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Profile and treatment outcomes among young patients with tuberculosis aged 15–24 years in Faridabad district of Haryana, India

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ABSTRACT

Objective This study examined profile and treatment outcomes of young patients with tuberculosis (TB) registered at a district TB centre under the National TB Elimination Programme in Faridabad district of Haryana state in India.

Methods In this secondary data analysis, we studied the records of young TB patients aged 15–24 years registered under a TB programme during October 2013–December 2017 in Faridabad district of Haryana state.

Results We analysed records of 5257 young patients with TB. Majority (58.7%) were patients with pulmonary TB and most of them (83.6%) were registered as new patients. Majority of the young patients with TB (93.2%) had a successful treatment outcome, and patients having sputum result 2+ or less and patients who did not have a previous history of TB were found to be significantly associated with a successful treatment outcome on multivariable analysis.

Conclusion There was a high treatment success rate noted in young patients with TB. More focus is needed to patients having a history of TB and sputum result >2+. Targeted interventions can be designed for these groups in future programmatic strategies to reduce disease burden in this section of young population.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ We have included young age groups (15–24 years), whose parameters are often not looked in routine tuberculosis (TB) programmatic settings in India.
⇒ A large sample is included in the study for analysis.
⇒ Generalisability will be limited to similar settings in the northern part of India.
⇒ The study suffers from limitations owing to the retrospective analysis of the records.
⇒ Information about risk behaviours and social status vulnerability of young people was not available for inclusion in the analysis that could impact the TB outcomes.

INTRODUCTION

Tuberculosis (TB) is the ninth leading cause of death worldwide.[1] Globally, an estimated 10.0 million (range: 8.9–11.0 million) people developed TB disease in 2019, with an estimated 1.2 million (range: 1.1–1.3 million) TB deaths among HIV-negative people in 2019.[2] India accounts for a quarter of the global TB burden with estimated 2.6 million new cases and notified 2.4 million cases in 2019, and 0.44 million deaths among HIV-negative people.[3]

The WHO defines 'adolescents' as individuals in the 10–19 years age group and 'youth' as the 15–24 years age group, collectively referred as young people.[4] These are susceptible to high force of TB infection due to engagement in wide social gatherings in schools and colleges. The WHO estimated that 1.78 million (1.23–3.00 million) young people developed TB in 2012, accounting for 17% of all new TB cases globally, and young people in the WHO South East Asian region experienced the greatest number of TB episodes.[5] Previous data show that the risk of TB increases dramatically during adolescence, and young people face unique challenges in terms of case detection and effective treatment.[6] Prevention of onward transmission requires reaching people with TB disease who spend a lot of time untreated and around other people who might acquire TB infection, and young people.[7]

Epidemiological information on TB among young population has always been vital for planning control strategies, and there is a paucity of data regarding clinical characteristics and programme-defined treatment outcomes for this age group at the district level. Hence, the present study was aimed to study the profile and treatment outcomes of young TB cases registered under a TB programme in Faridabad district of Haryana state.

METHODS

Study design

A secondary analysis of existing data of young patients with TB registered at a district

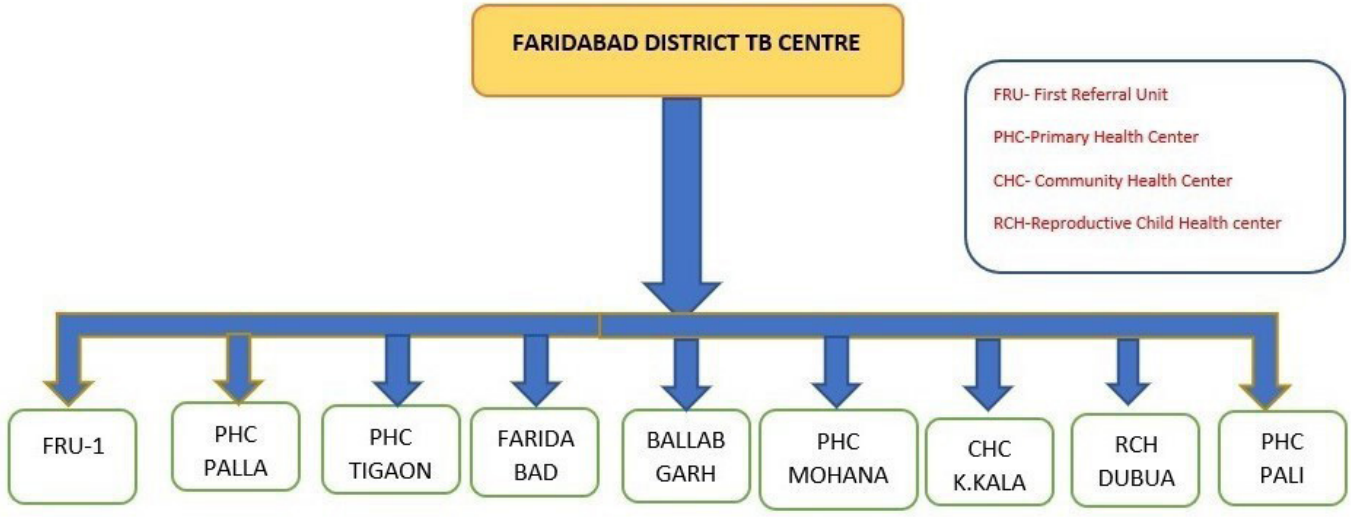

Figure 1 Flow chart of Faridabad district TB centre and nine tuberculosis units distributed under it. TB, tuberculosis.

TB centre (DTC) under the National TB Elimination Programme in Faridabad district.

Study setting

As per report of 2011 census,[8] within the national capital region, Faridabad is the most populous district of Haryana state with a population of 1 798 954. The Revised National TB Control Programme (RNTCP) was adopted in Faridabad district in April 2000. The current study was carried out in a DTC of Faridabad district during December 2018–June 2019. It has nine TB units (TUs) under it covering different areas within Faridabad district (figure 1). Under the national TB programme, there is a network of DTCs at a district level and TUs at a subdistrict level.[9] The TU is the nodal point for TB control activities within the subdistrict and is usually situated at any of these levels—primary health centre, community health centre, first referral unit, dispensaries, reproductive child health units and medical colleges. The TU sends quarterly reports to DTC in prescribed format regarding screening, diagnosis and treatment of patients at the TU under the RNTCP.[10] The details of all the patients with TB registered at TUs were recorded in TB registers maintained at the level of TUs. Information regarding the age, sex, weight of the patient, type of patient, category of treatment, history of TB, type of sputum smear, HIV status and treatment outcomes of patients with TB registered at TUs was sent to the district TB office quarterly in prescribed reporting formats.

Study population

We performed a retrospective record review of all young (within the age group 15–24 years) patients with TB registered in the DTC of Faridabad from October 2013 to December 2017. The data pertaining to paediatric years (≤14 years) and TB are described elsewhere and are not included in this report.[11] Data were retrieved until December 2017 as there were considerable policy and programmatic changes after this period owing to TB elimination efforts initiated in the area. After seeking permission from the district TB officer, TB registers available at nine TUs were accessed for collecting information regarding all the young TB cases registered during the study period. Sociodemographic and treatment-related data of the study population were extracted from TB registers maintained at each TU. If the treatment outcome of any TB case was missing, that case was excluded. Treatment outcomes listed in the register were found to be 97% accurate when programmatic guidelines were applied to the clinical information provided for each case, and were corrected when those criteria were not met.

Study variables and definitions

The following definitions of treatment outcomes were used in this study as per national guidelines[9 12]:

1. Cured: patients with microbiologically confirmed TB at the beginning of treatment who were smear or culture negative at the end of the complete treatment.
2. Treatment completed: a patient with TB who has completed treatment without evidence of failure or clinical deterioration but with no record to show that the smear or culture result of biological specimen in the last month of treatment was negative, either because the test was not done or because the result was unavailable.

The variables included in the study from the TB register were as follows: age, sex, type of patient, category of treatment, history of TB, type of sputum smear, HIV status and treatment outcomes. We defined an outcome as 'successful' if the patient was declared as cured or treatment completed at the end of treatment and 'others' if the patient was declared defaulter, failure, died, switched to multidrug-resistant (MDR) treatment (category IV) during or at the end of treatment.

Patient and public involvement

No patient was involved as this was a secondary data analysis undertaken from routine programmatic records.

Data analysis

Data were entered into Microsoft Excel V.2016 (Microsoft, Redmond, Washington, USA) and analysed using STATA V.13 (Stata Corp, College Station, Texas, USA). Descriptive statistics were applied to analyse type of TB, type of patient, sputum result status, HIV status and treatment outcomes of a TB case. Variables were summarised by proportions and 95% CIs. Bivariable logistic regression analysis was performed considering treatment outcome as the dependent variable and the following independent variables: sputum smear result, type of TB, history of TB, type of patient and category of treatment. Variables found to be significant on bivariable analysis were included in the multivariable logistic regression model to study factors associated with treatment outcomes. Crude and adjusted ORs were computed along with 95% CIs.

RESULTS

In the present study, data of 5257 young patients with TB during October 2013–December 2017 were analysed. The maximum number of patients with TB was registered during the year 2016 (28.4%) followed by 2014 (22%). Out of 5257 patients, the majority (39%) belonged to Ballabgarh TU and Faridabad TU.

The mean age (±SD) of study participants was 19.5 (±2.8) years. Forty-eight per cent of patients were 15–19 years old and 52% were 20–24 years old. A slightly higher proportion of women were part of the study sample (53%) with male to female ratio as 0.8:1 (table 1).

Table 1 Distribution of patients with TB according to key variables (N=5257)

Variable	Age group (in years) 15–19 (n=2527) No (%)	Age group (in years) 20–24 (n=2730) No (%)	Total N=5257 No
Sex			
Male	1102 (43.6)	1358 (49.7)	2460
Female	1425 (56.4)	1372 (50.3)	2797
Type of TB			
Pulmonary	1510 (59.8)	1578 (57.8)	3088
Extrapulmonary	1017 (40.2)	1152 (42.2)	2169
Category of treatment			
I	2167 (85.8)	2230 (81.7)	4397
II	360 (14.2)	500 (18.3)	860
History of TB			
Yes	397 (15.7)	538 (19.7)	935
No	2130 (84.3)	2192 (80.3)	4322
Type of patient			
New	2167 (85.8)	2230 (81.7)	4397
Relapse	100 (3.9)	161 (5.9)	261
Treatment after default	76 (3.0)	99 (3.6)	175
Failure	27 (1.1)	22 (0.8)	49
Others	157 (6.2)	218 (8.0)	375
Sputum smear (n=3088)			
Positive	864 (57.2)	948 (60.1)	1812
Negative	646 (42.8)	630 (39.9)	1276
HIV status			
Positive	3 (0.1)	5 (0.2)	8
Negative	2102 (83.2)	2181 (79.9)	4283
Unknown	422 (16.7)	544 (19.9)	966

Column percentages are presented as proportions.
TB, tuberculosis.

Clinical characteristics of patients with TB

Out of 5257 patients with TB, majority (58.7%) had pulmonary TB and 41.3% had extrapulmonary TB. Most of the patients (83.6%) were on category I of treatment. Young adults in the age group 15–19 years (86%) comprised a slightly higher proportion of category I treatment patients than participants aged 20–24 years (82%). Out of all aged 20–24 years, 20% had a history of TB, compared with 16% in young patients with TB aged 15–19 years. Most of the patients (83.6%) were new patients with TB, whereas only 4.9% were relapse and 3.3% were failure cases. Among 3088 patients with pulmonary TB, 58.7% had sputum-positive TB, and 52.3% of patients with sputum-positive TB belonged to 20–24 years of age group. Out of 5257 patients, most (81.6%) patients had a record of their HIV status and only 8 patients with TB were HIV positive (table 1). Individual age wise segregation of these characteristics is also shown in online supplemental table 1.

Treatment outcomes

Out of 5257 young patients with TB, most (93.2%) had successful treatment outcomes (cured (30.8%) and treatment completed (62.4%)). The treatment success rate was similar in both the age bands—93.3% in patients aged 15–19 years and 93.1% in adults aged 20–24 years. Around 3% of patients with TB defaulted the treatment and 1.2% patients switched to category IV treatment. Treatment outcome rates were relatively the same in both age groups (p=0.739) (figure 2 and table 2). A segregated age wise analysis was also performed and is presented in online supplemental table 2. Major differences were not found with only slight 1% higher occurrence of combined outcomes compared with the total set of patients (failure/default/death/shift to category IV/transfer out) in age band 17–22 years.

A successful treatment outcome was significantly higher among sputum smear-negative patients than positive ones (p<0.05). A higher proportion of successful treatment was seen among patients diagnosed with extrapulmonary TB, without a history of TB and newly diagnosed patients

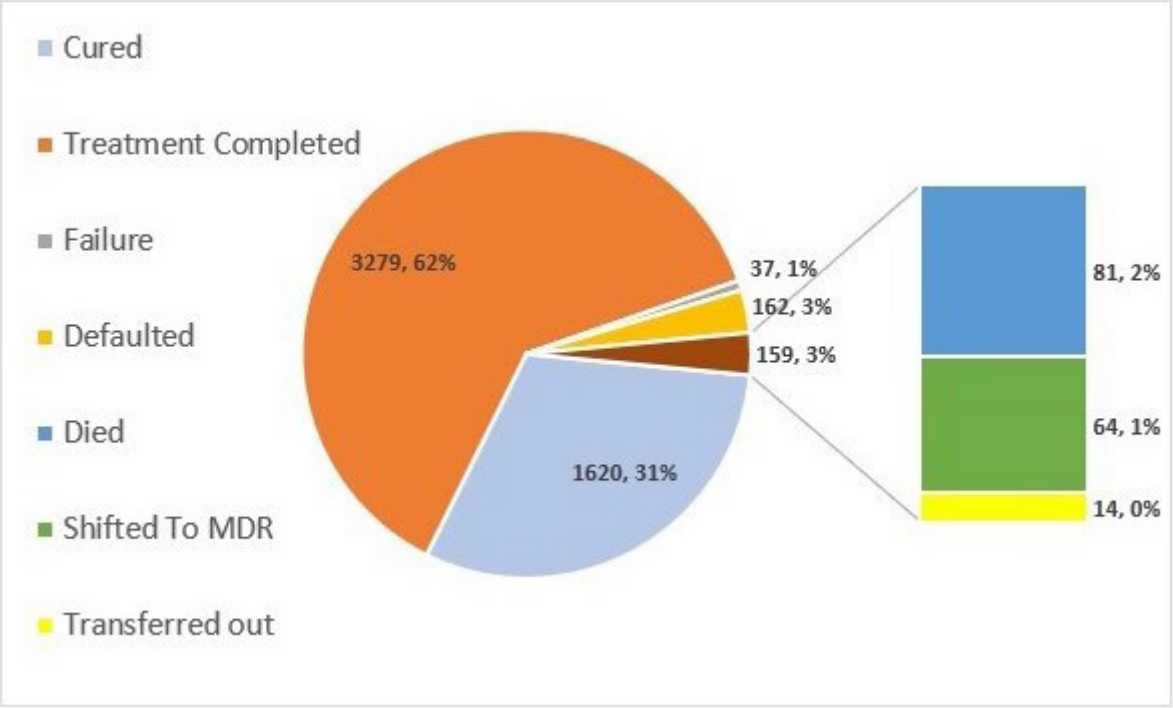

Figure 2 Distribution of patients with TB according to treatment outcomes (n=5257). MDR, multidrug resistant; TB, tuberculosis.

with TB, and these differences were statistically significant (p<0.05) (table 3).

Factors associated with successful treatment outcomes

We used bivariable and multivariable logistic regression analyses to study the factors associated with successful treatment outcomes. In bivariable analysis, sex, category of TB treatment, sputum result, type of TB and history of TB treatment were significantly associated with successful treatment outcomes. In the multivariable logistic regression model, for patients with TB compared with those who had negative sputum smear result, odds of a successful treatment outcome were lower in those who had higher tubercle bacillary load evident through sputum positivity (and the OR decreasing further as the sputum severity was

Table 2 Distribution of patients with TB according to treatment outcomes (n=5257)

Treatment outcome	Age group in years 15–19 No (%)	20–24 No (%)	Total No (%)	P value
Cured	782 (30.9)	838 (30.7)	1620 (30.8)	0.739
Treatment completed	1576 (62.4)	1703 (62.4)	3279 (62.4)	
Failure	21 (0.8)	16 (0.6)	37 (0.7)	
Defaulted	77 (3.0)	85 (3.1)	162 (3.1)	
Died	38 (1.5)	43 (1.6)	81 (1.5)	
Shifted to category IV	29 (1.1)	35 (1.3)	64 (1.2)	
Transferred out	4 (0.2)	10 (0.4)	14 (0.3)	
Total	2527 (100)	2730 (100)	5257 (100)	

TB, tuberculosis.

Table 3 Association of treatment outcomes with clinical characteristics (n=5243)

Variables	Treatment outcome Successful* No (%)	Others† No (%)	Total No	P value
Sputum smear (n=3075)				
Positive	1565 (86.8)	239 (13.2)	1804	0.009
Negative	1197 (94.2)	74 (5.8)	1271	
Type of TB				
Pulmonary	2762 (89.8)	313 (10.2)	3075	<0.001
Extrapulmonary	2137 (98.6)	31 (1.4)	2168	
History of TB				
Yes	770 (82.8)	160 (17.2)	930	<0.001
No	4129 (95.7)	184 (4.3)	4313	
Type of patient				
New	4197 (95.7)	191 (4.3)	4388	0.025
Others	702 (82.1)	153 (17.9)	855	
Category of treatment				
I	4197 (95.7)	191 (4.3)	4388	<0.001
II	702 (82.1)	153 (17.9)	85	

*Successful—cured, treatment completed.
†Others—died, failure, defaulted, shifted to MDR treatment.
MDR, multidrug resistant; TB, tuberculosis.

Table 4 Factors associated with successful treatment outcomes among young patients with TB

Variable	No (%)	Unadjusted OR (95% CI)	Unadjusted P value	Adjusted OR (95% CI)	Adjusted P value
Sex					
Male	2271 (46.4)	1.00		1.00	
Female	2628 (53.6)	1.30 (1.04 to 1.61)	0.019	1.02 (0.80 to 1.29)	0.86
Age (years)					
15–19	2358 (48.1)	1.00		–	
20–24	2541 (51.9)	0.99 (0.79 to 1.23)	0.95	–	
Category of treatment					
I	4197 (85.7)	1.00		1.00	
II	702 (14.3)	0.20 (0.16 to 0.26)	<0.001	0.8 (0.34 to 1.86)	0.61
Sputum result					
Negative	1197 (43.3)	1.00		1.00	
Scanty	67 (2.4)	0.52 (0.37 to 0.73)	<0.001	0.55 (0.26 to 1.13)	0.108
1+	637 (23.1)	0.36 (0.26 to 0.50)	<0.001	0.67 (0.47 to 0.95)	0.026
2+	541 (19.6)	0.31 (0.19 to 0.44)	<0.001	0.46 (0.33 to 0.65)	<0.001
3+	320 (11.6)	0.41 (0.20 to 0.83)	0.014	0.42 (0.29 to 0.60)	<0.001
History of TB treatment					
Yes	770 (51.7)	1.00		1.00	
No	4129 (84.3)	4.46 (3.72 to 5.84)	<0.001	2.88 (1.24 to 6.66)	0.013
Type of TB					
Pulmonary	2762 (56.4)	1.00		1.00	
Extrapulmonary	2137 (43.6)	7.81 (5.37 to 11.3)	<0.001	3.23 (0.42 to 24.4)	0.25

TB, tuberculosis.

increasing). The adjusted ORs (AORs) obtained in this context were as follows: scanty sputum (AOR: 0.55 (95% CI: 0.26 to 1.13); p=1.08), sputum 1+ (AOR 0.67 (95% CI: 0.47 to 0.95); p=0.026) and sputum 2+ (AOR: 0.46 (95% CI: 0.33 to 0.65); p<0.001), respectively. Patients who did not have a history of TB had approximately three times higher odds of a successful treatment outcome (AOR: 2.9 (95% CI: 1.24 to 6.66); p=0.013) (table 4).

DISCUSSION

In the present study, records of 5257 young patients with TB from Faridabad district registered under RNTCP during October 2013–December 2017 were analysed. The mean age (±SD) of study participants was 19.5 (±2.8) years. Majority (53.2%) of patients with TB were women. Similar findings were reported by Enane *et al*[13] among young adult patients with TB in which the mean age was 22.2 years and majority were women (52.9%).

In the present study of TB in young adults, we found out that a higher proportion was constituted by pulmonary TB cases (59%) and majority (84%) were on category I treatment. Our findings were supported by a review done on adolescents and young adults by Moscibrodzki *et al*[14] and Chiang *et al*.[15] Young adults aged 20–24 years were significantly comprising the higher percentage of category II patients than patients aged 15–19 years (p<0.001). A study conducted among adolescents and young adults in Botswana by Enane *et al*[13] reported similar findings. This age group is most likely to come in contact with other non-infected people, thereby augmenting the risk of spreading the infection. We found that most of the patients (84%) were new patients with TB whereas only 5% were relapse and 3% failure cases. The findings were consistent with the reported annual report in Faridabad district.[16] Our results were similar to a study done among adolescents and young adults in Botswana by Enane *et al*[13] in 2016. Sharma *et al*,[17] in their study among patients attending a DOTS (Directly Observed Treatment, Short Course) centre in Delhi, reported a lower proportion of new patients with TB and higher proportion of relapse. This difference may be due to inclusion of adult patients along with young people in their study.

In our study, around 18% of patients had a history of TB in earlier life and a higher number of patients (58%) aged 20–24 years had a history of TB than patients aged 15–19 years (43%) (p<0.001). This was higher compared with the findings reported by Enane *et al*[13] (8.1%) among young patients with TB in Botswana. This difference may be due to the high burden of TB in India compared with other countries.

We found that, out of 3088 patients with pulmonary TB, majority (58.7%) were sputum positive and more than half (52.3%) of sputum-positive patients were in 20–24 years of age group. On the other hand, Enane *et al*[13] and Chiang *et al*[15] reported a sputum positive rate among adolescents as 54.5% and 90.8%, respectively. This variation may be due to the difference in study setting and sample size.

In the present study, out of 5257 patients, the record of HIV status was available for 4291 (81.6%) patients with TB and only 8 patients with TB were positive. Recent studies done in Haiti, Botswana and Cape Town reported a higher HIV positive rate among adolescents and young adults.[13 18 19] This difference may be due to the low prevalence of HIV in Haryana state (general population prevalence of 0.18%) and opt-out HIV testing option under RNTCP.[20]

In this study, we categorised the treatment outcome as successful (cured or treatment completed) and others (failure, defaulted, died, switched to MDR treatment). In our study, most of the young patients with TB (93.2%) had a successful treatment outcome. The treatment success rate was almost similar in age groups of 20–24 years and 15–19 years. Around 3% defaulted the treatment and 1.2% were switched to category IV (MDR) treatment. As per the annual TB report 2021 of the government of India, treatment success rate, default (loss to follow-up) rate and change in treatment regimen rate in Haryana state for the year 2019 were 79%, 4.1% and 0.6%, respectively. The difference in the treatment success rate and loss to follow-up rate in the present study and annual TB report was due to difference in age group; the national report provided data only for adult and paediatric (≤14 years) patients with TB. A study conducted by Enane *et al*[13] among similar age group in Botswana reported a lower treatment success rate (87.2%) and higher failure (1.5%) and default rate (8.8%). Similarly, a study by Reif *et al*[18] among adolescent and young patients with TB in Haiti reported a lower successful treatment outcome rate (77%) and a higher failure and default rate (20%). This difference may be explained by higher HIV prevalence in their study, high poverty and unstable home life in the African region.

In the present study, in the bivariable analysis, sex, category of TB treatment, sputum result, type of TB and history of TB were found to be significantly associated with a successful treatment outcome. In the multivariable analysis, patients who did not have a history of TB (AOR: 2.9, 95% CI: 1.24 to 6.66) and patients having sputum result 2+ or less (AOR: 0.46, 95% CI: 0.33 to 0.65) were associated with a successful treatment outcome compared with those who had a history of TB and sputum smear negative for TB, respectively. This highlights that young patients with TB having sputum result 1+, 2+ or more (compared with negative) and having a history of TB warrant higher focus while managing them to achieve a 100% treatment success rate and protecting them from developing drug resistance in further life. Studies done by Chiang *et al*[15] and Osman *et al*[21] reported the predictors of pulmonary or thoracic involvement in TB and mortality of TB, respectively, but data on predictors of a successful treatment outcome among adolescent and young population are added by the present study. Studies from Brazil have reported the following factors associated with unfavourable outcomes (loss to follow-up/death/treatment failure) among adolescents with TB retreatment as seen in our study: presence of HIV infection, vulnerable characteristics (homelessness, imprisonment, substance use) and place of residence.[22 23] We did not have information about social and personal risk behaviours prevalent among young people including tobacco, and alcohol and illicit substance use—all of which can affect outcomes in patients with TB. Future studies done prospectively could note these risk factors as study variables as routine programmatic data do not record them and measure treatment outcomes in young patients with TB in an Indian setting.

The present study had certain strengths such as large sample size, inclusion of young adults, often whose disaggregated data not presented in the programme reports, and application of logistic regression to study factors associated with treatment outcomes. This study adds substantial epidemiological data on TB among young population. Limitations to extrapolation from the study are because it was a retrospective record review and there had been poor record-keeping at some TUs. Some data were missing from the records, and only the available information from the records was included in the analysis. Therefore, it was not possible to study the factors like weight gain during treatment, type of extrapulmonary TB, number of missed doses and history of TB contact in the family due to incomplete data.

CONCLUSION

Our study is one of the few to report profile and treatment outcomes among young patients with TB. A higher proportion of female and young adults in age group 20–24 years constituted the majority of patients registered under RNTCP of Faridabad district within the broad age of 15–24 years. Most of the patients were new patients and had pulmonary TB. The treatment success rate was high and very few patients switched to MDR-TB treatment. Factors like sputum result and history of TB were found to be significantly associated with a successful treatment outcome. More emphasis should be given to young patients with TB having high sputum positive result (>2+) and having a history of TB to achieve Sustainable Development Goals related to TB.

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Contributors BDK and SM have contributed to the conceptualisation, design, conduct, data collection, resources, and analysis of the research work and writing

of the manuscript. Both the authors approve the final version of the manuscript. Both BDK and SM act as gurantor of the manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval Ethics approval was taken from the Institutional Ethics Committee, AIIMS, New Delhi (reference number: IEC-639/07.12.2018). Permission from the district TB office was taken for accessing patients' data from the TB registers. All information collected during the study was kept confidential. No personal identifiers were disclosed and analysis was done in aggregate, with data access only limited to study investigators (BK, SM). As this was a retrospective assessment of routine programmatic data, individual patient consent was deemed unnecessary.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplemental information.

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Supplemental material. Table. 1. Distribution of TB patients according to key variables (N=5257)

		Age in Years										Total
		15 (n=528) No. (%)	**16 (n=429) No. (%)**	**17 (n=508) No. (%)**	**18 (n=651) No. (%)**	**19 (n=411) No. (%)**	**20 (n=669) No. (%)**	**21 (n=448) No. (%)**	**22 (n=700) No. (%)**	**23 (n=470) No. (%)**	**24 (n=443) No. (%)**	**N=5257 No. (%)**
Sex	**Male**	161 (30.5)	155(36.1)	247(48.6)	325(49.9)	214(52.1)	340(50.8)	219(48.9)	355(50.7)	214(45.5)	230(51.9)	2460 (46.8)
	Female	367(69.5)	274(63.9)	261(51.4)	326(50.1)	197(47.9)	329(49.2)	229(51.1)	345(49.3)	256(54.5)	213(48.1)	2797 (53.2)
Type of TB	**Pulmonary**	295(55.9)	270(62.9)	287(56.5)	422(64.8)	236(57.4)	403(60.2)	242(54.1)	427(61)	265(56.4)	241(54.4)	3088(58.7)
	Extra-pulmonary	233(44.1)	159(37.1)	221(43.5)	229(35.2)	175(42.6)	266(39.8)	206(45.9)	273(39)	205(43.6)	202(45.6)	2169(41.3)
Category of Treatment	**I**	476(90.1)	358(83.4)	436(85.8)	553(84.9)	344(83.7)	549(82.1)	370(82.6)	563(80.4)	385(81.9)	363(81.9)	4,397(83.6)
	II	52(9.9)	71(16.6)	72(14.2)	98(15.1)	67(16.3)	120(17.9)	78(17.4)	137(19.6)	85(18.1)	80(18.1)	860(16.4)
	Yes	64(12.1)	77(17.9)	76(14.9)	107(16.4)	73(17.8)	125(18.7)	86(19.2)	148(21.2)	92(19.6)	87(19.6)	935(17.8)

Past H/O of TB	**No**	464(87.9)	352(82.1)	432(85.1)	544(83.6)	338(82.2)	544(81.3)	362(80.8)	552(78.8)	378(80.4)	356(80.4)	4322(82.2)
Type of Patient	**New**	476(90.2)	358(83.4)	436(85.8)	553(84.9)	344(83.7)	549(82.1)	370(82.7)	563(80.4)	385(81.9)	363(82)	4397(83.6)
	Relapse	15(2.8)	16(3.7)	21(4.2)	29(4.4)	19(4.6)	45(6.7)	28(6.2)	35(5.0)	26(5.5)	27(6.2)	261(4.9)
	Treatment After Default	12(2.3)	15(3.5)	14(2.7)	22(3.4)	13(3.3)	21(3.1)	13(2.9)	29(4.1)	14(2.9)	22(5)	175(3.3)
	Failure	4(0.7)	7(1.6)	6(1.2)	5(0.8)	5(1.2)	2(0.3)	2(0.4)	13(1.8)	5(1.2)	0(0.0)	49(1)
	others	21(3.9)	32(7.5)	31(6.1)	40(6.1)	29(7.2)	52(7.8)	35(7.8)	60(8.7)	40(8.6)	30 (6.8)	375(7.2)
Sputum smear	**Positive**	168(56.9)	150(55.6)	164(57.1)	245(58.1)	133(56.4)	242(60.1)	138(57.1)	251(58.8)	141(53.2)	148(61.4)	1775(56.8)
	Negative	127(43.1)	120(44.4)	123(42.9)	177(41.9)	103(43.6)	161(39.9)	104(42.9)	176(41.2)	124(46.8)	93(38.6)	1313(42.2)
HIV status	**Positive**	0(0.0)	1(0.2)	1(0.2)	0(0.0)	1(0.2)	1(0.2)	0(0.0)	3(0.4)	1(0.2)	0(0.0)	8 (0.2)
	Negative	450(85.2)	358(83.5)	402(79.1)	544(83.6)	348(84.7)	532(79.5)	364(81.3)	555(79.3)	375(79.8)	355(80.1)	4283(81.5)
	Unknown	78(14.8)	70(16.3)	10(20.7)	107(16.4)	62(15.1)	136(20.3)	84(18.7)	142(20.3)	94(20)	88(19.9)	966(18.3)

Table. 2. Distribution of TB patients according age and treatment outcome (n=5257)

Treatment outcome	Age Group in years										Total
	15 (n=528) No. (%)	**16 (n=429) No. (%)**	**17 (n=508) No. (%)**	**18 (n=651) No. (%)**	**19 (n=411) No. (%)**	**20 (n=669) No. (%)**	**21 (n=448) No. (%)**	**22 (n=700) No. (%)**	**23 (n=470) No. (%)**	**24 (n=443) No. (%)**	**N=5257 No. (%)**
Cured	154(29.2)	140(32.6)	147(28.9)	223(34.2)	118(28.7)	225(33.6)	124(27.7)	216(30.8)	142(30.2)	131(29.6)	1620(30.8)
Treatment Completed	343(64.9)	264(61.6)	327(64.4)	376(57.7)	266(64.7)	398(59.5)	295(65.9)	426(60.8)	302(64.2)	282(63.6)	3279(62.4)
Failure	4(0.7)	5(1.2)	1(0.2)	6(0.9)	5(1.2)	6(0.9)	0(0.0)	6(0.8)	1(0.2)	3(0.7)	37(0.7)
Defaulted	13(2.6)	9(2.1)	19(3.7)	24(3.8)	12(2.9)	28(4.2)	15(3.3)	24(3.4)	4(0.8)	14(3.1)	162(3.1)
Died	9(01.7)	1(0.2)	9(1.9)	12(1.9)	7(1.8)	8(1.3)	5(1.1)	12(1.7)	11(2.3)	7(1.7)	81(1.5)
Shifted to Category IV	4(0.7)	9(2.2)	5(0.9)	9(1.4)	2(0.5)	3(0.4)	6(1.3)	14(2.0)	7(1.5)	5(1.1)	64(1.2)
Transferred out	1(0.2)	1(0.1)	0(0.0)	1(0.1)	1(0.2)	1(0.1)	3(0.7)	2(0.3)	3(0.7)	1(0.2)	14(0.3)
Total	528	429	508	651	411	669	448	700	470	443	5257