR = 1.72, 95% CI (1.14, 2.62)] compared to those with reactive HIV test results and without the ability to read and write, respectively (Table 5).

7. Discussion

This research was intended to assess the prevalence of successful TB treatment among patients enrolled in the DOTS program from 2014 to 2018 in the East Gojjam zone, Ethiopia. Initially, 610 (56.3%) of the overall patients enrolled in the DOTS program were having a referral paper written by health extension workers. This may be because, during those years in Ethiopia, there was a strong search for suspects who had a persistent cough for 2 weeks or more which was even linked with the health development army.

Of all patients enrolled in the DOTS program, 248 (22.9%) of them were positive for HIV which was lower [10,11] but higher than the findings of other researches in Ethiopia [5,7,9] [6,8].

Based on the findings of this research, the prevalence of successful TB treatment outcomes among male patients was 87.8% (431/491) while for females; it was 83.6% (311/372). There is a 4.2% difference in successful TB treatment outcomes between male and female patients favoring male patients. Though this finding is consistent with some of the findings from Ethiopia [5,10], still there is a difference among the other findings from Ethiopia [6–9].

The overall (male and female) prevalence of successful TB treatment outcomes among patients enrolled in the DOTS program in public health facilities of East Gojjam zonal administration was 86% (742/863). Even though it is consistent with some of

Table 5. Bivariate and multivariate determinants of TB treatment outcome among both sexes TB patients enrolled in DOTS program in east Gojjam zone, Amhara region, northwest Ethiopia, 2019 (n = 863).

	TB treatment outcome				
Variable	Unsuccessful	Successful	Crude COR (95% CI)	Adjusted AOR (95% CI)	P-Value
Sex					
Male	54[11%]	437[89%]	1.78[1.20, 2.61]	1.81[1.21, 2.7]*	P = 0.004
Female	67[18%]	305[82%]	1	1	
Place of residence					
Urban	77[12%]	567[88%]	1.85[1.23, 2.78]	1.63[1.06, 2.50]*	*P = 0. 017*
Rural	44[21%]	175[89%]	1	1	
Smear result during entry to DOTS program					
Pulmonary TB positive	22[7.1%]	290[92.9%]	2.56[1.44, 4.55]	2.77[1.54, 4.97]*	*P = 0.001*
Pulmonary TB negative	67[18.9%]	287 [81.1%]	0.83[.052, 1.32]	0.929[0.56, 1.5]	*P > 0.05*
Extra-pulmonary TB	32[16.2%]	165[83.8%]	1	1	
Educational status					
Unable to read and write	77[17.3%]	368[82.7%]	1	1	*P = 0.01*
Able to read and write	44[10.5%]	374[89.5%]	1.78[1.2, 2.65]	1.72[1.14, 2.62]*	
HIV test result					
Reactive	42[20.4%]	164[79.6%]	1	1	*P = 0.001*
Non-reactive	79[12%]	578[88%]	1.87[1.24, 2.83]	2.0[1.33, 3.14]*	

*Significant below 0.05 level

the research findings in Ethiopia [4, 8], it was higher than some of the findings [5,7,9,12,13], while lower than the other findings in the world [6,10,14,15].

In most cases, the prevalence of successful TB treatment outcomes among males, females, and both sexes varies with the articles reviewed. This difference could be justified related to calculating treatment success rate in which some of the authors included default/lost to follow-up [5,6,11], as part of unsuccessful TB treatment outcomes while others did not.

Male patients enrolled in the DOTS program had a higher chance of having a successful TB treatment outcome than female patients. The possible rationale for the discovery could be related to the fact that in Ethiopia, females perform the majority of household duties, which may force these women to compromise the treatment guideline.

Urban residency favors male patients who are more likely to have successful TB treatment outcomes compared to rural ones. In most areas of Ethiopia, urban males are usually more literate, and accessible to media and health facilities than rural males. Therefore, opportunities might push male urban patients to effectively and efficiently utilize the DOTS program thereby having better successful TB treatment outcomes compared to rural males.

Enrollment in a DOTS program with a non-reactive HIV test result offers male TB patients more likely to have a successful TB treatment outcome compared to those enrolled in care with reactive HIV test results. The finding was supported by evidence from Ethiopia [5,6,9,11]. In fact, the finding from Afar was obtained only among smear-positive pulmonary tuberculosis patients [9] of both sexes [5,6,9,11], while the other findings from Ethiopia included default [5,6,11] and transfer out [5] as unsuccessful TB treatment outcomes. This might happen due to the fact that male patients with reactive HIV test results are usually prone to death (due to HIV or TB itself) and treatment failure which could lead to unsuccessful TB treatment outcome.

The likelihood of having a successful TB treatment outcome is higher among TB patients enrolled in DOTS program with positive pulmonary TB results than among those enrolled in the DOTS program with extra-pulmonary TB. This finding was not comparable with the research findings from Ethiopia where one research found that there was no association between enrollment in DOTS program with positive pulmonary TB and extra-pulmonary TB and successful TB treatment outcome [11], while the other finding indicated that male patients enrolled in DOTS program with extra-pulmonary TB had the higher probability of having successful TB treatment outcome compared to those TB patients enrolled in DOTS program with extra-pulmonary TB [6].

The existence of an association between residency and successful TB treatment outcome for both sexes together was also analyzed and the probability of having a successful TB treatment outcome was higher among urban residents compared to their counterparts. Similar evidence was obtained in research conducted in Debre Tabor, Northwest Ethiopia [8].

TB patients of both sexes enrolled in the DOTS program with a pulmonary positive TB test result were more likely to have a successful TB treatment outcome compared to those TB patients enrolled in the DOTS program with extra-pulmonary TB. Similar evidence was obtained in research conducted at Azezo Health Center, Northwest Ethiopia [7] but contradicts with the finding from west Gojjam, Northwest Ethiopia [6].

TB patients of both sexes with a non-reactive HIV test result were more likely to have a successful TB treatment outcome compared to those enrolled to care with a reactive HIV test result. It was supported by the findings from Portugal [14] and Ethiopia [4,6,7,9,11].

The ability to read and write improves the likelihood of having a successful TB treatment outcome compared to TB patients of both sexes with the educational status of being unable to read and write. Consequently, only records of female TB patients with the ability to read and write in their educational background during enrollment in the DOTS program were more likely to have successful TB treatment outcomes compared to records of those female patients without the ability to read and write. According to the national guideline for TB, the treatment of a patient is supervised at home by a trained TB treatment supporter who is identified by a patient her/himself [2]. The effectiveness of the treatment is dependent on the skill of the TB treatment supporter while selecting competent TB treatment supporter is also dependent on the skill of the patient her/himself as well. Hence, those TB patients with the capability to read and write might read leaflets, brochures, and other advertising materials usually distributed by the TB prevention and control department at DOTS room and everywhere. Hence, they could better understand the consequences of misuse of the DOTS program and therefore cooperate with TB treatment supporter.

8. Strength of the study

The data used for this research was collected from records of patients enrolled in the DOTS program within five consecutive years (2014–2018). The patient information was primarily recorded as a routine DOTS program which could make the data free of deliberate manipulation.

Moreover, this research included a relatively large sample size compared to previously conducted researches. It is a well-known fact that as the sample size increases, the closeness of the parameter to the true value also increases

9. The weakness of the study

Since this research is based on secondary data, all variables that can affect successful TB treatment outcomes are not included. Moreover, being unable to include variables with missing data could somehow affect the validity of the findings.

10. Conclusion

The magnitude of successful TB treatment outcomes among patients enrolled in the DOTS program within public health facilities was lower than the target set by the national TB and leprosy control strategic plan. Moreover, there is a 4.2% difference in successful TB treatment outcome between male and female TB patients favoring male patients. Place of residence, smear results during entry to the DOTS program, and HIV test results were identified as factors affecting TB treatment outcomes among male TB patients. Similarly, places of residence; smear result during entry to the program; HIV test result; and educational status were significantly associated with TB treatment outcomes in both male and female TB patients. However, only educational status was found to be associated with TB treatment outcome in the records of female TB patients enrolled in the DOTS program. FMoH, regional health bureau, zonal health department, and facilities should counsel and support in advance those TB patients without the ability to read and write, both male and female HIV-positive TB patients, extra-pulmonary TB patients enrolled in the DOTS program, and patients from rural areas. Moreover, researchers should do further research to justify reasons for the existence of a difference in successful TB treatment outcomes between male and female patients, urban and rural residents, the different patient categories, and HIV status.

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Data availability

The SPSS data used to support the findings of this study are available from the corresponding author upon request.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Authors' contributions

Maru Meseret designed the study, prepared the proposal, supervised data collection, analyzed, and interpreted the data.

Getaye Tizazu, Habtamu Temesgen, and Mulugeta Tesfa coached the research from proposal development to data interpretation. Maru Meseret drafted and prepared the manuscript. All authors read and approved the final manuscript.

Ethical statement

Ethically, this research was approved by the Debre Markos University College of Health Science Institutional Research Ethics Review Committee (with ethical approval reference number; HSC/R/C/Ser/Co/180/8/11). The zonal health department, district health office, facility officials, and administrators agreed to perform the research. Moreover, the purpose of the study and its procedures were explained with the assurance of confidentiality.

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