

# Alternative medicine: an ethnographic study of how practitioners of Indian medical systems manage TB in Mumbai

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Received 5 November 2015; revised 4 January 2016; accepted 11 January 2016

**Background:** Mumbai is a hot spot for drug-resistant TB, and private practitioners trained in AYUSH systems (Ayurveda, yoga, Unani, Siddha and homeopathy) are major healthcare providers. It is important to understand how AYUSH practitioners manage patients with TB or presumptive TB.

**Methods:** We conducted semi-structured interviews of 175 Mumbai slum-based practitioners holding degrees in Ayurveda, homeopathy and Unani. Most providers gave multiple interviews. We observed 10 providers in clinical interactions, documenting: clinical examinations, symptoms, history taking, prescriptions and diagnostic tests.

**Results:** No practitioners exclusively used his or her system of training. The practice of biomedicine is frequent, with practitioners often using biomedical disease categories and diagnostics. The use of homeopathy was rare (only 4% of consultations with homeopaths resulted in homeopathic remedies) and Ayurveda rarer (3% of consultations). For TB, all mentioned chest x-ray while 31 (17.7%) mentioned sputum smear as a TB test. One hundred and sixty-four practitioners (93.7%) reported referring TB patients to a public hospital or chest physician. Eleven practitioners (6.3%) reported treating patients with TB. Nine (5.1%) reported treating patients with drug-susceptible TB with at least one second-line drug.

**Conclusions:** Important sources of health care in Mumbai's slums, AYUSH physicians frequently use biomedical therapies and most refer patients with TB to chest physicians or the public sector. They are integral to TB care and control.

**Keywords:** AYUSH, Cross-practice, Diagnosis, India, Private sector, Tuberculosis

## Introduction

Of the 9 million TB cases worldwide in 2014, India accounted for 25% of cases.<sup>1</sup> India also accounts for 1 of the 3 million 'missing' cases—patients with TB who are either not diagnosed or not notified.<sup>1</sup> TB incidence is persistently high in India, despite the efforts of the Revised National TB Control Programme (RNTCP), and the emergence of severe forms of drug-resistant TB has augmented the problem.<sup>2</sup>

Research suggests that the majority of visits to healthcare providers are to the private sector.<sup>3–5</sup> Patients with TB follow this general pattern, with 50% choosing the private sector.<sup>6</sup> Alarming, the quality of private sector TB care has been shown to be sub-optimal.<sup>7–11</sup> In light of this work, many advocate a stronger integration of the private sector within TB control programs, to find missing cases, decrease diagnostic delay and avert multidrug-resistant (MDR) TB.<sup>12–19</sup>

Private healthcare in rural and urban India is heterogeneous, fragmented and mostly unregulated.<sup>20–23</sup> The private sector

includes biomedical providers who have specializations and advanced degrees, general practitioners holding bachelor degrees in biomedicine (though it is most often referred to as allopathic, western, or modern medicine in India, we use biomedicine here as this term indicates a set of care giving practices based in biology that use biopharmaceuticals) or an AYUSH system (Ayurveda, yoga, Unani, Siddha, and homeopathy), and practitioners without any formal training.<sup>24–26</sup>

The 2015 National Health Profile records show that 44% of all medical degree holders in India (736 538 doctors) have a degree in AYUSH systems. Of these, 135 357 were registered in Maharashtra while the less developed states of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh have 303 502 registered AYUSH practitioners as compared to 168 632 practitioners with degrees in biomedicine.<sup>27</sup>

In, Mumbai, Maharashtra's largest city, studies of 12 high-slum population wards suggest AYUSH practitioners are important health care providers.<sup>28</sup> Detailed provider mapping data recorded by Vijayan and colleagues<sup>29</sup> show that 3751 (507%) of 7396 private

practitioners were AYUSH. In high slum proportion health posts, the AYUSH to biomedically trained provider ratios ranged from 8.6:1 to 1.42:1. Another Mumbai-based study focusing on patient pathways to care revealed that a majority of people later diagnosed with TB sought care from an AYUSH provider before moving on to a biomedically trained practitioner. The study showed a similar trend among those with cough not diagnosed as having TB.<sup>30</sup>

Although AYUSH practitioners hold degrees in systems of medicine recognized and regulated by the government of India, little research focuses on them. Most analyzes include AYUSH practitioners in the 'informal provider' category,<sup>31–33</sup> even though today they receive 4.5 years of formal training and earn the equivalent of an MBBS degree in their own system. Other analyzes include AYUSH practitioners with physicians holding degrees in biomedicine<sup>34</sup> or exclude them from the study population altogether.<sup>35–37</sup> In both cases we are left with insufficient data on their roles in TB care.

In response to AYUSH providers as a first point of care we developed a research project in Mumbai to understand the role of private, clinic-based AYUSH-trained practitioners in slum healthcare infrastructures, and examine how AYUSH practitioners usually manage patients with presumptive and diagnosed TB.

## Methods

We devised and implemented an ethnography-based research protocol combining in-depth semi-structured interviews and clinical observation between August 2014 and September 2015. Part of a larger ongoing TB Private-Provider Interface Agency (PPIA) that included an ethnographic component to collect data on private practice,<sup>38</sup> a medical anthropologist (AM) developed and implemented the study in two of Mumbai's high TB risk slums in northern Mumbai. The locations were chosen purposively from the six high drug-resistant TB risk wards identified by Mumbai's TB control program<sup>28</sup> to represent different demographic and socio-economic patterns. One is unplanned, majority Hindu and Maharashtrian with most people owning their home. The other is a planned slum, built after 1960s slum clearances drives, majority Muslim, predominately non-Maharashtrian and most people renting their homes. Both cover about 1 km<sup>2</sup>. Author AM conducted an ethnographic study that included TB affected people, general physicians, chest specialists, pharmacists and pharmaceutical wholesalers; the data presented here comes from only general physicians (AYUSH and non-specialist physicians most often identify themselves as general physicians). We aimed to interview all AYUSH providers in both slums. To do so, AM mapped each provider in the two slums and checked the list with local pharmacists and physicians as well as the mapping data compiled by Vijayan and colleagues. Any practitioner displaying an AYUSH degree in the two study slums was included in the study population. We interviewed no practitioners of Siddha, yoga or naturopathy as no practitioner in our study areas held degrees in these systems.

AM, fluent in Hindi, conducted over 400 interviews with 175 AYUSH practitioners. He interviewed 70 practitioners trained in Ayurveda, 78 trained in homeopathy and 27 trained in Unani. Twenty-two practitioners were female and 153 were male. Interviews occurred in-clinic.

After five informal conversations and 5 hours of observation in waiting rooms to attain an initial sense of the situation, we

developed a broad set of questions to understand interviewees' general practice (such as how often they used biomedicine or their system of expertise, continuing education in either system, common patient presentation and their use of biomedical diagnostics), their role in TB care (if they treated patients with TB and with which system, preferred referral physicians, or knew signs and symptoms of TB) and experience with patients with TB in the preceding year. AM memorized the questions and changed the order and word choice as necessary to probe for information. To facilitate complete physician narratives and reduce the effects of researcher preconception, AM did not use a survey form though he took notes and audio-recorded interviews. Memorizing the questionnaire may have led providers to perceive interviews as unimportant and limited the study's ability to generate identical narratives for statistical analysis. Two practitioners asked for written question lists to be used and a list was provided.

More than half of practitioners were interviewed at least twice. We conducted follow-up interviews within 1 month, after reviewing each physician's previous interview, and any already interviewed neighbors. Follow-ups are conversational in style working to answer two or three larger questions that emerged from previous interviews. They served to build trust, assess change in practice over time, develop new themes and check earlier statements. Twenty practitioners were interviewed more than five times. Multiple interviews were conducted to gain a more nuanced insight on practices not often shared with a stranger.

AM conducted clinical observation in 10 interviewed practitioners' clinics. We selected clinics visited by at least 40 patients daily. After interviewing a selected physician twice, AM sat inside the exam room with the physician observing consultations with all patients throughout the clinic's working period for five consecutive days. Observation included documenting patient symptoms, and physician's history taking, clinical examinations, diagnostic or referral recommendations, the system of pharmaceutical distributed or prescribed, and diagnosis or suspicion given for each patient in a notebook as the consultation occurred. Observation resulted in 208 hours of observation and 2000 observed patient interactions. Practitioner interview data and observation were correlated for correspondence and crosschecked with interviews of local drug wholesalers and pharmacists. Though observation may have affected the type of care provided, we conducted multiple interviews and observations of the same provider to build rapport and minimize observer bias.

As primary care providers in our sample rarely maintain medical records or follow written protocols, we did not review any records or written protocols. Semi-structured interviews and unstructured conversations with physicians allowed for flexibility while observed clinical consultations presented in situ examples of provider behavior.

## Data analysis

We analyzed data by writing detailed descriptions of diagnostic practices, clinical settings, patient interactions and examination practices, and organized them by doctor qualification. We also transcribed audio files and crosschecked notes to compile a list of important themes that we correlated with the provider's system of study. Identities and locations were masked to protect study participants' identities. Each transcription includes a coded physician ID, date, degree and ward code and was filed

twice, once by date and once by physician ID. Filing physicians' interviews together allowed us to read trends within a single provider's narrative while by date allowed us to analyze how themes emerged as AM began to inductively analyze the data during data collection.

We analyzed observation data by transferring notes into an excel spreadsheet while simultaneously listening to observation recordings to cross check for fidelity. We then used Microsoft Excel (Microsoft Corp., Redmond, WA, USA) to tabulate the total numbers of referrals, investigation requests, alternative medicine use, diagnoses, prescriptions, patient complaints and clinical examinations done. We then compared dates of the month, number of days after initiation of observation, physician and physician degree.

Reviewing interviews and observations, we generated a unique list of themes weekly. We continued to examine for themes and crosschecked new and existing interviews as well as observations as data accumulated. We looked for repetitions and variation in interview content and contexts (claims made before and after a comment) to be validated in further interviews. We focused on themes that occurred in both interview and observation. Our analysis is inductive and foregrounds themes that occur in both narrative and practice though we worked to understand disjuncture between ideals recounted in interviews and practices observed.

## Ethics

All participants consented to being part of the study and a Research Ethics Board at McGill University Health Centre approved the study. An information sheet was available for participants. Participants gave oral consent and their data have been anonymized.

## Results

### Characteristics of practitioners interviewed

#### *Bachelor of Ayurvedic Medicine and Surgery*

Seventy practitioners interviewed held degrees in Ayurvedic medicine (BAMS)—a medical system originating in Sanskrit philosophical texts emphasizing balance and associated with Indian nationalism movements<sup>39-41</sup>—from universities throughout India though most studied in one of Mumbai's four Ayurvedic medical colleges. BAMS physicians we interviewed ranged in age from 29 to 72 years. Their years of practice ranged from 2 to nearly 50 years and they saw between 40 and 110 patients in a day. Their clinics were often exam rooms with attached waiting areas in converted storefronts.

#### *Bachelor of Homeopathic Medicine and Surgery*

Seventy-eight practitioners interviewed held degrees in homeopathic medicine (BHMS)—a system of medicine developed in 19th century Europe with roots in German naturopathy movements and theories of vitalism<sup>42</sup>—ranging from BHMS to doctors of homeopathic medicine and surgery. Most were trained in Mumbai's colleges but others received training in north India or other cities in Maharashtra. Homeopathy practitioners ranged in age from 24 to 68 while years of experience ranged from 1 to 45. They saw between 50 and 120 patients per day and like BAMS physicians often practiced in converted storefront clinics.

#### *Bachelor of Unani Medicine and Surgery*

We interviewed 27 physicians with training in Unani medicine (BUMS)—a medical system with roots in Galenic medicine of Greece and Arabic language scholars in the middle ages<sup>43</sup>—from universities across north India. Most rented their clinic and lived within 2 km of it. They were older and all men, between 40 and 60 years with between 15 and 35 years of experience. They saw 20 to 60 patients a day and often had smaller clinics.

Sampled practitioners collected an average consultation fee of 50 rupees (US\$1=Rps 66) for biomedicine. These fees included three doses of biomedical pharmaceuticals and a meeting with the doctor. Though many also chose to write a prescription for four or five tablets of antibiotics like amoxicillin or ciprofloxacin, patient costs are relatively low. The same physicians' consultation fees while using his or her AYUSH systems is higher often, between 100 and 300 rupees.

## Biomedicine

None of the 175 practitioners interviewed exclusively practiced their system of training. Practitioners estimated using their system of training between 0 and 40% of the time. Clinical observation revealed that homeopaths use homeopathy slightly more than those trained in Ayurveda. Of the 1000 interactions we observed at homeopathic providers' clinics, the practitioners prescribed a homeopathic remedy as part of treatment only 44 times (4.4%) while prescribing biomedicine in the remaining 956 interactions. Similarly of the 1000 observations at Ayurvedic providers' clinics, the practitioners prescribed an Ayurveda remedy 30 times (3.0%) while the remaining 970 interactions used biomedicine. AYUSH most commonly used antipyretics (paracetamol and ibuprofen), nimesulide, ranitidine, basic antibiotics (amoxicillin, ciprofloxacin or cephalosporin) and dexamethasone. They relied heavily on tablets. IV fluids were rare, though 269 of 2000 interactions included an injection. All of the 175 practitioners distributed medicines from the clinic and prescription practices varied, some wrote each patient a prescription while others only rarely.

All physicians reported using their own system of medicine for chronic conditions, while they preferred biomedicine for acute conditions. One BAMS practitioner explained:

*If it is a chronic case, like osteoarthritis or rheumatic arthritis, and modern medicine doesn't answer this, I mean biomedicine, in those cases I use Ayurveda. If a case is relapsing, like if a malaria case is relapsing time and time again then I give chloroquine and ayurvedic medicine too. I use Ayurveda when I cannot get a good result from biomedicine. Of course, modern (bio)medicine, modern technology, modern diagnosis systems are appreciable and from a diagnosis point of view absolutely fine. However from a medicine point of view there are a lot of side effects and a lot of medicines are not so effective. So, many patients who took modern (bio)medicine for a long time got renal failure.*

Practitioners listed asthma, chronic obstructive pulmonary disease (COPD), arthritis, diabetes, high blood pressure, hepatitis, hair loss, acne, uterine fibroids and Crohn's disease as syndromes for which they might practice one of the AYUSH systems. Another practitioner said: *It's not that I never use Ayurveda; with chronic diseases we are seeing now like skin diseases, like itching, boils,*

or relapsing acne it is useful. But these kinds of patients are only a very small portion of the patients I see. Only one had ever treated a TB patient with an AYUSH system of medicine.

### Diagnosis

All of the 175 practitioners reported having ever used biomedical diagnostic tests and felt comfortable referring patients with presumptive TB to local private and public laboratories. They tended to think of diagnosis as crosscutting medical systems. A BAMS practitioner makes these similarities particularly clear:

*Diagnosis is important, I see in our college when teaching us they did complete blood counts, erythrocyte sedimentation rates and whatever the patient needed. I use biomedical diagnostic tests because they give more information and more information is always a good thing. See if the patient has a pneumonia, a pleurisy, or TB how will I come to know? I'll get an x-ray. If the x-ray is not clear then we'll go for a CT scan. You can do an ESR or a CBC. So all parameters—SGPT, Mantoux test, sputum, we do. The medicine is a different thing but the diagnosis is first and it is same.*

Another practitioner with a degree in homeopathy explained:

*Diagnosis is not about the system, in both systems (biomedicine and homeopathy) the diagnosis is the same, the symptoms are the same, and the body will have the same problems but the pathy decides the medicine. Take for example my practice and compare that to a doctors practicing with a BAMS degree and a doctor with an MBBS degree. If the three of us saw the same patient at the same time, in nine of 10 patients we would ask the same questions, do the same clinical procedures, and ask for the same tests, in the tenth we might differ because we may think to use homeopathy or Ayurveda. We are treating disease based on the same thing, just the actual remedy differs.*

Practitioners with degrees in Ayurveda felt that even though their system had its own way of conceptualizing the body with humors these were only useful when thinking about ayurvedic pharmacology:

*I take the same history as anyone else. Of course in Ayurveda we have vatta, pitha, and kapha but I think with them much less. Most often I think with blood counts and fever and breath sounds but occasionally when I will used ayurvedic medicine I think with humors to get the medicine correct but I'm out of practice.*

In observation, very little difference in history taking or diagnostic test ordering behavior emerged between BAMS and BHMS physicians. BHMS physicians tended to ask one more question of the patients but none used the detailed history taking measures they suggested characterized homeopathic histories.

### Suspecting TB

All practitioners reported seeing at least one patient with presumptive TB (i.e., typical pulmonary TB symptoms like two or more weeks of cough) in the preceding year and were familiar with the four first-line anti-TB drugs. Nonetheless, physicians

trained in AYUSH required several visits to begin suspecting TB. The first few visits they treated patients with broad-spectrum antibiotics and other symptomatic drugs. After several visits over 5 to 10 days, they started to think diagnostically. A BAMS physician shared this timeline:

*At first I treat any patient with a fever with paracetamol, nimesulide and a simple antibiotic. Usually I start with amoxicillin. After a few days I switch to cephalosporin and usually that helps. If the patient gets no relief from the fever after changing antibiotic I may switch again to something like levofloxacin and ask for blood tests like CBC and ESR. If blood tests are noteworthy I continue the antibiotics and begin to think maybe it's pneumonia if there is cough, but usually pneumonia will respond. If it does not then I think TB and get a chest x-ray. Then if I see a shadow I refer to a consultant or the public sector.*

Most physicians estimate the process lasts 10 to 14 days. One who thought more about TB used this system: *There is considerable TB in my area so when other doctors, after antibiotics and symptomatic treatment does not give a good result think about a CBC and ESR I order a chest x-ray right away.* No practitioner suggested ordering a laboratory investigation on the first visit but instead tried managing the fever associated with TB. A BAMS practitioner said *If the patient has a long history of cough before coming to me and has crepitation, then maybe I'll ask for blood work and an x-ray on the third visit but I always try with antibiotics first. If it goes away, good, if not I will catch it on the x-ray.*

All physicians considered several weeks of cough the sentinel for TB, while 103 of 175 suggested fever and weight loss were stronger TB indicators. *Most of my TB patients I recognized because of fever that did not respond. Most did not have noticeable cough or complain of it. Instead many were experiencing weight loss and I could not get their fever in control,* a BHMS physician explained.

Very few considered cough without fever a possible case of TB. One BUMS physician explained:

*A cough can be many things, right? Allergic, bacterial, COPD, some other irritation, etc. I first think of these things. I rule them out and then I think maybe its TB. If there is fever then allergy and COPD are already out of the question. Of course if the patient is diabetic, has a family history of TB, or is HIV positive then I may think it's more likely TB than an allergy.*

Only after confirming a diagnosis did physicians feel comfortable referring. A BHMS practitioner explained: *I refer when I know what the problem is but cannot manage it here. I very rarely send a case because I am confused about it. Most often I know what the problem is but feel someone else can treat it better. I follow that rule for TB too.*

### Treatment of TB

The majority, 164 of 175 providers, preferred to refer known TB patients to a chest specialist or the public sector. One BAMS practitioner said:

*I began to suspect one of my patients as having TB when she did not improve after antibiotics and two weeks of treatment. I asked her for an x-ray and it seemed very clearly to be TB so I*



sent her to a chest specialist I know. He started her on treatment and now she sees both of us. I counsel her but the treatment is his.

Indeed, this kind of team approach seemed most common with about half of practitioners acting as DOTS providers (or treatment supporters) for patients they referred to the RNTCP for treatment. Another BAMS practitioner outlined the relationship like this:

*Though I'm not always sure that the DOTS alternate day therapy is best, I send TB patients to BMC (Brihanmumbai Municipal Corporation) because they take care of the dosage and pay for the patient. I give the medicines and its very inexpensive for the patient. I diagnose the patient with TB and then send to the BMC for confirmation. Then the patient comes back with their DOTS box, so you can say I am treating TB but not doing it alone.*

Though many had treated TB patients in the past, most cited a concern from MDR-TB as a reason to refer patients. A BUMS practitioner recalled:

*I stopped treating TB patients last year. I became a little afraid of MDR-TB and the BMC told us that because of MDR-TB we should not treat TB. I treated one or two after that, but one case was a little complicated and these are people's lives we are dealing with. Its better to refer, then I do not need to worry about it and the patient gets good treatment.*

Another BHMS practitioner gave a different reasons for choosing not to treat TB patients:

*My patients are poor and the TB treatment is long. The drugs are not so expensive but if I treat them and they have a money shortage they might stop treatment and then I am responsible. Its better they go to the city's clinics. I am a DOTS provider so I keep the patient with me and he gets free drugs.*

Still this particular doctor was privately treating a TB patient:

*I have a TB patient in my care now. He was very sick of a long time and could not tolerate the TB medicines. Eventually he was admitted to the TB hospital but they told him his case was too advanced and he should go home. He came to me and begged me to do something. I did not feel I could stand by so I said, 'let's try the normal TB medicines one more time, just the simple ones, no streptomycin, no cycloserine just ethambutol, rifampicin and isoniazid.' I started him on that and he's been improving well for the last 5 months. Sometimes we have to try to manage the patients that the BMC does not.*

Another practitioner with a BHMS degree had a similar patient:

*I have six patients in my care under the BMC DOTS program and one I am treating privately. The one in private I tried to send to the BMC, she gave two sputum smears two different times but all of them came up negative despite the classic TB symptoms, except cough. They told her she did not have TB. Still, I suspected TB, probably extra-pulmonary and started her on a week of treatment [an HRZE fixed dose combination common in the Indian private sector]. She is in her seventh month of treatment and is doing extremely well.*

Though these and other AYUSH physicians had a single TB patient, another five physicians treated several TB patients without

referring them. A BAMS physician who treats 10 TB patients annually shared his strategic decision to manage TB:

*I treat normal (drug sensitive) TB. Most (AYUSH) doctors do not treat but some who want to make a name for themselves as a general practitioner who sees complicated cases, like a second level GP they need to think about treating everything. Many physicians who see a patient with something like a lymph node will send him to a specialist right away but I send for an FNAC (fine needle aspiration cytology) and if it turns out to be TB then I start TB treatment. If I ask them to test and they say no then when they go to a specialist and he asks for the same test they realize I was right. So I try to treat.*

Another well-established BHMS practitioner explained:

*Why shouldn't I treat TB? I know how to give a patient AKT4. I know that if he does not improve I should send for a drug sensitivity test. I'd start on second line drugs then. My patients trust me and I know how to manage TB, if I did not feel confidence then I would refer but in my case the specialists and I will do the same thing.*

This physician, however, is the only one of 175 doctors who managed MDR-TB alone. He is not the only one to diverge from the Standards of TB Care in India.<sup>44</sup>

Three added streptomycin to the HRZE regimen, two added a fluoroquinolone, three added both drugs and one physician used streptomycin, levofloxacin and kanamycin. Of the 175 physicians only one felt that an AYUSH system was useful for TB treatment.

## Discussion

AYUSH practitioners use antibiotics and other pharmaceuticals far more often than their own system and tend only to diverge from biomedicine in cases of chronic disease or at the patient's request. They rely on laboratory-based diagnostic tests and, when thinking diagnostically, use biomedical disease categories. No physician reported ordering any test for a patient with presumed TB on the first visit and only 31 physicians reported to ask patients with presumptive TB for a sputum smear after a TB indicative CBC, ESR and chest x-ray. These three tests combined with a range of antibiotics were relied upon as TB diagnostic tools. Most estimated a delay of 10 to 14 days before suspecting TB and should be considered as a significant source of diagnostic delay. A systematic review of India specific TB delay studies reported health system or diagnostic delay at 28.4 days.<sup>45</sup> Similarly, a standardized patient study in Delhi found diagnostic testing on presumptive TB patients' first visits was low across qualifications, though AYUSH providers were less likely than MBBS physicians to order a sputum smear or chest x-ray.<sup>46</sup> Interventions designed to reduce diagnostic delay may need to encourage AYUSH as well as biomedical practitioners to begin the cascade of diagnostic tests earlier. In particular, x-ray as a first screening tool should be encouraged and even when ESR and CBC are normal.

Like Patwardhan and colleagues, our results suggest that AYUSH practitioners do not consider AYUSH medical systems as resources for the treatment of TB.<sup>47</sup> Of the 175 doctors, 164 did not initiate TB treatment but preferred to refer the patient to a chest physician or the public sector. Yet, some treat TB when the patient has left the public sector. Similarly, our results align

with Uplekar and Shepard,<sup>4,8</sup> showing that nine of the 11 practitioners who treated TB on their own include at least one second line drug in their regimen. Interventions designed to engage AYUSH practitioners should facilitate stronger connections with high quality specialists or the public sector. By strengthening these connections, AYUSH providers will be better able to better support patients and guide them to the best possible care. In addition a stronger focus by the public sector on extra-pulmonary TB may help further reduce the role of AYUSH practitioners in the treatment of TB. Finally, those who choose to treat should be limited in the use of second-line drugs by stronger drug regulation and physician accountability in the context of MDR-TB.

Though our study was not geared to assess the quality of care provided by these physicians, their practice, diagnostic paradigm, referral patterns and knowledge of TB suggests they be analyzed in a category of their own rather than as informal providers or biomedicine-trained physicians. Moreover, their high patient loads, tendency to refer patients for TB care and desire to continue learning about biomedicine suggests they are candidates for PPIA interventions. Streamlining the referral processes from AYUSH providers to the public sector may help reduce patient delays. Indeed, AYUSH providers in Mumbai have been engaged in PPIA intervention projects, and 1500 providers are currently engaged in a TB PPIA project (S. Vijayan personal communication).

## Conclusions

We strongly encourage the integration of these integrated medical professionals in programs aimed at controlling TB in India by allowing access to reduced cost diagnostic services, facilitating relationships with chest physicians and the RNTCP, and empowering them to help guide patients through the course of treatment. Leaving AYUSH-trained practitioners out of TB control has created a space for non-standard regimens and left them with a sense that TB is not a significant concern in Mumbai.

**Authors' contributions:** AM, MP: concepts, literature search, manuscript editing, manuscript review, intellectual content definition. AM: design, data acquisition, data analysis, manuscript preparation. Both authors read and approved the final version. AM is guarantor of the paper.

**Acknowledgements:** We are grateful to Shibu Vijayan and Rishabh Chopra for fieldwork support.

**Funding:** This study was funded by the Bill & Melinda Gates Foundation [grant number OPP1091843]. MP is supported by a Canada Research Chair from CIHR.

**Competing interests:** The authors have no financial or industry conflicts. MP serves as a consultant to the Bill & Melinda Gates Foundation.

**Ethical approval:** A Research Ethics Board at McGill University Health Centre approved the study.

## References

- 1 WHO. Global Tuberculosis Report 2014. Geneva: World Health Organization; 2014.
- 2 Satyanarayana S, Subbaraman R, Shete P et al. Quality of tuberculosis care in India: a systematic review. *Int J Tuberc Lung Dis* 2015;19:751–63.
- 3 Das J, Hammer J. Location, location, location: residence, wealth, and the quality of medical care in Delhi, India. *Health Aff* 2007;26:w338–51.
- 4 Das J, Holla A, Das V et al. In urban and rural India, a standardized patient study showed low levels of provider training and huge quality gaps. *Health Aff* 2012;31:2774–84.
- 5 Berman PA. Rethinking health care systems: private health care provision in India. *World Dev* 1998;26:1463–79.
- 6 Satyanarayana S, Nair SA, Chadha SS et al. From where are tuberculosis patients accessing treatment in India? Results from a cross-sectional community based survey of 30 districts. *PLoS One* 2011;6:e24160.
- 7 Uplekar MW, Juvekar SK, Parande SD et al. Tuberculosis management in private practice and its implications. *Indian J Tuberc* 1996;43:19–22.
- 8 Uplekar M, Juvekar S, Morankar S et al. Tuberculosis patients and practitioners in private clinics in India. *Int J Tuberc Lung Dis* 1998;2:324–9.
- 9 Uplekar M, Pathania V, Raviglione M. Private practitioners and public health: weak links in tuberculosis control. *Lancet* 2001;358:912–6.
- 10 Udawadia ZF, Pinto LM, Uplekar MW. Tuberculosis management by private practitioners in Mumbai, India: has anything changed in two decades? *PLoS One* 2010;5:e12023.
- 11 Achanta S, Jaju J, Kumar AMV et al. Tuberculosis management practices by private practitioners in Andhra Pradesh, India. *PLoS One* 2013;8:e71119.
- 12 Lönnroth K, Uplekar M, Arora VK et al. Public-private mix for DOTS implementation: what makes it work? *Bull World Health Organ* 2004;82:580–6.
- 13 Dewan PK, Lal SS, Lönnroth K et al. Improving tuberculosis control through public-private collaboration in India: literature review. *BMJ* 2006;332:574–8.
- 14 Sheikh K, Porter J, Kielmann K et al. Public-private partnerships for equity of access to care for tuberculosis and HIV/AIDS: lessons from Pune, India. *Trans R Soc Trop Med Hyg* 2006;100:312–20.
- 15 Kumar MKA, Dewan PK, Nair PKJ et al. Improved tuberculosis case detection through public-private partnership and laboratory-based surveillance, Kannur District, Kerala, India, 2001–2002. *Int J Tuberc Lung Dis* 2005;9:870–6.
- 16 Sehgal S, Dewan PK, Chauhan LS et al. Public-private mix TB activities in Meerut, Uttar Pradesh, north India: Delivering DOTS via collaboration with private providers and non-governmental organisations. *Indian J Tuberc* 2007;54:79.
- 17 Kane S, Dewan PK, Gupta D et al. Large-scale public-private partnership for improving TB-HIV services for high-risk groups in India [Notes from the field]. *Int J Tuberc Lung Dis* 2010;14:1066–8.
- 18 Sachdeva KS, Kumar A, Dewan P et al. New vision for Revised National Tuberculosis Control Programme (RNTCP): universal access—“reaching the un-reached”. *Indian J Med Res* 2012;135:690.
- 19 Lei X, Liu Q, Escobar E et al. Public-private mix for tuberculosis care and control: a systematic review. *Int J Infect Dis* 2015;34:20–32.
- 20 Bhat R. Characteristics of private medical practice in India: a provider perspective. *Health Policy Plan* 1999;14:26–37.
- 21 George A, Iyer A. Unfree markets: socially embedded informal health providers in northern Karnataka, India. *Soc Sci Med* 2013;96:297–304.
- 22 Kamat VR. Private practitioners and their role in the resurgence of malaria in Mumbai (Bombay) and Navi Mumbai (New Bombay), India: serving the affected or aiding an epidemic? *Soc Sci Med* 2001;52:885–909.

- 23 Kumar R, Jaiswal V, Tripathi S et al. Inequity in health care delivery in India: the problem of rural medical practitioners. *Health Care Anal* 2007;15:223–33.
- 24 Cross J, MacGregor HN. Knowledge, legitimacy and economic practice in informal markets for medicine: A critical review of research. *Soc Sci Med* 2010;71:1593–600.
- 25 Pinto S. Development without institutions: ersatz medicine and the politics of everyday life in rural north India. *Cult Anthropol* 2004;19:337–64.
- 26 Ministry of AYUSH. [Home page] New Delhi: Ministry of AYUSH. <http://indianmedicine.nic.in/> [accessed 30 October 2015].
- 27 Central Bureau of Health Intelligence. National Health Profile. New Delhi: Government of India; 2015.
- 28 Mumbai District TB Control Society. Mumbai Mission for TB control: Towards Universal Access to TB control. Mumbai: Municipal Commission of Greater Mumbai; 2013.
- 29 Vijayan S, Khetarpal M, Datta M et al. Chemists and less-than-fully qualified providers dominate Mumbai's health provider universe. Paper presented at the 45th Union World Conference on Lung Health, Barcelona, Spain, 28 October to 1 November 2014.
- 30 Patil A, Ranjan S, Dolakhiya Y et al. Profile of providers approached by TB patients from first onset of TB symptoms until first initiation of ATT, Mumbai and Patna. Paper presented at the 69th National Conference of Tuberculosis and Chest Diseases, Mumbai, India, 6 February 2015.
- 31 Kanungo S, Bhowmik K, Mahapatra T et al. Perceived Morbidity, Healthcare-Seeking Behavior and Their Determinants in a Poor-Resource Setting: Observation from India. *PLoS ONE* 2015;5:e012586.
- 32 May C, Roth K, Panda P. Non-degree allopathic practitioners as first contact points for acute illness episodes: insights from a qualitative study in rural northern India. *Health Serv Res* 2014;14:182–93.
- 33 Kermode M, Muani V. Injection practices in the formal and informal healthcare sectors in rural north India. *Indian J Med Res* 2006;124:513.
- 34 Dror DM, van Putten-Rademaker O, Koren R. Cost of illness: evidence from a study in five resource-poor locations in India. *Indian J Med Res* 2008;127:347.
- 35 Yadav A, Garg SK, Chopra H et al. Treatment practices in pulmonary tuberculosis by private sector physicians of Meerut, Uttar Pradesh. *Indian J Chest Dis Allied Sci* 2012;3:161–3.
- 36 Prasad R, Nautiyal R, Mukherji P et al. Treatment of new pulmonary tuberculosis patients: what do allopathic doctors do in India? *Int J Tuberc Lung Dis* 2002;6:895–902.
- 37 Yadav S, Patel A, Unadkat SV et al. Evaluation of management of TB patients by general practitioners of Jamnagar city. *Indian J Community Med* 2006;31:259–60.
- 38 McDowell A, Pai M. Treatment as diagnosis and diagnosis as treatment: Empirical management of presumptive TB in the Indian private sector. *Int J Tuberc Lung Dis*. Forthcoming 2016.
- 39 Berger R. From the biomoral to the biopolitical: Ayurveda's political histories. *South Asian Hist Cult* 2013;4:48–64.
- 40 Berger R. *Ayurveda Made Modern: Political Histories of Indigenous Medicine in North India, 1900–1955*. New York: Palgrave Macmillan; 2013.
- 41 Alter JS. *Gandhi's body: sex, diet, and the politics of nationalism*. Philadelphia: University of Pennsylvania Press; 2000.
- 42 Wood M. *Vitalism: the history of herbalism, homeopathy, and flower essences*. Berkeley, CA: North Atlantic Books; 2000.
- 43 Sheehan HE, Hussain SJ. *Unani Tibb: History, theory, and contemporary practice in South Asia*. *Ann Am Acad Pol Soc Sci* 2002;583:122–35.
- 44 Sreenivas A, Rade K, Sachdeva K et al. *Standards for TB care in India*. New Delhi: World Health Organization; 2014.
- 45 Sreeramareddy CT, Qin ZZ, Satyanarayana S et al. Delays in diagnosis and treatment of pulmonary tuberculosis in India: a systematic review. *Int J Tuberc Lung Dis* 2014;18:255–66.
- 46 Das J, Kwan A, Daniels B et al. Use of standardised patients to assess quality of tuberculosis care: a pilot, cross-sectional study. *Lancet Infect Dis* 2015;15:1305–13.
- 47 Patwardhan K, Gehlot S, Singh G et al. The Ayurveda Education in India: How Well Are the Graduates Exposed to Basic Clinical Skills? *Evid Based Complement Alternat Med* 2009;2011:21.
- 48 Uplekar MW, Shepard DS. Treatment of tuberculosis by private general practitioners in India. *Tubercle* 1991;72:284–90.