Preplanned Studies

Acceptability of Tuberculosis Preventive Treatment Strategies Among Healthcare Workers Using an Online Survey — China, 2021

Lifeng Fa[1]; Caihong Xu[1]; Jun Cheng[1]; Hui Zhang[1,#]

Summary

What is already known about this topic?

In the absence of effective vaccines, tuberculosis preventive treatment (TPT) is essential for the rapid decrease in incidences of tuberculosis (TB), and healthcare workers' acceptability is vital to implementing TPT.

What is added by this report?

Overall, 86.5% of healthcare workers knew what TPT was. Most (56.3%) healthcare workers agreed to implement TPT among high-risk groups with latent tuberculosis infection. Drug resistance, adverse events, and unguaranteed efficacy were three main barriers for healthcare workers in accepting TPT.

What are the implications for public health practice?

To further promote and implement TPT in China, practical measures included policy support, high-quality training for healthcare workers, and enhanced public awareness of TB prevention and control.

It is estimated that about 1/4 of the world's population is latently infected with mycobacterium tuberculosis (MTB) (*1*). Previous studies showed that 5% to 10% of latent tuberculosis infection patients (LTBIs) might develop active tuberculosis (TB) if left untreated (*2*). Tuberculosis preventive treatment (TPT), with no effective vaccines, is essential for decreasing TB incidence. The World Health Organization (WHO) has made TPT an essential component of the "End TB Strategy" since 2010. TPT pilot studies among college students, close contacts of infectious patients, and people living with human immunodeficiency virus (PLHIV) in some provinces in China started in the 1990s. China is the second highest TB burden country, accounting for 8.5% of estimated incident cases globally (*3*). At present, there are no implementation requirements for high-risk groups in the National TB Program (NTP), except for student close contacts of pulmonary tuberculosis (PTB) patients.

A questionnaire was generated using an online survey tool Wenjuanxing (WJX, https://www.wjx.cn/, in Chinese). Considering TB burden status and economic levels, we selected Beijing, Tianjin, Shanghai, and five provinces in each of China's eastern, central, and western regions. The survey was conducted from November 18 to December 9 in 2020. Questionnaires were delivered to the heads of provincial-level CDCs, who then distributed the questionnaires to other leaders at the municipal and county levels, which were then distributed to WeChat groups to be filled out voluntarily by healthcare workers (HCWs). Questions included demographic characteristics, whether HCWs have heard of TPT, acceptability to implement TPT, the reasons for disagreeing with TPT, and preconditions that China should have to implement TPT. Data were collected through WJX, cleaned in Microsoft Office Excel (version 2016; Microsoft Corp, Washington, USA) and analyzed with SAS (version 9.4, SAS Institute, Inc. Cary, NC, USA). We presented categorized variables as frequencies and proportions. Logistic regression was used to assess associations between demographic characteristics and survey responses with a significance of α =0.05. Multivariable analysis included adjustment for age, gender, education level, institution, region, and years of experience as a TB HCW.

A total of 5,547 HCWs participated in the survey, with a mean age of (40.9±8.9) years. Among them, 2,057 (37.1%) were males, 1,965 (35.4%) were from central region, 2,788 (50.3%) had bachelor degrees and 3,382 (61.0%) had engaged in TB control for 10 years or fewer. Of all participants, 4,796 (86.5%) HCWs heard of TPT.

Fewer female HCWs had heard of TPT than male HCWs [adjusted odds ratio (OR)=0.735, 95% confidence interval (CI): 0.616–0.876, P<0.001]. A higher proportion of HCWs with postgraduate or

higher education (adjusted OR=4.515, 95% CI: 2.134–9.550, *P*<0.001) had heard of TPT compared with those with secondary or lower education. Compared to the CDC, a lower proportion of HCWs in TB designated hospital (adjusted OR=0.621, 95% CI: 0.497–0.776, *P*<0.001) and primary health care institutions (adjusted OR=0.360, 95% CI: 0.283–0.457, *P*<0.001) had heard of TPT. Years of experience as a TB HCW was positively associated with having heard of TPT (Table 1).

Among HCWs who had heard of TPT, 1,421 (29.6%) agreed to implement TPT among all LTBIs, 2,698 (56.3%) agreed to implement TPT among high-risk populations with LTBI, 528 (11.2%) held neutral attitudes, and 139 (2.9%) did not agree. In CDC and TB designated hospitals, a high proportion of HCWs agreed to carry out TPT among high-risk populations with LTBI. In primary healthcare institutions, HCWs agreeing to implement TPT among all LTBIs were in roughly the same proportions as HCWs agreeing to implement TPT among high-risk populations with LTBI (Table 2).

Among the 139 HCWs who disagreed with TPT, the reasons why they disagreed with TPT were the

TABLE 1. Characteristics of HCWs who had heard of TPT in China, 2020.

Factor	HCWs who had heard of TPT (n, %)	HCWs who had not heard of TPT (n, %)	Unadjusted OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value
Total	4,796/5,547 (86.5)	751/5,547 (13.5)				
Age, years						
≤30	719 (84.0)	137 (16.0)	1.000		1.000	
31–40	1,521 (86.3)	241 (13.7)	1.203 (0.958–1.510)	0.112	0.965 (0.762–1.222)	0.766
41–50	1,790 (87.2)	264 (12.8)	1.293 (1.033–1.616)	0.025	0.958 (0.749–1.225)	0.730
≥50	766 (87.5)	109 (12.5)	1.339 (1.021–1.757)	0.035	0.783 (0.569–1.078)	0.134
Gender						
Male	1,835 (89.2)	222 (10.8)	1.000		1.000	
Female	2,961 (84.8)	529 (15.2)	0.677 (0.573–0.801)	<0.001	0.735 (0.616–0.876)	<0.001
Education Level						
Senior high school degree or below	585 (81.9)	129 (18.1)	1.000		1.000	
Junior college	1,488 (84.0)	284 (16.0)	1.155 (0.919–1.453)	0.217	1.013 (0.794–1.291)	0.919
Bachelor degrees	2,458 (88.2)	330 (11.8)	1.642 (1.315–2.052)	<0.001	1.209 (0.940–1.553)	0.139
Postgraduate and above	265 (97.1)	8 (2.9)	7.303 (3.524–15.135)	<0.001	4.515 (2.134–9.550)	<0.001
Institution						
CDC	1,454 (92.1)	124 (7.9)	1.000		1.000	
Designated TB hospital	2,292 (87.6)	324 (12.4)	0.603 (0.486–0.750)	<0.001	0.621 (0.497–0.776)	<0.001
Primary health care institutions	1,050 (77.6)	303 (22.4)	0.296 (0.236–0.370)	<0.001	0.360 (0.283–0.457)	<0.001
Region						
Beijing, Tianjin, Shanghai	321 (88.9)	40 (11.1)	1.000		1.000	
East	1,731 (88.7)	220 (11.3)	0.980 (0.686–1.402)	0.913	1.215 (0.839–1.760)	0.302
Middle	1,626 (82.8)	339 (17.2)	0.598 (0.422–0.847)	0.004	0.713 (0.497–1.023)	0.067
West	1,118 (88.0)	152 (12.0)	0.917 (0.633–1.327)	0.644	0.961 (0.656–1.409)	0.840
Years of experience as a TB HCW, year						
≤10	2,830 (83.7)	552 (16.3)	1.000		1.000	
11–20	1,164 (90.6)	120 (9.4)	1.892 (1.535–2.332)	<0.001	1.596 (1.274–2.001)	<0.001
21–30	674 (90.7)	69 (9.3)	1.905 (1.463–2.481)	<0.001	1.823 (1.352–2.458)	<0.001
≥31	128 (92.8)	10 (7.2)	2.497 (1.303–4.782)	0.006	2.555 (1.271–5.137)	<0.001

Abbreviations: HCWs=healthcare workers; TPT=tuberculosis preventive treatment; OR=odds ratio; CI=confidence interval; TB=tuberculosis.

TABLE 2. Acceptability of HCWs on TPT in different institutions in China, 2020.

Organization	Agree TPT for all people with LTBI, n (%)	Agree TPT for key groups with LTBI, n (%)	Neutrality, n (%)	Disagree, n (%)	Total, n
CDC	309 (21.3)	915 (62.9)	171 (11.8)	59 (4.1)	1,454
Designated TB hospital	646 (28.2)	1,313 (57.3)	275 (12.0)	58 (2.5)	2,292
Primary health care institutions	466 (44.4)	470 (44.8)	92 (8.8)	22 (2.1)	1,050
Total	1,421 (29.6)	2,698 (56.3)	538 (11.2)	139 (2.9)	4,796

Abbreviations: HCWs=healthcare workers; TPT=tuberculosis preventive treatment; LTBI=latent tuberculosis infection; TB=tuberculosis.

following, in order: "Worrying about acquired drug resistance" (72.7%, 101/139); "Worrying about adverse events" (70.5%, 98/139); "Unguaranteed efficacy" (69.8%, 97/139); "Lacking financial support" (35.3%, 49/139); "Lacking sufficient staff" (34.5%, 48/139); "Troublesome administration of medication" (28.1%, 39/139); and "No policy support" (28.1%, 39/139).

This showed how HCWs think that "high acceptability of TPT of the TPT target population and their families," "HCWs with enough professional knowledge of TPT," and "policy support" were three primary preconditions for China to implement TPT. The proportions of HCWs in CDC and TB designated hospitals were roughly the same. In multivariable logistic regression, statistically significant differences in the perceptions were found in "HCWs with professional knowledge of TPT" and "adequate staff" among HCWs in different institutions (Table 3).

DISCUSSION

The results showed that 86.5% of HCWs had heard of TPT. Although TPT is not included in the NTP, it is regarded as an important technical measure in the "*Chinese Technical Specification for Tuberculosis Prevention and Control*" issued in 2020. This shows a certain basis of TPT in China, and thus a high percentage of HCWs have heard of TPT. However, primary HCWs (PHCWs) were the least familiar with TPT. HCWs with more years of experience in TB control and higher education have a stronger ability to obtain information actively, so they are more likely to have heard of TPT.

TPT should be selectively implemented on populations with the highest risk of progression to active TB, who would benefit most from it. Most HCWs (56.3%) agreed to carry out TPT among high-risk populations with LTBI, as the risk of developing active TB is particularly elevated among children under the age of 5 years, human immunodeficiency virus /acquired immunodeficiency syndrome, and people with compromised immunity (*4*–*5*). It was estimated that about 360 million people are latently infected with MTB in China, which makes TPT challenging because of difficult medication management, enormous costs, and the risk of severe adverse events. However, nearly half (44.4%) of the PHCWs lack awareness of recommendations on TPT proposed by WHO. To change this situation, we should strengthen the professional training of PHCWs and HCWs on TPT understanding.

In this study, a minority of HCWs were against TPT due to their perception of drug resistance, adverse events, and unguaranteed efficacy, resulting from insufficient TPT knowledge. Currently, there is no evidence of drug resistance caused by TPT. The incidence of adverse events is low, and TPT efficacy is high (*6*). TPT has not been effectively used in the past, and standardized treatment of LTBI will help to achieve NTP. Therefore, there is a need to provide updated evidence related to TPT to improve understanding of the benefits and risks of TPT among HCWs.

This study was subject to some limitations. This was an online survey using a convenience sampling method. Although this study had extensive geographic coverage across China and a large sample size, participants' representativeness might be limited. Futhermore, the acceptability of TPT was self-reported, and there were no repeated verification questions or detailed resources included in the questionnaire.

In order to further promote the implementation of TPT in China, the government and other relevant departments need to provide adequate personnel, funding, and policy support for TPT. Further studies are necessary to model the impact of TPT on morbidity, evaluate the economic benefits of TPT reducing TB burden, and assess patients' perceptions of TPT and efficacy in order to address the concerns of the government, TB HCWs, and patients and promote the implementation of TPT in China (*7*).

TABLE 3. The opinions on preconditions for implementing TPT among HCWs in China, 2020.

Question	Yes, n (%)	No, n (%)	Unadjusted OR (95% CI)	*P* value	Adjusted OR (95% CI)	*P* value
Q1: Do you think the TPT target population and their families should have high acceptability toward TPT?						
All	4,123/4,796 (86.0)	673/4,796 (14.0)				
CDC	1,232 (84.7)	222 (15.3)	1.000		1.000	
TB designated hospital	1,990 (86.8)	302 (13.2)	1.187 (0.985–1.432)	0.072	1.140 (0.941–1.382)	0.182
Primary healthcare institutions	901 (85.8)	149 (14.2)	1.090 (0.870–1.364)	0.454	1.263 (0.990–1.611)	0.060
Q2: Do you think HCWs should have enough professional knowledge of TPT?						
All	3,850/4,796 (80.7)	946/4,796 (19.3)				
CDC	1.089 (74.9)	365 (25.1)	1.000		1.000	
TB designated hospital	1,904 (83.1)	388 (16.9)	1.645 (1.400–1.933)	<0.001	1.585 (1.343–1.870)	<0.001
Primary healthcare institutions	857 (81.6)	193 (18.4)	1.489 (1.224–1.811)	<0.001	1.737 (1.404–2.150)	<0.001
Q3: Do you think implementing TPT should have adequate staff?						
All	2,958/4,796 (62.0)	1,838/4,796 (38.0)				
CDC	844 (58.1)	610 (41.9)	1.000		1.000	
TB designated hospital	1,429 (62.4)	863 (37.6)	1.197 (1.047–1.369)	0.009	1.181 (1.029–1.355)	0.018
Primary healthcare institutions	685 (65.2)	365 (34.8)	1.356 (1.151–1.599)	<0.001	1.313 (1.100–1.568)	0.003
Q4: Do you think implementing TPT needs financial support?						
All	3,284/4,796 (68.5)	1,512/4,796 (31.5)				
CDC	1.002 (68.9)	452 (31.1)	1.000		1.000	
TB designated hospital	1,553 (67.8)	739 (32.2)	0.948 (0.823–1.092)	0.459	0.955 (0.827–1.104)	0.533
Primary healthcare institutions	729 (69.4)	321 (30.6)	1.024 (0.863–1.217)	0.783	1.083 (0.900–1.304)	0.399
Q5: Do you think implementing TPT needs professional guidance from relevant experts?						
All	3,222/4,796 (67.2)	1,573/4,796 (32.8)				
CDC	981 (67.5)	473 (32.5)	1.000		1.000	
TB designated hospital	1,539 (67.2)	753 (32.8)	0.985 (0.857–1.134)	0.838	0.984 (0.852–1.136)	0.823
Primary healthcare institutions	702 (66.9)	348(33.1)	0.973 (0.821–1.152)	0.748	0.999 (0.832–1.200)	0.994
Q6: Do you think implementing TPT needs policy support?						
All	3,315/4,796 (69.1)	1,481/4,796 (30.9)				
CDC	1,010 (69.5)	444 (30.5)	1.000		1.000	
TB designated hospital	1,620 (70.7)	672 (29.3)	1.060 (0.918–1.223)	0.427	1.075 (0.928–1.245)	0.334
Primary healthcare institutions	685 (65.2)	365 (34.8)	0.825 (0.697–0.977)	0.026	0.883 (0.735–1.061)	0.185

Abbreviations: TPT=tuberculosis preventive treatment; HCWs=healthcare workers; OR=odds ratio; CI=confidence interval; TB=tuberculosis.

Acknowledgments: The staff in the provincial-level CDCs, local CDCs, TB designated hospitals, and primary healthcare institutions.

Conflicts of interest: No conflicts of interest.

Funding: Supported by The National Major Projects of China (2017ZX10201302–001).

doi: 10.46234/ccdcw2022.050

[#] Corresponding author: Hui Zhang, zhanghui@chinacdc.cn.

[1] National Center for Tuberculosis Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China.

Submitted: November 24, 2021; Accepted: March 15, 2022

REFERENCES

1. Houben RMGJ, Dodd PJ. The Global burden of latent tuberculosis infection: a re-estimation using mathematical modelling. PLoS Med 2016;13(10):e1002152. http://dx.doi.org/10.1371/journal.pmed.1002152.
2. Park SY, Han SM, Kim YM, Kim J, Lee S, Yang J, et al. Risk of active tuberculosis development in contacts exposed to infectious tuberculosis in congregate settings in Korea. Sci Rep 2020;10(1):1306. http://dx.doi.org/10.1038/s41598-020-57697-1.
3. World Health Organization. Global Tuberculosis Report 2021. Geneva: World Health Organization. 2021. https://www.who.int/publications/i/item/9789240037021. [2022-1-17].
4. Getahun H, Matteelli A, Chaisson RE, Raviglione M. Latent *Mycobacterium tuberculosis* infection. N Engl J Med 2015;372(22):2127 – 35. http://dx.doi.org/10.1056/NEJMra1405427.
5. Rangaka MX, Wilkinson RJ, Boulle A, Glynn JR, Fielding K, van Cutsem G, et al. Isoniazid plus antiretroviral therapy to prevent tuberculosis: a randomised double-blind, placebo-controlled trial. Lancet 2014;384(9944):682 – 90. http://dx.doi.org/10.1016/S0140-6736(14)60162-8.
6. Zenner D, Beer N, Harris RJ, Lipman MC, Stagg HR, van der Werf MJ. Treatment of latent tuberculosis infection: an updated network meta-analysis. Ann Intern Med 2017;167(4):248 – 55. http://dx.doi.org/10.7326/M17-0609.
7. Oxlade O, den Boon S, Menzies D, Falzon D, Lane MY, Kanchar A, et al. TB preventive treatment in high- and intermediate-incidence countries: research needs for scale-up. Int J Tuberc Lung Dis 2021;25(10):823 – 31. http://dx.doi.org/10.5588/ijtld.21.0293.