

# Is the tuberculosis knowledge awareness obstructing tuberculosis infection in rural areas of Anqing, China?

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## Research article

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# Abstract

## Background

Health education on tuberculosis is considered as one of the major measures for prevention of tuberculosis disease epidemic. This study is to assess the effects of tuberculosis awareness on tuberculosis infection in rural areas in China.

## Methods

This study was conducted in rural areas of Anhui province, China. There 1118 newly diagnosed TB patients were selected as case group while 384 participants with no TB disease enrolled in control group. Univariate analysis and Multivariable logistic regression model were carried out to assess the effect of TB awareness on TB infection.

## Results

The univariate analysis showed that four core knowledge items of TB, sex, age, education, domicile, smoking, drinking, income, contacting with TB patients, vaccination of bacillus calmette guerin and living area on TB were significantly different between the case and control groups ( $P < 0.05$ ). The multivariate logistic regression analysis revealed that education ( $OR = 0.242$ ,  $P = 0.001$ ), income ( $OR = 0.555$ ,  $P = 0.016$ ) were protective factors and domicile ( $OR = 0.073$ ,  $P = 0.026$ ), contacting with TB patients ( $OR = 3.020$ ,  $P = 0.017$ ) were risk factors for TB infection. However, the awareness or any item of knowledge of TB were not found to be related to TB infection.

## Conclusions

The awareness of TB is not the main influencing factor for TB infection in rural areas, the contents or forms of health education towards TB maybe modified in rural areas.

## Background

Tuberculosis is a serious communicable disease around the world. In 2015, about 10.4 million people developed TB and 1.4 million died from this disease<sup>1</sup>. Current studies revealed that gender and age, degree of education, smoking, contact with TB patients, income level, history of BCG vaccination and infection with HIV were probably associated to TB infection<sup>2-8</sup>. In addition to those factors, the lack of awareness about TB was considered to be the most important factor that increased the risk of exposure to TB<sup>9</sup>. Especially, loss of knowledge on the cause, mode of transmission, and symptoms as well as

irregular treatment of TB would pose a great challenge to control the disease<sup>10–13</sup>. Furthermore, poor awareness of TB was also an influencing factor of MDR-TB<sup>14</sup>.

Unfortunately, the awareness of TB was found to be very poor, especially in rural areas<sup>15,16</sup>. Study from Sudan manifested that there was no significant difference of awareness about TB between TB cases and controls<sup>17</sup>. As a consequence, in order to provide a scientific basis for TB prevention, we conducted this case-control study to assess the effects of awareness on TB infection and explore influencing factors for TB infection in Anqing area.

## Methods

### Study participants and sampling

This study was carried out between June 2014 and December 2015 in Anqing area. The study site was located in typical rural area of central China and in the southwest of Anhui province with relatively high prevalence of TB and the majority of the population were from rural areas with much lower economic level. Therefore, this area is well representing TB epidemic in rural areas of China. A total of 1502 participants were selected in the communities from eight counties, newly diagnosed TB patients were enrolled in the case group, and healthy controls was recruited randomly within the neighborhood or the household of the TB case. The diagnosis are strictly based on laboratory inspections such as chest X-ray examination, sputum smear examination and clinical symptoms. All participants were informed about the objectives of the study and provided verbal informed consent before the survey. Newly detected sputum smear positive pulmonary TB patients > 15 years who had presented at local medical institutions were eligible for inclusion. People who refused to participate or worked in other city were excluded. The study population was finally gathered on the basis of 1118 cases and 384 controls.

We defined cases as adults (aged 15 years and older) with sputum smear positive pulmonary TB. They were interviewed immediately after diagnosis. Those who did not have a sputum smear confirmed diagnosis were excluded from the study. We selected controls randomly that had a sputum smear negative TB from the database. All cases and the controls came from the same source population in this study.

### Study Design And Data Collection

The data collection tool was a unified self-administered questionnaire which was designed according to the World Health Organization guidelines<sup>18</sup>, and then it was pre-tested among 100 people who did not participate in the study and was modified as necessary. Participants were interviewed face-to-face by investigators who had medical science background from local Centers for Disease Control and Prevention (CDC). All information about cases was inquired before their suffering from TB disease.

The questionnaire consists of questions on demographic and socioeconomic characteristics (sex, age, education, domicile, smoking-alcohol abuse, other respiratory system medical history, contact with TB patients, history of BCG vaccination, income and living space) of the study participants and their awareness of TB. The awareness section contained 6 questions (details in Table 1).

Table 1  
Univariate analysis of knowledge awareness of TB infection

Question	Case ( <i>n</i> = 1118)%	Control ( <i>n</i> = 384)%	<i>P</i> -Value
Do you know relevant information about tuberculosis			0.436
Awareness	612(54.38)	219(56.25)	
Unawareness	506(45.62)	165(43.75)	
What is the main pathogen causing tuberculosis			0.001
Awareness	463(41.41)	199(51.82)	
Unawareness	655(58.59)	185(48.18)	
What is the cardinal symptom of TB patients			0.044
Awareness	611(54.65)	187(48.70)	
Unawareness	507(45.35)	197(51.30)	
Is tuberculosis a contagious disease			0.634
Awareness	881(78.80)	307(79.95)	
Unawareness	237(21.20)	77(20.05)	
What is the source of infection of tuberculosis			0.001
Awareness	384(34.35)	98(25.52)	
Unawareness	734(65.65)	286(74.48)	
What is the route of transmission of tuberculosis			0.040
Awareness	615(55.01)	188(48.96)	
Unawareness	503(44.99)	196(51.04)	

## Statistical Analysis

After the data was organized and edited to allow computer entry of all responses. Data was entered into database established using EpiData 3.0 with double entry. SPSS 18.0 was used for statistical analysis. Descriptive statistics with table of frequency distribution was used to summarize demographic and

socioeconomic characteristics and the level of knowledge towards TB. Pearson chi-square test was conducted to evaluate the statistical significant of sex, age and other demographic and socioeconomic variates with the outcome variables (TB infection) in univariate analysis. In the knowledge section, chi-square test was carried out to evaluate the association of the awareness of TB with the outcome variables. At last, multivariable logistic regression model was used to identify the influencing factors and odds ratio (OR) was used to report strength of association between the final variables and the target outcome variables.  $P < 0.05$  was considered to indicate a statistically significant difference.

## Results

### General information

A total of 1118 cases averaged  $50.98 \pm 17.97$  years of age, the youngest and the oldest of whom were 15 and 90 years of age respectively. 384 controls averaged  $36.52 \pm 18.01$  years of age, the youngest and the oldest of whom were 8 and 93 years of age respectively. Male: female ratio in case and control groups were 2.58:1 and 1.26:1 respectively.

The study participants were classified into four age groups: 60 years of age or older, 40 to 59 years of age, 25 to 39 years of age, 15 to 24 years of age. Significant difference was detected in case and control groups ( $P < 0.001$ ) and details have been presented in Table 2.

Table 2  
Univariate analysis of influencing factors for TB infection

Characteristics	Case ( <i>n</i> = 1118)%	Control ( <i>n</i> = 384)%	<i>P</i> -Value
Sex			< 0.001
Male	806 (72.09)	214 (55.73)	
Female	312 (27.91)	170 (44.27)	
Age group (yr)			< 0.001
8–24	146 (13.06)	117 (30.47)	
25–39	158 (14.13)	99 (25.78)	
40–59	354 (31.66)	123 (32.03)	
≥ 60	460 (41.15)	45 (11.72)	
Education			< 0.001
Primary Schooling or below	655 (58.59)	96 (25.00)	
High school	409 (36.58)	228 (59.38)	
College degree or above	54 (4.83)	60 (15.62)	
Domicile			< 0.001
Urban dwellers	133 (11.90)	86 (22.40)	
Rural dwellers	985 (88.10)	298 (77.60)	
Smoking			< 0.001
Yes	262 (23.43)	71 (18.32)	
Quit	236 (21.11)	26 (6.54)	
No	620 (55.46)	287 (75.13)	
Drinking			0.071
Yes	310 (27.73)	88 (22.91)	
No	808 (72.27)	296 (77.09)	
Average annual income(RMB)			< 0.001
< 4000	421 (37.66)	120 (31.25)	
4000–11000	509 (45.53)	133 (34.64)	
> 11000	188 (16.82)	131 (34.11)	
Contact with TB patients			0.004

Characteristics	Case ( <i>n</i> = 1118)%	Control ( <i>n</i> = 384)%	<i>P</i> -Value
Yes	151 (13.51)	72 (18.75)	
No	491 (43.92)	182 (47.40)	
Have no idea	476 (42.57)	130 (33.85)	
BCG vaccination			< 0.001
Yes	421 (37.66)	275 (71.61)	
No	697 (62.34)	109 (28.39)	
Living area (m <sup>2</sup> )			0.028
< 30	391 (34.97)	165 (42.97)	
30–60	613 (54.83)	183 (47.66)	
> 60	114 (10.20)	36 (9.37)	

## Univariate Analysis Of Knowledge Awareness On Tb Infection

Table 1 showed that questions of “What is the main pathogen causing tuberculosis”, “What is the cardinal symptom of TB patients”, “What is the source of infection of tuberculosis” and “What is the route of transmission of tuberculosis” differed significantly compared with control group ( $P < 0.05$ ); While there were no significant differences at the questions of “Do you know relevant information about tuberculosis” and “Is tuberculosis a contagious disease” compared with the control group.

## Univariate Analysis Of General Influencing Factors

Table 2 showed that sex, age group, education, domicile, smoking, drinking, average annual income, contact with TB patients, BCG vaccination and living area differed significantly compared with the control group ( $P < 0.05$ ); While there were no significant differences in drinking.

## Multivariate logistic regression analysis of knowledge awareness for TB infection

Table 3 showed the results of the multivariable analysis. Four questions above, sex, age, education, domicile, smoking, average annual income and contact with TB patients were put into multivariate logistic regression model to identify the influencing factors for TB. After adjustment for age, education, domicile, smoking status, income, contact with TB patients, the following variables remained in the final

model: education( $OR = 0.242$ ,  $P = 0.001$ ), income( $OR = 0.555$ ,  $P = 0.016$ ), domicile ( $OR = 0.073$ ,  $P = 0.026$ ), contacting with TB patients ( $OR = 3.020$ ,  $P = 0.017$ ).

Table 3  
Multivariate logistic regression analysis for knowledge awareness

Factors	<i>B</i>	<i>S.E.</i>	<i>Wald</i> $\chi^2$	<i>OR</i>	<i>95%CI</i>	<i>P</i>
Education	-1.420	0.330	18.473	0.242	0.126–0.462	0.001
Domicile	0.928	0.417	4.958	0.073	0.006–0.821	0.026
Income	-0.589	0.245	5.795	0.555	0.344–0.896	0.016
Contact with TB patients	1.105	0.462	5.737	3.020	1.222–7.463	0.017
Adjustment for age, education, domicile, smoking status, income, contact with TB patients						

## Discussion

The results of this study showed that most of the community's members of rural area have information about TB disease. The finding is similar to the results of studies from Afar Region<sup>19</sup>, South West Ethiopia<sup>20</sup> and North Ethiopia<sup>21,22</sup>, Malaysia<sup>23</sup> and rural China<sup>24</sup>. In our study, about 44.07% of the respondents (41.41% for case and 51.82% for control) knew that TB was caused by *Mycobacterium tuberculosis*, which was higher than 3.3% in Itang special district, South West Ethiopia<sup>25</sup>. More than half of the participants (53.13%) responded correctly to the question that main symptoms of tuberculosis, which was inferior to high-school learners (63.0%) in South African<sup>26</sup> and members (72.4%) in Somali Regional State (SRS) of Ethiopia<sup>27</sup>. A majority of people (79.09%) identified that TB was a communicable disease and 53.46% were aware of its transmission route, which was in accordance with the study in Ethiopia (80.0%)<sup>27</sup>. Univariate analysis showed that the second, third, fifth and the sixth core information differed significantly compared with the control group. In Esmael A and Obuku EA's research, lack of knowledge and erroneous beliefs about TB are common amongst TB patients<sup>15,28</sup>. In view of demographic and socioeconomic factors, our findings showed that males have higher risk of TB than females, which was in line with previous studies of tuberculosis<sup>29,30</sup>. The risk of TB increased progressively with age in the case group<sup>31</sup>, probably because of low immune level among aged. We found that the risk of TB in cases with higher education background were much lower than those with less education, in another words, high degree of education was the protective factor of TB<sup>29</sup>, it may be because higher-educated people know how to protect themselves better. Findings from some studies<sup>32–34</sup> revealed that smoking was independently associated with TB, which was consistent with our findings. Our results were in line with previous studies<sup>35</sup> in that a higher income was consistently associated with reduced TB risk. It is likely that people with higher income will have higher medical assurance level. Close contact with TB patients was another well described risk factor for TB<sup>36,37</sup>. This study showed that BCG vaccination differs significantly from the control group<sup>38</sup>. In Lienhardt C' research<sup>9</sup>, overcrowding has



been previously documented as a strong risk for TB, which was in line with our results. In multivariate analysis, we put demographic and socio-economic factors with significant differences in univariate analysis and four core TB information into logistic regression equation. However, four core TB information was not as significant as other studies on TB infection. It reveals that the awareness of TB don't play an important role as expected in Anqing, China or probably suggests that health education was not far from enough in the region. In other words, the results at least guide us to change the direction of TB prevention in this area.

## **Limitations**

In this study, there are several limitations. Firstly, this research was conducted in the specified region of Anqing area, which may not be representative of those at the national level. Secondly, the questionnaire did not contain the information on occupation and HIV status.

## **Conclusions**

In summary, our study identified some influencing factors associated with TB infection, of which education, average annual income were protective factors for TB infection, while domicile, contact with TB patients were risk factors. However, it turned out that knowledge awareness of TB has little relationship with TB infection. The contents and forms of health education towards TB maybe modified in rural areas.

## **Abbreviations**

OR:Odds ratio; CI:Confidence interval; MDR-TB:Multi drug resistance TB; TB:Tuberculosis; MDR-TB:Multiple drug resistance TB; BCG:Bacillus Calmette - Guerin;

## **Declarations**

## **Ethical considerations**

The study was carried out in compliance with the Declaration of Helsinki of the World Medical Association, and according to a protocol approved by Medical Ethics Committee of Wannan Medical College. The objectives of the study were explained to the study participants and verbal consent was obtained before interviewing each participant.

## **Conflict of Interest:**

No conflict of interest was declared by the authors.

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## Authors' contributions

YFZ analyzed and interpreted the data, drafted and revised the manuscript. YFW conceived and designed the study, participated in data collection and critically reviewed the manuscript. ZPZ, HW, XMW, CXW, and HX participated in data collection and reviewed the manuscript. All authors read and approved the final manuscript version for publication.

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