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Influence of tuberculosis knowledge on acceptance of preventive treatment and the moderating role of tuberculosis stigma among China's general population: cross-sectional analysis

Nan Wang[1†], Lin Wu[1†], Zhaoyue Liu[1], Junping Liu[1†], Xinru Liu[1], Yajie Feng[1], Huanyu Zhang[1], Xinle Yin[1], Yaping Liu[1], Yue Zhou[1], Yu Cui[1*], Qunhong Wu[1*] and Libo Liang[1*]

Abstract

Background Preventive treatment of tuberculosis infection (TBI) is considered a crucial strategy to prevent and control tuberculosis (TB). However, the acceptance and completion rates of preventive therapy for TBI are still far from optimistic. Evidence is mounting that TB knowledge and stigma may have a substantial effect on acceptance of TBI treatment. This study aimed to explore the effect of stigma on the relationship between the level of TB knowledge and acceptance of TBI treatment.

Methods 7017 general population were included in the study. We adjusted for the covariates at the individual. Stepwise logistic regression was used to examine the moderating role of TB stigma and also explore the association between TB knowledge and acceptance of TBI treatment.

Results The acceptance rate of TBI treatment among the respondents was 84.38% ($n=5921$). Among respondents, a significant positive correlation between acceptance of TBI treatment and TB knowledge (OR = 1.096,95%CI = 1.073,1.118). Additionally, the association between TB knowledge and acceptance of TBI treatment was found to be moderated by TB stigma. In other words, TB stigma was found to weaken the impact of TB knowledge on acceptance of TBI treatment (OR = 0.994,95%CI = 0.991,0.996).

Conclusion The findings of the study indicated that having a high level of awareness about TB can enhance the general population's acceptability of TBI treatment. TB stigma moderated this association; it weakened the relationship between TB knowledge and individuals' willingness to accept TBI treatment. To mitigate TB stigma and enhance

[†]Nan Wang, Lin Wu and Junping Liu contributed equally to this work.

*Correspondence:
Yu Cui
hmucuiyu@126.com
Qunhong Wu
wuqunhong@163.com
Libo Liang
llbhit@163.com
Full list of author information is available at the end of the article

the intention of individuals with TBI to accept preventive therapy, it is imperative to enhance TB-related health education.

Keywords Tuberculosis, Tuberculosis infection, Stigma, Treatment, Acceptance, General population

Introduction

Tuberculosis (TB)is recognized primary cause of death from a single infectious agent worldwide, it is presenting a grave risk to human life and well-being. TB infection (TBI) has been considered the major source of new TB cases. While most people who inhale Mycobacterium tuberculosis (Mtb) will not go on to active TB, about 5–10% of people infected develop the disease in their lifetime [1, 2]. At a conservative estimate, nearly 25%of the global population is estimated to have been infected with Mycobacterium tuberculosis [3, 4], with an estimated 360 million cases of TBI in China [5]. A study revealed that the annual incidence of developing active TB among individuals with TBI was estimated to be 0.87% (0.68% to 1.07%) [6]. Eliminating TB is not feasible as long as there remains a large number of people with TBI.

Research has indicated that tuberculosis preventive treatment can provide a protective effect ranging from 60 to 90% [7]. In 2015, the World Health Organization incorporated systematic screening and preventive therapy of individuals with TBI a fundamental component of the strategic goal [8]. The total number of individuals accepting preventive therapy for TBI between 2018 and 2021 amounted to 12.5 million, which indicated only 42% of the global target, it falls significantly short of the expected goal [9]. In the study by Huang et al., 43% of individuals diagnosed with TBI accepted preventive therapy, but only 19% completed the therapy [10]. This result is significantly lower than the 90% of respondents willing to accept TBI treatment in a study of the general population in Brazil. [11] The poor rates of treatment completion among individuals with TBI could prohibit reaching the 2035 End TB Strategy goals.

In addition to the low rates of treatment completion, the existing screening policies may fail to identify target populations at risk for TBI [12]. A study conducted in China observed that 43.1% of people with active TB had no symptoms, and up to 53.2% of those with symptomatic TB did not actively seek medical treatment [13]. Due to the TB-related stigma, individuals may hide a diagnosis of TB. Previous studies have indicated that more than 50% of individuals in China choose to conceal their TB diagnosis from their social circle and no more than 40% of people with TB voluntarily reduce their interactions with others [14]. Furthermore, individuals working in high-risk environments for TB are more likely to develop TBI, such as health workers, correctional staff [15, 16]. Moreover, those who live in countries with a high burden of TB and have compromised immune systems, such as people suffering from HIV or HBV, malnutrition, or diabetes, have a higher risk of acquiring TBI and progressing to TB disease [17–20]. As a result, without immunological testing with tuberculin or an interferon-gamma test, many individuals will be unaware that they have TBI. This poses a significant challenge to the efforts aimed at ending TB in high—burden countries. In order to increase the willingness to treat TBI, particularly in key populations, it is crucial to understand the Chinese public's attitude towards treating TBI and the factors that influence it. Most studies focus on individuals with TBI or healthcare workers [21–24]. There has been less previous evidence for the general population. Therefore, this study aimed to describe the acceptance of TBI treatment among the general population in China and explore the association between TB knowledge and the acceptance of TBI treatment. Furthermore, people with TB stigma may endure psychological and physiological harm, and avoid diagnosis and treatment [25]. Accordingly, this study will examine the moderating effect of stigma on this association (Fig. 1).

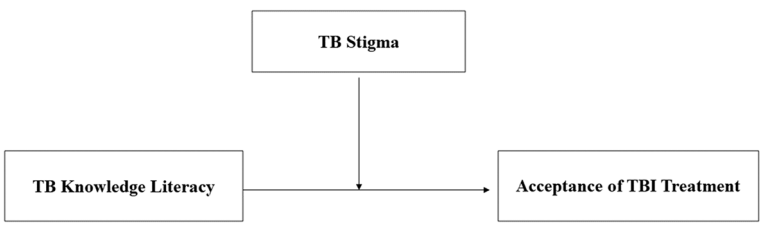


Fig. 1 A conceptual model of the relationship between TB stigma on TB knowledge and Acceptance of TBI treatment

Methods

Participants

This cross-sectional survey was conducted in April 2022 using China's online survey platform "Questionnaire Star" for online research. Researchers sent links to the online survey through Chinese social media networks. This survey was disseminated to participants in 31 provinces of mainland China. To ensure the questionnaire's quality, participants needed to meet the following conditions: (1) age ≥ 18 years; (2) clear consciousness, clear organization, and ability to understand the content of the questionnaire (3) after reading the online informed consent form, the participants expressed their willingness to take part in this study. A total of 8623 participants were investigated in this study. The researcher removed 448 invalid questionnaires with short answer times and high repetition of answers. The study primarily examined the general population's willingness to treat TBI. Consequently, 1158 patients and respondents with a previous history of TB were excluded from this study. Ultimately, 7017 eligible participants were included in this study.

Measures

To collect quantitative data, a structured questionnaire was designed by the researchers. The questionnaire was developed by the pertinent literature. All data collected were kept anonymous. The questionnaire was composed of four parts: sociodemographic characteristics, TB knowledge, TB-related stigma, and acceptance of TBI treatment. Sociodemographic characteristics included sex, age, household characteristics, education and employment, history of TB or contact with TB, and alcohol and smoking habits. More details about these questions are described in Supplementary Material 1.

TB Knowledge

The level of TB knowledge serves as the independent variable in this study. The TB knowledge questionnaire (Supplementary Material 1: TB knowledge questionnaire) was developed for this study based on the Global Tuberculosis Report 2022 [9], the "Guidelines for Implementing the National Tuberculosis Control Program in China (2008 Edition) [26]" and "Core Information and Knowledge Essentials for TB Prevention and Control (2016 Edition) [27]". The questionnaire covers six key areas: symptoms, mode of transmission, treatment, curability of TB, knowledge of TB control and the national-free TB treatment policy. The survey consists of nine questions, with each question allocated a maximum of 2 points out of a total of 18 points. Single-choice questions are awarded 2 points for a correct answer, while 0 points for an incorrect answer. Points for multiple-choice questions are assigned according to the response's relevance. Since there is a primary and secondary distinction between TB symptoms and prevention, prolonged cough or sometimes with blood were assigned 0.8 points, and night sweats, weakness, fever, fatigue, and weight loss were assigned 0.2 points based on the relevant information in the Core Information and Knowledge Essentials for TB Prevention and Control (2016 Edition) [27]. Among the preventive behaviors, disposing of sputum and using tissues properly, covering your mouth and nose when coughing or sneezing, and wearing a mask were given 0.6 points, and keeping ventilation was given 0.2 points. The sum of all correct choices was utilized as the final score for TB knowledge. Higher scores on the questionnaire indicate higher levels of TB knowledge.

Tuberculosis-related stigma scale (TSS)

The Tuberculosis-related stigma scale, designed and developed by Van Rie et al. in 2008, is a self-report inventory consisting of 24 items (Supplementary material 1: Tuberculosis-related stigma scale) [28]. It is composed of two dimensions: community perceptions of TB (Cronbach's alphas = 0.88) and patient perceptions of TB (Cronbach's alphas = 0.82). Each dimension contains 12 entries. A 4-point Likert scale was employed to measure stigma. The scale ranged from 0 to 72, with higher scores indicating a greater level of stigma.

Given the research object was the general population, the TSS scale was subsequently modified with the consent of Professor Van Rie. The section about patient perspectives toward TB has been removed, while the section about community perspectives toward TB had been preserved and modified. A 4-point Likert scale was employed to measure the level of public stigma (1 = Strongly disagree 2 = Disagree 3 = Agree 4 = Strongly agree). The value of each item ranges from 0 to 3, totaling 12 entries. The scale ranged from 0 to 36, with higher scores indicating a greater degree of public stigma. The internal consistency of the modified scales was reassessed by calculating Cronbach's alphas. A structural equation modeling (SEM) analysis was conducted using Amos software to assess the fit of the model derived from exploratory factor analysis with a separate data set.

Acceptance of TBI treatment

The dependent variable in this study is acceptance of TBI treatment. It was measured by the question "If you are a person with tuberculosis infection, are you willing to accept the treatment of tuberculosis infection?" The answer was assessed via a 4-point Likert scale (1 = Strongly disagree 2 = Disagree 3 = Agree 4 = Strongly agree). In the subsequent data analysis, the answer was divided into 2 categories: either accepting treatment or refusing treatment.

Table 1 Demographic characteristics of the participants

Variables	Total	TBI treatment intention		X^2	P
		Yes (*n* / %)	No (*n* / %)		
Gender				28.833	< 0.001
Female	3410	2959(86.8%)	451(13.2%)		
Male	3607	2962(82.1%)	645(17.9%)		
Age				13.628	< 0.001
18 ~ 35	6219	5212(83.8%)	1007(16.2%)		
35 ~ 55	798	709(88.8%)	89(12.6%)		
Residence type				0.702	0.402
Rural	1773	1485(82.2%)	288(16.2%)		
City	5244	4436(84.6%)	808(15.4%)		
Occupation				10.624	< 0.001
Non-student	5638	4718(83.7%)	920(16.3%)		
Student	1379	1203(87.2%)	176(12.8%)		
Marriage				12.643	< 0.001
Married	3239	2787(86.0%)	452(14.0%)		
Single	3778	3134(83.0%)	644(17.0%)		
Number of children				5.153	0.023
Have children	3339	2783(83.3%)	556(16.7%)		
No children	3678	3138(85.3%)	540(14.7%)		
Monthly income(RMB)				17.070	< 0.001
≤ 5000	3683	3045(82.7%)	638(17.3%)		
> 5000	3334	2876(86.3%)	458(13.7%)		
Sleep time(h)				45.157	< 0.001
≤ 7	3764	3278(87.1%)	486(12.9%)		
> 7	3253	2643(81.2%)	610(18.8%)		
Total	7017	5921(84.38%)	1096(15.62%)		

Statistical analysis

We calculated the frequency and percentage of participant demographics. We assessed group differences between respondents with and without acceptance of TBI treatment by Chi-square test. The normality of the variables was assessed using the Kolmogorov–Smirnov test. Spearman's non-parametric correlation analysis was used to assess correlations between TB knowledge, TB-related stigma and TBI treatment intention. After controlling for potential confounding factors, we conducted a stepwise logistic regression analysis to examine the moderating effects of the TB stigma. Item analysis was done to know the internal consistency of TSS by calculating Cronbach's α coefficient; exploratory factor analysis was carried out to identify construct validity of TSS. All data analyses were performed using SPSS 22.0 and AMOS 22.0, $P < 0.05$ was considered statistically significant.

Results

Study sample characteristics

Overall, more than 80% general population were willing to accept TBI treatment. Participants' characteristics and acceptance of TBI treatment are displayed in Table 1. Men (82.1%) were slightly less willing to accept treatment than women (86.8%), and despite a smaller representation of students (87.2%) and individuals older than 35 years (88.8%) in the survey, their inclination towards accepting treatment for TBI was higher. The proportion of married (86.0%) accepting TBI treatment was higher than unmarried (83.0%). A higher proportion of respondents with a higher monthly income (> 5000 RMB) (86.3%) and short-time sleep duration (< 7 h/day) (87.1%) exhibited a greater propensity to accept TBI treatment. All of the above demographic variables are with a statistical difference ($P < 0.001$).

The lifestyle of the participant and their awareness of TB are displayed in Table 2. It was found that respondents who had never smoked exhibited a higher willingness to accept treatment for TBI (85.4%). More than 90% of participants had no close contact with TB patients. Interestingly, participants without close contact (85.4%) exhibited a higher willingness to accept TBI treatment.

Table 2 Participant's lifestyle and tuberculosis awareness

Variables	Total	TBI treatment intention		X^2	P
		Yes(*n*/ %)	No(*n*/ %)		
Current Tobacco use				25.194	< 0.001
No	5696	4866(85.4%)	830(14.6%)		
Yes	1321	1055(79.9%)	266(20.1%)		
Contact person				58.145	< 0.001
No	6444	5501(85.4%)	943(14.6%)		
Yes	573	420(73.3%)	153(26.7%)		
Had heard of TBI				3.583	0.058
No	512	447(87.3%)	65(14.5%)		
Yes	6505	5474(84.2%)	1031(15.8%)		
Will TBI develop into TB				191.239	< 0.001
No	967	671(69.4%)	296(30.6%)		
Yes/ not always	6050	5250(86.8%)	800(13.2%)		
TB Knowledge				61.449	< 0.001
Low literacy (≤ 11)	3348	2706(80.8%)	642(19.2%)		
High literacy (> 11)	3669	3215(87.6%)	454(12.4%)		
TB Stigma				220.083	< 0.001
Low stigma(≤ 18)	3945	3105(78.7%)	840(21.3%)		
High stigma (> 18)	3072	2816(91.7%)	256(8.3%)		
Total	7017	5921(84.38%)	1096(15.62%)		

Participants who held the belief that TBI would certainly or likely develop into active TB exhibited a greater inclination to accept TBI treatment. Respondents with higher levels of TB knowledge and stigma exhibited a greater willingness to accept TBI treatment.

Tuberculosis-related stigma scale assessments

To ensure the scientific rigor and accuracy of the study findings, the revised scale underwent rigorous testing to assess its reliability and validity. The Cronbach alpha coefficient of 0.944 suggests that the scale has good reliability. Bartlett's test of sphericity was significant ($P<0.001$) and Kaiser–Meyer–Olkin (KMO) value was 0.959, indicating that the dataset was suitable for factor analyses. The goodness-of-fit indices of the final scales were good, with a normed-fit index (NFI) of 0.905, comparative fit index (CFI) of 0.906, and root mean square error of approximation (RMSEA) of 0.045. The aforementioned data suggests that the revised scale showed a high reliability. (Table 3).

Correlations of the variables

The Kolmogorov–Smirnov test revealed that the data pertaining to TB knowledge, stigma, and acceptance of TBI treatment exhibited non-normal distributions($P<0.000$). Consequently, Spearman's nonparametric test was employed for conducting correlation analysis. Table 4 presents the correlations of the study variables. The results indicate that there is a positive correlation between TB knowledge and TB stigma with acceptance of TBI treatment ($\rho=0.096$, $P<0.01$; $\rho=0.158$, $P<0.01$). And there is a negative correlation between TB knowledge and TB stigma($\rho=$ -0.172, $P<0.01$).

Moderating effects

Stepwise logistic regression analysis showed that receiving TB knowledge education was positively associated with acceptance of preventive therapy (OR = 1.096,95% CI = 1.073,1.118), and the impact of TB knowledge on acceptance of TBI treatment was moderated by TB stigma in a negative manner (OR = 0.994,95%CI = 0.991,0 .996). The results are reported in Table 5.

In order to enhance the reliability of the findings, an Ordinal Logistic regression analysis was performed, with TBI treatment intentions classified into four categories: Strongly disagree, Disagree, Agree, Strongly agree. The findings of the research align with those of the binary dependent variable. The results are reported in Supplementary material 2.

In order to conduct a more comprehensive examination of the moderating effect of TB stigma, we performed a simple slope analysis by dividing tuberculosis stigma into low and high-stigma groups. Figure 2 illustrates that

Table 4 Correlations among TB Knowledge, Stigma, and Acceptance of TBI treatment

Variables	Mean ± SD	Spearman's non-parametric correlation		
		TB Knowledge	TB Stigma	Acceptance of TBI treatment
TB Knowledge	11.07 ± 3.996	1		
TB Stigma	17.06 ± 8.615	-0.172**	1	
Acceptance of TBI treatment	0.840 ± 0.863	0.096**	0.158**	1

* $p<0.05$. ** $p<0.01$. *** $p<0.001$

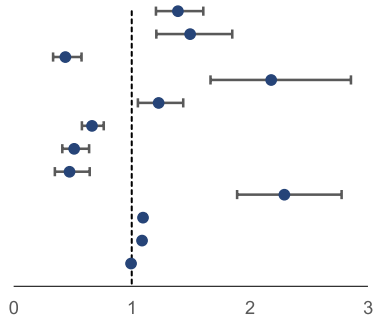
Table 3 Descriptive characteristics and Cronbach alpha of the modified TSS scale

Variables	Mean ± SD	S^2	Cov	MSB	MSE	Cronbach's alpha
You may not want to share a meal with a friend who has TB.	2.72 ± 0.890	0.793	0.814	62.683	0.784	0.944
You feel uncomfortable when you are near someone with TB.	2.34 ± 0.923	0.782	0.790	126.435	0.764	
If a person has TB, then you will treat them differently in the future.	2.51 ± 0.884	0.851	0.853	33.478	0.847	
You do not want TB patients to play with your children.	2.54 ± 0.931	0.867	0.879	244.674	0.832	
You want to keep a distance from people with TB.	2.67 ± 0.865	0.784	0.756	222.116	0.716	
Do you think people with TB are disgusting?	2.06 ± 0.907	0.823	0.812	1.316	0.823	
You are reluctant to speak to someone with TB.	2.21 ± 0.920	0.846	0.839	17.169	0.844	
You are afraid of tuberculosis patients.	2.38 ± 0.930	0.865	0.867	95.401	0.851	
You try to avoid contact with people with tuberculosis.	2.63 ± 0.894	0.799	0.800	280.378	0.760	
You may not want to eat or drink with a relative who has TB.	2.54 ± 0.901	0.813	0.822	219.359	0.782	
You do not like living in the same neighborhood as someone with TB.	2.27 ± 0.931	0.867	0.864	42.465	0.861	
Do you think children with tuberculosis should not be enrolled in school?	2.20 ± 0.985	0.971	0.970	12.002	0.969	
Bartlett's test of sphericity						0.000
KMO measure of sampling adequacy						0.959

Cov covariate

Table 5. Stepwise logistic regression of Acceptance of TBI treatment

Variables	*P*	*OR (95%CI)*
Sex(ref=male)	0.000	1.391(1.205,1.606)
Occupation(ref=non-student)	0.000	1.495(1.208,1.851)
Marriage(ref=married)	0.000	0.439(0.334,0.575)
Number of children (ref=have children)	0.000	2.182(1.667,2.856)
Monthly income(ref=≤5k)	0.009	1.229(1.052,1.436)
Sleep time(ref=≤7h)	0.000	0.664(0.578,0.763)
Contact person (ref=no)	0.000	0.513(0.412,0.639)
Have you heard of TBI（ref=no）	0.000	0.474(0.349,0.644)
Will TBI develop into TB（ref=no/not sure）	0.000	2.292(1.892,2.777)
TB Knowledge	0.000	1.096(1.073,1.118)
TB Stigma	0.000	1.088(1.077,1.098)
TB Knowledge × TB Stigma	0.000	0.994(0.991,0.996)



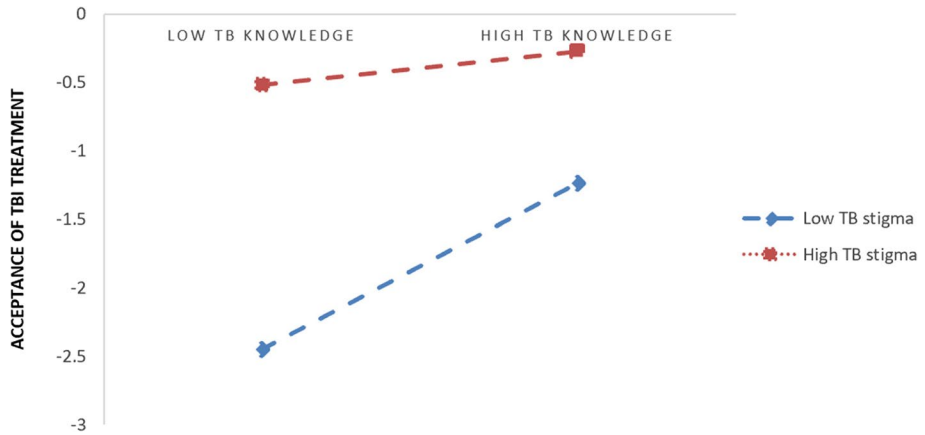


Fig. 2 Relationship between TB knowledge and Acceptance of TBI treatment for high and low levels of TB stigma

the impact of TB knowledge on TBI treatment intention is more significant when there is a low level of TBI stigma. However, as the TB stigma increases, the positive effect of TB knowledge on TBI treatment intention gradually diminishes.

Discussion

In this study, we found that the Chinese general population had a higher willingness to accept preventive therapy if they had TBI. Females, students, married, childless, with a higher monthly income, and having proper knowledge about TB are more likely to seek and accept preventive therapy. Unfortunately, contact individuals are less willing to accept treatment for TBI.

This study found that the public who had a low level of TB knowledge were less likely to accept preventive therapy. This finding is consistent with previous research conducted in this area [22, 29]. We speculate that the phenomenon is due to the Protection Motivation Theory (PTM) [30]. When the general population is aware that TBI can develop into active TB, they may be fearful and act proactively to protect their families, friends, and themselves [29]. In addition, misconceptions regarding the disease can serve as a significant obstacle to making informed behavioral choices. Consequently, individuals who hold misconceptions about TB may exhibit reluctance to accept TBI treatment [31]. Medications like isoniazid, rifampicin, and rifapentine may cause adverse drug reactions (ADRs), including asymptomatic liver enzyme elevation, peripheral neuropathy, hepatotoxicity, cutaneous and hypersensitivity reactions, and gastrointestinal intolerance, potentially discouraging individuals from pursuing TBI preventive therapy [32].

TB stigma has a negative moderating effect on the relationship between TB knowledge and acceptance of TBI treatment, which means increased TB stigma would weaken the positive effect of TB knowledge on public acceptance of TBI treatment. The factors contributing to

the low rates of adherence and completion in TBI treatment are multifaceted, with the presence of TB stigma playing a significant role [33, 34]. The general population's knowledge of TB and TBI was low in China, and they confused it with TB disease to the extent of experiencing TBI- associated stigma, which further discouraged individuals from seeking treatment [35]. The stigma was reduced by the extensive explanation of TBI and treatment possibilities by medical professionals [36]. There is also the possibility that the public opts to forgo preventive therapy due to concerns about potential discrimination [10]. Contacts who have had recent infection to MTB and are at a specified likelihood of developing TB disease during the period of incubation (up to 2 years) are recommended to undergo preventive treatment. While the WHO advocates for a shorter course of preventive treatment, there is a concern regarding the perception of taking medications like isoniazid, rifampicin, or rifapentine. This apprehension stems from the possibility that others may misinterpret their use of these drugs as active TB, leading to stigmatization and discrimination. Consequently, this apprehension may lead to a decreased acceptance of TBI treatment.

Both the exposure to patients with TB and the perceptions of TBI had a significant influence on individuals' intentions to seek TBI treatment. Close contacts exhibited a decreased willingness to accept preventive therapy. This phenomenon could be attributed to individuals who have come into contact with symptomatic TB patients failing to recognize the connection between active TB and TBI which is asymptomatic [37]. For this reason, there is a diminished sense of urgency in pursuing preventive therapy for TBI. Also, individuals with TBI may have encountered instances of discrimination and social stigma directed towards TB patients and their families [38]. Thus, they may fear being misconstrued as having active TB and opt not to seek TBI diagnosis and treatment. Individuals who hold the belief that TBI will progress to active TB are more inclined to accept TBI treatment. This is largely due to the fact that access to preventive therapy is effective in preventing active TB and reducing the health and economic burden. The greater inclination of the student to accept TBI treatment compared to other occupational cohorts may be attributed to the continuous efforts in TB prevention and control specifically targeting the students in China. Furthermore, students are also concerned if they are required to suspend their studies after contracting TB, which may have a detrimental impact on their education [39]. Consequently, both students and parents attach great importance to the prevention of TB. In relation to economic status, individuals who have higher monthly incomes are more inclined to seek treatment for TBI. The treatment costs are identified as a significant factor that hinders TBI patients from accessing treatment [40], so individuals with higher income are more inclined to seek preventive therapy, as they are more capacity to do so.

Other individual attributes also demonstrated a notable impact on the inclination to treat TBI. Females exhibited a higher inclination towards accepting TBI treatment in comparison to males. This disparity can potentially be attributed to the traditional Chinese culture, in which males typically assume the primary responsibility for generating household income. As a result, their demanding schedules may hinder their ability to seek medical treatment in hospitals. Additionally, previous studies have shown that males display lower adherence to health behaviors and preventive activities when compared to females [41]. In relation to their marital status, married people are more likely to accept TBI treatment, which is consistent with research conducted by Hirsch-Moverman Y et al. [42, 43]. This phenomenon could be attributed to the apprehension experienced by unmarried individuals with TBI, who fear that their treatment will be exposed and misinterpreted as active TB and that the resulting social stigma will adversely impact their marriage. Married people, in contrast, exhibit a higher propensity to accept TBI treatment due to their stable familial environment and access to robust family support. The inclination to accept TBI treatment was higher among childless individuals, potentially due to the indirect influence of economic stress.

The findings of this study have strong policy implications. It is recommended that local communities should regularly carry out education and awareness activities about TBI and TB to raise the public's awareness and reverse public stigma. Unmarried and economically disadvantaged groups are particularly in need of attention. The data indicate that free screening and standardized treatment for TB in specialist hospital will be required, which are crucial for the prevention and management of TB. Therefore, the policies implemented in China stipulate that individuals with suspected TB symptoms or suspected TB patients can receive a complimentary chest X-ray examination and free sputum smear test during their initial visit to a district-level TB designated medical institution to enhance the motivation and standardization of TB treatment.

Conclusions

This study emphasizes the significant role of TB knowledge and stigma in the eradication of TB. To accomplish the global objective of the End TB Strategy at the earliest opportunity, it is imperative to not only continue the dissemination of TB-related information to the general population, but also to address the issue of

TB stigma, offer social and spiritual assistance to TBI or TB patients. Key and vulnerable populations should also be encouraged to accept the management of TBI. Access to free screening should be readily available to any individual who interacts with the health system. Furthermore, patients with TBI who exhibit symptoms indicative of TB should be provided with complimentary sputum tests and chest X-ray examinations. In addition, the process of policy formulation should integrate the current circumstances of the TB epidemic and prevailing policies in different regions of China.

Limitations

The study is limited by the fact that the survey was carried out with the Chinese general population. This decision was made after carefully considering the prevailing circumstances of a densely populated area with a significant burden of TB in China. Second, as a cross-sectional study, we cannot determine the causality of relationships between TB knowledge, TB stigma and acceptance of TBI treatment, despite the survey used to support this research was theoretically sound. Third, the uneven age distribution in the sample population. Influenced by an online questionnaire during COVID-19, the majority of participants were young (Supplementary Material 3: Age distribution of respondents). In future studies, finding TBI key populations, optimizing the structure of age groups, and conducting interventional and longitudinal studies could better elucidate the impact of stigma on the relationship between accepted TB knowledge and acceptance of TBI treatment.

Abbreviations

TBI	Tuberculosis Infection
TB	Tuberculosis
Mtb	Mycobacterium tuberculosis
HBV	Hepatitis B Virus infection
BCG	Bacillus Calmette-Guerin
TSS	Tuberculosis-related Stigma Scale
RMSEA	Root Mean Square Error of Approximation
CFI	Comparative Fit Index
KMO	Kaiser–Meyer–Olkin
NFI	Normed-Fit Index
AVE	Average Extracted Variance Value
CR	Combined Reliability
PTM	Protection Motivation Theory
ADRs	Adverse drug reactions

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-024-19812-z.

Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

Acknowledgements

We thank all of the participants of the survey.The data used in the current study are not publicly available due to privacy or ethical restrictions, but they are available from the corresponding author upon reasonable request.

Authors' contributions

N. W, J. L, L. W, Z. L, and X. L conceived and designed the study. N. W, Y. F and Y. Z drafted the paper. N. W, H. Z, Y. L and X. Y performed the analysis. Y. C assisted with collecting literature and providing suggestions for this manuscript. L. L and Q. W critically revised important intellectual content and agreed to submit the final version for publication.

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Availability of data and materials

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The survey was voluntary and anonymous. Respondents were requested to provide implied informed consent prior to completing the survey. The study protocol complies with the Declaration of Helsinki and obtained approval from the Ethics Committee of Harbin Medical University (HMUIRB2023021).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Department of Social Medicine, School of Health Management, Harbin Medical University, No.157 Baojian Road, Nangang District, Harbin, Heilongjiang 150081, China.

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