Preplanned Studies

Scaling Up Tuberculosis Preventive Treatment: Progress and Factors Influencing Optimization — China, 2022–2025

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Summary

What is already known about this topic?

Tuberculosis preventive treatment (TPT) is critical in preventing latent tuberculosis infection (LTBI) progression to active tuberculosis. China has integrated TPT into national Tuberculosis (TB) control; however, systematic national data on TPT implementation in China are scarce.

What is added by the report?

TPT recipient number in China increased 2.5-fold (2022–2025), with around 79% using short-course regimens. Among 2,676 individuals with LTBI, TPT acceptance and completion rates were 45.14% and 85.18%, respectively. Key acceptance factors included age, ethnicity, occupation, treatment institution, immunocompromised status, and purified protein derivative results.

What are the implications for public health practice?

To improve TPT effectiveness, public health strategies should integrate TPT into routine clinics, promote short-course regimens, and target high-risk groups (e.g., immunocompromised individuals and the elderly) to increase acceptance rates and reduce disparities to achieve TB elimination.

ABSTRACT

Introduction: Tuberculosis preventive treatment (TPT) is pivotal in preventing the progression of latent tuberculosis infection (LTBI) to active tuberculosis (ATB). However, systematic, national data on TPT implementation in China are scarce. We characterized the scale-up of the TPT between 2022 and 2025, and identified the factors associated with its acceptance and completion.

Methods: This preplanned cross-sectional study utilized two levels of national TPT surveillance [31 provincial-level administrative divisions (PLADs), 2022–2025] and 2,676 individuals with LTBI (five PLADs, 2023–2024). The analyses included descriptive statistics and Firth-penalized logistic regression (R 4.3.1).

Results: The number of TPT recipients increased 2.5-fold (37,514–92,331) with approximately 79% short-course regimen use. The acceptance and completion rates were 45.14% and 85.18%, respectively. Higher acceptance was observed in individuals aged 15–44 years [odds ratio (*OR*)=0.648, 95% confidence interval (*CI*): 0.469, 0.896], ethnic minorities (*OR*=5.045, 95% *CI*: 1.910, 16.914), healthcare workers (*OR*=82.029, 95% *CI*: 16.422, 822.390), and designated hospitals (*OR*=3.620, 95% *CI*: 2.507, 5.281). It was lower in immunocompromised individuals (*OR*=0.409, 95% *CI*: 0.219, 0.749) and those with moderate PPD positivity (*OR*=0.384, 95% *CI*: 0.275, 0.533).

Conclusions: China has progressed in scaling up the TPT; however, low acceptance and subgroup disparities persist. Integrating TPT into routine clinical practice, prioritizing short-course regimens, and targeting high-risk groups are critical for TB elimination.

Tuberculosis (TB) remains a major global public health challenge, with 10.7 million new cases reported worldwide in 2024. China accounts for 6.5% of global cases (ranking fourth globally) (*1*), bearing a substantial TB burden. Latent tuberculosis infection (LTBI) refers to a persistent immune response to *Mycobacterium tuberculosis* antigens without clinical, bacteriological, or radiological evidence of active TB. As a vast reservoir for future TB cases, 5%–10% of individuals with LTBI develop active TB during their lifetime, severely hindering the global aim of ending the TB epidemic (*2*). The LTBI rates in China are 18.1% in individuals aged ≥5 years and 20.3% in those aged ≥15 years, indicating a considerable potential risk of active TB transmission. In the absence of an effective adult TB vaccine, tuberculosis preventive treatment (TPT) has emerged as a cornerstone intervention to block the progression of LTBI to active

disease, making it indispensable for reducing TB incidence and advancing the elimination of the TB epidemic (*3*). Recognizing its critical significance, China has integrated TPT into its national TB control strategies and has successively issued key policies, including the TB Prevention and Control Management Guidelines (*4*) and the National TB Prevention and Control Plan (2024–2030) (*5*), which explicitly designate TPT as a core indicator of TB prevention efforts. However, despite these clear policy commitments, there remains a critical gap in national-level systematic data on TPT implementation, including coverage, adherence, and factors influencing its effectiveness. Moreover, both global and national TPT implementations face major challenges, such as low acceptance and completion rates, further limiting their effectiveness in TB control. This knowledge deficit not only restricts the ability to assess whether the TPT is meeting its intended public health goals but also hinders the optimization of strategies to achieve a broader impact. To address this gap, we analyzed the national TPT data from 2022 to 2025 to characterize the current implementation status, identify barriers in the care cascade, and explore the key influencing factors. The findings of this study provide evidence-based insights to refine China's TPT policies and accelerate progress toward ending the TB epidemic.

This preplanned cross-sectional study used two-level data. Nationally, the TPT progress was analyzed using the 2022–2025 data for 31 provincial-level administrative divisions (PLADs) obtained from the Chinese Disease Control and Prevention Information System. Provincially, to identify factors influencing TPT acceptance, the Centers for Disease Control and Prevention (CDC) designated hospitals and health centers in five PLADs (Jiangsu, Henan, Shaanxi, Yunnan, and Xinjiang Uygur Autonomous Region) were selected via convenience sampling based on the implementation feasibility. Anonymized data were extracted using structured forms from routinely registered individuals with LTBI documented between 2023 and 2024. All eligible individuals recorded during the study period were included. The investigators were trained by public health staff from the participating institutions to ensure standardized procedures and consistent variable definitions. Quality control measures included supervisory reviews and data verification to ensure completeness and logical consistency across PLADs. Statistical analyses were performed using R (Version 4.4.3, Vienna, Austria, https://www.r-project.org/). Descriptive statistics summarized the national TPT progress. Associations with TPT acceptance were evaluated using univariate and multivariate Firth-penalized logistic regressions. Bidirectional stepwise selection (α =0.05 for entry and removal) was used to determine the final model. As a sensitivity analysis, multilevel logistic regression, with PLAD specified as a random intercept, was conducted to account for potential regional clustering.

The number of national TPT recipients increased steadily from 37,514 in 2022 to 92,331 in 2025, with students who have been in close contact with TB patients being the largest group across all years (21,654 in 2022 to 34,616 in 2025). In addition, close contacts with patients having bacteriologically positive TB also reported a sharp increase (7,683 in 2022 to 28,854 in 2025). Short-course regimens were the main TPT strategies, with utilization rates of 79.2% (29,725/37,514) in 2022, 78.8% (41,639/52,836) in 2023, 76.5% (66,555/87,034) in 2024, and 79.6% (73,517/92,331) in 2025, which remained consistently high throughout the study period (Figure 1).

In total, 2,676 individuals with LTBI were included in the survey. The overall acceptance rate of the TPT was 45.14% (1,208/2,676). Among those who initiated TPT, 85.18% (1,029/1,208) completed the full course (Table 1).

Multivariate logistic regression analysis identified several factors that were significantly associated with TPT acceptance. Key factors included age [15–44 *vs.* 0–14: odds ratio (*OR*)=0.648, 95% confidence interval (*CI*): 0.469, 0.896, *P*=0.009]; ethnicity (other ethnic groups vs. Han: *OR*=5.045, 95% *CI*: 1.910, 16.914, *P*<0.001); PLAD (e.g., Jiangsu *vs.* Henan: *OR*=31.499, 95% *CI*: 15.320, 68.720, *P*<0.001; Xinjiang *vs.* Henan: *OR*=8.610, 95% *CI*: 2.353, 26.462, *P*=0.002); education level (senior high school *vs.* junior school and below: *OR*=0.721, 95% *CI*: 0.527, 0.986, *P*=0.041); population classification (HIV/AIDS/immunocompromised *vs.* densely populated place population: *OR*=0.409, 95% *CI*: 0.219, 0.749, *P*=0.004; healthcare workers vs. densely populated place population: *OR*=82.029, 95% *CI*: 16.422, 822.390, *P*<0.001); TPT-providing institution (designated hospital *vs.* CDC: *OR*=3.620, 95% *CI*: 2.507, 5.281, *P*<0.001); and infection test result (PPD moderate positive *vs.* PPD strong positive: *OR*=0.384, 95% *CI*: 0.275, 0.533, *P*<0.001) (Table 2). Completion rates varied considerably across subgroups, being notably low for healthcare workers (41.67%) and those on immunotherapy regimens (51.21%) but high for ethnic minorities (91.51%) and the elderly (90.64%). The random-intercept variance for the PLADs was 1.93, suggesting moderate between-provincial heterogeneity. However, the fixed-effect

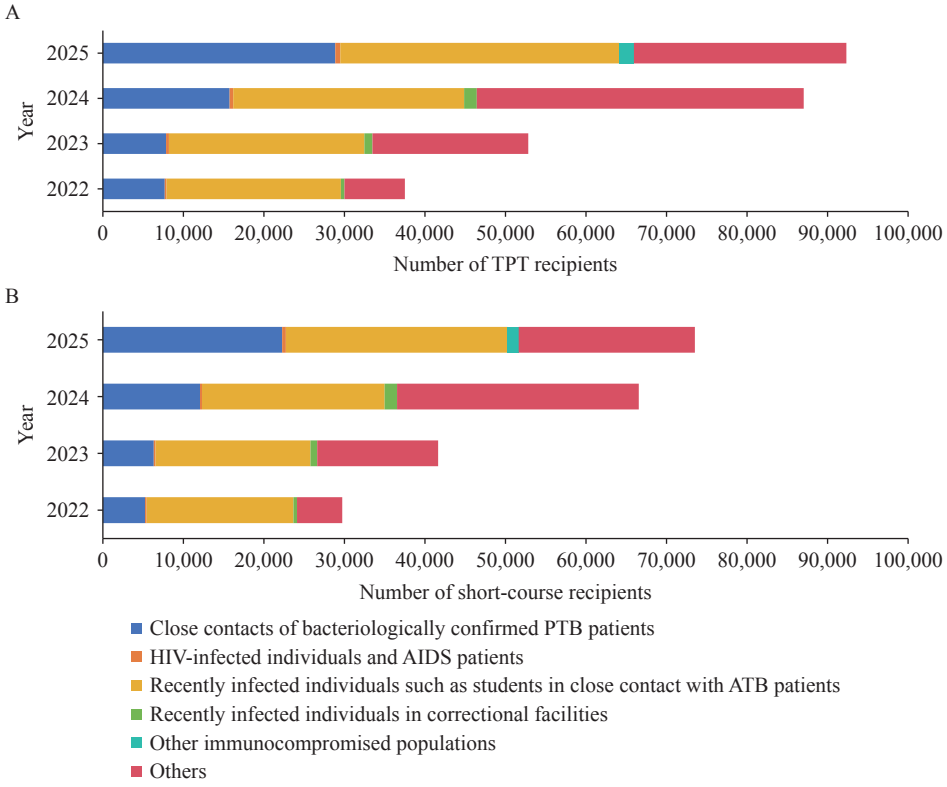

FIGURE 1. TPT implementation and scale-up in China from 2022 to 2025. (A) Individuals on TPT; (B) Individuals on shorter regimens.
Abbreviation: PTB=pulmonary tuberculosis; HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; ATB=active tuberculosis; TPT=tuberculosis preventive treatment.

estimates were not materially altered (Supplementary Table S1, available at https://weekly.chinacdc.cn).

DISCUSSION

LTBI affects nearly one-quarter of the global population, forming the largest reservoir of ATB and hindering its global elimination (*6*). TPT effectively halts LTBI progression to ATB (*7*); however, its global implementation is compromised by low acceptance and completion rates (*8*). We addressed the evidence gap by investigating TPT uptake, completion, and associated factors among individuals with LTBI in China to identify optimized national prevention strategies.

We demonstrated that China's TPT scale-up achieved remarkable progress during 2022–2025, with a 2.5-fold increase in recipients and consistently high utilization (around 79%) of WHO-recommended short-course regimens, validating the effectiveness of national TB control policies. Although the post-acceptance completion rate (85.18%) indicated good adherence, the overall acceptance rate (45.14%) was a critical bottleneck, with stark disparities across subgroups: acceptance was extremely low in adults ≥60 years, individuals living with HIV/AIDS (PLHIV), immunocompromised individuals and Shaanxi residents, but high in healthcare workers, ethnic minorities, and Jiangsu/Xinjiang residents. Grassroots institutions (designated TB hospitals and community health centers) outperformed CDCs in TPT delivery, underscoring the value of routine clinical settings for preventive care. Therefore, policies must shift the focus from merely promoting completion to actively facilitating acceptance. Our data strongly advocate for the integration of TPT services into designated hospitals and health centers, which are associated with four-fold and two-fold higher odds of acceptance, respectively, compared to CDC facilities. This suggests a policy shift toward not "mainstreaming" TPT into routine clinical care settings where patients already seek services, potentially improving the accessibility and perceived legitimacy of treatment (*9*). Secondly, the superior completion rate of the $3H_2P_2$ regimen (90.93%) supports the urgent need for national programs to prioritize the procurement and rollout of shorter, patient-friendly regimens to improve overall

TABLE 1. TPT acceptance and completion rates among individuals with LTBI by demographic and clinical characteristics, China, 2023–2024.

Variable	Total (*n*)	TPT acceptance [*n*/(%)]		TPT completion [*n*/(%)]	
Total	2,676	1,208	45.14	1,029	85.18
Age (years)					
0–14	453	215	47.46	193	89.77
15–44	1,416	599	42.30	491	81.97
45–59	273	191	69.96	161	84.29
≥60	534	203	38.01	184	90.64
Gender					
Male	1,343	587	43.71	512	87.22
Female	1,333	621	46.59	517	83.25
Ethnicity					
Han	2,179	784	35.98	641	81.76
Other ethnic groups	497	424	85.31	388	91.51
PLAD					
Henan	1,038	143	13.78	105	73.43
Jiangsu	387	304	78.55	253	83.22
Shanxi	207	14	6.76	2	14.29
Xinjiang Uygur Autonomous Region	460	387	84.13	354	91.47
Yunnan	584	360	61.64	315	87.50
Education level					
Junior school and below	1,292	692	53.56	617	89.16
Senior high school	1,066	294	27.58	247	84.01
College and above	318	222	69.81	165	74.32
Population classification					
HIV/AIDS and other immunocompromised	402	76	18.91	66	86.84
Household close contacts of TB patients	568	448	78.87	385	85.94
Densely populated place population	1,646	635	38.58	545	85.83
Healthcare workers	25	24	96.00	10	41.67
Other	35	25	71.43	23	92.00
TPT-providing institution					
CDC	297	63	21.21	41	65.08
Designated hospital	1,948	962	49.38	837	87.01
Health center	431	183	42.46	151	82.51
Infection test result					
PPD strong positive	1,479	811	54.83	713	87.92
PPD moderate positive	675	96	14.22	85	88.54
TBST positive	438	229	52.28	177	77.29
IGRA positive	84	72	85.71	54	75.00
TPT regimen					
6-9H	–	46	–	39	84.78
$3H_2P_2$	–	474	–	431	90.93
3HR	–	529	–	453	85.63
Immunotherapy	–	207	–	106	51.21

Note: "–" means data not available.
Abbreviation: TPT=tuberculosis preventive treatment; LTBI=latent tuberculosis infection; PLAD=provincial-level administrative division; HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; TB=tuberculosis; CDC=Centers for Disease Control and Prevention; PPD=purified protein derivative; TBST=tuberculosis skin test; IGRA=interferon-gamma release assay; H=isoniazid; P=rifapentine; R=rifampicin; Ref.=reference group; 6-9H=a 6-month or 9-month regimen of daily isoniazid monotherapy, H 5 mg/kg (max 300 mg) daily; $3H_2P_2$=a 3-month regimen of twice-weekly isoniazid plus rifapentine, ≥50 kg: H 600 mg and P 600 mg twice weekly, <50 kg: H 500 mg and P 450 mg twice weekly; 3HR=a 3-month regimen of weekly isoniazid plus rifampicin, ≥50 kg: H 300 mg and P 600 mg twice weekly, <50 kg: H 300 mg and P 450 mg daily; Immunotherapy=a 3-month immunotherapy regimen consisting of *Mycobacterium bovis* vaccine administered once every 2 weeks.

TABLE 2. Univariate and multivariable logistic regression analyses of factors associated with TPT acceptance among individuals with LTBI, China, 2023–2024.

Variable	Univariate analysis		Multivariate analysis	
	P	*OR* (95% *CI*)	*P*	*OR* (95% *CI*)
Age (years)				
0–14	Ref.		Ref.	
15–44	0.054	0.812 (0.656, 1.004)	0.009	0.648 (0.469, 0.896)
45–59	<0.001	2.569 (1.876, 3.539)	0.136	0.695 (0.432, 1.122)
≥60	0.003	0.679 (0.527, 0.875)	0.254	0.735 (0.435, 1.250)
Gender				
Male	Ref.		Ref.	
Female	0.135	1.123 (0.965, 1.308)	0.388	1.096 (0.890, 1.350)
Ethnicity				
Han	Ref.		Ref.	
Other ethnic groups	<0.001	10.274 (7.949, 13.450)	<0.001	5.045 (1.910, 16.914)
PLAD				
Henan	Ref.		Ref.	
Jiangsu	<0.001	22.757 (16.948, 30.861)	<0.001	31.499 (15.320, 68.720)
Shaanxi	0.004	0.468 (0.256, 0.794)	0.470	0.726 (0.301, 1.723)
Xinjiang Uygur Autonomous Region	<0.001	32.900 (24.382, 44.927)	0.002	8.610 (2.353, 26.462)
Yunnan	<0.001	10.021 (7.881, 12.804)	<0.001	6.198 (4.363, 8.869)
Education level				
Junior school and below	Ref.		Ref.	
Senior high school	<0.001	0.331 (0.278, 0.393)	0.041	0.721 (0.527, 0.986)
College and above	<0.001	1.999 (1.542, 2.609)	0.208	0.787 (0.542, 1.142)
Population classification				
HIV/AIDS and other immunocompromised	<0.001	0.373 (0.284, 0.485)	0.004	0.409 (0.219, 0.749)
Household close contacts of TB patients	<0.001	5.924 (4.749, 7.438)	0.002	0.454 (0.275, 0.744)
Densely populated place population	Ref.		Ref.	
Healthcare workers	<0.001	25.997 (6.752, 233.246)	<0.001	82.029 (16.422, 822.390)
Other	<0.001	3.865 (1.924, 8.342)	0.014	0.260 (0.097, 0.752)
TPT-providing institution				
CDC	Ref.		Ref.	
Designated hospital	<0.001	3.603 (2.710, 4.855)	<0.001	3.620 (2.507, 5.281)
Health center	<0.001	2.727 (1.956, 3.838)	0.064	1.892 (0.963, 3.664)
Infection test result				
PPD strong positive	Ref.		Ref.	
PPD moderate positive	<0.001	0.137 (0.108, 0.173)	<0.001	0.384 (0.275, 0.533)
TBST positive	0.347	0.902 (0.729, 1.117)	0.734	0.901 (0.485, 1.626)
IGRA positive	<0.001	4.778 (2.695, 9.205)	0.514	1.363 (0.539, 3.506)

Abbreviation: TPT=tuberculosis preventive treatment; LTBI=latent tuberculosis infection; PLAD=provincial-level administrative division; HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; TB=tuberculosis; PPD=purified protein derivative; TBST=tuberculosis skin test; IGRA=interferon-gamma release assay; *OR*=odds ratio; *CI*=confidence interval; Ref.=reference group.

program effectiveness (*10*). Third, identified risk groups, such as immunocompromised individuals and residents of low-performing PLADs, require tailored proactive outreach strategies. For example, seamlessly integrating TPT acceptance into HIV care clinics and implementing performance-based financing for TPT in

lagging regions could be effective measures derived from our evidence.

The findings in this report are subject to at least two limitations. First, the survey on TPT influencing factors used convenience sampling, selecting PLADs/counties with active screening and complete data, which may have led to selection bias and limited the generalizability of the results to the whole country. Second, the surveillance data did not include detailed information on TPT follow-up and adverse reactions, which may be crucial factors influencing TPT completion, and were not analyzed in this study.

To optimize China's TPT strategy and effectiveness, targeted recommendations based on study findings include prioritizing TPT for high-risk groups, such as student close contacts and bacteriologically positive TB patient contacts. In addition, personalized measures (simplified screening, free drugs, and regular follow-ups) should be used for the elderly (≥60 years), HIV-infected, and immunocompromised individuals to improve acceptance. Optimizing grassroots services involves shifting TPT from CDCs to designated hospitals and community/township health centers; training grassroots staff on TPT screening, regimen selection, and adverse reactions; and establishing standardized processes to improve accessibility and quality. Standardizing short-course regimens and expanding coverage require maintaining high utilization of 3HR/$3H_2P_2$ through regular safety and effectiveness evaluations, resuming standardized TPT for detainees, and expanding coverage for immunocompromised groups via standardized protocols. Establishing a comprehensive TPT cascade system involves integrating LTBI screening, TPT acceptance, adherence, and follow-up into the national TB surveillance to track cascade losses and promptly address implementation barriers. Finally, promoting regional balance includes increasing financial and technical support for low-acceptance central/western regions (e.g., Shaanxi), establishing cross-regional platforms for experience sharing, and narrowing implementation disparities.

Conflicts of interest: No conflicts of interest.

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SUPPLEMENTARY MATERIAL

To account for potential regional clustering, a multilevel logistic regression model with province specified as a random intercept was used for the sensitivity analysis. Fixed-effects estimates are presented as odds ratios (*OR*s) with 95% confidence intervals (*CI*s).

The random-intercept variance for the province was 1.93 (standard deviation=1.39), indicating moderate between-province heterogeneity. The model did not exhibit a singular fit (isSingular=FALSE), suggesting a stable estimation of the random effects.

Provincial-specific random intercept estimates are shown below: 1) PLAD 2: −1.38, 2) PLAD 3: 2.06, 3) PLAD 4: −1.66, 4) PLAD 6: 0.56, 5) PLAD 7: 0.44.

These findings indicate variability in the baseline TPT initiation probability across PLADs; however, the fixed-effects estimates remained directionally consistent with the primary Firth-penalized logistic regression analysis.

SUPPLEMENTARY TABLE S1. Multilevel logistic regression analysis of factors associated with TPT initiation.

Variable	Multilevel logistic regression analysis	
	P	***OR* (95% *CI*)**
Age (years)		
0–14	Ref.	
15–44	0.010	0.653 (0.472, 0.903)
45–59	0.145	0.700 (0.434, 1.131)
≥60	0.265	0.740 (0.435, 1.257)
Gender		
Male	Ref.	
Female	0.387	1.096 (0.890, 1.351)
Ethnicity		
Han	Ref.	
Other ethnic groups	0.001	6.205 (2.086, 18.457)
Education level		
Junior school and below	Ref.	
Senior high school	0.034	0.712 (0.520, 0.975)
College and above	0.220	0.791 (0.544, 1.150)
Population classification		
HIV/AIDS and other immunocompromised	0.003	0.398 (0.216, 0.737)
Household close contacts of patients with TB	0.002	0.464 (0.282, 0.763)
Densely populated place population	Ref.	
Healthcare workers	0.000	117.768 (13.496, 1,027.662)
Other	0.014	0.275 (0.098, 0.770)
TPT-providing institution		
CDC	Ref.	
Designated hospital	<0.001	3.711 (2.552, 5.397)
Health center	0.061	1.883 (0.971, 3.650)
Infection test result		
PPD strong positive	Ref.	
PPD moderate positive	<0.001	0.378 (0.271, 0.526)
TBST positive	0.764	0.913 (0.505, 1.652)
IGRA positive	0.427	1.460 (0.574, 3.710)

Abbreviation: TPT=tuberculosis preventive treatment; HIV=human immunodeficiency virus; AIDS=acquired immunodeficiency syndrome; TB=tuberculosis; CDC=Centers for Disease Control and Prevention; PPD=purified protein derivative; TBST=tuberculosis skin test; IGRA=interferon-gamma release assay; *OR*=odds ratio; 95% *CI*=95% confidence interval; Ref.=reference group.