TB patient delay, diagnosis delay, and treatment among migrants in Shanghai in 2018- 2020: a mixed-methods study

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Abstract

Background

The relatively high TB incidence rate among internal migrants raises a major concern on TB control in China. This study examines TB patient delay, diagnosis delay, and treatment performance in Shanghai in 2018–2020 focusing on disparities between migrant and local TB patients.

Methods

This study employed mixed methods. We obtained TB register data in 2018–2020 from the TB information management system (TBIMS) in Shanghai to examine patient delay, diagnosis delay, and treatment completion by resident type. Qualitative interviews were conducted with TB administrators and community healthcare providers to understand factors associated with TB treatment for migrant and local patients.

Results

From 2018 to 2020, migrant TB patients accounted for 44.40% of total cases, with an average age of 34.50, compared to local patients averaging 55.82 years old. Overall, there was no significant difference in patient delay between migrant and local patients (18.47 days on average). 22.12% of migrants and 16.52% of locals experienced diagnosis delays exceeding 14 days, respectively. After adjusting for all variables, migrant patients (OR 1.30, 95%CI, 1.18–1.44) and initial care-seeking at general hospitals (OR 3.76, 95% CI 3.45–4.09) were associated with a higher probability of diagnosis delay. 93.9% of migrant patients and 89.4% of the local patients had a successful TB treatment without statistically significant difference after adjusting for all variables. Qualitative interviews revealed a standard approach to managing TB patients in Shanghai no matter their resident type. Young migrant patients who were able to maintain their jobs in Shanghai often had better treatment adherence. Despite more patients postponed seeking care due to fear of COVID-19 and inconvenient access to care in 2020, the COVID-19 epidemic had minimal impact on TB treatment for both groups attributed to community-based case management.

Conclusions

There were no significant differences in TB patient delay and treatment outcome by type of resident between 2018 and 2020 in Shanghai, but migrant patients were more likely to experience diagnosis delay. It should improve awareness and knowledge of TB among healthcare professionals at general hospitals to mitigate the risk of diagnosis delay.

Background

Tuberculosis (TB) is a global health challenge, and it is one of the leading causes of death worldwide, causing 1.6 million deaths in 2021 globally [1]. Ending TB has been included in the sustainable development agenda. The World Health Organization's (WHO) End TB Strategy laid out the milestones and targets that include reducing the absolute number of TB deaths and TB incidence rate by 90% and 80% by 2030 compared with 2015, respectively [1]. However, the COVID-19 pandemic undermined the TB control efforts in many low- and middle-income countries showing devastating impacts on access to TB diagnosis and treatment as well as the increase in the number of deaths from TB between 2019 and 2021 [1–4].

China is one of high TB burden countries. Over the past three decades, China has made substantial progress in reducing TB incidence and mortality [5, 6]. However, socio-economically vulnerable people, such as internal migrants are more likely to suffer from TB and are less likely to access and adhere to TB treatment having a higher TB burden compared to residents [7–10]. Most internal migrants are young adults who move to big cities from less developed areas and tend to have poor coverage of local social security schemes, insufficient social support and sub-optimal living conditions [8, 9, 11, 12]. According to the latest national survey in 2020, domestic migrants accounted for 26.6% of the total population, and migrant patients accounts for one-fifth of the TB patients registered in a national web-based TB information management system (TBIMS) in 2015 [13, 14]. Financial difficulty, lack of social protection, and social discrimination are the most common factors leading to not seeking professional care, drop-out or interruption of TB treatment among migrant patients [10, 15, 16].

Since the 2000s, China has piloted and started the transition from a vertical TB control model led by China Center for Disease Control and Prevention (CDC) to an integrated TB control network consisting of CDC, TB-designated hospitals, and primary healthcare centers [17]. Under this integrated TB control model, the CDC is mainly in charge of TB surveillance and monitoring. TB-designated hospitals provide healthcare services for TB diagnosis and treatment, and primary healthcare facilities are responsible for referrals of suspected TB patients and follow-up with diagnosed TB patients [5]. When the outbreak of COVID-19 in 2020, China had experienced a short-term period with strict strategy for COVID-19 prevention and control between January and March in 2020 nationwide and then a long-term regular prevention and control period for the scattered outbreaks of COVID-19 [18, 19]. During these periods, TB-designated hospitals were assigned for COVID-19 treatment and some TB clinics were closed, particularly during the period with strict strategy. Primary healthcare workers (PHWs) were involved in community-based COVID-19 prevention and control [20]. Previous studies in China indicated that the COVID-19 prevention and control strategies interrupted routine TB care delivery [21–23].

Shanghai, a municipality, has the largest Gross Domestic Product (GDP) of China and GDP per capita $26,984 (1 USD = 6.73 CNY) in 2022 [24, 25]. In 2022, the migrant population (people lived in Shanghai over 6 months but did not have a Shanghai 'hukou') accounted for 40.64% of the total residents in Shanghai [24]. A retrospective study reported that in 2016–2018 migrants accounted for 67.4% of the

total pulmonary TB patients registered in a suburban district in Shanghai [12]. Currently, there is little evidence on TB control for migrant patients in Shanghai at the city level, especially in the post-pandemic period.

This study aims to systematically examine delay in patients seeking care and TB diagnosis as well as treatment outcome between 2018 and 2020, with a focus on the differences between the migrant and local TB patients using the TBIMS registry data in Shanghai. We also investigated challenges and health system responses for TB control during an emerging public health event, the COVID-19 pandemic.

Methods

A mixed-method approach, including secondary data analysis and qualitative interviews, was used in this study.

Data sources

TB register data

The data of drug-sensitive TB patients registered between January 1st, 2018 and December 31st, 2020 in Shanghai was extracted from the TBIMS, which is a national registry system developed by China CDC for the compulsory recording of confirmed TB patients, including their demographic information (including sex, age, occupation etc.), clinical visits, diagnosis, treatment, and case management information. Patients with unclear records, unreasonable registration dates, first medical consulting dates, and diagnosis dates were excluded. A total of 17,533 bacteriologically confirmed and clinically diagnosed pulmonary TB patients in Shanghai were finally included in the analysis.

Qualitative data

We selected one well-developed district and one relatively low-income district to conduct qualitative interviews. Semi-structured individual face-to-face in-depth interviews were carried out with TB administrators at the provincial and district CDC levels (n = 3) to explore their perceptions on strategies and challenges of providing high-quality TB care, especially TB treatment and management for migrant TB patients during COVID-19 epidemic. In addition, two focus group discussions (FGDs) were conducted with community healthcare workers from two districts of Shanghai, with four and six interviewees in each group, respectively to understand their practice on TB case management and perceived supports and challenges in TB control for migrant TB patients and their experiences during COVID-19 pandemic.

On average, individual in-depth interviews and FGDs with TB professionals lasted around one hour. All interviews were conducted by experienced researchers in a private setting and recorded after obtaining the interviewees' oral consent.

Data analysis

Quantitative data

This study examined TB case notification, patient delay, diagnosis delay, treatment examination and outcome. TB case notification reflected the number of TB patients diagnosed and registered in TBIMS. Patient delay, which is defined as the interval between the onset of the first symptoms and the initial medical consultation, was considered to be over 14 days if this time interval elapsed. Diagnosis delay is defined as the interval between the initial medical consultation and the date of diagnosis over 14 days. The smear test at the end of the second month of treatment is a significant indicator of the patient's response to treatment and the detection of drug-resistant cases. Patients who were either cured or had successfully completed the course of treatment (new and relapsed TB patients are required to complete a six-month and eight-month course of treatment, respectively) were considered to have received successful treatment.

We presented TB notifications, patient delay, and diagnosis delay by quarter between 2018/2019 and 2020 in stratification of migrants and local residents. We compared the results of the sputum test at the end of the second month of treatment among initially etiology-positive TB patients and treatment outcome between 2019 and 2020 by migrants and local residents. Chi-square tests were conducted to examine if there were significant differences between the local and migrant patients in socio-economic characteristics and the outcome measures. Patient delay (> 14 days or not), diagnosis delay (> 14 days or not), whether sputum tests were taken at the end of the second month of treatment and successfully received treatment or not were defined as the binary dependent variable. The explanatory variables include sex, age, occupation, patient type (new or relapse), type of residence, and diagnosed time (before the first quarter of 2020, in the first quarter of 2020, and after the first quarter of 2020), and the type of facilities where patients received their initial medical consultation related to TB diagnosis. All statistical analyses were performed using Stata 16.

Qualitative

All qualitative interviews were transcribed into words. In this study, we summarized the perceptions of TB administrators and TB care practitioners on good practices and challenges in TB case management during the COVID-19 pandemic. Additionally, we have examined the disparities between migrant and local patients, thereby contributing contextual interpretations to our quantitative findings.

We adopted the thematic analysis approach. Initially, a framework was developed based on the topic guide and categories emerging from the transcripts. Subsequently, all qualitative data were coded and charted using this framework, which was further refined during the analysis process. The interviews were conducted in Chinese, and one of the co-authors (YJ) translated the quotations into English. We used NVIVO 12 Pro for data analysis.

Results

Demographic and socio-economic characteristics of the patients

A total of 9,745 local patients and 7,788 migrant patients were included in this study (Table 1). The demographic and socio-economic characteristics of local and migrant TB patients differed significantly. Notably, migrant patients, with an average age of 34.50, tended to be younger, with 48.45% under the age of 30 and only 7.47% over 60. In contrast, more than half of the local patients (50.72%) were over 60, and only 12.33% were under 30, with an average age of 55.82. Additionally, the majority of local patients were retired (47.30%), while migrant patients had a higher rate of employment. Qualitative interviews with community healthcare providers indicated co-existing white collar and bule collar among migrant TB patients.

The study found that 97.37% of TB patients were detected through symptomatic visits. 3.93% of migrant TB patients were detected through active case finding, which was slightly higher than local residents (1.59%). 60% of TB patients were sputum positive while 4% of patients did not have etiology results. Among sputum negative patients (36.09%), the proportion of migrant patients (38.29%) was slightly higher than local residents (34.34%). 72.04% of local TB patients and 63.03% of migrant patients initially visited hospitals Specialist in pulmonary diseases ($P < 0.01$). One third of migrant patients first went to general hospitals, and around 80% of these general hospitals were at the district level.

Table 1
Demographic and socio-economic characteristics of local and migrant TB patients in Shanghai from 2018 to 2020

	Total (n = 17,533)	Local (n = 9,745)	Migrant (n = 7,788)	P value (Local, Migrant)
Registered Year (%)				
2018	35.44	35.08	35.89	0.021
2019	33.86	34.74	32.76	
2020	30.70	30.18	31.36	
Age (%)				
< 30	28.38	12.33	48.45	< 0.001
30–59	40.11	36.94	44.08	
>=60	31.51	50.72	7.47	
Sex (%)				
Male	67.02	69.59	63.80	< 0.001
Female	32.98	30.41	36.20	
Occupation (%)				
Employed	21.56	12.46	32.95	< 0.001
Student	4.61	3.48	6.02	
Unemployment or self-employment in household cleaning services	20.05	15.05	26.31	
Farmer	2.67	3.62	1.48	
Retired	29.21	47.30	6.57	
Other*	21.90	18.08	26.67	
Patient source (%)				
Active case finding	2.63	1.59	3.93	< 0.001
Symptomatic visits	97.37	98.41	96.07	
Test Results at diagnosis (%)				
Positive	59.90	60.92	58.62	< 0.001
Negative	36.09	34.34	38.29	

	Total (n = 17,533)	Local (n = 9,745)	Migrant (n = 7,788)	P value (Local, Migrant)
Registered Year (%)				
Without etiology	4.01	4.74	3.09	
Initial Consultation Facility[#]				
Specialist hospital	68.04	72.04	63.03	< 0.001
General hospital	31.90	27.89	36.92	
CDCs	0.06	0.06	0.05	

*Other contains patients whose occupation was unknown or be recorded as “other” in the register system, and children who are not attending school. [#]All Specialist hospitals are designated as TB hospitals, while the "General hospital" category includes both TB-designated and regular hospitals.

TB care seeking and diagnosis

Patient delay

In 2018–2020, the average patient delay among TB patients was 18.47 days (18.48 days among local residents and 18.47 days among migrants), and 36.22% of the patients (36.65% of local residents and 35.68% of migrants) experienced over 14 days’ delay. After controlling all variables, we found there was no significant difference in patient delay by type of resident (OR1.03, 95%CI, 0.95–1.11). Female patients, patients aged over 30, those who were unemployed or self-employed in households cleaning services or farming and patients diagnosed in 2020 were more likely to experience a delay in seeking care compared to their counterparts (Table 2).

We found a higher rate of patient delays in each quarter of 2020 compared to the corresponding period in 2019 (Supplementary table 1). The percentage of patient delay in the first quarter of 2020 was the highest (41.98%) showing a notable difference between local patients (46.40%) and migrant patients (36.43%). Since the second quarter of 2020, the percentage of patient delay gradually decreased, particularly among local TB patients, whereas the percentage of patient delay among migrant patients slightly increased but there were no significant differences between the two groups.

Qualitative interviews with TB professionals revealed a significant patient delay in the first quarter of 2020 attributable to inconvenience faced by patients, especially for older population in accessing healthcare, given the suggestion of self-quarantine, stop of public transportation and interrupted routine healthcare delivery caused by the COVID-19 pandemic. This may explain a serious patient delay among old local TB patients in 2020. In addition, one TB administrator at the district level highlighted that TB and COVID-19 shared similar symptoms including fever and cough. Consequently, some patients worried

about being collective quarantined for a differential diagnosis to identify the underlying cause of their symptoms, which further discouraged individuals seeking timely medical care.

“When the COVID-19 epidemic is very serious, they (symptomatic people/potential TB patients) may bear it for a while (postpone seeing a doctor) and will not go to the hospital immediately. After all, back then, if you went to the hospital, there was a high chance of being quarantined before accurate diagnosis (as TB had similar symptoms with COVID-19).” (TB administrator, district-level CDC)

Diagnosis delay

Migrant TB patients experienced longer diagnosis delay between 2018 and 2020, with an average of 11.43 days compared to 9.18 days for locals. The percentage of patients experiencing a delay over 14 days was 22.12% for migrants and 16.52% for locals, with a significant difference. In addition, 12.69% of the patients initially seeking care at specialist hospitals experienced an over 14 days diagnosis delay, while 55.02% of patients seeing a doctor at general hospitals experienced such delay. After adjusting for all variables, migrant patients (OR 1.30, 95%CI, 1.18–1.44) and patients who had their first medical consultation at general hospitals (OR 3.76, 95% CI 3.45–4.09) were more likely to experience a diagnosis delay compared to their counterparts (Table 2).

There was no significant influence of COVID-19 epidemic on diagnosis delay. The percentage of migrant patients visiting general hospitals initially decreased from 37.79% in 2019 to 31.49% in 2020. By the last quarter of 2020, there was no significant difference in diagnosis delay over 14 days between migrant (17.96%) and local patients (17.92%) ($P > 0.05$).

Table 2
Patient characteristics associated with patient delay and diagnosis delay in 2018–2020

Characteristics	Patient delay			Diagnosis delay		
	Odds ratio (OR)	(95%CI)	P value	Odds ratio (OR)	(95%CI)	P value
Age						
< 30	1.00			1.00		
30–59	1.13	(1.04, 1.23)	0.004	0.98	(0.88,1.09)	0.708
>=60	1.24	(1.07, 1.43)	0.004	0.94	(0.78,1.13)	0.500
Sex						
Male	1.00			1.00		
Female	1.14	(1.07, 1.22)	< 0.001	0.94	(0.86,1.02)	0.128
Occupation						
Employed	1.00			1.00		
Student	1.15	(0.97, 1.36)	0.10	0.82	(0.67,1.02)	0.069
Unemployment or self-employment in household cleaning services	1.35	(1.22, 1.49)	< 0.001	0.85	(0.75,0.95)	0.005
Farmer	1.27	(1.03, 1.57)	0.028	0.90	(0.71,1.14)	0.387
Retired	1.10	(0.95, 1.27)	0.213	0.97	(0.81,1.16)	0.763
Other*	1.15	(1.05, 1.27)	0.004	0.55	(0.48,0.64)	< 0.001
Patient Type						
Relapse	1.00			1.00		
New	0.89	(0.80, 1.00)	0.044	1.33	(1.13,1.56)	0.001
Residence						
Local	1.00			1.00		
Migrant	1.03	(0.95, 1.11)	0.464	1.30	(1.18,1.44)	< 0.001

Characteristics	Patient delay			Diagnosis delay		
	Odds ratio (OR)	(95%CI)	P value	Odds ratio (OR)	(95%CI)	P value
Age						
Diagnosed Time						
2018–2019	1.00			1.00		
2020Q1	1.33	(1.16, 1.53)	< 0.001	1.05	(0.88,1.26)	0.558
2020Q2-Q4	1.14	(1.06, 1.23)	0.001	0.89	(0.81,0.98)	0.019
Initial Consultation Facility[#]	–					
Specialist hospital				1.00		
General hospital				3.76	(3.45,4.09)	< 0.001
CDCs				3.13	(1.27,7.71)	0.013

*Other contains patients whose occupation was unknown or be recorded as “other” in the register system, and children who are not attending school. [#]All Specialist hospitals are designated as TB hospitals, while the "General hospital" category includes both TB-designated and regular hospitals.

The total number of registered TB patients decreased from 6214 in 2018 to 5383 in 2020 with a significant drop in the first quarter of 2020, which was in correspondence with the period when the strategy for COVID-19 prevention and control was stringent (Fig. 1). The number of detected TB patients among local residents was overall higher than migrants in each study year. The proportion of migrant TB patients among the total registered TB cases in 2018, 2019, and 2020 was 44.98%, 42.98%, and 45.37%, respectively, demonstrating a relatively stable trend.

TB treatment

Sputum test at the second month of treatment

In 2019–2020, 63.9% of TB positive patients underwent sputum testing at the 2nd month of treatment. The uptake rate was significantly higher among local patients (66.36%) compared to migrant patients (60.68%) ($P < 0.001$), while there was a notable decrease in the proportion of patients undergoing the test between the fourth quarter of 2019 and the second quarter of 2020 without significant difference by type of resident (Supplementary table 3). After adjusting for all variables, unemployment (OR 0.79, 95%CI 0.68–0.92), migrant status (OR 0.84, 95%CI 0.75–0.95), and strict strategies for prevention and control of

COVID-19 epidemic in the first quarter of 2020 (OR 0.65, 95% CI 0.53–0.81) were negatively associated with undergoing sputum testing (Table 3).

Table 3
TB positive patients' characteristics associated with the uptake of sputum test at the second month of treatment in 2019–2020

Characteristics	Odds ratio (OR)	(95%CI)	P value
Age			
< 30	1.00		
30–59	1.14	(0.99, 1.30)	0.061
>=60	1.44	(1.15, 1.82)	0.002
Sex			
Male	1.00		
Female	0.98	(0.88, 1.09)	0.750
Occupation			
Employed	1.00		
Student	0.69	(0.53, 0.90)	0.006
Unemployment or self-employment in household cleaning services	0.79	(0.68, 0.92)	0.002
Farmer	1.09	(0.77, 1.54)	0.638
Retired	0.70	(0.56, 0.88)	0.002
Other*	0.66	(0.56, 0.78)	< 0.001
Patient Type			
Relapse	1.00		
New	1.25	(1.06, 1.47)	0.007
Residence			
Local	1.00		
Migrant	0.84	(0.75, 0.95)	0.004
Diagnosed Time			

Characteristics	Odds ratio (OR)	(95%CI)	P value
Age			
2019	1.00		
2020Q1	0.65	(0.53, 0.81)	< 0.001
2020Q2-Q4	0.79	(0.71, 0.88)	< 0.001

*Other contains patients whose occupation was unknown or be recorded as “other” in the register system, and children who are not attending school.

Provincial and district TB administrators said that TB patients no matter their resident type were managed according to the standard for TB control. Several community healthcare providers mentioned that TB patients’ adherence to sputum tests at the end of 2nd month of treatment was generally low, although they reminded TB patients according to the register list no matter their type of residence. Some patients did not have sputum at the end of the 2nd month of treatment and some patients perceived inconvenience in taking the test due to a long waiting time at a provincial-level designated hospital. One community healthcare provider mentioned that the COVID-19 pandemic had further exacerbated this situation.

“Migrants are managed the same way as residents, we don't differentiate based on their household registration, as long as they are (the TB patients) in Shanghai, we treat them as infectious disease cases.” (TB administrator in Shanghai)

“They (the tuberculosis patients) originally went for sputum tests infrequently as required, and their level of cooperation (adherence) was not high. If you specifically ask them to go for a sputum test during the pandemic, they will definitely refuse.” (community healthcare worker, FGD)

Successful TB treatment

In 2018–2020, 91.38% of TB patients were cured or completed anti-TB treatment, 93.86% of migrant patients, and 89.40% of the local patients respectively (P < 0.001). However, after adjusting for all variables, successful TB treatment showed no significant difference between the local and migrant patients (Table 4). Female and young patients were more likely to have successful TB treatment than their counterparts.

Table 4
TB patients' characteristics associated with successful TB treatment 2018–2020

Characteristics	Odds ratio (OR)	(95%CI)	P value
Age			
< 30	1.00		
30–59	0.82	(0.69, 0.97)	0.025
>=60	0.45	(0.35, 0.58)	< 0.001
Sex			
Male	1.00		
Female	1.47	(1.29, 1.67)	< 0.001
Occupation			
Employed	1.00		
Student	0.95	(0.66, 1.35)	0.760
Unemployment or self-employment in household cleaning services	0.99	(0.81, 1.20)	0.907
Farmer	0.90	(0.63, 1.28)	0.550
Retired	0.84	(0.65, 1.07)	0.160
Other*	0.97	(0.80, 1.18)	0.760
Patient Type			
Relapse	1.00		
New	3.02	(2.62, 3.48)	< 0.001
Residence			
Local	1.00		
Migrant	1.10	(0.96, 1.27)	0.163
Diagnosed Time			

Characteristics	Odds ratio (OR)	(95%CI)	P value
Age			
2018–2019	1.00		
2020Q1	0.82	(0.65, 1.05)	0.112
2020Q2-Q4	0.80	(0.70, 0.91)	< 0.001

*Other contains patients whose occupation was unknown or be recorded as “other” in the register system, and children who are not attending school.

According to healthcare providers who are responsible for managing TB cases, young migrant TB patients generally exhibited better treatment adherence than some older local ones. They mentioned that few migrant patients had difficulty in affording TB treatment in Shanghai, and community healthcare providers often suggested them return to their hometown for treatment. However, many young migrant patients would maintain their jobs in Shanghai and thus they actively adhere to TB treatment. One community healthcare provider said *“In the past, TB patients dropped out because of financial difficulties. But now, these cases are much less (in Shanghai).”*

“The adherence among the migrant population is actually even better than the local…It's the older generation (that struggles with adherence), for example, there's an old man, no matter what you tell him, he won't listen.” (community healthcare worker, FGD)

With the COVID-19 epidemic, TB outpatient clinics remained operational and accessible in Shanghai, even during the strictest periods of COVID-19 prevention and control said by a TB administrator. They coordinated the delivery of anti-TB drugs to guarantee access for patients in Shanghai and established communication with CDCs outside the city to ensure drug availability for registered migrant patients in Shanghai when patients returned to their hometowns. Furthermore, in one district, volunteers were recruited to deliver anti-TB drugs to patients under quarantine. Thus, almost all TB professionals thought the COVID-19 epidemic had little impact on TB treatment for the registered patients in Shanghai.

“We introduced a medication delivery service, where we would send the medications directly to all registered patients by mail. The idea was to ensure they wouldn't miss any doses and have uninterrupted treatment.” (TB administrator in Shanghai)

"To be honest, since the outbreak of COVID-19, the amount of work related to the epidemic has increased, but the work related to TB prevention and control hasn't decreased....We make sure to stay in regular contact with them (the tuberculosis patients) and repeatedly stress the importance of not stopping their medication and attending scheduled check-ups. " (community healthcare worker, FGD)

Discussion

In this study, migrant and local patients showed no significant difference in patient delay, while migrant TB patients were more prone to experiencing diagnosis delays compared to local patients in general. In the context of the COVID-19 epidemic, there was a notable increase in patient delays, especially for local patients. Migrant patients showed a declined percentage of experiencing diagnosis delay after the outbreak of COVID-19 in the year 2020. The successful anti-TB treatment rate remained high with no significant difference by the type of resident, despite young migrant TB patients showed better treatment adherence.

The migrant TB patients accounted for 44.4% of all registered TB patients in Shanghai, which was much higher than the national average, 18.2% according to the national TB register data in 2014–2015 [14]. A study using TB register data from 32 provinces reported a slight decrease in patient delays nationwide from 2018 to 2022 and found that TB patients in eastern regions of China experienced shorter patient delays compared to those in central and western regions [26]. Previous studies conducted in China, one in the eastern area and another one in the western area reported that migrant TB patients were more likely to experience patient delay compared to local patients [27, 28]. Our study did not identify significant differences in patient delay between local patients and migrant patients in Shanghai, which is consistent with the findings from a previous study conducted in Shanghai in 2014–2015 [10]. The availability and easy accessibility of health resources in Shanghai could prevent patient delays for both migrant and local patients [10, 29]. Previous studies in China indicated that poor economic status, limited social support, and a lack of knowledge about TB were the main barriers for migrant TB patients seeking TB care [14, 28, 30–32]. Similarly, our study found that vulnerable patients, such as those who are unemployed or self-employed for household cleaning services, were more likely to experience delays in seeking medical care.

Between 2018 and 2020, migrant TB patients were more prone to experiencing diagnosis delays compared to local patients, aligning with findings from a national study and a study conducted in an eastern province of China [16, 27]. Diagnosis delays may be attributed to insufficient healthcare professionals' awareness and knowledge of TB, especially in general hospitals [33]. In our study, patients who initially sought care at general hospitals exhibited a higher likelihood of experiencing diagnosis delays. Migrant TB patients were more inclined to visit general hospitals at relatively lower level and the possible reasons might be more convenience for care seeking, less waiting time, and relatively low cost compared to the specialist hospital. After COVID-19 outbreak in 2020, the proportion of TB diagnosis delay decreased which might be attributable to differential diagnoses for airborne infection diseases.

The sputum test at the end of 2nd month of treatment is to assess the effect of anti-TB treatment and detect drug-resistant TB that will require alternative treatment approaches to improve treatment outcomes. We found that migrant patients were more likely to miss this test compared to local patients. Despite community healthcare providers perceived better adherence to TB treatment among young migrant patients, their work status or high levels of mobility may be negatively associated with undergoing the test at certain time periods. A previous study used the same data source in Shanghai

from 2006 to 2010 showed a lower chance for migrant patients to successfully complete the treatment partly due to financial difficulties in affording TB care [29], which is inconsistent with our finding. According to our qualitative findings, migrant patients who were not able to afford TB treatment in Shanghai might return to their hometown and those who decided to stay had often good adherence to TB treatment. In a perspective of TB management, standard case management was applied for all patients registered in Shanghai no matter their resident type. In 2018, the municipal government issued a policy to provide subsidy for TB treatment covering residents and migrants with residence permission. This may also encourage patients to complete TB treatment.

The 2022 global TB report highlighted the detrimental impact of the COVID-19 pandemic on TB diagnosis and treatment, resulting in reduced case detection and increased global TB deaths [1]. Our study found a significant drop in registered TB patients, including both locals and migrants, during the first quarter of 2020 in Shanghai, aligning with strict COVID-19 prevention measures in China, like self-quarantine and transportation restrictions. We discovered that patients' reluctance to seek healthcare was primarily due to fear of contracting COVID-19 and difficulties accessing medical services in the first quarter of 2020. These findings align with studies on healthcare utilization in China during the same period [22, 34]. In addition, we found that more local patients experienced patient delay under the strict strategy for pandemic prevention and control than migrant patients. A possible explanation is that half of local patients are aged over 60 who are advised to limit contact with others to reduce the risk of COVID-19 [35] and may be more fear of exposure or concerned about overwhelming hospitals [36, 37]. Following the COVID-19 outbreak, some presumptive TB patients could be treated in priority for the similar symptoms with COVID-19, then diagnosed more quickly [21]. In this study, the influence of COVID-19 pandemic on TB treatment was relatively minimal, primarily attributed to various strategies for anti-TB drugs availability and accessibility. However, the proportion of positive TB patients who underwent sputum test at the end of 2nd month treatment decreased during the pandemic. The decrease in the number of patients undergoing sputum test may be partly attributed to patients’ hesitancy of seeking care and partly attributed to the overwhelming demand for lab tests related to COVID-19 [21].

The Chinese government has highlighted strengthening the public health system and promoting coordination of preventive and clinical services addressing challenges of emerging infectious diseases. This also provides the opportunity to strengthen TB prevention and control. This study demonstrated prompt actions to ensure TB care during emerging public health events, which contributed to minimal impact on TB treatment. To mitigate the risk of patient delay in seeking care, innovative approaches such as online medical care platforms or remote medical care could be explored when the resource allows, like in a developed region, Shanghai. Even in regions with abundant medical resources, it is essential to focus on enhancing the capacity of district-level general hospitals. In addition, financial and social support should be targeted at economically vulnerable groups, as unemployed patients were more likely to experience patient delay found in this study.

This study used TB register data to exhibit the trends of TB notification and treatment among local and migrant TB patients before and after the COVID-19 pandemic, while this study has several limitations.

First, Shanghai is one of the most economically developed cities in China. Many migrant populations in the region have received good education and have relatively good socio-economic status, especially for those who are able to afford medical care in Shanghai. However, based on the register data, we could not gain an understanding of TB care among migrants who left Shanghai. This group might be more socially and economically vulnerable. In addition, the data after the outbreak of COVID-19 only covered the year 2020. Given that the regular prevention and control measures for COVID-19 extended until 2022, additional data is required to comprehensively assess TB control following the pandemic.

Conclusions

In the period between 2018 and 2020 in Shanghai, there were no significant differences in patient delay and treatment outcomes between migrant and local TB patients, while migrant patients were more likely to experience diagnosis delay than local patients. In the context of the COVID-19 epidemic, there was a notable increase in TB patient delay, particularly for old local residents but a decrease in diagnosis delay without significant difference by the type of resident. Innovative approaches like online medical care platforms or remote health services could be explored to enhance the delivery of TB care during emerging public health events. Additionally, there should be a focus on strengthening the capacity of district-level general hospitals for TB detection and providing more attention to vulnerable patients, such as those who are unemployed.

Declarations

Ethics approval and consent to participate: This study obtained the approval from the Institutional Review Board at Duke Kunshan University (FEA00021580).

Consent for publication: All authors have read and approved the manuscript in the current format and agreed with this publication.

Availability of data and materials: The quantitative data used in this study are managed by Shanghai CDC and are not publicly available.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: YJ and WJ are co-first authors of this study. YJ participated in qualitative interviews, conducted data analysis and interpretation of both quantitative and qualitative data, and drafted the manuscript. WJ participated in the design of the qualitative study, conducted qualitative interviews, quantitative data analysis and results interpretation, and manuscript revisions. XX and CJ coordinated data collection, participated in results interpretation and revision of the manuscript. ZL participated in qualitative data analysis. ST contributed to the study design and results interpretation. QL initiated the study concept, led the study, and participated in writing the manuscript.

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Figures

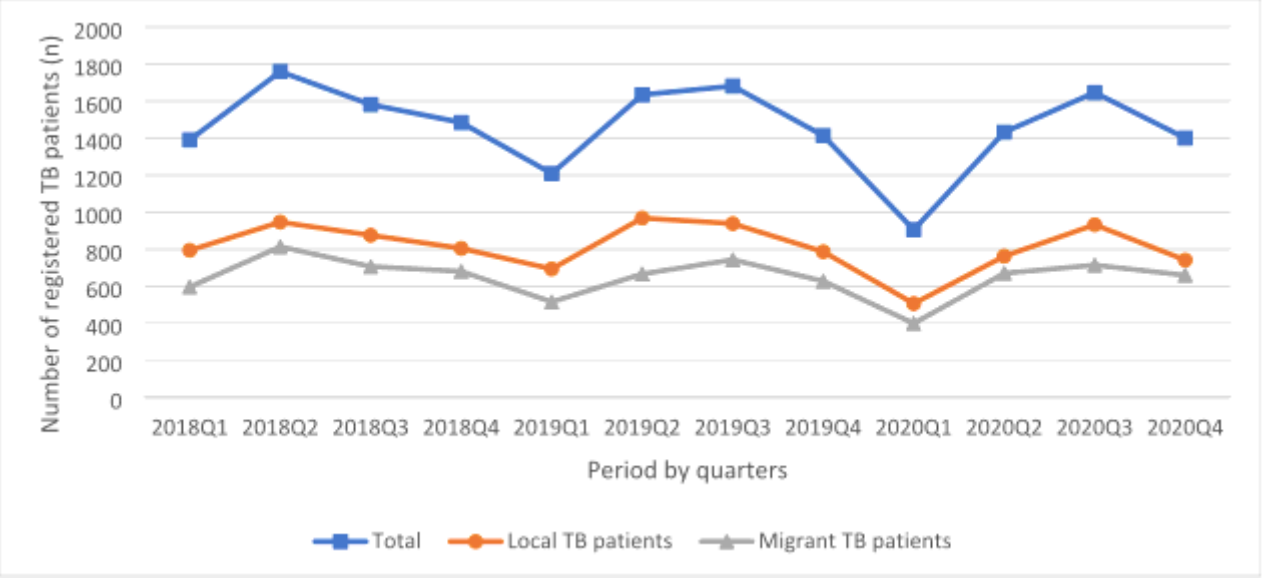

Figure 1

Number of registered TB patients in Shanghai from 2018 to 2020 each quarter

Supplementary Files

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- Supplementarytables.docx