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Are informal healthcare providers knowledgeable in tuberculosis care? A cross-sectional survey using vignettes in West Bengal, India

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Background: India accounts for one-quarter of the world's TB cases. Despite efforts to engage the private sector in India's National TB Elimination Program, informal healthcare providers (IPs), who serve as the first contact for a significant TB patients, remain grossly underutilised. However, considering the substantial evidence establishing IPs' role in patients' care pathway, it is essential to expand the evidence base regarding their knowledge in TB care.

Methods: We conducted a cross-sectional study in the Birbhum district of West Bengal, India. The data were collected using the TB vignette among 331 IPs (165 trained and 166 untrained). The correct case management was defined following India's Technical and Operational Guidelines for TB Control.

Results: Overall, IPs demonstrated a suboptimal level of knowledge in TB care. IPs exhibited the lowest knowledge in asking essential history questions (all four: 5.4% and at least two: 21.7%) compared with ordering sputum test (76.1%), making a correct diagnosis (83.3%) and appropriate referrals (100%). Nonetheless, a statistically significant difference in knowledge (in most domains of TB care) was observed between trained and untrained IPs.

Conclusions: This study identifies gaps in IPs' knowledge in TB care. However, the observed significant difference between the trained and untrained groups indicates a positive impact of training in improving IPs' knowledge in TB care.

Keywords: India, informal healthcare providers, quality of care, tuberculosis, tuberculosis care, vignettes.

Introduction

According to the WHO, globally, an estimated 9.9 million people were infected with TB in 2020, and India accounted for the highest burden (26%).[1] The WHO roadmap for Public-Private mix for TB prevention and care urges national TB programmes (NTPs), depending on their context, to expand their partnership with the private sector and engage all healthcare providers (both formal and informal) in TB care.[2] The Lancet commission report on TB also recommends developing an inclusive approach in TB care by transitioning from acknowledgement to prioritisation of private providers, and this remains crucially important for countries like India with a high disease burden and a dominant private system.[1,3,4]

India's National TB Elimination Program (NTEP) has made notable progress in its engagement with the formal private sector, as demonstrated by an increase in TB case notification of 75% from 2013 to 2019, partially attributed to the contribution of this sector.[1] But a cadre within the private system often referred to as informal healthcare providers (IPs) remain grossly underutilised, despite being identified as the first point of contact for a significant proportion of TB patients.[5,6] Multiple health-seeking behaviour studies carried out among TB patients have reported that IPs are the preferred provider or are approached for initial care

(ranging from 10 to 59%) by patients in their care pathway.[7–9] The significant role of IPs in the TB care pathway aligns with evidence documenting their substantial presence in India's healthcare system.[10,11] In some states their number is estimated to be double that of qualified doctors, and a few studies report their presence ranging from 41 to 67%.[12–14] Notably, a recent scoping review paper has highlighted IPs' role in all three domains (prevention, detection and treatment) of TB care and their potential in improving TB care outcomes, emphasising the need to engage IPs in national TB programmes (NTPs).[15]

India's National Strategic Plan for TB Elimination (2017–2025) stresses the identification of a presumptive TB case at the first point of contact (either private or public).[16] To achieve this goal, the engagement of IPs remains vital as seeking care from IPs has been recognised as one of the reasons for diagnostic delay among TB patients.[8,9,17] The TB care cascade model also identifies poor case finding as a gap in India's NTEP.[18] IPs could play a role in strengthening the linkage between the informal and formal systems, as identified in a review by Thapa et al., leading to improved and timely diagnosis of TB cases.[15] In this scenario, considering their current role in TB care, it is essential to expand the evidence base to ascertain the quality of TB care delivered by these providers, similar to providers in the formal system.[19] The quality of TB care is multidimensional. Providers' competence is one crucial component and can be measured using knowledge indicators.[20] The use of vignettes, an inexpensive and effective tool to measure providers' knowledge, is a well-accepted method in TB care.[5,21,22] It is important to note that previous studies of provider knowledge in the private sector focus on formal providers, and only a limited body of evidence exists for IPs, and of those that are available, some have methodological limitations.[5,19,21,23] One prominent feature of this study is new evidence comparing the TB care knowledge between trained and untrained IPs. This was feasible as the Liver Foundation, West Bengal (LFWB), a local public health organisation, was involved in training IPs using a 9-mo (initially started as a 12-mo) structured programme.[24] The LFWB is a not-for-profit, non-government organisation involved in both programmatic and research activities focused on liver diseases as well as in the field of public health, especially for the capacity building of the rural healthcare system. It functions independently from the government system and has no agreement to provide any kind of formal TB care services. Hence, in this context, we conducted a comprehensive cross-sectional survey in collaboration with the LFWB, solely designed for this cadre of the health workforce with an aim to measure their overall TB care knowledge using a standard vignettes method and further compare it between trained and untrained IPs.

Materials and Methods

Study design and population

We performed a cross-sectional study among IPs covering all 19 blocks of the Birbhum district in West Bengal. Birbhum is the northernmost district in the Burdwan division and extends over 4545 square km with a total population of 3 502 402. The primary occupation is agriculture, and the annual per capita income is 53 122 Indian rupees (approximately US$723).[25] As per the India TB report 2021, West Bengal reported 79 093 TB patients, 56% of the total expected cases.[26]

The informal providers who participated in this study were either enrolled with the LFWB as part of their training programme or affiliated with local IP associations. Referring to the Government of West Bengal's definition, we define IPs as 'independent providers who function at the informal level and lack appropriate training or qualification for the type of services they offer'.[27] In this study, we only included those IPs whose primary practice was based on the allopathic system of medicine. IPs classified as trained in this study participated in a structured training programme administered by the LFWB, which included a range of subjects such as anatomy, physiology, pharmacology, safe motherhood, emergency medicine, public health concepts and programmes. It also had sessions on TB covering topics such as TB control, suspecting TB cases and national TB programme guidelines, including contra-indicated actions in TB suspects.[24] We did not provide any additional training or evaluation as part of this study as that was beyond its scope.

The sample size was calculated using STATA software version 17 (StataCorp [2021], College Station, Texas, USA) for two proportions. The level of significance was set at 5% and power at 80%. The knowledge proportion for the untrained IPs was taken as 30.9% from a paper by Mohanan et al.[5] Referring to a previous study by Das et al., we assumed an estimated 15% difference in knowledge between the two groups, so the proportion for the trained group was set at 45.9%.[28] The final calculated sample size was 162 IPs in each group.

The sampling frame for the trained group was obtained from the LFWB training registry. However, for the untrained group, we requested local IP associations in 19 blocks to develop a sampling frame. As part of the process, the leaders from the local IP association contacted the registered IPs and explained the scope and objectives of the study. The list of IPs who voluntarily agreed to participate in this survey was provided by IP associations of all 19 blocks. The final sampling frame included 518 trained IPs and 219 untrained IPs. The IPs in both groups were selected using the lottery method, and those chosen randomly were contacted and invited to participate in this study.

Survey tool and data collection method

The use of vignettes to evaluate the knowledge of a similar cadre of the health workforce is a well-accepted method.[29] In the vignette method, the provider (study participant) is presented with a case, and the interviewer plays the role of the patient. In this study, the interviewer started by telling the IP that they have been experiencing a fever, cough and weakness for the last month. Then the participant (IP) was asked to proceed as they would do in their regular practice if someone with such symptoms visited their clinic. The rest of the interview was guided by questions asked by the provider (IP). All the information such as the clinical history, physical examinations, laboratory tests, diagnosis and any treatment provided by the IP was recorded. The patient (interviewer) response, including test results, was provided in the vignettes, and the interviewer was required to follow the script. The TB vignette we utilised in this study was obtained from researchers who have performed previous work in TB care

Table 1. Expected correct case management

Item	Definition
EHT	If a provider asks all four key questions: - Cough duration - Fever duration and pattern - Weight loss - Haemoptysis.
Essential test ordered	If a provider orders a sputum test. We did not include chest x-ray as essential, considering the setting where IPs function.
Correct diagnosis	If a provider makes a diagnosis as 'TB'.
Correct treatment	Providers like IPs are not expected to initiate the treatment for TB patients, so correct treatment was defined as referral of TB cases to higher health facilities.

Abbreviation: EHT, essential history taking.

in India.[21] The tool was available in Bengali, the local language of our study site. Please check the Supplementary File S1 for a copy of the study tool**.**

In this study, we defined correct case management as per India's Technical and Operational Guidelines for TB Control and by referring to previous studies utilising a similar method combined with the authors' expertise in this field.[5,21,30] The scenario presented to IPs was a presumed TB case, and the definitions for expected correct case management are presented in Table 1. In many states, practising as an IP is illegal and can attract punishment.[14] In this context, a lack of clarity exists regarding the role and expectations of IPs in India's national TB guidelines and policies.[14] So the correct case management definitions used in this study were designed solely to provide a broad overview of IPs' knowledge in different domains of TB care.

Two trained Research Assistants (RAs) collected data from February to March 2020. The interviews were conducted in the local language (Bengali) at the LFWB office at Suri (headquarters of Birbhum district) to ensure confidentiality. Study participants were provided with 300 INR (approximately US$4.5) to compensate for their travel costs. Data collectors (RAs) started interviews by asking sociodemographic questions regarding age, gender, education, years of work experience and then the TB vignette was administered. Each interview lasted for an average of 30 min. To minimise sharing of information during the day of the interview, a dedicated person was allocated to maintain the flow of participants, and new arrivals were asked to wait in a separate room.

Statistical analysis

The TB vignette we used in this study (provided as Supplementary File 1) was structured to obtain quantifiable data. During the interview, if the study participant (IP) asked a specific question such as cough duration, then the interviewer (RA) marked it as checked in the history-taking section of the data collection form. Only questions asked by IPs were marked on the data collection form, and such an arrangement made the process simple for interviewers (RAs) to collect data from a large sample of IPs. When the data were prepared for analysis, each response was entered in a dichotomous format as 'yes' or 'no'. This data structure allowed us to compare proportions between the groups (trained vs untrained). We chose this format to report findings using proportions as it permitted comparison of responses between groups at the level of individual questions (such as cough duration) as well as in an aggregated form by categories (all or at least half of the essential history taking).

The participants' characteristics are described. The difference in knowledge between the trained and untrained groups was tested using the χ^2 test or Mann–Whitney U test as appropriate. We used a logistic regression model to calculate adjusted ORs to test the association between providers' training and the correct case management. Data analysis was conducted in STATA software version 17 (StataCorp [2021], College Station, Texas, USA).

Results

A total of 331 IPs (165 trained and 166 untrained) participated in the study. Table 2 describes provider characteristics stratified by their training status. Most IPs were males in both groups, 96.3% (319/331). More than half of the providers in both groups had received education of post-secondary and higher. The higher degree qualifications were in the arts, commerce and basic sciences. Their work experience ranged from 1 to 50 y and the mean duration was higher in the trained group ($p<0.001$). The daily median number of work hours was found to be seven, but IPs reported providing service at any time if requested to by patients. They served an average of 15 (10–25) patients per day, and 94.5% (313/331) of IPs provided services through private clinics. Interestingly, more than one-third of IPs in both groups worked with formal practitioners, primarily doctors, before starting their practice as an IP. Working as an IP was the primary occupation for more than 83.9% (278/331) of the providers in both groups.

Table 3 presents the performance of IPs in asking history questions, ordering laboratory tests and making a correct diagnosis and referral. Out of 49 questions for history taking, the average number of questions asked by trained and untrained IPs was four and three, respectively ($p<0.001$). Among the four essential questions, duration of cough was the most common question asked by both providers, with a higher percentage among

Table 2. Background characteristics of informal healthcare providers (n=331)

Variable	Trained (n=165)	Untrained (n=166)	p
Age (y), mean (SD)	44.6 (8.0)	40.5 (10.1)	0.0001
Gender, n (%)[a]			
Male	164 (99.4)	155 (93.3)	0.006
Female	1 (0.6)	11 (6.7)	
Married, n (%)[a]			
Yes	161 (97.5)	150 (90.3)	0.009
No	4 (2.5)	16 (9.7)	
Religion, n (%)			
Hindu	104 (63.1)	111 (66.8)	NS[b]
Muslim	61 (36.9)	55 (33.2)	
Highest education received, n (%)[a]			
Primary	1 (0.7)	1 (0.7)	NS[b]
Secondary and below	27 (16.3)	32 (19.1)	
Post-secondary	74 (44.9)	79 (47.6)	
Higher degree education	63 (38.1)	54 (32.6)	
Work experience as IP (y), mean (SD)	19.0 (7.3)	14.4 (9.3)	<0.001
No. of working hours (each day), mean (SD)	7.7 (2.1)	7.0 (2.2)	0.0053
Patients served (each day), median (IQR)	15 (10–25)	15 (10–25)	NS
Own a private clinic, n (%)[a]			
Yes	155 (93.9)	158 (95.1)	NS[b]
No	10 (6.1)	8 (4.9)	
How learned to work as IP, n (%)[a]			
Working with a doctor/nurse	77 (46.7)	75 (45.1)	NS[b]
From parents/grandparents	33 (20.1)	25 (15.1)	
Vocational training	22 (13.3)	26 (15.7)	
From relatives/sibling	14 (8.5)	20 (12.1)	
Working at a hospital/pharmacy	12 (7.2)	13 (7.9)	
From another IP	7 (4.2)	7 (4.1)	
Working as an IP—primary occupation, n (%)			
Yes	139 (84.2)	139 (83.7)	NS[b]
No	26 (15.8)	27 (16.3)	

[a]Exact test.
[b]NS, not significant.

trained (63.6%) than untrained (47.5%) IPs (p=0.003). However, except for cough duration, overall, only one-third of providers asked other essential history questions. The proportion of respondents making a test order for the sputum test was higher (84.2 vs 68.0%, p<0.001) among trained IPs. Overall, >80% of the IPs diagnosed TB correctly, and 100% referred those cases to higher health facilities.

Figure 1 displays the overall performance (completed by at least 10% of the providers) of IPs (n=331) on the TB vignette. Recommended history taking such as family history of TB, current consumption of alcohol, smoking, patient's profession and any previous visit to other care providers were asked by <5% of providers. Similarly, essential physical examinations such as pulse rate and auscultation were also carried out by <5% of the providers. For detailed findings on IPs' performance on TB vignettes, please refer to Supplementary File S2.

The adjusted OR for trained providers to perform correct case management compared with untrained providers is presented in Table 4. The odds of taking a complete history (all four) were 4.28 times higher (p=0.031) for trained compared with untrained providers. Similarly, the odds of ordering a sputum test were 2.02 times higher for trained vs untrained providers, but this was not statistically significant. The odds for trained providers for advising containment were also 3.85 higher than for untrained providers (p<0.001).

Discussion

Overall, the knowledge of IPs in TB care was found to be suboptimal. The lowest level of knowledge was exhibited in asking

Table 3. IPs' knowledge of history taking, ordering laboratory tests, diagnosis and treatment by training status

	Overall (n=331)	[1] Trained (n=165)	[2] Untrained (n=166)	p	DIFF [1–2][a]
Number of history questions asked (49 in total), median (IQR)	4 (2–6)	4 (3–7)	3 (1–5)	<0.001***	NA[b]
EHT, n (%)					
Complete EHT (all 4 questions)	18 (5.4)	15 (9.0)	3 (1.8)	0.003**	7.2
Half-complete EHT (at least 2 questions)	72 (21.7)	44 (26.6)	28 (16.8)	0.03**	9.8
Cough duration	184 (55.5)	105 (63.6)	79 (47.5)	0.003**	16.1
Fever	119 (35.9)	70 (42.4)	49 (29.5)	0.01**	12.9
Weight loss	101 (30.5)	59 (35.7)	42 (25.3)	0.03**	10.4
Haemoptysis	126 (38.0)	69 (41.8)	57 (34.3)	NS[c]	7.5
Number of laboratory tests ordered (26 in total), median (IQR)	2 (1–4)	2 (1–4)	2 (1–3)	NS[c]	NA[b]
Essential test ordered, n (%)					
Sputum test	252 (76.1)	139 (84.2)	113 (68.0)	0.001**	16.2
Diagnosis					
Gave a correct diagnosis—TB, n (%)	276 (83.3)	147 (89.0)	129 (77.7)	0.005**	11.3
Complete EHT and correct diagnosis, n (%)	18 (5.4)	15 (9.1)	3 (1.8)	0.003**	7.3
Half-complete EHT and correct diagnosis, n (%)	68 (20.5)	42 (25.4)	26 (15.6)	0.02**	9.8
Complete EHT and a sputum test and correct diagnosis, n (%)	18 (5.4)	15 (9.1)	3 (1.8)	0.003**	7.3
Half-complete EHT and a sputum test and correct diagnosis, n (%)	62 (18.7)	38 (23.0)	24 (14.4)	0.04**	8.6
Correct treatment—referral, n (%)	276 (100)	147 (100)	129 (100)	NA[b]	0

**p<0.05. ***p<0.001. [a]Difference in proportion. [b]Not applicable. [c]Not significant.

essential history questions; 5.4% asked all four key questions, and 21.7% asked at least two questions. However, >80% of the providers gave a correct diagnosis, and 100% of those correctly suspecting TB reported referring those cases to higher health facilities. Interestingly, we observed a significant difference in knowledge (in most domains of TB care) between trained and untrained IPs.

In general, IPs having a suboptimal level of knowledge of TB care is consistent with the previous studies from the Bihar and Haryana states of India.[5,23] In our study, IPs performed relatively better in ordering laboratory tests and making a correct diagnosis and treatment compared with asking essential history questions. Similar findings of providers (including IPs) making a higher percentage of correct diagnoses was also reported in a paper by Mohanan et al.[5] Such a discrepancy could have resulted from a higher chance of contamination bias in a community-based, cross-sectional study, and especially in a setting where study members maintain a close relationship, such as the strong local network of IPs observed in our study setting.[31] Furthermore, as part of the ethics requirements, we needed to inform the participants about the scope and objectives of the study during the invitation process, so this could have influenced their response to the diagnosis of disease. We identify this as one of the limitations of the vignette's method, which could be addressed by utilising methodologies such as standardised patients.[32] Additionally, mixed-method studies with a qualitative arm can also help to understand such discrepancies as they allow a deeper understanding of the study topic, which is limited by the quantitative nature of surveys.

To address these issues in the current study, while analysing the study data, we combined their response to correct diagnosis (as TB) with their ability to ask essential history questions and order a sputum test (Table 3). We found that the percentage of the providers matching these criteria (making a correct diagnosis after asking all or at least half of the key history questions and/or ordering a sputum test) was lower for both trained and untrained IPs, supporting our argument regarding the overall suboptimal level of TB care knowledge among IPs. However, the findings on the referral of all cases after suspecting a case of TB is consistent with the result we obtained from a cross-sectional practice survey. The study was carried out among 203 IPs in West Bengal with a goal to document field-level TB care practices of IPs using a retrospective case study method.[33] It implies that their knowledge of referral of TB cases reported in this study matches the findings from the practice survey. We found that referral to a higher health facility was their preferred case management approach once they suspected or diagnosed a patient with TB.

We would like to note that it is difficult to define appropriate knowledge for IPs as there is no clarity on their role and expectations in India's NTEP. Nonetheless, considering the existing literature, which highlights IPs as the first point of contact for a significant proportion of TB patients, their knowledge of appropriately screening patients by asking essential history questions is undoubtedly crucial.[9,34] However, our study noted the lowest level of knowledge among IPs in this domain. It is also important to consider that complete history taking in TB service delivery has been found to be insufficient among both informal and formal providers in India.[5,21]

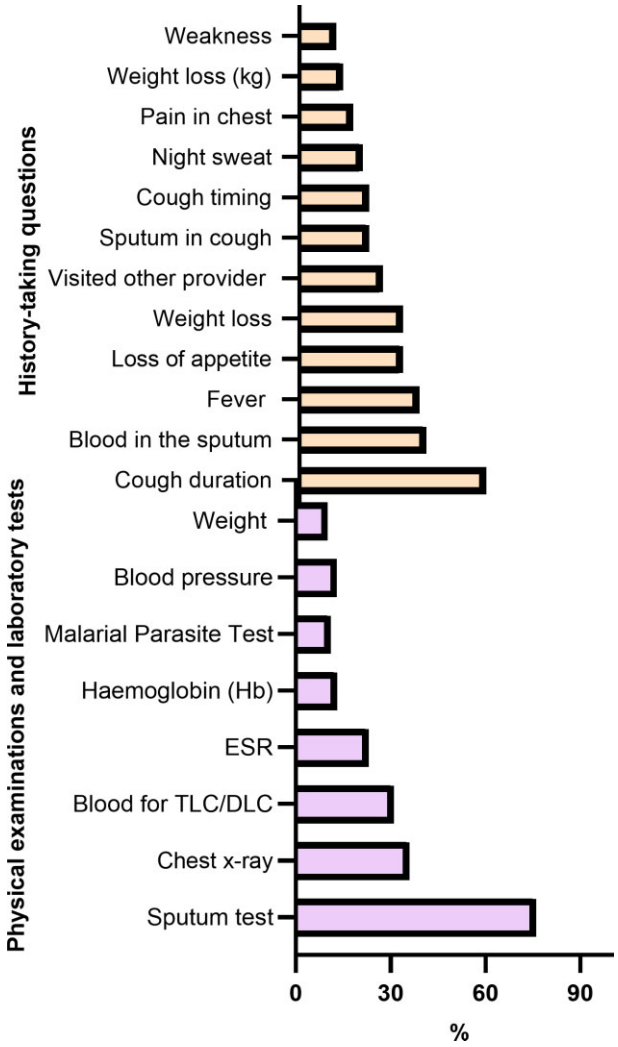

Figure 1. IPs' overall performance on TB vignette*. DLC, differential leukocyte count; ESR, erythrocyte sedimentation rate; TLC, total leukocyte count. *Completed by at least 10% of providers (n=331).

We report the following relatively high percentages of laboratory tests and correct diagnosis by IPs compared with a study performed by Mohanan et al. utilising a similar data collection tool: sputum test (76.1 vs 16.9%), chest radiograph (38.2 vs 29.6%) and correct diagnosis (83.3 vs 59.6%).[5] This could be due to the difference in exposure and engagement of the IPs in West Bengal facilitated by the recognition of these providers by the state government.[27] Although little official documentation in government reports and scientific publications exists regarding IPs' engagement in TB care, during our fieldwork we found that some IPs in the state were involved in different pilot TB projects like Southern Health Improvement Samity (SHIS) and also with the NTEP informally.[35] Such involvement could have resulted in an overall higher level of knowledge among IPs in West Bengal, but making a comparative analysis is beyond the scope of this study. Future studies can conduct such analysis by collecting data from other states to gain a deeper insight into the variation in knowledge with reference to IP recognition.

Even though a suboptimal level of knowledge was found among IPs in both groups, a higher level of knowledge (statistically significant) was documented among trained compared with untrained IPs. Our results reinforce the findings from a randomised controlled trial reporting improvement in the quality of care delivered by IPs with a structured training programme.[28] A similar result of a higher level of TB care knowledge among trained IPs was reported in a study from Bangladesh conducted by Islam et al.[36] As the training was not administered as part of this research project, and the goal of the study was to provide an account of the overall difference in knowledge based on their existing training status, we did not examine the content and quality of the training as part of this study. This is an area that needs to be explored in future research. However, the significant difference, as noted between the two groups, is a clear indication of the positive impact of training on IPs' knowledge.

This study has a few limitations. First, as the participants were informed about the study topic and objectives during the initial contact as part of the consent process, we assume that some sharing of information between IPs could have influenced their responses during the interview. Second, there are no guidelines for IPs in TB care, so we lacked a standard benchmark to compare the knowledge of IPs in TB care. We defined correct management following India's TB guideline, but it was still subjected to researchers' judgement to determine appropriate TB management by IPs. Third, we attempted to make the sampling random, but the list received from the IPs' professional body for the untrained group might have included those IPs who are active in delivery of care in the community, possess higher levels of knowledge and are closely connected to the IPs' professional bodies. Therefore, it may not be an accurate representation of untrained IPs in the region. Lastly, generalising findings to other settings has to be done cautiously, primarily because the recognition of IPs in health systems and their role in formal TB care programmes varies within

Table 4. Unadjusted and adjusted ORs for trained compared with untrained providers

Action taken by IPs	Unadjusted OR (95% CI)	p	Adjusted OR[a]	p
EHT	5.43 (1.54 to 19.14)	0.008	4.28 (1.13 to 16.14)	0.031
Order sputum test	2.50 (1.47 to 4.26)	0.001	2.02 (0.93 to 4.38)	0.072
Order chest radiograph	1.12 (0.71 to 1.75)	0.618	0.61 (0.34 to 1.10)	0.103
Correct diagnosis	2.34 (1.27 to 4.31)	0.006	0.69 (0.27 to 1.75)	0.442
Recommend containment	4.02 (2.46 to 6.57)	0.000	3.85 (2.17 to 6.82)	0.000

[a]Adjusted for age and years of work experience

and between countries, and these factors could influence their level of knowledge in TB care.

Conclusions

The overall level of knowledge among IPs in TB care was found to be suboptimal, but a significant difference was observed between trained and untrained providers. The odds of carrying out correct history taking, diagnosis and management were found to be higher in trained than in untrained providers, indicating a positive impact of training in improving IPs' knowledge in TB care. Considering the goal of this study was to evaluate TB care knowledge based on IPs' current training status, we did not assess the content and quality of training, which is an area to be explored in future research.

Supplementary data

Supplementary data are available at *International Health* online.

Authors' contributions: PT, RJ, JH, PM and PN conceived the study idea. PT, RJ, JH, PM, KB and PN wrote the study protocol and designed the study. PT, PM, DD and TM collected data in the field. PT, NB, DD and TM analysed the study data. PT wrote the first version of the manuscript. All the authors provided critical feedback on drafts and approved the final version of this manuscript submitted for publication.

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Ethical approval: Written informed consent was obtained from all participants. The ethics approvals were obtained from the UNSW Human Research Ethics Committee (HC191006) and the LFWB Institutional Ethics Committee for Human Research (IILDS/IECHR/01/202).

Data availability: Data are available from the corresponding author on reasonable request.

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