



RESEARCH ARTICLE

Effect of public-private interface agency in Patna and Mumbai, India: Does it alter durations and delays in care seeking for drug-sensitive pulmonary tuberculosis? [version 1; peer review: 2 approved]

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Abstract

Background: Public-private interface agency (PPIA) intervention models in Patna (E. India) and Mumbai (W. India) for pulmonary drug-sensitive (DS) tuberculosis (TB) patients were evaluated over 2 years after maturity to examine effect on reduction of patient pathways and retention. The models engaged private providers, diagnostic facilities and pharmacies into an effective network providing free diagnostic tests and treatment.





Methods: A population-based retrospective study was undertaken to assess effectiveness of the PPIA model in care pathways of 64 (Patna) and 86 (Mumbai) patients through in-depth interviews conducted within 6 months of initiation treatments to identify types and facilities accessed, duration to diagnosis and treatment. Median durations based on facilities accessed were statistically analysed. Comparisons were made with baseline values and endline pathways of patients accessing PPIA engaged/non-engaged facilities in private and public sectors.

Results: Compared to non-engaged facilities, persons accessing engaged facilities at first point-of-care had shorter pathways (Mumbai: 32 vs 43 days), (Patna: 15 vs 40 days). Duration for first care-seeking was considerably shorter for patients accessing PPIA in Patna and for both engaged and non-engaged private facilities in Mumbai (4 days). Whilst PPIA engaged facilities diagnosed more cases than others, the RNTCP in Mumbai provided diagnosis early. There was good retention of patients by PPIA-engaged (1st) facilities (90% post-diagnosis in Patna) but this was affected by the hub-spoke referral system in Mumbai (13%). Second diagnosis is a common feature in Mumbai. The spoke-hub model in Mumbai contributed considerably to treatment delay; PPIA-engaged providers were better at retaining patients post treatment initiation 11/25 (44%).

Conclusion: PPIA-engaged facilities, accessed at onset, result in marked reduction in pathway durations. Such initiatives should engage a critical mass of competent providers, proximal investigation facilities with enhanced disease awareness and literacy efforts amongst communities. Patient movement should be minimized for early treatment and retention.

Open Peer Review

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1 Amrita Daftary  , York University, Toronto, Canada		
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Any reports and responses or comments on the article can be found at the end of the article.

Keywords

Public private interface agency, DSTB, spoke and hub, pathways, duration and delays

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List of abbreviations

RNTCP: Revised National TB Control Programme; PPIA: Public Private Interface Agency; WHP: World Health Partners; CXR: Chest x-ray; CBNAAT: cartridge-based nucleic acid amplification test; PATH: Partnership for Appropriate Technologies in Health; HH: household; DS: drug sensitive; PPIA-E facility: PPIA-engaged facility; PPIA-NE facility: PPIA-non engaged facilities; DR: drug resistant.

Introduction

The National Strategic Plan of India envisages ending tuberculosis (TB) by 2025, ten years ahead of the END TB Strategy proposed by the WHO¹. It is estimated that 2.8 million new cases occur annually, of whom nearly a million are not being identified and notified². The Revised National TB Control Programme (RNTCP) employs various strategies to identify these cases early and treat them appropriately, in order to reduce disease transmission and meet these ambitious targets³.

Identifying symptomatic individuals in the community and bringing them on appropriate treatment is resource intensive and has had limited success^{4,5}. The RNTCP has attempted involvement of the private sector by employing various strategies⁶ over two decades with varying success⁷. The 14-city Public-Private Mix (PPM) projects initiated in 2003 had shown an overall increase in the number of cases notified. The Mahavir project in Hyderabad and the Kannur initiative in Kerala showed a 20 to 100% improvement in case detection⁶. While cost-effectiveness studies conducted on some of these PPM initiatives have found them to be expensive, it was concluded that these costs are likely to reduce the societal cost of shopping for private health care and improve standards of care⁸.

Several studies undertaken in recent years show delays in first care seeking, diagnosis and TB treatment among patients accessing both public and private sectors⁹⁻¹². In order to improve access to quality of TB care and thereby reduce delays in patient care pathways, a public-private interface agency (PPIA) intervention was implemented in Mumbai and Patna. It was hypothesized that if a patient reached a PPIA engaged formal facility at the first point of care, there would be less shopping between facilities, faster and more accurate TB diagnosis and quicker treatment initiation.

World Health Partners (WHP) implemented a PPIA model in Patna district from May 2014 to June 2016 that engaged and sensitized private providers, brought diagnostic facilities, and pharmacies into a referral network to provide adequate care, including free diagnostic tests like chest X-ray (CXR), smear microscopy, and cartridge-based nucleic acid amplification test (CBNAAT), facilitated TB notification and free TB treatment for notified patients and ensured treatment adherence support. The model engaged 71% (643) of the targeted 912 licensed formal providers and 71% (688) of 972 pharmacies (WHP Personal Communication).

In Mumbai, Partnership for Appropriate Technologies in Health (PATH) implemented a hub and spoke model from September

2014 to June 2016, which engaged private providers, both allopaths and non-allopaths to provide free diagnostic tests (X-ray and CB-NAAT), first line anti-TB treatment drugs and monitoring of treatment outcome. The spokes consisted of stand-alone clinics or OPD facilities whose main aim was to identify presumptive TB patients and refer them to hubs. Hubs were facilities which had a physician/chest specialist along with X-ray facility and a dispensing unit. They were assigned to provide diagnostic tests and prescribe treatment. A total of 7,396 doctors, 2,773 chemists and 747 laboratories were mapped in 15 high burden TB wards of the city, of which 51% doctors, 34% laboratories, and 13% chemists were prioritized and engaged in the PPIA intervention (PATH Personal Communication).

At 2 years after the baseline study in Patna⁹ and 2 years and 8 months after in Mumbai¹⁰, end-line studies were conducted in the same areas to study the impact of the PPIA on patient TB care pathways. Although many earlier studies have looked at delays in diagnosis and treatment among TB patients, these studies, for the first time assessed a specific intervention in terms of its effect in reducing delays in TB diagnosis and treatment.

Methods

Study design

The end-line studies were conducted between August 2016 and January 2017 in Patna and between March 2017 and July 2017 in Mumbai after the PPIA intervention had been in place for 27 months in Patna and 29 months in Mumbai. These studies were conducted to assess the impact of the intervention in both cities. The end-line studies were population-based, two-stage, retrospective studies conducted in the same study areas as the baseline studies in both cities^{9,10}. The first stage surveys conducted by a contracted survey organization in both cities involved a primary cross-sectional household (HH) survey to identify patients who had been diagnosed and initiated on TB treatment (available as *Extended data*¹³). Within a week of identification, these patients were contacted by a trained team of researchers from FMR, and those who met the inclusion criteria and were willing to participate were included in the second stage of the study. The inclusion criteria were as follows: a) patients with only pulmonary TB, b) patients diagnosed as drug-sensitive (DS) and initiated on first-line TB treatment in their respective cities, c) patients who were initiated on treatment not earlier than six months from the time of interview. The number of participants was selected through convenience-based sampling.

The second stage consisted of in-depth interviews of willing patients, using a semi-structured interview schedule to document their TB care pathways (interview guide available as *Extended data*¹³). Written informed consent was obtained from all patients willing to participate in the study. Consent was sought for participation in the interview, digital audio recording and note keeping of the patients' responses, reviewing of patient's TB care seeking-related documents and permission to publish data in any report, journal, etc. In case of minors, consent was obtained from their parents/guardians/carers.

Interviews were conducted at a location and time preferred by each participant by trained health researchers from FMR largely in patient's homes. Family members were sometime present at the time of the interviews, which extended from 45 minutes to 1 hour. No repeat interviews were carried out. Patients were confirmed as DS based on their test results and treatment regimen at the time of interview. The end-line interview assessed the time taken by patients from onset of TB symptoms until the current/most recent treatment initiation (unlike the baseline study where only first treatment initiation was considered)^{9,10}, along with the type of facilities accessed.

Information provided by patients during the interview was verified as far as possible with reports prescription or other documentation provided by the patient.

Ethics approval and consent to participate

The study received ethical declaration from the Institutional Ethics Committee (IEC) of the Foundation for Medical Research (vide IEC no. FMR/IEC/TB/01/2013). Written informed consent was obtained from all patients willing to participate in the study. In case of minors, consent was obtained from their parents/guardians/carers.

Data management

Quantitative data were filled on structured physical formats by the researchers at the end of the interview. For the purpose of quality check, three levels of verification were conducted by listening to recorded interviews. First, each researcher team cross-checked the quantitative data forms of interviews conducted by another research team. Subsequently 25% of interviews were cross-checked by senior researchers for errors, and finally a random set of 10% of interviews were checked by the consultants on the study. On completion of quality checks, the data were entered in CSPro v5. Open ended questions were coded and maintained in a codebook in an excel format. These data were then imported into SPSS v.19 (SPSS, Inc., Chicago, IL, USA) for analysis.

Operational definitions

Facility classification

1. Public Facility: Facilities for control of TB which are run by the Municipal Corporation of the respective city or the state government under the RNTCP.

2. Private Facility: Facilities which are run by private allopaths, non-allopaths, informal health providers and chemists.

3. PPIA-engaged Facility (PPIA-E Facility): Facilities which consented to engage with the PPIA. In Mumbai, only private providers were a part of the PPIA intervention whereas in Patna, PPIA-E facilities included both public and private facilities.

4. PPIA-non engaged Facility (PPIA-NE Facility): Private facilities which were not engaged with the PPIA initiative.

The total pathway was divided into three components for computing durations:

- **First care seeking duration:** Time interval between onset of symptom and first seeking care (duration of 15 days or more was considered as a first care seeking delay)¹⁴.
- **Duration to TB Diagnosis:** Time interval between first seeking care and first TB diagnosis by a facility (duration of 15 days or more was considered as a diagnostic delay)¹⁵.
- **Duration to TB Treatment initiation:** Time interval between first TB diagnosis and initiation of TB treatment for the first time. In case of multiple diagnostic episodes prior to treatment initiation, the first diagnostic episode was considered for computation. (duration of more than 7 days was considered as a treatment initiation delay)¹⁵.

Data analysis

Facilities were determined as PPIA-E based on the names and addresses provided by patient interviews and documents, which were compared to the list of engaged facilities provided by PPIA in Patna and Mumbai respectively.

The total time taken from onset of TB symptoms to first care-seeking and until initiation of first line treatment was estimated by dates collected for various events and presented as medians and means (in days).

The themes for analysis were identified in advance. The median pathway durations of patients accessing different types of facilities at baseline and end-line were compared until the point of first treatment initiation to see if any difference was seen in pathways to TB care following the PPIA intervention in both cities. The prime comparison comprised of assessing the median duration from first care seeking until treatment initiation between patients accessing PPIA-E private facility at first point of care and those who did not. Other points of analysis included assessing the role of PPIA-E facilities in diagnosis and initiation of treatment, as well as the retention of the patients from the beginning of the pathway.

Median pathway differences were compared using the Mann Whitney U-test with significance established at p-values ≤ 0.05 . Significant difference in the proportion of patients was estimated using Chi-square.

Since patients in the end-line study were followed until their current TB treatment, descriptive analysis for patients presenting an extended pathway is included to understand the reasons for shopping post their first diagnosis and treatment initiation.

Results

Patient selection

The household survey identified 285 and 230 PTB patients in Patna and Mumbai, respectively, of which only 64 (22%) in Patna and 86 (37%) in Mumbai were included in the study. Enlisting rate was low in both cities; in Patna primarily due to patients not meeting the inclusion criteria (62%) (Refer to study design) and in Mumbai, due to patients being diagnosed with drug-resistant (DR) TB (20%). Additionally, the reasons

for exclusion from the study are reflected in [Table 1](#). Individual results of baseline and end-line surveys are available as *Underlying data*^{16,17}.

Demographics

[Table 2](#) reflects the comparison of patient profiles in both cities at baseline and end-line. Though certain trends were observed, the differences were not found to be significant. Low socio-economic status was retained in the end-line studies for both cities and higher numbers of patients were unemployed in both the cities at end-line studies.

The proportion of minor patients aged 17 years and younger was higher in Patna when compared with the baseline ([Table 2](#)).

The proportion of income generators among the patients in Mumbai had increased at end-line (47%, n=40/86) as compared to 33% at baseline¹⁰.

Pathways to TB care

First point of care

Had patients heard about the PPIA initiative?

Patna: In total, 52% of the patients (33/64) in Patna were aware of the PPIA initiative; 21 patients from providers they accessed along their pathways and 12 patients through media and posters.

Mumbai: In Mumbai, 42% of the patients (n=36/86) were aware of the PPIA intervention in the community, with 32 reportedly being provided information by the providers accessed along their pathways. Only 4 patients had sourced their awareness through media and posters.

What were the first care seeking facilities that patients accessed?

[Table 3a, b](#) shows the facilities first accessed by patients after the onset of symptoms, in Patna and Mumbai respectively.

Patna: The proportion of patients seeking care from public facilities (6%, n=4/64) was very similar to that reported in the

baseline study⁹. However, the proportion of patients consulting a chemist (53%, n=34/64) was significantly more than the 25% reported in the baseline study (p=0.001, chi square =10.64). Less than one-fourth (23%, n=15/64) of the patients had consulted a PPIA-E facility, and two-thirds of these (67%, n=10/15) a private facility. Frequently cited reasons for accessing a PPIA-E facility were as follows: good/effective medicines, someone known had been previously treated or were on treatment, and subsidized fees. Reasons for accessing a PPIA-NE private facility were as follows: close to home, good reputation of the provider, whereas for accessing a PPIA-NE public facility the reasons cited were free medicines or worsening of symptoms.

Mumbai: Close to three-fourths of the patients (74%, n=64/86) had sought help from a private facility; almost half of these (48%, n=31/64) had consulted a PPIA-E private facility. The proportion of patients accessing a public sector facility as their first point of care were 21% (n=18/86) in the end-line study.

How soon after developing symptoms did patients seek care?

Patna: The median time taken for all patients to first access care after onset of symptoms was 9.5 days¹ in Patna which was similar to the 9 days¹ reported for the baseline study⁹. The median time taken for patients accessing a PPIA-E private facility at first point was 4 days as opposed to 10^{#1} days for those accessing PPIA-NE private facility and 8 days¹ for those accessing a private facility at first point during baseline ([Table 4a](#)).

Only 4/64 patients approached a public facility at first point of care. The median time taken for the patients who approached the public facility was 7.5 days¹ at end-line compared to 18.5 days at baseline.

¹Durations which fall within the standard norms of care

Table 1. Reasons for patient exclusion in Patna and Mumbai.

Reasons for patient exclusion	Mumbai, n (%) (N = 230)	Patna, n (%) (N = 285)
DR TB Cases	46 (20)	3 (1.1)
Refusals	28 (12.2)	18 (6.3)
Inconsistent information	0 (0)	2 (0.7)
Irregular treatment	14 (6.1)	5 (1.7)
EPTB Cases	14 (6.1)	41 (14.4)
No TB documents	10 (4.3)	40 (14)
Diagnosed / treated 6 months before study	4 (1.8)	90 (31.6)
Diagnosed outside the city	8 (3.4)	0 (0)
Migration	13 (5.7)	18 (6.3)
Died	7 (3)	4 (1.4)
DS-TB self-reporting patients	86 (37.4)	64 (22.5)

Table 2. Patient characteristics.

Patient characteristics	Patna baseline, n (%) (N=64)	Patna end-line, n (%) (N=64)	Mumbai baseline, n (%) (N=76)	Mumbai end-line, n (%) (N=86)
Age (years)				
≤17	19 (30)	27 (42)	8 (11)	10 (12)
>18	45 (70)	37 (58)	68 (89)	76 (88)
Gender				
Male	33 (52)	27 (42)	46 (61)	42 (49)
Female	31 (48)	37 (58)	30 (39)	44 (51)
Occupation				
Student	13 (20)	21 (33)	9 (12)	14 (16)
Housewife/unemployed	23 (36)	18 (28)	40 (53)	29 (34)
Self employed	10 (16)	8 (12)	10 (13)	6 (7)
Daily wage/casual	6 (9)	7 (11)	6 (8)	15 (17)
Salaried	9 (14)	3 (5)	11 (14)	19 (22)
Retired	0 (0)	1 (2)	0 (0)	2 (2)
Not available-Undefined	3 (5)	6(09)	0 (0)	1 (1)
Education				
Illiterate	22 (34)	19 (30)	14 (18)	14 (16)
Literate but no formal education	7 (11)	4 (6)	0 (0)	1 (1)
Primary (<4th standard)	7 (11)	17 (26)	8 (11)	6 (7)
Secondary (<9th standard)	15 (23)	7 (11)	32 (42)	30 (35)
Senior secondary (SSC/HSC)	8 (13)	12 (19)	16 (21)	27 (31)
Graduate and above	3 (5)	2 (3)	4 (5)	7 (8)
Not applicable (children ≤5 yrs)	2 (3)	3 (5)	2 (3)	1 (1)
Use of addictive substances				
No	43 (67)	42 (66)	52 (68)	60 (70)
Yes	21 (33)	22 (34)	24 (32)	22 (25)
Don't Know	0 (0)	0 (0)	0 (0)	4 (5)
Chronic conditions				
No	54 (84)	52 (81)	63 (83)	65 (76)
Yes	9 (14)	12 (19)	13 (17)	21 (24)
Not available	1 (2)	0 (0)	0 (0)	0 (0)

Frequently cited reasons for accessing a PPIA-E facility at end-line were as follows: good/effective medicines, someone known had been previously treated or was on treatment, and subsidized fees. Reasons for accessing a PPIA-NE private facility were as follows: close to home, good reputation of the provider, whereas for accessing a PPIA-NE public facility the reasons cited were free medicine or worsening of symptoms.

Mumbai: In Mumbai the time taken to access care had decreased significantly from 15 days at baseline¹⁰ to 4 days¹ at end-line (p-value = 0.00).

No significant difference was seen in the first care seeking duration for patients accessing PPIA-E private facilities vs. patients accessing PPIA-NE private facilities at Mumbai; however, both the groups had a significantly shorter first care seeking pathway as compared to baseline (Table 4b).

The commonly cited reasons for a majority of the patients accessing a PPIA-E or a PPIA-NE private facility at first point were similar: close to home or the availability of the family doctor who practiced there. The reasons cited for accessing the public sector included: availability of effective or subsidized

Table 3. Type of facilities accessed by patients in the TB care pathway in Patna (A) and Mumbai (B).

(A) Patna				
Patna	First care seeking, n (%) (N=64)	First diagnosis, n (%) (N=64)	Final diagnosis, n (%) (N=4)	Treatment initiation, n (%) (N=64)
Type of facility				
PPIA NE public	3 (5)	6 (9.5)	-	6 (9.5)
PPIA NE private	16 (25)	18 (28)	-	17 (26)
PPIA NE chemist	30 (47)	-	-	-
PPIA public	1 (2)	6 (9.5)	1 (25)	6 (9.5)
PPIA private	10 (15)	34 (53)	3 (75)	35 (55)
PPIA chemist	4 (6)	-		NA
(B) Mumbai				
Type of facility	First care seeking, n (%) (N=86)	First diagnosis, n (%) (N=86)	Final diagnosis, n (%) (N=35)	Treatment initiation, n (%) (N=86)
Public	18 (21)	25 (29)	10 (29)	28 (32)
PPIA NE private	33 (38)	16 (19)	3 (8)	3 (4)
PPIA NE chemist	4 (5)	-	-	-
PPIA spoke	28 (34)	23 (27)	1 (3)	3 (3)
PPIA hub	3 (2)	22 (25)	21 (60)	52 (61)

Table 4. Pathway durations baseline & end-line for public, private and PPIA-engaged private facilities in Patna (A) and Mumbai (B). All figures are depicted in days as median (mean, standard deviation).

(A) Patna					
Patna Pathways Median (Mean, SD)	Baseline Private Facility at first point (N=60)	End-line PPIA-E private facility at first point (N=14)	End-line PPIA-NE Private facility at first point (N=46)	Baseline Public Facility at first point (N=4)	End-line Public facility at first point (N=4)
First care seeking duration (days)	8 (15,19.9)	4 (24.9, 40.7)	10 (16,22.8)	18.5 (17,5.2)	7.5 (9,9.6)
Diagnostic duration (days)	*9.5 (24.6,34.5)	9.5 (23.1,32.3)	*20.5 (40.2,52.5)	2.5 (3.5,3.2)	18 (30.3, 33)
Treatment duration (days)	0 (1.8,5.9)	0 (0.7, 1.3)	0 (4,20.7)	1 (2.5,3.8)	0.5 (1.5,2.4)
Total Pathway duration (days)	27.5 (41.4,40.5)	15 (48.6, 63)	40.5 (60.2,60)	21.5 (23,5.9)	38 (40.75, 30.3)
(B) Mumbai					
Pathways Median (Mean, SD)	Baseline Private facility at first point (N=53)	End-line PPIA-E Private facility at first point (N=31)	End-line PPIA-NE Private facility at first point (N=37)	Baseline Public facility at first point (N=23)	End-line Public facility at first point (N=18)
First care seeking duration (days)	*14 (21.6,28.5)	*4 (9.6, 13.6)	*4 (11,15.4)	15 (30.4,51.1)	7.5 (11, 11.8)
Diagnostic duration (days)	21 (21,50)	16 (30, 37.1)	27 (43.4, 64.6)	10 (23.4,33.4)	10 (26.9, 29.8)
Treatment duration (days)	2 (5.2,9.3)	3 (6.4, 9.8)	2 (4, 4.7)	*0 (3.4,11)	*5.5 (14.9, 32.8)
Total Pathway duration (days)	*46 (68,67.7)	*32 (45.9, 42.5)	43 (58, 63)	41 (57.2,64.3)	39 (52.8, 44.3)

*Denotes significance at p-value 0.05.

medicines, recommendation of a family member, and positive feedback from another patient.

TB diagnostic pathway

Patna: Patients who had accessed a PPIA-E private facility took 9.5 days¹ to get diagnosed after first accessing care, which was similar to that for patients accessing a private facility as first point of care during the baseline study⁹. However, those patients who accessed a PPIA-NE private facility as the first point of care took significantly longer to get diagnosed, i.e. 20.5 days ($p < 0.05$). A significantly higher proportion of patients who approached a PPIA-E facility at the first point of care were diagnosed without any delay as compare to those who accessed a PPIA-NE facility (64% vs 39%; [Table 5a](#)).

In total, 90% of patients who approached a PPIA-E private facility (non-chemist) at first point of care were diagnosed by the same facility as compared to only 19% of the patients who approached a PPIA-NE private facility (chi-square =12.56, p-value = 0.0004). In the entire pathway 63% (n=40/64) of the patients were first diagnosed by a PPIA-E facility ([Table 3a](#)). A total of 77% percent (n=49/64) of patients had approached up to two facilities before approaching the facility which diagnosed them with TB.

Mumbai: Although not significant, the median diagnostic duration for patients accessing a PPIA-E facility as the first point of care was 16 days which was lesser than the 27 days for those who accessed a PPIA-NE private facility and the 19 days reported in the baseline study¹⁰. Patients approaching a public facility at first point, however, showed the least diagnostic duration of 10 days¹ ($p > 0.05$) which was the same as that at baseline ([Table 4b](#)).

Two of the three patients that had accessed a PPIA-Ehub and two of the 28 patients (7%) that had accessed a PPIA-E spoke

as the first point of contact were diagnosed by them. Only 9 out of 33 (27%) patients who approached a PPIA-NE private facility were diagnosed at the same facility. More than half of the total patients (52%, n=45/64) were first diagnosed by a PPIA-E facility: 23 by a PPIA-E spoke and 22 by a PPIA-E hub ([Table 3b](#)). Among those who accessed public facilities as first point of care, 44% (n=8/18) were retained for diagnosis and three (17%) were referred for diagnosis.

A higher proportion of patients (48%, n =15/31) obtained diagnosis within the stipulated time when they first approached a PPIA-E private facility as compared to a PPIA-NE private facility (30%, n=11/37); this was also higher compared to the 41% in the baseline study who approached a private facility⁹. The highest proportion of patients (56%) who obtained diagnosis within the stipulated time were those who had approached a public facility as their first point of care, at both study time points ([Table 5b](#)).

A total of 49% (n=42/86) of patients had approached up to two facilities before approaching the facility which diagnosed them with TB.

TB treatment pathway

What happens to patients after they are first diagnosed with TB?

Patna: After being diagnosed with TB for the first time, four out of the 64 patients (6%) from Patna were retested and re-diagnosed before being initiated on TB treatment ([Table 3a](#)).

Mumbai: Seeking and obtaining a second diagnosis was far more common in Mumbai. Forty-one percent (n=35/86) of the patients were retested and re-diagnosed before being initiated on TB treatment ([Table 3b](#)). [Figure 1](#) shows the facilities that re-diagnosed the patients before treatment initiation. Undergoing re-diagnosis was more commonly seen among patients who were initially diagnosed by a PPIA spoke (78%, n=18/23) or

Table 5. Proportion of patients showing delay and no delay in Patna (A) and Mumbai (B) based on the type of facility at first point of care.

(A) Patna					
Diagnostic/treatment delay	Baseline private (n=60)	Baseline public (n=4)	End-line private (n=46)	End-line public (n=4)	End-line PPIA private (n=14)
No diagnostic delay	36 (60%)	4 (100%)	18 (39.1%)	2 (50%)	9 (64.3%)
With diagnostic delay	24 (40%)	0 (0%)	28 (60.9%)	3 (75%)	5 (35.7%)
No treatment delay	56 (93.4%)	3 (75%)	43 (93.5%)	4 (100%)	14 (100%)
With treatment delay	4 (6.6%)	1 (25%)	3 (6.5%)	0 (0%)	0 (0%)
(B) Mumbai					
Diagnostic/treatment delay	Baseline private (n=53)	Baseline public (n=23)	End-line private (n=37)	End-line public (n=18)	End-line PPIA private (n=31)
No diagnostic delay	22 (41.5%)	13 (56.5%)	11 (29.7%)	10 (55.6%)	15 (48.4%)
With diagnostic delay	31 (58.5%)	10 (43.5%)	26 (70.1%)	8 (44.4%)	16 (51.6%)
No treatment delay	41 (77.4%)	22 (95.7%)	28 (75.7%)	10 (55.6%)	23 (74.2%)
With treatment delay	12 (22.6%)	1 (4.3%)	9 (24.3%)	8 (44.4%)	8 (25.8%)

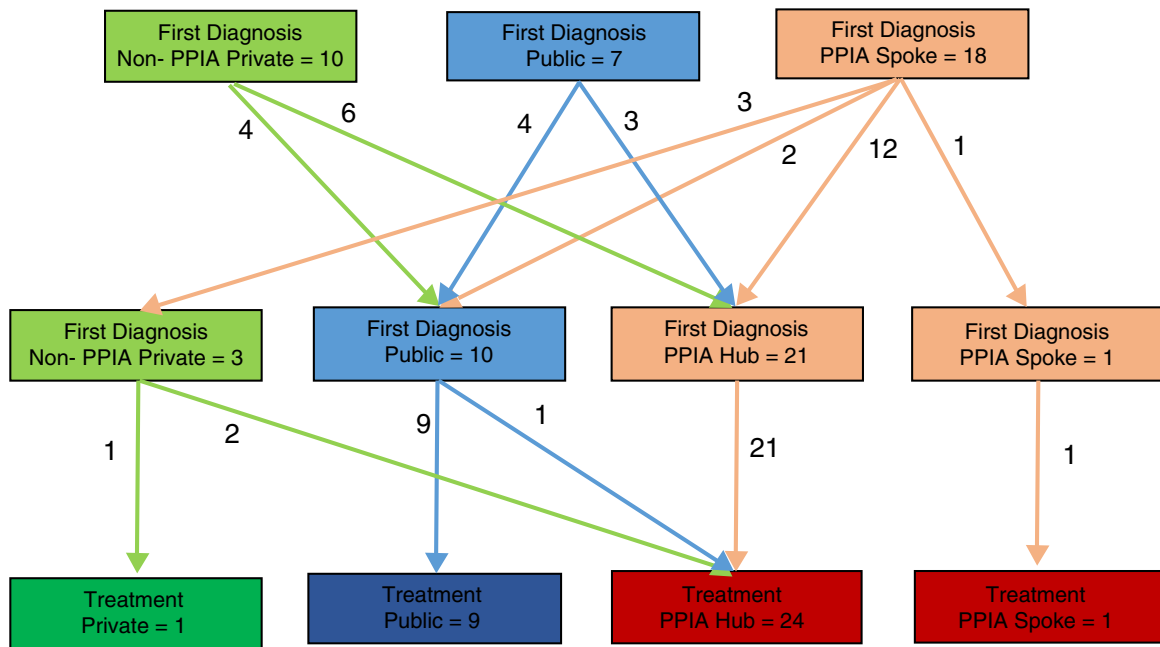


Figure 1. Facility switching for multiple TB diagnosis before treatment initiation in Mumbai.

by a PPIA-NE facility (62%, n=10/16) and was less common among patients who had accessed the public facility (28%, n=7/25) for diagnosis. It was noteworthy that none of 22 patients diagnosed by a PPIA-E hub facility were re-diagnosed. Of the 35 (63%) final diagnoses, 22 were made by PPIA-E facilities. Some of the common reason for leaving the first diagnosing provider was referrals by the previous provider (71%) and patient seeking of a second opinion (11%).

After how long are patients being initiated on TB treatment after their first diagnosis?

Patna: In Patna, 95% (n=61/64) of the patients were initiated on TB treatment without any delay and 74% (n=45/61) of them on the same day. A total of 61% (n=37/61) of the patients who had no treatment initiation delay, were diagnosed by PPIA-E facilities, 29% (n=18/61) by a PPIA-NE private and 10% (n=6/61) by a PPIA-NE public facility. Only three patients in Patna had a delayed TB treatment initiation, all of who had been diagnosed by a PPIA-E facility (2 private and 1 public).

In total, 92% (n=59/64) of patients were initiated on treatment by their diagnosing facility. More patients approaching a PPIA-E private facility at first point of care were initiated on treatment by the same facility (80%, n=8/10) compared to those who approached a PPIA-NE private facility (19%, n=3/16). The rapidity of initiation of treatment was compromised for the four patients who had multiple diagnosis with a median of 10 days (Range: 3–140)

Of the 64 patients in Patna, 92% of patients were initiated on treatment by their diagnosing facility and only five patients moved to a different facility to initiate TB treatment.

Overall, 80% (n=51/64) of patients in Patna had accessed up to two facilities before initiating their TB treatment.

Mumbai: In total, 71% (n=61/86) of the patients from Mumbai were initiated on treatment without any delay, one-third of these (n=20/61) on the same day of diagnosis. The proportion of patients showing no treatment initiation delay was higher among those who were diagnosed by PPIA-E facilities (56%, n=34/61), compared to those diagnosed by public facilities (30%, n=17/61) and PPIA-NE facilities (16%, n=10/61). Paradoxically, among the 25 patients who had a treatment delay, the larger proportion had been diagnosed by PPIA-E facilities (44%, n=11/25), followed by PPIA-NE facilities (24%, n=6/25) and public facilities (32%, n=8/25).

Four of the 31 (13%) patients who had accessed the PPIA-E spoke (n=2)/hub facility (n=2) (Table 3b) as the first point of care, were diagnosed and treated by the same facility.

No patient who had accessed a PPIA-NE private facility at first point was initiated on treatment by them. Of the 18 patients that had first approached a public facility, 6 (33%) were retained with the system. Close to two-thirds of the patients (55/86) had subsequent to their diagnosis, moved to another facility for

initiating their treatment, of which 25% (14/55) had accessed more than two facilities after being diagnosed.

Two-thirds of the patients (62%, n=53/86) had approached up to three facilities before getting initiated on TB treatment after their diagnosis.

Total TB pathway

Patna: The median total pathway duration (from onset of symptoms to initiation of first TB treatment) of patients in Patna was 15 days¹ for those accessing a PPIA-E private facility at first point of care, 38days for those accessing a public facility and 40.5 days for those accessing PPIA-NE private facility (Figure 2). The pathway duration showed a reduction from the 27.5 days¹ for those accessing a private facility, but an increase from the 21.5 days¹ for those accessing a public facility in the baseline study⁹. The total number of facilities accessed by the patients during their pathway ranged from 1–4 (median: 2).

Mumbai: In Mumbai, the total pathway duration was 43 days for patients accessing a PPIA-NE private facility at first point of care. There was a significant decrease in the median total pathway for patients accessing a PPIA-E facility (32 days)¹ at first point of care as compared to the patients accessing a private facility at baseline (46 days) (p<= 0.05). The duration for patients accessing a public facility was similar in the end-line and baseline studies (39 and 41 days, respectively) (Figure 2). The total number of facilities accessed by the patients during their total care pathway at end-line ranged from 1–8 (median: 3).

Extended pathway to TB care in the end-line study
Does the patient pathway to TB care end once treatment is initiated?

After being initiated on TB treatment for the first time, 10 out of the 64 patients in Patna (16%) and 9 out of the 86 patients in

Mumbai (10%) left the treating facilities and showed an extended pathway in the end-line study. This was further looked into to understand what made these patients leave their treating facilities.

Patna: From the 4% (n=2/51) of patients who were initiated on treatment by PPIA-E facilities and 62% (n=8/13) who were initiated on treatment by a PPIA-NE facility had an extended pathway. The median pathway duration for patients from first care seeking until first treatment initiation was 38 days (mean: 41 days, range: 5-79 days) which was extended by an additional 49 days (mean: 72 days, range: 5-187 days) due to the multiple treatment episodes. Figure 3 presents the reasons for the extended pathway for patients in Patna.

Mumbai: A total of 9 out of the 86 patients from Mumbai had an extended pathway. This group with extended pathways constituted 11% (n=6/55) of those initiated on treatment by a PPIA-E facility, 66% (n=2/3) of those initiated on treatment by a PPIA-NE facility and 4% (n=1/28) of those initiated on treatment by a public facility. The total median pathway duration for these patients from first care seeking until first treatment initiation was 62 days (mean: 50 days, range: 2-206 days). However, the median duration between first TB treatment initiation and current/final TB treatment initiation was an additional 28 days (mean: 34 days, range: 3-70 days). Figure 4 presents the reasons for the extended pathway for patients in Mumbai.

Discussion

Public-private partnerships (PPP) have been implemented globally to improve access, care and support for TB patients accessing private health care. Many interventions have been evaluated for increase in case detection rates^{18,19} and few for cost effectiveness⁸. Our end-line study undertaken in the two cities of Mumbai and Patna to evaluate the effect of a PPIA

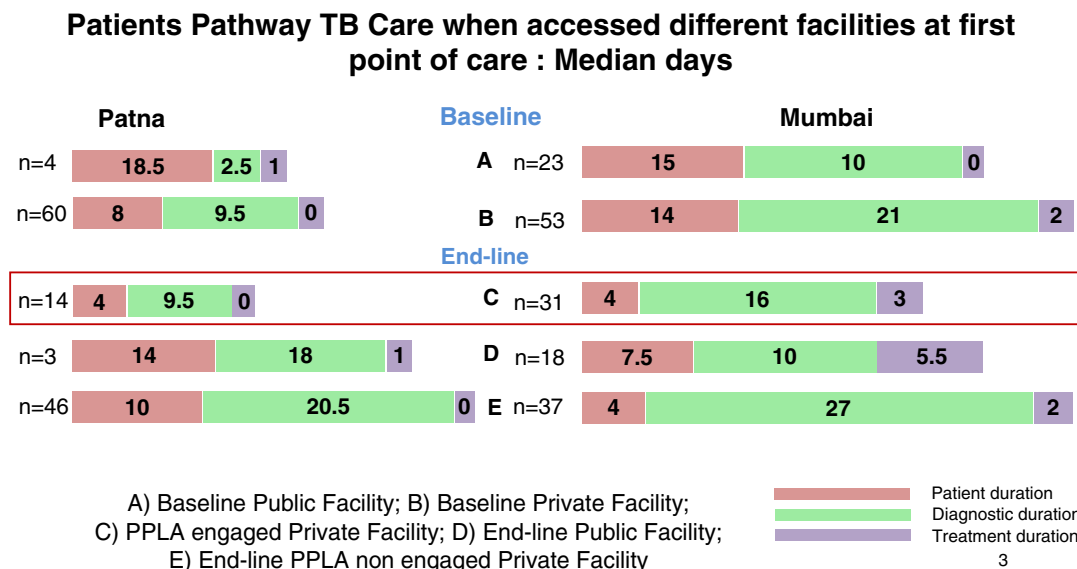


Figure 2. Patient total Pathways to TB Care in Mumbai & Patna.

Patient Journey post Treatment Initiation in Patna

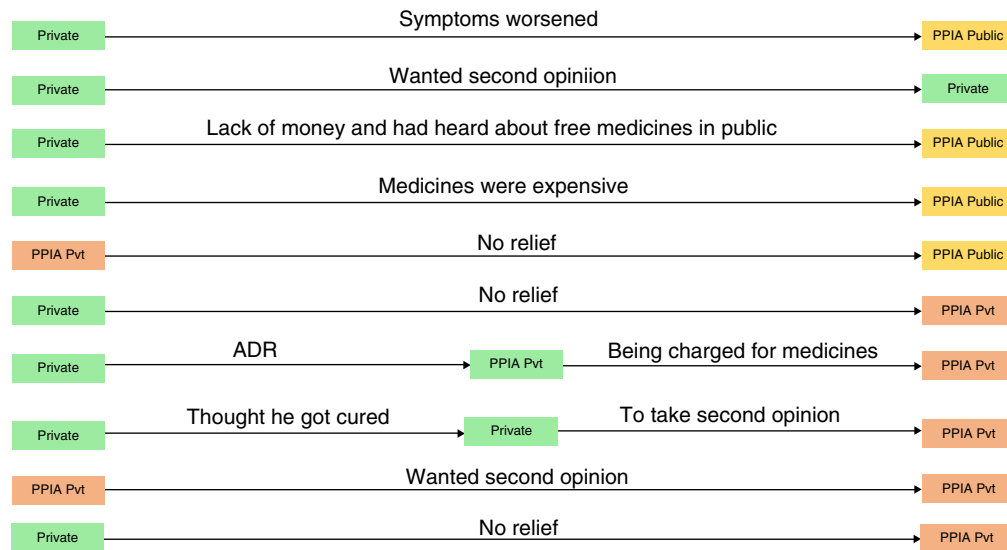


Figure 3. The extended pathway for patients in Patna.

Patient Journey post Treatment Initiation in Mumbai

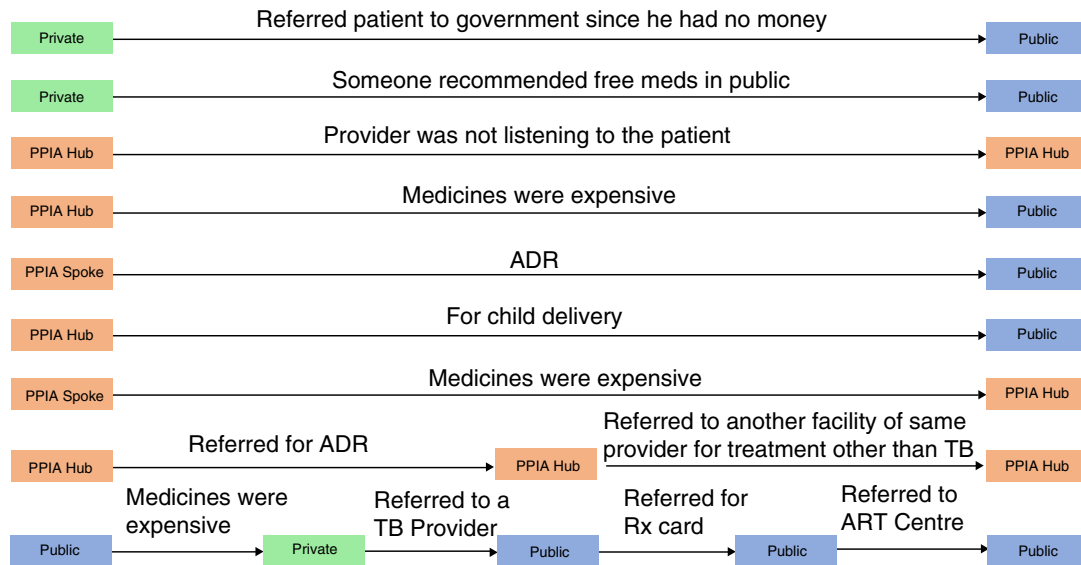


Figure 4. The extended pathway for patients in Mumbai.

intervention on durations and delays in TB care is, to our knowledge, the first of its kind.

The initiative at the two sites had their own distinct flavours. Firstly, the model was played out differently in the two cities.

Mumbai practised a spoke and hub referral model, whereas in Patna a one-stage approach (sans referrals) prevailed. Only private practitioners participated in the initiative in Mumbai whereas in Patna, public practitioners also engaged with the PPIA as private system providers. Molecular diagnostic

CBNAAT technology was readily available in Mumbai with 28 instruments operational, whereas Patna during the evaluation was witnessing a relatively slow uptake of the CBNAAT (three pieces of equipment installed). Lastly, in Patna there was relatively more effort to make its citizens aware of PPIA engagement with private providers. (WHP and PATH Personal Communication).

Delays in diagnosis and initiation of treatment have been of concern for patients seeking private care^{20,21}. The PPIA intervention in Patna and Mumbai was precisely designed to achieve early diagnosis and ensure prompt initiation of appropriate treatment. We discuss to what extent the PPIA has been effective in reducing diagnostic and treatment delays and encouraging patient retention in uncomplicated PTB in both cities. The analytical framework includes comparisons of patient pathway durations between PPIA-E and PPIA-NE providers in both private and public at end-line as well as durations recorded at baseline prior to the PPIA initiation. The small sample size contributes to the quantitative data, while able to portray trends for durations and retentions, was unable to provide statistical significance to many comparisons.

In both the cities, as documented by most studies from India²²⁻²⁵, the private sector (including chemists in Patna) was predominantly accessed by patients at first point of care. The PPIA intervention did not specifically involve community engagement measures. Therefore, despite moderate attempts at community engagement in Patna, the study observed that a low proportion of patients (23%) accessed PPIA-E facilities at first point of care. Even those that accessed PPIA-E facilities had approached these randomly probably due to proximity to their residence, as seen from the reasons that patients provided for choosing their first facility. The other reason for the smaller proportions of patients consulting a PPIA-E facility could also be due to the less than optimal coverage of the private practitioners by the PPIA, not necessarily in terms of geographic area, but also the proportion of private practitioners engaged and the asynchronous locations of patients and practitioners. (Patna: 71%, Mumbai: 41%) (Personal Communication, WHP and PATH). Expansion of the base of engaged practitioners and designing approaches to raise community awareness to PPIA and its benefits, and also incorporating content to improve disease and treatment literacy²⁶ becomes an important message for similar initiatives in the future. This is brought out strikingly in Mumbai which showed a significant decrease in first care-seeking duration attributable to the intense awareness drives undertaken by the public system, especially after 2016. An informed patient can be a more adherent patient achieving better outcomes. Paradoxically, despite obvious implications for patient outcome, information education and communication/advocacy communication and social mobilization activities are categorised as those that have no indicators and are therefore not measurable. This viewpoint has led to cumulative ignorance about TB globally. No wonder then that at the recent UN High Level Meetings in September 2018, minimal support was allocated for IEC activities²⁷.

Our study clearly shows that patients in both cities, who first approached PPIA-E facilities, took considerably shorter time to get diagnosed. Retention of patients after first contact was also satisfactory at PPIA-E facilities at first point of care, with figures of 90% and 67% at Patna and Mumbai, respectively. The retention in Mumbai was only seemingly affected by the spoke-hub referral where the former often referred their patients to a hub for diagnosis.

The public facilities in Mumbai however showed the least diagnostic duration when approached at first point of care though retention of patients after first contact was compromised. A higher proportion of patients approaching a PPIA-E facility showed no delay in diagnosis (64% and 48% in Patna & Mumbai respectively) when compared to a PPIA-NE facility. Timely diagnosis in Mumbai at public facilities consulted at first point of care remained constant at baseline¹⁰ and end-line showing a sustenance in its efficacy.

Patient movement after obtaining first diagnosis was noted in both cities, although it was far more common in Mumbai with its vast numbers and types of private practitioners. While in Patna, patients gravitated from PPIA-NE to PPIA-E facilities, in Mumbai, PPIA-E spoke patients witnessed the most movement due to the mandatory process of a second diagnostic procedure largely from a PPIA hub. A significant proportion of patients who were moved to the public sector (25%) and the PPIA-NE facilities (63%) for first diagnosis were subjected to re-diagnosis. Thus, the patients from the PPIA-NE facilities showed the largest movement after the first diagnosis, with PPIA-E hub patients showing a strong tendency to remain with their providers.

The triggers for patient movement were manifold, namely dissatisfaction with provider, denial of diagnosis, recommendations from friends or relatives or even referrals by providers themselves. These require to be better understood in different contexts through an explanatory model framework²⁸.

After initiation of treatment by their diagnostic facility, movement of patients was minimal. The largest proportion of patients that showed no delay in initiation of treatment in both cities were from the PPIA-E segment. Paradoxically in Mumbai the largest proportion of patients showing delay had also been diagnosed by a PPIA-E facility. Patients with multiple diagnostic episodes also showed the longest treatment initiation pathways. Retention of the patient at first point of care to treatment initiation was weak even in those who had accessed PPIA-E facilities.

The limitations of small sample sizes and possible recall bias notwithstanding, our findings show that accessing a PPIA-E facility at first point of care undoubtedly shortened the total care pathway in both cities. In contrast, patients who accessed non-engaged private providers at first point of care had the longest pathways. These are observations consistent with previous findings that the type of provider first consulted was

the most important risk factors for delays¹² and that patients who accessed private non-engaged facilities had longer downstream delays²².

The issue of extended pathways to care beyond initiation of treatment in 10–15% of patients in both cities was an additional component of the end-line study. The majority of those who demonstrated extended pathways in Patna moved from the PPIA NE sector to the PPIA-E/public facilities. Mumbai provided a contrast since the extended pathway was noted in largely PPIA-E patients (hub and spoke) with most patients finally accessing public facilities. Dissatisfaction with the physician expenses and inability to address adverse drug reactions were reported by patients as key reasons.

The number of providers accessed for DS-TB in Patna and Mumbai ranged from 1–4 and 1–8, respectively. Minimizing patient movement would require a uniform standard of care²⁹ that could, over time, generate implicit trust among patients for the provider accessed. This coupled with enhanced disease literacy would shorten patient delay significantly. Costs of drugs and consultation are often a significant cause of movement from the private to the public sectors²². Therefore extending the free availability of diagnostics and drugs to private patients as in the Joint Effort for Elimination of TB (JEET) programme³⁰ is expected to immensely benefit patients, provided the public system is able to retain the inter-sectoral patients by providing good quality services at a reasonable consultation which could be regulated.

The issue of provider quality of care in terms of diagnosed tests applied and treatment prescribed was, however, not examined in this study. Amongst the PPIA-E providers also, other quality indicators such as delays, retentions were not absolute. Although deviant delays/movement could also be an outcome of patient behaviour, any future public private initiative should include frequent sensitization of providers so that they are capable of managing treatment and adverse reactions. Though we have no data to support this, communication skills of provider and empathetic behaviour (such as time spent with patient) would be useful add-ons as would the provision of free/subsidized diagnostics and medication.

Additionally, the design of any PPI should be to lessen patient movement. Movement reduces energy and motivation in an already vulnerable patient. Providers and ancillary diagnostic/path services should, as far as possible, be proximal to patient as well as provider location to avoid delays and sustain treatment motivation³¹.

The present study provides a strong indication of the utility of public-private system interactions to tackle drug sensitive pulmonary TB and provides guidance to move further on the pathways of patient centred care³². Certain key lessons emerge from this study for strategic involvement of the private sector. These are to monitor progress, engage maximum providers, and build their capacities to offer standard quality of care. Finally, as evinced in both Mumbai and Patna, flexibility of PPM

structures to suit local context and dynamics is a successful strategy.

Data availability

Underlying data

Figshare: Mumbai Patna Baseline data. <https://doi.org/10.6084/m9.figshare.11949117.v1>¹⁶.

This project contains the following underlying data:

- Mumbai_BL_DS_TB cases (XLSX). (Baseline household survey data for participants in Mumbai.)
- Patna_BL_DS_TB cases (XLSX). (Baseline household survey data for participants in Patna.)

Figshare: Mumbai Patna Endline data. <https://doi.org/10.6084/m9.figshare.11949147.v1>¹⁷.

This project contains the following underlying data:

- Mumbai_EL_DS_TB cases (XLSX). (Endline household survey data for participants in Mumbai.)
- Patna_EL_DS_TB cases (XLSX). (Endline household survey data for participants in Patna.)

The transcripts and audio recordings of the interviews cannot be shared as patient identifiers cannot be removed. However, this information can be requested from the Institutional Ethics Committee. The decision will be taken on case to case basis. Queries and requests for data access should be directed to The Foundation for Medical Research Institutional Review and Ethics Committee at fmr-irec@fmrindia.org. Granting of access of data will be at the discretion of the FMR-IREC.

Extended data

Figshare: Supplementary Data. <https://doi.org/10.6084/m9.figshare.12045867.v1>¹³.

This project contains the following extended data:

- BMGF Codebook Mumbai (XLSX). (Codebook for Mumbai surveys.)
- BMGF Codebook_patna (XLSX). (Codebook for Patna surveys.)
- BMGF_Mumbai Datasheet Questnr (DOCX). (Survey questionnaire for Mumbai.)
- BMGF_Patna Datasheet Questnr (DOCX). (Survey questionnaire for Patna.)
- Final_interview_Guide_Mum (PDF). (Interview guide for Mumbai.)
- Final_interview_Guide_Patna (PDF). (Interview guide for Patna.)

Unrestricted data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC0 1.0 Public domain dedication).

Author's contributions

SS1 (MSc.) was involved in manuscript writing, Data analysis for Mumbai and Patna, quality check of the data, and data entry in Mumbai and Patna. SS2 (B. Pharm, MPH) was involved in Manuscript Writing and Data Analysis. SR (MD) was involved in reviewing the manuscript and quality check of the data in Mumbai and Patna. SKR (BPT, MPH) was the field coordinator for data collection in Mumbai, data collection and data entry for Mumbai and Patna and gave inputs for data analysis.

EL (MPH) was involved in reviewing of the manuscript and field coordination in

SK(MSc.) was involved in formatting of the manuscript, quality check of the data in Mumbai and Patna, Data entry in Mumbai and Patna and field work in Mumbai.

YD (MD) was involved in conceptualization and designing for the project, Manuscript writing and Quality check of data in Mumbai and Patna.

NM (PhD) was the overall in-charge of the project and was involved in conceptualization and designing of the project and manuscript writing.

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This article presents a vast array of carefully collected and curated data. To my mind it makes three important contributions to the conversation about innovative tuberculosis (TB) interventions in India and other TB-affected communities. First, it presents a unique mode for assessing programmatic interventions. Second, it highlights the combined importance of work to reduce delay and provide quality treatment. Third, it compares the private sector (intervention acceptors and non-acceptors) with public sector care. Though at times a difficult read the report of this study is crucial for public health actors, intervention scientists, and social sciences of health researchers worldwide.

First, the paper presents a new paradigm for assessing and comparing the effect of a particular public health intervention. In this case the authors look to a public private partnership aimed at reducing rates of TB and improving the quality of its care in two Indian cities. By conducting a baseline and endline patient pathway survey the team is able to show an effect on the speed to diagnosis and other desirable outcomes like reduced provider switching, stronger referral processes, shorter periods before first care seeking and reductions in treatment delay. They are also able to identify troubling effects like unexplained re-testing. These findings in and of themselves provide an important set of metrics with which to understand the effects of an intervention. They are also comparable across space and time, so they allow for comparisons between interventions as well as no intervention. This kind of metric is a crucial tool because it is a measure of success and failure which can provide data more quickly than waiting for a population level impact on incidence and prevalence. Though population level mortality and morbidity reduction shown through incidence and prevalence trends will remain the goal, this paper presents a tool to understand and assess the patient and community-level effects that will bring about a shift in population indicators across time.

Second, the paper presents novel data on what happens to patients after treatment initiation. They do so by considering the shifts people make between care providers rather than a single-minded attention to treatment adherence. They show, what we ought know but often forget, that patient care extends past treatment initiation and that patient-provider relationships continue to matter for successful TB care at the individual and population level. Figures 3 and 4 show that, despite the free provision of TB drugs in the PPIA-engaged private sector, the cost of medicines continues to burden patients. This is a crucial

corrective to PPIA engagement programs and suggests we pay better attention to patient costs regardless of sector. If patients are moving from the private to the public sector as these data indicate, it suggests that either physicians are supplementing their TB treatments with expensive pharmaceuticals or their consultations fees across the duration of care are burdensome. Nonetheless the data show that patients moved from non-PPIA-accepting private physicians to both PPIA accepting and public sector care. This is a heartening data point which shows that patients once inside the PPIA system did not leave it for other private sector physicians. These suggestive data points open yet another avenue by which to consider the effect of intervention.

Finally, the paper is part of a very small body of work that has the data to compare public and private sector indicators. Their data strongly suggests that the public sector continues to be an important source of reliable care. They show that without intervention the public sector (in Mumbai at least) was the best performing in terms of diagnostic delay. They also show that the engaged private sector outperforms the public when it comes to time from diagnosis to treatment initiation. The research's innovative design has thus provided two action points: 1) build a PPIA system in which first point of care is a PPIA engaging physician and 2) work within the public sector to streamline diagnosis to treatment initiation. Overall their results show that the public sector, in Mumbai at least, continues to be an important source of TB care and our collective effort to engage the private sector should not be considered as an either/or initiative but ought in tandem with support to the public sector.

As an anthropologist working for over 10 years with TB patients in India, I found myself busy underlining this text and writing exclamation in its margins. Most exclamations were "wow" and "why?". Though out of the scope of this paper, I was left wanting to learn more about the kinds of events that led to surprising findings like 25% of patients visiting 2 or more facilities after diagnosis, or why rates of retesting were so high in both cities, or what might explain why only 19% of non-accepting private clinics in Patna were able to retain their patients through diagnosis. These stunning findings are important insights and it is clear that the researchers probed their interviewees about the why's and how's of their treatment journey. However, the form they chose privileges quantitative trends over an analysis of patient actions and meanings. That said they open many new avenues for qualitative research, and I would encourage them to conduct a qualitative analysis of their data.

Finally, I wonder, as Prof. Daftary does, about the effects of their inclusion criteria on the broader evidentiary power of their results. Certainly, these criteria allow for the kinds of comparability I lauded above, but they raise questions about what we can take from this study as data about the state of all TB care and care seeking in each of these cities. By removing non-pulmonary forms of TB, patients without a diagnostic report or microbiological confirmation, and those suffering from MDR-TB from their sample, they remove a large diversity of people and events that make up the TB landscape in India. Luckily the authors do not make claims about the landscape in each city but make rather modest assertions about indicators of change within this smaller population due to an intervention. Readers might keep in mind that their study, though deep, tells us about one manifestation of TB among many.

Overall, this is a laudable study that maintains and exceeds expectations of methodological and analytical rigor. The authors have made claims clearly based in the evidence they present here and help readers think through innovative ways to understand public health action at intermediate scales. Their manuscript merits indexing.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

No source data required

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: I have been associated with FMR while conducting ethnographic work among private sector physicians and privately treated TB patients in Mumbai. This has no relation to the research and analysis presented in this manuscript and has not affected the quality and content of my review.

Reviewer Expertise: Anthropology, health seeking, South Asia, tuberculosis, global health, the private sector, diagnosis and care.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 07 May 2020

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Amrita Daftary 

School of Health Policy and Management, York University, Toronto, Canada

This paper articulates in remarkable detail the nuances of TB care seeking, diagnosis and treatment initiation in the context of a PPIA initiative in two urban centres of India. The research team has highlighted how complex the pathway to TB care can be and especially highlighted the continuous shuffling that patients undergo even when an apparently more seamless linkage to services has been attempted.

There are lot of results and comparisons to sift through. Figure 2 is the most helpful summation as it addresses the primary research questions that the authors seek to address. It would be helpful in the discussion to very succinctly tease that finding apart, so readers can fully appreciate the benefit (and lack thereof - where no apparent effect or a negative effect was noted) of engaging private providers in each city, what appeared to work / fail in each city (and why, if possible). This would be a main take home message of the paper, in my opinion, and could guide future goals of PPIA programs (e.g., that reduction in diagnostic delay is indeed a feasible and attainable goal, with certain caveats / unknowns)

An important outcome of the PPIA appears to be a reduction in patient delay (again, from Fig 2) vs impacts on other types of delays. One important implication that the authors could consider raising is the opportunity to educate and support presumptive patients about TB infection control at the first point of contact. The opportunity brought on by an early patient-provider interaction should not be missed, particularly given greater awareness about social distancing and isolation in current times. Whether or not potential patients abide by these recommendations is of course a separate matter but if timely TB diagnosis is aimed to prevent transmission and reduce incidence (alongside direct patient impacts), then the gains of reduced patient delay should be capitalized on.

The eligibility criteria as displayed in text compared to patients excluded in Table 1 are not intuitively understood. Suggest adding a brief statement in text about who was excluded.

Over/about 2/3 of the target sample was excluded from the study for a number of (justifiable) reasons. That being said, it would be of interest for readers to learn the authors' opinions about how those missed pathways could contribute to our understanding of patient pathways more broadly, less so around DRTB and EPTB but more so around migration, self reporting patients (20-35% of the target sample) who likely did attempt to access care from a provider if the questions were probed, and persons having no TB documents. As these factors all contribute to the complex reality in which many patients seek medical care. In future work, for example, would some of these patients be included?

I have otherwise no substantial comments on the analysis. Thank you for the opportunity to review this paper.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: FMR and I have collaborated on some exploratory work with TB survivors in Mumbai. This has no relation to the PPIA projects discussed in this manuscript and has not affected the quality or content of my candid review.

Reviewer Expertise: tuberculosis, social and behavioural research, private sector, patient perspectives, qualitative methods

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.
