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<td>doi</td>
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Demographic and Socioeconomic Disparity in Knowledge About Tuberculosis in Inner Mongolia, China

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Received February 6, 2014; accepted December 2, 2014; released online March 21, 2015

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ABSTRACT

Background: The aim of this study is to evaluate the awareness status, attitudes, and care-seeking behaviors concerning tuberculosis (TB) and associated factors among the public in Inner Mongolia, China.

Methods: A five-stage sampling was conducted, in which counties as the primary survey units and towns, villages, and households as sub-survey units were selected progressively. A standardized questionnaire was used to collect TB information. Complex survey analysis methods, including the procedures of survey frequency and survey logistic regression, were applied for analysis of TB knowledge and associated factors. The sample was weighted by survey design, non-respondent, and post-stratification adjustment.

Results: Among 10,581 respondents, awareness that TB is an infectious disease was 86.7%. Knowing that a cough lasting ≥3 weeks is suggestive of TB was 26.9%. Knowledge about TB dispensaries in county administrative areas was reported by 68.3% of respondents, and knowledge about the free TB detection/treatment policy was reported by 57.5% of respondents. About 52.5% of participants would stigmatize TB patients. Compared with the majority Han ethnic group, Mongolians and other minorities were 1.52–2.18 times more likely to know about TB curability, TB symptoms, the free detection/treatment policy, and TB dispensaries’ locations, but were less likely to know about the TB transmission mode (odds ratio, 0.74; 95% confidence interval, 0.65–0.84). The main sources of TB information were TV (65.6%) and other persons (47.2%). In the past year, 19.7% of TB knowledge was from acquaintances, and 16.1% was from TB institutes.

Conclusions: Improvement in knowledge about TB risk (symptoms and transmission), the free treatment policy, and facilities is necessary and should be provided through effective multimedia for different target populations.

Key words: tuberculosis; knowledge; ethnic groups; media source; China

INTRODUCTION

China has the second largest tuberculosis (TB) epidemic in the world, with an estimated annual incidence of 1.30 million cases and 160,000 deaths, and the prevalence of pulmonary TB in 2000 was 367 per 100,000 people.1 Knowledge about TB and awareness of medical assistance are important for the success of TB control and prevention.2,3 Delays in TB case detection and treatment are associated with lack of TB knowledge, poor attitudes toward personal health, traditional beliefs and cultural factors, inability to access affordable healthcare services, and fear of stigmatization.4–9

Inner Mongolia is a multi-ethnic, geographically vast region and has the third-worst TB prevalence in China. The 4th national TB survey showed that the prevalence of TB and smear-positive TB was 612 and 146.4 per 100,000 people in Inner Mongolia in 2000, respectively.10 China issued a 10-year National TB Control Plan (2001–2010), aiming to
achieve 80% TB awareness among the public, 90% training of
TB prevention techniques among village doctors, and 100%
involvement in TB prevention and treatment by medical
institutes.\textsuperscript{1,2} Since then, a series of health promotion activities
have been carried out, including a campaign to spread
knowledge about TB using posters and commercials on
TV and in other media.\textsuperscript{2} To monitor the progress of the
implementation, Inner Mongolia participated in a national
population-based cross-sectional study on knowledge,
attitudes, and practices (KAP) concerning TB in public in
2006.\textsuperscript{11} Information about TB knowledge at the national level
was published by the Chinese Center for Disease Control
and Prevention (China CDC); however, information about
Inner Mongolia, the region with the largest population of
Mongolians in China, has not been reported.

The present study aimed to estimate the level of knowledge,
attitudes, and health-seeking behaviors concerning TB among
the public and to examine how those are affected by
demographic, socioeconomic, and policy factors in Inner
Mongolia. This study can serve as baseline information of
TB knowledge among the public for monitoring the
achievement of health promotion and TB control programs
in Inner Mongolia in the future.

\textbf{METHODS}

\textbf{Study population and sampling}

Participants were residents of Inner Mongolia aged 12 to 65
years who had lived at their present residence for more than
six months before the survey started. In the survey, a five-
stage sampling scheme was adopted, following the framework
of the ‘Third National Health Service Survey’.\textsuperscript{2,12} In brief,
101 counties in Inner Mongolia were first categorized into 3
groups based on their gross domestic product (GDP) in 2005
(<185/185–370/≥370 million USD); then, 3 counties were
randomly selected from each GDP group. Further, through
a systematic randomized method, 2 towns from each county,
3 villages/communities from each town, and 100 households
from each village/community were selected, step by step.
Finally, from each selected household, two individuals were
chosen whose birthdays were closest to the interview date.
Unsuccessfully interviewed subjects, such as those who
missed visits three times, were replaced by individuals
within five years’ age difference, who were from the nearest
non-sampled villages (eFigure 1).

\textbf{Questionnaire}

The standardized questionnaire from the national survey
included information on demographic and socioeconomic
characteristics (age, sex, ethnicity, education, occupation,
economic area, marital status, health insurance, and family
income in the past year), knowledge, attitude, and related care-
seeking behavior concerning TB (27 questions), as well as
questions on how TB information was received, from which
sources, and what the favorite TB information they received
was.

The validity of the questionnaire was established through
content and expert validity.\textsuperscript{2} Participants were interviewed by
investigators from local CDCs and TB dispensaries who were
intensively trained at the provincial level.\textsuperscript{2} Twenty percent
of questionnaires from each sampled village/community were
randomly selected for verification, and 5% of questionnaire
responders were re-interviewed at their household by the
investigators from the provincial CDC. The study was
approved by the China National Ethics Committee of
Operational Research on TB and the Inner Mongolia
Department of Health.

\textbf{Data analysis}

In total 10 800 questionnaires were delivered to the selected
study subjects. The response rate was 98.2%. From 10 604
collected questionnaires, 23 questionnaires with systematic
errors were excluded, leaving 10 581 subjects for final
analysis.

The internal consistency of TB knowledge outcomes were
tested by Cronbach’s alpha, which included the overall
awareness of TB as an infectious disease, that TB is
transmitted by coughing/sneezing of TB patients, prolonged
cough lasting three weeks or more being suggestive of TB,
the curability of TB, the free TB detection/treatment policy,
TB dispensaries in the county and larger administrative area,
and stigmatization of TB patients. The outcomes of TB
knowledge (7 questions) were categorized as either correct or
incorrect answers (including missing values). Complex survey
data analysis methods were applied for the sample weighted
by multiple sampling design, non-respondent rates, and post-
stratification adjustments. The sample design weights were
estimated according to the 2000 Inner Mongolia census
(eTable 1). The post-stratification weights were calculated
from the percentages of combination cells of age (5 groups),
sex (2 levels), ethnicity (3 categories), education (3 levels),
and region (2 levels) from the census divided by the
percentages of corresponding cells in the sample after being
weighted by survey design and non-response rate.\textsuperscript{13,14}

Survey logistic regression models were applied to measure
associations between each TB knowledge outcome and
demographic and socioeconomic factors, with adjusted odds
ratios (ORs) and 95% confidence intervals (CIs) presented.
In addition, one point was given for each correct answer to
measure the overall knowledge acquired.\textsuperscript{15} The proportions
and means of outcomes were computed by weighted samples.
All analysis procedures were conducted after stratifying by
GDP levels and clustering by counties, towns, villages, and
households. Survey variances were estimated by the Taylor
series variance method. All analyses were performed using
SAS 9.31 statistical software (SAS Institute, Cary, NC, USA).
All $P$ values reported were two-sided and the significance
level was set at $<0.05$. 

\textit{J Epidemiol} 2015;25(4):312-320
RESULTS

Table 1 shows the characteristics of 10,581 unweighted and 23,323,349 weighted survey participants. The mean (standard error) age was 37.4 (0.20) years. Farmers had lower income (44.6% in the lowest category of family income) and less education (41.9% in elementary or lower level) than other occupations. More than 28.8% of students were from rural areas. The percentage with health insurance was lower among farmers (31.9%), commercial and service employees (25.1%), and students (20.8%) than among participants with other occupations. Compared with ethnic Han, minorities had lower education (29.1% vs 20.9% in elementary school or lower and 22.2% vs 35.9% in high school or above; \( P < 0.001 \)), more rural residents (71.5% vs 33.3%; \( P < 0.001 \)), more residents with middle and fewer with high family income (37.7% vs 27.4% and 24.3% vs 30.3%; \( P < 0.001 \)), more unmarried residents (26.1% vs 21.5%; \( P < 0.001 \)), and fewer with medical insurance (23.9% vs 42.5%; \( P < 0.001 \)).

Knowledge of TB

The Cronbach’s alpha values for testing the internal consistency of TB knowledge outcomes were between 0.655 and 0.827. Considering all respondents, 91.1% had heard of TB and 86.7% knew TB is an infectious disease (Table 2). About 80.7% of respondents knew at least 1 TB symptom, 26.9% knew the suggestive TB symptom (cough), and 63.3% knew the TB transmission mode. More than 68.3% were aware of the existence of TB dispensaries in the county and larger administrative area, while 85.1% believed that TB could be partially or completely cured, and about 57.5% knew about the national policy of free TB diagnosis and treatment.
and services employees, and students had lower TB or had higher family income (Table 3). Farmers, commercial resided in an urban area, were married, had medical insurance, TB knowledge scores were higher in residents who were male, Knowledge in subpopulation participants had ever learned from or provided others with prevention and control; however, less than 13.6% of total of 7.0% responded to all 7 outcome questions correctly. TB knowledge (ie, the suggestive TB symptom of cough and respondents who responded correctly to 2 key questions about as usual if their neighbors suffered from TB. The rate of Only 32.1% would give support to or treat their neighbors as usual if their neighbors suffered from TB. The rate of respondents who responded correctly to 2 key questions about TB knowledge (ie, the suggestive TB symptom of cough and the free TB detection/treatment policy) was 21.0%; 19.9% correctly answered 3 key questions (also knowing about TB dispensaries in the county or larger administrative area). A total of 7.0% responded to all 7 outcome questions correctly. About 88.9% of participants were willing to learn TB knowledge or to attend community activities for TB prevention and control; however, less than 13.6% of participants had ever learned from or provided others with the TB knowledge (Table 2).

Knowledge in subpopulation TB knowledge scores were higher in residents who were male, resided in an urban area, were married, had medical insurance, or had higher family income (Table 3). Farmers, commercial and services employees, and students had lower TB knowledge scores than other occupations. Compared to the 12–19 years age group (78.2% were students), participants aged 20–29 years were 1.44 times more likely to know of the TB free detection/treatment policy. Men were 15%–22% more likely than women to know the suggestive TB symptoms, transmission mode, treatment policy, and the location of TB dispensaries. Urban residents were 27%–94% more likely than rural residents to know about TB, except for the TB treatment policy. Married persons were 52%–91% more likely than others to have TB knowledge (except for knowledge of the suggestive TB symptoms).

Among occupations, health care workers were 3.48–4.39 times more likely than farmers to know the suggestive TB symptoms, treatment policy, and TB dispensaries. Commercial and service employees and factory workers were 50%–33% less likely to know about TB treatment policy than farmers. Compared with Han Chinese, minorities were 1.52–2.18 times more likely to have TB knowledge but 26% less likely to know about the TB transmission mode. These disparities in acquired TB knowledge among Han and minorities are shown in Figure 1.

The higher their education, the more TB knowledge participants had acquired (Figure 2). Adjusted ORs were 1.43–4.03 in participants who had junior high school education and above compared with those who had only elementary or lower education. Similarly, middle- and high-income families were 1.25–2.51 times more likely than lower-income families to know about TB’s infectiousness, curability, transmission mode, and TB dispensaries; but were 27%–17% less likely to know suggestive TB symptoms. In addition, participants who were from rural areas, had less education, or were farmers or professional technicians were more likely to stigmatize TB patients than participants in other groups.

Sources of tuberculosis knowledge TV programs (65.6%) and personal sources (47.2%) were the main communication channels of TB knowledge, while less influential channels were TB campaigns or exhibitions (3.6%), the internet (4.4%), schools (6.2%), and audiovisual products (0.8%). Among persons who knew the suggestive TB symptom, the main sources were cassettes/tapes/CDs (53.1%) and the internet (49.9%), and the least influential source was from other persons (26.5%). In participants knowing the TB treatment policy, the main sources were cassettes/tapes/CDs (86.4%) and posters (80.0%), and the least influential sources were schools (66.8%) and other persons (62.5%). Further, the main source in participants knowing about the locations of TB dispensaries was posters (92.0%), and the least influential sources were schools (75.7%) and other persons (72.0%). TB knowledge obtained in the past year was almost equally obtained from family members, acquaintances, general medical settings, or TB institutes, which were more common sources than school teachers or schoolmates (P < 0.001). The favorite source of TB information varied (P < 0.001) (Table 4).

DISCUSSION
It is evident that there are major gaps in knowledge about TB among demographic and socioeconomic groups in Inner
Mongolia. Although the overall awareness of TB in Inner Mongolia was above the contemporary target of the national TB control strategy, core knowledge about TB, such as the TB transmission mode, suggestive symptoms, and the national free TB detection/treatment policy, was less known (~70%). Particularly, lower levels of TB knowledge were evident among farmers, students, rural residents, and those who had less education or lower income.

The highest priority of TB control is early diagnosis and treatment of infectious TB cases.7 More than two months’ delay in TB diagnosis may increase the likelihood of developing smear-positive TB by seven- to eight-fold.16 Lack of sufficient awareness among the public of the symptoms and signs of TB is one of the factors responsible for treatment delay.8,15,16 Overall TB awareness among the public in Inner Mongolia was lower than the national average (89.0%)9 and in Yangzhong, a rich county in the southeast of China (92.1%),17 but higher than in Gansu province (68.7%).18 The core knowledge acquired in Inner Mongolia was higher than the national average (11.3%) for 2 key questions and 9.1% for 3 key questions) but similar to Gansu province (23% for 2 key questions and 20.2% for 3 key questions).19 The awareness levels of TB policy and TB dispensaries in Inner Mongolia were higher than Xian (45.9%) aware of TB policy)19 and Yangzhong (39.2% and 42.3%) provinces.17 However, awareness in Inner Mongolia of TB symptoms and of transmission mode were higher than in Shaxi province (13.9% and 55.4%)20 but lower than in Xian province (48.4% and 90.7%).19

In this study, the overall level of awareness of TB infection was similar to the U.S. National Health Interview Survey in ≥18-year-old household residents (87.0%) between 2000 and 2005.13 In our study, the rate of responding correctly about the TB airborne transmission route (63.3%) was similar to that in a study in Vietnam (62.4%)15 and higher than in studies in the U.S. (44%)21 and Serbia (22.9%).22 Awareness of TB curability (85.1%) was higher than in the U.S. study (32.0%)21 and Vietnamese study (74.0%)23 and similar to the rate in the Serbian study (86.6%).22 The proportion of correct answers to all 7 outcome questions in our study was similar to the
national average (9.1%)\(^2\) and higher than in the Vietnamese survey (4.4%).\(^{15}\)

In our study, women, students, farmers, the unmarried, those with economic difficulties, and less educated people appeared to have less TB knowledge, which was similar to the results of other studies.\(^2,17,20,23,24\) Mongolians and other minorities were more likely than ethnic Han to know about the national policy of free TB treatment and about TB symptoms and curability but were less likely to know about the TB transmission mode. For TB transmission mode, about 34.0%
of minorities answered ‘don’t know’ or ‘not sure’, which was higher than in Han respondents (17.6%). This might be due to traditional beliefs about transmission of diseases in Mongolian ethnic groups, such as ‘TB was inherited’ and ‘worked very heavily and drank cold water immediately after, causing the lung to split into pieces’.22 It should be noted that Mongolians and other minorities were more likely to have lower education, be rural residents, be unmarried, and have no health insurance than Han respondents. In addition, the low rate of TB knowledge acquisition among commercial and service employees should also be given close attention. These phenomena might reflect the ineffective or insufficient coverage of TB information delivered by media and/or mass campaigns in Inner Mongolia. The rapid economic growth and urbanization in parts of Inner Mongolia and the increasing migrant population has led to a wider gap between urban and rural areas.25 It has been reported that the levels of knowledge and awareness of TB in urban residents were lower than that of rural residents.26 Nevertheless, more targeted TB control programs in different subpopulations need to be considered by policy-makers.

Diagnostic delay in the healthcare system may occur due to a lack of availability of services or low awareness of TB among healthcare workers.7 Surprisingly, only 57.1% of health employees in our study gave correct answers about the 3 key questions regarding TB knowledge, and 18.6% gave correct answers for all 7 TB knowledge questions, although their correct response rates were higher than among other respondents. In this study, about 25.4% of participants would initially visit various hospitals or clinics other than TB-related settings if they suspected TB infection. It has been reported that less educated, low-income, and old people were less likely to seek care at all or more likely to seek care at the village level than others.23 Training in TB knowledge for health workers in local medical settings needs to be strengthened, as they should remain vigilant and may reduce the TB diagnosis delay by regulating doctor referrals in TB control and prevention.17,19,27

Health-seeking behavior is not only decided by the KAP of individual patients, but also by socio-cultural determinants, such as stigma.6 Stigmatization can lead to further social isolation, delayed diagnosis, and poor adherence to therapy and can also contribute to a continued increase in TB incidence and the problem of drug resistance.28,29 In this study, 52.5% of participants were likely to keep their distance from TB patients, which was lower than the national average (71.9%) but still high.2 Thus, health promotion campaigns to reduce social stigma by reinforcing the belief that TB is widespread and treatable should be implemented, along with improving TB knowledge among the public.2,28

The sources of TB information most commonly reported in our study were similar to those reported in the survey in Vietnam (64.6% from TV and 42.7% from friends/relatives).15 As the coverage of TV programs and communications with acquaintances are high, these two ways of delivering or sharing TB information should be strengthened. However, for specific knowledge (eg, coughing for three weeks or more is suggestive of TB), TV programs and personal communications might not be the best way. In addition, the proportion of respondents receiving TB information in schools was very low. As modern technology develops, besides the current paper-based promotion materials, new and effective multimedia methods, such as the internet and audiovisual materials for campaigns or routine deliveries, are necessary. Such campaigns should include materials in minority languages and uncomplicated materials for less educated people. Inner Mongolia has made efforts and achieved substantial results in reducing the TB burden in the past decades. However, education of the public to achieve broad dissemination and pertinence of TB information through every possible means and in every possible venue, including the media, public health departments, and school systems, must go forward to continue TB control improvement.27 Without extensive public health education, the significant activities of the past years, which have dealt creatively with the reappearance of TB, will diminish in importance.

**Limitations**

First, we used data from the 2000 Inner Mongolia census to calculate the sample design weights, due to the unavailability of information on administrative divisions and populations in selected towns, villages, and households in 2006. This may have resulted in slightly different estimations of weights and potential outcome variances in this study. Second, some lifestyle-related factors, such as smoking, alcohol drinking, and chronic disease history, were not

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**Table 4. Sources and communication channels of tuberculosis information**

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<tr>
<th>Source of TB knowledge</th>
<th>% weighted sample</th>
<th>95% CI</th>
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<tr>
<td>Broadcast</td>
<td>33.4</td>
<td>32.0–34.9</td>
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<tr>
<td>Newspaper/magazine/book</td>
<td>21.4</td>
<td>20.1–22.7</td>
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<tr>
<td>Pamphlet/leaflet</td>
<td>29.5</td>
<td>28.2–30.9</td>
</tr>
<tr>
<td>Television</td>
<td>65.6</td>
<td>64.2–67.0</td>
</tr>
<tr>
<td>Campaign/exhibition</td>
<td>3.6</td>
<td>3.0–4.1</td>
</tr>
<tr>
<td>Poster</td>
<td>16.7</td>
<td>15.6–17.9</td>
</tr>
<tr>
<td>Internet</td>
<td>4.4</td>
<td>3.8–5.1</td>
</tr>
<tr>
<td>Other person</td>
<td>47.2</td>
<td>45.8–48.6</td>
</tr>
<tr>
<td>School</td>
<td>6.2</td>
<td>5.5–7.0</td>
</tr>
<tr>
<td>Cassette/video tape/CD</td>
<td>0.8</td>
<td>0.5–1.0</td>
</tr>
<tr>
<td>Source of TB knowledge last year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family member or relative</td>
<td>15.7</td>
<td>14.6–16.8</td>
</tr>
<tr>
<td>Colleague/friend/neighbor</td>
<td>19.7</td>
<td>18.5–20.9</td>
</tr>
<tr>
<td>School teacher/schoolmate</td>
<td>7.5</td>
<td>6.7–8.3</td>
</tr>
<tr>
<td>Private/village/township/county hospital or clinic</td>
<td>16.8</td>
<td>15.8–17.7</td>
</tr>
<tr>
<td>TB dispensary/local CDC/TB hospital</td>
<td>16.1</td>
<td>15.1–17.1</td>
</tr>
<tr>
<td>Favorite TB information media</td>
<td></td>
<td></td>
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<tr>
<td>Audio-visual materials</td>
<td>13.0</td>
<td>12.1–13.9</td>
</tr>
<tr>
<td>Written materials</td>
<td>25.9</td>
<td>24.6–27.3</td>
</tr>
<tr>
<td>Picture-based materials</td>
<td>16.5</td>
<td>15.5–17.5</td>
</tr>
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</table>

CI, confidence interval; CDC, Center for Disease Control and Prevention; TB, tuberculosis.

*Multiple choice.*

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Disparity of Tuberculosis Knowledge in Inner Mongolia
collected for adjustment in the multivariate analysis.\textsuperscript{21} Third, we only used cough as the suggestive TB symptom in the analysis, although other signs and symptoms were mentioned in this study.\textsuperscript{2}

**Conclusions**

The level of overall public awareness of TB in Inner Mongolia was higher than the contemporary national strategy target; however, core knowledge was still relatively low and showed disparities among ethnicities, occupations, and regions. The fundamental way to increase early TB care behavior is to increase TB knowledge among the public. Health promotion campaigns need to be regularly conducted using effective multimedia-based materials that suit different demographic groups (women, farmers, students, rural residents, minorities, and those with lower education). Further, similar studies need to be carried out to measure and monitor the changes in KAP when fulfilling national and regional TB control and prevention programs in Inner Mongolia.

**ONLINE ONLY MATERIALS**

eTable 1. Sample design weights and non-response weight.

**ACKNOWLEDGEMENTS**

The authors are grateful for significant contributions to the data collection by the staff from Yuquan District Center for Disease Control and Prevention (CDC), Huhhot; Qingshan District CDC, Baotou; Chenbahu Banner CDC, Hulunbeier; Ewenke Autonomous Banner Tuberculosis Dispensary, Hulunbeier; Keerqinyouyiqian Banner Tuberculosis Dispensary, Xing’an; Shangdu County CDC, Jining; Zhuozi County CDC, Jining; Zhenglan Banner CDC, Xilingoule; and Hangjinhou Banner CDC, Bayannaoer. We thank Brian K. Purdue, Medical English Communications Center, University of Tsukuba, for excellent English revision.

E Ma and L Ren made equal contributions to this study, analyzed the data, and wrote the manuscript; L Ren, W-S Wang, and Y Ren, implemented this study; L Ren and Y Ren designed this study; and H Takahashi, Y Wagatsuma, F Gao, F-F Gao, W-R Wang, and L Bi critically reviewed and revised the manuscript.

Conflicts of interest: None declared.

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