Preplanned Studies

Differences Between the Local and Migrant Populations in Healthcare Service Use and Direct Cost of Tuberculosis Treatment — Shanghai Municipality, China, 2020–2021

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Summary

What is already known about this topic?

Tuberculosis (TB) disproportionately affects socially vulnerable populations, particularly the migrant population. Shanghai has implemented a policy providing additional reimbursement for TB diagnosis and treatment beyond standard health insurance coverage for residents. However, comprehensive evidence on TB care utilization patterns and treatment costs remains limited, especially on the disparities between local and migrant populations

What is added by this report?

From 2020 to 2021, local and migrant TB patients in Shanghai demonstrated comparable outpatient visit frequencies with an overall hospitalization rate of 85.7%. Migrant TB patients without resident permits are ineligible for government reimbursement, resulting in over half of the patients encountering out-of-pocket costs that exceed 20% of their annual household income for TB treatments.

What are the implications for public health practice?

The government's reimbursement policy should be expanded to include the most vulnerable populations, specifically migrant patients without residency permits, to strengthen the financial risk protection for TB patients.

ABSTRACT

Background: Tuberculosis (TB) disproportionately impacts socially vulnerable populations, including migrants. This study aimed to investigate the utilization of TB care services and the financial burden on TB patients during 2020–2021 in Shanghai and to examine differences between local and migrant patients.

Methods: A retrospective survey was conducted in three districts of Shanghai among drug-sensitive TB patients who initiated treatment on or after January 24, 2020, and had completed treatment by the time of the interview in 2021. The study used a designed sampling ratio of 1∶1 for both local and migrant populations, and examined the use of outpatient and inpatient care, as well as the direct costs of treatment. Descriptive analyses and statistical tests were utilized to assess differences in patient characteristics between locals and migrants, with and without a residence permit. Logistic regression was used to examine the impact of migrant status on service usage and financial burden, after adjusting for demographic and socio-economic factors.

Results: The study included a total of 196 TB patients, comprising 88 locals and 108 migrants. No significant differences in the average number of outpatient visits were observed between migrant and local patients. Migrants with a residence permit (RP) had the highest hospitalization rate (92.86%), followed by migrants without an RP (86.84%), and then local patients (79.55%). The median out-of-pocket (OOP) payment for the entire treatment course, including medical and non-medical costs, was 15,845 yuan for migrants without an RP, with descending amounts for migrants with an RP, and then local patients (P<0.001). The proportion of patients incurring OOP payments exceeding 20% of their annual household income was also highest among migrants without an RP (57.14%). Regression analysis indicated that migrants without an RP faced the highest financial risk during TB treatment. Even migrants with an RP showed significantly higher financial risk compared to local patients (P<0.05).

Conclusions: During 2020–2021, the utilization of TB care in Shanghai was high among both local and migrant TB patients. Nevertheless, significant financial burdens were more pronounced among migrant patients without RP.

Tuberculosis (TB) remains a significant global health challenge that disproportionally affects socially vulnerable populations. Studies from low-income and middle-income countries have demonstrated that domestic migrant workers face higher risk of TB and often encounter financial hardships when seeking treatment (*1*–*4*). Global TB service capacity experienced disruption between 2020 and 2022 due to coronavirus disease 2019 (COVID-19) pandemic (*5*–*6*). In 2018, Shanghai Municipality, China, implemented a policy providing government reimbursement, after health insurance reimbursement, for out-of-pocket (OOP) payments related to essential TB diagnosis and treatment services. This policy extends to both local and migrant patients holding a Shanghai Resident Permit (RP). Within this policy framework, migrant TB patients are defined as individuals without permanent registered residence in Shanghai, who reside in the city, and are managed by the Shanghai CDC. This study analyzed TB care utilization and its associated costs from 2020 to 2021 by linking the data from a TB patient survey with the Shanghai TB registry and government reimbursement records. Specifically comparing these aspects between the local and migrant populations. The findings revealed that the average number of outpatient visits was 11.48 for local patients, 11.33 for migrant patients with an RP, and 9.92 for migrant patients without an RP, while the overall hospitalization rate was at 85.7%. Migrant patients without an RP incurred the highest OOP payments for complete TB treatment, with over half of them experiencing OOP payments exceeding 20% of their annual household income.

A TB patient survey was conducted across three districts in Shanghai, selected based on local patient registration volumes and varying economic levels. The survey data were integrated with the Shanghai TB registry and government financial records to evaluate treatment utilization patterns and associated expenses. The study specifically focused on rifampicin-sensitive patients who initiated treatment after January 25, 2020, and completed their treatment course by the interview date. To ensure robust comparative analysis, the study design aimed for equal representation between local and migrant patients. Sample size calculations were performed using Stata's 'sampsi' command, targeting the detection of a minimum 15% difference in the proportion of patients experiencing high financial burden between local and migrant populations, assuming a 30% baseline incidence among local patients. With parameters set at 0.05 significance level and 80% power, the required sample size was calculated at 252 participants, with a target enrollment of 300 to ensure adequate statistical power. Patient enrollment followed chronological order based on registration dates, and participants completed a structured questionnaire capturing: 1) demographic and socioeconomic information; 2) TB treatment care utilization patterns; and 3) comprehensive direct medical and non-medical treatment costs.

Care utilization assessment encompassed multiple metrics: outpatient visit frequency, hospitalization rates, total hospital stays, and average length of hospital stays. The total OOP payment for complete TB treatment included both medical and non-medical expenses. OOP medical payments were calculated by subtracting health insurance and government reimbursements from total medical costs. Non-medical payments encompassed transportation, caregiver fees, food, and accommodation expenses incurred during treatment. A high financial risk threshold was established at the point when total OOP payments exceed 20% of annual household income.

To analyze differences in TB care utilization, OOP expenses, and financial burden among three residential groups — locals, migrants with RP, and migrants without RP — multiple statistical approaches were employed. Chi-square tests and F-tests were applied where appropriate, while the Kruskal-Wallis H test was specifically used for analyzing non-normally distributed expense data. Linear regression models were constructed to examine the factors associated with OOP costs for TB treatment, while logistic regression was utilized to investigate the factors associated with TB-related hospitalization and elevated financial risk from care utilization. The identification of relevant demographic, socioeconomic, and disease-related covariates for multivariate analysis was conducted through stepwise regressions using forward selection, with a threshold *P*-value of 0.15.

Due to logistical constraints, 196 TB patients were enrolled, comprising of 88 locals and 108 migrants (70 with resident permits). Approximately 90% were new TB cases (Table 1). Migrant patients were significantly younger than local patients ($P<0.001$). Comorbidities were present in over one-third of local patients compared to approximately 12% of migrant patients ($P<0.001$). While more than half of local patients were

TABLE 1. Demographic and socioeconomic characteristics of TB patients.

Characteristics	Total		Local		Migrant with RP		Migrant without RP		*P*
	N	%	*N*	%	*N*	%	*N*	%	
All	196		88	44.9	70	35.7	38	19.4	
District									
Baoshan	82	41.84	29	32.95	29	41.43	24	63.16	<0.001
Hongkou	41	20.92	32	36.36	9	12.86	0	0	
Jingan	73	37.24	27	30.68	32	45.71	14	36.84	
Age (years)									
<30	64	32.65	13	14.77	25	35.71	26	68.42	<0.001
30 –59	81	41.33	33	37.5	38	54.29	10	26.32	
≥60	51	26.02	42	47.73	7	10	2	5.46	
Sex									
Female	85	43.37	32	36.36	37	52.86	16	42.11	0.114
Male	111	56.63	56	63.64	33	47.14	22	57.89	
Education									
Primary school or secondary school	13	6.63	8	9.09	3	4.29	2	5.26	0.275
High school or vocational school	84	42.86	43	48.86	27	38.37	14	36.84	
College or university and above	99	50.51	37	42.05	40	57.14	22	57.89	
Employment status after the pandemic									
Employed	111	56.63	27	30.68	55	78.57	29	76.32	<0.001
Retired	57	29.08	48	54.55	8	11.43	1	2.63	
Others	28	14.29	13	14.77	7	10	8	21.05	
Annual income*									
Below average	47	23.98	17	19.12	16	22.86	14	36.84	0.103
Above average	149	76.02	71	80.68	54	77.14	24	63.16	
Medical insurance†									
No insurance	10	5.21	1	1.18	5	7.25	4	10.53	<0.001
Shanghai UEBMI	113	58.85	54	63.53	45	65.22	14	36.84	
Shanghai URRBMI	31	16.15	25	29.41	4	5.80	2	5.26	
Medical insurance at hometown	27	14t.06	–	–	11	15.94	15	39.47	
Others	11	5.73	4	4.71	4	5.80	3	7.89	
Patient type									
New	178	90.82	78	88.64	66	94.29	34	89.47	0.451
Relapse	18	9.18	10	11.36	4	5.71	4	10.53	
Diagnosis results§									
Positive	114	58.16	53	60.23	37	52.86	24	63.16	0.508
Negative	82	41.84	35	39.77	33	47.14	14	36.84	
Comorbidities¶									
No comorbidity	149	76.41	54	62.07	62	88.57	33	86.84	<0.001
≥1 Comorbidity	46	23.59	33	37.93	8	11.43	5	13.16	

Note: "–" means not applicable.
Abbreviation: TB=tuberculosis; RP=residence permit; UEBMI=urban employee basic medical insurance; URRBMI=urban and rural resident basic medical insurance; CNY=Chinese Yuan.
* Shanghai's 2020 per capita urban disposable income: 72,232 CNY.
† Medical insurance data were missing for 4 local patients and 1 migrant with an RP.
§ Diagnosis results were negative, including TB patients for whom etiological test results are not available.
¶ Data on comorbidities were missing for one local patient.

retired, over 75% of migrant patients were employed (P<0.001). Notably, 76% of participants reported incomes exceeding Shanghai's 2020 per capita urban disposable income. Among migrant patients, 7.25% with an RP and 10.53% without an RP lacked medical insurance coverage.

Regarding TB treatment utilization, patients averaged 11.12 outpatient visits, with an overall hospitalization rate of 85.71%. Among patient subgroups, migrants holding an RP demonstrated the highest hospitalization rate (92.86%), followed by migrants without an RP (86.84%), and local patients (79.55%). The mean hospital stay duration was 7.79 days, with migrants without an RP experiencing the longest stays. However, these differences did not reach statistical significance.

Analysis of medical expenditure revealed that migrants without an RP incurred the highest total OOP payments (median 15,845 Chinese Yuan), followed by migrants with an RP, and then local patients (P<0.001) (Table 2). Outpatient care comprised 57.46% of total OOP payments before government reimbursements. Dunn's tests demonstrated statistically significant differences in both total and medical OOP payments among all three residential groups (P<0.001). Significant differences in both outpatient and inpatient payments were observed between local patients and both migrant groups (P<0.001), though no significant differences emerged between the two migrant groups. The proportion of patients experiencing catastrophic health expenditure (OOP payments exceeding 20% of annual household income) was markedly higher among migrants without an RP (57.14%, 16/28) compared to local patients (2.60%, 2/77).

Multivariate analysis (Table 3) revealed that migrants with an RP had significantly higher odds of hospitalization [odds ratio (OR)=4.12, P<0.05], while migrants without an RP incurred significantly higher OOP payments compared to locals (P<0.05). Shanghai basic medical insurance enrollment and above-average income were also associated with higher OOP payments (P<0.05). Migrants without an RP faced the highest financial risk during TB treatment, and even migrants with an RP demonstrated significantly higher financial risk compared to local patients (P<0.05).

DISCUSSION

This study revealed that from 2020 to 2021, the majority of patients with drug-sensitive TB in Shanghai adhered to prescribed outpatient treatment regimens and hospitalization schedules. While migrant TB patients demonstrated a higher propensity for hospitalization, their overall length of hospital stays was comparable to local patients. Both migrant groups — those with and without an RP — incurred significantly higher OOP costs compared to local patients. Furthermore, migrant patients without an RP faced the highest risk of experiencing severe financial burden due to TB treatment.

TB care utilization in Shanghai was maintained at adequate levels from 2020 to 2021. However, according to clinical guidelines, inpatient care might not be medically necessary for most TB patients (*7*). The findings revealed higher hospitalization rates and OOP payments among migrant patients, despite their notably younger demographic profile and lower

TABLE 2. OOP Payment for TB Treatment by Residence Type.

OOP payment	Total (n=168)		Local (n=77)		Migrant with RP (n=63)		Migrant without RP (n=28)		P (KW H test)
	Median	(Q1, Q3)	Median	(Q1, Q3)	Median	(Q1, Q3)	Median	(Q1, Q3)	
Total OOP payment	6,199	(3,120, 12.436)	4,264	(2,242, 7,335)	7,410	(4,511, 15,135)	15,845	(8,601, 31,611)	<0.001
Medical OOP before government reimbursement	7,685	(4,774, 13,000)	5,834	(3,800, 9,122)	8,285	(5,650, 16,900)	15,820	(8,501, 30,505)	<0.001
Outpatient (%)	3,925 (57.46)	(2,116, 6,094)	3,000 (57.86)	(1,800, 4,511)	4,565 (58.89)	(2,700, 8,400)	5,750 (55.05)	(3,850, 17,400)	<0.001
Inpatient (%)	3,241 (42.54)	(1,200, 5,384)	2,294 (42.14)	(639, 4,991)	3,602 (41.11)	(1,723, 6,500)	5,497 (44.95)	(1,411, 14,500)	<0.01
Government reimbursement	1,286	(0, 2,666)	2,070	(1,070, 2,845)	1529	(0, 2,819)	–		0.13
Non-medical payment	30	(4,258)	2	(4,233)	60	(6,360)	40	(0, 238)	0.51

Note: "–" means not applicable

Abbreviation: TB=tuberculosis; OOP=out-of-pocket; RP=residence permit; SD=standard deviation; KW=Kruskal-Wallis;

TABLE 3. Factors associated with TB-related hospitalization, OOP payments, and financial burden.

Factors	Hospitalization incidence				OOP				OOP payment exceeding 20% of the annual household income			
	OR	*P*	95% *CI*		Coef.	*P*	95% *CI*		*OR*	*P*	95% *CI*	
Residential type												
Local	ref.								ref.			
Migrant with RP	4.12	0.014	1.34	12.72	0.317	0.155	−0.121,	0.755	9.14	0.012	1.63,	51.22
Migrant without RP	1.96	0.293	0.56	6.83	0.698	0.028	0.078,	1.319	53.25	0.000	7.50,	378.24
Age (years)												
<30	ref.								ref.			
30–59	1.31	0.620	0.45	3.74	−0.162	0.441	−0.577,	0.253	0.36	0.106	0.11,	1.24
≥60	1.57	0.471	0.46	5.34	0.099	0.781	−0.602,	0.799	0.42	0.382	0.06,	2.92
Sex												
Male					−0.272	0.104	−0.601,	0.057				
Etiological diagnosis												
Positive	2.20	0.063	0.96	5.07								
Annual income												
Above average					−0.507	0.009	−0.888,	−0.126				
Education												
Below high school									ref.			
High school/vocational									0.60	0.665	0.06,	6.20
College and above									0.12	0.096	0.01,	1.46
Medical insurance												
Insurance outside SH					ref.							
UEBMI					−0.631	0.024	−1.178,	−0.085				
URRBMI					−0.905	0.007	−1.560,	−0.250				
Others					−0.552	0.098	−1.208,	0.104				
Employment status												
Employed					ref.							
Retired					−0.392	0.207	−1.002,	0.219				
Others					−0.020	0.940	−0.535,	0.495				

Abbreviation: TB=tuberculosis; OOP=out-of-pocket payment; OR=odds ratio; *CI*=confidence interval; ref.=reference; coef.=coefficient; RP=residence permit; SH=Shanghai; UEBMI=urban employee basic medical insurance; URRBMI=urban and rural resident basic medical insurance.

comorbidity rates — factors that should theoretically indicate less need for intensive treatment. This paradox may be explained by several factors. Firstly, younger migrants may prioritize rapid recovery to resume employment, which is unlike the predominantly retired local population. Secondly, the migrant patients in this study, who reported higher incomes compared to other regions, often sought care at top-tier hospitals where comprehensive testing is mandatory for accurate diagnosis and exclusion of conditions, such as endobronchial TB. Thirdly, higher reimbursement rates for inpatient services may incentivize hospitalization for comprehensive diagnostics and treatment. These patterns suggest potential service overprovision, especially in younger migrants who demonstrate a greater willingness to incur healthcare costs. This aligns with previous empirical research documenting provider-induced demand within China's TB treatment system (*8*–*9*). Moreover, the absence of local health insurance office oversight for

healthcare services and associated costs among uninsured migrant patients in Shanghai may further contribute to service overprovision for this demographic.

This study underscores the critical role of government reimbursement policies in mitigating financial risk as these policies covered 25% of OOP medical payments for local patients, with only two individuals experiencing high financial burden. In stark contrast, more than half of the migrant patients without RP remain ineligible for reimbursement, facing substantial financial risks.

A nationwide cross-sectional survey conducted in 2020 among TB patients in China similarly revealed significant financial burdens persisting despite the implementation of a basic free TB care package (*10*). These findings strongly suggest the need to expand government reimbursement policies to encompass all TB patients, including migrants without an RP, targeting support to low-income patients.

Several limitations warrant consideration in this study. First, the target sample size of this study could not be achieved due to COVID-19 prevention and control measures in Shanghai during the data collection period. The healthcare workers in primary healthcare centers who were responsible for patient interview, were unable to complete interviews due to their pandemic-related commitments, necessitating early termination of recruitment. Additionally, cost analysis was limited to 168 samples due to patients' inability to recall expenses or locate receipts. Furthermore, this study included only migrant TB patients who remained in Shanghai for treatment. Lower-income migrant workers, particularly those facing temporary unemployment, may have returned to their hometowns due to Shanghai's high living costs, potentially introducing selection bias. Consequently, these findings may not be generalizable to the broader migrant population.

Nevertheless, this research has revealed both substantial financial risks for migrant patients and potential TB care overutilization — patterns likely to be replicated in other urban cities with significant high-income migrant populations. Given these limitations, future research should prioritize investigating migrant patients from lower socioeconomic backgrounds to identify effective interventions promoting TB treatment completion.

Conflicts of interest: The authors declare that they have no competing interests.

Ethical statement: Approved by the Institutional Review Board (IRB) of Duke Kunshan University (No. FWA00021580). Informed consent was obtained from all participants who participated in this study.

Acknowledgments: We extend our sincere gratitude to Hanzhi Peng, Yueqian Zhang, and Shen Shen, Yike Wang, Daianji Liu, students from Duke Kunshan University, for their contributions to the quality checking and data entry of the questionnaires for this study. We also acknowledge all participants and coordinators from primary healthcare institutions for their assistance in completing data collection.

Funding: This study was funded by Duke Kunshan University.

doi: 10.46234/ccdcw2025.072

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Submitted: April 24, 2024
Accepted: March 10, 2025
Issued: March 28, 2025

REFERENCES

1. Abarca Tomás B, Pell C, Bueno Cavanillas A, Guillén Solvas J, Pool R, Roura M. Tuberculosis in migrant populations. A systematic review of the qualitative literature. PLoS One 2013;8(12):e82440. https://doi.org/10.1371/journal.pone.0082440.
2. Lu LP, Jiang Q, Hong JJ, Jin XP, Gao Q, Bang H, et al. Catastrophic costs of tuberculosis care in a population with internal migrants in China. BMC Health Serv Res 2020;20(1):832. https://doi.org/10.1186/s12913-020-05686-5.
3. Tang Y, Zhao MG, Wang YX, Gong YH, Yin X, Zhao AG, et al. Non-adherence to anti-tuberculosis treatment among internal migrants with pulmonary tuberculosis in Shenzhen, China: a cross-sectional study. BMC Public Health 2015;15(1):474. https://doi.org/10.1186/s12889-015-1789-z.
4. Zhou CC, Chu J, Liu JN, Tobe RG, Gen H, Wang XZ, et al. Adherence to tuberculosis treatment among migrant pulmonary tuberculosis patients in Shandong, China: a quantitative survey study. PLoS One 2012;7(12):e52334. https://doi.org/10.1371/journal.pone.0052334.
5. Arega B, Negesso A, Taye B, Weldeyohhans G, Bewket B, Negussie T, et al. Impact of COVID-19 pandemic on TB prevention and care in Addis Ababa, Ethiopia: a retrospective database study. BMJ Open 2022;12(2):e053290. https://doi.org/10.1136/bmjopen-2021-053290.
6. Abdool Karim Q, Baxter C. COVID-19: impact on the HIV and tuberculosis response, service delivery, and research in South Africa. Curr HIV/AIDS Rep 2022;19(1):46 – 53. https://doi.org/10.1007/

s11904-021-00588-5.
7. Zheng XF, Zhong FY, Zhang XP. Doctors' compliance with national guidelines and clinical pathway on the treatment of tuberculosis inpatients in Hubei, China. J Eval Clin Pract 2014;20(3):288 – 93. https://doi.org/10.1111/jep.12127.
8. Tang SL, Wang LX, Wang H, Chin DP. Access to and affordability of healthcare for TB patients in China: issues and challenges. Infect Dis Poverty 2016;5:10. https://doi.org/10.1186/s40249-016-0096-y.
9. Mao WH, Jiang WX, Hamilton C, Zhang H, Huang F, Lucas H, et al. Over- and under-treatment of TB patients in Eastern China: an analysis based on health insurance claims data. Trop Med Int Health 2019;24 (9):1078 – 87. https://doi.org/10.1111/tmi.13287.
10. Xu CH, Xia YY, Hu DM, Zhang XM, Zhao YL. Financial burden of tuberculosis patients - China, 2020. China CDC Wkly 2023;5(12): 266 – 70. https://doi.org/10.46234/ccdcw2023.048.