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Tuberculosis screening among patients with diabetes mellitus: Is it necessary, and how should it be done? ——A survey of endocrinologists in Hunan Province, China

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Abstract

Background

Diabetes mellitus(DM) is known to increase the risk of tuberculosis(TB) and contribute to adverse outcomes. WHO highlighted the necessity of bidirectional screening for the two diseases. However, the limited literature suggests that endocrinologists don't seem to be actively screen TB among DM patients.

Methods

Stratified sampling was used to select 43 general public hospitals(GPHs) at three different levels in Hunan province of China: 14 3rd-level GPHs, 13 2nd-level GPHs, and 16 1st-level GPHs. 284 endocrinologists working in the enrolled hospitals were invited to participate in the on site questionnaire survey and 277 qualified.

Results

The allocation of digital X-ray cameras, tuberculin skin tests, sputumAcid fast bacillus smears, sputum cultures for mycobacterium tuberculosis, andinterferon gamma release assays in 43 GPHs were 90.7%, 72.1%, 55.8%, 34.9%, 27.9%, with significant differences between there different leves(P both <0.05). 62.5% (173/277) of the endocrinologists considered it necessary to proactively initiate TB screening for DM patients at first diagnosis and 80.9% (140/173) of them considered it necessary to regularly screen TB among DM patients during follow up. However, when admitting patients, 197 endocrinologists chose TB screening only for DM patients with suspected TB symptoms.The most possible reasons DM patients wouldn’t undergo TB screening were “patients refused(76.5%)”, “patients didn’t complain of the main symptom(46.9%)”, and “TB screening related tests haven’t been conducted in the hospital(35.7%)”.

Conclusions

Although endocrinologists displayed some TB related knowledge and awareness of the need for proactive screening, the actual screening rate in the clinical setting was low. This may be related to multiple factors, such as the lack of relevant guidelines, patient communication, or mobilization, or the corresponding tests have not yet been conducted in the hospitals..

Key Points

WHO have highlighted the necessity of bidirectional-screening of tuberculosis and diabetes-mellitus. Although endocrinologists displayed high awareness of proactive TB-screening, the actual screening rate in the clinical setting was low. This may be related to multiple factors: patients, doctors, and medical institutions.

1. Background

Tuberculosis (TB) and diabetes mellitus (DM) are global diseases with high incidences, and both pose a serious threat to human health [1]. The relationship between the two diseases have long been recognized. In the past 10–15 years, studies of various populations in different areas reached similar conclusions [2–9]: DM increases the risks of latent tuberculosis infection (LTBI) and active tuberculosis, and DM-TB co-infectious patients have worse treatment outcomes than patients with simple tuberculosis. DM has been widespread since the 1980s, and the prevalence of global adult DM has increased by 20% in less than 30 years; 80% of these patients are found in low- and middle-income countries such as China [10, 11]. These countries are also high-burden TB countries. This may hinder progress toward the global goal of ending tuberculosis by 2030.

In response to the severe global situation of TB and DM, the World Health Organization (WHO) and the International Federation of Tuberculosis and Pulmonary Diseases highlighted in 2011 the necessity of bidirectional screening [12] and published the Diabetes Mellitus-Tuberculosis Management Basic Practice Guidelines online in 2019. At present, the Chinese version of the practice guidelines has not been released. Although the significance and necessity of joint DM-TB management and bidirectional screening are well known, the complicated bidirectional screening process remains a challenge in China. Few studies have focused on the endocrinologists directly involved in the diagnosis, treatment, and management of DM patients, and the degree of their awareness and implementation of screening for TB among DM patients is unclear.

In view of the fact that DM patients in China usually seek medical management at general public hospitals (GPHs), we conducted a survey in 43 GPHs in Hunan Province of China from November 2019 to January 2020 regarding the allocation of TB screening related tests and endocrinologists' awareness and implementation of TB screening among DM patients. We aim to provide data for the formulation of a DM-TB co-management plan in China.

2. Methods

2.1 Survey questionnaire design

Two survey questionnaires were utilized in the study; both were designed according to TB-related guidelines and textbooks [13–15]. The surveys included single-choice, multiple-choice, and fill-in-the-blank questions.

The first questionnaire was the "hospital questionnaire," which covered basic information of the participating hospitals and the allocation of digital X-ray cameras (DR), tuberculin skin tests (TST), sputum acid-fast bacillus (AFB) smears, sputum cultures for mycobacterium-tuberculosis (MTB), and interferon gamma release assays (IGRA).

The second questionnaire was for endocrinologists; it included their basic information (title, education, working years, and the number of outpatients daily or hospitalizations monthly), their awareness and implementation of screening for TB among DM patients, as well as the reasons for missed screening.

2.2 Sample and grouping

In Hunan Province of central south China, there are 71 3rd -level GPHs, 288 2nd -level GPHs, and 83 1st -level GPHs [16]. We included different levels of GPHs in our sample and used the questionnaires to obtain data regarding health-resource allocation related to TB screening among the three GPH levels in central south China from November 1, 2019 to January 31, 2020. Stratified sampling was used to select 43 GPHs at three different levels in Hunan province: 14 3rd -level GPHs, 13 2nd -level GPHs, and 16 1st -level GPHs. We invited 284 endocrinologists working in the enrolled hospitals to participate in the on-site questionnaire survey; of these, 277 qualified. Finally, we divided the participants into three groups according to GPH level:100 endocrinologists in 3rd -level GPHs, 87 in 2nd -level GPHs, and 90 in 1st -level GPHs.

2.3 Investigation method

After selecting the hospitals, a clinician (non-endocrinologist) was selected and trained online as the investigator in each hospital. Then, the investigator organized participation in the on-site paper questionnaire survey, which was anonymous and submitted on the spot. The endocrinologists were forbidden from consulting books/periodicals and discussing the survey with other participants. The hospital questionnaire was filled out by the investigator after consulting the leader of the relevant hospital department.

2.4 Ethics statement

This study was approved by the Ethical Review Committee of responsible units

(Changsha Central Hospital) and we have obtained verbal informed consent from all subjects who participated in the questionnaire survey.

2.5 Data analysis

Stratified sampling was used in this investigation. Data were analyzed using SPSS 22.0 statistical software using simple descriptive statistics. Comparisons of health-resource allocation related to TB screening among different GPH levels were obtained using the chi-square test. Logic regression analysis was used to determine the relevant factors affecting the endocrinologists' screening awareness. *P*-values ≤ 0.05 were considered statistically significant.

In addition, some concepts were merged or explained in the statistical data: (1) "More patients admitted" was defined as "more than 30 outpatients per day or more than 60 hospitalization per month;" (2) "Imaging examination" was defined as "DR and/or chest computed tomography;" (3) "Immunology examination" was defined as "TST and/or IGRA;" (4) "Bacteriology examination" was defined as "Sputum AFB smear and/or sputum culture for MTB."

3. Results

3.1 Allocation of health resources related to TB screening in different GPH levels

3.1.1 DR

All 2nd - and 3rd -level GPHs were equipped with DR, and only 75.0% of 1st -level GPHs were equipped, resulting in an overall percentage of 90.7%. The difference was statistically significant ($P < 0.05$) (Table 1).

Table 1
Digital X-ray equipment in 43 general public hospitals of different levels

health resources related to TB screening	GPH level	Total GPHs (N)	The nuber of GPHs equipped (n)	The ratio of GPHs equipped (%)	$\chi 2^a$	*P*
DR	1	16	12	75		
	2	13	13	100	7.44[a]	0.0242
	3	14	14	100		
TST	1	16	4	25		
	2	13	13	100	28.09[b]	0.0000
	3	14	14	100		
sputum AFB smear	1	16	0	0		
	2	13	10	76.9	33.64[c]	0.0000
	3	14	14	100		
sputum culture for MTB	1	16	0	0		
	2	13	6	46.1	14.63[d]	0.0007
	3	14	9	64.3		
IGRA	1	16	0	0		
	2	13	2	15.4	20.39[e]	0.0000
	3	14	10	71.4		

[a]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 3.77$, $P = 0.052$; Level 1 vs. Level 3, $\chi^2 = 4.04$, $P = 0.044$.

[b]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 16.63$, $P = 0.000$; Level 1 vs. Level 3, $\chi^2 = 17.50$, $P = 0.000$.

[c]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 18.79$, $P = 0.000$; Level 1 vs. Level 3, $\chi^2 = 30.00$, $P = 0.000$; Level 2 vs. Level 3, $\chi^2 = 3.63$, $P = 0.570$.

[d]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 9.31$, $P = 0.002$; Level 1 vs. Level 3, $\chi^2 = 14.69$, $P = 0.000$; Level 2 vs. Level 3, $\chi^2 = 0.90$, $P = 0.343$.

[e]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 2.64$, $P = 0.104$; Level 1 vs. Level 3, $\chi^2 = 17.14$, $P = 0.000$; Level 2 vs. Level 3, $\chi^2 = 8.17$, $P = 0.003$.

3.1.2 TST

Overall, TST was used in 72.1% (31/43) of GPHs. All 2nd - and 3rd -level GPHs had launched the use of TST; however, only 25.0% (4/16) of 1st -level GPHs had. The difference between the percentage of 1st -level GPHs and that of the others was statistically significant ($P < 0.025$) (Table 2).

Table 2
Use of tuberculin skin tests in 43 general public hospitals of different levels

GPH level	Total GPHs (N)	GPHs using TST (N)	GPHs using TST (%)	$\chi 2^a$	*P*
1	16	4	25		
2	13	13	100	28.09	0.0000
3	14	14	100		
[a]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 16.63$, $P = 0.000$; Level 1 vs. Level 3, $\chi^2 = 17.50$, $P = 0.000$.					
GPH: general public hospital; TST: tuberculin skin tests					

3.1.3 Sputum AFB smear

Overall, 55.8% (24/43) of the GPHs utilized sputum AFB smear; however, none of the 1st -level GPHs had launched the use of sputum AFB smear for local residents. Of the three levels of GPHs, 0%, 76.9% (10/13), and 100.0% utilized sputum AFB smear, respectively ($P < 0.05$) (Table 3).

Table 3
Use of sputum acid-fast bacillus smear in 43 general public hospitals of different levels

GPHs level	Total GPHs (N)	GPHs using sputum AFB smear (N)	GPHs using sputum AFB smear (%)	χ^{2a}	*P*
1	16	0	0		
2	13	10	76.9	33.64	0.0000
3	14	14	100		
[a]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 18.79$, $P = 0.000$; Level 1 vs. Level 3, $\chi^2 = 30.00$, $P = 0.000$; Level 2 vs. Level 3, $\chi^2 = 3.63$, $P = 0.570$.					
GPH: general public hospital; AFB: acid-fast bacillus					

3.1.4 Sputum culture for MTB

Overall, only 34.9% (15/43) of GPHs conducted sputum cultures for MTB. Unfortunately, none of the 1st -level GPHs had launched the use of sputum culture for MTB; of the three levels of GPHs, 0%, 46.1% (6/13), and 64.3% (9/14) utilized sputum culture for MTB, respectively ($P < 0.05$) (Table 4).

Table 4
Use of sputum culture for mycobacterium-tuberculosis in 43 general public hospitals of different levels

GPH level	Total GPHs (N)	GPHs using sputum culture for MTB (N)	GPHs using sputum culture for MTB (%)	χ^{2a}	*P*
1	16	0	0		
2	13	6	46.1	14.63	0.0007
3	14	9	64.3		
[a]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 9.31$, $P = 0.002$; Level 1 vs. Level 3, $\chi^2 = 14.69$, $P = 0.000$; Level 2 vs. Level 3, $\chi^2 = 0.90$, $P = 0.343$.					
GPH: general public hospital; MTB: mycobacterium-tuberculosis					

3.1.5 IGRA

Only 27.9% (12/43) of GPHs conducted IGRA. None of the 1st -level GPHs had launched the use of IGRA for local residents; of the three levels of GPHs, 0%, 15.4% (2/13), and 71.4% (10/14) utilized IGRA, respectively ($P < 0.05$) (Table 5).

Table 5
Use of interferon gamma release assays in 43 general public hospitals of different levels

GPH level	Total GPHs (N)	GPHs using IGRA (N)	GPHs using IGRA (%)	χ^{2a}	*P*
1	16	0	0		
2	13	2	15.4	20.39	0.0000
3	14	10	71.4		
[a]Split chi-square comparison: Level 1 vs. Level 2, $\chi^2 = 2.64$, $P = 0.104$; Level 1 vs. Level 3, $\chi^2 = 17.14$, $P = 0.000$; Level 2 vs. Level 3, $\chi^2 = 8.17$, $P = 0.003$.					
GPH: general public hospital; IGRA: interferon gamma release assays					

3.2 Endocrinologists' awareness and implementation of TB screening among

DM patients

3.2.1 Awareness of active screening

3.2.1.1 Awareness of active routine screening at first diagnosis

Overall, 62.5% (173/277) of the endocrinologists considered it necessary to proactively initiate TB screening for DM patients at first diagnosis. In univariate models, > 5 years working experience, a senior title, and more patients admitted were associated with increased awareness of active routine screening at first diagnosis. In multivariate models, endocrinologists with > 5 years working experience (adjusted hazard ratio [aHR]: 2.536, 95% confidence interval [CI]: 1.395–4.610) and a senior title (aHR: 2.242, 95%CI: 1.021–4.923) remained statistically significant (Table 6).

Table 6
Logistic regression analysis of endocrinologists' awareness of the need for tuberculosis screening among diabetes patients

Variable	Cases, N (%)	Univariate analysis		Multivariate analysis	
		HR (95% CI)	*P*	aHR (95% CI)	*P*
Working in a 2nd - or 3rd - level GPH	178 (64.3)	1.537 (0.920–2.570)	0.101	-	
> 5 years working experience	144 (52.0)	3.595 (2.151–6.008)	0.000	2.536 (1.395–4.610)	0.002
Senior title	72 (26.0)	4.071 (2.066–8.020)	0.000	2.242 (1.021–4.923)	0.044
Master's degree or higher	91 (32.9)	1.164 (0.691–1.962)	0.567	-	
More patients admitted	59 (21.3)	2.260 (1.171–4.362)	0.015	0.703 (0.297–1.668)	0.424

GPH: general public hospital; HR: hazard ratio; CI: confidence interval; aHR: adjusted hazard ratio

3.2.1.2 Awareness of regular screening at follow-up visit

Of the173 endocrinologists with first screening awareness, 80.9% (140/173) considered it necessary to regularly screen for TB among DM patients during follow-up. In both univariate and multivariate models, a master's degree or above (aHR: 2.699; 95% CI: 1.033–7.049) and more patients admitted (aHR: 4.23; 95% CI: 1.212–14.719) were associated with increased screening awareness (Table 7).

Table 7
Logistic regression analysis of endocrinologists' awareness of the need for regular tuberculosis screening among diabetes patients

Variable	Cases, N (%)	Univariate analysis		Multivariate analysis	
		HR(95% CI)	*P*	aHR (95% CI)	*P*
Working in a 2nd - or 3rd - level GPH	123 (64.3)	0.485 (0.187–1.259)	0.137	-	
> 5 years working experience	110 (52.0)	0.846 (0.380–1.885)	0.683	-	
Senior title	60 (26.0)	1.278 (0.563–2.898)	0.557	-	
Master's degree or higher	59 (32.9)	2.741 (1.062–7.076)	0.037	2.699 (1.033–7.049)	0.043
More patients admitted	45 (21.3)	4.286 (1.239–14.819)	0.022	4.233 (1.212–14.719)	0.024

GPH: general public hospital; HR: hazard ratio; CI: confidence interval; aHR: adjusted hazard ratio

3.2.1.3 Regular screening frequency

Of the 140 endocrinologists with regular screening awareness, 72.9% thought the appropriate frequency of regular TB screening is "once a year;" the other 22.1%, 2%, and 10.0% of endocrinologists chose "3–6 months," "1–2 months," and "unclear," respectively.

3.2.2 Choosing TB screening methods

To screen for TB among DM patients without suspicious symptoms, 138 endocrinologists chose pulmonary imaging; 63 chose immunological examination and pulmonary imaging; 20 chose immunological examination, pulmonary imaging, and bacteriological examination; 16 chose only immunological examination; 13 chose pulmonary imaging and bacteriological examination; 4 chose only bacteriological examination; 3 chose bacteriological examination and immunological examination; and the other 20 chose "unclear." Immunological examination was included in the responses of 102 endocrinologists, and pulmonary imaging was included in the responses of 234.

To screen for TB among DM patients with suspicious symptoms, 119 endocrinologists chose immunological examination, pulmonary imaging, and bacteriological examination; 100 chose immunological examination and pulmonary imaging; 16 chose only immunological examination; 14 chose only pulmonary imaging; 12 chose pulmonary imaging and bacteriological examination; 1 chose only bacteriological examination; 1 chose bacteriological examination and immunological examination; and the other 14 chose "unclear." Immunological examination was included in the responses of 236 endocrinologists, pulmonary imaging was included in the responses of 245, and bacteriological examination was included in the responses of 133.

3.2.3 Implementation of TB screening for DM patients

Our survey revealed that endocrinologists' implementation of TB screening for DM patients was not consistent with their screening awareness.

When admitting patients with DM, 71.1% (197/277) of the endocrinologists chose screening for TB only if the patient had suspected TB symptoms or if related test results indicated TB; the other 7.9% (22/277), 7.2% (20/277), and 13.7% (38/277) selected "Routine screening at the first diagnosis," "Routine screening at the first diagnosis and regular screening at the follow-up," and "generally not," respectively.

3.3 Possible factors affecting screening

The top three possible reasons DM patients would not undergo routine TB screening were "patients refused to undergo relevant examinations," "patients did not complain of the main symptom so did not require TB screening,", and "TB-screening-related tests have not yet been conducted in the hospital." The percentages of endocrinologists who selected these reasons were 76.5% (212/277), 46.9% (130/277), and 35.7% (99/277), respectively.

The top three possible reasons for DM patients refusing to be screened for TB were "the patients have no relevant symptoms or medical history and do not think that they may have TB", "the patients do not understand the relevant knowledge of DM and TB," and "economic reasons." The percentages of endocrinologists who selected these responses were 88.1% (244/277), 76.9% (213/277), and 72.2% (200/277), respectively.

4. Discussion

This is the first study to investigate the allocation of TB-screening-related tests and endocrinologists' awareness and implementation of TB screening for DM patients in the GPHs of China. We found that TB-screening-related tests were unevenly implemented in GPHs of different levels, and some of the percentages of GPHs that had implemented tests fluctuated from 0-100%; these were especially low among 1st -level GPHs. More than half of the endocrinologists were aware of the need for active TB screening for DM patients, and their selections of screening tests were relatively reasonable. However, in the clinical setting, the percentages of doctors actively initiating screening is extremely low, which may be caused by three factors: patients, doctors, and medical institutions.

Currently, with implementation of the graded diagnosis and treatment system in China [17–19], most patients with DM, especially asymptomatic patients, choose 1st - and 2nd -level GPHs for the first diagnosis and regular review. According to the practice guidelines, it is necessary to conduct systematic TB screening for newly diagnosed DM patients and DM patients undergoing regular review in China and other countries with a high burden of TB. However, we found the implementation rate of TB-screening-related tests was generally low among GPHs, and the distribution of GPHs at all levels was statistically uneven ($P < 0.05$). Only 2nd - and 3rd -level GPHs were equipped for DR and TST, which are simple and

inexpensive; the percentages of 1st -level GPHs utilizing DR and TST were 75.0% and 25.0%, respectively. The sputum AFB smear, sputum culture for MTB, and IGRA were not popular, with percentages of GPHs at the three levels of only 55.8%, 34.9%, and 27.9%, respectively; 16 1st -level GPHs had not conducted these three tests. This is roughly similar to the various medical-resource deployment trends reported in many provinces and cities across China [20–24]. We inferred that the unbalanced allocation of health resources may be one of the reasons why endocrinologists have failed to proactively initiate TB screening. This inference was also confirmed in a subsequent investigation of the causes of missed screening. For the multiple-choice question “common reasons why DM patients do not receive TB screening,” 35.7% of the endocrinologists’ answers included the option “TB-screening-related tests have not yet been conducted n our hospital.” It was encouraging to note, however, that some endocrinologists’ carefully been noted “this inspection has not yet been conducted in our hospital, but we send specimens to a third-party inspection agency to do the test.” This shows that these endocrinologists have a good grasp of the basic knowledge regarding TB screening and diagnosis.

Our findings have indeed confirmed that endocrinologists’ awareness of the need for TB screening is relatively high. We found that 62.5% (173/277) of the doctors were aware of the need for proactive TB screening among DM patients at first diagnosis; a senior title and more working years were the main factors affecting endocrinologists’ awareness of the need for this first screening. Of these 173 doctors, 80.9% (140/173) were aware of the need for regular screening; education and the number of patients admitted were the main factors affecting this awareness. This shows endocrinologists’ awareness of the need for systematic TB screening of DM patients to be relatively high. The higher the professional title and education level, the longer the working period, and the greater the number of patients admitted, the more likely an endocrinologist will be aware of these issues.

There has been controversy regarding which test is best for TB screening of DM patients. Undoubtedly, bacteriological examination is the gold standard for the diagnosis of TB. However, due to its low positive rate, high technical and specimen requirements, and long time limit, it is not suitable for the screening of asymptomatic individuals [25]. DM increases the risk of LTBI and active TB, and immunological tests such as TST and IGRA are indispensable for LTBI screening [5, 13, 26]. Imaging examination is confirmed to have better sensitivity and specificity in the diagnosis of tuberculosis; it can significantly reduce the need for microbiological examination and is a powerful tool for TB screening [27, 28]. For the multiple-choice question regarding the preferred tests for “TB screening among DM patients without suspected symptoms of TB,” 234 doctors’ responses included “imaging examination,” and the responses of 102 included “immunology examination.” For the multiple-choice question regarding “TB screening/diagnosis for DM patients with suspected symptoms of TB,” 245 endocrinologists’ responses included “imaging examination,” the responses of 236 included “immunology examination,” and the responses of 133 included “bacteriological examination.” The endocrinologists’ choices of screening methods show they have a certain level of TB-related knowledge; it also indirectly points to the methods more readily accepted by doctors and patients.

Inconsistent with the endocrinologists' screening awareness, we found that only 15.1% would initiate TB screening (the first screening and/or regular screening), 71.1% (197/277) would initiate TB screening/diagnosis only when "the patient has suspected pulmonary TB symptoms or related test results indicating TB," and even 13.7% indicated they had "never screened."

We have conducted a subsequent investigation to determine the reasons behind the lack of practical screening and why relevant tests have not yet been conducted in many hospitals (35.7%). As previously mentioned, endocrinologists indicated that the main reasons to be "patients rejected" (76.5%) and "the patient has no relevant symptoms and thought no screening was necessary" (46.9%). The three most commonly reported reasons for patients refusing to be screened for TB were "patients have no relevant symptoms or medical history and do not think that they may have TB," "patients do not understand that DM may be easily combined with TB," and "economic reasons," 88.1%, 76.9%, and 72.2% of the endocrinologist responded with these answers, respectively.

This study has certain limitations. We did not mention the Xpert MTB/RIF in our questionnaire survey because it has not been conducted in most areas of Hunan province and is not been covered by medical insurance. In addition, the small number of doctors participating in the survey may also be a limitation, and it is necessary to organize more regional and larger investigations.

5. Conclusions

In summary, although endocrinologists displayed some TB-related knowledge and awareness of the need for proactive screening, the actual screening rate in the clinical setting was low. This may be related to multiple factors, such as the lack of relevant guidelines, patient communication, or mobilization, or the corresponding tests have not yet been conducted in the hospitals.

The conclusion of the study reminds us that in addition to developing guidelines and documenting the expert consensus on bidirectional screening and joint management for DM and TB, it is equally important to examine resource allocation related to TB screening, pre-job and on-the-job training, advocacy, communication, and social mobilization.

Abbreviations

TB: Tuberculosis; DM:diabetes mellitus; LTBI:latent tuberculosis infection; World WHO:Health Organization; GPHs:general public hospitals; DR:digital X-ray cameras; TST:tuberculin skin tests; AFB:acid-fast bacillus; MTB:mycobacterium-tuberculosis; IGRA:interferon gamma release assays; aHR:adjusted hazard ratio; CI:confidence interval.

Declarations

Author contributions

Conceived and designed the study: Bei Chengli, Deng Ping, Xie Hebin. Designed the questionnaire: Bei Chengli, Yang Fen, Fu Manjiao, Xie Hebin. Trained the investigators: Bei Chengli, Yang Fen. Collected data, analyzed the data and interpreted the results: Bei Chengli, Yang Fen, Xie Hebin. Wrote the paper: Bei Chengli. Revised the manuscript: Bei Chengli, Yang Fen, Fu Manjiao, Xie Hebin, Deng Ping. All authors have read and approved the final manuscript.

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Disclaimer

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Competing interest

The authors declare that they have no competing interests.

Consent for publication

Not Applicable

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