Tropical Medicine and International Health doi:10.1111/tmi.13380

VOLUME 25 NO 5 PP 612–617 MAY 2020

TB diagnostic cascade among patients registered under the Revised National TB Control Programme in Chennai, South India

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Abstract

OBJECTIVE To discern and quantify the TB diagnostic cascade among patients registered under the Revised National TB Control Programme, Chennai city, Tamil Nadu, South India.
METHODS This cross-sectional study was conducted in metropolitan Chennai from February 2017 to March 2018. We interviewed TB patients retrospectively on their diagnostic attempt in different health facilities.
RESULTS Of 455 TB patients, only 4.4% received their diagnosis at their first health facility. Of 1250 visits to health facilities, the vast majority (79.4 vs. 20.6%) was in the public rather than the private sector. 56% of patients went to a public facility as the first point of care, of whom 1.6% shifted to private facilities subsequently. The remaining 54.4% shifted between up to five government health facilities. Male patients and those with a higher family income were more likely to shift from private to public.
CONCLUSION Most shifts between diagnostic facilities occurred in the public sector. This necessitates interventions at public health facilities for strengthening and extending services to TB patients at their first point of care.

keywords tuberculosis, cascade, pattern of diagnosis, time to diagnosis, shifting for TB diagnosis, India

Sustainable Development Goals (SDGs): SDG 3 (good health and well-being), SDG 5 (gender equity), SDG 16 (peace, justice and strong institutions)

Introduction

Delay in diagnosis of tuberculosis (TB) is a major challenge for TB control and prevention in low- and middle-income countries. Many studies have attempted to study the diagnostic delay from both patient and provider perspectives [1]. These studies have generally focused on the time taken for diagnosis from patient and providers. A systematic review of 40 studies conducted in low- and middle-income countries involving 18 975 patients revealed that the median diagnostic delay ranged from 30 to 366.5 days due to patient and health system-related reasons [1]. Among diagnosed TB patents in India, an average delay of 58 days has been recorded, and patients are seen by an average of 2.7 healthcare providers for diagnosis [1]. Another systematic review highlights that almost one-fifth of TB patients who accessed government TB services but end up not successfully diagnosed or drop out after diagnosis before starting treatment [2].

So far, studies in India which have the highest number of 'missing TB cases' have generally quantified the average delay until diagnosis or the proportion of patients who got delayed or missed a diagnosis [3–5]. The path to diagnosis is not a linear one from one provider to another, which is the key assumption of all earlier studies on diagnostic cascades. Instead, TB patients approach different providers at different times and may shift between providers. This complex pathway which TB patients navigate for a diagnosis remains poorly understood.

The present study attempts to understand and quantify the shifts of TB patients between different providers for diagnosis before they initiate treatment in Chennai metro city in South India.

Methods

Study area and population

Data for this study were collected prospectively in the metropolitan city of Chennai in South India among patients registered under the Revised National TB Control Programme (RNTCP). The study treatment units were selected based on the probability proportional to size method. Four of the seven TB units (TUs) in the study area were selected, namely Tondiarpet, East Cemetery Road, Elango Nagar and Puliyanthoppu. All pulmonary and extra-pulmonary TB patients consecutively registered under RNTCP between February 2017 and March 2018 in category I and II were included.

Data collection, entry and analysis

A semi-structured and pre-coded questionnaire was used to collect data. The questionnaire elicited information on demographic (age, sex) and socio-economic characteristics (education, occupation) of patients, as well as information on shifts between public and private health facilities for TB diagnosis since the onset of symptoms.

Trained field investigators collected data from April 2017 to June 2018 at RNTCP centres when patients came for treatment. On the spot, the senior person checked all data collected and random checks were done by the Principal Investigator. Completed records and forms were scrutinised by a statistician and sent for data entry in Epi Info. Data were checked for errors and analysed using the STATA 12.0 software. Descriptive statistics were calculated and graphs generated. We used univariate and multivariate analysis to find out which factors were independently associated with shifts between health facilities.

Definitions

For this study purpose, we used the following definitions of public and private facilities:

TB diagnostic cascade: A process through which a TB-symptomatic individual subsequently visited health facilities to undergo evaluation and successfully diagnosed with TB and started treatment.

Volume of shifts: Product of the number of patients and number of times they approached health facilities for TB diagnosis.

*Public Facilities***:** District hospitals, government pharmacies and primary health centres.

Private Facilities: Private clinics, private hospitals, private health centres, mission/NGO hospitals, private pharmacies and medical shops.

Ethical issues

Trained field investigators approached eligible individuals and explained the procedures, risks and benefits of the study in the local language. Written informed consent was obtained from all individuals willing to participate. For participants between 15 and 18 years, assent was obtained from the individuals and written informed consent was obtained from parents/guardians. Children below 15 years were not included in the study. This study was approved by the Institutional Ethics Committee of Indian Council of Medical Research – National Institute for Research in Tuberculosis, Chennai.

Results

A total of 455 TB patients were interviewed, of whom 316 (69.4%) were males; 239 (52.5%) were in the age group of 19–45 years, 361 (79.5%) were literate, 152 (33.4%) were wage earners, 149 (32.5%) were not working and 367 (80.7%) were pulmonary TB patients.

Overall, 20 (4.4%) patients visited one health facility, 188 (41%) visited two and 156 (34%) visited three health facilities for diagnosis. The remaining 72 (16%), 16 (3.5%) and 3 (<1%) patients visited four, five and six health facilities, respectively. Only 4.4% patients got diagnosed with TB at their first public health facility visit (Figure 1). Of the remaining, 35.6% patients visited two public health facilities and 5.7% visited two private health facilities for TB diagnosis. Another 13.8%, 1.5% and 0.7% patients visited, respectively, three, four and five public health facilities, whereas 20.4%, 14.3%, 2.9% and 0.7% patients visited, respectively, three, four, five and six private health facilities for TB diagnosis.

The total number of visits for TB diagnosis was calculated as the product of the number of patients and the number of times they visited health facilities. A total 1250 visits were made; 2.7 visits on average per TB diagnosis (Figure 2). A total of 993 visits were to public and 257 to private facilities. Of the 993 visits at public facilities, 350, 368 and 190 were made at second, third and fourth facilities, respectively. Of the 257 visits at private facilities, 100 and 98 were made at third and fourth facilities, respectively. Thus, overall more visits were made to public (993/1250 = 79.4%) than private facilities (257/1250 = 20.6%).

Table 1 shows the shifts of TB patients registered under RNTCP in Chennai city: patients visited at least one and

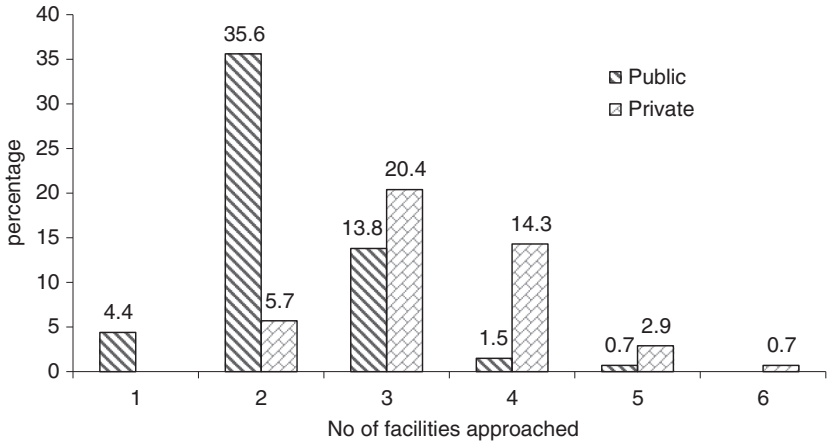

Figure 1 Proportion of TB patients approaching different number of public and private facilities for TB diagnosis.

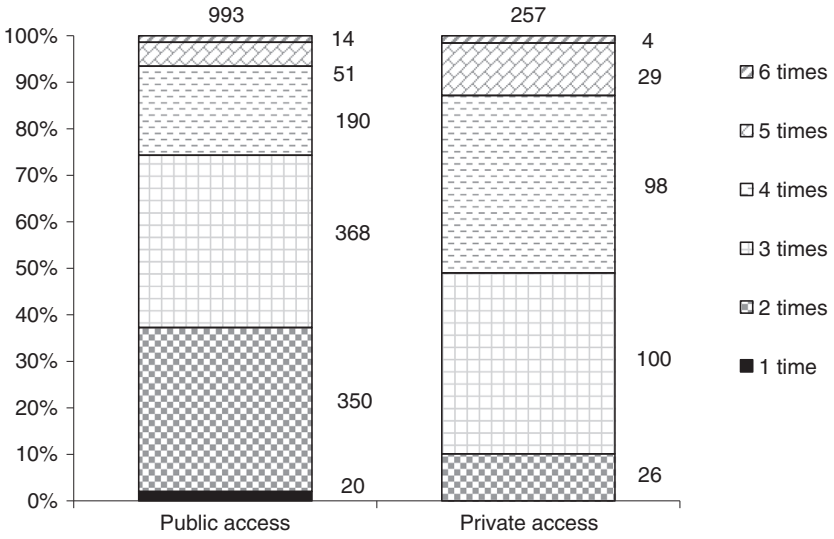

Figure 2 Volume of diagnostic accesses made by patients in different health facilities.

at most six facilities for their TB diagnosis. Of the total 56% who visited public facilities initially, 1.6% shifted to private ones subsequently. The remaining 54.4% of patients shifted within the public sector. Of the 44% who approached private facilities first, 77% shifted to other private facilities and subsequently almost all shifted to government health facilities. Our univariate and multivariate analysis shows that male sex and higher family income (Rs 100 001–200 000) were associated with shifts from the private to the public sector (Table 2). Patients with a higher family income (Rs 100 001–200 000) were more likely to shift more than twice (Table 3).

Discussion

Our study attempted to assess the pathway to diagnosis of TB patients registered under RNTCP in Chennai, where TB diagnostic services are supposed to be relatively easily accessible [6]. We found that despite RNTCP efforts to provide free and decentralised TB diagnostic facilities, only a very small proportion (4.4%) of patients received a diagnosis from their first point-of-care facility. A huge proportion of patients have to visit more than one facility for diagnosis of TB. Why?

The shifts between facilities to diagnose TB in Chennai may be due to the city's better health infrastructure (both

Table 1 Shifting pattern of TB patients for their diagnosis

Shifting pattern						Total patients	Total access
1	2	3	4	5	6		
Public						20	20
Public	Public					162	324
Private	Public					26	52
Private	Public	Public				88	264
Public	Public	Public				61	183
Private	Private	Public				5	15
Public	Private	Public				2	6
Private	Public	Public	Public			37	148
Private	Private	Public	Public			24	96
Public	Public	Public	Public			5	20
Private	Private	Private	Public			3	12
Public	Private	Public	Public			2	8
Private	Public	Private	Public			1	4
Private	Private	Public	Public	Public		6	30
Private	Private	Private	Public	Public		5	25
Public	Public	Public	Public	Public		3	15
Private	Public	Public	Public	Public		2	10
Private	Private	Private	Public	Public	Public	1	6
Private	Private	Public	Private	Public	Public	1	6
Private	Private	Private	Private	Public	Public	1	6
Total access						455	1250

Table 2 Factors associated with shift between health facilities of TB patients for their diagnosis

Demographic and socio-economic characteristics		Total	No shift	Shift	Within public		Private to public		OR (95% CI)	P-value	aOR (95% CI)	P-value
					No	%	No	%				
Gender	Female	139	8	131	57	44	74	56	1		1	
	Male	316	12	304	174	57	130	43	1.7 (1.14–2.62)	0.009	1.6 (1.01–2.79)	0.043
Age in years	<25	108	4	104	45	43	59	57	1		1	
	26–45	178	7	171	98	57	73	43	0.5 (0.34–0.92)	0.024	0.6 (0.34–1.06)	0.081
	>45	169	9	160	88	55	72	45	0.6 (0.37–1.02)	0.063	0.7 (0.39–1.19)	0.183
Education	Illiterate	94	4	90	46	51	44	49	1		1	
	Literature	361	16	345	185	54	160	46	0.9 (0.56–1.43)	0.671	0.79 (0.48–1.29)	0.350
Occupation	Unemployed	149	7	142	69	49	73	51	1		1	
	Employed	306	13	293	162	55	131	45	0.7 (0.51–1.14)	0.190	1.1 (0.67–1.92)	0.0631
Family income (Rs)	<100 000	141	11	130	78	60	52	40	1		1	
	100 001–200 000	172	7	165	79	48	86	52	1.6 (1.02–2.60)	0.039	1.7 (1.06–2.75)	0.027
	>200 000	142	2	140	74	53	66	47	1.3 (0.82–2.16)	0.23	1.34 (0.84–2.32)	0.194

public and private), demand for quality of care and perception about the services. Our finding corroborates a study in metropolitan Mumbai which highlighted that improved education, higher awareness and the presence of more health facilities in urban areas had increased consumption of healthcare services [7]. Similarly, a study from Chennai reported that patients with TB symptoms used tertialry health facilities due to their reputation [8].

Previous studies have assessed diagnostic delays in terms of number of days [9–13]. We used a new measure of "access volume", which is the total number of visits made by a patient for diagnosis. This concept has already been used in HIV programmes to calculate the client volume of female sex workers and to calculate treatment volumes to predict number of patients undergoing treatment in the private sector for TB [14]. We similarly

Table 3 Factors associated with number of shifts made by TB patients for diagnosis

Demographic and socio-economic characteristics			≤2 health facilities		>2 health facilities					
		No.	No.	%	No.	%	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Gender	Female	139	47	28	81	53	1		1	
	Male	316	42	72	166	58	1.3 (0.84–1.89)	0.30	0.6 (0.40–1.09)	0.10
Age in years	≤25	108	43	22	62	57	1		1	
	26–45	178	47	40	94	53	0.8 (0.51–1.34)	0.52	0.8 (0.46–1.3)	0.43
	>45	169	46	38	91	54	0.9 (0.53–1.41)	0.65	1.2 (0.74–1.9)	0.42
Education	Illiterate	94	50	23	47	50	1		1	
	Literature	361	45	77	200	55	1.2 (0.79–1.96)	0.41	1.1 (0.73–1.9)	0.4
Occupation	Unemployed	149	48	34	78	52	1		1	
	Employed	306	45	66	169	55	1.1 (0.76–1.66)	0.63	1.4 (0.87–2.4)	0.15
Family income (Rs)	≤100 000	141	52	36	67	48	1		1	
	100 001 to 200 000	172	40	33	103	60	1.6 (1.05–2.58)	0.04	1.6 (1.01–2.5)	0.04
	>200 000	142	46	31	77	54	1.3 (0.82–2.09)	0.31	1.2 (0.74–1.9)	0.42

applied the concept to calculate volume of shifts between facilities for diagnosis. A total of 1250 visits were made by 455 patients for diagnosis. The great majority of shifts occurred between public (79.4%) rather than private facilities (20.6%) despite the equal proportions of patients who approached public and private facilities (56.0% and 43.9%) as the first point of care. Our findings challenge the assumption that in India first point of care at a private facility mostly leads to delay in diagnosis. All but 4.4% of our patients who accessed both public and private facilities as first point of care experienced delay, and shifts between public facilities were more common than between private ones. This calls for strengthening the diagnostic services in both public and private facilities and improving the quality of services provided. There is also a need for improving the awareness of the community about the availability of adequate TB diagnostic facilities in the vicinity to avoid shifts and subsequent delays.

Further, this indicator could be used to evaluate the effectiveness of TB diagnostic services: along with unit cost and time per visit at public and private facilities, diagnostic access volume could be used to estimate diagnostic costs at national and state level.

Previous studies reported that the first contact with private health providers was a risk factor for delay in TB diagnosis [3–5,11]. Our study also found that for those who initially approached a private facility, the diagnostic cascade extended up to six providers. Thus, our findings show that if the first visit is to a private facility, it leads to an increased number of days to diagnosis of TB; and if the first visit is to a public facility, it leads to more shifts between facilities. This may result in more costs, time and effort for patients and increased transmission of TB in the community. We reemphasise the need to strengthen the referral process within the public health system [6].

Regarding shifts within the private sector, of the 44% who first approached private facilities, 77% shifted to another. After this point, all patients were subsequently referred to public facilities and further shifts occurred within public facilities. This indicates the need for strengthening diagnostic services in both private and public facilities to enable TB diagnosis at the first point of care. Many studies already recommend sensitisation and intervention to facilitate timely and appropriate referrals for TB patients to early diagnosis and initiation of treatment [15]. This needs to be implemented urgently to reduce shifts and delays in TB diagnosis. Through multivariate analysis, we found that higher income status was significantly associated with shifts between public facilities and from private to public facilities, perhaps because wealthier patients have the means to do so. We also found that males shift more frequently from private to public than females, which underscores gender differences in terms of access.

This study has limitations: the data collected from TB patients were self-reported and thus may be subject to recall bias. This study was done in a metropolitan city in India, and our findings are not necessarily transferable to other parts of the country.

Conclusion

The present study documents the pathways to diagnosis of TB patients registered under RNTCP in Chennai and quantifies the volume of diagnostic access in public and private health facilities. Most diagnostic access occurred in the public sector, as did most shifts between facilities.

This necessitates interventions at both public and private sectors to strengthen and improve diagnostic services for TB patients at their first point of care.

Acknowledgement

This study was supported by the Global Fund through Central TB Division, Ministry of Health and Family Welfare, Government of India and Indian Council of Medical Research, New Delhi, India.

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