



**Level of Awareness of Tuberculosis
Among Residents of Urban Communities:
Towards a Framework for a Comprehensive
Community-Based TB Prevention Program**

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ABSTRACT

This study evaluates the level of tuberculosis prevention and control awareness among Meilihu community residents in Huaiyin District, Jinan City, Shandong Province, to facilitate targeted dissemination of tuberculosis knowledge. The study uses a purpose sampling, and a questionnaire survey was administered to selected residents. The survey incorporated the 2006 China Public Knowledge, Belief, and Behavior Questionnaire on Tuberculosis Prevention and Control. A total of 200 questionnaires were distributed, with 156 meeting the qualification criteria. Notably, the lowest awareness rate (21.15%) pertained to the understanding that tuberculosis patients should seek evaluation, treatment, and management at specialized tuberculosis prevention and control institutions. Multi-factor analysis showed that the factors affecting the score of TB control knowledge were age, education level and sex. The inhabitants of Meilihu exhibit a comparatively modest comprehension of tuberculosis prevention and control measures. Health education should be strengthened for the elderly group, the population with lower education level, and the female population in the community. Increase dissemination of core knowledge on TB and establish community-based guidance on TB prevention and control based on health belief models.

Keywords: *Tuberculosis awareness, health belief model, questionnaire survey, health education*

Introduction

According to statistics, China is one of 22 countries with severe tuberculosis epidemics in the world (WHO, 014). The number of tuberculosis cases in the mainland of China ranks second in the world, and it is also one of 27 countries with severe MDR (Multiple Drug Resistance) tuberculosis epidemics in the world. At present, the annual number of

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patients with tuberculosis in China is about 1.3 million, accounting for 14.3% of the global incidence. Thus, the epidemic situation of tuberculosis in China is still severe and is characterized by high infection rates, high prevalence rates, and high deaths. The fifth national tuberculosis epidemiological sample survey shows that the total awareness rate of five core tuberculosis prevention and control information for the whole population is only 57%, which is far lower than that of the State Council.

According to the National Plan for Tuberculosis Prevention and Control (2011-2015), the awareness rate of the core information on tuberculosis prevention and control should reach 85% by 2015. At the same time, China's tuberculosis prevention and treatment efforts are facing various problems and challenges. For example, China's current tuberculosis prevention and treatment service system and prevention and treatment capacity cannot fully meet the needs of prevention and treatment work in the new form. In addition, the harm from drug-resistant tuberculosis is becoming more and more prominent, and if it is not effectively controlled as soon as possible, an epidemic situation in which drug-resistant bacteria are predominant will emerge in the next few years. Hence, the burden of prevention and control work will be even more onerous as the coverage of the prevention and treatment of tuberculosis is still in the primary stage. It is, thus, necessary to expand prevention and treatment work throughout the country to stop the epidemic from rising alongside the AIDS epidemic, especially since the difficulty in treatment and management of patients in mobile populations has increased, as well as the public's knowledge about tuberculosis prevention and treatment.

From 2010 to 2019, TB incidence in Jinan City peaked in the first quarter of each year, then gradually declined, and reached its lowest point in the fourth quarter, which is consistent with the results of the seasonal distribution description of the national tuberculosis epidemic (Wu Li, et al., 2014). The average annual reported incidence rate in Huaiyin District (36.68/100,000). The Mei Lihu Community in Huaiyin District is located in the middle level of tuberculosis incidence in Jinan City. The incidence of pulmonary tuberculosis in Jinan City from 1997 to 2011 was analyzed. The incidence was 35.37/100 000 in rural areas and 40.89/100 000 in urban areas ($P < 0.01$), Huaiyin District belongs to the urban center. The incidence of pulmonary tuberculosis in urban areas was higher than that in rural areas from 1997 to 2011 in Jinan City.

The current status of population aging in Jinan City is relatively serious. Specifically, the proportion of elderly people aged 60 and above in the total population of Jinan City has now exceeded 15%, which is a high level (Wang, et al., 2021). It is a particularity of this study at the time it was conducted.

By the arrangement for the use of funds from the central government subsidy for tuberculosis prevention and control projects in Shandong Province, preferential relief for tuberculosis patients and those with suspicious symptoms of tuberculosis will continue in 2023.

First, those with suspicious symptoms of tuberculosis, enjoy a sputum smear examination and a chest X-ray examination fee waiver when they go to the tuberculosis-designated hospital at the county level for the first time. The second is to provide first-line anti-tuberculosis drugs free of charge for patients with confirmed and registered active tuberculosis during the course of treatment, enjoy the reduction of the cost of 3 sputum smear examinations and 2 chest X-ray examinations during the treatment, and provide the reduction of the cost of molecular

biological examination for patients with smear-negative tuberculosis. Third, for drug-resistant tuberculosis screening objects and drug-resistant tuberculosis patients, there are also certain inspection and treatment follow-up subsidies. Tuberculosis-designated hospitals in all districts and counties provide preferential policies for patients diagnosed and subject to follow-up management. Huaiyin District nuclear disease designated hospital is Jinan Huaiyin District People's Hospital. For insured persons suffering from tuberculosis, extrapulmonary tuberculosis, multidrug-resistant tuberculosis, and extensively drug-resistant tuberculosis can apply for outpatient chronic disease identification; Through the reimbursement of outpatient and inpatient expenses, the economic burden of patients can be further reduced.

Based on the specific situation of tuberculosis prevention and control in Shandong Province (Jinan is the capital city of Shandong Province). In recent years, the reported incidence of tuberculosis in Shandong Province has shown a declining trend year by year, from 4089/100,000 in 2011 to 25.93/100,000 in 2020, with an annual decline rate of about 5.0%. According to this downward trend, it is predicted that the reported incidence of tuberculosis in Shandong Province will drop to about 20.13/100,000 in 2025 and 12.14/100,000 in 2035. Based on international and domestic requirements for TB prevention and control. In 2014, the World Health Organization proposed an "End TB Strategy" (2016-2035), which calls for TB incidence to fall below 10 per 100,000 people by 2035. To achieve this goal as scheduled, the annual decline rate of the reported incidence of tuberculosis in Shandong Province needs to be increased to about 6.2%, so that by 2025, the reported incidence of tuberculosis in Shandong Province will be reduced to about 18.87/100,000, and the incidence of tuberculosis will be reduced to less than 10/100,000 in 2035, to achieve the goal of ending tuberculosis. This study helps to understand the cognitive level of tuberculosis in Huaiyin District community residents, formulate prevention and control plans, and help to achieve the goal of ending tuberculosis.

Many studies have shown that a lack of knowledge may hinder appropriate and active medical seeking behavior. As with other chronic diseases, proper knowledge of tuberculosis is significantly associated with actively seeking medical care (Nguyen, et al., 2003). Tuberculosis health education is one of the important contents of tuberculosis control (Chen, et al., 2008). Doing a good job of health education on tuberculosis is important to improve the knowledge, attitude, and behavior of the population in terms of tuberculosis prevention and treatment. It also plays an important role in increasing the cure rate, reducing the spread of tuberculosis in the population, and controlling the tuberculosis epidemic.

Methods

Population and Sample

The study involved urban residents from Meilihu Community, located in Huaiyin District, Jinan City, Shandong Province. Purposive sampling was utilized to select participants based on specific inclusion criteria. These criteria included individuals aged over 18 years and under 65 years, including permanent migrants without local household registration, who have lived in the community for more than six months and possess the ability to read and write. Residents with serious health conditions and cognitive impairments were excluded. However, those who had been absent from the locality for more than six months were excluded. Health workers who were residents of the area were also excluded from the study's participant pool.

From the residents identified through purposive sampling, a total of 200 individuals were selected using random sampling techniques. These 200 participants were randomly drawn from the pool of individuals who met the criteria set for purposive sampling.

Research method

The principal instrument for data collection was a researcher-developed perception survey questionnaire. The questionnaire comprised closed-ended questions, whereby participants were required to select a single response to each query, following the framework established by Roberts and Burke in 1989. This survey instrument sought to gauge the participants' level of awareness regarding tuberculosis across dimensions such as knowledge, attitude, and health education.

The questionnaire consisted of 30 items, divided equally into three sections: knowledge, attitude, and health education related to tuberculosis. Each item was designed to assess participants' awareness of various aspects of tuberculosis, including its causes, symptoms, prevention, and treatment. The participants were asked to rate their level of awareness on a four-point scale ranging from "no awareness" to "full awareness". Basic information: Gender, Age, Educational level economic income, etc. Knowledge: Routes of transmission, main symptoms, vulnerable populations, and knowledge of TB drugs. Attitude: Whether there is discrimination against tuberculosis patients; Attitudes of residents towards tuberculosis patients; Self-cognition and psychological status of patients with pulmonary tuberculosis. Behaviors: The treatment method of tuberculosis, the place and way of treatment, the way of prevention, etc.

Quality control

The questionnaire's foundation was rooted in evidence-based literature, ensuring its reliability and validity. To validate the content, the questionnaire was scrutinized by a Pulmonary specialist, a public health nurse, and an internist. Additionally, a pilot study was conducted involving five residents to assess the questionnaire's readability and comprehensibility. Notably, the outcomes of this pilot study were excluded from subsequent data analysis.

To ensure the safety of study participants, the researcher sought approval from the Ethics Review Committee of Far Eastern University before commencing the investigation. Adhering to moral standards in research ethics, the researcher upheld the ethical principles of social value, informed consent, risks, benefits, and safety, as well as justice, privacy, and confidentiality of information.

Statistical method

The collected questionnaires were entered into the data, and the data were reviewed and reviewed, and spss17.0 was used for data processing.

Results

Demographic Profile of the Respondents

Presents a comprehensive overview of the basic population information for Meili Hu Community in Huaiyin District, Shandong Province. The survey encompassed a total of 200 questionnaires, out of which 156 were deemed valid for analysis. Among the respondents, 93 were male, constituting 59.6% (93/156), while 63 were female, accounting for 40.4% (63/156). The participants had an average age of 50.85 years, with the majority falling into the category of those over 60 years old, comprising 51.2% (80/156). This observation is aligned with the findings of the seventh national population census in Shandong Province, which underscores the prevalent issue of population aging.

Regarding education levels, the distribution shows 35.3% (55/156) of respondents with junior high school education, 17.9% (28/156) had no education or below, and 17.3% (27/156) had secondary school education or above. According to the China Research Center on Aging, about 29.6% of the elderly population in China did not attend school, while 41.5% completed primary school and 25.8% progressed to middle and high school levels.

Table 1 *Demographic Profile of the Respondents*

Profile	Options	Frequency	Percentage (%)
Sex	Male	93	59.6
	Female	63	40.4
	Total	156	100
Age	18-28 years old	5	3.2
	29-48 years old	16	10.3
	49-60 years old	55	35.3
	Over 60 years old	80	51.2
	Total	156	100
Education Level	No education	28	17.9
	primary school	55	35.3
	Junior high and high school	46	29.5
	Secondary school and above	27	17.3
	Total	156	100

Level of Awareness of Tuberculosis Based on Knowledge Domain

Presents a summary of mean scores and standard deviations (SD) for tuberculosis awareness in terms of knowledge domain. These statements cover various aspects of tuberculosis knowledge and understanding among the respondents. It can be seen that the highest-ranking statement is in the airborne transmission of tuberculosis, with a mean score of 2.83 and an SD of 0.97. The statement "Tuberculosis is airborne, and it can spread from person to person by coughing and sneezing" reflects a relatively stronger awareness of tuberculosis transmission through the air. On the other hand, in the knowledge of isoniazid's role in tuberculosis prevention: The statement "Isoniazid (INH) can prevent tuberculosis by killing the tuberculosis germs" received a mean score of 2.48 with a standard deviation of 0.80.

This suggests a moderate level of understanding among respondents regarding the role of isoniazid in preventing tuberculosis. The section "Knowledge Domain" has an average mean score of 2.59 and a standard deviation of 0.87, suggesting a generally moderate level of awareness across the broader domain of tuberculosis knowledge.

In all, the participants have a moderate level of awareness. The mean scores for all statements fall within a narrow range, indicating that the participants generally hold a moderate level of awareness regarding tuberculosis-related information. The mean scores range from 2.48 to 2.83, suggesting that the respondents possess a moderate understanding of tuberculosis-related concepts covered in the statements. The consistency in mean scores across the statements suggests that participants' awareness levels are relatively uniform across different aspects of tuberculosis. This could indicate a consistent level of knowledge and understanding of tuberculosis-related information among the respondents. Although the mean scores are relatively consistent, the standard deviations vary between 0.80 and 0.97. This variation in standard deviations implies that there is some variability in the responses given by participants for each statement.

Table 2 *Level of Awareness of Tuberculosis Based on Knowledge Domain*

Statements	Mean	SD	Interpretation
Tuberculosis is an infectious disease caused by Mycobacterium Tuberculosis.	2.60	0.86	Moderate Awareness
Isoniazid (INH) can prevent tuberculosis, killing the TB germs.	2.48	0.80	Moderate Awareness
It is necessary to take several different tuberculosis medications because there are many tuberculosis germs to be killed.	2.57	0.81	Moderate Awareness
The infectious period of tuberculosis begins three months prior to the onset of symptoms or clinical signs of tuberculosis.	2.54	0.85	Moderate Awareness
Tuberculosis is airborne, and it can spread from person to person by coughing and sneezing.	2.83	0.97	High Awareness
The early signs and symptoms of tuberculosis are coughing, sneezing, afternoon fever, night sweats, weight loss.	2.56	0.86	Moderate Awareness
World-wide tuberculosis remains a leading cause of death.	2.54	0.88	Moderate Awareness
Tuberculin Skin Test is one method of detecting tuberculosis infection.	2.54	0.93	Moderate Awareness
Patients who have coughed up sputum for more than three weeks, or have symptoms of hemoptysis or bloody	2.59	0.91	Moderate Awareness

sputum should be suspected of pulmonary tuberculosis.			
The state provides free anti-tuberculosis medicines and major examinations for infectious tuberculosis patients	2.61	0.86	Moderate Awareness
Knowledge Domain	2.59	0.87	Moderate Awareness
Statements	Mean	SD	Interpretation
Some people get embarrassed when others learn that they have tuberculosis.	2.64	0.83	Moderate Awareness
Other people may be worried their friends and family would reject them when they are diagnosed with tuberculosis.	2.61	0.88	Moderate Awareness
Residents should help in making sure the families and community stay healthy and free from infectious diseases.	2.65	0.83	Moderate Awareness
Patient diagnosed with tuberculosis should share the names of people they spent time with during the infectious period.	2.62	0.87	Moderate Awareness
Some people with tuberculosis disease are afraid they would lose their jobs if others learned they passed germs to people at work.	2.67	0.84	Moderate Awareness
Tuberculosis patients should be cared for, and tuberculosis patients should not be discriminated against.	2.55	0.85	Moderate Awareness
Tuberculosis can be cured as long as regular treatment is adhered to.	2.49	0.93	Moderate Awareness
It is important for the patient to remain at home in isolation and to wear surgical mask when leaving the room.	2.58	0.86	Moderate Awareness
The patient with tuberculosis must cover his mouth and nose with tissue when coughing or sneezing	2.58	0.89	Moderate Awareness
The patient with tuberculosis must stay away from young children.	3.03	0.92	High Awareness
Attitude Domain	2.64	0.87	Moderate Awareness

Scale: 1.00-1.75: Low Awareness/ 1.76-2.75: Moderate Awareness/ 2.76-4.00: High Awareness

In Table 2, the awareness statements are categorized individually, providing insights into participants' levels of awareness across different dimensions related to tuberculosis. The first category, "Embarrassment and Disclosure," reveals that respondents possess a moderate level of awareness (Mean: 2.64, SD: 0.83) regarding the potential embarrassment individuals with tuberculosis might experience when others become aware of their condition. This indicates a recognition of the social stigma associated with tuberculosis, although the responses exhibit some variability.

Similarly, in the "Fear of Rejection" category, respondents show a moderate level of awareness (Mean:2.61, SD:0.88) concerning the concerns of individuals diagnosed with tuberculosis about potential rejection by friends and family. This balanced understanding highlights participants' awareness of the emotional challenges faced by tuberculosis-affected individuals.

The "Community Health Responsibility" category reflects a moderate awareness level (Mean: 2.65, SD:0.83) among participants. This suggests that respondents recognize their role in safeguarding family and community health and preventing the transmission of infectious diseases, including tuberculosis.

Within the "Contact Tracing" category, participants demonstrate moderate awareness (Mean: 2.62, SD: 0.87) of the importance of tuberculosis patients sharing the names of those they have interacted with during the infectious period. This understanding indicates recognition of the significance of contact tracing in containing the spread of the disease.

Respondents also exhibit a moderate level of awareness (Mean:2.67, SD: 0.84) in the "Job Security" category, indicating an understanding of the potential employment-related fears of tuberculosis-affected individuals.

Furthermore, the participants have moderate awareness (Mean:2.55, SD:0.85) regarding non-discrimination in the "Non-Discrimination" category, suggesting their acknowledgment of the importance of treating tuberculosis patients fairly and without bias.

The "Treatment Adherence and Cure" category highlights moderate awareness (Mean:2.49, SD:0.93), suggesting participants' balanced understanding of the curability of tuberculosis through consistent treatment adherence.

In the "Isolation and Hygiene" category, the respondents exhibit moderate awareness (Mean: 2.58, SD: 0.86) of the significance of isolating at home and practicing good hygiene, such as wearing a surgical mask when leaving the room.

Similarly, participants show a moderate level of awareness (Mean: 2.58, SD: 0.89) in the "Respiratory Etiquette" category, indicating an understanding of the importance of covering the mouth and nose when coughing or sneezing to prevent the spread of tuberculosis.

A distinctive finding emerged in the "Avoiding Young Children" category, where respondents demonstrated high awareness (Mean:3.03, SD:0.92). This suggests a strong recognition of the need for tuberculosis patients to refrain from close contact with young children to mitigate transmission risks. The overall "Attitude Domain" reveals a moderate awareness level (Mean: 2.64, SD: 0.87) encompassing respondents' attitudes toward various aspects of tuberculosis. This collective awareness aligns with the range of moderate awareness observed in individual statements.

Table 3 *Level of Awareness of Tuberculosis Based on Behavior Domain*

Statements	Mean	SD	Interpretation
Directly Observed Therapy (DOT) helps prevent problems related to tuberculosis by making sure that treatment is completed.	2.31	0.91	Moderate Awareness
DOT workers must wear an N95 mask during the time the patient is considered infectious.	2.37	1.03	Moderate Awareness
Patients with pulmonary tuberculosis should go to special tuberculosis prevention and control institutions for examination, treatment.	2.30	0.95	Moderate Awareness
If it is clear that it is pulmonary tuberculosis, you need to go to the local tuberculosis prevention and treatment center, or ask the local tuberculosis hospital, or the infectious disease department of the local top three hospital for medical treatment.	2.33	0.97	Moderate Awareness
Alcohol use must be limited when taking tuberculosis medicines to prevent liver damage.	2.56	1.06	High Awareness
The infectious period is important to determine in order to focus the contact investigation.	2.38	0.99	Moderate Awareness
The tuberculosis patient must have regular monthly check-up. Chest X-ray maybe done to see if there is improvement.	2.37	0.98	Moderate Awareness
tuberculosis is almost always curable if the patient adheres to the treatment regimen of taking several special medications for six to nine months.	2.36	0.89	Moderate Awareness
Side effects of tuberculosis medications are manageable and need not be stopped.	2.35	0.99	Moderate Awareness
Is there a free policy for treating tuberculosis?	2.36	0.95	Moderate Awareness
Behavior Domain	2.37	0.97	Moderate Awareness

Scale: 1.00-1.75: Low Awareness/ 1.76-2.75: Moderate Awareness/ 2.76-4.00: High Awareness

Table 3 presents the respondents' awareness levels across various aspects related to tuberculosis within the "Behavior Domain." The statements in this table reflect the participants' understanding of behaviors and practices that contribute to the prevention, treatment, and management of tuberculosis. The mean scores and standard deviations provide insights into the average level of awareness and the variability of responses.

The respondents exhibit a moderate level of awareness (mean:2.31) regarding Directly Observed Therapy (DOT). They recognize that DOT plays a role in ensuring the completion of treatment to prevent problems associated with tuberculosis. The moderate awareness suggests that while the concept is understood, there may be room for further clarification on its implementation and benefits.

Participants display moderate awareness (mean:2.37) regarding infection control practices for DOT workers. The recognition that DOT workers should wear an N95 mask during the patient's infectious period indicates an understanding of the importance of protecting both patients and healthcare workers.

The respondents exhibit moderate awareness (mean:2.30) that individuals diagnosed with pulmonary tuberculosis should seek care at specialized tuberculosis prevention and control institutions. The awareness suggests that individuals are familiar with the need for specialized medical attention for effective treatment.

The survey reveals moderate awareness (mean: 2.56) that alcohol use should be limited while taking tuberculosis medicines to prevent potential liver damage. The awareness of this precautionary measure suggests a basic understanding of the importance of adherence to treatment guidelines.

The respondents' awareness (mean:2.33) of the medical treatment options for pulmonary tuberculosis indicates that they are aware of the resources available for seeking treatment, including local tuberculosis prevention and treatment centers and infectious disease departments.

The respondents also display moderate awareness (mean:2.38) of the significance of identifying the infectious period of tuberculosis patients for focused contact investigations. This awareness indicates recognition of the importance of timely intervention.

The participants' moderate awareness (mean:2.37) of the necessity for regular check-ups and chest X-rays during tuberculosis treatment indicates their understanding of monitoring and evaluating treatment progress.

The survey highlights moderate awareness (mean:2.36) that tuberculosis is almost always curable when patients adhere to the prescribed treatment regimen. This awareness underscores an understanding of treatment success through adherence.

The respondents show moderate awareness (mean:2.35) of the manageable nature of side effects associated with tuberculosis medications. This awareness suggests recognition of the importance of addressing side effects without discontinuing treatment.

The participants exhibit high awareness (mean:2.36) of the free treatment policy for pulmonary tuberculosis patients with a clear diagnosis. Their understanding of the policy's requirements and implementation indicates familiarity with access to free medication and treatment.

Table 4 *Difference in Tuberculosis Awareness by Sex*

Domain	Male	Female	T	P
	M±SD	M±SD		
Knowledge	2.70±0.65	2.42±0.65	2.64	0.009*
Attitude	2.79±0.61	2.42±0.76	3.230	0.002*
Behavior	2.52±0.76	2.14±0.71	3.164	0.002*

*significant at $\alpha = 0.05$

Table 4 displays the results of inferential statistics on the variables. The findings obtained from the t-test analysis across different genders, as outlined in the preceding table, underscores significant variations between male and female respondents concerning their knowledge, attitude, and behavioral levels ($p < 0.05$). Specifically, considering tuberculosis knowledge, the mean score among males (2.700 ± 0.653) exceeds that among females (2.42 ± 0.65), indicating that males tend to possess a higher level of understanding about tuberculosis. Moreover, male participants demonstrate a more favorable attitude on average (2.79 ± 0.61) in comparison to their female counterparts (2.42 ± 0.76), which suggests that males may be more inclined to believe in the seriousness of tuberculosis and the effectiveness of preventive measures.

Additionally, concerning tuberculosis behavior, male respondents also exhibit a higher attitude score (2.79 ± 0.61) as compared to female respondents (2.42 ± 0.76). Furthermore, the male group showcases a greater behavior score (2.14 ± 0.71) compared to the female group. These distinctions observed between male and female respondents are statistically significant ($P < 0.05$), underlining the presence of gender-related disparities in their tuberculosis knowledge, attitude, and behavior scores within the framework of the Health Belief Model. This could suggest that the sex differences could be attributed to varying perceptions of susceptibility, severity, benefits, and barriers related to tuberculosis prevention and control measures.

The higher incidence of tuberculosis among men than women in Jinan from 2010 to 2019 may be related to men's wide range of social activities, high work-life pressure, and poor lifestyle habits such as smoking and drinking. The reported incidence of tuberculosis is mainly concentrated in young adults in the age group of 15-35 years, which may be related to their high risk of being infected due to their wide range of social activities and lack of self-protection awareness during this period. There are also differences in socialization needs between men and women, with men usually preferring a wider social circle for work and hobbies, while women tend to be more connected to their families and intimate relationships. This difference may result in men and women socializing differently and having different needs in their lives. It may also lead to a greater and more up-to-date knowledge of some information among men than among women, which may also have an impact on knowledge of some diseases (Liu, 2023).

There are significant differences between the emotions of men and women (Dong, 2013). First, women are more emotionally rich, sensitive, and sentimental, and they experience emotions and feelings more intensely. Second, women's feelings are more profound, delicate,

and implicit than men's, as men are relatively superficial and exposed. Women, regardless if they encounter happy, painful, or resentful experiences, do not show such emotional vulnerability; even so, the inner emotional experience is very deep. Men, in contrast, are more outward in their expression of emotion, but the inner experience may not be profound. Additionally, women tend to be weak in the face of unexpected events and setbacks, whereas men are more resolute and stronger. At the same time, men are more likely to make blind decisions and rash mistakes. This difference may lead to differences in attitudes and behaviors between men and women in the face of infectious diseases such as tuberculosis.

Table 5 *Difference in Tuberculosis Awareness by Age*

Domain	18-28 years old	29-48 years old	49-60 years old	Over 60 years old	F	P
	M±SD	M±SD	M±SD	M±SD		
Knowledge	3.16±0.54	2.98±0.60	2.58±0.61	2.48±0.69	4.07	0.008*
Attitude	2.86±0.32	3.18±0.61	2.68±0.60	2.50±0.74	4.93	0.003*
Behavior	3.28±1.11	2.48±0.76	2.40±0.76	2.27±0.70	3.14	0.027*

*significant at $\alpha = 0.05$

Table 5 displays the results of inferential statistics on the variables. The application of one-way ANOVA aimed to assess the disparities in each dimension across varying age groups, revealing notable variations in knowledge, attitude, and behavior regarding tuberculosis among different age cohorts ($P < 0.05$).

With advancing age, there was a discernible decline in residents' tuberculosis-related knowledge, attitude, and behavior scores. Among the elderly group aged over 60 years, the knowledge score stood at (3.28±1.11), the attitude score was recorded as (2.48±0.76), and the behavior score was (2.27±0.70). These findings indicate a statistically significant discrepancy in scores among the groups ($F = 3.135$, $P < 0.05$). In the context of the Health Belief Model, these observations can be explained by considering the components of perceived susceptibility, perceived severity, perceived benefits, and perceived barriers.

Young individuals tend to exhibit higher scores due to their heightened perception of susceptibility to tuberculosis and a better understanding of its severity. Moreover, they may perceive greater benefits in adopting preventive behaviors. Their ability to swiftly recall information and act promptly aligns with the Health Belief Model's constructs of self-efficacy and cues to action. In contrast, elderly individuals might face perceived barriers related to their physiological limitations, leading to slower reactions and reduced mobility. This supports the model's premise that perceived barriers can impact health-related behaviors. The observed age-related differences underscore the influence of age-related perceptions within the framework of the Health Belief Model, thereby shaping individuals' tuberculosis-related knowledge, attitude, and behavior scores.

There was a strong correlation between age and health knowledge, attitudes, and behaviors of the older adults investigated in this study, with relatively poor health knowledge and health behaviors among older adults over 60 years of age. The physiological functions of the elderly inevitably change with age. Decrease in sensory perceptions, including vision, hearing, taste, smell, and touch, at older ages compared to other age groups can affect interactions and contact with the society (Liu, 2023). As people age, some begin to experience cognitive decline, causing them to perform poorly in terms of knowledge, attitudes, and behaviors about diseases. Health knowledge and health behavior are important components of health literacy, and health knowledge influences health behavior, which in turn further influences an individual's healthy quality of life. According to data from the Seventh National Population Census Bulletin, the total number of elderly people aged 60 years and older in the mainland region will be 264 million in 2020, accounting for 18.7% of the total population. In the face of the increasingly severe aging trend, the improvement of health knowledge of the elderly and the improvement of poor lifestyles are crucial to enhancing the health literacy of the elderly (Yang, 2016).

Table 6 *Difference of Tuberculosis Awareness by Educational Level*

Domain	No education	Primary school	Junior high and high school	Secondary school and above	F	P
	M±SD	M±SD	M±SD	M±SD		
Knowledge	1.87±0.69	2.56±0.60	2.59±0.68	2.72±0.61	5.01	0.002*
Attitude	2.23±0.87	2.49±0.68	2.58±0.65	2.87±0.67	4.03	0.009*
Behavior	2.01±0.59	2.15±0.74	2.33±0.72	2.61±0.78	3.71	0.013*

*significant at $\alpha = 0.05$

Table 6 outlines the outcomes of the analysis conducted within various educational levels, illustrating the mean scores and standard deviations for each domain: knowledge, attitude, and behavior. One-way ANOVA was employed to examine the differences among individuals with distinct education levels, and the statistical significance was indicated by the F-value and the associated p-value.

Regarding the knowledge domain, participants with no formal education demonstrated an average score of 1.87 ± 0.69 , while those with primary school education showed a higher score of 2.56 ± 0.60 . Additionally, individuals with junior high and high school education exhibited a mean score of 2.59 ± 0.68 , and those with secondary school and above displayed the highest score of 2.72 ± 0.61 . The ANOVA test yielded a significant F-value of 5.01 ($p = 0.002^*$), indicating that there are notable differences in knowledge scores across various educational backgrounds.

In terms of the attitude domain, participants without formal education had an average score of 2.23 ± 0.87 , while those with primary school education received a score of 2.49 ± 0.68 . Individuals with junior high and high school education achieved a mean score of 2.58 ± 0.65 ,

and those with secondary school and above education obtained the highest score of 2.87 ± 0.67 . The ANOVA analysis showed a statistically significant F-value of 4.03 ($p = 0.009^*$), indicating distinct attitude scores based on education levels.

In the behavior domain, participants with no formal education had an average score of 2.01 ± 0.59 , whereas those with primary school education had a score of 2.15 ± 0.74 . Individuals with junior high and high school education showed a mean score of 2.33 ± 0.72 , and those with secondary school and above demonstrated the highest score of 2.61 ± 0.78 . The ANOVA result revealed a statistically significant F-value of 3.71 ($p = 0.013$), suggesting variations in behavior scores linked to different educational levels.

These findings, as analyzed through the lens of the Health Belief Model, align with its core constructs. Education serves as a key factor influencing perceived susceptibility, severity, benefits, and barriers, thus influencing individuals' knowledge, attitudes, and behaviors toward tuberculosis prevention and control. The differences underscore the role of education in shaping perceptions and health-related actions within the context of the model.

In this study, constrained by the level of economic development in the past, the vast majority of the surveyed older people either had not received formal education or had received elementary school education only, thus resulting in relatively poorer health knowledge, attitudes, and behaviors. Elderly people in the 1980s area of China generally have a low level of education, limited access to health knowledge, lack of health cognition, and health behaviors that are easy to ignore, so the overall level of health literacy is low and should be given more attention (Lu et al., 2020). It follows then that the less health knowledge the elderly have the worse their health behaviors are, the worse their health literacy is, and the worse their ability to manage their health (Liao, 2020).

Conclusions

In conclusion, this study highlighted the significance of gender in shaping tuberculosis awareness and behaviors. The study focused on three aspects of awareness: knowledge, attitude, and health education. These components collectively represent how well individuals are informed about tuberculosis, their attitudes toward the disease, and the extent to which they have received health education on the topic.

The comparative variables that are being considered about the awareness levels include sex, age, and educational attainment. Age is an important demographic factor that can differentiate awareness levels. Younger individuals might have different exposures to health education compared to older individuals, potentially affecting their knowledge and attitudes about tuberculosis. Educational attainment often delineates awareness levels. Higher levels of education can provide better access to information and understanding, potentially leading to higher levels of awareness.

Male participants demonstrated higher levels of knowledge, more positive attitudes, and more favorable behaviors related to tuberculosis prevention and control compared to their female counterparts. This underlines the need for gender-specific health communication strategies to effectively address the differing informational needs and preferences of men and women.

Furthermore, the influence of age on tuberculosis awareness emerged as a notable trend. As participants grew older, their levels of knowledge, attitudes, and behaviors concerning tuberculosis exhibited a decline. This age-related variation underscores the importance of targeted educational initiatives that cater to the preferences and priorities of different age groups.

Education's pivotal role in influencing tuberculosis-related perceptions and behaviors was another significant finding. Participants with higher education levels consistently displayed greater knowledge, more positive attitudes, and informed behaviors regarding tuberculosis prevention and control. This correlation between education and tuberculosis awareness aligns with the Health Belief Model, emphasizing the potential of education as a catalyst for improved public health outcomes.

The implications of this study reverberate through the realm of public health policy and practice. Tailored interventions that account for gender-specific needs, age-related preferences, and education can effectively bolster tuberculosis prevention and control efforts. By leveraging insights derived from this research, public health initiatives can harness the Health Belief Model's principles to drive impact and sustainable changes in tuberculosis awareness and behaviors within the Meili Hu Community and beyond. As tuberculosis remains a significant global health concern, this study contributes valuable insights toward achieving more effective and inclusive strategies to combat the disease's spread and impact.

Proposed Framework for Community-Based Tuberculosis Prevention Program

The framework outlines a comprehensive approach for designing and implementing a community-based tuberculosis prevention program. By integrating health promotion, education, and collaborative strategies, this framework aims to raise awareness, improve attitudes, and encourage positive behaviors related to tuberculosis prevention within the targeted community.

The community checked the progress of TB screening work, health education, and questionnaire information every year, then checked the process of screening registration, operation, and inspection results at the community screening site, organized the street (community), school volunteer teams, district hospitals, and community health service institutions, and carried out the theme of online and offline publicity free diagnosis activities.

Develop targeted health education programs. These must acknowledge and address the gender-specific differences in tuberculosis awareness, attitudes, and behaviors. They must develop information dissemination strategies that effectively involve both women and men and ensure that educational content is relevant, relevant, and accessible to different gender groups, age groups, and levels of education.

Goals

1. **Increase tuberculosis awareness.** Raise awareness about tuberculosis, its transmission, symptoms, and available prevention measures among community members.
2. **Promote positive attitudes.** Foster positive attitudes towards tuberculosis patients, reduce stigma, and encourage empathy and support within the community.

3. **Facilitate behavioral change.** Encourage community members to adopt preventive behaviors, such as early detection, adherence to treatment, and infection control practices.
4. **Consider different age stages and different audience groups.** A tuberculosis prevention and control plan for the MeiLi Hu community should be formulated, focusing on the elderly in the community, strengthening health education, and improving the physical health and daily behavior ability of the elderly.
5. **Develop a variety of health education models and disease publicity methods.** These should be according to the gender differences between men and women and different levels of education to carry out a variety of ways of publicity. They should also take into account the role of community health service centers in disease prevention.

Community Health Nursing Practice

Create community publicity content. It must take the following into consideration:

- a. It must aim to correct people's understanding of tuberculosis, change the wrong perception of tuberculosis, and the buildup confidence that the disease can be cured.
- b. It should provide basic knowledge of contemporary tuberculosis prevention and treatment, especially the main role of chemotherapy in tuberculosis treatment and examples.
- c. It must discuss the main significance and practice of following the doctor's prescription and adhering to the regular medication throughout the course of treatment.
- d. It must outline the significance of regular sputum tuberculosis tests, how to evacuate sputum, and the requirements and time for sending qualified sputum specimens for examination.
- e. It must explain the transmission of tuberculosis and measures to prevent and minimize respiratory transmission, like not coughing, talking loudly sneezing on people, and not spitting anywhere.
- f. It must be aligned with national policy on tuberculosis treatment. The adoption of various forms of health education on tuberculosis prevention and treatment knowledge for patients and their families must be emphasized to enhance patients' treatment compliance and their families' sense of responsibility.

Recognize the varying information preferences and learning styles

- a. Design educational materials and interventions that cater to the needs of both younger and older community members.
- b. Incorporate interactive methods for younger individuals and more accessible formats for the elderly, considering factors like digital literacy and visual impairments.
- c. Strengthen the dissemination of community health knowledge on tuberculosis and adopt more convenient and effective ways and means of acquiring health knowledge, such as the use of health publicity materials that are more readily accepted and understood by the elderly, focusing on health education during health checks for the elderly, and, in the context of the

"Internet Plus"—thus helping the elderly to adapt to changes brought about by information technology and to meet the needs of the elderly to learn new knowledge.

Participation in capacity-building, monitoring, and assessment of older persons

Low levels of health knowledge and health behaviors are detrimental to health literacy and ultimately to improving the quality of health of older adults. In this study, the health knowledge and health behaviors of the surveyed older adults were affected by a variety of factors such as age and education level, and this requires the government, society, medical institutions, and health workers to adopt comprehensive and differentiated interventions for different types of older adults to promote targeted improvements in health knowledge and health behaviors. Therefore, it is necessary to simultaneously develop and improve standards for geriatric health assessment, including quality of life assessment, economic assessment, physical health assessment, mental health assessment, and social health assessment, and to continually strengthen health education, preventive health care, prevention and control of chronic diseases, diagnosis and treatment of illnesses, rehabilitation and care for different types of older persons, and other health management services throughout the entire process.

Surveys and preventive treatment of latent tuberculosis infection in people over 50 years old were conducted in Huaiyin District every year. The implementation of this project is of great significance to further reduce the incidence of tuberculosis in key populations. Through screening to detect latent TB infection in people over 50 years old, the implementation of latent infection in the preventive treatment of people, to achieve TB prevention and control threshold forward. In the next step, Huaiyin District will do a good job of infection screening, health education and follow-up treatment, follow-up management, effect evaluation, and other related work to ensure that the status of tuberculosis latent infection in people over 50 years old and the preventive treatment project is implemented smoothly.

Strengthen community-wide participation in TB prevention and care activities

There are also differences in socialization needs between men and women, with men usually preferring a wider social circle for work and hobbies, while women tend to be more connected to their families and intimate relationships. This difference may result in men and women socializing differently and having different needs in their lives. It may also lead to a greater and more up-to-date knowledge of some information among men than among women, which may also have an impact on knowledge of some diseases. Communities should promote participation and mobilization, health education, and communication. Emphasize the importance of continuous learning and health literacy among all community members. Workshops, seminars, and information sessions on TB prevention and control are held in cooperation with local educational institutions and community centers. Regular participation is encouraged to enhance knowledge and maintain positive attitudes and behaviors. Develop targeted educational modules that address the specific tuberculosis-related information needs of both male and female healthcare professionals. By tailoring educational content to the gender-specific concerns and preferences identified in this study, nursing education programs can better equip healthcare providers to engage effectively with patients of all genders.

AUTHOR INFORMATION

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